

**Co-creating evaluation framework for Extension for Community Healthcare Outcomes
implementation quality**

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DISSERTATION

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DISCLAIMER

The findings and conclusion in this dissertation are those of the author and do not necessarily represent the official position of U.S. Centers for Disease Control and Prevention.

DEDICATION

This dissertation is dedicated to my father, Dr. Srijoy Kumar Ghosh, who has been my inspiration. A strategic thinker, futurist and a visionary leader who inculcated in me values of honesty, leading by example, perseverance, and hard work. I have relentlessly pursued our dreams and led with positivity and great attitude despite numerous obstacles thrown at me. This labor of love and persistence, and a journey of continuous growth into an adaptive pragmatic leader is for you dad – I know you are proud of me.

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TABLE OF CONTENTS

CHAPTER 1: BACKGROUND AND PROBLEM STATEMENT	1
A. Capacity Building and PEPFAR.....	1
B. Project Extension for Community Healthcare Outcomes (ECHO).....	5
C. Proof of Concept Countries: India and Tanzania.....	9
D. Emerging Need to Develop an Evaluation Framework to assess Quality of Implementation	13
E. Problem/Opportunity Statement.....	15
F. Study Objective	17
G. Research Questions.....	17
H. Leadership Implications and Relevance	18
CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK.....	22
A.Literature Review.....	222
B. Conceptual Framework	29
CHAPTER 3: STUDY DESIGN, METHODS, AND DATA COLLECTION	46
A.Study Design	465
B.Data Collection.....	47
C.Data Analysis	53
D.Triangulation of data sources for validity and credibility to ensure Quality and Rigor	57
E. Ethics and Protection of Human Subjects	61
CHAPTER 4: RESULTS	63
PAPER 1: Appreciative inquiry and the co-creation of an evaluation framework for Extension for Community Healthcare Outcomes (ECHO) implementation: a two-country experience.....	66
PAPER 2: A protocol for a comprehensive monitoring and evaluation framework with a compendium of tools to assess quality of Project ECHO (Extension for Community Health Outcomes) implementation.....	1300
PAPER 3: Qualitative validation of an evaluation framework and compendium of tools to assess quality of Extension for Community Health Outcomes (ECHO) implementation.....	152
CHAPTER 5: DISCUSSION AND CONCLUSIONS	200
A.Synthesis, integration, and interpretation of findings.....	200
B. Appreciative inquiry – SCORE, best practice for an interim evaluation approach	22111
C. Quantitative and Qualitative Result Synthesis.....	215
D. Triangulation.....	218

E. Limitations	221
F.Implications for Public Health Leadership and Practice	223
G. Implications for Research	230
H. Lessons Learned.....	234
I. Recommendations.....	238
J. Conclusions and Next steps.....	243
CITED LITERATURE.....	245
APPENDIX	
Appendix A: Code Book.....	266
Appendix B: Data Measurement Table.....	274
Appendix C: Tables on strengths, challenges, opportunities/aspirations from MAXQDA.....	279
Appendix D: SCORE relationship with a priori codes.....	283
Appendix E: SCORE Evaluation form	284
Appendix F: Key Informant Interview Guide.....	287
Appendix G: List of documents for document review.....	293
Appendix H: MAXQDA visualization and outputs.....	298
Appendix I: Appendices with Data Collection tools for Paper 2....	302
Appendix J: <i>Curriculum Vitae</i>	4358
Appendix K: IRB approvals.....	372

LIST OF TABLES

Table 1. Moore’s Framework used for ECHO evaluation.....	35
Table 2. Facilitation questions for the Appreciative Inquiry-based SCORE methodology.....	49
Table 3. List of manuscripts	57
Table 4. Recommendation Summary table to promote/lead implementation of recommendation	242

LIST OF FIGURES

Figure 1. PEPFAR’s Capacity Building Framework, and Types of Activities	2
Figure 2 The four pillars or the ABCD of the ECHO model.....	6
Figure 3 The ECHO model and adult learning	7
Figure 4. Comparison of SWOT vs SCORE	24
Figure 5. Conceptual Framework	32
Figure 6.Triangulation	54
Figure 7. Action Research Cycles to assess quality of ECHO implementation	206
Figure 8. Recommended evaluation activities based on KII and document review	21095
Figure 9. Example of pulse-point checks or interim indicators of progress	213
Figure 10. Revised Conceptual Framework.....	22144
Figure 11. Triangulation of results from the 3 data sources (AI-SCORE, KII, Document Review).....	220
Figure 2202. Proposed monitoring tool to assess elements of high-quality ECHO implementation	233

LIST OF ABBREVIATIONS

AGREE	Appraisal of Guidelines, Research and Evaluation
AI	Appreciative inquiry
CAS	Complex Adaptive System
CDC	U.S. Centers for Disease Control and Prevention
CDC-India	CDC India country office
CDC-Tanzania	CDC Tanzania country office
CoP	Communities of Practice
CTD	Central Tuberculosis Division
COVID-19	Coronavirus Disease, 2019
DE	Developmental Evaluation
DGHT	Division of Global HIV and Tuberculosis
DTO	District TB Officer
ECHO	Project Extension for Community Healthcare Outcomes
FGD	Focus Group Discussion
GOI	Government of India
GOT	Government of Tanzania
GTB	Global TB Branch
HIV	Human Immunodeficiency Virus
HRSA	Health Research Service Administration
HW21	Health Workforce for the 21 st Century (PEPFAR and HRSA supported 5-year Human Resources for Health Global Initiative)
ICAN	Infection Control Africa Network
IOM	Institute of Medicine
IRB	Institutional Review Board
JHPIEGO	Johns Hopkins Program for International Education in Gynecology and Obstetrics
KI	Key informant
KII	Key informant interview
LT	Laboratory technician
M&E	Monitoring and Evaluation
MOH	Ministry of Health
MOHCDGEC	Ministry of Health Community Development Gender Elderly and Children (Tanzania)
MOHFW	Ministry of Health and Family Welfare (India)
MDR TB	Multidrug-resistant tuberculosis
NACP	National AIDS Control Program
NGO	Non-government organization
NITRD	National Institute for Tuberculosis and Respiratory Diseases
NTEP	National TB Elimination Program (NTEP was renamed in 2020)
PAR	Participatory Action Research
PEPFAR	President's Emergency Plan for AIDS Relief
PHFI	Public Health Foundation of India
PLHIV	People living with HIV
PMDT	Programmatic Management of Drug-resistant Tuberculosis
SCORE	Strengths, Challenges, Opportunities, Aspirations, measurable Results, and Evaluation of AI-based approach
SSI	Semi-structured interview
STDC	State TB Training and Demonstration Center
STO	State TB Officer

TB	Tuberculosis
TZ HIV ECHO	Tanzania HIV ECHO program
UIC	University of Illinois at Chicago, School of Public Health
UMB	University of Maryland, Baltimore
UNAIDS	United Nations HIV/AIDS
UNGA HLM	United Nations General Assembly High-level Meeting
UNM	University of New Mexico, Health Science Center
WHO	World Health Organization
XDR TB	Extensively drug-resistant tuberculosis

SUMMARY

The United States Centers for Disease Control and Prevention (CDC), through PEPFAR, supports a third of all people receiving HIV care globally, working side-by-side with on-the-ground partners to improve methods for finding, treating, and preventing HIV and tuberculosis (TB). However, a shortage of trained medical professionals has impeded efforts in Sub-Saharan Africa and Asia. Gaps remain in service delivery, staff capacity, training and knowledge dissemination on updated guidelines. The Extension for Community Healthcare Outcomes (ECHO™) model leverages video-enabled technology to build capacity and promote collaboration through mentorship, and case-based learning to manage complex diseases and building communities of practice. CDC is encouraging using the ECHO model in more than 23 countries across six continents. However, no comprehensive evaluation framework exists to assess quality of ECHO implementation.

Baseline data on process, participation, knowledge or outcomes were not collected in both India and Tanzania; hence a developmental evaluation with participatory action research design was proposed. For stakeholder engagement, which is the first step in any evaluation, a modified, strengths-based, appreciative inquiry (AI) approach called the SCORE (Strengths, Challenges, Opportunities/Aspirations, measurable Results, and Evaluation to assess acceptability and feasibility) guided the focus group discussions of diverse stakeholders in India and Tanzania to understand the current perceptions of ECHO. A systematic qualitative analysis of the proceedings identified the following perceptions of strength: capacity building, and establishing communities of practice; however, challenges included securing resources, engaging leadership, and building systems for monitoring programmatic impact. Strengthening internet connectivity, addressing logistical challenges, encouraging session interactivity, and having scale-up plans were opportunities/aspirations for improvement and sustainability.

There was no statistically significant difference in individual measures of acceptability and feasibility overall between the two countries. Median composite scores for acceptability in Tanzania were higher than India, and statistically significant [India vs. Tanzania median scores: 30 vs. 33 ($p=0.03$)]; Composite feasibility scores out of 24 were identical, i.e., 21 and statistically not significant. Based on the constructs gathered from the AI workshops in India and Tanzania, a practical protocol for evaluating ECHO program implementation, including an evaluation framework and compendium of tools were developed.

To validate the evaluation framework, key informant interviews (KII) and latent content analysis

was conducted through a document review process that triangulated the following findings. There was unanimous consensus on assessing capacity building, participation, administrative and logistical support, and information technology. SCORE was acceptable and feasible based on evaluation findings, encouraged 6 to 12 months post-implementation as an interim evaluation approach; readiness assessment was recommended before scale-up. Although recognized as important, the impact of communities of practice, political will and engagement, and measures of public health impact were not being assessed routinely. Further research to explore assessing these constructs are needed. ECHO programs globally can refer to a protocol, and a simpler framework and toolkit that can be contextualized.

CHAPTER 1: BACKGROUND AND PROBLEM STATEMENT

A. Capacity Building and PEPFAR

Capacity building is integral to systems strengthening, ownership, and transition to host country implementation and sustainability of the President's Emergency Plan for AIDS Relief (PEPFAR), an inarguable investment of the United States Government in fighting the global HIV and tuberculosis epidemics (PEPFAR, 2012). *Capacity* is defined as the ability of individuals and organizations or organizational units to perform functions effectively, efficiently and sustainably (UNDP, 2008). *Capacity building* is an evidence-driven process of strengthening the abilities of individuals, organizations, and systems to perform core functions sustainably, and to continue to improve and develop over time (UNDP, 2008). Capacity building is an inherent part of initiatives and activities underway in PEPFAR, including program activities in all technical areas covering prevention, care and treatment, and cross-cutting areas of health system strengthening, workforce development, and integrated health services, civil society programs, country ownership, and transition to local partner implementation (PEPFAR, 2012) (Figure 1).

U.S. government investment in capacity building through PEPFAR, within the context of national HIV/AIDS plans, seeks to assist host governments' efforts to understand their local epidemics and respond strategically to prevent new infections, care for and treat infected and affected populations, and mitigate the social and economic consequences of HIV and tuberculosis. Effective capacity building efforts target local governments, implementing partners, nongovernmental organizations, knowledge networks, communities, academic institutions and the private sector, with a goal toward enhancing the short- and long-term programmatic management of HIV and tuberculosis care and treatment within their respective countries. Part of this process includes a country's ability to drive the process to identify, source, and manage on-going capacity building and workforce development efforts as a sustained government-led effort to target change (IOM, 2013).

Thus U.S. Centers for Disease Control and Prevention (CDC), is one of the main interagency PEPFAR implementers, providing HIV treatment to a third of all people living with HIV (PLHIV) in the world (PEPFAR, 2019). CDC works side-by-side with on-the-ground partners to improve methods for finding, treating, and preventing HIV and TB. PEPFAR strategy, in partnership with individual Ministries of Health and implementing partners, is to ensure 95 percent PLHIV know their HIV status, 95 percent of people who know their status access antiretroviral treatment (ART), and 95 percent of people on ART have suppressed viral loads (UNAIDS, 2014). This bold course is planned through continued aggressive focus, quarterly analysis for routine monitoring and evaluation, and partner alignment for maximum impact (PEPFAR, 2019). Beyond saving an estimated 17 million lives, this strategy hopes to reduce the future costs required to sustain the HIV/AIDS response and strengthen systems in country while building capacity and enhancing workforce development (Country Operating Plan 2020 guidance).

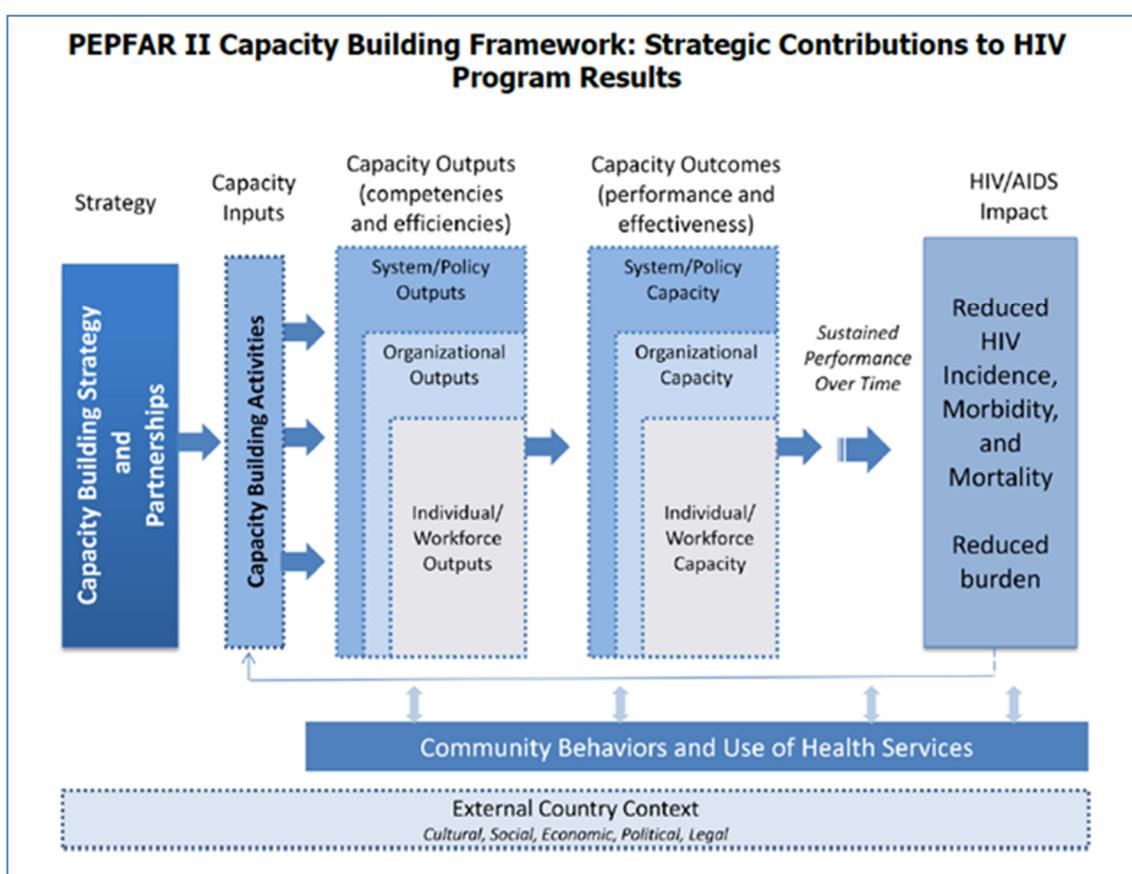


Figure 1. PEPFAR's Capacity Building Framework

Since 2003, the first year of PEPFAR, substantial progress has been achieved. However, many challenges and gaps remain. In 2006 the World Health Organization's World Health Report 2006—Working Together for Health established that fifty-seven countries had “critical shortages” of health workers; thirty-six of those countries were in sub-Saharan Africa. The report estimated that there was a global shortfall of 2.4 million doctors, nurses, and midwives (WHO, 2006). The lack of doctors and medical professionals impedes efforts in sub-Saharan Africa and Asia. This leads to gaps in service delivery, staff capacity, training and knowledge dissemination, and managing complex multi-specialty disease conditions (Das *et al.*, 2007, Eichenberger *et al.*, 2019). In the early phase of PEPFAR implementation, the UNAIDS Global Steering Committee, for example, has ranked this as one of the major obstacles to scaling up the HIV/AIDS response (UNAIDS, 2006). Some of the driving forces that lead to workforce challenges in addition to shortage of skilled workers is the mix of skills may need retraining or taskforce shifting, uneven distribution in urban vs rural settings, working conditions, such as unsafe work environment, inadequate compensation, motivators or other non-financial incentives (World Health Report, 2006). Skill mix and imbalances compounded in PEPFAR regions that needed to build, maintain, and sustain capacity within PEPFAR-supported implementing partners, local, and national governments that were responsible to meeting and scaling up targets for people living with HIV (PLHIV) and people living with TB (PEPFAR Capacity Building Framework, 2012, OGAC2020).

Furthermore, the Institute of Medicine (IOM) evaluation of PEPFAR programs recommended “Transforming Knowledge Management to Improve Effectiveness” (IOM, 2013). The ability to generate, use, and disseminate knowledge is fundamental for not only care and treatment of PLHIV but also for program management and improvement and, ultimately, for the sustainability of PEPFAR's efforts (IOM, 2013). CDC's workforce of clinicians, health scientists, prevention specialists, epidemiologists, laboratorians, and public health advisors are strategically located in PEPFAR-supported countries to work directly with Ministries of Health and other local partners to build institutional capacity (PEPFAR,

2013). CDC's decade-long relationships with Ministries of Health have inspired the trust and on-the-ground collaborations that supports the transfer of knowledge and skills that are essential to implement and sustain an effective HIV response

The recognition that implementing HIV care and treatment would need additional emphasis to build a health care workforce, especially nurses, clinical officers, laboratory personnel, and pharmacists, among others and train them to provide high quality care. To sustain these efforts as well as addressing mentorship of clinical faculty, innovative and cost-effective means for workforce training and expansion are needed (UNAIDS, 2006).

Leveraging technology for knowledge dissemination is already a part of allopathic medical training and education (Mullan *et al*, 2012). The ECHO model builds upon this foundation and expands capacity by sharing knowledge, disseminating best practices, and building communities of practice (Struminger *et al.*, 2017). Routine ECHO model encourages coaching, and mentoring between CDC, public health specialists, and local providers' while strengthening systems and supporting these capacity building efforts. Overtime, local providers acquire the knowledge and skills to treat patients with complex conditions — such as HIV, TB and other health conditions — and manage these patients within their local communities.

Project ECHO helps address most intractable public health problems, including inadequate or disparities in access to care, rising costs, systemic inefficiencies, and unequal or slow diffusion of best practices not only in the United States but across the globe (Struminger *et al*, 2017). Project ECHO has expanded worldwide, in urban and rural areas, at service delivery and academic institutions, for a multitude of conditions and diseases. Currently, there are more than 650 functional ECHO Programs addressing more than 70 conditions to over 70,000 learners in in more than 40 countries (<https://echo.unm.edu/echos-impact>). Two noteworthy global initiatives of Project ECHO focus on HIV

and tuberculosis (TB). These programs have rapidly expanded across Africa, Asia, and Latin America to provide supportive care for the programmatic management of HIV, and TB, including the most difficult to treat form of multidrug resistant TB (MDR TB). In addition to improving direct patient care, these programs include laboratory strengthening, and data management activities. PEPFAR has been a supporter of leveraging Project ECHO to address the global HIV/TB epidemic, to share most recent guideline, offer treatment and care options to those suffering from HIV and TB, by reaching out to the physicians in difficult to access in remote and rural communities (OGAC, 2011).

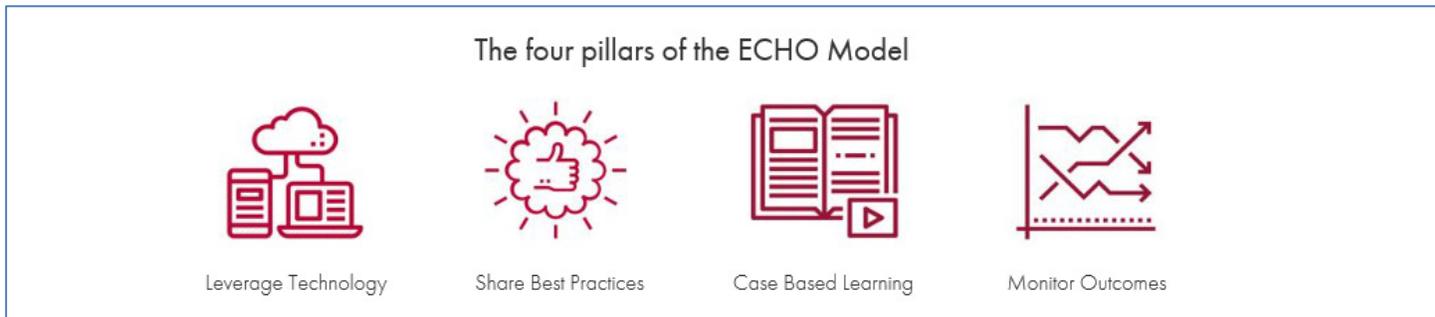
B. Project Extension for Community Healthcare Outcomes (ECHO)

Extension for Community Healthcare Outcomes (ECHO) is an educational initiative and a movement to de-monopolize knowledge and amplify capacity to provide best-practice care for underserved people all over the world (Arora *et al.*, 2007). Dr. Sanjeev Arora, a gastroenterologist (liver disease doctor) in Albuquerque, NM, was frustrated that thousands of patients with hepatitis C (HCV) could not access effective treatment due to lack of specialists in the many rural communities of New Mexico (Arora *et al.*, 2007). Since only two clinics in the entire state provided specialized care for HCV, Dr. Arora was inspired to develop an innovative intervention that could increase access to high-quality care in rural settings without having to travel long distances. In 2003, ECHO was born with a philosophy of leveraging technology to bridge geographical isolation by connecting high-quality distance medical education to diagnose, treat, and manage patients with complex diseases (Arora *et al.*, 2007).

The ECHO model includes four core components: *A: Amplification of knowledge by leveraging technology to bridge geographical gaps, B: share best practices to reduce disparity, promote mentorship, and guided practice, C: case-based learning to master complexity, and D: database utilization to monitor outcomes* (Arora *et al.*, 2007). As adaptation and implementation of the ECHO model expanded globally, policymakers recognized the potential of ECHO to exponentially expand

workforce capacity to treat more patients sooner, and with higher quality using existing resources (Struminger *et al.*, 2017).

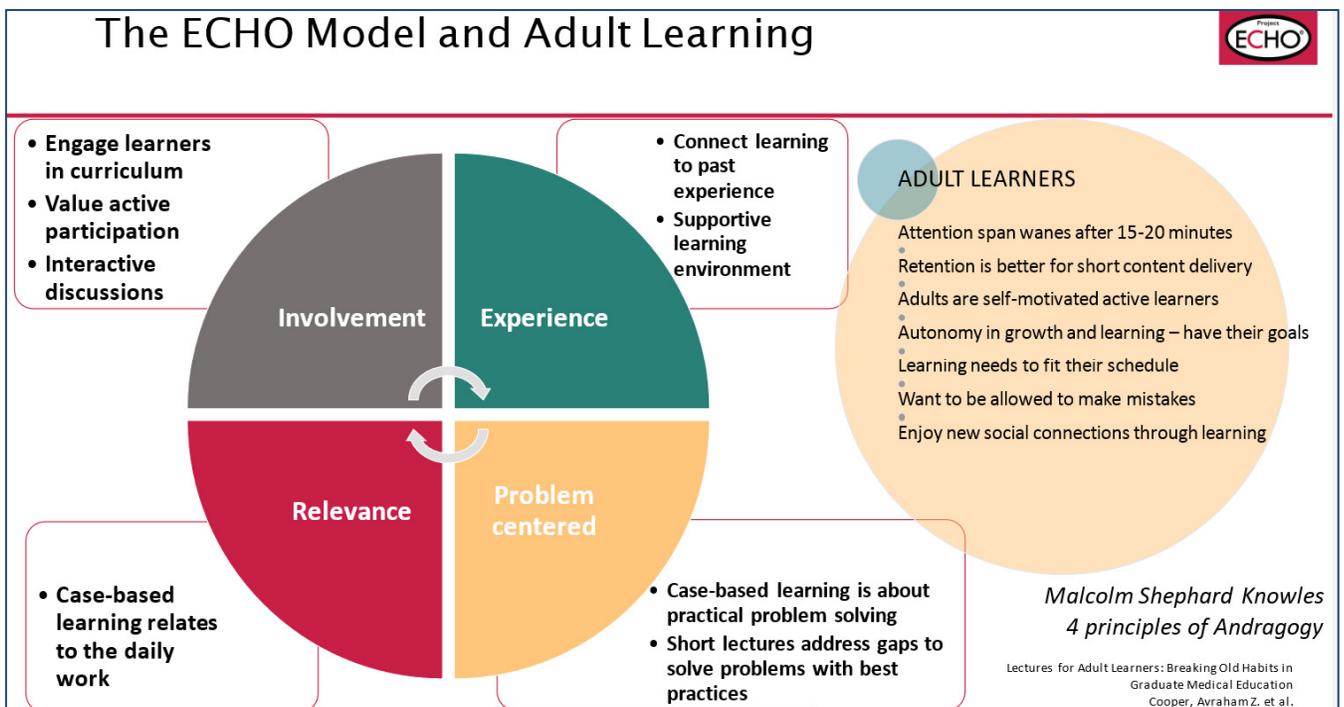
Figure 2 The four pillars or the ABCD of the ECHO model



Source: <https://www.echoindia.in/about/>

The theoretical basis of the learning process in Project ECHO incorporates three theories of adult learning (Arora *et al.*, 2010): Social Cognitive Theory (Bandura *et al.*, 1991), Situated Learning Theory (Lave *et al.*, 1991) and Community of Practice Theory (Vygotsky *et al.*, 1978). Project has been heavily influenced by these theories. As seen in Figure 3, Malcolm Knowles' andragogy (adult learning) makes the following assumptions about design of learning: (1) Adults need to know why they need to learn something (2) Adults need to learn experientially, (3) Adults approach learning as problem-solving, and (4) Adults learn best when the topic is of immediate value (Knowles, 1984). In practical terms, andragogy means that instruction for adults needs to focus more on the process and less on the content being taught. Strategies such as case studies, role playing, simulations, and self-evaluation are most useful. Effective and successful instructors adopt a role of facilitator or resource rather than lecturer or grader (Cooper *et al.*, 2017).

Figure 3 The ECHO model and adult learning



Source: Knowles' 4 principles of Andragogy (adult learning)

Social Cognitive Theory describes three key characteristics that increase a person's confidence to change their behavior: (1) and reinforcing the new information through positive feedback from the clinical mentor and hub team through follow-up interactions (*i.e.*, emails, phone consultations), and by additional resources and materials (Arora *et al.*, 2007, Arora *et al.*, 2010, Arora *et al.*, 2014); (2) direct positive reinforcement by persons in influential positions after engaging in the new action (Bandura, 1986, Bandura, 1991); (3) personal belief that acting upon new information will outweigh the costs of continuing with the status quo or doing nothing; (4) self-efficacy to implement and perform the new action (Bandura, 1991).

Situated Learning Theory suggests that collaboration and social interaction contributes to successful learning (Lave, 1991). If providers perceive themselves as part of a community of peers, it creates ownership and commitment to the cause, along with a learning benefit beyond what other traditional trainings or one-on-one mentoring provide. This theory builds on the *Situated Learning Theory*; whereby social interaction and collaboration enhance the learning process to build the same technical knowledge and skills in a community of learners (Komaromy, 2016).

Finally, the *Communities of Practice Theory* suggests that the benefit from shared knowledge can lead to higher productivity (Struminger *et al.*, 2017; Braithwaite, 2009; Komaromy, 2016). Project ECHO differs from self-guided, online, or virtual education programs by maximizing ongoing interactions with peers and experts, using a virtual platform to connect people in a “All teach, all learn” environment (Arora *et al.*, 2014) (Figure 5). This includes a continuous mentoring program encouraging collaborative learning and coaching not only from experts, but also, through peer-to-peer feedback and interaction (Komaromy, 2016). Thus, Project ECHO’s tele mentoring model supports multiple learners to create a community of practice, in the spirit of “All teach, all learn”. This differs from traditional telemedicine. Most telemedicine programs are synchronous, where a provider gives advice to a single patient or another provider in real time using virtual technology. ECHO also differs from eConsults. eConsults are asynchronous, where a specialist gives advice to a provider for a single patient through an electronic medical record, and not direct, person-to-person interaction. Thus, ECHO design has a potential “force multiplier effect,” to re-imagine healthcare delivery (Arora *et al.*, 2014). ECHO participant health-care providers are offered an enormous opportunity to extend their technical expertise and medical knowledge through active participation in communities of practice with potential impact on the larger society. ECHO clinicians are empowered to provide better care to more people (Arora *et al.*, 2010, Arora *et al.*, 2014).

C. Proof of Concept Countries: India and Tanzania

Project ECHO built workforce capacity in various global settings. I am purposefully selecting India and Tanzania to be the proof of concept countries for my dissertation. Proof of concept is a realization of a certain method or idea in order to demonstrate feasibility, or verifying a concept or theory has practical potential (Rabinowitz *et al*, 2013). India bears a disproportionate proportion of the world's tuberculosis (TB) burden (3 million of the 10 million persons with TB in 2018), including the most people with MDR TB (130,000 persons of the 550,000 persons with MDR TB in 2018) (WHO, 2019). Tanzania is one of the 13 high-priority PEPFAR countries from the HIV epidemic perspective and is approaching epidemic control of HIV. Both HIV and TB are infectious diseases that require a multi-disciplinary team to manage, prevent, and control. Project ECHO is a viable approach to manage MDR TB patients and HIV patients, disseminate new guidelines, share best practices and experiences. Project ECHO can also be used as a platform for programmatic scale-up.

PEPFAR implementation partners funded by CDC/interagency monies, play an important role in ECHO programs, usually in collaboration with the national Ministries of Health (OGAC, 2020). There are the two primary implementing partners for ECHO in India and Tanzania who are critical stakeholders: National Institute of TB and Respiratory Disease (NITDR), and University of Maryland-Baltimore (UMB), respectively.

(i). National Institute of TB and Respiratory Disease and MDR-TB management in India

The National Institute for TB and Respiratory Disease (NITRD), located in New Delhi, India, is a national center of excellence and a multi-specialty hospital that manages >1,000 MDR TB patients annually (Singla *et al.*, 2015). In India, approximately one out of five persons needing MDR TB treatment actually receive it, and among those who do receive treatment, less than half (48%) who start treatment finish successfully (CTD, 2016). These rates are driven by treatment failure, loss to follow-up, and

premature death. In 2017, the proportion of deaths during MDR TB treatment in India was higher than the global average (20% vs. 14%) (CTD, 2018; Naik *et al.*, 2018). NITRD has been a leader in adopting innovative strategies for health education and service delivery. As an early adopter of Project ECHO in 2016, NITRD has leveraged technology to implement a collaborative model of medical education and clinical care management by using a multipoint video conferencing to enable virtual communities of practice for their MDR TB practice. NITRD connects specialist teams at local, regional, and international academic medical centers and centers of excellence with district level teams of doctors, nurses, laboratorians, pharmacists, and community health workers across the globe (Struminger *et al.*, 2017).

The TB ECHO model at NITRD offers an opportunity to build communities of practice through collaborations between National Centers of Excellence, the Revised National TB Control Program, now called National TB Elimination Program (NTEP), Central TB Division (CTD, 2017), and local community health partners in an ‘all teach, all learn’ interactive format (India TB Report, 2020). During NITRD-facilitated ECHO sessions through their hubs, local providers receive expert consultation, support, case-based learning, and guided practice to treat patients with complex TB (*e.g.*, MDR and XDR TB, extrapulmonary TB disease, complex TB cases with other comorbid conditions such as diabetes mellitus, hepatitis, and other non-specific respiratory diseases) in their own communities. The learning sessions offer an opportunity for District TB Officers (DTOs) to present complex TB patient cases and programmatically relevant challenges. The ECHO format fosters discussion regarding the case presentation by a district TB team with medical specialists at the NITRD. Individualized case recommendations are offered as well. Through regular engagement through bi-monthly engagement via video conferencing, that involves coaching and mentoring in tele ECHO clinics, providers and public health specialists become experts and over time as they acquire the knowledge and skills to treat patients with complex conditions — such as MDR TB — and manage these patients within their local communities.

Since November 2016, NITRD facilitated more than 150 ECHO sessions, reaching more than 200 community partners. The recently released revised guidelines for PMDT in India included a subsection endorsing the ECHO model to “improve quality of care for DR TB patients in India” (CTD, PMDT, 2017). Moreover, the Ministry of Health (MOH) had expressed interest in expanding TB ECHO to all states of India; however, there is no national plan for the coordination and expansion of TB ECHO activities and no standardized, national curriculum for ECHO-based PMDT service delivery, nor has an evaluation plan for the implementation scale-up plan been established by the NTEP.

(ii). University of Maryland-Baltimore and HIV management in Tanzania

Tanzania is one the 13 PEPFAR high-priority countries, with 1.6 million people living with HIV. The estimated prevalence of HIV in the adult general population is 4.6% (UNAIDS, 2018). Each year, approximately 72,000 people become newly infected with HIV and 24,000 people die from an AIDS-related illness in Tanzania (UNAIDS, 2018). PEPFAR has supported the Government of Tanzania to implement HIV care, treatment, and prevention through health systems strengthening. Scaling-up access to ART helped Tanzania minimize the impact of the epidemic. The United Nations AIDS Scale Up Goals aim to diagnose 95% of all HIV-positive persons, provide ART for 95% of those diagnosed, and achieve viral suppression for 95% of those treated by 2025 (UNAIDS, 2018). As of August 2019, 78% of Tanzanians know their HIV status; of whom 92% are on current treatment (71% of all people living with HIV) and, 87% are virally suppressed (62% of all people living with HIV) (PEPFAR, 2019). However, the focus for the country has been case finding and index testing. Despite the efforts to meet PEPFAR target, structural, legal, and social barriers to services exist (PEPFAR, 2020). According to WHO, Tanzania has one of the lowest physician-to-patient ratios in the world, with just 0.04 physicians per 1,000 people as of 2014 (CIA Factbook, 2020). The lack of doctors and medical professionals is more pronounced in rural areas, where there are often no physicians or medical care professionals available to manage complex HIV patients (Mbaruku *et al.*, 2014).

Gaps remain in HIV service delivery. HIV specialists practice primarily in large referral hospitals. The ability to manage complicated HIV patients in other locations of the health care delivery system are lacking. In addition, available specialists are not able to provide regular mentorship and supervision of health care workers in the peripheral health facilities. To address these gaps, innovative approaches are needed. Tanzania has been using the HIV ECHO model offers an opportunity to build bridges between Ministry of Health (MOH), National Association for AIDS Control Program (NACP), CDC country offices, large hospitals, implementing partners, and local community health partners in an ‘all teach, all learn’ interactive format. During ECHO sessions, local providers including medical and nursing professionals receive expert consultation, support, case-based learning, and guided practice to treat patients with complex HIV (*e.g.*, advanced HIV disease, side-effects monitoring, with other comorbid conditions such as diabetes mellitus, hepatitis, and TB) in their own communities. The learning sessions offer an opportunity for regional HIV Control Medical Officers and health care providers to present complex patients and programmatically relevant challenges. ECHO fosters discussion among multi-disciplinary medical specialists, MOH, CDC, laboratorians, and pharmacists. Individualized patient recommendations are offered along with didactic knowledge disseminating information. ECHO offers an opportunity for local clinicians in remote locations to seek guidance and support from subject matter experts in larger referral hospitals. The didactic presentations are based on a HIV curriculum developed to meet the needs of providers and through the use of national HIV guidelines and evidence-based practices. The training curriculum includes topics such as ART adherence support; drug-related adverse event surveillance and management; drug resistance, and second-line treatments; laboratory and diagnostics, neurologic manifestations of HIV; and managing opportunistic infections such as cryptococcosis, hepatitis, TB, multidrug-resistant TB, and toxoplasmosis. Additionally, the HIV ECHO platform is used to support the national dissemination of new guidelines and provides a venue for mentoring the rollout and scaleup of new guidelines. UMB has facilitated 37 weekly ECHO sessions

since November 2018. Over 75 facilities are registered, including 1000 participants attending over all [Personal communication with Dr. Brenna Roth, UMB, December 2019).

The Tanzania HIV ECHO has ambition to become a super-hub. An ECHO super-hub entails an organizational infrastructure and experience to train and support other hubs within the ECHO system. Sub-hubs are expected to maintain high fidelity in order to continue the effective growth of the ECHO movement and contribute to the larger goal of touching 1 billion lives by ECHO (Struminger *et al*, 2019). A comprehensive evaluation framework is required to translate knowledge into practice, build sustainable communities of practice, and ultimately improve the treatment outcomes of the patients they treat. Currently, there is no formal evaluation plan for assessing ECHO implementation within Tanzania, even in the face of the rapid and extensive expansion. It will be difficult to monitor fidelity during the expansion without a formal evaluation plan. At this point it is unknown if participants of the HIV ECHO sessions are able to increase knowledge, translate knowledge into practice, build sustainable communities of practice.

D. Emerging Need to Develop an Evaluation Framework to assess Quality of Implementation

Quality of ECHO implementation is affected by various factors related to patients themselves, providers, communities, and the type of intervention or innovations. The collection of implementation data for various aspects of program process, outcomes, and improvement (*e.g.*, delivery [organizational functioning], training, and technical assistance) are essential features of program evaluations. More information is needed on which, and how, various factors influence ECHO implementation in different community settings is especially relevant in the context of scale-up plans. Since high-quality implementation is a bridge that closes a gap between an organizational decision to adopt an intervention and the routine use of that intervention, stakeholders play an important role in transitioning and

sustaining innovative, consistent, skilled, and committed health care providers in their use of an intervention.

It is important to ensure an evidence-based program is implemented with high quality in order to achieve the intended effects. High-quality implementation should be the standard for program replication and expansion. Continual quality improvements (CQI) and periodic evaluations may inform local practice, funding, and public policy. The importance of maintaining high-quality implementation has been studied in several areas, including education, mental health, health care, technology, industry, and management (Serhal, 2015). Moreover, implementation is important regardless of characteristics of the target population, the type of program, or specific program goals. Thus, it is necessary to understand factors that support a high-quality ECHO implementation for any disease condition including my case study examples HIV and TB. Developing an adaptable framework with a toolkit to monitor progress, assess potential successes, and develop explicit recommendations for broader scale-up and use would have global implications. A standard set of reproducible monitoring and evaluation tools could ensure standardized process steps for replication and sustainability. This may help facilitate country ownership by providing the skills needed for local partners will take on more leadership and direct program implementation roles over time, and international partners transition to technical assistance roles. This transition to local partners under PEPFAR has been underway in many country programs for some time; however, it has not been systematically integrated into in all aspects of PEPFAR programming.

To achieve significant impact and sustainable improvements, it is imperative to evaluate program implementation. Program evaluation is “the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future program development (Patton, 1997). Systematic and routine assessments of stakeholder inter-relationships, with multiple perspectives, are required to reflect on the boundary choices through a system thinking approach (Williams *et al.*, 2014). Stakeholder

perspectives are even more relevant to solve complex adaptive challenges (Heifetz, Grashow, and Linsky, 2009) such as developing a monitoring and evaluation (M&E) framework for an already established program such as Project ECHO.

Complex adaptive systems (CAS) such as of NITRD Project ECHO or UMB HIV ECHO are set in dynamic environments, interacting with a wide variety of stakeholders, interests, and factors, often with disparate demands (Rouse, 2008; Tolf, 2015). Project ECHO in both India and Tanzania, have complex multi-layered systems. These systems have been changing inherently over time, with adaptation and learning being unpredictable. Such systems are called agile systems defined as “the ability of an organization to thrive in a continuously changing, unpredictable environment” (Dove, 1999, p19). Understanding the influence of the various stakeholders of an agile system such as Project ECHO implementation, in two different global settings of India and Tanzania will be essential towards the development of a sustainable, adaptable evaluation framework.

E. Problem/Opportunity Statement

Project ECHO leverages technology to demonopolize knowledge, and bridge gaps in geography, share best practices to reduce disparity, promote mentorship, and guided practice, through case-based learning and monitoring participation through a database. Currently, there are over 70,000 learners and 650 ECHO Programs in more than 37 countries globally for more than 70 diseases and health conditions (<https://echo.unm.edu/echos-impact>). In the past decade, Project ECHO has rapidly expanded across Africa, Asia, and Latin America supporting care and treatment for HIV and TB, as well as laboratory strengthening activities. Despite addressing healthcare system’s most intractable problems, including inadequate or disparities in access to care, rising costs, systemic inefficiencies, and unequal or slow diffusion of best practices, a systematic framework to assess quality of implementation of Project ECHO has not be undertaken. Quality of implementation is affected by various factors related to patients

themselves, providers, communities, and the type of intervention or innovations and the collection of implementation data for various aspects of program process, outcomes, and improvement, more information is needed on which, and how, various factors influence ECHO implementation in different country settings. This clinical education and workforce development, capacity building, and system strengthening initiative, especially in resource-constrained settings gained more momentum due to strong renewed commitment by the Ministries of Health in India and Tanzania to accelerate and advance the millennium development goals of ending TB and controlling HIV epidemic in the world by 2030.

Stakeholders play an important role in transitioning to become innovative, consistent, and skilled participants, committed to ensuring an evidence-based program to achieve the intended effects. High-quality implementation should be the standard for program replication and expansion. Furthermore, the concept of “high-quality” implementation fits an appreciative inquiry, assets-based approach, identifying and building on already existing implementation capacity.

Engaging stakeholders in self-determined change may be acceptable and supportive of capacity building in the context of global public health work in low- and middle-income country settings. Stakeholders who attend and facilitate ECHO sessions will help in identifying preliminary elements of high-quality ECHO implementation in these two disparate settings through a proof of concept of a comprehensive evaluation framework. It will be important to design practical systems for data collection, analysis, and routine monitoring in the short-term that will help with measuring process impact as well as setting up systems for more effective long-term monitoring of patient outcomes. Furthermore, it will help document short-term success in achieving interim or long-term outcomes in a context where population or patient-level outcomes cannot be shown in the shorter term. This comprehensive evaluation framework with a compendium of tools will help ECHO programs more effectively plan, develop, implement, monitor performance, improve quality, and routinely measure public health impact of ECHO

activities sustainably over time. Assessing feasibility and acceptability of this evaluation framework should be valuable for ECHO programs in resource-limited settings globally.

F. Study Objective

The objective of the study is to develop a proof of concept for a comprehensive evaluation framework with a compendium of tools designed to assess quality of ECHO implementation in routine practice.

G. Research Questions

1.) What are the stakeholders' perceptions of high-quality ECHO implementation?

- (i) What are the stakeholders' perceptions of high-quality ECHO implementation in India and Tanzania (proof of concept countries)?
- (ii) How do stakeholders' perception of high-quality ECHO implementation compare within and between stakeholder groups in India and Tanzania?

2.) How acceptable and feasible is it to apply a modified appreciative inquiry-based SCORE approach?

- (i) How reliable are the items in the evaluation form that measure acceptability and feasibility for SCORE workshop evaluation?
- (ii) How do stakeholders' acceptability and feasibility of using a modified appreciative inquiry-based SCORE approach compare within and between stakeholder groups in India and Tanzania?

3.) What does a comprehensive evaluation protocol and compendium of tools entail that assesses ECHO implementation quality?

4.) What is the validity and acceptability of a proposed adaptable comprehensive evaluation framework, including a modifiable toolkit, designed to assess the quality of an ECHO implementation?

- (i) How well are the *a priori* constructs and data collection tools actually measuring what they are supposed to measure programmatically (Construct validity)?
- (ii) What is the feasibility and acceptability of the evaluation framework and compendium of tools that assess quality of ECHO implementation?
- (iii) What are the recommendations to improve acceptability and usability of the evaluation framework and compendium of tools that assess quality of ECHO implementation?

H. Leadership Implications and Relevance

There are several leadership implications.

“Now more than ever, to succeed in global health, we need to find the outliers, the exemplars...Often things fail not because there are no good examples to copy from, as well as local processes and appetite to do such copying is lacking. Most health systems are somewhere in the middle of successes and failures. We need to pay attention to how successes and failures sit together, uncomfortably”.

Dr. Madhu Pai (McGill University) [Forbes article, July 13, 2020](#)

Utility of a standardized monitoring and evaluation framework and toolkit for Project ECHO

Project ECHO is committed to addressing the needs of the most vulnerable populations by equipping communities with the right knowledge, at the right place, at the right time. In 2018, out of the 1.7 million people were treated for TB by the Indian government. However, an estimated 2.2 million people with TB were presumed to have received care in the largely unregulated private sector (Arinaminpathy *et al.*, 2016) and an additional 1 million people with TB remained undiagnosed or otherwise not linked to care (Pai *et al.*, 2017). As stated by Moonan *et al.*, finding, treating, and following these patients to cure is an enormous task. This will require “constant innovation, persistent program monitoring and evaluation, and locally-driven solutions to address the diverse and dynamic tuberculosis

epidemiology” (Moonan *et al.*, 2018). To achieve tuberculosis elimination in India or HIV control in Tanzania, evidence-based, cost-effective and sustainable interventions (Pai *et al.*, 2017, Moonan *et al.*, 2018) are imperative.

The Government of India has set an ambitious goal for TB elimination, whereby reducing the national TB incidence rate from >1,250 cases per million people to <100 cases per million people within the next decade (Uplekar *et al.*, 2015). In a national address, Prime Minister Modi called for innovation, and building communities of practices (ND Modi, 2018). While the ECHO model was not specifically named in the Prime Minister’s address, there is potential for virtual communities of practice (vCoP) models such as ECHO to play a major role. Just recently, the Indian Prime Minister’s Office, declared that the ECHO program will be expanded nation-wide (India TB Report, 2020). To help facilitate this process, recently ECHO Trust secured \$20 million in philanthropic grant funding, including \$10 million from Co-Impact (a consortium of philanthropists including Nandan and Rohini Nilekani, Bill and Melinda Gates, the Rockefeller Foundation, the Skoll Foundation, among others) and \$10 million from TATA Trust (India’s largest donor foundation). The priority focus of this funding will be to support TB, mental health services, and viral hepatitis ECHO programs in India. This project, along with CDC partnership will demonstrate leadership in guiding the core processes for monitoring and evaluating high-quality ECHO implementation.

Similarly, HIV ECHO program in Tanzania offers a unique opportunity to demonstrate leadership in Africa through this proof of concept that will help in building evaluation capacity and institutionalize conducting routine monitoring and evaluation activities. Routine mentoring of the Ministry of Health and implementing partners will emphasize workforce capacity building. Instilling ownership and willingness to impart knowledge to impact public health outcomes will make implementation of ECHO as well as

routine monitoring for continuous quality improvement and evaluating impact long-term will make the implementation of ECHO more sustainable.

This comprehensive evaluation framework and toolkit will help assess and improve TB and HIV programs not only in India and Tanzania, but also other programs globally, especially in low resource settings. We seek to more effectively develop, implement, monitor performance, and improve the quality of ECHO activities. This framework and modifiable tools will be available for use by anyone interested in ECHO implementation across the world. Lessons from the study can help inform potential enhancements to the ECHO implementation model, improve the quality of interactions of the participants, foster translation of knowledge into practice, guide building and expanding sustainable communities of practice, and ultimately supporting the Millennium Development Goals (MDGs) related to TB, HIV, more efficiently (Chibba, 2011).

Routine Programmatic, yet customizable M&E toolkit for PEPFAR without “Re-inventing the Wheel”

There is a huge potential to apply this framework and toolkit in a widely growing community of PEPFAR programs throughout the world. Since the initial launch of the Namibia HIV ECHO – Project ECHO’s first program in Africa – in November 2015, Project ECHO’s presence in Africa has grown to more than 22 programs in 13 countries (<https://echo.unm.edu/global-echo-initiatives-in-hiv-tb-and-laboratory-science/>). Namibia has conducted an evaluation, however additional, over 12 new programs are in different stages of development and implementation in ten existing and additional countries (<https://echo.unm.edu/global-echo-initiatives-in-hiv-tb-and-laboratory-science/>). Through partnerships with the Africa Centers for Disease Control (Africa CDC) and the African Society of Laboratory Medicine (ASLM), ECHO engages spoke participants in more than 12 countries. Partners at Ministries of Health all over the continent are recognizing the potential of the ECHO model™ to more effectively build workforce capacity across health systems. East Africa has programs in Kenya, Tanzania, Uganda,

Ethiopia and South Sudan. Kenya launched the first TB ECHO in Africa in 2016 and an HIV ECHO later that year. The TB ECHO program added a pediatric TB ECHO in Western Kenya. The Africa CDC's Regional Collaborating Centre for East Africa in Kenya operates as an ECHO hub, connecting over 10 countries in the region for discussion of infectious disease outbreak situations and the implementation of International Health Regulations.

In Central and West Africa, the first francophone ECHO in Africa for HIV care and treatment launched at the end of 2017 in Côte d'Ivoire (<https://echo.unm.edu/global-echo-initiatives-in-hiv-tb-and-laboratory-science/>). Nigeria implemented a HIV ECHO in the spring of 2018 and recently launched an Integrated Disease Surveillance and Response (IDSR) ECHO fall of 2019. The Africa CDC connects senior public health officials across Central Africa from about ten African Union member states to share information on infectious disease outbreaks in the region. This established network has helped to address the recent Ebola outbreaks in the Democratic Republic of Congo. In addition to the Namibia program, Southern Africa has active ECHO programs in Zambia and South Africa. The Infection Control Africa Network (ICAN) launched a multi-country Infection Control ECHO in spring 2018. The Africa CDC Southern Region RCC operates a hub in Zambia, connecting 10 countries for information sharing on IHR implementation. ECHO is a partner in Zambia on the Health Workforce for the 21st Century (HW21) initiative, as part of a consortium led by JHPIEGO and funded through the Health Resources & Services Administration (HRSA); tele ECHO programs with a focus on HIV have launched across four regions in the first year. With the “mushrooming” effect of ECHO expansion, I anticipate much interest and need to utilize an already validated evaluation framework with customizable data collection tool without “re-inventing the wheel”.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

A. Literature Review

As part of understanding theoretical concepts related to the ECHO program as well as a variety of evaluation frameworks including the sustainability framework, I have searched PubMed, the Grey literature and synthesized more than 60 peer-reviewed publications using key word searches (Keywords included: ECHO evaluation, evaluation framework, implementation framework, evaluation of ECHO implementation). This search was the foundation of the constructs that support my *a priori* codebook as well as design for my research. While reviewing various evaluation frameworks as well as review papers on ECHO evaluations conducted thus far, there were no predefined measures, pre-determined indicators, pre-post assessments, nor baseline data available for work in India and Tanzania. Thus, a developmental evaluation (DE) approach was deemed most appropriate. Moreover, because stakeholder engagement is a key element of the ECHO model, co-creation and participatory approaches to developing the framework and tool were highly desirable. Thus, an appreciative inquiry approach using the developmental evaluation (DE), participatory action research methodology was the main theoretical framework (see details below in conceptual framework).

Appreciative Inquiry to co-create an evaluation framework

Appreciative inquiry is a positive, strength-based, participatory methodology that seeks to discover the best in people and their organizations (Stratton, 2010). An Appreciative Inquiry approach to engaging stakeholders in understating their perspectives about ECHO was chosen for this DrPH research because focusing on strengths support co-development and self-discovery towards a strategic change. Since there is buy-in from the participants themselves, this approach of inquiry aligns well with developmental evaluation and qualitative data collection. The emphasis is on participatory approach to co-creating an evaluation framework by examining *how* a successful event or experience occurred so that

it could be replicated (Hammond, 2013). According to Burkus (2011), appreciative inquiry aims “to bring out the best in people, organizations, and the world around them and to do so by developing a culture that appreciates strengths (Figure 4). Appreciative Inquiry was used to focusses on strengths, opportunities, aspirations, and results (SOAR). This approach is in contrast to SWOT that highlights weakness, and is draining for stakeholders, the basic questions to be answered are: (i) What are the greatest strengths of the ECHO program? (ii) What are the challenges that are impediments to a successful ECHO implementation? (iii)What are best possible opportunities to leverage for a preferred future? What are the measurable results that will tell us we’ve achieved that vision of the future?

SOAR approach differs from a traditional SWOT approach since the focus and framing for SWOT is on weakness, and threats focusing on negativity than the reframed counterpart of opportunities and alternative approached of SOAR (Stavros, 2009). As shown in Figure 4, While SWOT is based on competitiveness, and “Just be better” attitude, SOAR is based on potential “be the best possible”. While evidence shows SWOT leads to incremental improvement, SOAR focuses on value generation and innovation. Needless to say, SWOT is based on a hierarchical organizational top down approach, stakeholder engagement is key for SOAR making this an appropriate methodology for my research. While SWOT focus on strategic planning and analysis, SOAR focuses on planning and implementation. And last but not the least, while SWOT pays attention to gaps, the idea to conduct SOAR is to pay attention to results (Stavros and Cole, 2013).

To my knowledge an appreciative inquiry approach has not been used as a method including Challenges, understanding of Opportunities and aspirations towards a vision in the short- and long-term, moving towards measurable Results and then Evaluating the process of SCOR itself (SCORE).

Figure 4. Comparison of SWOT vs SCORE



Source: Short video from Jon Townsend: <https://appreciativeinquiry.champlain.edu/learn/appreciative-inquiry-introduction/>

Developmental Evaluation

Developmental evaluation (DE) has been applied to complex interventions during early stages of social innovation (Patton, 2011). DE facilitates near real-time feedback to program staff as part of the evaluation process, thus facilitating a continuous development and learning loop (Lewin, 1984a). DE facilitates systems change along the continuum of small-scale, routine, and incremental changes to long-term, larger-scale implementation as they unfold in practice as innovation evolves over time (Carr, 1986, Langley, 2009). The results from this type of feedback stimulates new patterns of behavior and activity that leads to change during the process. Because of the ongoing and changing intensity, quantity, and quality of information generated by the variability of this agile system, the feedback might look different

each time an evaluator examines it. With these new patterns and sense-making processes in place, smaller components within the system will adapt to the changes created through the larger system, in this case, emphasizing a pragmatic systems-thinking approach (Ivankova, 2006; Patton, 2011). This design seems aligned to the described context, so along with action research, may be most suitable to assess whether the ECHO implementation is high-quality or not.

Since Project ECHO recognizes the community of providers, practitioners, implementers, and patients as units of the community. Thus, a pragmatic system thinking approach was conducted to build on strengths and resources within the community, that facilitated a collaborative partnership between and among various partners in the community.

Many social scientists recognize that developing effective interventions is the first step towards improving the health outcomes and impact for a variety of populations. (Durlak *et al*, 2008). In order to establish a system for routine monitoring and evaluation, defining the characteristics of program implementation, program outcomes and impact are needed. The implementation process is influenced by the characteristics of the communities, providers and the program itself (organizational functioning). Several studies have reported various program characteristics that influence implementation (Dane and Schneider, 1998; Durlak, 2008; Hogue, 2005; Hansen and McNeal, 1999). Those most relevant to this research, included: (i) fidelity; (ii) dosage; (iii) quality; (iv) responsiveness; (v) program differentiation; (vi) comparison of conditions of implementation; (vii) participation/reach; and (viii) agility/adaptation.

Fidelity is defined as the extent to which delivery of an intervention adheres to the protocol or program model originally developed (Mowbray, 2003). In a traditional evaluation, criteria for studying fidelity are defined during the evaluation plan. If it is feasible to develop, evaluation frameworks should include measurements for fidelity. Thus, it will be possible to use this framework as the program is

adopted and replicated in new settings. In a complex adaptive system such as ECHO, political, social, and environmental pressures require constant adaptation and evolution beyond what was originally intended.

Dosage refers to how much of the original program has been delivered usually measured by quantity, and intervention's/program strength. Project ECHO is a low dose, high frequency learning model (Rowe *et al*, 2009, Bluestone *et al*, 2013), meaning low cost set up but leveraging technology and following adult learning principals has a multiplier effect. However, the optimal dose, based on time and frequency (*e.g.*, 60 minutes vs 90-minute ECHO sessions vs 120 minutes ECHO sessions once or twice a week, or twice or once monthly) has not been evaluated previously. It is likely the optimal dose will vary depending on the complexity of the problem, and technical knowledge required to address the problem, and the longevity of the community of practice by the ECHO program.

Quality refers to how well program components have been conducted (*e.g.*, are the main program elements delivered clearly and correctly). Quality of implementation is influenced by various factors, including patient characteristics, provider characteristics, community characteristics, and the type of intervention or innovations implemented (Durlak and DuPre, 2008). Thus, this research will collection information on the varying factors affecting programmatic implementation.

Participant responsiveness refers to how well the program stimulates the interest, motivates participation and engagement, or holds the attention of participants – an important criterion for sustainability. In addition, it is important to assess how well the program responds to the needs of the participants. Nigeria ECHO is great example of flexibility, and adaptability of ECHO, where HIV ECHO was initiated in 2018 in Abuja. In the fall of 2019, in order to meet PEPFAR targets to find additional HIV cases and put them to treatment, the existing infrastructure of ECHO began to be utilized to find 500,000 patients with HIV, put them and retain them on treatment by September 2020, focusing on 4 surge states (Comprehensive, Integrated, Resilient ART System -CIRAS presentation, Oct 2019).

Program differentiation involves the extent to which a program's theory and practices can be distinguished from other programs (program uniqueness). ECHO is uniquely positioned to expand within the PEPFAR system, be it TB or HIV. ECHO programs operate differently in different countries focusing on different health conditions, which makes evaluating these programs interesting.

Monitoring of the implementation factors is another important element. This involves describing the nature and amount of services received by members of these groups (exposure to ECHO experience, usual care, alternative services). Program reach (participation rates, program scope) refers to the rate of involvement and representativeness of program participants. There is adaptation, which refers to agility of the program to adapt to changes made in the original program during implementation (program modification, reinvention) while maintaining fidelity. All these elements influence the integrity of the program as it gets replicated and expanded. It ultimately influences whether the program is able to remain effective and high-quality, when it's replicated in different settings, i.e., a proxy indication of sustainability (Schell *et al.*, 2013; Luke *et al.*, 2014)).

Implementation needs evaluation

Implementation is a bridge that closes a gap between an organizational decision to adopt an intervention and the routine use of that intervention (Damschroder, 2009). Moreover, implementation is a constantly changing dynamic process in which key stakeholders become innovative, consistent, skilled, and committed in their use of an intervention such a Project ECHO (Klein *et al.*, 1996). Another definition of implementation refers to efforts designed to get evidence-based programs or practices of known dimensions into use via effective change strategies (Damschroder *et al.*, 2009). The importance of periodically monitoring program implementation can help make mid-course adjustments to ensure a sustainable high-quality implementation (Meyers *et al.*, 2012). For example, an evidence-based program may fail in one setting due to poor implementation, but the same program may be successful in another

setting when it is implemented with high-quality. Or implementation may not be as impactful due to lack of adjustments to different cultural, environmental, or social contexts. A DE approach to developing a monitoring and evaluation (M&E) framework with a toolkit can help practitioners within the system identify what works for them, build on it, and share both specific innovation and lessons learned about the process of adaptation with others in the Communities of practice (CoP) (More on this later on Page 45). An appreciative or assets-based approach to assessment was undertaken to develop this framework. High-quality implementation is the joint responsibility of multiple stakeholders who typically include funders, policy makers, program developers, researchers, local practitioners, and local administrators (Durlak, 2012). Ideally, the program is a co-creation in which everyone has a stake and some responsibility for its success.

Understanding multiple stakeholder perspectives', relationships, and the boundaries through a pragmatic system thinking lens (Williams, 20012) will be key to evaluating a high-quality ECHO implementation. Various evaluation frameworks and reviews focused on health care (Greenhalph *et al*, 2005; Damschroder, 2009; Serhal *et al* 2018), bring consensus on the factors needed for high-quality implementation. The relative importance of each factor and how different factors may interact to influence implementation has helped me develop this conceptual framework.

For example, some factors to consider for achievement of a high-quality ECHO implementation include societal- or community-level factors, including political will, policy requirements by MOHs, and the availability of funding. Some factors are related to whether local practitioners perceiving a need for the program and recognize its potential benefits. Yet others pertain to the characteristics of the organization conducting the program; such as, engaged and motivated leadership that promoted innovation, and are open to change, and flexible in practice in order to achieve desired outcomes (Durlak, 2013).

Lack of developed benchmarks or indicators of success to measure progress and/or change, as well as good monitoring and feedback system can help identify when problems may be hindering quality implementation (DuFrene *et al*, 2005; Greenwood *et al*, 2003). Changes related to leadership and staff, sudden budget re-authorizations, lack of direction, and guidance may lead to unfavorable or favorable implementation outcomes, organically. To achieve high-quality implementation, the process needs to be given sufficient time. Because the quality of implementation is so important to program outcomes, it is essential to learn what is necessary to achieve this level of implementation. Convergent evidence from various researchers on implementation science has been adapted by Durlak and DuPre, 2008. Twenty-three factors from this systematic review as well as PEPFAR strategy that were categorized into 5 broad categories (i) community- or societal-factors that I plan to study are availability of administrative resources such as funding and implementing personnel, and, political will, (ii) perception of participant practitioner satisfaction, self-efficacy and skill proficiency and practice, capacity building, needs and benefits of programs (iii) programmatic factors such as program activities into routine practice, shared vision and consensus, and (iv) implementation process to adaptability and expansion, (v) host or implementer organizational factors such as integration of study public health impact, effective leadership, and expanding communities of practice.

B. Conceptual Framework

The study's conceptual framework was based on a combination of the ecological models developed by Durlak and DuPree, 2008, and an interactive systems framework for dissemination and implementation (Wandersman *et al*, 2008). A systematic review of peer-reviewed literature of similar models, white and grey literature, and other journal articles along with engagement of variety of stakeholders to assess the constructs formed the basis for development of the conceptual evaluation framework and constructs for data collection for this study. Effective implementation is influenced by five categories: Innovations, Providers, Communities, Organizational capacity, Training and technical

assistance. The conceptual framework for this study has been adapted and influenced by these theories and Moore's conceptual model (Table 2). The twenty-three factors are categorized into 5 main categories:

A. Community-wide or societal factors [(1)scientific theory and research (2) political pressures (3) Availability of funding (4) local, state or federal policies, practioner] B. Practitioner characteristics (5) Perceived need for the program (6) Perceived benefits of the program (7) Self-efficacy (8) Skill proficiency C. Characteristics of the program (9) Compatibility or fit with the local settings, (10) Adaptability D. Factors related to the organization hosting the program [(11) Positive work climate (12) Openness to change and innovation (13) Integration of new programming (14) Shared vision and consensus about the program (15) Shared decision-making (16) Coordination with other agencies (17) Openness and clarity of communication among staff and supervisors (18) Formulation of tasks (workgroups, teams, etc.), (19) Effective leadership (20) Program champion (internal advocate) (21) Managerial/supervisory/administrative support] E. Factors specific to implementation process (22) Successful training (23) On-going technical assistance

As shown in Figure 5, the purple circles and boxes relate to assessment of concepts at individual participants of ECHO and are highly connected to the organizational level factors (thus black solid bi-directional arrows). Research Question 1 (RQ1) assesses the perception of stakeholders on their definition of high-quality ECHO implementation. This data was gathered through the appreciative inquiry approach (see more in Chapter 3). Assessing participation, engagement of participants, participant satisfaction, knowledge gained from capacity building activities, and perception of application of knowledge for patient care and management are included at this level. Measurable constructs were obtained from Phase 1 data collection of the appreciative inquiry-based approach (More in Chapter 3). Additional constructs to answer RQ1 at the organizational level with infrastructure, IT, resources, and logistic details at the secondary level (in grey circle and boxes, Figure 5) shall be disclosed through AI-based Phase 1 of the data collection. Organization procedures, administration of the ECHO sessions

themselves, even though directly affecting the participants and participation, are highly related to the logistical and infrastructural stability aspects of implementation. These individual and organizational factors impact the knowledge translated into practice component of public health impact at the systemic level thus promoting CoP as a whole (green circles and boxes).

A protocol to collect this information systematically and in a standardized way for other ECHO programs was done through the designed protocol which answers RQ3.

Validation of the data collection tools and framework, and lessons learned, and recommendations were addressed through answering (RQ4). Qualitative validation through key informant interviews and document reviews triangulated with Phase 1 findings helped revise tools before implementing them in Tanzania after this dissertation is defended. Actual pilot testing of the proposed evaluation framework and data collection tools was beyond the scope of the dissertation. Detailed description of the concepts at each level and the evidence supporting their selection are elaborated below.

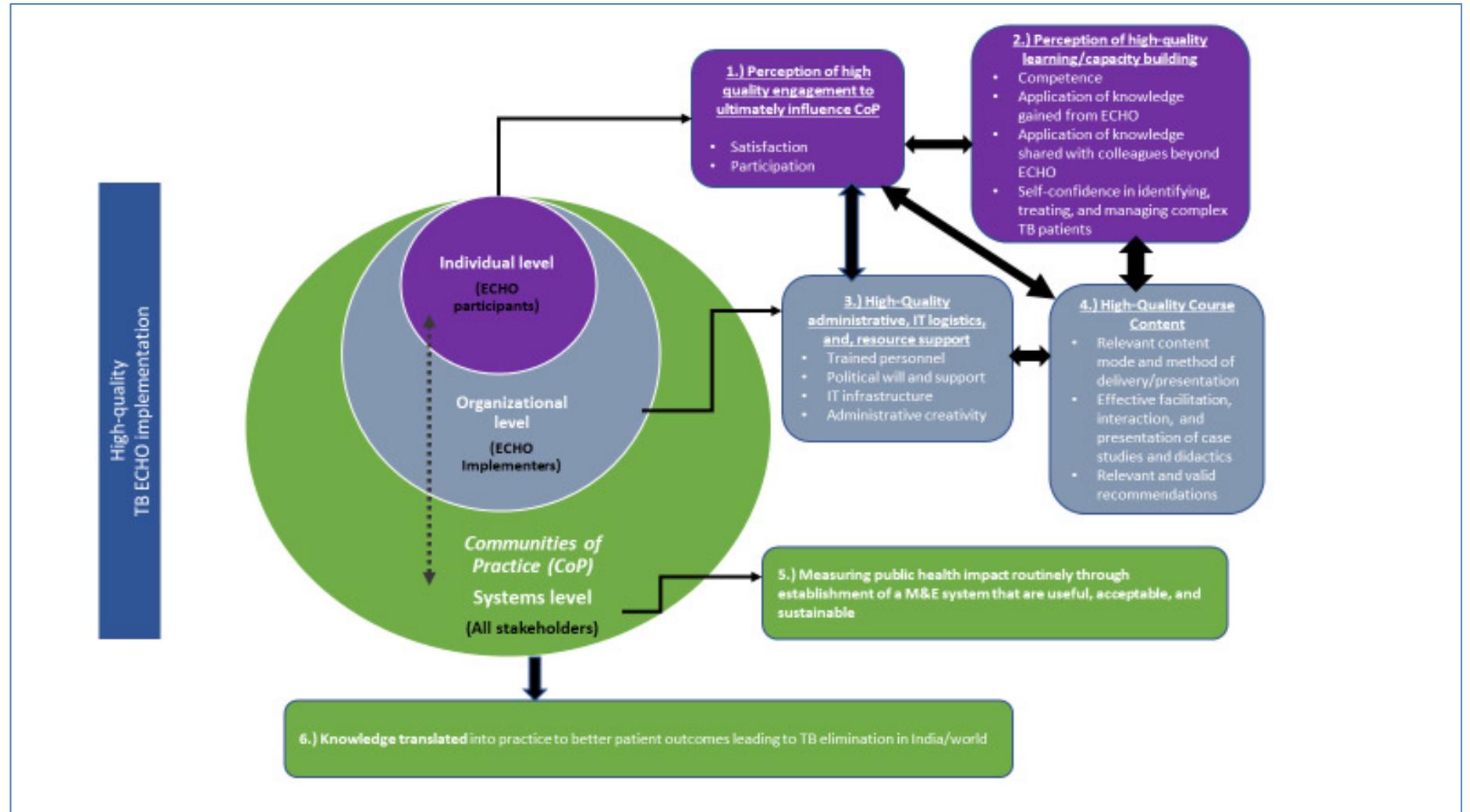


Figure 5. Conceptual Framework with measurable concepts to identify constructs to assess high-quality ECHO implementation

Individual Level (ECHO participants)

The first level of inquiry was at the individual level. Individual perspectives clarified factors that promote participation, engagement, satisfaction, learning, and capacity building at a participant level.

(1) High quality participation, engagement and satisfaction with ECHO program

From Durlak's model, it is important for participants to recognize the benefits of an innovation, feel confident in their ability to understand and perform what is expected (self-efficacy), and have the required skills and proficiency to implement a high-quality and more effective TB ECHO (Barr, 2002; Kallestad and Olweus, 2003; Ringwalt, 2003). Prior ECHO evaluations used frameworks related to Moore's model, that is, from an outcome model from the participant's perspective (e.g., participation, satisfaction, learning, performance, patient health, and community health). At the spoke level, focus will be on the participants in ECHO sessions by the paramedical staff (healthcare workers, laboratory technicians) and the DTOs. Similarly, *Satisfaction* that is measured as the degree to which the expectations of the participants about the setting and delivery of the program and perception of satisfaction from gaining new knowledge (based on Moore's model) shall be of interest for this research.

Zhou's systematic review 39 ECHO programs titled "The Impact of Project ECHO on Participant and Patient Outcomes: A Systematic Review" (2016) provided insights on participation and engagement-related findings (Zhou, 2016). However, none of the included studies were about TB or HIV ECHOs exclusively. One ECHO study included HIV/AIDS as an integrated complex chronic care package (Hepatitis C/psychiatric/HIV/AID/pain management) for civilians and aboriginal population in the Pacific Northwest U.S. (Scott *et al.*, 2012). Not only was there an absence of TB ECHO or HIV ECHO related outcome or impact evaluations, but also none of the studies focused on process or quality implementation related research or evaluations. Also, their finding showed that the median number of participants was 38 (interquartile range of 65). Since both NITRD TB and Tanzania's HIV ECHO

programs reaches more than 150 participants at each bi-monthly TB ECHO and weekly HIV ECHO sessions, this study, if conducted would be much larger with a larger and has a larger potential for impact.

According to Zhou *et al.*, 13 studies contained data from surveys and/or semi-structured interviews indicated a high level of satisfaction with the educational components of the ECHO sessions (Zhou *et al.*, 2016). Also, the way data was collected may influence results since participants may be unwilling to disclose at baseline due to lack of knowledge on a particular topic.

(2) High-quality learning and capacity building

Moore's evaluation framework for continuing medical education (CME) usually measures program outcomes and quality assessments (Table 1). **Learning** measured as the degree to which participants could demonstrate that they know what the program intended them to know (includes both declarative and procedural knowledge); **Competence** measured by the degree to which participants could show in an educational setting how to do what the program intended them to be able to do (includes perceived self-efficacy/self-confidence); **Performance** measured as the degree to which participants could do what the program intended them to be able to do in their practices; **Patient health** is when the health status of patients improved due to changes in the practice behavior of participants; **Community health** is the degree to which the health status of a community of patients changed due to changes in the practice behavior of participants (Moore, 2003). Patient health and community health aspects are beyond the scope of this dissertation which will focus on measuring the first five aspects of Moore's model. A comprehensive literature review showed that the studies on ECHO evaluation are small and document no evidence of quality assessments or understanding of fidelity (Zhou *et al.*, 2016).

Moore's framework also does not address the holistic pragmatic view through a system's thinking lens, which was of interest to me. The approach will be to assess the current status of TB ECHO and to

establish a systematic process to monitor public health impact long-term through a theory of change model. Qualitative data collection tools shall assess provider's perception of learning, competence and satisfaction with MDRTB ECHO implementation. Capacity building strengthens the value-add of the TB ECHO model that seeks to bridge knowledge gaps between specialists at specialty centers or hubs and care providers at the spokes (Zhou *et al*, 2016). Previous studies have shown that the most common motivating factors to participate in ECHO sessions include the desire to increase one's knowledge base, apply new knowledge to future patients, save patients' traveling time, and increase collaboration with specialists (Zhou *et al*, 2016). Previous studies have studied outcomes of participation, satisfaction and learning (Levels 1-3) from the Moore's framework (See more on how this has been addressed in Paper 3).

Table 1. Moore's Framework used for ECHO evaluation

Framework for Outcomes Evaluation			
Original CME Framework*	Expanded CME Framework	Description	Source of Data
Participation	Participation (Level 1)	Number of physicians and other health care professionals who participated in the CME activity	Attendance records
Satisfaction	Satisfaction (Level 2)	The degree to which the expectations of the participants about the setting and delivery of the CME activity were met	Questionnaires completed by attendees after a CME activity
Learning	Learning: Declarative Knowledge (Level 3A)	The degree to which participants state what the CME activity intended them to know	Objective: Pre- and posttests of knowledge Subjective: Self-report of knowledge gain
	Learning: Procedural Knowledge (Level 3B)	The degree to which participants state how to do what the CME activity intended them to know how to do	Objective: Pre- and posttests of knowledge Subjective: Self-report of knowledge gain
	Competence (Level 4)	The degree to which participants show in an educational setting how to do what the CME activity intended them to be able to do	Objective: Observation in educational setting Subjective: Self-report of competence; intention to change
Performance	Performance (Level 5)	The degree to which participants do what the CME activity intended them to be able to do in their practice	Objective: Observation of performance in patient care setting; patient charts; administrative databases Subjective: Self-report of performance
Patient Health	Patient Health (Level 6)	The degree to which the health status of patients improves because of changes in the practice behavior of participants	Objective: Health status measures recorded in patient charts or administrative databases Subjective: Patient self-report of health status
Community Health	Community Health (Level 7)	The degree to which the health status of a community of patients changes because of changes in the practice behavior of participants	Objective: Epidemiological data and reports Subjective: Community self-report

*Moore DE Jr. A framework for outcomes evaluation in the continuing professional development of physicians. In: Davis D, Barnes BE, Fox R, eds. *The Continuing Professional Development of Physicians: From Research to Practice*. Chicago, IL. American Medical Association Press; 2003:249-274.

Organizational Level (ECHO implementers)

Organizational capacity can be divided into (a) general organization factors such as availability of administrative resources, positive work climate, political will, integration of new programming into routine practice and routines, and shared vision and commitment by existing staff (Fixsen, 2005; Greenhalgh, 2005; and Stith, 2006); (b) specific practices and processes for engaging and expanding communities of practice, coordination with other partners and agencies, effective mechanisms for open and frequent communication internally and externally, formulation or tasks, internal functioning, and

processes to accomplish tasks (Greenhalgh, 2005), (c) leadership support, program champion, administrative support.

(3) High-quality administrative support (IT logistics, funding stability, communication, political will)

When a program has the necessary human, informational, and financial resources, it is more likely to achieve program goals and positively affect health (Handley, 2016; Hawe, 1997). However, little is known about the infrastructure and processes that transform these resources into positive health outcomes. This study will collect data on these constructs to explore connections to how these factors might impact TB ECHO implementation.

Seventy percent of Indians live in rural areas making the equivalent of \$3 USD per day, and a major portion of that goes towards food and shelter and not towards health care (Devarakonda, 2015). Transportation facilities in rural India are poor, making access to medical facilities difficult, and medical infrastructure is often minimal, making the available medical care insufficient. A major challenge presented to India is to provide healthcare that is accessible, available and affordable to people in rural areas and the low-income bracket, low-resource settings. Innovative organizations such as NITRD, cultivate an environment of love for learning and to try and adapt new approaches. On a related note, in Tanzania, there were approximately 5 physicians and 50 nurses and midwives per 100,000 population, compared with the WHO minimum threshold of 228 health workers per 100,000 population (Chen *et al.*, 2004; Tanzania MOHSW, 2013; WHO 2006). Rural areas, where 70.4% of the population live, are particularly underserved (Das *et al.*, 2007; Mbaruku *et al.*, 2014). This dearth of rural clinicians in the context of a resource-constrained health system can lead to varying degrees of dissatisfaction among health workers (Mbaruku *et al.*, 2014). As indicated by Mbaruku, clinical officers were less satisfied with

infrastructure and supportive interpersonal environment than nurses or health aides (Mbaruku *et al.*, 2014). Sufficient staff, equipment, supplies, and general infrastructure would be needed to implement programs such as ECHO.

Program champions, especially those in leadership roles can play a key role in influencing and driving change from adoption to sustainability (Durlak, 2008). Having decision-making processes in place, community engagement and input, internal and external support, administrative as well as funding are critical to success. Non-hierarchical roles and interaction based on mutual trust, open and transparent communication channels, and shared responsibility are all key ingredients for successful and sustainable implementation (Hahn, 2005, Rogers, 2003).

Funding is a necessary but an insufficient condition for effective implementation. Finally, assessing political will, which is the commitment of political leaders and bureaucrats to undertake actions to achieve a set of objectives and to sustain the costs of those actions over time (Tilley *et al.*, 2018). Policies to institutionalize new procedures and practices, especially to support routine systematical collection and reporting of results are essential for high-quality implementation (Serhal, 2015). Leadership engagement and support for an administrative and financial infrastructure are also key ingredients for a successful implementation.

(4) High-quality course content and delivery

According to CDC, high-quality training must meet eight science-based training standards: (i) training needs assessment informs training development; (ii) training includes learning objectives that are SMART (*i.e.*, specific, measurable, achievable, relevant, and time-bound); (iii) training content is accurate and relevant; (iv) training includes opportunities for learner engagement; (v) training is designed

for usability and accessibility; (vi) training evaluation informs improvement; (vii) training includes opportunity for learner assessment; (viii) training includes follow-up support for the learner (<https://www.cdc.gov/trainingdevelopment/standards/standards.html>). A checklist to facilitate learning and preparation for delivering high-quality course content and delivery have shown to be effective (https://www.cdc.gov/trainingdevelopment/standards/pdfs/QATrainingChecklist_508.pdf).

Some of the data collection tools to evaluate the quality will be relevant to the recommendations for the case studies and didactic presentations, are based on the Appraisal of Guidelines, Research and Evaluation (AGREE) tool (Brouwers *et al.*, 2010). This generic instrument was developed and validated to appraise the quality of clinical guidelines. While these guidelines were scored highly for the clarity of their presentations and their descriptions of “scope and purpose”, they were judged to have reasonable levels of editorial independence. They scored poorly on the “stakeholder involvement” (particularly due to lack of involvement of patient groups and pre-piloting of the guidelines) and “applicability” domains of the AGREE instrument (McAlister *et al.*, 2007). For this study, the Agree tool was modified to develop data collection tools to assess expert recommendations related to the case studies presented during ECHO sessions. Already validated indicators through AGREE were modified and used to collect data on the course content, facilitation, case study and recommendation validity, relevance, and accuracy.

Community-level public health impact (ECHO Decision makers)

Even though assessing this was beyond the scope of my dissertation, demonstrating impact of an intervention such as TB or HIV ECHO towards public health priorities is important to ultimately reduce health inequities, improve management and care for patients, and ultimately overall public health. In this context, of TB or HIV ECHO intervention being implemented over couple years, understanding its value and impact on the participants and ultimately the patients served by the program would be key. However,

the scope of this study focused on providers and users of MDRTB or HIV ECHO at the hub and spoke levels. There was no direct interaction with MDRTB or HIV patients to understand impact of the ECHO program on their health outcomes. Measuring public health impact can be broad, hence this research focuses on developing a framework that will support the establishment of routine monitoring and evaluation (M&E) system that can eventually extend to understand impact on patient outcomes.

(5) Establishing a M&E system to assess a high-quality TB or HIV ECHO implementation routinely

Implementation science focuses more on understanding the nature and type of gaps between expected results and observed outcomes. Evaluation research may stop once challenges and barriers related to performance of specific projects are determined (Handley *et al.*, 2016). Goals of quality improvement (QI) and monitoring are similar and often less focused on creating generalizable knowledge than on addressing the immediate problems in programmatic context (Handley *et al.*, 2016). Despite these differences, many QI and M&E-related research studies are aligned with implementation science principles.

Early monitoring of implementation followed promptly by retraining has doubled the fidelity of implementation to over 85% for providers who were having initial difficulties (DuFrene *et al.*, 2005; Greenwood *et al.*, 2003). However, the debate of fidelity/adaptation debate has been persistent. And considering the role of M&E from the beginning ensure that programs are modified to accommodate local needs as long as the critical features of a program are delivered as planned (DuFrene *et al.*, 2005).

Thus, using AI approach validated the *a priori* constructs, hence setting up a system to routinely collect programmatic data may be beneficial in the long run to measure public health impact. Proactive monitoring systems may be developed to identify challenges as they arise during implementation and provide feedback to stakeholders for informed, rapid corrective action. Both local and objective external

monitoring and accountability systems should be considered to identify implementation barriers and propose solutions sooner rather than later, e.g., to accommodate staff turnover before and during program implementation, most sites hosted multiple training workshops or sent new staff to other sites for training or cross-training (NYAM, 2017). Or considering routine quarterly pre-post tests to training courses to measure impact over time (assuming knowledge gain and learning is improving, hence impacting patient outcomes ultimately (Braithwaite *et al*, 2009; NYAM, 2017).

Program evaluation of understanding the value-add of any intervention is critical to understand impact overall. TB ECHO Evaluation 101 provides guidelines and tips to keep in mind while designing an evaluation study (NYAM, 2017). Program evaluation is a key component in the framework to understand sustainability (CDC, 2013). Expansion and adaptation of TB or HIV ECHO programs throughout India or Tanzania will be informed by recommendations based on this assessment (Schell *et al*, 2013). Since this M&E framework and data collection tools were co-created by the stakeholders from the validated constructs from the appreciative inquiry workshop and then key-informant interviews (KII), vetted the proposed framework, there may be better buy-in and impact sustainability of any ECHO program globally.

(6) Impact or Assessing whether knowledge translated into practice

The mechanisms of change from research to practice that closes the evidence–practice gap should be guided by the following three key principles (Handley, 2016). Impact should be seen through (1) Behavior change, which is inherent to the translation of evidence into practice, policy, and public health improvements. One example of how behavioral theory is used to structure understanding of barriers and develop implementation strategies is the COM-B model (capability, opportunity, and motivation) and the related Behavior Change Wheel (BCW) (Mitchie, 2015). The COM-B model specifies that changing the

occurrence of any behavior requires changing Capability, and/or Opportunity and/or Motivation. ‘Capability’ refers to the ability to engage in the thoughts or physical processes necessary for the behavior, ‘Opportunity’ relates to factors in the environment or social setting that influence behavior and ‘Motivation’ is the conscious belief as well as unconsciously based emotions/impulses that direct behavior. Thus, the COM-B model can be used to ‘diagnose’ why the desired behavior is not occurring. Evaluation frameworks such as the RE-AIM (Reach, Effectiveness, Adoption, Implementation and Maintenance) framework can be helpful to guide the selection of process and health outcomes to assess (Glasgow *et al.*, 2015). (2) Engagement with a variety of individuals and stakeholder organizations is critical to achieving effective translation and sustained improvement in implementation outcomes. Stakeholders will vary depending on the research question and can include individuals (patients, providers, community members and so on), delivery systems (clinics, hospitals) and others (payers, government agencies, funders and so on) (Hadley, 2010). (3) Non-linear or cyclical approach is a unique feature of implementation science research. This benefits from flexibility and often non-linear approaches in order to fit within real-world situations. In practice, since there is a need to adopt a cyclical, rather than linear, approach for a long-term view, translating evidence into practice requires attention to real-world settings in which many contextual variables will influence the implementation process and require revisiting earlier steps in the process. For example, new barriers can become apparent over time or reflect changes in the environment, such as the addition of new guidelines or technologies that impact the processes involved in the behavior (Ivankova *et al.*, 2003).

This study provided a preliminary understanding of how knowledge may or may not be translated into practice (or not). Identifying gaps in the process may help with corrective action currently and design better program practice and/or future research studies.

(7) Communities of Practice (CoP)

At a systems level, understanding the role of virtual communities of practice was important. Communities of Practice (CoP) is defined as a phenomenon where groups of people interact on an ongoing basis to share knowledge and expertise about common practices, problems, or topics (Wenger, 2009). Leveraging technology towards setting up virtual CoP play a central role towards knowledge transfer (e.g., ECHO model) (Arora *et al*, 2007; Struminger *et al*, 2017), and building and expanding knowledge network (KN). A KN refers to a set of connections among people who provide resources to solve problems, share knowledge, and make further connections (Wenger *et al*. 2011). The CoP model that includes a KN can provide opportunities to break down professional and organizational barriers (Ranmuthugala *et al*. 2011b) and support the learning of newcomers to a field that deals with diagnosis, treatment, and, management of complex multi-drug resistant TB cases (Lave and Wenger, 1991). The ECHO™ model can facilitate CoP by translating and sharing tacit knowledge or ‘know how,’ which can be a key to capacity building, thereby promoting implementation of evidence-based practices (Wenger 1998; Barwick *et al*. 2009).

CoPs offer new ways of structuring collaboration in response to the challenges of complex systems. With the current emphasis on partnerships, collaboration, and networks, and with the momentum of the CoP model, new concepts, methodologies, and techniques to understanding the mechanisms and the potential value of these networks will be necessary. Wenger prefers to think of community as an aspect of social structure in which learning takes place. The community comprises of networks that refers to the set of relationships, personal interactions, and connections among participants who have personal reasons to connect. Links that facilitate learning, such as information flows, helpful linkages, joint problem solving, and knowledge creation consist of these KN (Wenger, 2009). In addition, the community aspect refers to the development of a shared identity around a topic or set of challenges such as managing

and treating patients with MDRTB or HIV. Social learning represents a collective intention – however tacit and distributed – to steward a domain of knowledge and to sustain collaborative learning about it (Sims, 2014). The work of community is to develop the learning partnership that creates an identity around a common agenda or area for learning that in turn fosters active learning (McKellar *et al.*, 2014). It is to specify why people are there, what they can learn from each other, and what they can achieve by learning together. It is to develop a collective sense of trust and commitment (Sims, 2018). The work of CoP is to optimize the connectivity among people to increase the extent and density of the network by strengthening existing connections, enabling new connections and getting a speedy response. Since the network's growth potential leads to unexpected connections that expand CoP, hence assumption that knowledge dissemination would ultimately improve practice (Wenger, 2009).

Li and colleagues (Li *et al.*, 2009) identify four characteristics for an effective CoP (i) social interaction among members, (ii) knowledge sharing, (iii) knowledge creation, and (iv) identity (being part of an ECHO movement) building; however, these were not consistently present in all CoPs that were reviewed by them. There was also a lack of clarity in the responsibilities of CoP facilitators and how power dynamics should be handled within a CoP group. Bertone and colleagues (Bertone *et al.*, 2012) evaluation framework assessed CoP using these six dimensions (i) available resources, (ii) strategies to mobilize resources, (iii) knowledge management processes, (iv) expansion of knowledge, (v) knowledge-based policies and practices, (vi) better health and welfare outcomes. These are planned to be measured through the proposed data collection tools in Tanzania, again beyond the scope of this dissertation. Li *et al.* found that understanding the responses to the following five questions could help with insights on CoP: (i) Why was the group formed? (ii) Who was included in the group? (iii) How did members communicate? (iv) What did the members do or produce, individually or collectively? (v) Where and how often did members interact with each other? The proposed data collection tools piloted, even though beyond the scope of this dissertation, provided insights to these 5 questions. However, since CoPs were used as a tool

to enroll key professionals and create, mobilize, diffuse, and integrate knowledge relating to innovation (especially in hard-to-reach areas), it is very relevant for this research to describe the TB or HIV ECHO CoP at the individual, organizational level, and its impact at the systems level (Figure 9). Identifying, managing and treating TB or HIV cases that require multidisciplinary approach where experts and practitioners use each other's experience of knowledge and practice through a combination of didactic presentations as well as case study presentations as a learning resource lead to sense making and addressing challenges they face individually or collectively towards a common goal of achieving TB and HIV epidemic control.

CHAPTER 3: STUDY DESIGN, METHODS, AND DATA COLLECTION

A. Study Design

The primary study design was a qualitative 2-country case study design using appreciative inquiry approach with developmental evaluation framing on stakeholder's perceptions and beliefs that identified elements of high-quality ECHO implementation (Yin, 2009, Maxwell, 2013, Patton, 2010). According to Yin, a case study design is appropriate when the lessons learned from the cases are reflective and informative of the experiences of average countries or organizations. Both India and Tanzania had implemented Project ECHO for more than a year, and as many more ECHO programs are starting, lessons from the 2 countries in Asia and Africa will help in understanding of application of co-creating an evaluation framework, engagement of a variety of stakeholders from different roles.

Acknowledging the value of qualitative research, this design provided the best methodology for descriptive examination and cross-case findings for asset-based understanding of strengths, challenges and opportunities, while dreaming and discovering long-term vision or potential aspirations to strive for (Cooperrider, 2005; Stavros, 2009). Since no quantitative or qualitative process or outcome indicators had been pre-determined to understand impact of ECHO, this design allowed for flexibility to build upon *a priori* constructs and validated the co-created framework and data collection tools.

Given the goal of this dissertation and the focus of the research questions was understanding the diverse perspectives of stakeholders in the two-country context (India and Tanzania), the primary unit of analysis were the two country ECHO programs: TB ECHO program in India and the HIV ECHO program in Tanzania. Within country analysis on the various stakeholders' perspectives by their roles in ECHO implementation as well as between country analysis, *9e.g.*, whether decision makers have different perspectives or not). A stratified analysis was pursued among the various stakeholder roles answering whether the decision makers in India and Tanzania had similar or different perspectives on elements of high-

quality ECHO implementation. And how the perspectives compare between and within the different stakeholder roles. A data measurement table summarized all the data collection instruments for data collection and analytic phases and steps ([Appendix B](#)).

B. Data Collection

For this study, primary qualitative data collection entailed collecting various perspectives from appreciative inquiry approach (large multiple simultaneous focus group discussions and then reported back as a large group). This data was used to identify key constructs for measurement for the compendium of tools. A detailed code book was used for all three Phases of data collection ([Appendix A](#)). Once the protocol with an evaluation framework and data collection tools were developed, this framework and the elements to assess high quality ECHO implementation were validated through key-informant interviews and select document reviews. This process of triangulation assessed which elements aligned with perceptions of the KI ([Appendix F](#)) as well as content analyzed through relevant documents ([Appendix G](#)) (Maxwell, 2013; US GAO, 1996). Qualitative key informant interviews allowed gaining a deeper understanding of an individual's views, attitudes, or beliefs, and was guided by an interview instrument that helped facilitate a discussion (Fossey *et al.*, 2002). Key informant interviews are “optimal for collecting data on individuals' personal histories, perspectives, and experiences, particularly when sensitive topics are being explored” (Family Health International, 2005). Three approaches to effective and useful qualitative data collection via interviews (Patton, 2002) identifies utilization of an interview guide. The interview guide ([Appendix F](#)) provided a guide that helped follow the same line of inquiry for each respondent – and ensured each respondent was asked about the same topics in the same order systematically. In addition, documents

reviewed assessed whether the *a priori* constructs of interest converged or diverged from the other 2 data collection phases. Data collection was conducted in the following sequence:

Phase 1: Appreciative inquiry Workshops in India and Tanzania

A month in advance of the data collection for AI workshop, invitations were sent to participants by the ECHO implementers. Workshops included five (Strengths, Challenges, Opportunities, Aspirations, and measurable results) structured focus group discussions (FGD) with homogenous stakeholder groups to understand the current status of Project ECHO, and develop process indicators and data collection tools for the evaluation framework. The agenda for the workshop included several didactic presentations about the AI methodology, update on the status of the ECHO program, followed by facilitated breakout sessions for each of the core elements of SCORE in 5 small homogenous groups. In India, each of the stakeholder groups met 5 times to discuss strengths, challenges, opportunities, aspirations, measurable results collecting qualitative data from a total of 20 mini-focus group discussions. In Tanzania, there were 15 mini-focus group discussions for the 3 stakeholder groups. While large group reflections and report outs were conducted in India after each of the 5 sessions, there was enough time for only 1 large report out session in Tanzania. Specific discussion questions aligned with the individual components of the SCORE methodology is displayed in (Table 2).

FGD facilitators and non-participant note takers were assigned to each group in India. However, due to limited resources and dedicated staff, only FGD facilitators and participant-volunteer note takers were available in Tanzania. Breakout groups shared a written summary of their discussions on flip charts and verbally in large group report outs in both India and Tanzania. All sessions in Tanzania were audio recorded.

Participants

Stakeholders from various hubs and spokes including representatives from the Ministry of Health, implementing partners, specialists, health care providers, laboratory technicians, and health care workers were invited to attend a workshop in both the countries to reflect, communicate, and co-create an ECHO implementation evaluation framework.

Table 2 Facilitation questions for the Appreciative Inquiry workshops using modified SCORE (Strengths, Challenges, Opportunities/Aspirations, Measurable Results, evaluation of AI) methodology

Strengths	Challenges	Opportunities/Aspirations	(Measurable) Results	Evaluation of the appreciative inquiry approach (refer evaluation form- Appendix F)
<p>What is <i>your personal proudest</i> achievement since you started participating in the start of the ECHO program?</p>	<p>What components of the ECHO program are <i>particularly challenging for you?</i></p>	<p>Given the strengths and challenges outlined in the previous session, what are <i>the top 3 opportunities</i> where we might focus our efforts?</p> <p>Who are possible <i>new partners</i> we might consider engaging in our work? What <i>new services</i>, partners or processes etc. we may consider?</p>	<p>Considering the strengths, challenges, opportunities, and aspirations, what <i>meaningful measures</i> would indicate we are on <i>track to achieve success</i> for the ECHO program? (measures may be at multiple levels: ECHO implementer, provider, patients, community outcomes)</p>	<p>Did workshop meet objectives?</p> <p>How satisfied were you with SCORE workshop?</p>
<p>What are you <i>most proud about the ECHO program?</i> How do these things that you are proud about reflect your strengths?</p>	<p>What are the <i>burning issues or challenges</i> experienced by the <i>ECHO program?</i></p>	<p>Given our long-term aspirations, what does success look like 6 months/a year from now? (short-term vision/outcome)</p>	<p>What would a list of prioritized measures for short-term, medium-term, and long-term successes look like?</p>	<p>How acceptable was the AI workshop?</p>
<p>What are the ECHO program's <i>area of excellence?</i></p>	<p>What has been the <i>biggest challenge</i> associated with the ECHO program?</p>	<p>What's your <i>vision of success</i> in <i>2 years</i> from now? (medium-term vision/outcome)</p>	<p>What data sources exist where we can get these measures from?</p> <p>Who should be responsible for collecting these measures?</p>	<p>How feasible was it to conduct AI workshop?</p>
<p>What can other ECHO programs learn from</p>		<p>Where do you see ECHO in <i>3/ 5 years</i> from now? (long-term vision/outcome)</p>	<p>How often would it be practical to</p>	

India's TB ECHO or Tanzania's HIV ECHO program?			collect each of these measures?	
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SCORE Workshop evaluation

Evaluation of the workshop included questions ([Appendix E](#)) on acceptability and feasibility of AI approach was collected through anonymous surveys at the end of the AI workshop to answer the second research question in whether SCORE was acceptable and feasible ("E" of SCORE). Participants were requested to complete workshop evaluation forms based on a 4-point Likert-scale (Kreitchmann *et al.*, 2019). Various categories were ranked based on whether objectives were met making the workshop acceptable (objectives were met=4, and not met=1) and whether participants were satisfied making the workshop feasible (completely satisfied=4, not satisfied=1) were collected at the completion of the workshop to assess acceptability and feasibility of the SCORE process. All 15 items are distributed among acceptability and feasibility measures.

Acceptability of the SCORE workshop was defined on whether objectives were met to capture:

- a) Diverse perspectives on Strengths of ECHO
- b) Diverse perspectives on Challenges of ECHO
- c) Diverse perspectives on Opportunities of ECHO
- d) Diverse perspectives on Aspirations of ECHO
- e) Diverse perspectives on measures of Success for ECHO
- f) Opportunities to contribute knowledge and personal experience at the SCORE workshop
- g) Opportunities to gain skills and knowledge to support TB/HIV work

- h) Opportunities to gain skills and knowledge to apply evaluation efforts in general
- i) Avenues to build relationships and contact to help with TB/HIV ECHO related work

Feasibility of the SCORE workshop was defined on whether there was satisfaction with the following:

- j) General structure and breaks
- k) Presentations
- l) Breakout group discussions
- m) Large group report outs
- n) Logistics (space, food, seating)
- o) Pre-workshop coordination and information

Open-ended qualitative responses were obtained and analyzed as well.

Phase 2: Key-informant interviews

Semi-structured key-informant interviews (KII) were conducted to gather one on one between the feedback on defining high-quality ECHO implementation, to assess acceptability and feasibility of the evaluation framework and data collection tools. Acceptability and feasibility are defined by user-friendliness and the application of the tools in program context. Thus, eligible key informants (KI) were purposefully selected based on prior experience with designing, facilitating, or implementing ECHO programs. Selection criteria included those who could provide insightful feedback and knowledge of a variety of global ECHO programs across Africa, Asia, Latin America, or the USA. KI represented various academic, government or PEPFAR implementing partner agencies (IOM, 2013). Recruitment emails were sent to 15 eligible persons.

Email invitations included a description of the purpose of the evaluation process, a copy of the proposed evaluation framework, data collection tools, and results from the appreciative inquiry workshop in India (Ghosh *et al.*, 2020, forthcoming). An interview guide with 14 semi-structured questions were used to guide the KII ([Appendix F](#)). All interviews were conducted in English using Zoom (Zoom Video Communications; San Jose, CA, USA); audio recordings captured were transcribed electronically using Temi.com machine transcription and then reviewed and edited by lead researcher to ensure accuracy and completeness.

An interview codebook was developed and compared by a primary and secondary coder to assess inter-coder reliability for couple of the interviews. Transcripts were imported and analyzed using MAXQDA (VERBI GmbH; Berlin, Germany). Consistency or discrepancy of constructs among the different key informants was assessed (Patton, 2015).

Phase 3: Document Review

To assess alignment with the main constructs of interest, a document review (US GAO, 1996; Krippendorff, 1980) was performed on select peer-reviewed publications, evaluation reports, meeting minutes, and slide presentations. Eligible documents were recommended by the key informant or credible contacts with knowledge of ECHO implementation and evaluation, preferably from the countries or regions for which they were affiliated ([Appendix G](#)). Directed content analysis was conducted by searching documents for the main constructs of interest and determining the content validity of the data collection tools (Hseih & Shannon, 2005).

Content alignment was assessed through iterative reading of the documents to examine if there was alignment with proposed constructs of interest. If either of the constructs from the list of *a priori* constructs of interest were present, they were considered aligned; if these constructs of interest were absent, then they were considered divergent. For example, if one of the evaluation reports included satisfaction surveys or pre-post knowledge assessments, then capacity building construct was considered aligned; or focus group

discussions highlighted challenges about IT infrastructure, or lack of time to attend ECHO sessions, then constructs related to IT or logistics were considered aligned. If an *a priori* construct in the proposed data collection tools were not found in the documents, these constructs were considered absent. For example, if political will was not measured or captured in any of the data collection tools, this construct was considered to be absent. In other words, political will was not assessed by the respective ECHO programs.

C. Data Analysis

A summary of data collection and analysis has been displayed in a data measurement table ([Appendix B](#)).

Quantitative Analysis

In addition to quantifying the number of participants by generating descriptive statistics for each of the SCORE workshops in India and Tanzania, the evaluation forms including the four-point Likert-scale results from each of the SCORE workshops were analyzed.

SCORE Workshop Evaluation Forms

Items on the evaluation forms were quantified and analyzed individually as well as composite scores were developed to assess reliability of the instrument. Internal consistency or reliability of the instrument to measure what it's supposed to measure (construct validity) as measured by Cronbach's Alpha, which was considered to indirectly indicate the degree to which a set of items measure a single unidimensional latent construct. If the Cronbach alpha statistic was between 0.6-0.7, it indicated an acceptable level of reliability. If the Cronbach alpha statistic was 0.8 or greater, then the reliability was very good (Chronbach, 1988). Normality of the data was assessed using t-test statistics. Based on the normality plots, parametric or non-parametric statistics were used. Since the evaluation form had ordinal scaled data, Wilcoxon signed-rank

tests was conducted to compare acceptability and feasibility scores between India and Tanzania. Since there were more than 2 groups of participants at the SCORE workshops, acceptability and feasibility comparison within India, and Tanzania, was compared using Kruskal-Wallis statistic for all non-parametric data. A p-value of <0.05 was considered statistically significant and SAS (SAS Institute; Cary NC, USA) was utilized to conduct all quantitative analysis (Hollander, M. & Wolfe, DA, 1973).

Qualitative Analysis

(i) SCORE Workshop

Qualitative data analysis was a multi-cycle, multi-step analysis of the various qualitative data collection tools. (Strauss & Corbin, 1990; Miles, Huberman, & Saldaña, 2014). For each country, the first cycle of coding for the qualitative analysis will utilize *a priori* “big bucket” codes that have been based on perceptions of high-quality ECHO implementation. Coding was descriptive, conceptual, value-based, and thematic (Saldana 1990). A hybrid approach to coding permitted the addition of emergent codes/sub-codes if necessary and warranted by the data, for instance, if finer distinctions emerge from comparing examples coded within the “big bucket” codes such as “infrastructure/logistics/technology” or “participation and engagement” (Brixey 2006). Leadership engagement and political will were categorized into one construct. Computer Aided Qualitative Data Analysis Software (CAQDAS) such as MAXQDA (VERBI GmbH; Berlin, Germany) was utilized to systematize and document the coding process and results. Analytic and reflective memos in MAXQDA were incorporated and attached to the analysis. This will help interpret and integrate findings and provide explanations of the code findings.

A second cycle of coding, i.e., pattern coding entailed examining the relationships between the codes (themes) identified in the first cycle of coding, especially where the codes overlapped by reading through the data multiple times (Strauss & Corbin, 1990; Miles, Huberman, & Saldaña, 2014). Relationships between different ECHO participants’ responses, were identified and explanations developed and tested for

consistency throughout the data from multiple tools and respondents, in this second cycle of coding or “pattern making” (Miles, Huberman, & Saldana, 2014). (*e.g.*, if the perception of ECHO participants’ reveal that they feel sessions are informative and help increase their knowledge, then second cycle of analysis was used to understand whether this pattern was revealed in the other data collection tools, and for all the different groups (implementers, decision makers, subject matter experts).

Summary of key *a priori* codes that occur in the qualitative analysis supplemented with emergent codes were documented and compared across the 2 countries. The systematic, thematic qualitative analysis will summarize reflections from respondents in each of the AI workshops. This thematic analysis was tested by comparison to interviewer notes and observations from facilitators. Further validation compared results across the different data collection instruments (triangulation, construct and content validity), and looked for divergences. I tested possible alternative explanations as well as documented convergences.

Within-case (individual participants) analysis was conducted before cross-case analysis (between 2 countries) for the AI workshop discussions between the three different groups of decision makers (DM), health care providers (HCP), and implementers/subject matter experts (SME). Data-reduction efforts were undertaken to “weed out” ancillary information that did not appear to trigger any significant findings. Meeting, audio-recorded and transcribed notes were used for debriefing sessions following the case reviews.

Inter-rater reliability was assessed with the first couple flip chart and key-informant interview analysis. Independently coded data were discussed until inter-rater reliability of 80% or more was achieved. When the thematic analyses were conducted, peer-debriefing was conducted as part of the discussion to corroborate main themes, especially if there were discrepancies in interpretation and analysis of the codes, to reach consensus for analysis and interpretation of results. Thus, peer-debriefing helped explore aspects of the inquiry that might have otherwise remained only implicit in my mind. Surprising, new themes and complete disagreements were reported as part of the results. Analytical steps including analytic memoing in

MAXQDA, coding, and creating data displays were used to guide the analysis (Charmaz, 2006; Miles, Huberman, & Saldaña, 2014).

(ii) *Informant Interviews*

All KIIs were coded in MaxQDA by reading and re-reading the transcripts to understand perspectives on high-quality ECHO implementation and assessed acceptability of the evaluation framework and data collection tools. Acceptability was defined as user-friendliness (utility) and feasibility of the tools in the context of program implementation (CDC, 1999). An interview codebook was developed and compared between primary and secondary coders to assess inter-coder reliability ([Appendix A](#)). Transcripts were imported and analyzed using MAXQDA (VERBI GmbH; Berlin, Germany). Consistency or discrepancy of constructs among the different key informants were assessed (Patton, 2015). Making sense of conflicting and inconsistent patterns were reflected and reported. Dedicated time was spent in coding and condensation (shortening the text while still preserving meaning) (Erlingsson and Brysiewicz, 2017). To aid in analysis, time was reserved for reflection (Miles, Huberman, & Saldaña, 2014) and writing memos after each virtual interview (Miles & Huberman, 2014). These memos supported the process of coding and analysis.

For this qualitative data analysis, steps of data reduction, transformation, comparison, and integration were followed. Data from two different sources (AI workshop notes and KII notes) was stronger than one data source alone. Further probing of recurrent themes from KII, helped better understand the results. Following the analysis identifying key patterns and themes, were used to reduce the data that led to focus on main constructs for triangulation, testing the results across different data sources (Data triangulation). Next, co-investigators assessed what subset of data were presented as most relevant findings in easily understandable visuals (matrix, tables, graphs etc.) forming the best display for meaningful results. Data comparison then helped explain convergence and divergence of results between and among different data

collection methods and constructs. Before preliminary conclusions were summarized, previous qualitative results were compared to the coded responses from the KII interviews for validation. Recommendations were developed and tools modified based on results of the KII. Revised framework and tool shall be implemented in Tanzania after the dissertation defense.

D. Triangulation of data sources for validity and credibility to ensure Quality and Rigor

Triangulation, broadly defined as the comparison of results from multiple data collection methods and/or sources in the evaluation of the same phenomenon were used to document and understand convergence and divergence between the different factors that define high-quality ECHO implementation (Hsieh, 2005). Various concepts/variables/findings were further examined and stratified to understand variations between groups of respondents (physicians, administrators, paramedics, faculty, health care providers etc.) in perceptions and performance. Triangulation among respondents and between sources was used for cross-checking for internal consistency or reliability, as well as "*between-method*" triangulation to test the degree of external validity (Paul, 1996).

Triangulation of multiple qualitative data sources helped understand consistency across KII and document review. To triangulate findings from the key-informant interviews, the analysis of the patterns led to an interpretation of the contextual meaning for development of final recommendations to improve the framework and/or data collection tools (Hsieh and Shannon, 2005). Researcher bias was addressed by interpretation of the implicit (latent) meanings by member checking with the KI (Hsieh, 2005) and peer debriefing with co-authors. Member checks were accomplished by sharing the transcript and interpretations with 2 of the KI, from who data were solicited.

The mixed methods approach, with its use of multiple data collection methods and analysis techniques, provided for the opportunity to triangulate and integrate data in order to strengthen the evaluation findings and conclusions. Credibility refers to trustworthiness, or how believable a study is; whereas, validity is the extent to which a study accurately reflects or evaluates the concepts or ideas being investigated. Triangulation was used to integrate and synthesize the data collected from the three phase to propose a final list of essential elements to assess high-quality implementation.

In applying Yin's criteria that would address the quality of research, the following four elements of data quality were assessed: construct validity, internal validity, external validity, and reliability. To ensure construct validity, a solid environmental scanning was completed in February 2018 and September 2019 using the appreciative inquiry methodology that helped develop the constructs that formed the basis of the evaluation framework and the compendium of data collection tools (Phase 1). The key-informant interviews and the document reviews from Phase 2 and 3 validated these constructs, along with acceptability and usability of this framework and toolkit.

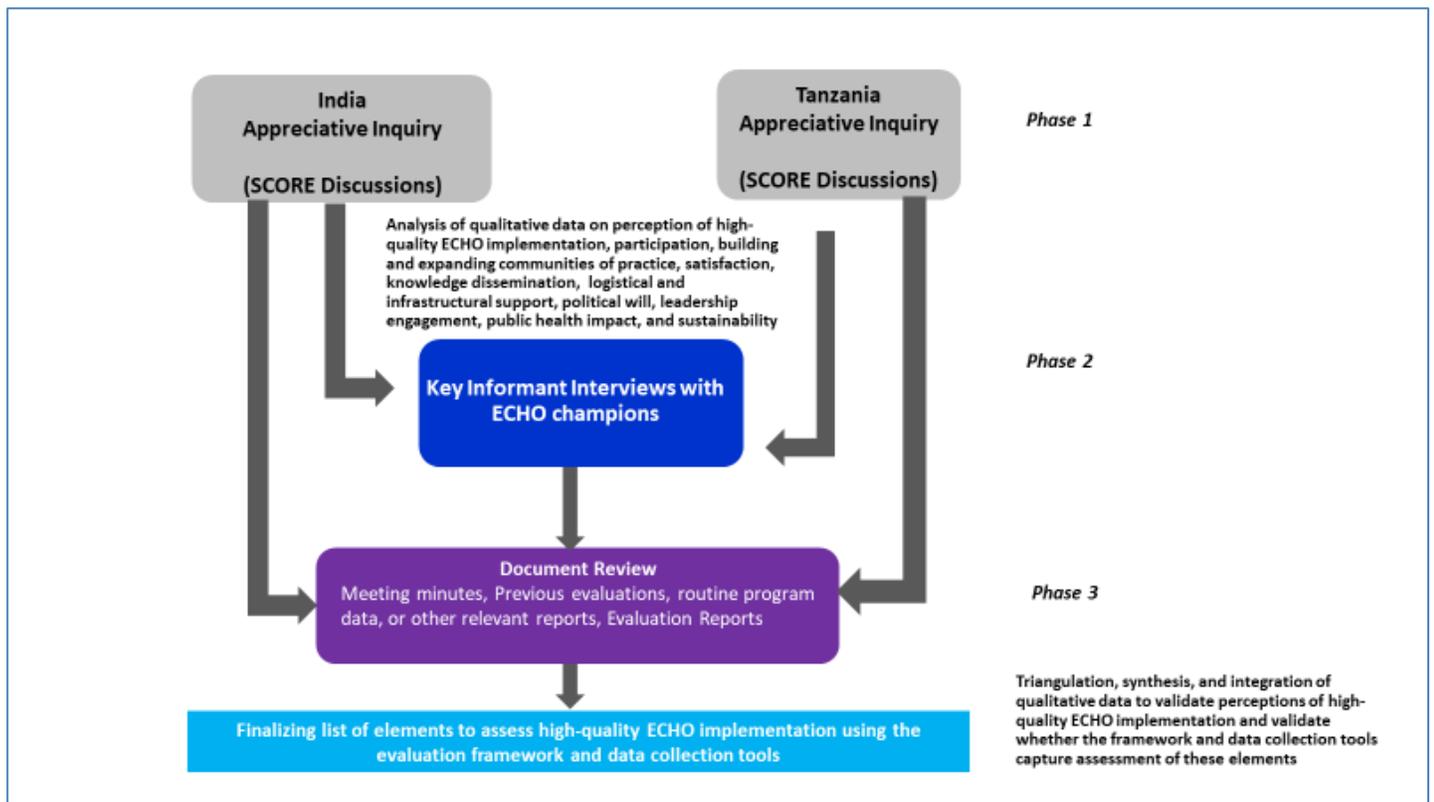


Figure 6. Triangulation

Data collection phases addressed the threat of convergence and divergence of multiple sources of evidence. To increase the validity of this evaluation, data triangulation involving different sources of information were utilized. Understanding convergence and divergence between the different data sources that define high-quality ECHO implementation provided a deeper understanding of the phenomena being studied (Table 2). Various concepts/variables/findings were further examined and stratified to understand multi-level variations.

To summarize, in addition to the methodological triangulation as discussed above, meaning confirming findings from different methods, meaning whether the constructs are measuring the phenomena they are supposed to measure (Miles and Huberman, 1994; Patton, 1990). (Figure 6). The following steps addressed the concerns with quality and rigor of the data collection and interpretation. (i) Data triangulation of 3 different data sources as discussed above –various questions asked in different ways shall address

convergence vs. discordance of key constructs (ii) Construct validity of the evaluation form with items on acceptability and feasibility shall be addressed using Cronbach alpha statistic. This statistic was utilized to assess whether the items measured are true measures of acceptability or show associations by chance. (iii) Content and construct validity shall be assessed through key-informants who will assess whether the evaluation framework assesses high-quality ECHO and if it's acceptable for implementation in any Project ECHO setting. (iv) Member check-in or reviews of transcripts by couple of the key-informants shall ensure that the data collected from the interviews are the same as the what was communicated, and message did not get 'lost in translation'.

To ensure internal validity, steps were taken to confirm what is measured is directly related to the constructs, thus ensuring construct validity is critical (measuring what is supposed to be measured and directly related to the constructs). Internal validity could be threatened by construct validity. Double coding with codebook was thus an essential step taken by investigator and another co-investigator. The triangulation method described above ensured construct and content validity since multiple data collection instruments will be used to measure same construct. Also, interpretation of results from various tools will ensure content validity. In addition, examination of rival explanations was systematically examined through in-depth understanding of alternative themes, and divergent patterns in context (Patton, 2001). The predispositions as well as contextual explanations shall be reported in the results (Cohen D, Crabtree, 2006).

Peer-debriefing or the process of exposing an unrelated colleague or cohort-mate as the second coder, parallel coding helped derive themes. The investigator was engaged in analytical sessions for the purpose of exploring aspects of the inquiry helped alleviate some of codes or themes that are implicit within the Principal investigator's mind" (Lincoln & Guba, 1985). This ensured thorough analytic probing and uncovering granted cultural biases, perspectives and assumptions that the Principal Investigator may have introduced due to being from the same cultural background and understanding. This also prevented cultural and researcher bias ensuring quality and rigor of the analysis. Thus, providing an opportunity to test and defend

emergent hypotheses and see if they seem reasonable and plausible in an unbiased way (Cohen D, Crabtree, 2006).

Intensive, long-term involvement with stakeholders using an action research phased design provided a more complete and rich data (Maxwell, 2013) for complete understanding of current status of TB ECHO implementation. Member checking, meaning reporting to the stakeholders results and seeking validity through different activities using KII ensures reporting results and affirmation through different action research cycles (Cohen & Crabtree, 2006). This method of member checks when data, analytic categories, interpretations and conclusions are tested with members of those groups from whom the data were originally obtained will increase validity and rigor of findings (Cohen & Crabtree, 2006). Since investigator shall be soliciting feedback about the framework and tools using KII, this will minimize misunderstandings.

Even though the findings from this study may not be generalizable, the framework and tools may be contextualized and used based on the recommendations of this evaluation.

E. Ethics and Protection of Human Subjects

Access to Personally Identifiable Information (PII)

No individual level PII was collected, analyzed or reported. All data were kept in password protected computers, only accessible to co-investigators. Audio/Video recordings shall be destroyed after data analysis, translation, and defense of this dissertation. Aggregate and anonymous quotations shall be reported or published for the mixed methods evaluation. Secondary data such as personal reflections/memos on the interview itself or links to other data were password protected and stored securely. Individual data will not be shared. All evaluation personnel signed a confidentiality agreement indicating that he/she has been instructed in confidentiality procedures.

Data storage, retention, and sharing plan

De-identified data shall be retained at CDC until all analysis is completed and planned manuscripts are published. Then all shall be archived under the CDC retention policy guideline. The manual, the evaluation framework and compendium of tools will be made publicly available through University of New Mexico Health Science Center (Project ECHO) websites or cloud-based file sharing platforms.

CHAPTER 4: RESULTS

Table 4. List of Manuscripts

My research results can be summarized into the following 3 papers that answer the 4 research questions

Paper	Research Question	Methods	Title and purpose of Manuscript	Peer-Reviewed Journal Consideration
1	<p>1.)What are the stakeholders’ perceptions of high-quality ECHO implementation?</p> <p>(i)What are the stakeholders’ perceptions of high-quality ECHO implementation in India and Tanzania (proof of concept countries)?</p> <p>(ii)How do stakeholders’ perception of high-quality ECHO implementation compare within and between stakeholder groups in India and Tanzania?</p> <p>2.)What is the acceptability and feasibility of using a modified appreciative inquiry, the SCORE (instead of SOAR) approach through the developmental evaluation lens in conceptualizing a comprehensive evaluation framework and compendium of tools?</p>	<p>Qualitative analysis of the data collected through appreciative inquiry-based SCORE Strengths, Challenges, Opportunities/Aspirations, Measurable Results, and Evaluation of the approach workshop.</p> <p>Quantitative analysis of evaluation survey data to assess acceptability and feasibility SCORE.</p> <p>Qualitative analysis of Key informant interviews to assess usefulness of SCORE.</p>	<p><i>Appreciative inquiry and the co-creation of an evaluation framework for Extension for Community Healthcare Outcomes (ECHO) implementation: a two-country experience</i></p> <p>describes an innovative methodology, never been used in TB or HIV, of utilizing a modified appreciative inquiry approach called SCORE (Strengths, Challenges, Opportunities/Aspirations, Measurable Results, and Evaluation of the approach) to gather a variety of perspectives from diverse stakeholders for TB in India and HIV in Tanzania.</p> <p>Comparing and contrasting the appreciative inquiry approaches, concordance and discordance in perceptions of characteristics of implementation in the different continent settings as well as different roles of stakeholders will be insightful.</p>	<p><i>Evaluation and Program Planning journal.</i></p>

2	<p>3.)What does a comprehensive evaluation protocol and compendium of tools entail that assesses ECHO implementation quality?</p>		<p><i>A protocol for a comprehensive monitoring and evaluation framework with a compendium of tools to assess high-quality Extension for Community Health Outcomes (ECHO) implementation</i> presents the implementation protocol for the evaluation framework and data collection tools.</p> <p>When published, this will have immediate scholarship and public health impact as a response to various requests for an evaluation protocol and data collection tools to assess quality of PEPFAR ECHO programs from various countries who are at different stages of planning or implementation of their Project ECHO programs.</p>	<p><i>BMJ Open</i> journal that publish protocols without results</p>
3	<p>4.) What is the validity and acceptability of a proposed adaptable comprehensive evaluation framework, including a modifiable toolkit, designed to assess the quality of an ECHO implementation?</p> <p>(i) How well are the <i>a priori</i> constructs and data collection tools actually measuring what they are supposed to measure programmatically (Construct validity)?</p> <p>(ii) What is the feasibility and acceptability of the evaluation</p>	<p>Qualitative analysis of key informant interviews.</p> <p>Document review to search for <i>a priori</i> codes and data collection tools.</p>	<p><i>Validating an evaluation framework and compendium of tools to assess quality of Extension for Community Health Outcomes (ECHO) implementation</i> will include feedback and validation of content/constructs from key informant interviews triangulated with findings from latent content analysis from select documents.</p> <p>Preliminary feedback from experts who had have experience with ECHO will provide feedback on utility and completeness of the</p>	<p><i>Journal for Public Health Promotion</i></p>

	<p>framework and compendium of tools that assess quality of ECHO implementation?</p> <p>(iii) What are the recommendations to improve acceptability and usability of the evaluation framework and compendium of tools that assess quality of ECHO implementation?</p>	<p>Triangulate the 3 data sources: AI-based SCORE, KII and document review to develop recommendations.</p>	<p>constructs that define high-quality ECHO implementation available publicly for wide use and adoption.</p>	
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PAPER 1: Appreciative inquiry and the co-creation of an evaluation framework for Extension for Community Healthcare Outcomes (ECHO) implementation: a two-country experience

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Abstract

There are persistent gaps in healthcare workforce capacity in Asia and Africa. Project ECHO (Extension for Community Healthcare Outcomes) leverages video-enabled technology to build capacity and promote collaboration through mentorship, and case-based learning. A modified, strengths-based, appreciative inquiry (AI) approach called the SCORE (Strengths, Challenges, Opportunities/Aspirations, measurable Results, and Evaluation measures) guided the focus group discussions with diverse stakeholders in India and Tanzania to understand the current perceptions of ECHO. A systematic qualitative analysis of the focus group discussion proceedings identified main elements for an evaluation framework. Feasibility and acceptability of AI approach were compared between SCORE evaluation results of Indian and Tanzanian participants utilizing non-parametric statistics and qualitative analysis of key informant (KI) interviews.

Perceptions of strength emphasized ECHO programs instilling capacity building and establishing communities of practice. However, challenges included securing resources, engaging leadership, and building systems for monitoring impact. Strengthening internet connectivity, addressing logistical challenges, encouraging session interactivity, and having scale-up plans were opportunities/aspirations for sustainability. AI was accepted by a majority of KI (85%), while feasibility was fair (69%).

Contextualizing and implementing SCORE, 6 to 12 months post-implementation. is a novel, acceptable, and feasible strategic planning approach, and may serve as a best practice to assess mid-course corrections for ECHO programs globally.

Keywords: evaluation, qualitative research, systems thinking, strategic planning, HIV, tuberculosis

Introduction

Since 2003, the Presidential Emergency Plan for AIDS Relief (PEPFAR) has made substantial progress toward the global elimination of human immunodeficiency virus (HIV) and tuberculosis (TB), including offering life-saving antiretroviral treatment (ART) to more than 15 million people, and ultimately averting 18 million pre-mature deaths worldwide (U.S. Department of State, 2020). However, according to World Health Report titled “Working Together for Health” (WHO, 2006; Collins *et al.*, 2010) among the gaps and challenges, fifty-seven countries reported to have “critical shortages” of health workers; and thirty-six of those countries were in sub-Saharan Africa. The report estimated a global shortfall of 2.4 million doctors, nurses, and midwives (WHO, 2009) that led to gaps in service delivery, staff capacity, training and knowledge dissemination, and managing complex multi-specialty disease conditions (Eichenberger, Weisser & Battegay, 2019). Workforce capacity remains a major obstacle to scaling up the global HIV/AIDS response (Collins *et al.*, 2010). In addition to shortage of skilled workers, international medical education is substantially variable from country to country (Holtzman *et al.*, 2014) and many healthcare workers may need retraining or taskforce shifting (Collins *et al.*, 2010). There is an uneven distribution of skilled workers between urban and rural settings and inadequate compensation, motivators or other non-financial incentives (WHO, 2006; Collins *et al.*, 2010). Skill mix (Holtzman *et al.*, 2014) and imbalances need to be addressed, built upon, and maintained to sustain capacity within PEPFAR-supported implementing partner agencies, and within local, and national governments that care for people living with HIV (PLHIV) and people living with TB (PEPFAR, 2012; OGAC, 2020).

Project ECHO leverages video-enabled technology to disseminate, and democratize knowledge, promote collaboration, and share best practices through mentorship, guided practice, and case-based learning (Arora *et al.*, 2007; Arora *et al.*, 2014). ECHO is used to build capacity in various global settings, including system strengthening and workforce development and mentoring in PEPFAR countries (Struminger *et al.*, 2017). A fundamental philosophy of Project ECHO is based on establishing communities of practice (Wenger & Snyder., 2002). Effective communities of practice involve continual learning, capacity building, and professional development, and accessing experts across geographic disparities (Struminger *et al.*, 2017). A multi-disciplinary collection of specialists, mentors, facilitators, and administrators join to form one or more “hub” sites and individual “spoke” sites consisting of generalists, healthcare providers, and mentees (Arora *et al.*, 2007). This novel approach increases access to some types of medical care that might not be available or practical otherwise. ECHO communities of practice may span multiple sessions and may occur on a regular and recurrent basis. Sessions may focus on a long-term

topic or curriculum, such as, the various complex aspects of routine HIV or TB control and management or may be used in the short-term. One recent example, was the rapid development and global expansion of COVID-19-based ECHO work that rapidly disseminated emergent knowledge, shared up-to-the-minute guidelines, and evolving best practices in near real time (Project ECHO, 2020).

Complex adaptive systems (CAS) such as the Indian and the Tanzanian ECHO programs is set in dynamic environments, interacting with a wide variety of stakeholders, interests, and factors, often with disparate demands (Rouse, 2008; Tolf, 2015). Careful and strategic planning that includes situational awareness, and a systems thinking approach are required to develop and evaluate effect public health interventions (Craig *et al.*, 2008, Williams, 2016). This process may include both formal and informal mechanisms of situational awareness, stakeholder engagement, and problem solving (Stame, 2010; Stame, 2014). A combination of formative and summative evaluation may be required to reframe traditional problem-solving approaches commonly used in public health, which typically focus on “*what is the problem*” or “*what is going wrong*” (Sandars & Murdoch-Eaton, 2017). Traditional processes of embracing the strengths, weaknesses, opportunities, and threats (SWOT) analysis (Pickton & Wright, 1998) often leads to negative consequences; these may include: a lack of focus on the most important and highest impact goals, no shared vision, no plans to support goals, and no evaluation of the plan after it has been developed (Bryson, 2011). Moreover, SWOT focuses on primarily weakness and threats; this perspective may be energy-draining and distasteful to individuals and organizations after repeated strategic planning sessions (Stavros & Cole, 2013).

Appreciative inquiry (AI) is an alternative, strategic planning method that emphasizes “*what is going well*,” and engages stakeholders in self-directed individual or organizational change (Cooperrider & Whitney, 2005; Stratton-Berkessel, 2010; Hammond, 2013). AI leverages the collective goals of participants to motivate change through four stages (4-D model): (Cooperrider *et al.*, 2005, Cooperrider, Whitney & Stavros, 2008; Fry *et al.*, 2002) (i) Discovery – determining what is positive and meaningful; (ii) Dream – envisioning a transformed future; (iii) Design – planning and implementing change, and; (iv) Destiny – evaluating and sustaining progress (Cooperrider *et al.*, 2005, Cooperrider, 2008; Fry *et al.*, 2002). An asset-based approach modified from the 4-D model, SOAR, uses strengths, opportunities, aspirations, and results (SOAR) for strategic planning, stimulate energy and empower participants to focus on strengths and successes (Stavros, 2009; Cooperrider and Whitney, 2005). SOAR offers an opportunity to identify and discuss strengths and opportunities, reframe deficits and challenges through the eyes of possibility and forward-thinking lens (Stavros, 2009). Evidence shows SWOT leads to incremental improvements; whereas, SOAR focuses on value generation and innovation (Stavros & Cole, 2013).

SWOT is based on hierarchical organization, and a “top down” approach; whereas broad stakeholder engagement that is self-managed promoting ownership is key for SOAR. Importantly, SWOT emphasizes identifying potential gaps, and risk mitigation; whereas, SOAR emphasizes transformative co-created change to achieve aspirational goals and measurable results (Stavros & Cole, 2013). Utilization of positive thinking approaches give an important role to the shared definition and co-construction of the "successes", thus leaving enough opportunities for evaluation as a tool for improving the effectiveness of the interventions (Lo Presti, 2016).

In order to focus on the positives, understand the current challenges that can lead to opportunities for change, and evaluate the process itself, we modified the SOAR methodology to include challenges (“C”), and evaluation indicators (“E”) to create a modified appreciative inquire approach (SCORE). These additions acknowledged potential challenges and included a formal process for developing relevant evaluation processes to assess progress and monitor desired outcomes through evaluation of the approach. SCORE was applied in two disparate, PEPFAR-supported countries, in India and Tanzania, respectively. Both countries are considered low-resourced, high-burden countries for both TB and HIV. India and Tanzania were purposefully selected. Both the countries are approaching TB and HIV epidemic control and struggling to sustain it due to lack of strong health care workforce capacity (Narain, 2015; Tanzania MOH, 2013). Both are infectious diseases that require a multi-disciplinary team to manage, prevent, and control. India bears a disproportionately large proportion of the world's tuberculosis (TB) burden —1.4 million of the 10 million persons with TB in 2019, including the most people with MDR TB —130,000 persons of the 488,000 persons with MDR TB in 2018 (WHO, 2020). Tanzania is one of the 13 high-priority PEPFAR countries with approximately 72,000 people becoming newly infected with HIV and 24,000 people dying from an AIDS-related illness per year in Tanzania (UNAIDS, 2018). PEPFAR has supported both Governments of India and Tanzania to implement HIV and TB care, treatment, and prevention through health systems strengthening, and scaling-up access to ART to minimize the impact of the epidemic in India and Tanzania, respectively.

Prior to the individual SCORE workshops, India facilitated >80 ECHO sessions during November 2016–February 2018; Tanzania facilitated 37 weekly sessions during November 2018–September 2019. In both India and Tanzania, as many as 30–35 spokes with 75–100 participants joined weekly sessions. We sought to assess acceptability and feasibility of SCORE as a facilitation methodology to understand the definition of high-quality ECHO implementation that would support design of a comprehensive evaluation framework.

Methods

Because no baseline data or pre-determined indicators to measure either process or outcome indicators were available for both the India TB and the Tanzania HIV ECHO programs, a developmental evaluation (DE) methodology (Patton, 2010) was considered, and ultimately led to an appreciative, strengths-based inquiry approach. A systematic qualitative analysis was conducted by reviewing FGD transcripts to document individual quotations and perceptions and identify key themes.

2.2. Participants

Stakeholders from various hubs and spokes including representatives from the Ministries of Health, implementing partners, specialists, health care providers, laboratory technicians, and other health care workers were invited to attend a workshop to reflect, communicate, and co-create an ECHO implementation evaluation framework.

2.3 Focus Group Discussions

Workshops included structured focus group discussions (FGD) to better understand the current status of Project ECHO implementation and develop process indicators and data collection tools for the evaluation framework. The agenda included several didactic presentations about the AI methodology, an update on the status of the ECHO program implementation, followed by facilitated breakout sessions for each of the core elements of SCORE in 5 small homogenous groups. Each session was followed by small group report backs, and a final reconvening of the full group to share and compare key discussions and perspectives of each of the five core elements (Appendix). FGD facilitators and non-participant note takers were assigned to each group in India. However, due to limited resources and dedicated staff, only FGD facilitators and participant-volunteer note takers were available in Tanzania. All sessions in Tanzania were audio recorded.

2.4 Workshop evaluation

Evaluation of the workshop that included questions on acceptability and feasibility of AI approach was collected through voluntary and anonymous surveys offered at the end of each workshop. Participants were requested to complete workshop evaluation forms based on a 4-point Likert-scale (Kreitchmann *et al.*, 2019). Various categories were ranked based on whether objectives were met (objectives were met=4, and not met=1) and whether participants were satisfied (completely satisfied=4, not satisfied=1) were collected

at the completion of the workshop to assess acceptability and feasibility of the SCORE process. Open-ended qualitative responses were obtained as well.

2.5 Key Informant Interviews

Semi-structured key informant interviews (KII) were conducted with a select group of ECHO champions to gather feedback on acceptability and usability of the SCORE approach. Selection criteria included those who could provide insightful feedback and knowledge of a variety of global ECHO programs across Africa, Asia, Latin America, or the USA. KI represented various academic, government or PEPFAR implementing partner agencies (IOM, 2013). Recruitment emails were sent to 15 eligible persons with prior experience with designing, facilitating, or implementing ECHO programs. All interviews were conducted in English using Zoom (Zoom Video Communications; San Jose, CA, USA); audio recordings captured were transcribed electronically using Temi.com machine transcription and then reviewed and edited by lead researcher to ensure accuracy and completeness. An interview codebook was developed and compared by a primary and secondary coder to assess inter-coder reliability for couple of the interviews. Transcripts were imported and analyzed using MAXQDA (VERBI GmbH; Berlin, Germany). Consistency or discrepancy of constructs among the different key informants was assessed (Patton, 2015).

2.6 Analysis and statistics

A systematic qualitative analysis was conducted by reviewing FGD transcripts to document individual quotations and perceptions and identify key themes. Content analysis was conducted from the flip chart notes from participants and transcripts from audio recordings (Strauss & Corbin, 1990, White & Marsh, 2006). Analytic memos, or a written investigation of a particular concept, theme or problem, reflected the emerging issues captured in the data (Patton, 2008). Between and within country analysis led to *a priori* codes grouped into the core SCORE themes; these codes led to the main constructs for measurement (Saldana, 2009). Hybrid coding methodology included *a priori*, and theory-based codes from literature review (Saldana, 2009). Quantification of the codes using frequencies and percentages provided opportunities for prioritization, concordance and discordance for cross-case analysis. The quantitative four-point Likert-scale results included acceptability and feasibility of the SCORE workshops from the evaluation forms.

Cronbach alpha statistics were generated to assess internal instrument validity of the fifteen items that determined acceptability (9 items) and feasibility (6 items). *Kruskal-Wallis* statistic were performed for all non-parametric data to compare and contrast feasibility and acceptability across and between countries

and stakeholders (Kuzon, Urbanchek & McCabe, 1996). An alpha of <0.05 was considered statistically significant and SAS (SAS Institute; Cary NC, USA) was utilized to conduct all analyzed.

2.7 Triangulation

Qualitative analysis of the codes on SCORE perceptions, open-ended questions on acceptability and feasibility of SCORE from the evaluations, and the key-informant interviews results were triangulated using Computer Aided Qualitative Data Analysis (CAQDAS) software, specifically MAXQDA 2020 (VERBI, software, 2019) for integration and synthesis of findings. Analysis and visualizations using MAXQDA (*e.g.*, code matrix browser, code relations browser, MAXMaps) were generated to visualize results for interpretation.

2.8 Ethical Considerations

Ethical approvals were obtained from U.S. Centers for Disease Control and Prevention (CDC), Division of Global HIV and Tuberculosis (DGHT), CDC-India office, CDC-Tanzania office, University of Illinois, Chicago, University of Maryland, Baltimore, National Institute of Tuberculosis and Respiratory Diseases (NITRD, New Delhi, India), and National Institute of Medical Research (Dar Salaam Tanzania). Ethical review committees determined this to be non-human subjects related research deemed as a program evaluation initiative (Quality Improvement/Quality Assurance).

Results

3.1 Participant profile in India

In India, 34 workshop participants were assigned to four homogenous breakout groups based on their employment-based position and responsibilities. Each of the four groups comprised of 6–8 persons. *Decision Maker (DM) group* included 6 leadership decision-making positions, represented by the four Indian National TB Centers of Excellence, WHO India Country Office, CDC India Office, State Tuberculosis Officer (STO) Delhi (DM). *Health care providers (HCP) group* included 17 paramedical staff comprised of laboratory technicians (LT), outreach field supervisors (STLS), Directly Observed Therapy (DOT) workers. *Subject Matter Experts and Implementers (SME and Implementers) group* included 11 NITRD faculty (*i.e.*, primary TB ECHO implementers in India) and District TB Officers (DTO). The

workshop was conducted over two days, eight hours each (n = 16 hours) by four facilitators and 2 note takers (Figure 1).

3.2 Participant profile in Tanzania

In Tanzania, 30 participants were assigned to three homogenous stakeholder groups. *Decision Maker (DM) group* included 5 administrative decision makers from MOH, CDC, and University of Maryland, Baltimore (UMB). *Health care providers (HCP)* included 10 facility level medical officers, nurses and social workers. *Subject Matter Experts and Implementers (SME and Implementers)* included 15 subject matter experts, nutritionist, and implementer physicians from UMB. The workshop was conducted over two days, five hours each (n = 10 hours) by three facilitators and 2 note takers (Figure 1).

3.3 Quantitative outcomes of FGDs

Table 1 displays select quotations (51 quotations from India and 60 quotations from Tanzania, respectively) that are categorized as strengths, challenges, opportunities/aspirations, and measurable results. A total of 581 (India=214, Tanzania=367) quotations were categorized into ten *a priori* codes excluding emergent codes that were identified through manual coding and analyzed using MAXQDA (Figure 2). Comparison of perceptions between India and Tanzania shows scale-up and expansion being predominant with 17% of codes from Indian participants as compared to 21% from Tanzania. Building capacity was next most predominant with 16% codes from India as compared to 11% from Tanzania and this was statistically significant (p=0.02). Codes from Indian participants related to measuring public health impact was 15% as compared to 9% from Tanzanian participants, which was statistically significant (p=0.01). There was no statistically significant difference in India and Tanzania when it came to perspectives about procuring administrative, funding, logistical resources (13% of total codes from each country). ECHO session related codes included content as well interactivity and were 12% vs. 10% for India and Tanzania, respectively. Perspectives about monitoring and evaluation (6% vs 2%) as well as utilizing information technology (4% vs. 3%) seemed of more interest in India than Tanzania, even though this associations were not statistically significant. Perceptions about garnering political will and leadership engagement (2% vs. 7%, p=0.57) as well as establishing communities of practice (3% vs. 8%, p=0.73) seemed less relevant in India as compared to Tanzania; both difference statistically not significant. The emergent codes related to Zoom, ECHO research, motivators and incentives seems more relevant to participants from Tanzania than India (5% in India as compares to 12% in Tanzania) (Figure 2).

Largest number of quotations related to stakeholder's perceptions of strength (237) followed by perceptions of aspirations and opportunities (154). Number of quotations on perception of challenges were the lowest (99). Out of 237 codes that represented strengths of ECHO, equal proportions were expressed by Decision Makers = 84 (35%), and HCP = 83 (35%). SME/Implementers expressed the rest of the 30% of codes on strengths of ECHO. Out of 99 codes that were perspectives on challenges, 26% were from decision makers, followed by 25% from HCP. SME/Implementers seemed most challenged 48 (48%) with the current status of ECHO. Out of 154 codes on aspirations/opportunities, 44% of the SME/Implementers shared ideas about future followed by 31% aspirations by Decision makers and 25% by HCP.

In India, out of a total of 149 codes overall, Decision Makers had 57 (38%) codes, HCP had 28 (19%) codes, SME/Implementers expressed 64 (43%) of codes. Decision makers in India vs. Tanzania weighed capacity building (19% vs. 6%), measuring public health impact (16% vs. 10%), ECHO session related comments (14% vs. 2%). In contrast, Tanzanian Decision makers expressed a higher proportions of perceptions compared to India for scale up and expansion (38% vs. 12%), administrative and resource related (16 vs. 5%), monitoring and evaluation (9% vs. 4%) and political will and leadership engagement related (13% vs. 12%). Indian SMEs/Implementers prioritized capacity building (24% vs.8%), and session content (23% vs. 16%), and procuring administrative, logistics resources (16% vs 13%). SMEs in Tanzania seemed to focus on scale-up and expansion (29% vs. 11%), M&E related perceptions (12% vs. 5%) and garnering political will (13% vs. 3%). HCPs in Tanzania every element more than HCP except for scale-up, which was highest was Indian HCPs (14% vs. 6%). In contrast, Tanzanian HCPs were focused on public health impact related perceptions (36% vs. 10%) (Figure 3).

Distribution of themes by strengths (214), challenges (107), and opportunities/aspirations (141) (SCO) stratified by stakeholder groups are described in detail below (Figures 3a-c). While Tanzania decision makers commented on scale-up as a strength, India SME/Implementers though measuring public health impact was key (Figure 3a). While Tanzanian HCP thought scale-up and procuring administrative resources and logistics a major challenge, India SME thought ECHO sessions were a challenge (Figure 3b). While Tanzanian HCPs aspired to be able to measure public health impact as well as increase participation, and garner political will and leadership, Indian SME/Implementers focused on scaling up as an opportunity (Figure 3c).

3.4 Qualitative outcomes of FGDs — Strengths

3.4.1 Capacity building, expanding partnerships, and communities of practice

A predominant strength articulated by stakeholders in both countries was the value of ECHO for capacity building and learning. As one stakeholder noted, *“Every time we are trained, we get new knowledge, it is a continuous process, there is follow-up”*. Building communities of practice, expanding partnerships for engaging others was another strength that became evident from the discussions (e.g., private providers, civil societies, and medical colleges in India that were outside the government sector, and additional agencies in Tanzania). Participants shared a clear sense of accomplishment about establishing communities of practice and capacity building, a sense of satisfaction, and acknowledgement exemplified by select quotes such as these: *“You solve common problems and you don’t feel alone.”* (Table 1) Using technology to save resources, patients, and time were recurrent in both countries.

3.4.2 Resource Saving, communication, scale-up and expansion

There was a generalized belief amongst participants that ECHO was a *“resource and time savings”* option. As providers *“we wouldn’t have to go for in-person trainings and could get knowledge virtually through ECHO.”*

Another stakeholder from Tanzania mentioned, *“Cost saving at some of the hospitals where if a case is presented, patients get exempt from the costs associated with diagnostics since the case was a referral for Project ECHO and the diagnostics were part of the recommendations from the ECHO session experts”*.

A medical provider (HCP) from Tanzania mentioned *“Sometimes instructions from ministry are delayed, we get this information from ECHO sessions and we can ask questions and engage in negotiations.”*

Discussions related to feeling proud about scale-up and expansion ensued. Many of the participants in India seemed inspired about *“Nationally, 100% coverage of all states/all districts with ECHO to reach TB free India strategy by 2025.”* Similar sentiment was shared by Tanzanian stakeholders *“100% coverage with all facilities having ECHO in 5 years is a long-term aspiration.”* (Table 1)

3.5 Qualitative outcomes of FGDs — Challenges

Perceptions related to challenges or barriers were identified from 101 quotations.

3.5.1 Resources, infrastructure, and logistics

Securing resources and infrastructure, such as availability of dedicated room/laptop, logistical challenges such as attendance, timing, language used were some of the challenges mentioned. In Tanzania, while SMEs thought the one-hour time assigned to the ECHO sessions was adequate, HCP thought that the ECHO sessions should be longer. A suggestion was made that the ECHO champion and coordinator, who could be HCP or clinic manager, could work together to adjust time and length of ECHO sessions based on how the complexity of the case presented. Non-availability of a dedicated room was another issue brought up by HCPs unanimously in Tanzania and India. To facilitate routine participation, a systematic room scheduling scheme at clinics with reservation logs that are observed so that rooms are not double booked would help save resources and use them more effectively and efficiently was discussed as a potential solution in Tanzania.

Participants from both countries noted that ECHO was saving resources, yet additional time was spent to coordinate recruiting new experts and presenting new topics to keep the ECHO participants engaged. Additionally, SMEs and HCP shared their concern of one-hour time being adequate vs. not enough time, so again managing the facilitation and topic more efficiently. This was thus coded as “*logistical and infrastructure*” instead of “*resources.*” (Table 1)

3.5.2 Session content

Perceptions related to maintaining high-quality course content with interaction and sustaining interest and availability of experts, and encouragement of interaction during ECHO sessions were persistent challenges mentioned by stakeholders from both countries. As one of the HCP commented, “*Having input from facilities and spokes in developing and dissemination of [the] curriculum*” would help garner buy-in from participants. For example, the absence of the role of nutrition in HIV/TB care and management was emphasized as a curriculum oversight by a vocal SME in Tanzania who suggested incorporating nutritional status in the case summary sheet for case presentation and inclusion in didactic presentation topics in the curriculum as a short-term outcome. Session content related quotations by Tanzanian SMEs that demonstrated a potential challenge that needed addressing, “*Case not routinely outlining the full investigation and physical findings.*” (Table 1)

HCPs in India emphasized the need to communicate topics that are relevant to DOT workers and laboratory technicians in Hindi, and eventually “*have sessions that [are] coordinated and run to promote learning and interaction*” of non-English speaking staff. Other key communication quotations related to the workshop included: “Communication about the meetings not shared in advance – they did not know that

first Wednesday of the month is reserved for Lab technicians/Health volunteers since email is shared only with District TB Officers [SME] *“due to multiple tasks, time management is a huge challenge: need to ensure that there is no saturation of topics, networking/liasing with multiple disciplines takes time affecting expanding partnerships”*.

One HCP from India mentioned *“Having >120 people on sessions is both a challenge and a strength”*. Other session-related comments were *“it would be helpful to link the didactic presentations to the cases”* and *“consider choosing a didactic topic and then finding a case[to match the session topic].”* The struggle to link case presentation with didactics was common in both India and Tanzania. Seeking feedback from the participants on the curriculum development and facilitating interaction were key issues that SMEs seem to grapple with in Tanzania. Some other participants commented on *“selection of topics”* and *“how accurate [is] the course content?”* and whether *“the recommendations during didactic related to the course content of the presentations and the case studies.”*

3.5.3 Technology infrastructure and internet connectivity

Addressing internet connectivity issues was unanimous challenge in both the countries. Technological infrastructure challenges quotations included: *“upgrade the infrastructure to provide uninterrupted services,”* and *“hard to see the computer screen when in large group.”* This led to participant’s inability to view and absorb the content covered in the ECHO sessions. Sometimes inaudible and visual disruptions seemed to be a barrier during the ECHO session.

3.5.4 Sustainability

Another key theme that emerged consistently within all groups in both countries related to concerns about sustainability. One of the Implementers from India mentioned, *“I often worry about how to preserve interest? And ensure providers attended consistently”* was something a SME brought up. Similar sentiment from Tanzania was *“Need continuous sensitization and consistent commitment from spokes.”* Few implementers from India [NITRD] revealed concerns about *“how they could sustain interest of the participants.”*

3.6 Qualitative outcomes of FGDs — Opportunities and Aspirations

Rich discussions ensued on opportunities for improvement and vision for the future (Table 1).

3.6.1 Need for sustainability, scale-up, and expansion plans

Ways to improve and own high-quality implementation and sustain participation and continued interest of participants as well as sustained engagement was a concern discussed by stakeholders.

Scaling up without an expansion plan was brought up as a challenge and a concern in both India and Tanzania. Some even said that they were concerned about not having enough resources for expansion of HIV ECHO sessions to additional sites. The decision-maker group encouraged development of a transition plan in place within two to three years to ensure that the MoH of Tanzania is able to assume management and implementation of ECHO programs completely and integrate them within the government health system. One Decision maker from Tanzania noted, *“This would ensure funding and resources dedicated to ECHO as it would be part of the national strategic plan, within the country’s health budget, and not an Annex.”*

Plans for scale-up, and expansion with expanding partnerships would be necessary. Desire of using ECHO to strengthen data quality of NIKSHAY (RNTCP TB reporting mechanism) was expressed and *“if there was a way to cross-check whether a patient who was discussed in the ECHO session has been reported in Nikshay”* to monitor outcomes.

One Tanzanian Decision maker noted, *“Within 5 years, my long-term aspiration is that ECHO will be absorbed within government, MOH, not UMB's ECHO, but TZ ECHO, written in the national strategic plan, not just an appendix”*

3.6.2 Resources, logistics, and infrastructure

Potential divergence was noted about resources. Some participants from both Tanzania and India noted that ECHO was *“saving resources”*, as clinicians were saving time and money by being able to provide expert consultation remotely; yet others in India mentioned that *“time [resources] would have to be managed more judiciously”* additional time was spent to coordinate and recruiting new experts. Presenting new topics or scientifically relevant guidelines to keep the ECHO participants engaged *“needed time and resources for preparation”* was one of the sentiments shared by an Indian SME.

3.6.3 Routine Monitoring opportunities

Several opportunities to integrate clinical monitoring were cited. One of the HCP from Tanzania mentioned, *“Routinely monitor ECHO and show impact of ECHO on patients and providers; lower number of referrals is an outcome to strive for long-term.”* Another HCP from India mentioned, *“Monitoring*

prescription practices in private vs. public sector". One of the SMEs from India mentioned "*Development of a clinical database to monitor patient outcomes and document whether recommendations were followed*" would be an aspiration.

3.6.4 Session content

"*Sessions should be more interactive*" was a unanimous message from both India and Tanzania SMEs and HCPs. Several comments were related to developing a government recognized system to link presentation at ECHO sessions with "*continuing professional development credits (CPD)*" which could be linked to medical license renewal.

3.6.5 Addressing internet connection challenges

One of the SME in India mentioned despite having highly advanced India's IT system, the technical glitches during ECHO sessions continue". One of the Tanzanian decision makers commented, "*Having a long-term aspiration of having fiber optic cables to increase connectivity since this will have to be done by the country.*" "*Empowering ECHO facilitators/champions to get training on IT and zoom connections could help sessions go more smoothly*", was an option discussed in Tanzania. There was consensus from both countries on "*Communities and national effort (should be made) to improve connectivity.*" Resources should be reserved for "*Technical maintenance and upgradation of infrastructure to provide uninterrupted services will be key for scale-up*" was a convergent theme from both countries. A Tanzanian decision maker mentioned, "*Since network is growing bigger and bigger, corporate social responsibility to focus on telecommunication*". However, this seemed more like a long-term aspiration.

3.6.6 Incentives and motivators

To improve and sustain participation for both presenters and participants, some stakeholders from both countries mentioned having incentives and motivators, which was uncovered as an emergent code. Not having any supplementary incentive for appropriate case finding for presentation by providers at facilities would be beneficial as it takes time, training, and energy to prepare cases. Small monetary incentives (*e.g.*, 20,000 TZ Schillings) should be considered to ensure sustainability of ECHO sessions.

This could also be tied to long-term aspirations for the government to officially acknowledge ECHO and integrate it into CPD credits or licensing procedures that would encourage a minimum number of ECHO presentations (*e.g.*, 3–5 presentations) a year for medical license renewal. This would increase enthusiasm and participation for didactic and case presentation by HCP. SMEs could also include this in their *curriculum vitae* for additional recognition. Addressing this challenge would benefit both the SMEs who prepare for ECHO sessions as well as HCP who are then motivated to attend these sessions.

3.7 Qualitative outcomes of FGDs — Measurable Results for routine monitoring and evaluation

Based on the discussions of strengths, challenges, and opportunities, workshop participants in both countries identified measurable indicators for routine monitoring and evaluation as their large breakout groups. While a large group in Tanzania concluded with adding data source for the indicators as well as frequency of data collection, India workshop did not (Table 2).

3.8 Workshop evaluation results

Out of 64 participants (India=34, Tanzania=30), 45 (India=24, Tanzania=21), India: 6 decision makers, 11 SME, and 7 HCPs responded from India; 2 decision makers, 10 SMEs, and 9 HCPs responded from Tanzania (70% overall response rate) (Figure 1). There were 15 (9 acceptability and 6 feasibility) related questions on whether participants answered a 4-point Likert Scale survey [4=objectives “completely met or completely satisfied”; 3=mostly met/mostly satisfied; 2=minimally met/satisfied” ; 1= “not met/not satisfied”]. Using Kruskal-Wallis Chi-Square statistic, the median composite scores for acceptability for Tanzania was higher than India and was statistically different [Median: 33 vs. 30, $p=0.03$], while the median composite scores for feasibility were the same in India and Tanzania (Median: 21, $p=0.72$), thus not statistically different. While acceptability had a higher Cronbach alpha statistic of 84%, feasibility items were fair with a Cronbach statistic of 69% (Table 3).

While majority of the stakeholders thought the SCORE workshop mostly met or completely met objectives, decision makers from Tanzania felt that the general structure and breakout groups as well as discussions with lessons learned needed more time. Of note is that that there were only 2 decision makers from Tanzania who completed the evaluation (Figure 4).

Open-ended questions on the evaluation forms unanimously complimented on the novelty factor of the AI approach. Composite median scores were higher in Tanzania than India for acceptability and was good (84%), while there was no difference in median scores for feasibility between the 2 countries, and the

Cronbach alpha was fair (69%) (Table 3). However, there were no statistically significant differences between overall median SCORE workshop scores between India and Tanzania overall (Table 4).

Even though there was no statistically significant difference for majority of the components measuring acceptability and feasibility, component indicating SCORE workshop supported obtaining skills & knowledge for TB & HIV was statistically significant [*Kruskal-Wallis Chi-sq*=9,066; *p*=0.008] (Table 5). However, it is worth noting that the component indicative of SCORE workshop helping gain skills & knowledge applicable for evaluation efforts in general (*Kruskal-Wallis Chi-Sq*=5.667; *p*=0.058) approached statistical differences (Table 5). When stratified by roles within India, there is statistically significant differences noted for median scores for Health care providers (HCP) as compared to Decision Makers (DM) and subject matter experts (SME) for the following 3 components related to components of acceptability (SCORE workshop allowed discussions on measures of success, provided opportunity to share personal experiences, provided a forum to obtain skills that could be applied to their TB and HIV work). For feasibility, the only component that was statistically different was pre-workshop coordination (Table 6a). When stratified by roles within Tanzania, the only component for statistically significant differences in acceptability component indicating SCORE workshop supported obtaining skills & knowledge for TB & HIV work. None of the feasibility components had any statistically significant relationships among stakeholder breakout groups within Tanzania (Table 6b)

Select feedback from comments in the open-ended session of the evaluation form substantiated the novelty and usefulness of the AI workshops: *“I thought it (AI workshop) was useful since analysis of strengths and challenges gives a chance to look at opportunities and what to aspire in the future”*; *“(AI workshop) focused as much on positive aspects as much as areas that needed improvement”*; *I liked the interactive session, could freely share without hierarchy*”; *“Workshop was useful and valuable, better to be done annually”*, *“Formulation of indicators to be incorporated in the framework was valuable.*

3.9 Key-informant interview results

Nine key informant interviews were conducted (two participants of AI workshop represented India and Tanzania). Even though 8 out of the 9 participants accepted a participatory workshop of this nature, there was much varied opinion about availability of dedicated resources including availability resources including an expert evaluator with effective facilitation skills and expertise in qualitative data analysis, presentation and use of results for decision making. All (100%) agreed to conducting such a workshop 6 months to a year post ECHO implementation and engagement of Ministry of Health are critical elements for such a workshop.

4. Discussion

4.1 Reflection on perspectives gathered about status of Project ECHO in India and Tanzania

Proud sentiments were shared about the current status of ECHO in stakeholders' respective countries, India and Tanzania. By promoting safe spaces, we were able to gather perspectives on what was working and unveil opportunities for change and improvement. Stakeholders from both countries boasted about how ECHO was “*spreading knowledge from classes to masses*” and was playing a role in building capacity of TB and HIV providers in India and Tanzania, they were able to highlight areas of improvement. Specifically, addressing internet connection issues, facilitators encouraging interaction during sessions, engaging political leaders (*i.e.*, MOH officials) during ECHO sessions, as well as, having a scale-up plan, were critical elements identified for sustaining high-quality ECHO implementation. Technological infrastructure (*i.e.*, accessing broadband connectivity) needs both immediate and long-term attention and remediation. It will be important to consider broadband and telecommunication improvements or alternate options as part of the countries' scale-up and expansion plans.

Emergent code indicating incentives such as CPD credit procedures for professional licensing and incentive options should be considered to formalize and encourage participation at hubs and spokes. Increasing demands and expansion of ECHO-related activities was evident. An integrated expansion and transition plan developed should include transition plan for the MOH implementation, coordination, and management. Scale-up plan would have to be adequately supported, both financially and with dedicated human resources from MOH with eventual transition to the country officials implementing ECHO instead of support from PEPFAR-implementing partners, as suggested in Tanzania. National governmental support and political leadership engagement will be key to implement and sustain these efforts to integrate with national public health vision and long-term public health goals. Dedicated staff to conduct routine monitoring and evaluation activities should be part of the national plan to routinely assess impact of Project ECHO and modify course corrections accordingly.

From our analysis, responding to administrative challenges, such as the number and timings of sessions, need careful attention and coordination for all ECHO-related activities. Designating one implementing partner coordinate all activities was brought up as a potential solution in Tanzania to manage consistency in session quality, attendance, and participation in Tanzania. Moreover, the impact on quality of on-going ECHO activities including implementer fatigue, routine monitoring of attendance, session quality, and session participation will be important considerations. Reminder trackers and WhatsApp

groups are mechanisms that Tanzanian implementing partner uses. In contrast, India uses iECHO. However, iECHO data is not being used routinely to adjust participation outcomes in India.

A Participatory Digital Attestation Platform (PDAP) technology which is now being pilot tested across various ECHO platforms (*e.g.*, in Tanzania) holds promise to empower staff and partners to set up, coordinate, monitor, and motivate large scale capacity building initiatives (Socion, 2020). PDAP is a digital platform that enables participants to track, organize, and share their training content with peers, monitor their training certifications that can be a motivator and incentive. Professional certifications instead of monetary remunerations could help in sustaining interest and incentives. Maintaining timely and topical case studies with corresponding didactic sessions warrants careful review and consideration. MOH could leverage this PDAP technology to promote national communities of practice, accreditation, skill building and capacity assessments as part of their national workforce development strategies.

4.2 Reflection and lessons learned from implementing a modified appreciative inquiry-based SCORE approach in India and Tanzania

4.2.1. Why engage in SCORE?

A modified appreciative inquiry-based SCORE approach offers an opportunity of engagement that provides freedom and latitude to level the playing field (Cooperrider & Whitney, 2005). Marginalized voices are able to build bridges across boundaries of power and authority that enables co-creation and produce self-directed change (Cooperrider & Whitney, 2005; Yudarawati, 2019). This approach encouraged a diverse set of stakeholders in both countries to participate in a strategically facilitated workshop where participants felt comfortable sharing their unique experiences freely in both India and Tanzania.

Improving communication, collaboration, and learning from peers, networking to share updates, and national guidelines to stay current in the field, while feeling a sense of belonging (Mabery, Gibbs-Scharf & Bara, 2013), are key principles of ECHO's virtual communities of practice that led to a process of co-creation of elements for an evaluation framework. Various studies have acknowledged that although participation is a negotiated practice with diverse stakeholder groups involved in framing and defining the parameters of participation, intentionality and inclusion are primary considerations for such workshops (Chouinard & Milley, 2018). Participatory practice through the AI methodology entails a normative, action-oriented approach to the co-creation of knowledge, a motivation and political input to democratize the

inquiry process and better represent the local and national context (Choinard & Milley, 2018). SCORE process focuses on positive ways to produce change in experiences and understanding of the world, and an inclination to act together (Lewis, Passmore & Cantore, 2008)

4.2.2. Who should be included in the SCORE process?

Successful change management requires attention, focus, and commitment of positive change catalysts in the form of clear roles and responsibilities (Cooperrider & Whitney, 2005). We included leadership in the form of sponsors, an AI consultant, an AI core team, and of course, participants. While leadership or the core decision makers in India and Tanzania were the champions who organize, coordinated, and lead by affirmation, the consultant, first author worked with the core team who facilitate development of questions that facilitate the process (Appendix), and conduct stakeholder analysis to understand the stakes, inter-relationships, and boundaries, which is critical in deciding on a list of stakeholders for inclusion (Williams & van't Hof, 2016). The core team determines the inclusion of stakeholders in the SCORE process that facilitates participatory evaluation, acknowledging that in a highly diverse, culturally complex, agile setting, the SCORE approach can offer additional challenges, given issues of inequity, power, voice, capacity and skill (Choinard & Milley, 2018).

Findings from various studies suggest selecting the correct stakeholders becomes all the more complex in the international development context, as there are numerous stakeholders representing very diverse roles and constituencies (*e.g.*, multiple agencies, donors, beneficiaries, politicians, evaluators, community program managers) (Bamberger, Vaessen, & Raimondo, 2016), all with often competing and contrasting issues, interests and voice. How community is defined, who represents the community, who speaks for whom, and who is selected for inclusion, thus remains controversial, as implications of inclusion and exclusion directly influences the participatory process (Cousins & Chouinard, 2012).

AI workshops in India and Tanzania were a convenient sample selection of stakeholders that were organized and recruited by local implementing partners. This selection may have influenced the results. We attempted to minimize this bias by developing *a priori* selection criteria to adequately represent a variety of influencers and perspectives. By following the code book closely during analysis ensured minimization of interpretation bias. Moreover, the intentional use of homogenous groups, facilitated a safe space for information gathering, especially amongst groups that are considered subservient to their supervisors in attendance. For example, the revelation of the language barrier among HCP was not revealed to the SME

and Implementers until the SCORE workshop in India that led to rapid change immediately. Overall, we believe this sample adequately represented the opinions of current ECHO stakeholders in both countries.

4.2.3 How should SCORE be conducted?

Inquiry is an intervention (Cooperrider & Whitney, 2005). The process entails how stakeholders discover best practices, think and talk about dreams, designing possibilities for change, and then sustaining momentum for performance to attain that change. For example, Alvarez *et al.* (2010) reported the use of workshops at the outset to support evaluation design and to train participants and near the end of the project to bring communities together to increase the reach of the findings to various stakeholder groups. As Cornwall and Jewkes (1995) argue, “*asking the who question enables us to look more closely to focus attention on the central issues of power and control*” (p. 1668). It is critical to consider who initiates the participatory process, whether it comes from the top down or the bottom up, from the funder or from the community, whether stakeholders are selected, volunteer for the task, or are obligated or compelled, all has a direct effect on the process and outcomes (Oakley, 1991), and importantly frames the boundaries of action and the knowledge jointly created in the process (Cornwall, 2008; Guijt & Shah, 2001).

SCORE enabled stakeholders (*e.g.*, HCP, decision makers, SME representing hubs or spokes) to achieve a clear understanding of their role, functions and contribution to the program, thus playing a major role in designing questions and planning for expectations and outcomes. The role of the facilitator was key to ensuring stakeholders have a clear understanding of the SCORE process, mitigating any power imbalances, and encouraging critical, honest, reflective feedback from the participants. Cross-culturally sensitive facilitators who are cognizant to nonverbal gestures, make eye contact, respect time, and encourage a safe space to share, promote a productive discussion, resulting in co-creation and information sharing. Even though physical proximity is key, similar efforts for virtual sessions would be a consideration worth exploring. Evaluating whether expectations and outcomes were mutually met or not will significantly affect how results of the workshop are utilized.

The availability of resources determines the scope of SCORE methodology. Despite the workshop in Tanzania lasting for 10 hours instead of 16 hours in India, participants larger number of quotations were obtained from Tanzania (367) than India (214) (Figure 2). Transcription from audio recordings may be more complete than relying on the flip chart notes alone that may have contributed to this discrepancy.

KII indicated that the SCORE process may be resource intensive yet had potential to be a qualitative interim evaluation approach that supplements other objective strategies. One key-informant felt that it did not have to be an evaluator facilitating the AI workshop, good facilitation skills to promote gathering honest responses could be sufficient, yet a critical requirement to undertake a SCORE process. One key-informant reported that as part of their Project ECHO's interim evaluation after a year of implementation in their country, they conducted key-informant interviews through site visits, which was resource intensive and certainly preferred this SCORE process instead.

The AI workshop in India was not recorded and we had to rely on written notes from various note-takers. However, content seemed to be captured comprehensively. In Tanzania, the workshop was recorded and transcribed; hence, verbatim notes were more completely captured, hence the larger number of quotations included in the analysis. Conducting the SCORE process virtually has not been attempted and needs to be explored.

4.2.4 When should SCORE be conducted?

No literature exists on appropriate timing to conduct SCORE. Nor is there a recommendation for the specific stage in the life cycle of a policy/program implementation when SCORE should be considered to imbibe change. Based on our experience, it was helpful to conduct SCORE 12 months post-implementation of both the TB and HIV ECHO programs. Any earlier than a year of implementation, using SCORE may not yield best results since stakeholders would lack experience and understanding of the programmatic potential. Thus, full consensus was received by key informants that an ideal time to conduct SCORE would be 6-12 months post implementation to be able to utilize the findings for course corrections to adopt change. Moreover, using the AI-based SCORE methodology utilizes the power of conversation in an agile complex adaptive system inspired by communities of practice to qualitatively reveal self-identified potential for change.

4.2.5 Limitations

Despite contribution to AI for a more participatory process, this study, recognizes that the validity of the findings is relevant to the composition of the FGDs. The selection of the participants was based on a convenient sample. More engaged and vocal participants may have been more enthusiastic and vocal about their opinions. Nevertheless, the appreciative philosophy accepts flexibility to adapt, and contextualize (Yudarwati, 2019). Lack of similar availability of time (at least 16 hours) to conduct the AI workshop in

Tanzania led to absence of a large group reflection session to gather reflective feedback. However, the evaluation results do not show overall statistically significant differences in the median scores in acceptability and feasibility of the SCORE workshop (Table 4). To our knowledge, ideal amount of time to conduct an AI has not been published. Nonetheless, Tanzania had a larger number of quotations than India (Table 5).

5. Conclusions

To our knowledge, this was the first time the AI-based SCORE methodology has been utilized for a TB or HIV ECHO program to co-create an evaluation framework, to build ownership by facilitating revelation of a multitude of perspectives from diverse stakeholders. It is hoped that the insights here shed light for evaluators and strategic thinkers and planners on determining factors to conduct SCORE process in their context. Given public health system's conundrum to be able to manage and plan for evaluation resources in this era of shrinking economy, we hope we have demonstrated the value of engage stakeholders to maximize limited resources. The SCORE approach has the potential to be implemented as a best practice that should be beneficial for interim course corrections. The ability to initiate, inquire, imagine, innovate, and inspire to implement change (AI approach) should be an integral recommendation for quality improvement process.

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Table 1. Select quotations by SCORE themes

Const ructs	Codes	India SCORE Workshop	SCORE (Strength=S, Challenge=C, Opportunities/Aspir ations=O, Measurable Results=R)	Tanzania SCORE Workshop	SCORE (Strength=S, Challenge=C, Opportunities/Aspiration s=O, Measurable Results=R)
Capacity Building	<i>Capacity Building</i>	<i>"We are proud that knowledge is spreading from classes to masses"</i>	<i>S</i>	<i>"It's a benefit for both the hospital and staff"</i>	<i>S</i>
	<i>Capacity Building</i>	<i>"We are proud about real time patient care and management"</i>	<i>S</i>	<i>"I am proud to be the one providing the right answers"</i>	<i>S</i>
	<i>Capacity Building</i>	<i>"Real time patient case management and care preventing death"</i>	<i>S</i>	<i>"A team of regional hospitals that can support the hospital at peripheral sites that do not have mentorship and expertise available"</i>	<i>S</i>
	<i>Capacity Building</i>	<i>"Improving data quality for program management and analysis"</i>	<i>O</i>	<i>[Making presentations take time].. "Having coaching or mentorship can support efficiency in preparation for the sessions"</i>	<i>S</i>
Communities of Practice (CoP)	<i>CoP</i>	<i>"Collective problem solving"</i>	<i>S</i>	<i>"There is fear of criticism" [when you are asked to present a case]</i>	<i>S</i>
	<i>CoP</i>	<i>"Ability to interact with professional colleagues working in various DTO chest clinics, lab,</i>	<i>S</i>	<i>"Number of ECHO stakeholder meetings held"</i>	<i>R</i>

		<i>implementing the RNTCP programs"</i>			
<i>CoP</i>		<i>"sharing the experience with international expert faculty in the field of mycobacteriology and treatment management including newer TB drugs"</i>	<i>S</i>	<i>"ability to interact with professional colleagues working in other clinics, lab, implementing best practices"</i>	<i>S</i>
<i>CoP</i>		<i>"Sessions should be more interactive"</i>	<i>O</i>	<i>"Sometimes instructions from ministry are delayed, we get this information from ECHO sessions and we can ask questions and engage in negotiations"</i>	<i>S</i>
<i>CoP</i>		<i>"all available experts to solve problems collectively"</i>	<i>S</i>	<i>"Every time we are trained, we get new knowledge--it is a continuous process, there is follow-up. SMEs give their recommendations in writing and it's easy to follow."</i>	<i>S</i>
<i>CoP</i>		<i>"Having >120 people on sessions is both a challenge and a strength"</i>	<i>S and C</i>	<i>"Have an ECHO champion lead other champions since they are at the same level (peer support) for presentations as well as follow-up"</i>	<i>O</i>
<i>CoP</i>			<i>S</i>	<i>"Creating safe and comfortable ECHO environment for spokes to attend ECHO sessions and learn from each other"</i>	<i>O</i>

<i>Communication</i>	<i>Communication</i>	<i>"Communication about the meetings not shared in advance – they did not know that the first Wednesday of the month is reserved for Lab technicians/health volunteers since email is shared with only DTOs"</i>	<i>C</i>	<i>"Reducing interprofessional bridges, i.e., increase communication between providers"</i>	<i>S</i>
<i>Expansion, replicability, and Scale up</i>	<i>Expansion of ECHO</i>	<i>"Nationally, 100% coverage of all states/all districts with ECHO to reach TB free India strategy by 2025"</i>	<i>R</i>	<i>"Within a year, ECHO scales up with becoming a Super-Hub"</i>	<i>R</i>
	<i>Expansion of ECHO</i>	<i>"Expansion of TB ECHO throughout the country with NITRD as a national hub in a phased manner in 3-5 years"</i>	<i>R</i>	<i>"within 2 years, having multiple zonal hubs operating, coordinating quality ECHO sessions"</i>	<i>R</i>
	<i>Expansion of ECHO</i>	<i>"NITRD should become a super hub and provide leadership and support to build MDR-TB capacity in the[South Asia] region"</i>	<i>O</i>	<i>"Within 5 years, my long-term aspiration is that ECHO will be absorbed within government, MOH, not UMB's ECHO, but TZ ECHO, written in the national strategic plan, not just an appendix"</i>	<i>R</i>
	<i>Expansion of ECHO</i>	<i>"Start ECHO at district level to engage lab technicians, health care volunteers, DOT providers"</i>	<i>O</i>	<i>"Increase in number of hubs to zonal hubs, to spokes, increasing participation"</i>	<i>R</i>
	<i>Expansion of ECHO</i>			<i>"100% coverage with all facilities having ECHO in 5"</i>	<i>R</i>

				<i>years is a long-term aspiration."</i>	
	<i>Expansion of ECHO</i>			<i>"Additional zonal hubs will need to be set up to manage additional spokes," and "spokes eventually becoming hubs".</i>	<i>O</i>
	<i>Expansion of ECHO</i>			<i>"Experience of index testing has scaled up and expanded across the country"</i>	<i>S</i>
	<i>Expansion of ECHO</i>			<i>"Growth from 1 ECHO program to 6 ECHO program areas"</i>	<i>R</i>
<i>Impact</i>	<i>Impact of ECHO</i>	<i>"Modifying patient care and adverse event monitoring real-time"</i>	<i>O</i>	<i>"This would ensure funding and resources dedicated to ECHO as it would be part of the national strategic plan, within the country's health budget, and not an Annex."</i>	<i>O</i>
	<i>Impact of ECHO</i>	<i>"Clinical management ECHO has capacity to create ripple effect which might be used for other programs"</i>	<i>O</i>	<i>"A long-term vision is to assess the proportion of spokes and hubs following the ECHO implementation protocol"</i>	<i>O</i>
	<i>Impact of ECHO</i>			<i>"Routinely monitor ECHO and show impact of ECHO on patients and providers"</i>	<i>O</i>
<i>Incentives and motivation</i>	<i>Incentive and motivation</i>			<i>"Incentive for presenter - a nominal amount of 20,000 Tz Schillings"</i>	<i>O</i>
	<i>Incentive and motivation</i>			<i>"continuing professional development credits (CPD)" which could be linked to medical license renewal"</i>	<i>O</i>

	<i>Incentive and motivation</i>			<i>"If a case is presented at the ECHO session, then patients sometimes get exemptions as they cannot afford tests, they are grateful"</i>	<i>S</i>
<i>Infrastructure and Logistics</i>	<i>Resources</i>	<i>"Saving time of patients and practitioners"</i>	<i>S</i>	<i>"Saving time of patients and providers"</i>	<i>S</i>
	<i>Resources</i>	<i>"resource and time savings" option since providers "wouldn't have to go for in-person trainings and could get knowledge virtually through ECHO"</i>	<i>S</i>	<i>"Having limited resources for expansion worries me as UMB is already stretched thin"</i>	<i>C</i>
	<i>Resources</i>	<i>"[the] video library [hosted at ECHO Trust website] had plans to be organized better so that ECHO clinic participants could refer to that library at a later time."</i>	<i>C</i>	<i>"Cost saving at some of the hospitals where if a case is presented, patients get exempt from the costs associated with diagnostics since it's part of the recommendations"</i>	<i>S</i>
	<i>Infrastructure</i>	<i>"hard to see the computer screen when in large group."</i>	<i>C</i>	<i>"Having one implementing partner coordinate all ECHOs in the country"</i>	<i>S</i>
	<i>Infrastructure</i>			<i>"Unavailability of a dedicated room was another issue brought up by HCP. To facilitate routine participation, a systematic room scheduling scheme at clinics with reservation logs that are observed so that rooms are not double booked would help save resources"</i>	<i>C</i>

				<i>and use them more effectively and efficiently"</i>	
	<i>Time management</i>	<i>"Due to multiple tasks, time management is a huge challenge: need to ensure that there is no saturation of topics, networking/liasoning with multiple disciplines takes time"</i>	<i>C</i>	<i>"Preparing presentations takes a lot of time"</i>	<i>C</i>
	<i>Infrastructure</i>			<i>"Getting contracts with better cell phone service is another idea that may help mitigate this challenge as well"</i>	<i>C</i>
<i>Funding</i>	<i>Funding</i>	<i>"hopefully there will be funding to sustain ECHO next year,"</i>	<i>C and O</i>		
<i>Technology and connectivity</i>	<i>IT related</i>	<i>"Number of sessions without interruptions"</i>	<i>R</i>	<i>"Need an IT person to set up equipment"</i>	<i>C</i>
	<i>IT related</i>	<i>"Uninterrupted power supply"</i>	<i>C</i>	<i>"Connectivity issues - 3 or 4 out of 23 sites cannot connect or have intermittent connectivity"</i>	<i>C</i>
	<i>IT related</i>	<i>"Technical glitches - broadband disconnections and audio/video quality"</i>	<i>C</i>	<i>"Empower facilitator and ECHO champions with IT"</i>	<i>C</i>
	<i>IT related</i>	<i>"Highly advanced IT system in India, yet these IT issues persist"</i>	<i>C</i>	<i>"Communities and national effort to improve connectivity"</i>	<i>O</i>

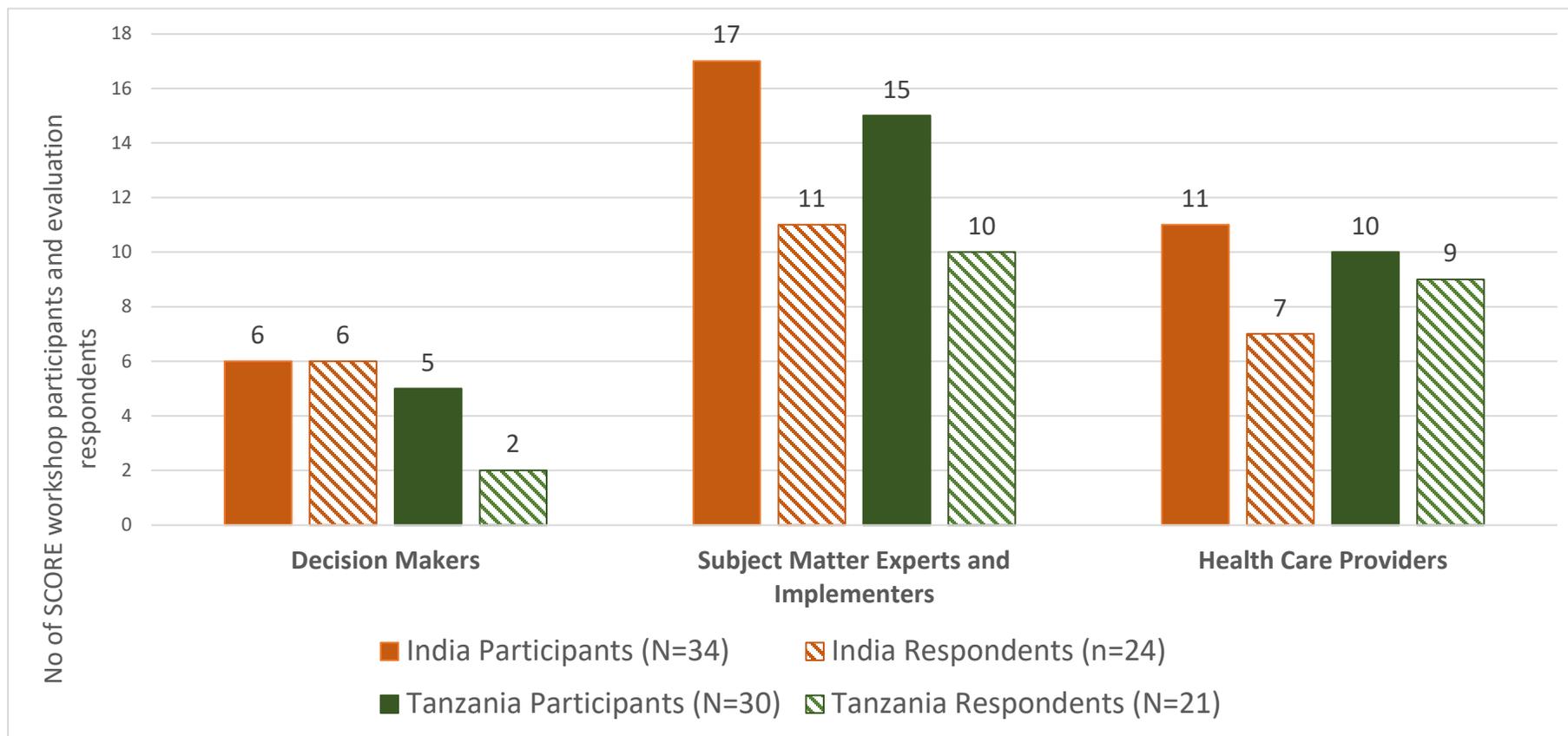
	<i>IT related</i>	<i>"upgrade the infrastructure to provide uninterrupted services"</i>	<i>C</i>	<i>"Having a long-term aspiration of having fiber optic cables to increase connectivity since this will have to be done by the country."</i>	<i>O</i>
	<i>IT related</i>	<i>"Proportion of ECHO sessions without disruptions"</i>	<i>R</i>	<i>"Proportion of ECHO sessions without disruptions or disconnections or uninterrupted services"</i>	<i>R</i>
<i>Outcomes</i>	<i>Outcomes</i>	<i>"if there was a way to cross-check whether a patient who was discussed in the ECHO session has been reported" to monitor outcomes.</i>	<i>R</i>	<i>"Saving people's lives with high quality case-based learning"</i>	<i>S</i>
	<i>Outcomes</i>	<i>"no feedback on recommendations of ECHO clinic (Did patient outcomes change)?"</i>	<i>C</i>	<i>"Lower number of referrals is an outcome to strive for long-term."</i>	<i>R</i>
<i>Participation</i>	<i>Participation</i>	<i>All staff" should be reconsidered to allow "full participation" of lesser-qualified staff since they are usually left out in order to keep health services open to patients</i>	<i>C</i>	<i>"ECHO increases number of people getting information at the same time - multiplier effect"</i>	<i>S</i>
<i>Political will</i>	<i>Political will</i>	<i>"Health is a state subject so coordination at national level and standardization"</i>	<i>O</i>	<i>"My government has embraced technology to support HIV programs"</i>	<i>S</i>
	<i>Political will</i>			<i>"The Chief Medical Officer and his engagement in HIV"</i>	<i>S</i>

				<i>ECHO program helps build the program</i>	
<i>Session content</i>	<i>Session content</i>	<i>"Align with didactic with case presentation"</i>	<i>C</i>		
	<i>Session content</i>	<i>"topics are good, whether speaker has justified the topic or not, [or if] knowledge of speaker is up to date"</i>	<i>C</i>	<i>"Having a feedback mechanism for everyone to be able to see how it's done by specialist"</i>	<i>O</i>
	<i>Session content</i>	<i>"Consider choosing a didactic topic and then finding a case."</i>	<i>O</i>	<i>"Having input from facilities and spoke in developing and dissemination of curriculum"</i>	<i>O</i>
	<i>Session content</i>	<i>"If you speak in Hindi, much better"</i>	<i>C</i>	<i>"integration of QI with HIV ECHO"</i>	<i>O</i>
	<i>Session content</i>	<i>"comprehension is good, [but] can spokes fill out feedback online [when it is not]?"</i>	<i>C</i>	<i>"Having input from facilities and spokes in developing the curriculum" would help in buy-in and participation"</i>	<i>O</i>
	<i>Session content</i>	<i>"course content was interesting"</i>	<i>S</i>	<i>"Absence of the role of nutrition in HIV/TB care and management"</i>	<i>C</i>
	<i>Session content</i>	<i>"sessions should be more interactive"</i>	<i>C</i>	<i>"Saving people's lives with case-based learning"</i>	<i>S</i>
	<i>Session content</i>	<i>"saving resources" as clinicians were saving time and money by being able to provide expert consultation remotely; yet SMEs in India mentioned that "time [resources] could have to be managed more judiciously"</i>	<i>S and O</i>	<i>"the recommendations during didactic related to the course content of the presentations and the case studies"</i>	
	<i>Session content</i>	<i>"How are selection to topics made? How"</i>	<i>C and O</i>		

		<i>accurate are the course content"</i>			
	<i>Session content</i>	<i>"Need to expand beyond MDR-TB topics, include diabetes, mental health"</i>	<i>O</i>	<i>"Case not routinely outlining the full investigation and physical findings"</i>	<i>C</i>
<i>Sustainability</i>	<i>Sustainability</i>	<i>"Need to ensure there is no saturation of topics"</i>	<i>C</i>		<i>C</i>
	<i>Sustainability</i>	<i>"how to preserve interest?" and "[ensure] that providers attend consistently,"</i>	<i>C</i>	<i>"Successful transition of HIV clinical ECHO from ICAP to UMB without interruption in quality of sessions including MOH in all activities overall"</i>	<i>O</i>
	<i>Sustainability</i>	<i>"how they could sustain interest of the participants."</i>	<i>C</i>	<i>"Need continuous sensitization and consistent commitment from spokes"</i>	<i>C</i>
<i>Zoom related discussion</i>	<i>Zoom related discussion</i>	<i>"DOT Workers can follow-up [with patients] using Zoom."</i>	<i>O</i>	<i>"Now we can use zoom for other things beyond ECHO as well"</i>	<i>S</i>
	<i>Zoom related discussion</i>	<i>"Zoom/ECHO could be used for video DOT, especially for well educated people with zoom who can be connected with the Indian government "</i>	<i>O</i>	<i>"No need for people to travel as they can login on zoom"</i>	<i>S</i>
	<i>Zoom related discussion</i>	<i>"Zoom could be used with DTO/MO to bridge between STS/HV/LTS because now the connection is between ECHO, RNTCP and DTO (not LTS/HV/DTO/RNTCP/ECHO)"</i>	<i>O</i>		

	<i>Zoom related discussion</i>	<i>“Zoom apps on phone could be available to initiate Q&A from patients while they are on TB treatment and management”</i>	<i>O</i>		
	<i>Zoom related discussion</i>	<i>“If patient gets feedback from zoom, then there will be less relapse/default, therefore increasing cure rate.”</i>	<i>O</i>		

Figure 1. Number of SCORE workshop participants and evaluation respondents by Country



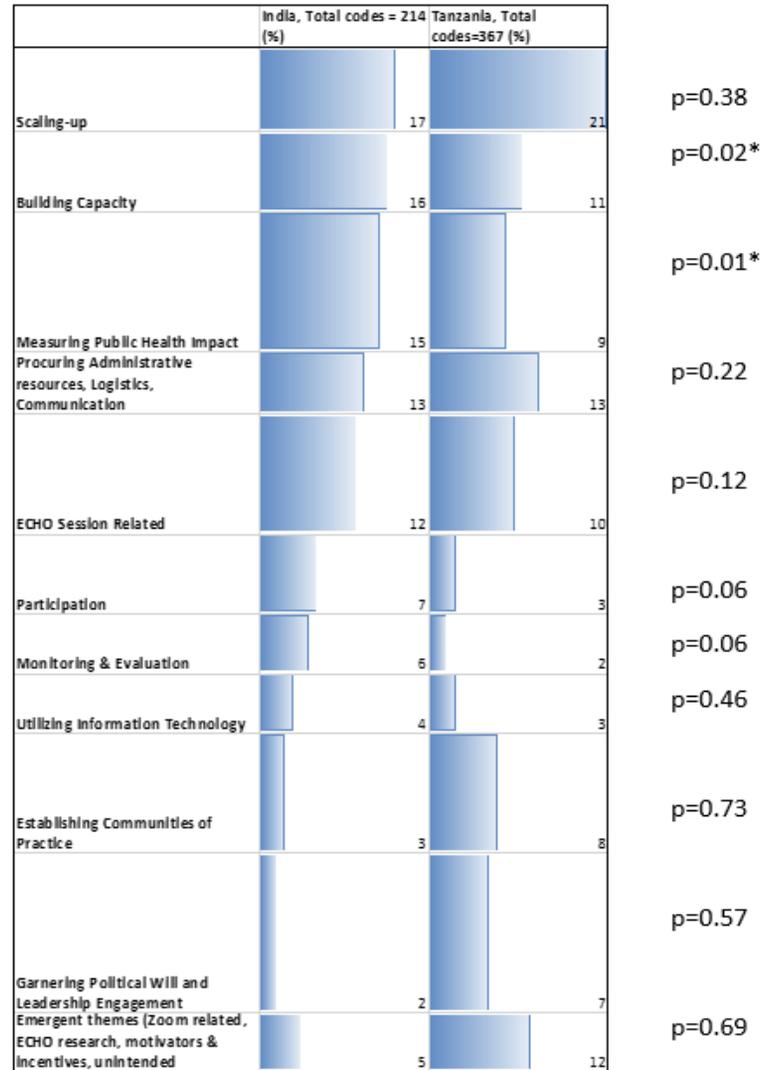


Figure 2. Distribution of perceptions of high-quality ECHO implementation by a priori constructs in India and Tanzania (%)

Figure 3. Distribution of perceptions of high-quality ECHO implementation by stakeholder types in India and Tanzania

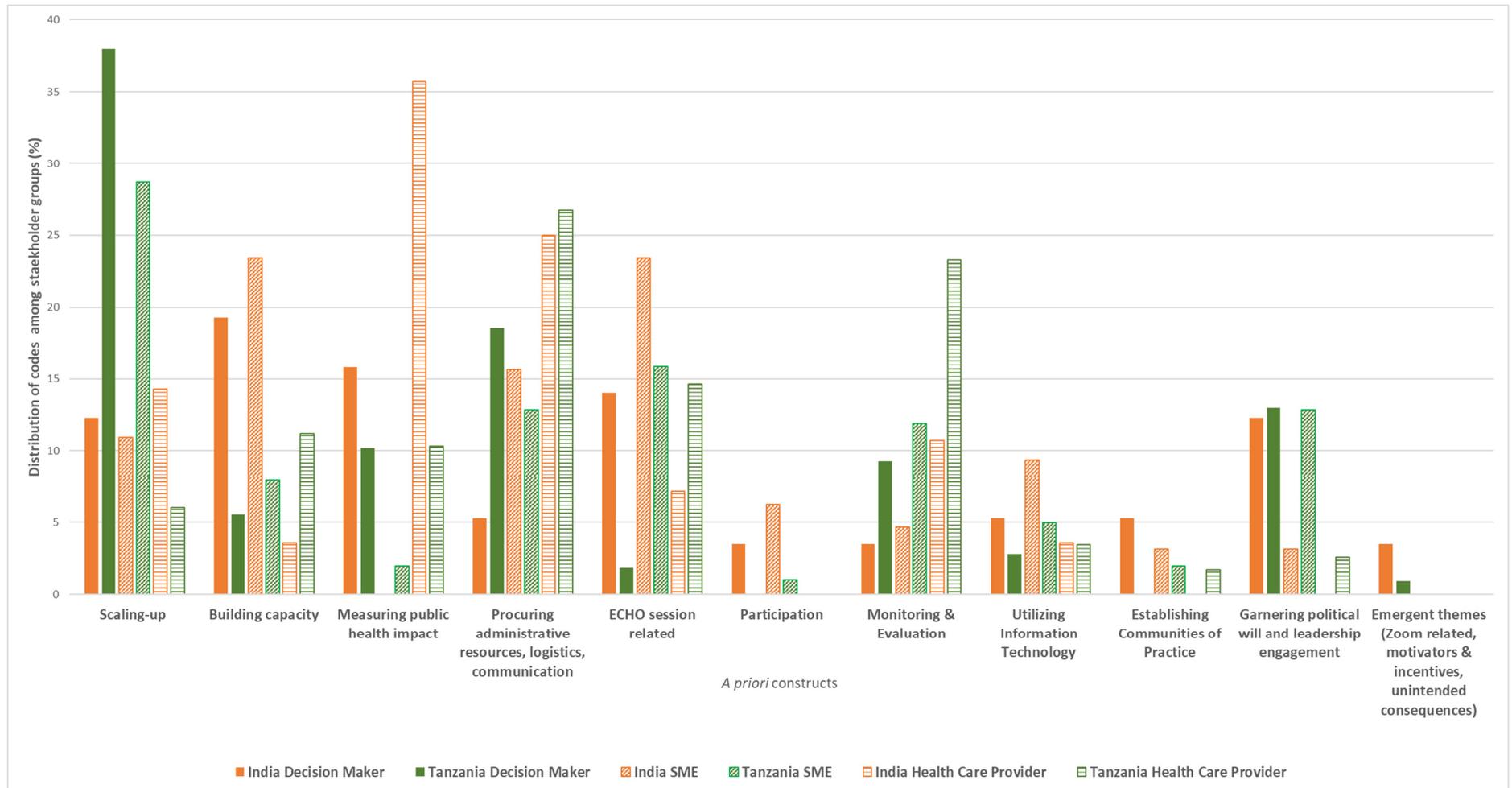


Figure3a. Distribution of Strengths by Stakeholder Roles, India and Tanzania (Total codes=214)

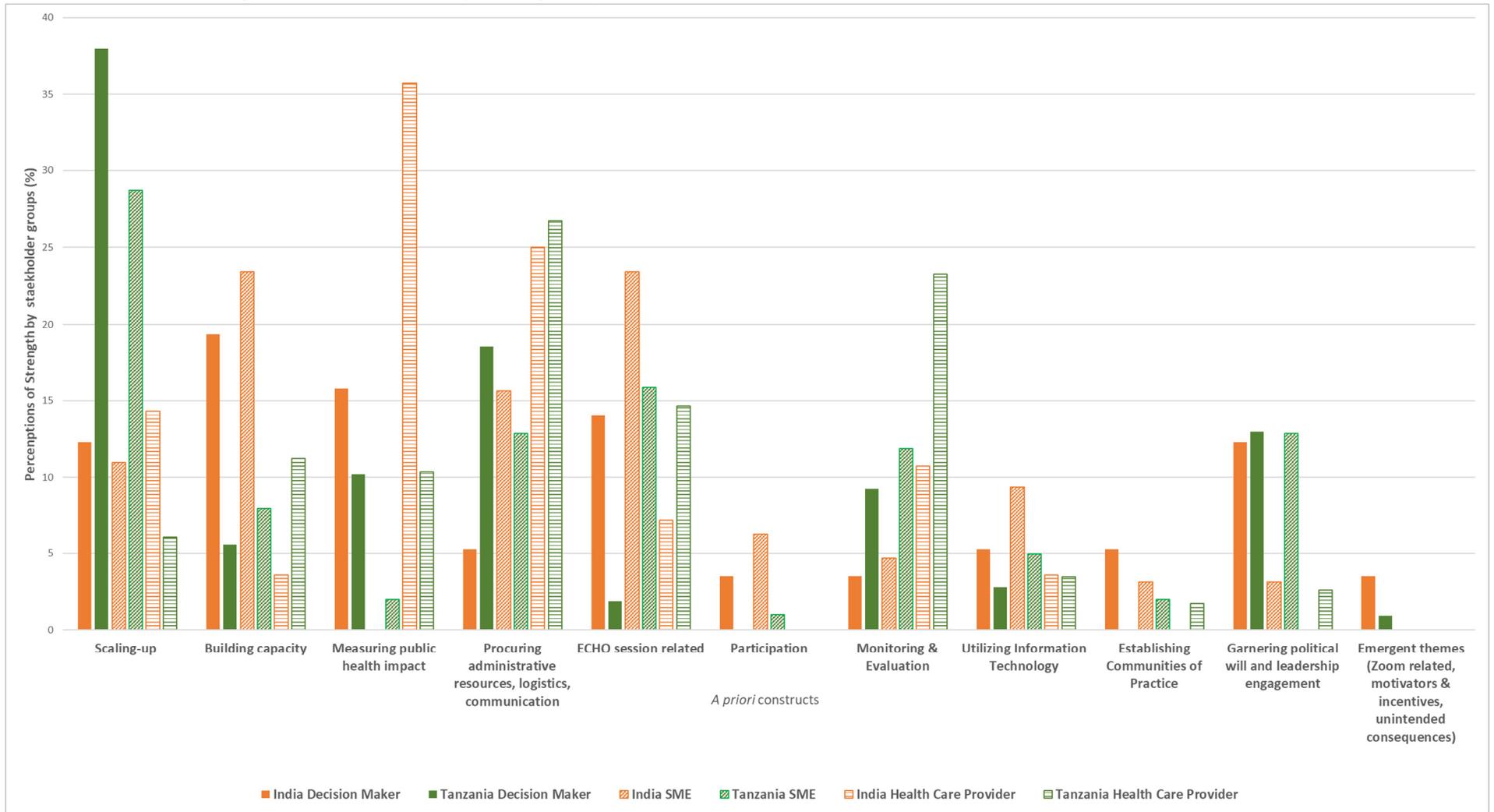


Figure 3b. Distribution of Challenges by Stakeholder Roles, India and Tanzania (Total codes=107)

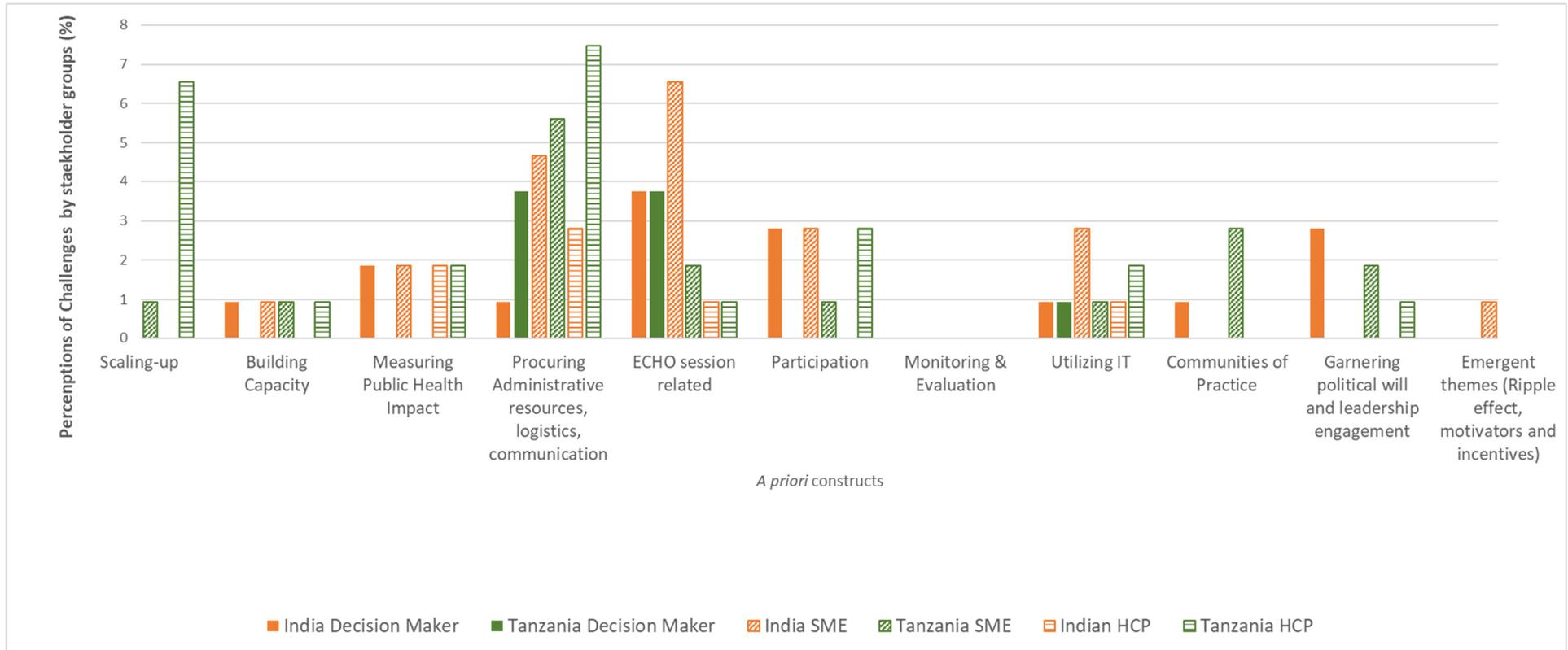


Figure 3c. Distribution of Opportunities/Aspirations by Stakeholder Roles, India and Tanzania (Total codes=141)

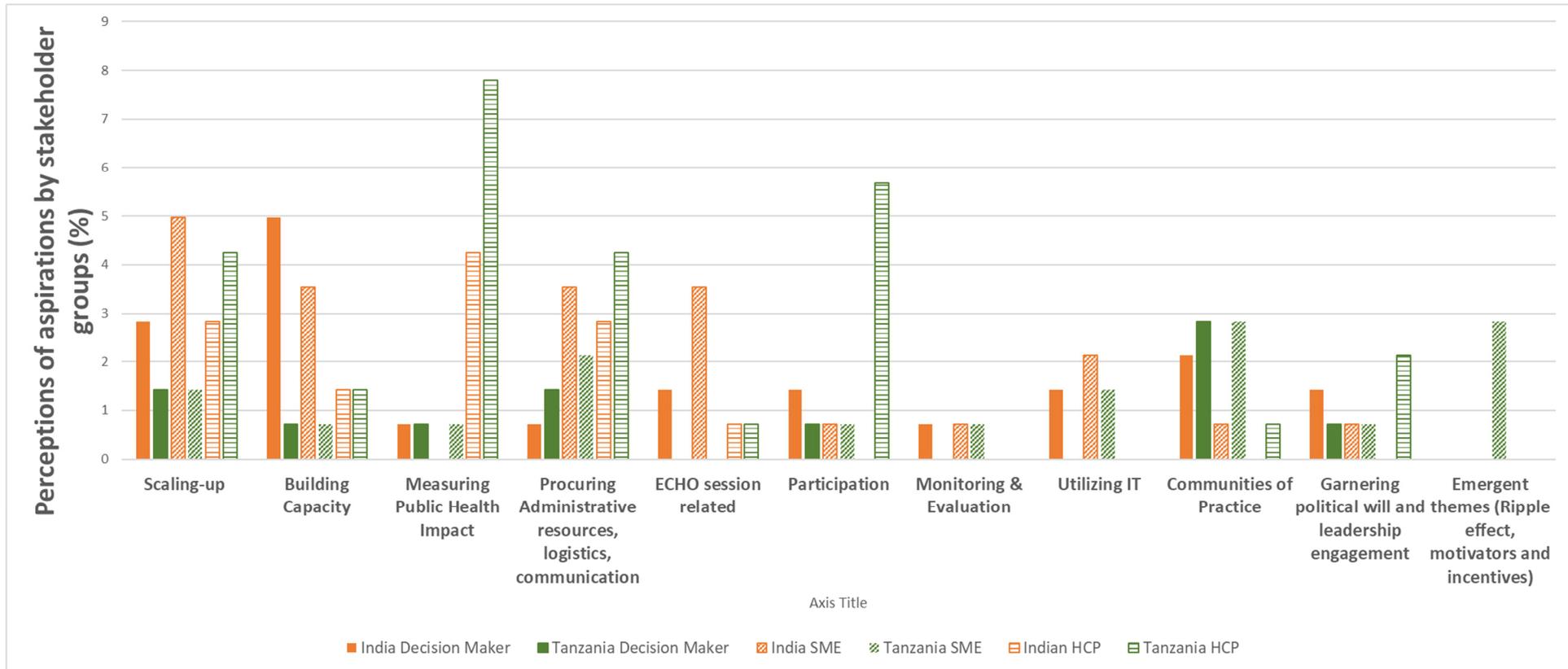


Table 2. List of indicators based on a priori codes, data sources for collection, and frequency of proposed data collection, India and Tanzania

	Construct	Indicator	India	Tanzania	Data Source in Tanzania	Frequency of data collection proposed
1	Participation	Number and percentage of Participants that attend ECHO sessions	Y	Y	Registration information	Weekly/Quarterly
2	Participation	Number of Hubs attending ECHO sessions	Y	Y	MOH	Quarterly
3	Participation	Number and percentage of Spokes that attend ECHO sessions	Y	Y	MOH/ECHO coordinators	Monthly
4	Participation	Number and percentage of spokes that drop out	Y	N	ECHO coordinators	Quarterly
5	Participation	Number of spokes/hub/geographic spread	Y	Y	MOH/ECHO coordinators	Quarterly
6	Participation	Number and percentage of ECHO sessions conducted among the ones that were planned	Y	Y	ECHO coordinators	Quarterly
7	Participation	Number of new ECHO sessions added	Y	N	ECHO coordinators	Semi-annually

8	Participation	Number of participants per topic/theme	Y	N	iECHO or routinely collected programmatic data	Quarterly
9	Participation	Number of participants per profession	Y	Y	iEcho or routinely collected programmatic data	Quarterly
10	Participation	Number of high-volume facilities engaged in ECHO	N	Y	MOH	Quarterly
11	ECHO Session	Number of cases presented/spoke	Y	Y	MOH/ECHO coordinators	Quarterly
12	ECHO Session	Types of cases presented (e.g., Lab, Clinical, guidelines etc.)	Y	N	iECHO	Quarterly
13	ECHO Session	Number of didactic/case presentations	Y	N	iECHO	Quarterly
14	ECHO Session	Number of cases sent for presentation	N	Y	ECHO coordinators	Quarterly
15	ECHO Session	Number of ECHOs downloaded/recorded*	Y	Y	You Tube	Quarterly

16	ECHO Session	% of participants who found topic relevant and interesting	Y	Y	iEcho or routinely collected programmatic data	Quarterly
17	ECHO Session	% of participants who were satisfied with ECHO session	Y	Y	Surveys	Quarterly
18	ECHO Session	% of participants who learned something new	Y	Y	Surveys	Quarterly
19	ECHO Session	Number of sessions that followed start/end time	N	Y	Feedback report by email/phone call to ECHO coordinators/UMB	Quarterly
20	ECHO Session	% of sessions with interactions/asking questions	Y	N	ECHO coordinators	Quarterly
21	ECHO Session	% of sessions reporting language barriers	Y	N	ECHO coordinators	Quarterly
22	Knowledge Gain	Increase in knowledge from post-tests*	Y	N	Pre-post tests	Every session
23	Knowledge Gain	% who gained knowledge from ECHO sessions	Y	Y	Pre-post tests	Quarterly
24	Communication	Number of WhatsApp message reminders sent	N	Y	ECHO coordinators	Quarterly

25	Impact	Number of referrals for HIV clinic by type of referral (skills, investigation at hospitalization)	N	Y	MOH	Quarterly
26	Impact	Increase in utilization of services by type	Y	N	MOH/ECHO coordinators	Annually
27	Impact	Number of providers change in practice	Y	N	FGD or data from sites	Annually
28	Impact	Were recommendations followed?*	N	Y	FGD or data from sites	Semi-annually or Annually
29	Impact	Number of times recommendations were followed*	Y	Y	FGD or data from sites	Semi-annually or Annually
30	Impact	Improvements in disease reporting/national notifications due to ECHO	Y	N	M&E timeliness checks for surveillance	Quarterly
31	Impact	Improvement in programmatic indicators (testing, retention, outcomes) due to ECHO	Y	Y	Programmatic/PEPFAR/national indicators assessed nationally by MOH or partners	Semi-annually/Annually

32	Impact	Number (%) of spoke participants believing they can present from confidence gained	Y	Y	Surveys	Quarterly
33	CoP	Number of SMEs per zone/state	Y	N	Excel spreadsheet managed by implementing partner	Quarterly
34	CoP	Number of stakeholder meetings conducted	Y	Y	MOH/ECHO coordinators	Quarterly
35	CoP	Number of non-CTC or TB staff attending	Y	Y	Attendance sheets	Weekly
36	CoP	Number of sensitization meetings	Y	Y	ECHO coordinators	Monthly
37	CoP	Level of engagement by spokes	Y	Y	Surveys	Quarterly
38	CoP	Number of spokes trained or mentored	Y	Y	MOH/ECHO coordinators	Quarterly
39	Expanding partnerships	Number of PHI staff engaged with ECHO	N	Y	MOH/ECHO coordinators	Annually
40	Expanding partnerships	Number (%) of private providers joining ECHO among those invited	Y	N	MOH/ECHO coordinators	Annually
41	Scale-up	Number of zonal/state hubs*	Y	Y	MOH/ECHO coordinators	Quarterly

42	Scale-up	Increase in number of intuitions or partner agencies	Y	N	MOH/ECHO coordinators	Annually
43	Scale-up	Number of spokes desire to become hubs	Y	Y	MOH/ECHO coordinators	Quarterly
44	Motivators/Incentives	Number of CPD points awarded*	Y	Y	MOH/ECHO coordinators	Quarterly
45	Administrative/Logistical/Resources	Number of spokes signing in timely (Timely attendance)	N	Y	MOH/ECHO coordinators	Quarterly
46	Administrative/Logistical/Resources	Number (%) of ECHO sessions with internet disruptions or technical issues among total ECHO sessions conducted	Y	Y	Feedback report by email/phone call to ECHO coordinators/UMB	Monthly
47	Administrative/Logistical/Resources	Number of IT trainings conducted per ECHO champions (to not depend on IT staff to initiate ECHOs)*	Y	Y	Training reports	Semi-annually

48	Administrative/Logistical/Resources	% reporting session timing as a challenge	Y	Y	MOH/ECHO coordinators	Quarterly
49	Administrative/Logistical/Resources	% of participants believing that ECHO saves times and resources for patients and providers	Y	Y	Surveys	Annually
50	Administrative/Logistical/Resources	% participants wanting to use Zoom for other activities	Y	Y	Surveys	Quarterly
51	Policy and procedures	Are there guidelines/SOPs on ECHO?*	N	Y	MOH/ECHO coordinators	Quarterly
52	Policy and procedures	How many spokes and hubs are following the ECHO SOPs?*	N	Y	MOH/ECHO coordinators	Quarterly

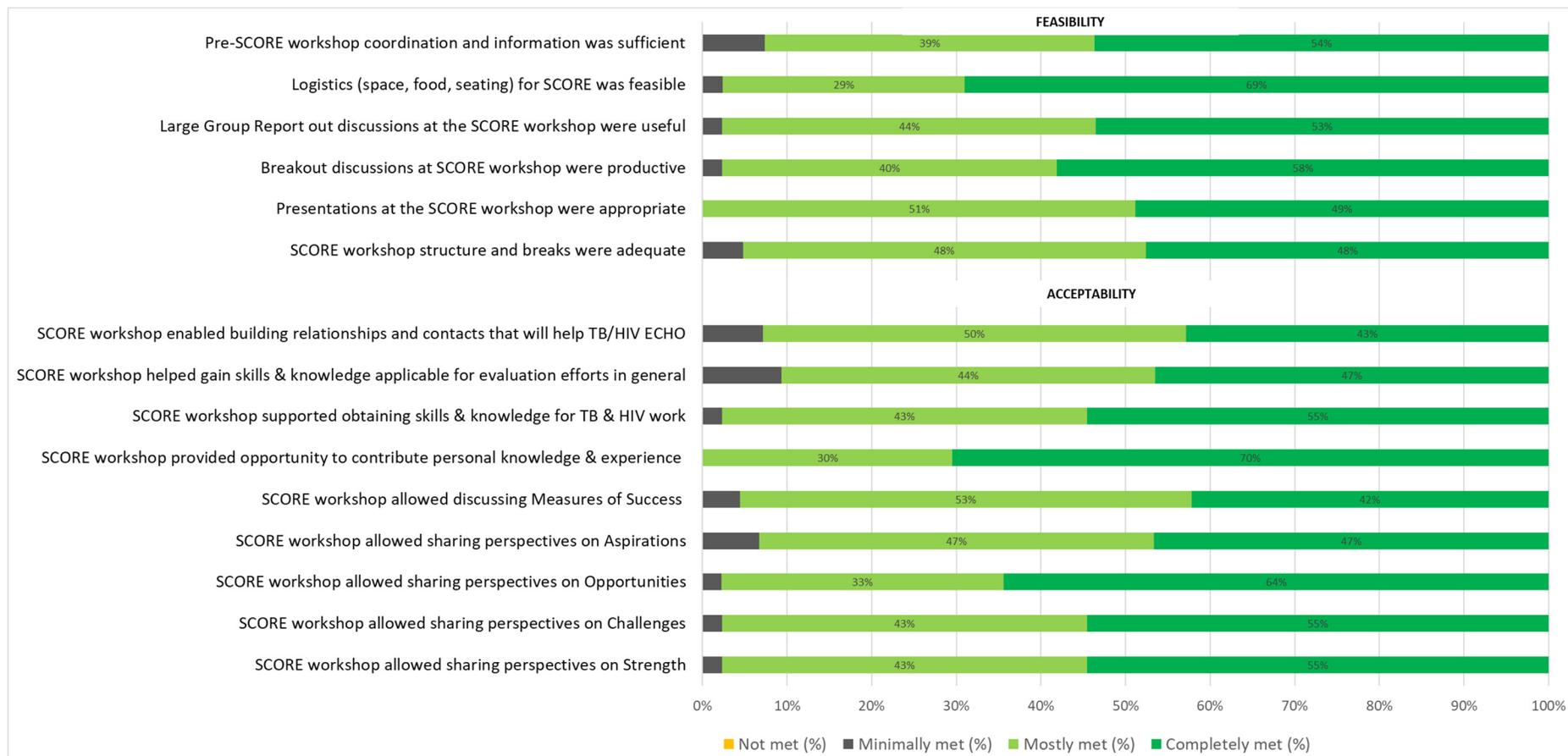


Figure 4. Overall Feasibility and Acceptability Components of the SCORE workshop for 45 participants [India (n=24) and Tanzania (n=21)]

Table 3: India and Tanzania Composite scores for Acceptability and Feasibility

	India		Tanzania		Kruskal-Wallis Chi-Sq	p-value	Cronbach Alpha
	N	Median (Min-Max)	N	Median (Min-Max)			
Composite Acceptability Scores (Max=36)	22	30 (22-35)	21	33 (25-36)	4.87	0.03*	0.85
Composite Feasibility Scores (Max=24)	22	21 (17-24)	21	21 (15-24)	0.13	0.72	0.69

*Significance at $p < 0.05$

Interpretation:

Using Kruskal-Wallis Chi-Square statistic, the median composite scores for acceptability for Tanzania was higher than India and was statistically different [Median: 33 vs. 30, $p=0.03$], while the median composite scores for feasibility were the same in India and Tanzania (Median: 21, $p=0.72$), thus not statistically different. While Cronbach statistic for acceptability was good (85%), Cronbach statistic for feasibility was fair (69%)

Table 4. Cross-Country Individual SCORE Components of Acceptability and Feasibility (between Countries)

		Component	India		Tanzania		Chi-Sq	p-value
			N	Median	N	Median		
ACCEPTABILITY	1	SCORE workshop allowed sharing perspectives on Strength	23	4	21	4	0.164	0.685
	2	SCORE workshop allowed sharing perspectives on Challenges	24	3	20	4	1.796	0.180
	3	SCORE workshop allowed sharing perspectives on Opportunities	24	4	21	4	0.964	0.326
	4	SCORE workshop allowed sharing perspectives on Aspirations	24	3	21	4	2.578	0.108
	5	SCORE workshop allowed discussing Measures of Success	24	3	21	3	0.892	0.345
	6	SCORE workshop provided opportunity to contribute personal knowledge & experience	24	4	21	3	1.091	0.296
	7	SCORE workshop supported obtaining skills & knowledge for TB & HIV work	24	4	21	4	1.574	0.209
	8	SCORE workshop helped gain skills & knowledge applicable for evaluation efforts in general	22	3	21	4	2.837	0.092
	9	SCORE workshop enabled building relationships and contacts that will help TB/HIV ECHO	21	3	21	3	0.516	0.472

		Component	India		Tanzania		Chi-Sq	p-value
			N	Median	N	Median		
FEASIBILITY	1	SCORE workshop structure and breaks were adequate	21	3	21	4	0.065	0.798
	2	Presentations at the SCORE workshop were appropriate	22	4	21	3	0.573	0.448
	3	Breakout discussions at SCORE workshop was productive	22	4	21	4	0.866	0.352
	4	Large Group Report out discussions at the SCORE workshop was useful	22	3.5	21	4	0.000	1.000
	5	Logistics (space, food, seating) for SCORE was feasible	22	4	21	4	0.506	0.476
	6	Pre-SCORE workshop coordination and information were sufficient	22	4	20	3.5	0.271	0.603

Interpretation:

There were no statistically significant differences between the medians for acceptability or feasibility components individually between cross-case (country) analysis between India and Tanzania overall.

Table 5. Comparison of Acceptability and Feasibility Components among Breakout Groups, Overall

		Component	Decision Makers		Health Care Providers		SME/Implementers		Chi
			N	Median	N	Median	N	Median	
ACCEPTABILITY	1	SCORE workshop allowed sharing perspectives on Strength	7	4.0	16	4.0	21	4.0	0.0
	2	SCORE workshop allowed sharing perspectives on Challenges	8	3.5	15	4.0	21	4.0	0.1
	3	SCORE workshop allowed sharing perspectives on Opportunities	8	3.5	16	4.0	21	4.0	1.3
	4	SCORE workshop allowed sharing perspectives on Aspirations	8	3.0	16	3.0	21	4.0	2.5
	5	SCORE workshop allowed discussing Measures of Success	8	3.0	16	4.0	21	3.0	4.9
	6	SCORE workshop provided opportunity to contribute personal knowledge & experience	8	3.5	16	4.0	21	4.0	2.1
	7	SCORE workshop supported obtaining skills & knowledge for TB & HIV work	8	3.0	16	4.0	21	3.0	9.0
	8	SCORE workshop helped gain skills & knowledge applicable for evaluation efforts in general	8	3.0	15	4.0	20	3.50	5.6
	9	SCORE workshop enabled building relationships and contacts that will help TB/HIV ECHO	7	3.0	15	3.0	20	3.0	2.0
FEASIB	1	SCORE workshop structure and breaks were adequate	7	3.0	15	4.0	20	4.0	4.3
	2	Presentations at the SCORE workshop were appropriate	8	3.0	15	4.0	20	4.0	2.1

3	Breakout discussions at SCORE workshop was productive	8	3.0	15	4.0	20	4.0	4.4
4	Large Group Report out discussions at the SCORE workshop was useful	8	3.0	15	3.0	20	4.0	4.4
5	Logistics (space, food, seating) for SCORE was feasible	8	4.0	15	4.0	20	4.0	1.2
6	Pre-SCORE workshop coordination and information were sufficient	8	3.0	14	4.0	20	4.0	3.1

Interpretation:

Even though there was no statistically significant differences for majority of the items measuring acceptability and feasibility, statistically significant differences were noted for an acceptability component indicating SCORE workshop supporting obtaining skills & knowledge for TB & HIV work, and approached statistical significant differences for SCORE workshop helping gain skills & knowledge applicable for evaluation efforts in general (p=0.058). It is worth noting that among these groups, median was different for Health Care Providers.

WITHIN COUNTRY ANALYSIS

Table 6a: Comparison of components of acceptability and feasibility between Stakeholder Breakout Groups, India (N=24)

		Component	Decision Makers = 6		Health Care Providers = 7		SME/Implementers = 11		<i>Chi-Square</i>	<i>p-value</i>
			N	Median	N	Median	N	Median		
ACCEPTABILITY	1	SCORE workshop allowed sharing perspectives on Strength	6	3.0	7	4.0	11	3.0	1.153	0.656
	2	SCORE workshop allowed sharing perspectives on Challenges	5	4.0	7	4.0	11	3.0	0.280	0.910
	3	SCORE workshop allowed sharing perspectives on Opportunities	6	3.5	7	4.0	11	4.0	0.964	0.621
	4	SCORE workshop allowed sharing perspectives on Aspirations	6	3.0	7	3.0	11	3.0	1.262	0.560
	5	SCORE workshop allowed discussing Measures of Success	6	3.0	7	4.0	11	4.0	16.578	<0.001*
	6	SCORE workshop provided opportunity to contribute personal knowledge & experience	6	3.0	7	4.0	11	3.0	6.655	0.035*
	7	SCORE workshop supported obtaining skills & knowledge for TB & HIV work	6	3.0	6	4.0	11	3.0	10.868	0.002*
	8	SCORE workshop helped gain skills	6	3.0	7	4.0	10	3.0	5.885	0.053

		& knowledge applicable for evaluation efforts in general								
	9	SCORE workshop enabled building relationships and contacts that will help TB/HIV ECHO	6	3.0	6	4.0	10	3.5	3.155	0.213
FEASIBILITY	1	SCORE workshop structure and breaks were adequate	5	3.0	6	4.0	10	3.0	2.370	0.305
	2	Presentations at the SCORE workshop were appropriate	5	3.0	6	4.0	10	4.0	5.343	0.075
	3	Breakout discussions at SCORE workshop was productive	6	3.0	6	3.0	10	3.5	1.018	0.857
	4	Large Group Report out discussions at the SCORE workshop was useful	6	3.0	6	4.0	10	3.5	3.451	0.179
	5	Logistics (space, food, seating) for SCORE was feasible	6	3.5	6	4.0	10	4.0	0.822	0.724
	6	Pre-SCORE workshop coordination and information were sufficient	6	3.0	6	4.0	10	3.0	8.512	0.012*

Interpretation:

When stratified by roles within India, there is statistically significant differences noted for median scores for Health care providers (HCP) as compared to Decision Makers (DM) and subject matter experts (SME) for the following 3 items related to components of acceptability (SCORE workshop allowed discussions on measures of success, provided opportunity to share personal experiences, provided a forum to obtain skills that could be applied to their TB and HIV work). For feasibility, the only component that was statistically different was pre-workshop coordination.

Table 6b: Comparison of components of acceptability and feasibility between Stakeholder Breakout Groups Tanzania (N=21)

		Component	Decision Makers = 2		Health Care Providers = 9		Subject Matter Experts/Implementers = 10		Chi-Square	p-value
			N	Median	N	Median	N	Median		
ACCEPTABILITY	1	SCORE workshop allowed sharing perspectives on Strength	2	3.5	9	3.0	10	4.0	0.842	0.654
	2	SCORE workshop allowed sharing perspectives on Challenges	2	3.0	8	4.0	10	4.0	0.626	0.826
	3	SCORE workshop allowed sharing perspectives on Opportunities	2	3.5	9	4.0	10	4.0	0.866	0.840
	4	SCORE workshop allowed sharing perspectives on Aspirations	2	3.5	9	3.0	10	4.0	1.246	0.675
	5	SCORE workshop allowed discussing Measures of Success	2	3.5	9	3.0	10	4.0	1.290	0.669
	6	SCORE workshop provided opportunity to contribute personal knowledge & experience	2	4.0	9	3.0	10	4.0	3.608	0.161
	7	SCORE workshop supported obtaining skills & knowledge for TB & HIV work	2	3.5	9	3.0	10	4.0	6.269	0.035*

	8	SCORE workshop helped gain skills & knowledge applicable for evaluation efforts in general	2	3.0	9	4.0	10	4.0	1.135	0.566
	9	SCORE workshop enabled building relationships and contacts that will help TB/HIV ECHO	2	3.0	9	4.0	10	3.0	0.443	0.844
FEASIBILITY	1	SCORE workshop structure and breaks were adequate	2	2.5	9	3.0	10	4.0	4.873	0.072
	2	Presentations at the SCORE workshop were appropriate	2	3.5	9	3.0	10	4.0	0.555	0.820
	3	Breakout discussions at SCORE workshop was productive	2	3.0	9	4.0	10	4.0	1.967	0.331
	4	Large Group Report out discussions at the SCORE workshop was useful	2	3.0	9	4.0	10	4.0	2.351	0.479
	5	Logistics (space, food, seating) for SCORE was feasible	2	4.0	9	4.0	10	4.0	2.163	0.376
	6	Pre-SCORE workshop coordination and information were sufficient	2	3.5	8	3.0	10	4.0	5.008	0.072

Interpretation:

When stratified by roles within Tanzania, the only component for statistically significant differences in acceptability component indicating SCORE workshop supported obtaining skills & knowledge for TB & HIV work. None of the feasibility components had any statistically significant relationships among stakeholder breakout groups within Tanzania.

Appendix

Strengths	Challenges	Opportunities/Aspirations	(Measurable) Results	Evaluation of the appreciative inquiry approach (refer evaluation form- Appendix F)
<p>What is <i>your personal proudest</i> achievement since you started participating in the start of the ECHO program?</p>	<p>What components of the ECHO program are <i>particularly challenging for you?</i></p>	<p>Given the strengths and challenges outlined in the previous session, what are <i>the top 3 opportunities</i> where we might focus our efforts?</p> <p>Who are possible <i>new partners</i> we might consider engaging in our work?</p> <p>What <i>new services</i>, partners or processes etc. we may consider?</p>	<p>Considering the strengths, challenges, opportunities, and aspirations, what <i>meaningful measures</i> would indicate we are on <i>track to achieve success</i> for the ECHO program? (measures may be at multiple levels: ECHO implementer, provider, patients, community outcomes)</p>	<p>Did workshop meet objectives?</p> <p>How satisfied were you with SCORE workshop?</p>
<p>What are you <i>most proud about the ECHO program?</i> How do these things that you are proud about reflect your strengths?</p>	<p>What are the <i>burning issues or challenges</i> experienced by the <i>ECHO program?</i></p>	<p>Given our long-term aspirations, what does success look like 6 months/a year from now? (short-term vision/outcome)</p>	<p>What would a list of prioritized measures for short-term, medium-term, and long-term successes look like?</p>	<p>How acceptable was the AI workshop?</p>
<p>What are the ECHO program's <i>area of excellence?</i></p>	<p>What has been the <i>biggest challenge</i> associated with the ECHO program?</p>	<p>What's your <i>vision of success</i> in <i>2 years</i> from now? (medium-term vision/outcome)</p>	<p>What data sources exist where we can get these measures from?</p> <p>Who should be responsible for collecting these measures?</p>	<p>How feasible was it to conduct AI workshop?</p>

<p>What can other ECHO programs learn from India's TB ECHO or Tanzania's HIV ECHO program?</p>		<p>Where do you see ECHO in 3/5 <i>years</i> from now? (long-term vision/outcome)</p>	<p>How often would it be practical to collect each of these measures?</p>	
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PAPER 2: A protocol for a comprehensive monitoring and evaluation framework with a compendium of tools to assess quality of Project ECHO (Extension for Community Health Outcomes) implementation

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2 tables

3 figures

8 appendices

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Word count: 3,746 (limit:4,000)

Abstract

Introduction: The United States Centers for Disease Control and Prevention (CDC), through PEPFAR, supports a third of all people receiving HIV care globally, working side-by-side with on-the-ground local partners to improve methods for finding, treating, and preventing HIV and tuberculosis. However, a shortage of trained medical professionals has impeded efforts in Sub-Saharan Africa and Asia. Gaps remain in service delivery, staff capacity, training, and knowledge dissemination on updated guidelines. The Project Extension for Community Healthcare Outcomes (ECHO™) model expands capacity to manage complex diseases by sharing knowledge, disseminating best practices, and building communities of practice. This manuscript describes a practical protocol for evaluating HIV ECHO program implementation, including an evaluation framework and compendium of tools that could be contextualized and replicated elsewhere.

Methods and analysis: Construct validity of the evaluation framework and tools (participant surveys, focus group discussions, and readiness assessment questionnaires) will be assessed by qualitative coding gathered from stakeholder perspectives. In addition, ECHO session content will be objectively reviewed for accuracy, content validity, delivery, appropriateness, and consistency with current guidelines. Finally, data from key informant interviews shall be triangulated with previous data sources to assess acceptability and feasibility of the evaluation framework and compendium of monitoring and evaluation tools. Pilot testing in Tanzania will further refine this protocol and offer an opportunity to adapt the tools within a local context.

Ethics: Ethical approval from the Independent Review Boards at the University of Maryland (Baltimore), University of Illinois, Chicago, Tanzania Ministry of Health, and US Centers for Disease Control and Prevention were obtained.

Strengths and Limitations

To our knowledge, this is a unique process for a diverse group of stakeholders to be engaged through an appreciative inquiry (change management) process to co-create a comprehensive evaluation framework and a compendium of tools to assess Tanzania's HIV The Project Extension for Community Healthcare Outcomes (ECHO™) implementation quality. The focus of the approach was participatory process evaluation with a potential to gather qualitative outcomes. One limitation is that adequate resources were unavailable to include additional global stakeholders.

Background

Centers for Disease Control and Prevention works side-by-side with partners in more than 50 countries to improve methods for finding, treating, and preventing HIV and tuberculosis (TB).^{1,2} However, a shortage of trained medical professionals impedes sustained success.³⁻⁶ Gaps also remain in training, staff capacity, service delivery, and managing complex disease conditions among people living with HIV (PLHIV).⁵⁻⁸ Clinical specialists practice primarily in large referral hospitals and rarely extend services into remote areas. In addition, specialists are not able to provide regular mentorship and supervision of health care workers in peripheral health facilities. To address these gaps, innovative approaches, such as, Project ECHO (Extension for Community Healthcare Outcomes) are needed.^{9,10}

ECHO's collaborative hub and spoke model connects a multi-disciplinary team of health professionals using multipoint video conferencing to enable virtual communities of practice (CoP).^{9,10} ECHO bridges specialist teams at local, regional, and international academic medical centers with teams of health workers across the globe to help disseminate best practices and improve health outcomes.¹⁰ The ECHO model has four components: 1) multipoint videoconferencing to leverage healthcare resources; 2) disease management model focused on improving outcomes by sharing best practices; 3) case-based learning to encourage collaborative patient management between local practitioners, their peers, and subject matter experts (SMEs); and 4) systematically monitoring outcomes.¹¹ ECHO offers an opportunity for local clinicians in remote healthcare settings to seek guidance and support from national and international SMEs. CDC Division of Global HIV and TB supports utilization and expansion of the ECHO model for clinical mentoring, virtual technical assistance, and knowledge dissemination to strengthen effective HIV and TB service delivery. CDC is supporting implementation of this approach in more than 23 countries across six continents.¹⁰

The importance of maintaining high-quality implementation has been studied in education, healthcare, technology, industry, and management.^{3,4,16} However, the quality of implementation is affected by various factors related to patients themselves, providers, communities, and the type of intervention or innovations.¹²⁻¹⁴ Program processes, outcomes, and continuous quality improvement (e.g., delivery [organizational functioning], training, and technical assistance) are essential features of program evaluations.¹² High-quality implementation should be the standard for program replication and expansion.¹⁵ It is necessary to understand elements that support high-quality ECHO implementation and

develop a framework to monitor progress, assess performance, and develop explicit recommendations for broader scale-up, replication, and sustainability.

This evaluation framework with compendium of tools will be pilot tested in Tanzania. Tanzania is one of 13 PEPFAR high-priority countries, with 1.6 million PLHIV where the estimated prevalence of HIV in the adult general population is 4.6%.¹ As of August 2019, 78% of Tanzanians know their HIV status; of whom 92% are on current treatment (71% of all PLHIV) and, 87% are virally suppressed (62% of all PLHIV).⁸ Despite the efforts to meet PEPFAR targets, structural, legal, and social barriers to services exist.⁸ According to WHO, Tanzania has one of the lowest physician-to-patient ratios in the world, with 0.04 physicians per 1,000 people as of 2014.⁸ The lack of doctors and medical professionals is more pronounced in rural areas, where there are often no physicians or medical care professionals available to manage complex HIV patients.^{5,6}

Reach

Tanzania has implemented an HIV ECHO clinic in an ‘all teach, all learn’ interactive format that is now reaching all regions of Tanzania. The University of Maryland at Baltimore (UMB) has facilitated more than 76 weekly ECHO sessions between November 2018 through July 2020. Over 197 facilities are registered and over 3,301 unique participants have attended until July 2020.

Evaluation Design

This is a multi-phased, mixed-methods,^{18, 23} developmental evaluation (DE) design¹⁸⁻²⁰ (Figure 1). A pragmatic process evaluation will address stakeholder perceptions of participation, engagement, satisfaction, learning, self-confidence and applying knowledge acquired in ECHO sessions to practice.^{21,22} Additionally, review of the ECHO sessions will assess quality of facilitation, content, interactivity during sessions, and applicability of recommendations provided.

Evaluation Objective

To develop a comprehensive evaluation framework with a compendium of tools designed to monitor and evaluate the quality of an HIV ECHO program implementation in routine practice that can be adapted for evaluation of any ECHO program. Specific evaluation questions are presented in Box 1.

Evaluation Activities (Appendix I)

Phase 0

Activity 1: Environmental scan, stakeholder engagement, and tool development

We will engage all stakeholders in a human centered design approach. To initiate this process, a modified appreciative inquiry methodology²³ was applied and guided an open discussion and elicited a variety of perspectives (strengths, challenges, opportunities, long-term aspirations, and measurable results) from key stakeholders convened in Tanzania. Details of this approach are discussed elsewhere (Ghosh, et al, 2020). Briefly, the emergent themes from the workshop are presented in Figure 2. These constructs informed the development of the final data collection tools.

Phase 1

Activity 2: Participant Survey

An anonymous, on-line, standardized survey will be deployed to better understand the perceptions and experiences of participants of the HIV ECHO clinic. Questions will be designed to gauge participant engagement, level of satisfaction with the HIV ECHO program delivery, perceived learning, perceived self-confidence in managing complex HIV patients, perceived competence, potential barriers to HIV ECHO participation, and the degree to which the HIV ECHO clinic has influenced participants to translate the knowledge they gained into practice (Appendix 2). Upon consent (Appendix 10), we will deploy the survey using the Qualtrics® (Qualtrics, Provo, UT, www.qualtrics.com) platform. Email addresses shall be obtained from participant registration forms and the iECHO database. The survey will take approximately 30 minutes to complete. Participants can choose to stop at any time, even if the survey is not complete.

Activity 3: Focus group discussions

A minimum of three focus group discussions (FGDs) will be conducted, consisting of five to six persons each (no more than 18 total). Each of the three groups will be comprised of participants who have similar backgrounds and experience. Efforts will be made to have staff with similar job roles or positions in the same focus groups to ensure that all participants are comfortable with participating and openly responding to the questions (Appendix 3A–B). Guided, well-structured discussions will probe into findings from the survey, to describe how they may be translating knowledge into practice (Appendix 3 A–C).

Participant names will not be recorded or written anywhere to ensure confidentiality. The focus group facilitator will explain the evaluation objectives, procedures, risks, benefits, and the informed consent process. Individuals will be provided an opportunity to ask questions before consenting. The focus groups will be conducted in-person in Kiswahili and/or English, depending on language skills of the facilitator and participants. Participants will be informed that the session’s audio will be recorded digitally. Recorded interview sessions will be stored on a secure cloud-based repository. A focus-group observer will assist the facilitator with recording and note-taking. To mitigate the possibility of FGD participant identity being disclosed and potentially resulting in stigma for participants, discussions will be held in a private setting with only evaluation participants in audience. At the beginning of each focus group, facilitators will reiterate the intended goals of the focus group. The facilitator will clarify that, as the project is an operational evaluation there are no “right” or “wrong” perceptions or thoughts with regards to feasibility. The facilitator will also ask participants to extend professional courtesy to their fellow participants and maintain the confidentiality of the conversation or thoughts expressed in the FGDs by not sharing them with others.

Activity 4: Objective review of session content

A peer-reviewed concept shall be utilized to validate the educational content, improve standards of quality, and provide credibility in a transparent review process. Select HIV experts from low- and high-HIV prevalence countries shall be invited to participate to maintain an impartial, fair, and objective assessment. Each reviewer will assess three sessions each, and each session will have three reviewers. See Table 1 for matrix of reviewer and session selections.

Facilitator Scorecard: Session recordings shall be randomly selected from previously conducted HIV ECHO session recordings for an objective review of the facilitation process using a standardized scorecard (Appendix 4A). An independent panel of reviewers will use the scorecard to rate objectively the facilitator on coordination of the session following the ECHO guidelines, engagement of participants, insights offered, and time management. Each reviewer will be given written instructions and a scorecard to rate the facilitator for their assigned session.

Didactic Presentation Review: A random selection of previous ECHO session recordings shall undergo an objective review for didactic presentation accuracy, content validity, and delivery (Appendix 4B). An independent panel of reviewers (both national and international experts) will be given written instructions and a scorecard to rate the didactic presentation for their assigned session. Each selected session will be reviewed using a standardized tool to assess the following:

Extent to which the session achieves stated learning objectives

Accuracy and validity of didactic presentations compared to recommended clinical practices as outlined in the most up-to-date national and international guidelines

Presentation quality (free from errors, effective, and engaging communication)

Case-based presentation and Recommendation Review: An independent panel of reviewers will use a standard scorecard to assess case presentations from a random selection of ECHO sessions. Each selected session will be reviewed for the following:

Extent to which the case-based presentation aligned with stated learning objectives.

Presentation quality (e.g., free from errors, effective and engaging communication).

Appropriateness of the recommendations.

Whether the recommendations were specific, measurable, achievable, reproducible, and time bound.

Whether the recommendations were consistent with current national and international guidelines for standard practices of care. At the conclusion of the individual scoring and assessments, the reviewers shall be convened to discuss convergence and divergence and give in-depth feedback on their review process and content.

Activity 5: Review of routinely collected programmatic data including iECHO analysis

Secondary de-identified data (e.g., number of participants, number of partners represented, timing of sessions, notable technical challenges) shall be analyzed to identify trends and monitor performance over time. (Appendix 5) Appropriate use, identification of use by stakeholders, frequency of data sharing between stakeholders, and overall utility of iECHO shall be assessed and discussed.

Activity 6: Readiness assessment checklist and questionnaire

An objective evaluator from the project team will administer readiness assessment questionnaires of newly enrolled ECHO site coordinators through face-to-face interviews with ECHO program coordinators preparing to launch new ECHO hubs (Appendix 6).

Phase 2

Activity 7: Key-informant interviews

A semi-structured interview with select key-informants shall provide personal insights based on their experience and perspective. Key informants will be given the framework, tools, and results from data collection in advance of the key informant interview (KII). They will be asked to provide written feedback to assess acceptability, feasibility, validity, and reliability of the compendium of tools and whether these tools capture the elements of high-quality ECHO implementation. During the KII, participants will be probed to expand on their written responses and offer points of clarification and suggestions for improvement.

Activity 8: Triangulation

Evaluation investigators will triangulate the data collected during Activities 2–7 and revise the framework and tools accordingly. Convergence and divergence of themes stratified by implementers shall help finalize the findings. Triangulation will ensure consistent findings through different data sources as well as help in understanding of inconsistencies, thus providing opportunities for deeper insight into the relationship between the quantitative and qualitative data collected.^{29,30} A final practical manual of the framework, compendium of tools, when and how to use them, and lessons learned from this evaluation shall be the final deliverable.

Activity 9: Stakeholders meeting to discuss results, and development of a dissemination plan.

A final stakeholder workshop of ~30 participants, including those present for Activity 1 (Stakeholder Workshop) shall be invited to discuss the results from all the activities above. This interactive workshop-style meeting shall be organized at the completion of data analysis and triangulation to present evaluation findings. Facilitated discussion of feedback on usability and acceptability of the tools and framework adoption routinely shall be sought by key stakeholders, some of whom would be the same participants who attended the environmental scan workshop. Tools, POC, and frequency of data collection shall be recommended as the final deliverable.

Inclusion criteria

Online survey: All participants who have attended at least one Tanzania HIV ECHO session facilitated by UMB are eligible to participate.

Focus group discussion: All participants who have attended at least one HIV ECHO session and completed the survey are eligible to participate. Twenty health care providers (HCP) and SMEs and/or implementers shall be randomly selected from the iECHO database and invited to participate in the FGD. There will be three FGDs (one with SMEs, one with HCPs, one with implementers), each comprised of 5–6 people in each group. Implementers could be ECHO coordinators who are primarily responsible for coordinating and delivering the ECHO sessions routinely. Location of the interviews shall be pre-determined, and invitations shall be sent one month in advance.

Readiness assessment: Two coordinators of new HIV ECHO hubs shall complete the readiness assessment checklist. These coordinators will be selected from those who have not started implementing their HIV ECHO hubs.

Key-informant interviews: Six purposively chosen opinion leaders or influencers who can advocate for ECHO from public, private, academic, and Ministry of health (MOH) shall be invited for interview.

Exclusion criteria

Persons who have never attended a Tanzania HIV ECHO session shall be excluded from participation in any data collection efforts.

Recruitment and Enrollment Procedures

Once the evaluation has been approved, the evaluation co-investigators will announce the opportunity to participate during an upcoming HIV ECHO session. Emails will be sent for those not in attendance. Participant emails will be furnished by UMB, who routinely collect contact information at the start of ECHO sessions. Stakeholders who attended the Appreciative Inquiry stakeholder workshop shall be enlisted to encourage colleague's participation in the online survey (Activity 2). All other activities shall include random selection of participants, or a purposeful invitation of expert faculty, paramedical staff, and implementers from the iECHO database.

For the FGD (Activity 3), 5–6 participants will be selected for each group from among participants with similar roles and responsibilities; they will be selected only if they completed the above ECHO participant survey.

For the key informant interviews (Activity 8), six key stakeholders (opinion leaders) will be selected amongst those engaged in ECHO implementation: two representatives from the two ECHO participant groups of HCP and SME, a representative from UMB and one from CDC-TZ, one from Tanzanian

MOH and one UMB administrator be invited to review summaries of results of Activities 1–7, and all data collection tools.

Sample size

Since data collected is not intended to be generalizable, no formal sampling frame is required. Purposeful (convenience) sampling will be used for most activities, except for Activity 2 (Participant Survey). The participant survey will be sent to all persons that attended at least one HIV ECHO session. We anticipate 150–200 persons will be invited to participate (Table 2).

Data Analysis

Descriptive statistics will be used to describe and summarize participant characteristics, perceptions, and self-efficacy measures of the HIV ECHO clinic. Chi square statistics shall be used to measure associations of favorable outcomes of HIV ECHO based on satisfaction and knowledge gained. Descriptive statistics for ordinal ratings (e.g., Likert scales) for Activities 2, 4, and 6 shall be generated using simple frequencies or percentages, and medians or modes will be used as the measure of central tendency. Non-parametric statistical techniques will be employed (e.g., Kruskal-Wallis). Based on the results, the 4-point scales may be recoded for simplicity of reporting. Stratified analysis between different groups (implementers and participants) will clarify relationships of the variety of perceptions on efficacy, satisfaction, and knowledge gain.

Results from the quantitative data shall be explored further through the FGDs. A systematic qualitative analysis will summarize individual and group reflections. A systematic content analysis will include searching for *a priori* codes and recurring themes. Auto coding and thematic analysis shall be conducted for the qualitative data and compared and contrasted with the survey data. Auto coding using MAXQDA (VERBI, GmbH; Berlin, Germany) will help with thematic analysis. Contextual or cross-case analysis for the significant codes shall be conducted between the various stakeholder roles. Understanding the frequency alignment or discordance of the *a priori* codes among the different stakeholders will be key. Data-reduction efforts shall be undertaken to eliminate ancillary information that did not appear to be significant or relevant. Emergent codes identified will lead to revising the original code book.^{21,25-26} Additionally, there will be voice recordings of interviews and meetings, FGDs, and interviews that shall be transcribed professionally and analyzed by at least two investigators to ensure inter-coder reliability of >90%.

Triangulation, broadly defined as the comparison of results from multiple data collection methods and/or sources in the evaluation of the same phenomenon shall be used to document and understand convergence and divergence of findings between the different data collection tools.²⁸ Various concepts/variables/findings shall be further examined and stratified to understand multi-level variations in perceptions and performance. Triangulation shall be used for cross-checking for internal consistency or reliability, as well as "*between-method*" triangulation to test the degree of external validity.^{29,30} Data comparison will then help explain convergence and divergence of results between and among different data collection methods and constructs.

For this qualitative data analysis, steps of data reduction, transformation, comparison, and integration will be followed. Data from two different sources (survey and FGD) is stronger than one data source alone, further probing of main concepts of interest from survey during FGD, will help to better understand the results.²⁹ Since the previous results shall be validated across the KIIs, the final presentation of results to the larger group of stakeholders shall inform development of final recommendations for high-quality ECHO implementation.

Data security, storage, and retention

All evaluation and programmatic data will be owned by the Tanzania MOH or Implementing Partner. In collaboration with the Tanzania MOH and co-investigators, -de-identified data shall be retained at CDC until all analysis is completed and planned manuscripts are published. No individual level personally identifiable information shall be collected, analyzed, or reported. All data will be kept in password protected computers, only accessible to co-investigators. Audio recordings shall be destroyed after data analysis and translation. Data will be stored under lock and key cabinets with access to limited personnel. Management of data shall be restricted to key personnel such as the Implementing Partner co-PI. Aggregate and anonymous quotations shall be reported or published for results of evaluation. All project information will be kept confidential and will be available only to authorized users involved in the evaluation project. All evaluation personnel will sign a confidentiality agreement indicating that he/she has been instructed in confidentiality procedures under their MOH public health program jurisdiction/implementing partner protocols and will observe them. Then all shall be archived under the MOH policies as custodian of the data. The evaluation framework and compendium of tools will be made publicly available through the University of New Mexico Health Science Center (Project ECHO) website or cloud-based file sharing platforms. See attached Appendix 9.

Ethics and Protection of Human Subjects

Project staff will obtain informed consent (Flesh-Kincaid Reading Level for Consent 7.5) for those individuals willing to participate in the evaluation activities. Consent forms will be in English and the local language, Kiswahili, describing the evaluation details, procedures, risks, and benefits. Forms will be translated from English to Kiswahili, then back to English to verify that nothing was lost or altered during translation. The individuals will be asked to read and review the document. If the participant is not able to read the document or has low literacy skills, the consent form will be read aloud by the evaluation staff and individuals will be offered an opportunity to ask questions about the evaluation and the consent process. Every effort will be made to ensure the protection of the rights and welfare of the participants.

It will be emphasized that evaluation participation is voluntary and that either agreeing or declining to participate in the evaluation will not have an impact on the individual's access to future ECHO programs. Participants will be informed that their participation is voluntary and that responses will remain anonymous and confidential. No names will be used in any publications or reports of evaluation findings. Signed consent forms will be stored in locked cabinets by project staff.

Publications and Dissemination of Results

Findings from this evaluation will be summarized and discussed with the respective government agencies and evaluation partners. No identifying information from questionnaires or interviews will be used in future reports, manuscripts, or presentations. Manuscripts based on these findings may be presented at scientific conferences and in peer-reviewed scientific journals. A team consisting of evaluation investigators, including representatives from investigating or collaborating institutions, will be responsible for approving all presentations and publications developed from evaluation data.

Anticipated benefits for ECHO programs

Lessons learned from implementing the evaluation framework will help understand essential elements recommended for developing and implementing a high-quality ECHO program. Recommendations to assess high-quality implementation will be beneficial for program implementation and evaluation planners irrespective of disease or health condition, or geographic location of the ECHO program. Routine process monitoring and evaluation tools shall be available to modify, contextualize, and utilize for their specific evaluation frameworks that will save resources globally.

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Box 1. Evaluation Questions

- 1.) What are the current stakeholder perceptions of high-quality HIV ECHO implementation?
 - 1.1.) How do HIV ECHO participants and implementers (Health care providers, faculty, ECHO organizers) perceive high-quality implementation?
 - 1.2.) How do HIV ECHO participants and implementers perceive their level of engagement in the HIV ECHO program?
 - 1.3.) How do HIV ECHO participants and implementers perceive their level of satisfaction with HIV ECHO program?
 - 1.4.) How do HIV ECHO participants and implementers perceive their learning?
 - 1.5.) How do HIV ECHO participants and implementers perceive their self-confidence in managing complex HIV patients?
 - 1.6.) How do HIV ECHO participants and implementers perceive their level of competence?
 - 1.7.) What do HIV ECHO participants and implementers perceive are potential barriers to HIV ECHO participation?
 - 1.8.) To what degree has HIV ECHO sessions influenced behavior of the participants?
 - 1.9.) Was the content of previous HIV ECHO didactic presentations, accurate, clear, and valid?
 - 1.10.) Was the content of previous HIV ECHO case-based presentations, accurate, clear, and valid?
 - 1.11.) Were case-based recommendations made by the expert panel applicable to the case presented, appropriate, useful, and, relevant?
- 2.) To what extent does the draft evaluation framework and compendium of tools describe, measure, and validate the described elements (constructs) to effectively monitor a high-quality HIV ECHO implementation routinely?
- 3.) What are the recommendations for improving the proposed evaluation framework and the compendium of monitoring and evaluation tools?

Box 2. Key informant questions

These interviews will assess the (i) utility (*Who needs what information?*), (ii) feasibility (*How much money, time, effort is needed to be conducting this evaluation routinely?*), (iii) propriety (*What steps can be taken for evaluation to be ethically conducted with regard to those involved and those affected?*), (iv) accuracy (*What design will lead to accurate information being collected?*).

Figure 1. Evaluation Implementation Phases

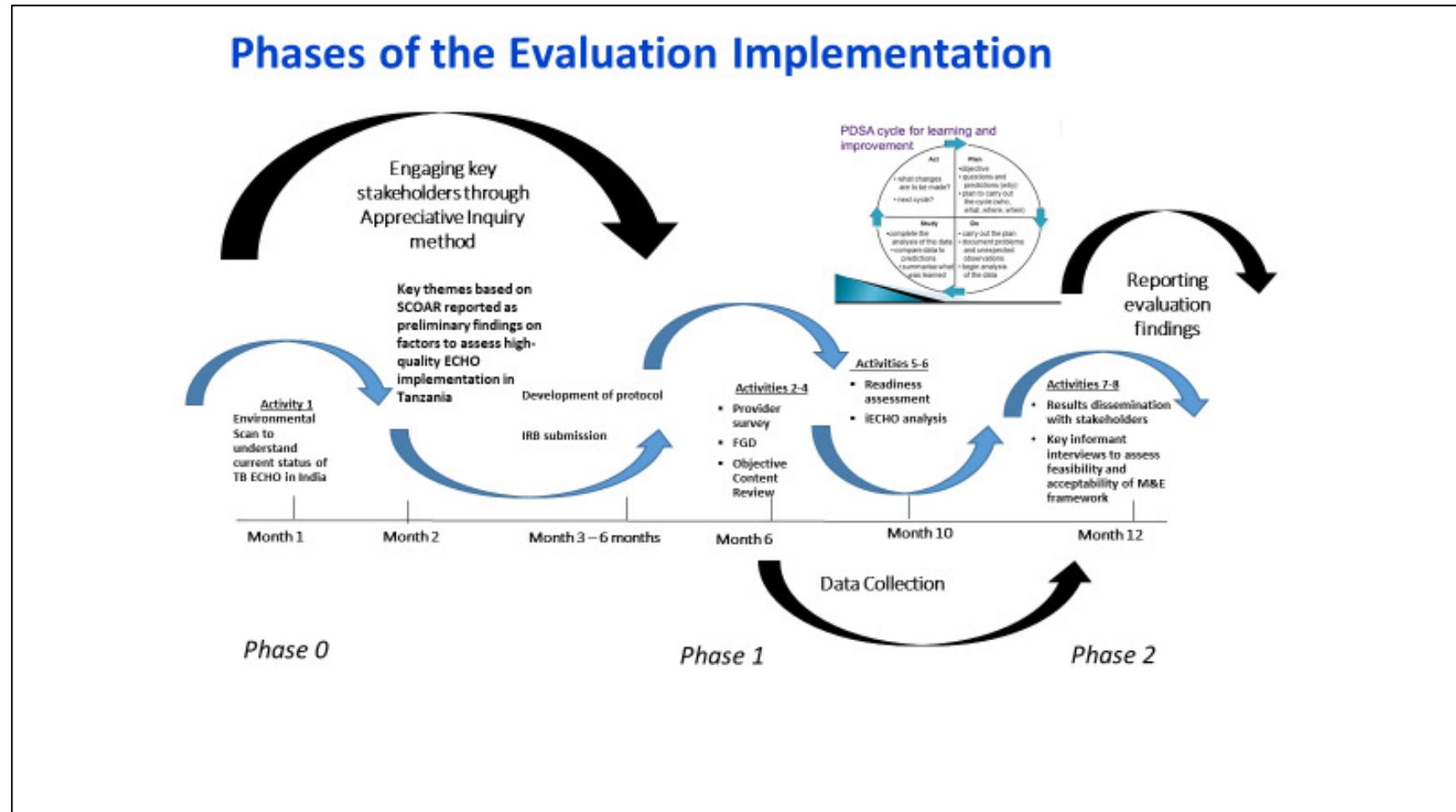


Figure 2. Proposed Comprehensive Evaluation Framework with evaluation activities

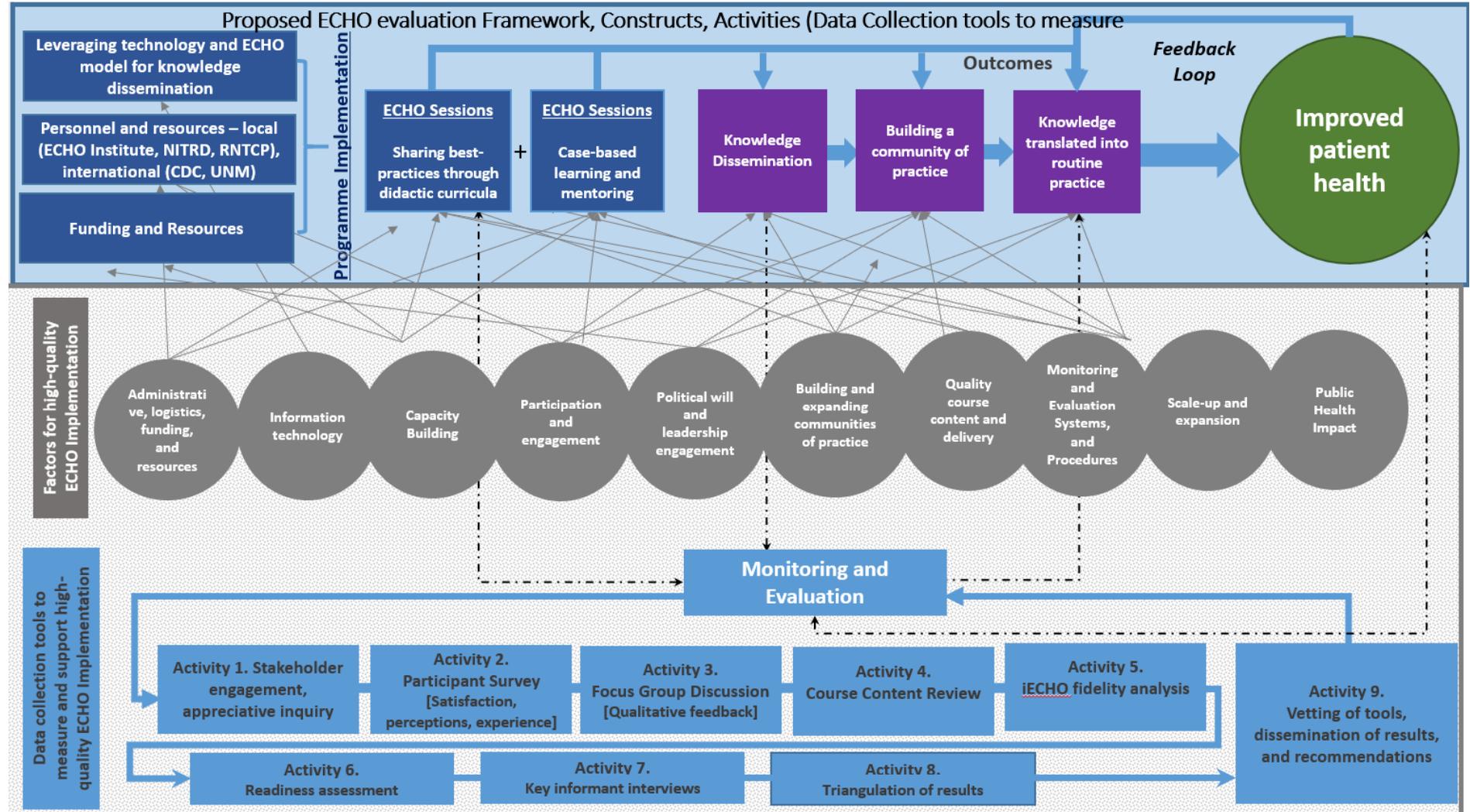
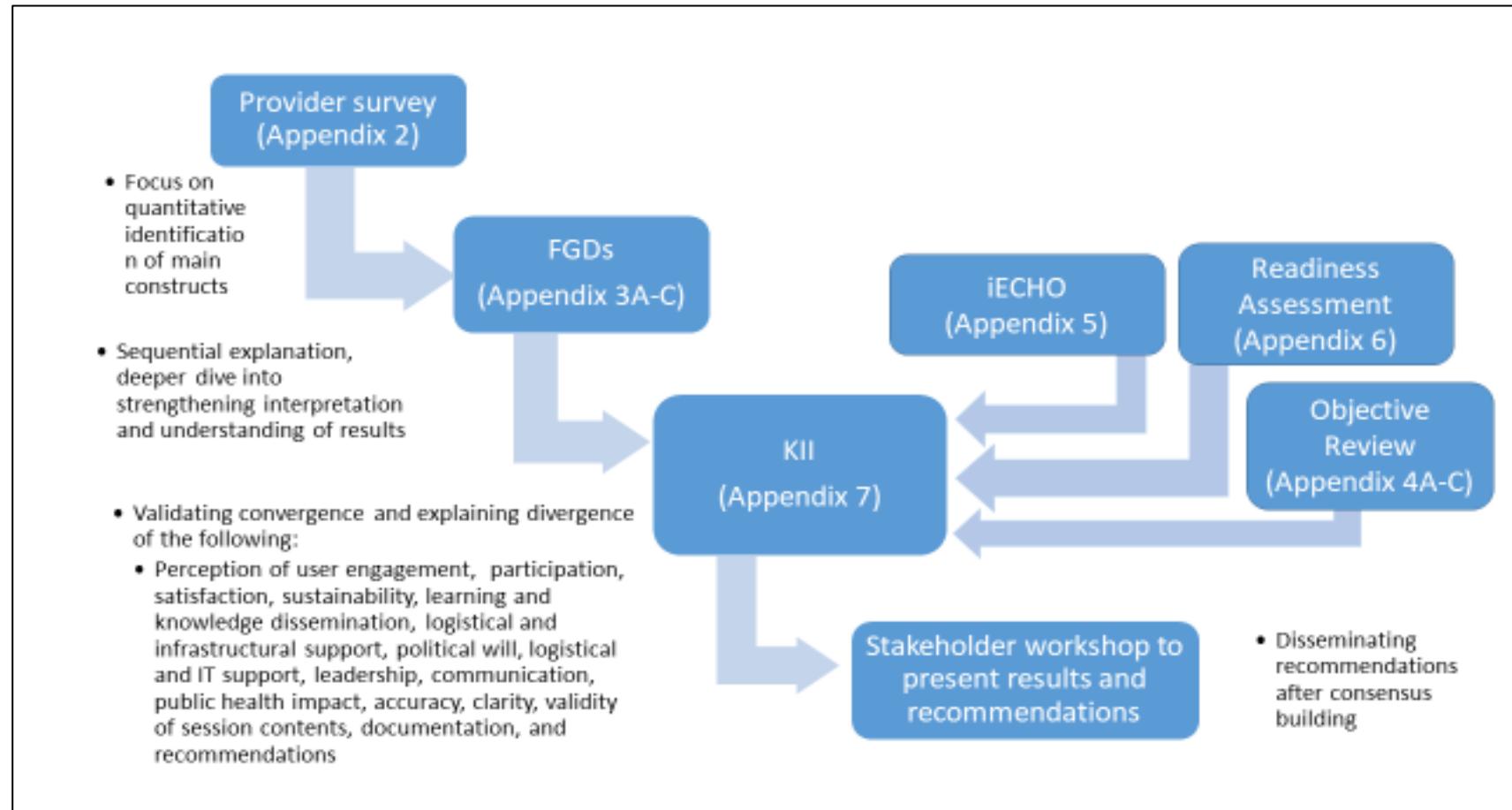


Figure 3. Triangulation of the tools



PAPER 3: Qualitative validation of an evaluation framework and compendium of tools to assess quality of Extension for Community Health Outcomes (ECHO) implementation

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Full-length Original Articles: These manuscripts may be up to 3,500 text words (not including 250 word abstract, tables/figures/images, or references). Manuscripts must include a conceptual framework, detail implications for practice and/or policy along with implications for further research, and clearly and specifically advance knowledge relevant to the field of health promotion. Print articles may include up to 30 references and up to 5 tables/figures/images.

Abstract: 250 words (250 limit)

Word Count: 3,434 words (3,500 limit)

Abstract

Extension for Community Health Outcomes (ECHO) leverages videoconferencing technology, evidence-based knowledge dissemination, and mentorship for a wide range of global public health programs. No systematic evaluation frameworks have been implemented to assess the quality of ECHO implementation. We conducted a qualitative validation for feasibility and acceptability of a proposed evaluation framework with data collection tools that assess quality of ECHO implementation. Triangulation of results from key informant interviews (KII) and document reviews provided qualitative feedback on the main constructs of interest: administrative, resources, logistics, and communication; information technology; political will, session content, monitoring and evaluation, capacity building, building communities of practice, public health impact, participation, sustainability and scale-up. Participant surveys focus group discussions (FGD) and tools to objectively review session content, participation, and assess site readiness were reviewed. Among nine KII and latent content analysis of 12 out of 15 select documents, unanimous consensus was found on assessment of administrative and logistical support, and information technology, capacity building, participation, as key elements for high-quality ECHO implementation. An appreciative inquiry-based SCORE methodology was supported as interim evaluation methodology; readiness assessment and objective content review were recommended before scale-up. FGD, despite being resource intensive, was appreciated especially if connected to participant surveys. Although recognized as important, political will and engagement, as well as documentation of monitoring and evaluation and scale-up plans was absent from documents reviewed. Based on this qualitative validation activity, a simpler framework with tools based on intended ECHO outcomes with a recommended timeline along the implementation lifecycle is recommended.

Background

Project ECHO leverages videoconferencing technology to build workforce capacity through didactic presentation, case-based learning, and facilitating collaborative virtual problem solving (Arora et al., 2010, Struminger et al., 2017). This model was adapted in over 39 countries including United States to address over 75 health conditions (e.g., antimicrobial resistance, diabetes, hepatitis, HIV, substance abuse, tuberculosis etc.) (Fischer et al., 2019).

In 2018, Rand Corporation was asked by Office of the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services to collect and analyze information on the status of ECHO, assess gaps that remain, and recommend how to address those gaps (Fischer et al., 2019), they reviewed 52 peer-reviewed articles on effectiveness of ECHO and ECHO-like models. One of the four main conclusions was that neither a comprehensive evaluation framework, nor any practical tools were available to assess implementation quality (Fischer et al., 2019). Moreover, evaluation designs included retrospective or prospective cohort studies with comparison groups using varying data collection methodologies such as focus group discussions, semi-structured interviews, pre-post tests, and surveys, mostly influenced by the Moore framework for continuous learning for physicians (Moore, Green, and Gallis, 2009). The Moore framework assesses knowledge gain and application for physicians' Continuing Medical Education (CME) program, ranging from rates of participation (level 1), satisfaction (level 2), declarative learning (level 3A), procedural knowledge (level 3B), competence (level 4), performance (level 5), patient health (level 6), community health (level 7) (Moore, Green, and Gallis, 2009). The Rand report recommended inclusion of rigorous reporting of program characteristics or evaluation design that expands beyond level 4 to assess performance, fidelity as well as patient and community health outcomes (Fischer et al., 2019).

An exhaustive literature review revealed complex intervention evaluation guidance, implementation science related frameworks that promoted the systematic uptake of research findings, and other evidence-based practices to improve the quality and effectiveness of health service (Eccles & Mittman, 2006; Braithwaite et al, 2009, Anderson, 2008; Durlak & Dupre, 2008; Damschroder, 2009). Moreover, the Consolidated Framework for Implementation Research (Damschroder et al., 2009), adapted framework for ECHO readiness (Serhal et al., 2018), and the public health program capacity for sustainability (Schell et al., 2013) influenced the development of a proposed comprehensive evaluation framework with user-friendly tools to assess high-quality ECHO implementation addressing program performance, and fidelity (Ghosh et al., 2020a).

Furthermore, stakeholder participation at two appreciative inquiry (AI)-based SCORE methodology (Strengths, Challenges, Opportunities/aspirations, measurable Results and Evaluation) in India and Tanzania (Ghosh et al., 2020b) led to a list of ten a priori constructs to assess high-quality ECHO implementation: [(i) administrative, resources, logistics, and communication; (ii) information technology; (iii) political will, (iv) session content, (v) monitoring and evaluation, (vi) capacity building, (vii) building communities of practice, (viii) public health impact, (ix) participation, (x) sustainability and scale-up. (Figure 1). Seven data collection tools were included to measure each construct: (i) focus group discussions (FGD) guided by appreciative inquiry approach to reveal Strengths, Challenges, Opportunities/aspirations, measurable Results and Evaluation of the SCORE workshop (ii) participant survey to assess satisfaction, and learning, (iii) FGD guides for health care providers, implementers and subject matter experts to understand whether knowledge is being translated into practice and other challenges to plan and conduct ECHO (iv) objective content review tools for ECHO sessions to assess clarity and delivery of content, facilitation, and acceptability of recommendations (v) readiness assessment questionnaires for sites (vi) iECHO tool to monitor participation (vii) key-informant interviews (KII) to triangulate and finalize feasibility and acceptability of the evaluation framework (Table 1).

Some of the elements, such as building communities of practice which includes learning and interaction during ECHO sessions but also understanding how the knowledge is applied in practice, makes building communities of practice a complicated construct to measure (Mabery et al, 2009). Similarly, measuring public health impact, another complex construct, could be measured from various angles for example impacts on patient outcomes or improvements in programmatic indicators e.g., increased HIV/TB testing or retention due to ECHO. Thus, valid and reliable instruments were needed (Rubio, 2003). Content validity is a prerequisite during framework and instrument development (Zamanzadeh et al., 2015). Content validity, also known as definition validity or logical validity, addresses the degree to which an instrument or evaluation framework sufficiently represents the content domain (Newman et al., 2013).

Overall aim of this study was to conduct a qualitative validation of the evaluation framework. This paper reports on triangulation of results from KII and latent content analysis to answer three primary research questions: (i) How valid are the constructs that define high-quality ECHO implementation (construct validity)?; (ii) Do the data collection tools measure what they are intended to measure (content validity)?; (iii) Was the evaluation framework and compendium of tools accepted by key stakeholders (Acceptability and feasibility)?

Methods

Key informant interviews

Semi-structured KII were conducted to gather feedback on defining high-quality ECHO implementation and assess acceptability of the evaluation framework and data collection tools. Acceptability was defined as user-friendliness (utility) and feasibility of the tools in the context of program implementation (CDC, 1999). Eligible key informants were purposefully selected based on prior experience with designing, facilitating, or implementing a variety of global ECHO programs across Africa, Asia, Latin America, and the USA. Participants represented various academic, government or PEPFAR implementing partner agencies (IOM, 2013). Participant recruitment emails included a description of the purpose of the evaluation process, a copy of the proposed evaluation framework, data collection tools, and results from the appreciative inquiry workshop in India (Ghosh et al., 2018). An interview guide with 14 semi-structured questions were used to guide the KII (Supplemental Appendix A). All interviews were conducted in English using Zoom™ (Zoom Video Communications; San Jose, CA, USA); audio recordings were transcribed using machine transcription (Temi.com) and then reviewed and edited by lead researcher to ensure accuracy and completeness.

An interview codebook was developed and compared between primary and secondary coders to assess inter-coder reliability. Transcripts were imported and analyzed using MAXQDA (VERBI GmbH; Berlin, Germany). Consistency or discrepancy of constructs among the different key informants were assessed (Patton, 2015).

Document Review

To assess alignment with the main constructs of interest, a document review (US GAO, 1996; Krippendorff, 1980) was performed on select peer-reviewed publications, evaluation reports, meeting minutes, and slide presentations. Eligible documents were recommended by the key informant or credible contacts with knowledge of ECHO implementation and evaluation, preferably from the countries or regions for which they were affiliated. (Supplemental Appendix B). Directed content analysis was conducted by searching documents for the main constructs of interest and determining the content validity of the data collection tools (Hsieh & Shannon, 2005).

Content alignment was assessed through iterative reading of the documents to examine if there was alignment with proposed constructs of interest. If either of the constructs from the list of a priori constructs of interest were present, they were considered aligned; if these constructs of interest were

absent, then they were considered divergent. For example, if one of the evaluation reports included satisfaction surveys or pre-post knowledge assessments, then capacity building construct was considered aligned; or focus group discussions highlighted challenges about IT infrastructure, or lack of time to attend ECHO sessions, then constructs related to IT or logistics were considered aligned (Table 2). If an a priori construct in the proposed data collection tools were not found in the documents, these constructs were considered absent. For example, if political will was not measured or captured in any of the data collection tools, this construct was considered to be absent.

Triangulation of data sources for validity and credibility

Triangulation of multiple qualitative data sources helped understand consistency between KII and document review. To triangulate findings from the key-informant interviews, the analysis of the patterns led to an interpretation of the contextual meaning with regards to the development of final recommendations, and to improve the framework or data collection tools (Holsti, 1969). Researcher bias was addressed by interpretation of the implicit (latent) meanings by member checking with individual key informants and peer debriefing with co-authors (Miles & Huberman, 1994). Member checks were accomplished by sharing the transcript and interpretations with at least two key informants, from who data were solicited.

Results

Key Informant Interviews

Fifteen key informants were invited to participate; 9 (60%) accepted and consented to review the evaluation framework, data instruments, and participate in a one-on-one interview. Key informants represented ECHO experiences from Africa (n=4), Asia (n=2), Latin America (n=1), North America (n=2). Seven (78%) key informants were female, and the vast majority (89%) had >5 years of experience with ECHO programs. Six informants were clinicians, 2 were leaders in quality improvement, and 1 was a laboratorian. Intercoder-reliability was 80% (VERBI GmbH; Berlin, Germany).

Document Review

Of 15 documents reviewed, the majority were evaluation reports (9, 60%). Other documents reviewed included, meeting minutes (2), PowerPoint presentations to stakeholders (1), an evaluation plan (1) and a peer-reviewed publication (2) (Supplemental Appendix B). Among these, 12 (80%) met

the inclusion criteria. Excluded documents included, evaluation planning meeting minutes from both India and Tanzania, and 1 evaluation report that was never received. Out of eligible documents, 8 (67%) of the documents that were from Africa, 5 were evaluation reports, 1 was a routine program QI survey analysis, 1 was an evaluation protocol, 1 was a PowerPoint slide set reporting preliminary evaluation findings. Among the 3 that were from Asia, 2 were manuscripts and 1 was an evaluation report. The document reviewed from the USA was a congressional report of technology enabled learning models (Supplemental Appendix B). Table 2 summarizes results that align with the perspectives from the KII. Excerpts and quotations from both KII and document reviews are included in the summary below. We describe the insights from KI and document review that are consistent or divergent from the a priori constructs defining elements of high-quality ECHO implementation.

Triangulation Results

Triangulation of all 3 data sources led to general consensus, enthusiasm and encouragement from SCORE participants as well as key informants about the framework with some suggestions to simplify it (Table 2). The constructs that aligned between the 3 data sources were capacity building, participation, scale-up of ECHO (which everyone is always excited and is a proxy indicator for success). Additionally, IT and resources related elements seem like an important element, again almost always included in ECHO reports and discussion. However, there was absence of assessing Communities of practice, objective reviews of ECHO sessions, political will, M&E plans and documentation, as well as process for measuring public health impact from documents that were reviewed. Moreover, none of the documents that were reviewed had mention of a comprehensive evaluation framework

Feedback on proposed Evaluation Framework and data collection tools

The majority of the key informants (7 of 9) felt there was merit in conducting process evaluation and incorporating mixed methods (qualitative and quantitative) to assess ECHO implementation quality. The framework was complimented as comprehensive and thorough. However, there was general consensus that implementing all of the evaluation tools simultaneously would be too cumbersome for programs. Thus, program evaluation plans should consider selecting a minimum set of tools to achieve program goals (Table 3, Figure 2).

The appreciative inquiry facilitated SCORE workshop was found to be acceptable and feasible by key informants. Key informants recommended SCORE workshops be conducted within 12 months of implementation, and before any scale-up or expansion (Ghosh et al., 2020). SCORE facilitated valuable information, albeit qualitative, and was considered a best practice to inform interim course-correction. However, it was acknowledged that SCORE workshops cannot be coordinated and conducted routinely by many implementing partners without direct support from MOH.

Triangulation summarized the following constructs as essential for assessing quality of ECHO Implementation: (i) Capacity building, (ii) Participation, (iii) Administrative/resources/logistics, (iv) Information technology (IT) related data. These constructs usually input indicators should be monitored routinely through suggested tools in the proposed framework (Tables 2 and 3). There was 100% agreement between KI and content analysis on contribution of ECHO towards in these constructs generally considered input related.

Constructs related to communities of practice and session content were multi-factorial. Measuring these constructs may require multiple indicators and tools to assess quality. Assembling the correct composition of facilitators and participants was key for high-quality ECHO implementation. This observation was corroborated by several key informant's comments that senior leadership and physicians dominate the discussions during ECHO sessions. A skilled facilitator or moderator may overcome these challenges as suggested by a third of the KI independently. A session facilitator was suggested as an 'ECHO Champion' who could facilitate interactivity, enrich discussions, and be cognizant of cultural and hierarchical environments to be able to moderate successful sessions (Table 2).

“Having excellent facilitation skills of the moderator are essential elements to having a successful ECHO”.

Notably, no mention or assessment of facilitator skills were included in any of the documents reviewed.

All key informants agreed that (vii) leadership engagement and political will, (viii) public health impact, (ix) monitoring and evaluation, and (x) scale up and expansion were important constructs, but they struggled how best to measure them. Moreover, no ECHO programs were systematically measuring political will or public health impact. Importantly, even though all programs were scaling up, none of the ECHO programs had formal documentation of a scale up or monitoring and evaluation plans. All key informants were proud of current achievements and the pending scale up of their

programs; yet most were unsure how best to monitor progress routinely. All key informants had a vision to expand either current programs (scale-up) or develop other programs (scale-out) beyond their focus area; however, they expressed concern that neither systematic evaluations nor formal expansion plans were currently in place. Key informants appreciated the availability of readiness assessment tools for this purpose (Table 3). All key informants mentioned national teams will conduct formal ECHO evaluations in the near future, however all the evaluation reports and evaluating entities in the countries currently are international implementing partners who are funded (Table 3). SC

Related to toolkit, 100% KI agreed that the survey was an acceptable tool that was feasible for delivery, data collection, analysis and reporting; although some felt 80 questions may be too much. Half of the KI felt that FGD is a great way to gather rich qualitative information that could not be obtained through structured surveys, especially related to experiences and challenges. The other half felt that conducting a FGDs would require skilled qualitative evaluators for conducting, analyzing and using results to make improvements. If you have to do it, do it *“once a year”*. The rest thought *“both survey and FGD are great tools, if used together as they complement each other.”* Key-informant interviews are critical for periodic check-ins. They are adaptable and can be used to measure capacity.

Another KI said, *“While this (FGD) could be done by National Programs or the implementing partners, I think the problem is that you get sort of more and more personal in key-informant interviews.”* Readiness assessment was preferred as a checklist instead of interview, and the session review got encouraging feedback. One KI exclaimed:

“I think this activity (session reviews), and the tools are the most innovative part of the entire toolset. This was the most exciting part I thought.”

None of the documents had session reviews as part of their evaluation; one protocol intended to undertake this in the near future. When KI were asked about tools or constructs that were missing, the response related to economic assessments could answer questions on what it would cost to do an ECHO session and how could benefit be calculated and documented. Five out of the nine of the key informants, and studies reviewed by Rand (Fischer et al., 2019) included the value of a pre-post test to assess knowledge gain. Notably, one key informant frankly stated, having a pre-post test would be a deterrent. *“Our ECHO sessions are for physicians who have ego and will not like to be tested”*

Discussion

Developing an evaluation framework based on a collaborative participatory appreciative inquiry approach (Mabery et al., 2013; Stavros, 2009) needed validation to assess credibility, and trustworthiness (Guba and Lincoln, 1982). Both key informant interviews and document review were conducted strategically and methodically (Miles & Huberman, 1994). Through key informants, experiential data came directly from knowledgeable and credible source. Diplomatic tact and poise were essential to manage these conversations, through active listening, following the sequence of questions, and within the research boundaries (Miles & Huberman, 2014; Robson & McCartan, 2011).

Setting targets or a vision for ECHO in a country at inception would be important to measure progress over time. While indicators measure change over time, a target reflects a vision and aspiration to achieve. Setting up a desired, feasible, realistic target at inception of ECHO implementation, e.g., High-quality ECHO implementation should have occurred in every state, or 100% coverage achieved in 5 years or all urban hospitals in a health district participating in ECHO in a year. Having a vision and definition of successful implementation with both process and outcome evaluation questions was imperative to pre-implementation. Collecting baseline data was key; however, if not collected, interim mini-evaluation using our SCORE methodology may help with midcourse-correction.

The minimum elements for measuring high-quality ECHO include capacity building, participation, administrative/infrastructure/resource and internet connection assessments. Readiness assessments (done pre-implementation) may guide resource allocation, addressing internet capacity and logistical challenges. Measuring the benefits of communities of practice may be direct, such as resolving a problem by learning from others experience. Or it may be indirect, such as experiencing a sense of belonging within a group dealing with similar issues.

Political will in context is the “*commitment of political leaders and bureaucrats to undertake action to achieve a set of objectives and to sustain the costs of those actions over time*” (Brinckerhoff, 2000). This term has been used without sufficient specificity as it is a complex and difficult concept to measure (Tilley, 2018). This sentiment was revealed by KIIs and document review. Leadership engagement and political will were contextual constructs that emerged to be deficient in the assessed ECHO programs as independently revealed by 4 key informants. Document review revealed absence of measure of political will; there was no reference to political will or leadership engagement in any of the documents. Despite the challenges in measuring this complex construct routinely, unpacking some of

the key components may help assess some sort of measure for political will and leadership engagement for assessing ECHO implementation quality.

Having an ECHO champion at the national MOH level helps. University of New Mexico could monitor as part of their global efforts, how many of their ECHO programs have an ECHO champion at the MOH level. Government initiation/support of a policy is a major driver and sustainer of any ECHO program and demonstrates leadership engagement from inception. Suggested monitoring indicators for a country could be, e.g., Number of countries with ECHO and/or ECHO evaluation included in their national strategic plans. Regular participation of a MOH representative leader or SME, monitored routinely through attendance logs shows support and leadership engagement and political support. Assessment of this information (along with routine monitoring of participants) can help advocacy or forums to re-engage MOH and government officials to maintain momentum.

Committed resources and effort over a long period of time and a mandate and accountability to sustain implementation of an intervention. A sporadic support or one-off pilot test support is usually a weak signal and a sign of wavering political will. For example, an official from MOH in a high position appearing at the first ECHO session and never showing up again for any of the sessions.

Measuring mobilization of stakeholders that assesses if the MOH involvement translates into additional partnerships or expansions of partnership could be one way to monitor/evaluate engagement. For example, national medical society advocacy groups engage and recruit additional SME/Hub or spoke partners of ECHO. Re(allocation) of resources would capture any changes in government budgets that support ECHO activities, equipment or personnel. Financial support or if MOH national evaluation teams have members or policies that support evaluating ECHO programs, it shows commitment to the cause, helps in sustainability of a national initiative/intervention. One way to monitor would be to assess what proportion of the national budget is utilized for ECHO implementation and/or evaluation?

Limitations

We convened a convenient sample of key informants. We cannot generalize the findings since this is a qualitative assessment, and not an intervention. Researcher bias was minimized through high inter-coder reliability for key informant interviews (81% and 82%, respectively for two KI interviews assessed) that required several discussions and consensus around coding and member check-in and peer-debriefing. Content analysis has been criticized as an overly simplified process; however, the iterative process and interpretation can be more complex and difficult than quantitative analysis because

it is less standardized and formulaic (Polit and Beck 2004). Another challenge of content analysis was the fact that it is very flexible and there is no simple, 'right' way of doing it. Expanding the number of documents for review may have yielded different results.

Conclusion

Validating the proposed evaluation framework qualitatively unpacked constructs that were not being assessed routinely. The knowledge generated from this research was used in the development of a set of recommendations that may offer a standardized, yet flexible, evaluation framework and toolkit for all ECHO programs. These findings have the potential to inform formal evaluation plans and may support the design of routine systems to monitor, evaluate, and document program performance.

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Table 1. Proposed data collection tools and constructs for measurement

Tool	Qualitative or Quantitative	Constructs to be measured	Measurement Description
<p>(1)Appreciative inquiry-based SCORE (Strength, Challenges, Opportunities/Aspirations, measurable Results, Evaluation of the AI-based workshop)</p>	<p>Qualitative</p>	<p>(i) Capacity Building, (ii) Participation, (iii) Building and expanding communities of practice, (iv) Administration, resources, communication, and logistics, (v) IT related, (vi) session content related, (vii) political will, (viii) public health impact, (ix) M&E, (x) scale up</p> <p>Emergent codes: motivators and incentives</p>	<p>(i)learning, capacity building, self-confidence, declarative application of knowledge g (ii) types and kinds of parti (iii) collaborative problem mentorships outside ECHO partnerships (iv) administrative, resourc (v) IT disruptions, lack of c (vi) Session content quality hierarchical cultural and fa sessions, time and content interaction during ECHO s (vii) leadership support, po engagement, (viii) anecdotal or quantita documentation of public he (ix) M&E, documentation, (x) Scale up and expansion</p>

<p>(2) Survey for participants</p> <p>(80—question survey with a few open-ended questions)</p>	<p>Quantitative</p> <p>And couple qualitative open-ended questions</p>	<p>(i)Capacity building (satisfaction), (ii) Participation, (iii) Building and expanding CoP, (iv) logistics, administrative and resources (v) IT related (vii) Political will and leadership engagement, (viii)public health impact (x) scale-up</p>	<p>. (i)learning, capacity build self-confidence, declarative application of knowledge g</p> <p>(ii) types and kinds of parti</p> <p>(iii) collaborative problem mentorships outside ECHC partnerships</p> <p>(iv) administrative, resource language, logistics,</p> <p>(v) IT disruptions, lack of c</p> <p>(vii) leadership support, pe engagement,</p> <p>(viii) anecdotal or quantita</p> <p>documentation of public he</p> <p>expansion plans or activitie</p>
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<p>(3) Focus Group Discussion (FGD)</p> <p>3 FGD guides with probes for decision makers, Health care workers, implementers/faculty</p>	<p>Qualitative</p>	<p>(i)Capacity Building, (iii) CoP, (iv) Logistic, administrative, communication, resources, (v) IT connectivity related (vi)ECHO Session, (vii) public health impact</p>	<p>(i)learning, capacity building, self-confidence, declarative application of knowledge g (iii) collaborative problem mentorships outside ECHO partnerships (iv) administrative, resource (v) IT disruptions, lack of c (vi) Session content quality hierarchical cultural and fa sessions, time and content interaction during ECHO s (viii) anecdotal or quantitative documentation of public he</p>
<p>(4) Objective Review</p> <p>3 different tools to assess Clarity of content, facilitation skills, and accurate and clear recommendations</p>	<p>Quantitative and Qualitative</p>	<p>(iii) CoP, (vi) Objective session review</p>	<p>(iii) collaborative problem mentorships outside ECHO partnerships (vi) Session content quality hierarchical cultural and fa sessions, time and content interaction during ECHO s</p>

<p>(5) Readiness assessment</p> <p>Interview with a new hub coordinator pre-implementation of ECHO</p> <p><i>(Needs to be revised to a checklist instead of a semi-structured interview)</i></p>	<p>Quantitative</p>	<p>(i) Capacity Building,(iii) Building and expanding communities of practice, (iv) Administration, resources, communication, and logistics, (v) IT related, (vii) political will, (ix) M&E, (x) scale up</p>	<p>(i)learning, capacity building, self-confidence, declarative application of knowledge g (iii) collaborative problem mentorships outside ECHO partnerships (iv) administrative, resource (v) IT disruptions, lack of c (vii) leadership support, po engagement, (viii) anecdotal or quantita documentation of public he (ix) M&E, documentation, (x) Scale up and expansion</p>
<p>(6) iECHO analysis</p>	<p>Quantitative</p>	<p>(ii) Participation</p>	<p>Number and type of particip trends for participations by vs hubs</p>
<p>(7) Key Informant Interviews</p>	<p>Qualitative</p>	<p>All 10 constructs</p>	<p>Sharing of all the previous mem check-in for acceptab</p>

Table 2. Triangulation Table validating results from Key Informant Interviews and Document Review

	Data Collection tools	Key Informant Interviews	Document Review
Evaluation Framework and toolkit	Proposed toolkit	Yes	No
Capacity Building	SCORE, Survey, FGD	Yes	Yes
Participation	Survey, FGD, iECHO	Yes	Yes
Community of Practice	SCORE, FGD, Readiness assessment	Yes	No
Scale-up of ECHO	SCORE, Survey, Readiness assessment	Yes	Yes
ECHO session	SCORE, Survey, FGD, Objective Session Review	No/Good idea	No
Information Technology Related	Survey, Readiness assessment, Objective Session Review	Yes	Yes
Resources, Infrastructure, Logistics, Communication, Language	SCORE, Survey, FGD, Readiness assessment	Yes	Yes
Political Will	Survey, Readiness assessment	No/Difficult to measure	No

M&E/Documentation	SCORE, Readiness assessment, FGD	No/Difficult to measure	No
Public Health Impact	Survey, FGD, Readiness assessment	No/Difficult to measure	No

Table 3. Triangulation table validating results from 9 Key-Informant Interview findings and 12 documents document reviews

Evaluation framework and constructs of interest from Appreciative Inquiry Approach	Data Collection tools to measure/assess high-quality ECHO	KII agreement whether the proposed evaluation framework and data collection tools ability to assess these constructs? (Yes/No/Possible)	Document review findings on concordance of constructs from the proposed evaluation framework	Select quotations and feedback	Notes explaining revisions to the proposed Evaluation Framework and data collection tools
Evaluation Framework and toolkit in general	Proposed toolkit	Yes	NA	<i>"I mean it looks great because I have everything but maybe it will be hard to follow like with the arrows. The only thing that, that I thought it was complex because you have to look at all the different</i>	This led to simplification of the framework to include only tools and a suggested timeline in the ECHO life-cycle

				<p><i>arrows going back and forth, but it's good that you have the activities, you remember them, like activity 1, 2, you could follow that through. I think it was on the top where it got more confusing to link activities with constructs for measurement”</i></p>	
Definition of ECHO	SCORE	Yes	Yes	<p><i>“If we come together and share information, by definition it is not necessarily ECHO. Using Zoom does not necessarily make it ECHO. ECHO is a platform, a virtual connectivity of multiple parties coming together for an hour, hour and a half of sharing case presentations combined with a didactic presentation.”</i></p>	<p>At least two of the KIs reflected on how definition and objective of the ECHO program is key as a health care or medical education intervention even before high-quality ECHO implementation can be defined and assessed. This was mirrored in the Rand Report, “ECHO</p>

					has been used interchangeably with ECHO-like activities” (Fischer et al, 2018). Moreover, SCORE workshops in India and Tanzania where a large group reflected on how using Zoom is not the same as the philosophy of ECHO (Ghosh et al, 2020).
(i) Capacity building and knowledge dissemination	SCORE, Participant, survey, FGD	Yes	Yes	<p>“<i>Session on Isoniazid preventive therapy was a big success for the HIV providers as we were scaling up IPT in our country</i>” (medical content)</p> <p>“<i>We are seeing huge amounts of team building and trust developed between different teams. We are</i></p>	Both KII and content analyses agree that this is a key construct that should be measured universally for all ECHO programs. If resources permit, pre-post ECHO

				<p><i>also witnessing quality of presentations improving immensely. They actually caught an outbreak at the NICU respirators and they had an opportunity to talk about this during an ECHO session. Once they identified the problem, each of them ensured, they went and cleaned these respirators” (working together)</i></p>	<p>knowledge assessment may be added since it was not in the proposed framework and data collection tools (Figure 1).</p>
(ii)Participation	Provider survey, FGD, iECHO	Yes	Yes	<p><i>“ I am not sure how you could capture all the different kind of participations since some providers attend more regularly and you see them every week. They are seeing the same faces and then they periodically see some new faces. Not all participants attend every week.”</i></p>	<p>As indicated by the evaluation reports, from the content analysis, even though 100% of the reports captured participation, the measures were not captured in a standardized way. Attendance logs are required electronically</p>

					<p>preferable but paper-based may work as an option. Routine monitoring and response to lower participation is necessary for a high-quality implementation. iECHO tool has not been used by most KII and is not being used appropriately. More efficient ways to measure participation may be explored using attestation platforms such as Socion Technology or others.</p>
(iii) Building/Expanding Communities of Practice	AI, FGD, Readiness assessment	Yes	No	<i>“There seem to be a correlation with the number of people that speak up and the sessions being</i>	Tools to measure CoP will be important. As assigned person could be

				<p><i>interactive, so interactions between participants who are not presenters (SME) or ECHO coordinators.”</i></p> <p><i>“ For me a successful ECHO implementation is one where there is peer sharing by allowing interactivity by having non-faculty members speak up is probably a critical element. To create a vibrant CoP is key!”</i></p>	<p>monitoring peer-interaction that could help facilitator.</p> <p>A 3-question poll at the end of every session, monitored routinely and used to make changes:</p> <p>(i)How relevant was the topic of this session to you and your clinic on a scale from 1-5 (1:Not relevant to 5:Very relevant)</p> <p>(ii)How do you rate the effectiveness of today's session? (1:Not effective to 5:Very effective).</p> <p>(iii) How likely will you</p>
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					<p>implement the lessons learned of this session in your clinic? (1:Not likely to 5:Very likely). Anecdotal evidence and personal communication indicate increasing use of whatsapp to sustain CoP, however, no reports or documents have systematically documented this to our knowledge.</p>
(iv)Resources/Logistics/ Admin/Infrastructure, Communication and language	AI, Provider survey, FGD, Readiness Assessment	Yes	Yes	<p><i>“Running sessions on time is critical to make a successful ECHO.”</i></p> <p><i>“Ensuring safety and security of ECHO equipment”</i></p>	<p>General consensus on measuring topics regularly were aligned between KII and content analysis. Existing tools capture assessing these</p>

					qualitatively through FGD or KII. Special attention should be made to assess language used for communication as well as translation services if needed.
(v)IT related	Provider survey, Readiness assessment, Objective session review	Yes	Yes	<p><i>“Tech issues were negatively impacting participation”</i></p> <p><i>“Most challenges have been around wifi connectivity that impacts high quality implementation”</i></p>	All nine KIs mentioned challenges with internet connectivity suggesting ways to measure this issues in the evaluation framework to be able to monitor and manage Zoom application and internet

					connections. Some way to measure improvements in the internet connectivity systematically should be part of the evaluation framework and data collection tools. At least half of the KII mentioned iECHO capturing this information, however they had never seen this information first-hand. The KIs seemed
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					frustrated about the fact that they were oblivious of whether trends or any of this information, whether improving or deteriorating were being documented, monitored or shared within the programs systematically.
(vi)Session related	AI, Provider survey, Objective session review tools for content, facilitation, and recommendation review, FGD	Yes	<i>Possible with modifying existing tools</i>	<i>“I think quality of recommendations is really important part because you can give an academic explanation about a recommendation with wonderful content experts with all the medical degrees in the</i>	Various elements of the ECHO Sessions need to be assessed (i) Interactions during ECHO sessions, (ii)Content (iii) Facilitation by the moderators

			<p><i>world but the key is to always have individuals with lived experiences. Based on U.S. experience, KI informed that they invited individuals living with HIV on the ECHO sessions.</i></p> <p><i>People living with HIV would be part of that faculty that facilitates interactivity, but also adds to the quality of recommendations that are not just from academic point of view, but from a practical real-world implementation strategy point of view.”</i></p> <p><i>“A lot of programs have been extremely hierarchical for a number of years.</i></p> <p>This experienced KI continued while</p>	<p>encouraging interactivity, and (iv) Time management, (v) SME competence and experience need to be assessed, (vi) Quality of content and recommendations assessed by 3rd party evaluator may be critical (vii) assessing feasibility of recommendation and learning should be considered (see expanding CoP)</p>
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				<p>comparing 2 ECHO programs focusing on 2 different topics, administrated by 2 different hubs in 2 different region, <i>“The reason one of the ECHO programs was a huge success and worked so well is because the folks who were signing on were at the same level of training and expertise within the program, while for the other program in an academic setting, when the senior consultant joins, folks are always deferring to him for expert advice and the discussion isn’t interactive, but if he wasn’t there the next week, they would have conversations between each other”</i> Sometimes, this senior physician recognizes this dynamic, and diverts the question</p>	<p>Some way to measure cultural aspect of ECHO, the hierarchy during facilitation should be incorporated. Existing session facilitation tools could incorporate and expand some key aspects of this element that emerged during the KII</p>
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				<i>to younger physician trainees in the audience”.</i>	
<i>(vii) Political will and leadership engagement</i>	Provider survey, Readiness assessment	<i>Yes</i>	<i>None of the documents measured this construct</i>	<p><i>“Strong buy-in from stakeholders, especially engagement from the Ministries of Health (MOH) is key to success. It’s a source of pride, a source of motivation for people to access these national experts in leadership positions that they normally have zero access to. To be able to learn from them and connect with them I think is very powerful and sustains participation.”</i></p> <p><i>“ECHO did not work out in this unnamed country and not sure what the different reasons might have been. Trouble getting</i></p>	<p>None of the evaluations include assessing political will since a key assumption by couple of KII was that without political will and engagement, ECHO cannot be launched or successful. None of the documents from content analysis assess any constructs related to political will or engagement.</p>

				<p><i>the MOU signed with the national government as well as personnel issues where the implementing partner was unresponsive were challenging. Lack of bandwidth, and absence of an ECHO champion to push the agenda”</i></p> <p><i>seemed like other factors that led to failure of launch of an ECHO.</i></p>	<p>One KI responded “I’ve not really devoted much thought into actually measuring (political will), it’s not to discredit that it might be worth measuring.” <i>If certain spokes are not showing interest, why include them? Those resources are better spent elsewhere anyway.”</i></p>
<p><i>(viii) Public Health Impact (PHI)</i></p>	<p>Provider survey, FGD, Readiness Assessment, Outcome evaluation is strongly recommended beyond provider</p>	<p><i>Possible with modifying existing tools</i></p>	<p><i>Possible with modifying existing tools</i></p>	<p><i>“Clinical mentors were being sent to these far-flung sites once in a blue moon to really just ask anyone if they were having problems and how can we help. Wasting money on</i></p>	<p>Most ways of assessing PHI was scale-up and anecdotal experiences of success being shared.</p>

	satisfaction, self-efficacy, knowledge gain.			<i>vehicles and gas. So at this juncture, even if we don't have a better solution for proving that there is public health impact of ECHO, it's definitely at least a better option to keep building capacity and promoting mentorships.”</i>	One KI recommended collecting qualitative stories as “success stories” (e.g. how ECHO was used to bring a LTFU HIV patient back to care” or a migrant TB case’s care was followed up between 2 Latin American countries through a Binational ECHO program)
<i>(ix) Scale-up, expansion and sustainability</i>	AI, Provider survey, Readiness assessment	Yes	<i>Yes</i>		Unanimously being captured by KII and evaluations as most of the ECHO are either 1 or 2 years from their launch and are being expanded countrywide.

					One recommendation is including an expansion plan, post-evaluation follow-up to include lessons learned from evaluations.
<i>(x)Monitoring, evaluation, and documentation systems for implementation of policies and practice</i>	SCORE, FGD, Readiness assessment	<i>Possible to capture with some existing tools and perhaps new tools</i>	<i>New tools and systems may be needed for documentation of change</i>		Not captured currently
<i>Emergent codes on zoom, research, incentives and motivators, and other topics of ECHO</i>	SCORE, FGD, Readiness assessment	<i>Possible with the correct tools</i>	<i>Knowledge assessment ECHOs included CME and CNE assessments that could be linked to national accreditation programs</i>	<i>“I think CME and CNE is imperative. I think CNE helps them get a good quality assurance mechanism for the ECHO program and help them gain confidence. And I think that it offers the dual function of being a good incentive but also ensuring quality content. CNE and CME is, an area where I’ve often had the partners</i>	At least 9 of the documents that included evaluation results proposed or reported improvement in knowledge and results of pre compared to post tests and how many CME/CNE/CPD credits were disseminated after

				<p><i>feel proud. It's definitely something that needs to be more routinized."</i></p>	<p>the ECHO program. From document review, only 1 evaluation reported proportion of participants who received CNE/CME/CPD points. Designing ECHO programs that include Continuing Medical/Nursing education or Professional Development (CME/CNE/CPD) credits is very important to sustain high-quality ECHO and routinely engage and encourage participation.</p>
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					<p>Nominal monetary incentives or remunerations would encourage Faculty and SME recruitment. None of the documents or KI mentioned any plans from MOH on this.</p> <p>Participatory Digital Accreditation technology such as Socion could be considered for certifications and non-monetary incentives nationally.</p>
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Table 4. Recommendation on the Data Collection Tools from proposed evaluation framework

(Evaluators can use this table as a guidance document for asking an evaluation question that can help determine specific data collection tool and considerations during design of an evaluation plan to assess high-quality ECHO implementation)

Evaluation Questions	Data Collection Tool	Frequency of Data Collection	Who should collect data?	Constructs to be measured	Qualitative/Quantitative Data and Analysis plan
1.) How do ECHO implementers and participants perceive capacity building and knowledge dissemination, learning, self-satisfaction, self-confidence, engagement?	Survey SCORE workshop	Annual and/or semi-annual (shorter survey as a pulse-check every 6 months after ECHO launch for routine monitoring)	ECHO coordinators who are usually implementing partners but long-term would transition into integration and collaboration with MOH	Building capacity and knowledge dissemination, Building and expanding CoP, Political will and leadership engagement	Quantitative data analyzed for descriptive statistics, Likert scale analysis using Excel or other statistical software if possible Qualitative data could be coded and analyzed using CAQDAS (computer-aided data analysis software)

<p>2. (i) Who are the participants?</p> <p>(ii) How many ECHO sessions have the participants attended?</p> <p>(iii) What is their mode of participation? (phone, computer)?</p> <p>(iv) Type of profession?</p> <p>(v) Length of engagement with ECHO</p>	<p>Survey</p>	<p>Every session</p>	<p>MOH</p>	<p>Participation, Building and expanding CoP</p> <p>Political will and leadership engagement</p>	<p>Quantitative data that can be accomplished using descriptive statistics using Excel or other statistical software if possible</p>
<p>3. (i) How is knowledge being translated into practice?</p> <p>(ii) How are providers following knowledge and</p>	<p>Focus Group Discussions</p>	<p>Semi-annual or Annual</p>	<p>Evaluation specialist, someone with good facilitation and qualitative analysis skills.</p>	<p>Capacity Building, Participation, ECHO Session content. CoP, Logistic/administrative, communication/resources IT related</p>	<p>Qualitative data could be coded and analyzed using CAQDAS (computer-aided data analysis software) such as MAXQDA or Atlas.ti or others</p>

<p>recommendation to improve patient outcomes? And if not, why not?</p> <p>(iii) What are the facilitators to promoting and expanding CoP? And if not, what are the barriers?</p> <p>(iv) To what degree has ECHO sessions influenced behavior of the participants?</p>			<p>Someone who is third-party and not part of the implementer or MOH employed.</p>		
<p>4. (i) Was the content of previous ECHO didactic presentations, accurate, clear, and valid?</p> <p>(ii) Was the content of</p>	<p>Objective review of ECHO sessions</p>	<p>6-9 months after launch and then repeat 12-18 months after the launch of the pilot ECHO period.</p>	<p>Third party consultant who would provide unbiased objective peer-review and recommend</p>	<p>Clarity of content, interactive facilitation, time and content facilitation and management skills. Acceptable and feasible recommendations.</p>	<p>Quantitative data analyzed in excel or other software.</p>

<p>previous ECHO case-based presentations, accurate, clear, and valid?</p> <p>(iii) Were case-based recommendations made by the expert panel applicable to the case presented, appropriate, useful, and, relevant?</p>			<p>improvements</p> <p>.</p> <p>Someone who can conduct this activity 6-9 after launch of ECHO and then repeat reviewing a session at the end of pilot period (12-18 months later) before expansion to ensure lessons learned from 6 months are revised and improved to produce high-quality ECHO sessions.</p>		
<p>5. How prepared and ready is a</p>	<p>Readiness assessment</p>	<p>Before expansion or scale-up for</p>	<p>If revised to a checklist, can be conducted</p>		<p>Checklist can be analyzed to generate descriptive statistics</p>

<p>new spoke or a hub?</p>	<p><i>(Needs to be revised to a checklist instead of a semi-structured interview)</i></p>	<p>adding new spokes (sites) or hubs, regions/zones / states</p>	<p>by an ECHO hub coordinator or implementer before expansion or scale-up</p> <p>Will not need qualitative data collection or analysis skills</p>		<p>using Quantitative data analysis software such as Excel.</p>
<p>6. How well is the fourth pillar (monitor and evaluate outcomes using iECHO) of ECHO being used stakeholders? Are findings being utilized by ECHO implementers or decision makers to make improvements?</p>	<p>iECHO analysis</p>	<p>Every ECHO session</p>	<p>Definitely needs to be revisited and alternative solutions explored.</p> <p>None of the KII had access to these tools, nor had they used results to make any improvements</p>	<p>Participation, Session interruptions due to IT related issues</p>	<p>Quantitative data analysis to generate descriptive statistics using Quantitative data analysis software such as Excel.</p>

<p>7. How acceptable in the evaluation framework and data collection tools? How feasible and useful are the results of the evaluation?</p>	<p>Key Informant Interview</p>	<p>Annual at the end of the evaluation period. Definitely before scale-up or expansion</p>	<p>Difficult to implement as extensive qualitative skills recommended to collect and analyze this data.</p> <p>Time and resources to prepare and present.</p> <p>Recommend one large group presentation at the end of the evaluation period with breakout groups to discuss acceptability and feasibility of the</p>	<p>Capacity Building, Participation, ECHO Session, CoP, Logistic/Administrative/Resource s/ communication, IT M&E, Public Health impact, Scale up and expansion</p> <p>Incentives/motivators</p>	<p>Qualitative data could be coded and analyzed using CAQDAS (computer-aided data analysis software) such as MAXQDA or Atlas.ti or others</p>
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			framework and tools.		
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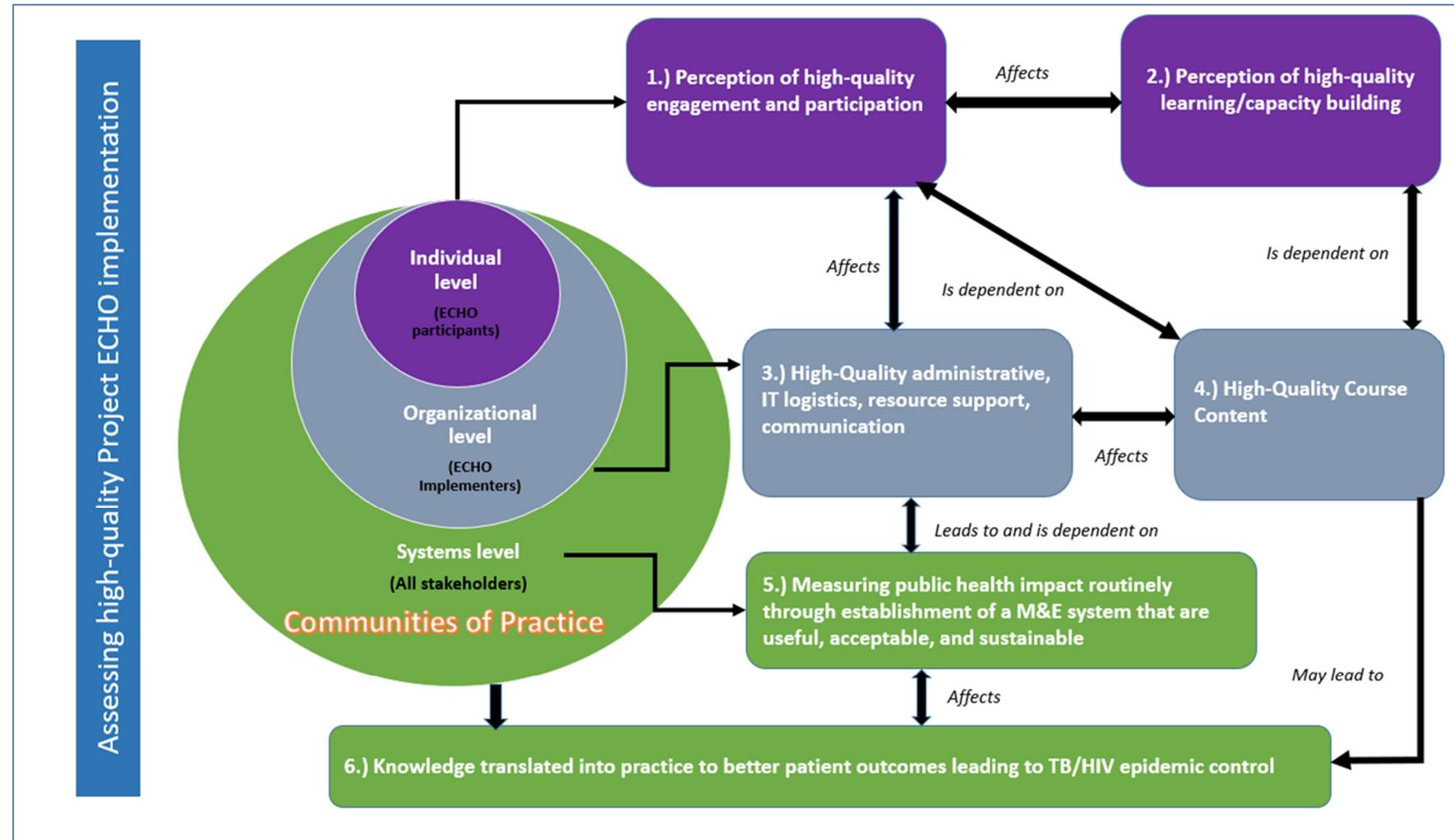
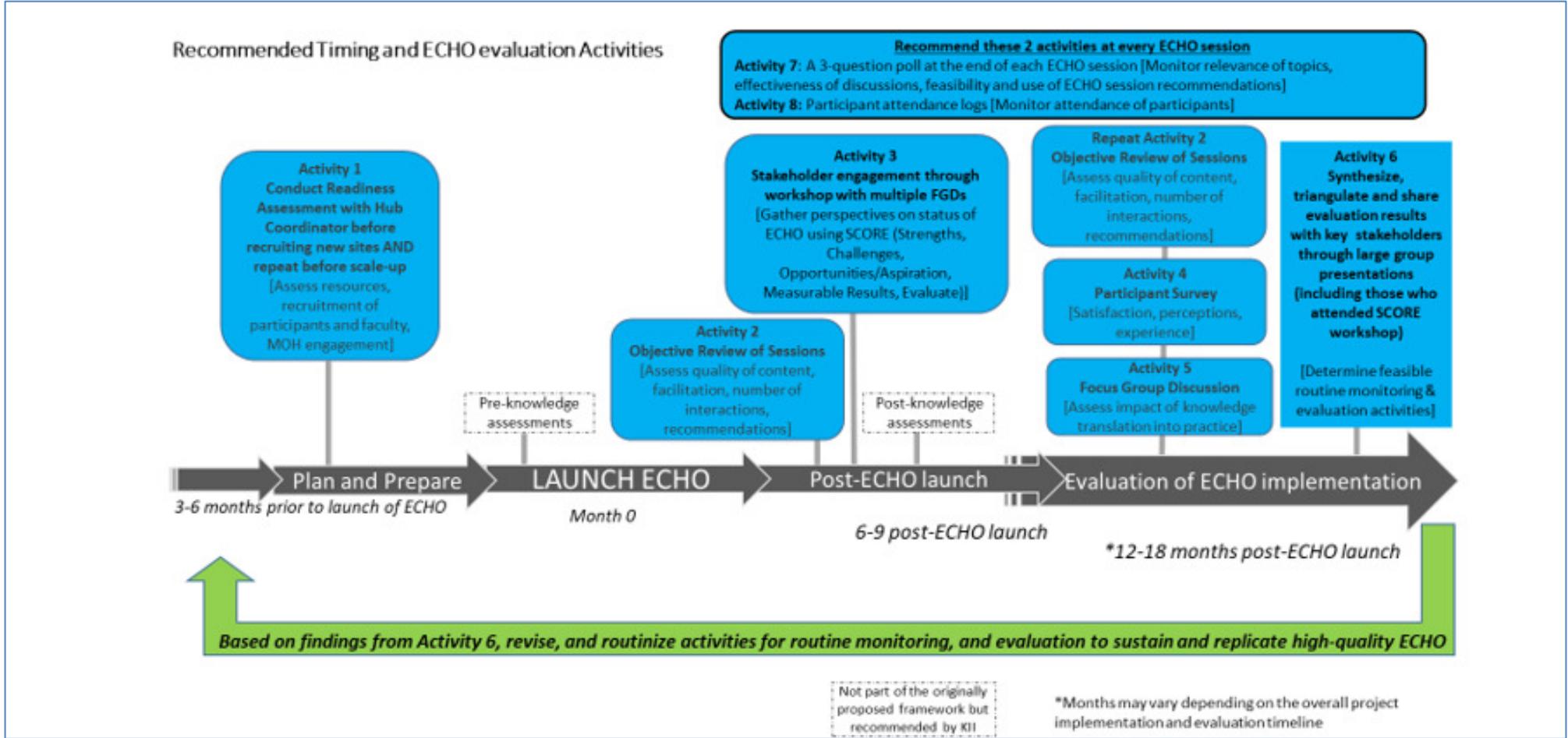


Figure 1. Conceptual Framework for assessing high-quality ECHO Implementation at individual, organizational, and at the Systems Level

Figure 2. Recommendations for an evaluation framework and with data collection tools



CHAPTER 5: DISCUSSION AND CONCLUSIONS

“When we seek to discover the best in others, we somehow bring out the best in ourselves.”

-William Arthur Ward

When I set out to identify and assess factors that would define high-quality ECHO implementation, I wanted to understand the perspectives of the various stakeholders, using a developmental evaluation and participatory action research methodology leveraging the systems thinking (stakeholders, interrelationships, and boundaries). Using the *a priori* constructs obtained from this approach, I then developed a comprehensive evaluation framework with a toolkit that needed to be validated. It was important to then prove the practical usability and feasibility of application of this proposed evaluation framework through key informant interviews and document reviews. This chapter summarizes, integrates and interprets the findings from my research. In addition, I outline potential limitations of my analytical approach, and elaborate on the leadership implications and public health practice. Three discrete peer-reviewed manuscripts are under preparation as shared in the previous chapter to further present and disseminate the findings and tools to a global audience.

A. integration, and interpretation of findings related to Systems Thinking, Process evaluation, Development Evaluation, and Participatory Action Research in the context of Complex Adaptive Systems

Both India and Tanzania began implementing their TB and HIV ECHO programs without establishing a formal evaluation plan, nor collecting baseline performance data to assess and maintain quality. Moreover, programmatic expansion and scale-up was planned without a well-defined mechanism for assessing outcomes or measures of success, or impact. A complex adaptive system (CAS) such as the

Indian and the Tanzanian ECHO programs is set in dynamic environments, interacting with a wide variety of stakeholders, interests, and factors, often with disparate demands (Rouse, 2008; Tolf, 2015). Process evaluation is more relevant to solving complex adaptive challenges (Heifetz, Grashow, and Linsky, 2009), such as developing a monitoring and evaluation (M&E) framework for an already established program such as Project ECHO. Using the systems thinking lens, it was important to acknowledge the factors that ensure successful outcomes that vary by context, culture, stakeholders, as well as relationships, among the program components (Steckler and Linnan, 2002, Williams and Hummelbrunner, 2010). Sustaining such agile systems defined as “the ability of an organization to thrive in a continuously changing, unpredictable environment” (Dove, 1999, p19) can be challenging. The relationship between a CAS being agile may be explained as having short and ongoing, iterative feedback cycles with a strategy that promotes multiple learning loops. This strategy for developmental evaluation can support participants, funders and policy makers who want assurances that the intervention is delivered, scaled-out or scaled-up with high-quality (Durlak, 2013). In fact, given a complex environment with contextual differences that’s constantly changing, this may be the only way to get such assurances. A regular evaluation design without this iterative participatory action research would not be able to accomplish this without the implicit understanding of this characteristic of CAS.

As demonstrated by the results of my research, the ECHO model itself, an example of a complex adaptive agile system, instead of focusing on traditional outcome evaluation, benefits from examining interactions between process (process evaluation) and interim outcomes in a complex environment where the unexpected can emerge out of interacting parts. Rather than dismissing the unexpected, it becomes a source of needed innovation. Incorporating divergent perspectives make outcomes more complex and unpredictable, but lessons learned were valuable to capture. For instance, the reactions of the Indian participants during the SCORE workshop enabled sharing divergent perspectives of health care workers such as the paramedical personnel, and the physicians who were mostly the SMEs or implementers. This

would not have been possible without the space provided through the appreciative inquiry-based SCORE approach. The fact that the timing of the Indian MDRTB ECHO sessions for health care workers from 2-3 pm Indian Standard Time (IST) was not suitable as the lab technicians and health volunteers (health care workers) would have to stop providing services to attend the MDRTB ECHO sessions was addressed immediately. Whenever topics relevant to health care workers were conducted, the ECHO sessions were from noon-1 IST (lunch time) so that MDRTB patients' services provided by the laboratorian technicians or health volunteers would not be hampered. Similarly, in Tanzania the discussions of incentives and motivators was predominant, and implementers/SME are pursuing options for going forward. Importance of perspectives and mental models of the stakeholders made a difference and would be missed otherwise. However, evaluation results of the SCORE workshop did not demonstrate this quantitatively. There were no statistically significant differences between the median scores for acceptability or feasibility between overall among the stakeholders in India and Tanzania (Paper 1, Table). Despite this, some similarities and differences occurred within the countries themselves for the various stakeholders that are highlighted in the AI and SCORE workshop section below.

ECHO, as a CAS, that has been defined as a nonlinear and dynamic system composed of independent agents such as the National Institute of Respiratory Disease (NITRD), University of Maryland (UMD), the various Ministries of Health (MOH), all of whom operate based on their own organizational, psychological or social norms (Rouse, 2000). Because agents' needs or desires, reflect in their norms or rules, are not homogenous, their goals and behaviors are likely to have different priorities, hence lead to conflicts. Since agents mentioned as above are intelligent, they adapt and change behaviors accordingly leading to agile, ever changing adaptations that have no single point of control (Rouse, 2000).

As a result, behaviors of CAS can usually be influenced rather than controlled. This is in line with developmental evaluation (DE) approach that assist organizations or stakeholders who are developing social change initiatives in complex or agile environments (Patton, 2011; Dove, 1999). DE has also been

characterized as a form of Participatory Action Research (PAR), (Lewin, 2003a, Ivankova, 2003) that is useful when working in Complex Adaptive Systems (CAS) settings that are on early stages of social innovation (Gamble, 2008). As described by Lewin, my research reflected the first cycle of an action research process (Lewin, 1948a).

Most models of action research do include some form of stakeholder participation, but what particular form this takes varies; I chose to use an appreciative inquiry approach which is an alternative, strategic planning asset-based approach that leverages collective goals and shares perspectives of participants to motivate change and incremental improvements and value generation (Stavros & Cole, 2013). Instead of focusing on a typical hierarchical organization, and a “top down” approach; this approach entailed broad stakeholder engagement that is self-managed, promoted ownership and sustainability. A specific tool (SOAR more on this later) from AI was modified to fit this agile DE approach through the action research, that was most appropriate for this dissertation. The feedback indicated that this approach could be routinized on an ongoing basis with emphasis on sustainable transformative co-created change to achieve aspirational goals and measurable results (Stavros & Cole, 2013). Thus, utilizing an appreciative inquiry (Stavros, 2009) through active inquiry, stakeholders were empowered through collaborative reflection, discussion, and action to influence change.

Incorporating a systematic action research process, implementing the DE methodology through a cyclical process consisting of planning, action, and fact finding with the stakeholders using an appreciative inquiry approach supported the inquiry to be holistic, grounded in practice, and sensitive to the context, thus promising to be more influential and sustainable than a routine evaluation. Results from the action research process lead to social change through routine practice (Carr & Kemmis, 1982) as shown by my research. Mini-interim evaluation results led to change immediately. The fact that Hindi (local national) language needed to be used for communication during ECHO sessions got captured,

which wouldn't otherwise have been documented. The ECHO sessions for paramedical staff has continued to be in Hindi, making rapid change as a result of the SCORE workshop.

One key-informant commented on the nature of evaluation evidence that is needed and/or useful:

[before ECHO] *“Clinical mentors were being sent to these far-flung sites once in a blue moon to really just ask anyone if they were having problems and how can we help. Wasting money on vehicles and gas. I just think this is way more efficient and the providers like it and we have the data to show that they like it through our program evaluations. So, at this juncture, even if we don't have a better solution (such as expensive patient outcome or intervention trials) for proving that there is public health impact of ECHO, it's definitely at least a better option to keep building capacity and promoting mentorships.”*

Another example of evidence to substantiate the value of process, qualitative evaluation of ECHO in understanding near- and medium-term program outcomes of ECHO from another key informant:

“The HIV program in country X presented a case as part of their case presentation of a woman with HIV who was lost to follow-up. One of the persons in the audience was a health navigator who goes and looks for this patient and brings her back to care. See how wonderful ECHO has been! So, some ways to collect these anecdotal short stories or vignettes should be considered part of qualitative evaluation?”

My dissertation was carefully designed to understand the intrinsic, cultural, and power complexities by including the stakeholders who are part of the DE process, thus creating buy-in and self-organizing design instead of external evaluators' developing an evaluation plan from the outside. An action research design required structured participation of stakeholders through the SCORE workshop,

key informants, as well as, carefully selected documents that were part of formal data collection and triangulation processes (PLAN in the action research cycle). Focusing on understanding their perspectives of SCORE: Strengths, Challenges, Opportunities/aspirations, measurable Results, and then Evaluating the process mirrored the ACT and DO part of a typical action research cycle. This framework went over and beyond the routine ECHO evaluations that have been conducted thus far, mostly using surveys, or key-informant interviews, and/or FGD (Fischer *et al.*, 2019). This process generated useable knowledge, such as, an evaluation framework with data collection tools, and a publicly accessible protocol for others to adapt to their own local context (Paper 2). The validation of the evaluation framework and data collection tools through KII and document review will lead to enhancements of the evaluation framework, and the data collection tools, and potential timings for the each evaluation activity (e.g., OBSERVE/STUDY in the action research cycle) (Figure 7). Not only will the utilization of findings (e.g., language barriers that were identified, or lack of political will) will fill the gap identified by current literature on quality of ECHO implementation, this PAR and DE methodology already addressed some of the practical problems such as using local language for ECHO sessions, and will thus lead to improving ECHO implementation overall, through this interim-evaluation approach. Unlike a traditional research approach that supports ‘translation’ of research into program improvement, actively involving stakeholders leads to more immediate program improvement where quality improvement becomes an intrinsic part of the evaluation research process, rather than a separate set that has to be taken after the evaluation results are produced.

Reflection (REFLECT in the action research cycle) on the triangulated results and feedback help PLAN the next iterative cycle that will entail implementation of the data collection tools themselves in Tanzania, which is beyond the scope of my dissertation (Figure 9). The second cycle will start with the implementation of the modified protocol (ACT in the action research cycle) from the lessons learned from the validation. Observing the results and reflecting on the data collected will conclude Cycle 2.

Developing recommendations to routinize this evaluation framework with the feasible and acceptable tools will continue this action research cycle, beyond the scope of my dissertation.

The main objective of the evaluation framework that captures the process to the outcome evaluation would be to capture “Why?” at each step. This would be key to understanding why certain parts of the CAS such as Project ECHO works and is considered successful, while there are certain parts that have impediments to success. Understanding what is not working and answering why would be the main component of this evaluation framework, to make continuous incremental improvements along the process. This would be essential to adapt the framework to different country or program settings and also be able to develop guiding principles to assess quality implementation.

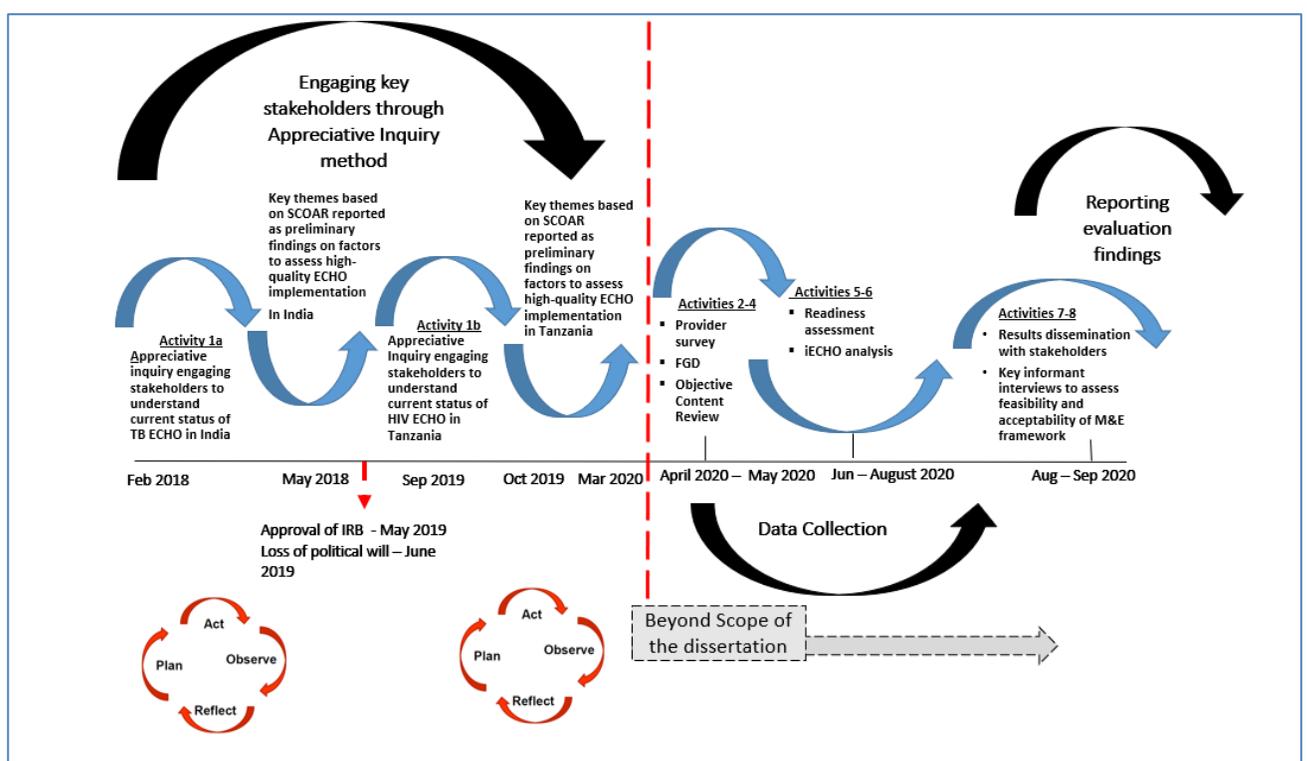


Figure 7. Action Research Cycles to assess quality of ECHO implementation

The proposed evaluation framework intends to engage stakeholders through SCORE, measure the readiness to implement the program, assess the quality of session content, measure public health impact, and explore contextual factors that influence success to building and sustaining communities of practice (more on this later), including garnering political will, engaging leaders, and effective resource allocation and use of technologies. To best of my knowledge, no previous ECHO evaluation included any of these components (Fischer et al., 2019). Thus, the proposed framework is a more exhaustive comprehensive toolkit focusing on more than a process evaluation that ECHO programs may adapt to their local context needs and expectations. This approach goes beyond process evaluation since it includes analysis of the relationship between the processes and expected outcomes from the perspective of the stakeholders within their interrelationship boundaries. For example, the proposed approach is able to dissect and understand effect of each of each of the components of complex constructs such as political will and leadership engagement. The need to capture the interim building blocks for each of these constructs is imperative in order to more effectively maximize the value of implementing ECHO and the learning from it. Usually each of the components of political will is dismissed as it is usually assumed to be an existing pre-requisite for input or a contextual factor in traditional evaluations. Once an understanding of political will, and leadership engagement at all levels become clarified, one can concretely and effectively plan for scale-up and/or expansion.

This was evident in both India and Tanzania. I am hopeful that offering open access to this flexible protocol (Paper 2 in Chapter 4) will encourage programs to consider assessing some or all the elements of their ECHO implementation quality as part of their evaluation. Developing and accessing public health impact is not a focus for the proposed framework. However, self-efficacy and professional satisfaction are included as proposed elements that could be assessed through the survey. Document review (content analysis) revealed pre-post knowledge assessments in various other ECHO evaluation strategies. These were not included initially in the proposed toolkit but was proposed as recommended evaluation activities

if a country is focusing on knowledge gain indicators (Figure 10). Proposed framework however explores gathering information on how the knowledge may be translated into practice through the focus group discussions. However, does not included economic assessments or pre-post knowledge checks. Knowledge assessments using Pre-post test: While at least 5 of the 9 KII and majority of the studies reviewed by Rand (Fischer et al, 2019) mentioned about adding a pre-post test to assess knowledge gain, one of the KI said that having a pre-post test would be a deterrent.

“My ECHO session is for physicians who have ego and will not like to be tested while her ECHO clinic (referring to a HIV ECHO clinic) in the same country, are full of health care providers, usually paramedical staff who are a talking lot, very communicative.”

The recommended simplified evaluation framework as a result of the validation is shown below (Figure 8). Simplified means sustainable and feasible with existing or minimal additional resources. While 100% of the KIs felt that the SCORE workshop was an innovative and a great idea, 4 out of the 9 KIs felt that just like FGD, SCORE could be challenging to conduct due to the requirement of a skilled qualitative evaluator. The skills and competencies would need the evaluator to be an experienced facilitator who would also analyze, reflect, share and use results to influence improvements. Six out of the 9 KI (75%) recommended that, *“If you have to do it, do it once a year”, especially 9-12 months after launch of Project ECHO program.*

Since more than half of the KI felt increasing interactions and routine pulse-checking (Wasserman 2010), especially assessing the impact of the ECHO sessions themselves was important in order to sustain engaging and promoting a vibrant CoP. One of the KIs suggested the following approach that they undertake at their non-PEPFAR HIV Project ECHO.

“So throughout the ECHO session, 3-question polls are conducted: (i) How relevant was the topic of this session to you and your clinic on a scale from 1-5 (1:Not relevant to 5:Very relevant) (ii) How do

you rate the effectiveness of today's session? (1:Not effective to 5:Very effective). And lastly, (iii) How likely will you implement the lessons learned of this session in your clinic? (1:Not likely to 5:Very likely). At the end of each of the poll questions, poll results show the results to all participants.”

An additional focus for Project ECHO in addition to the clinical ECHOs would be to include a “Data Quality Assessment/Improvement” focused ECHO where the “case” instead of being a HIV patient would be a data quality issue such as “*Data completeness in electronic medical records*”, didactic presentation would include “*Data completeness or timeliness tips and expert recommendations and best practices*” and facilitated discussion would include sharing experiences on what may be working of challenges in data completeness. This would help a vibrant CoP to resolving and better data quality that would directly impact program.

To sustain a high-quality ECHO implementation, a scale-up/expansion plan should be made a requirement. A proposed revised evaluation framework has been attached along with suggested data collection tools (Paper 2, Figure 2, Page 143 was the original, Revised simplified version is visualized below, Chapter 5, Figure 8, Page 167). All this will be based on vision of the ECHO program and the evaluation questions that are wished to be answered by stakeholders engaged in a DE process.

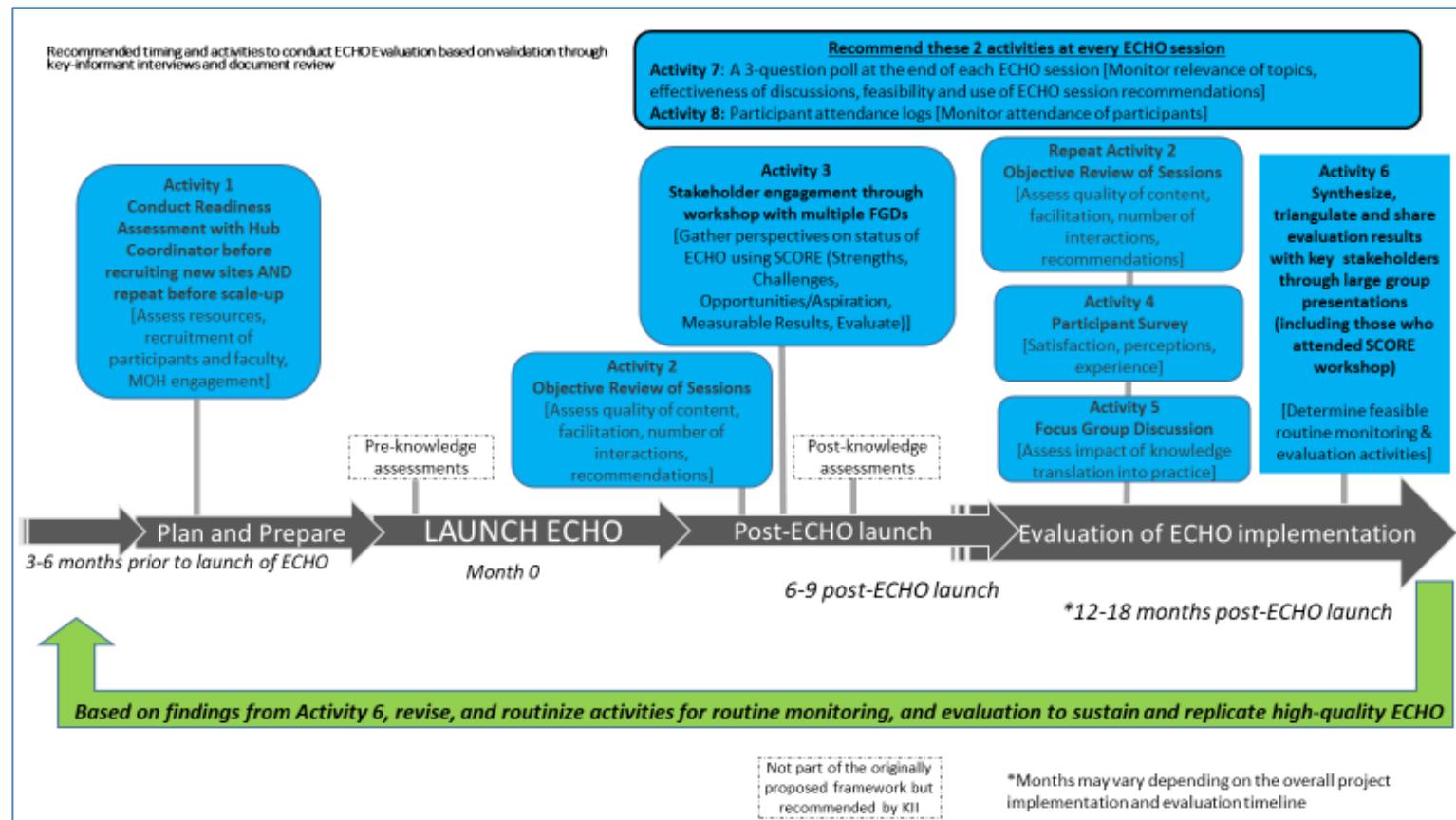


Figure 8. Recommended evaluation activities based on KII and document review to sustain high-quality ECHO implementation

B. Appreciative inquiry – SCORE approach as a “pulse-check” or “interim” evaluation technique leading to immediate change

Appreciative inquiry (AI) is an asset-based strategic planning approach that leverages collective goals and shares perspectives of participants to motivate change and incremental improvements (Stavros & Cole, 2013). Instead of focusing on hierarchical organization, and a “top down” approach; broad stakeholder engagement that is self-managed promoting ownership is key for SOAR (Strengths, Opportunities, Aspirations, and Results) that emphasizes sustainable transformative co-created change to achieve aspirational goals and measurable results (Stavros & Cole, 2013). A modified SOAR approach (Strengths, Opportunities, Aspirations and measurable Results) was transformed into a new application, SCORE (Strengths, Challenges, Opportunities/Aspirations, measurable Results and Evaluation of the process itself). In order to focus on the positives, understanding the current challenges that can lead to opportunities for change, and evaluate the process itself, we modified the SOAR methodology to include challenges (“C”). Stakeholders found diminishing value for distinguishing between opportunities and aspirations, hence merging them was in the interest of time and simplicity. It was important to be able to evaluate the SCOR process in itself, hence evaluation indicators (“E”) assessing acceptability and feasibility of the process as it is implemented elsewhere was needed. A revised conceptual framework explains this (Figure 10). These modifications created a modified appreciative inquire approach (SCORE). Thus, acknowledging potential challenges and included a formal process for developing relevant evaluation processes to assess progress and monitor desired outcomes through evaluation of the approach.

SCORE was applied in two disparate, low-resourced, PEPFAR-supported, purposefully selected countries, India and Tanzania. Both the countries are approaching TB and HIV epidemic control and struggling to sustain it due to lack of strong health care workforce capacity (Narain, 2015). Both are infectious diseases that require a multi-disciplinary team to manage, prevent, and control. Both countries

implementing ECHO without baseline data, hence developmental evaluation framing. Neither did the countries have a coherent vision for defining or achieve outcomes for high-quality implementation. Using appreciative inquiry through the systems thinking lens was appropriate and timely. Gathering multitude of perspectives by the stakeholders was imperative to co-create the evaluation framework and generate a feeling of buy-in (Williams, & Hummelbrunner, 2010). Appreciative inquiry began as an environmental scanning process (Rowel *et al*, 2005) that transitioned into a primary data collection method. This revealed the various system dynamics and interrelationships. Structural characteristics of the stakeholders and their interactions during ECHO sessions explained some of the characteristics of the communities of practice. As Peter Senge said, “...*the art of systems thinking lies in seeing through complexity to the underlying structures generating change.*”

Having interim pulse-points helped determine relationship between the stakeholder and the data collection source and activity for each component of ECHO (Wasserman, 2010). After each reporting cycle in the evaluation framework, it will be important to monitor the outcomes to ultimate adjust the interim pulse-points that reflect ultimate outcomes (Figure 9)

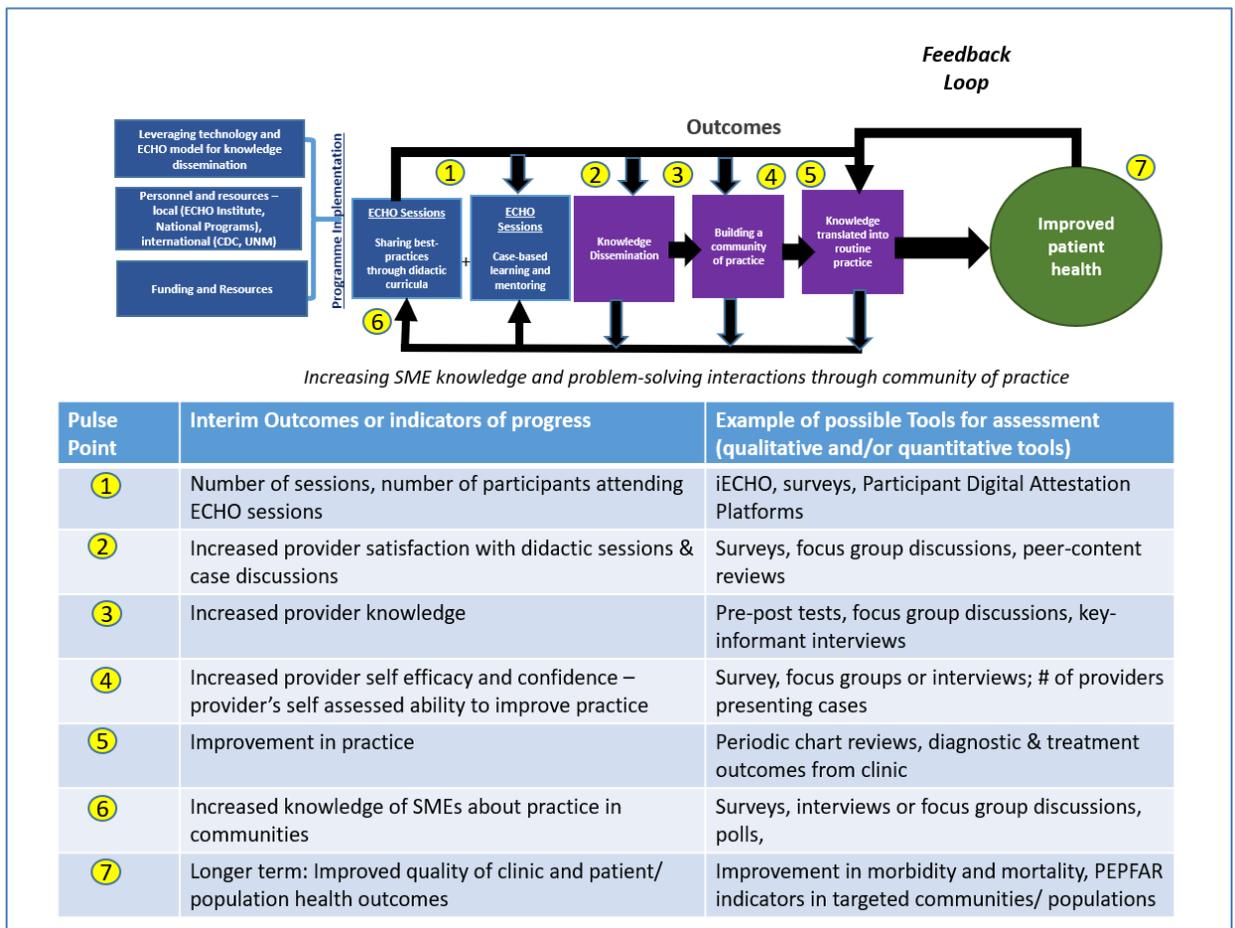


Figure 9. Example of pulse-point checks or interim indicators of progress for Project ECHO

This innovation was first applied in India, then later in Tanzania. The robustness of the process for engaging stakeholders from any disease or health condition (e.g., TB in India and HIV in Tanzania), suggests potential acceptability feasibility, as reproducible and accepted by key stakeholders and implementers (See Manuscript 1 in Chapter 4) in two different continents. SCORE has promise to be a best-practice approach, especially for those ECHO programs that do not have baseline data or measurable outcomes from inception. As an interim evaluation for mid-course corrections for ECHO programs several key elements of successful ECHO implementation were identified through the AI SCORE approach by stakeholders themselves; including some that stimulated opportunities for immediate change as well as aspirations for long-term outcomes.

Increasing demands for ECHO-related activities expansion in both India and Tanzania were evident during the SCORE process. However, neither country developed any systematic expansion plan. Notably, Tanzania began drafting a plan at the conclusion of SCORE sessions. Long-term plans by MOH are needed and should include broader strategic planning that includes evaluation strategies. Both Swahili and Hindi, the local languages in Tanzania and India, respectively, should be considered as a primary language for ECHO sessions, especially sessions designed for local healthcare providers, community health workers, and laboratory specialists. Taking into considerations for change through the interim-pulse points or interim evaluation results would help adjust the revised conceptual framework.t

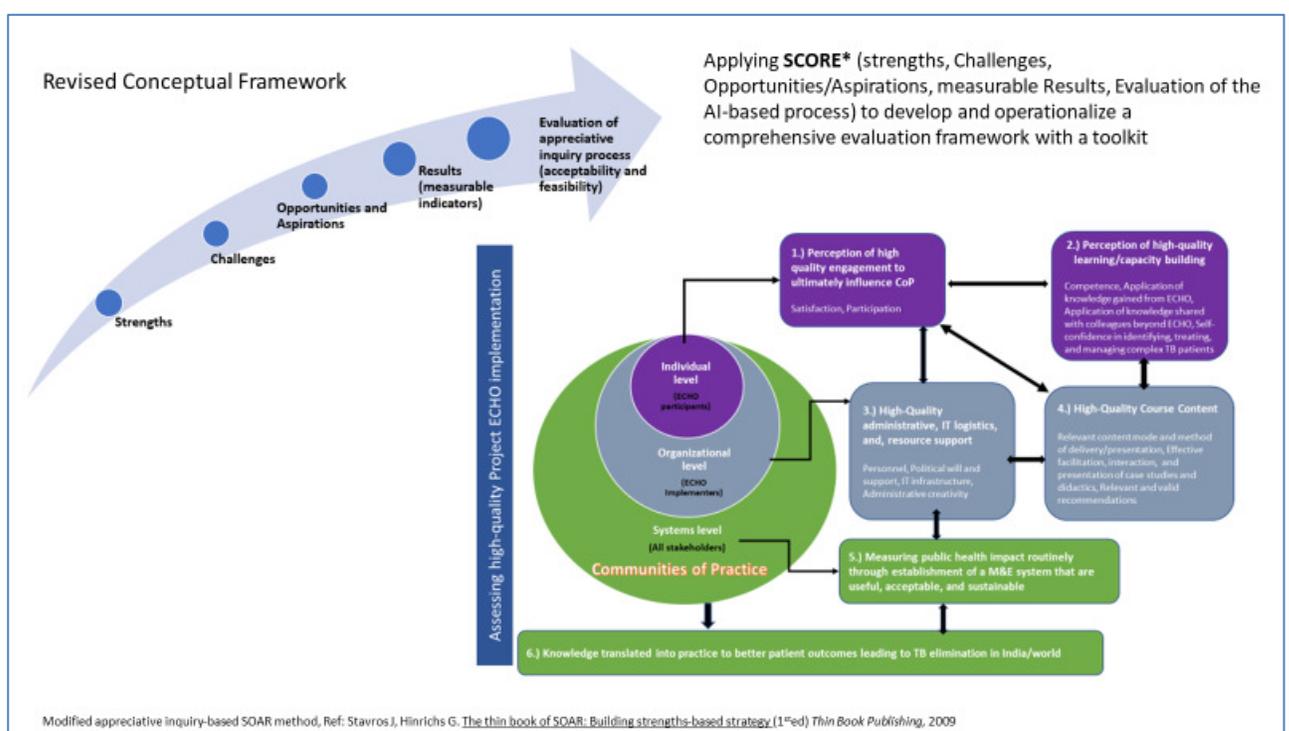


Figure 10. Revised Conceptual Framework

C. Qualitative and Quantitative results synthesis

Not only were proud sentiments shared about the current status of ECHO in stakeholders' respective countries, India and Tanzania, but by promoting safe spaces, gather perspectives on what was working, and unveiling opportunities for change and improvement were evident. Even though stakeholders from both countries boasted about how ECHO was "*spreading knowledge from classes to masses*" and was playing a role in building capacity of TB and HIV providers in India and Tanzania, they were able to highlight areas of improvement. Specifically, addressing internet connection issues, facilitators encouraging interaction during sessions, engaging political leaders during ECHO sessions such as MOH officials, as well as having a scale-up plan, were critical elements identified for sustaining high-quality ECHO implementation. Technological infrastructure (i.e., broadband connectivity) needs both immediate and long-term attention and remediation. It will be important to consider improved broadband and telecommunication improvements in the countries' scale-up and expansion plans.

Emergent code indicating incentives such as CPD credit procedures for professional licensing and incentive options should be considered to formalize and encourage participation at hubs and spokes. Increasing demands and expansion of ECHO-related activities was evident. An integrated expansion and transition plan developed should include transition plan for the MOH implementation, coordination, and management. Scale-up plan would have to be adequately supported, both financially and with dedicated human resources from MOH with eventual transition to the country officials implementing ECHO instead of support from PEPFAR-implementing partners, in Tanzania. National governmental support and political leadership engagement will be key to implement and sustain these efforts to integrate with national public health vision and long-term public health goals. Dedicated staff to conduct routine monitoring and evaluation activities should be part of the national plan to routinely assess impact of Project ECHO and modify course corrections accordingly.

Moreover, the impact on quality of on-going ECHO activities including implementer fatigue, routine monitoring of attendance, session quality, and session participation will be important considerations. Use of reminder trackers and WhatsApp are mechanisms that Tanzanian implementing partner uses. In contrast, India uses iECHO, both of which do not seem to be utilized to make improvements routinely. A Participatory Digital Attestation Platform (PDAP) technology which is now being pilot tested across various ECHO platforms (*e.g.*, in Tanzania) to enable large scale capacity building initiatives (Socion, 2020). PDAP could be utilized to increase participation, and for motivations and incentives, professional certifications instead of monetary remunerations could be a start. Sustaining interest and incentives, in contrast, maintaining timely and topical case studies with corresponding didactic sessions warrants careful review and consideration (more on this later in Chapter 6 recommendations).

Quantitative results of the evaluation forms were analyzed to understand acceptability and feasibility of the SCORE approach. Out of the 64 stakeholders who attended a SCORE workshop, 45 or 70% responded to the survey. Even though 100% of the decision makers responded to the survey from India while only 2 decision makers responded from Tanzania. A similar proportion of Subject Matter Experts and Implementers (SME and Implementers) responded from both countries. Whereas, fewer Health care providers (HCP) from India responded than Tanzania (Paper 1, Figure 1). This may have impacted the breakout group scores for the “E” or evaluation of the SCORE workshop. From the evaluation results analyzed, SCORE workshop was acceptable overall as seen by each of the components of acceptability ranging from 91% for the component where participants felt that SCORE helped them gain skills and knowledge that was applicable for evaluation efforts in general to 100% for the component where the participants felt that participating in SCORE helped them apply knowledge and skills that were applicable for their routine TB and HIV work (Paper 1, Figure 4). .Using a composite score to assess the reliability of the evaluation form was helpful in normalizing the data overall. The composite scores helped address whether the items to assess acceptability and feasibility were reliable in case this instrument is

used to evaluate SCORE workshops in other settings (Construct validity). Overall reliability measured with Cronbach alpha indicated items measuring acceptability (85%) to be higher than feasibility (69%) (Paper 1, Table 3). It is worth noting that components of acceptability has a higher Cronbach Alpha of 89% that is considered 'good' indicating that these components can measure acceptability consistently and can be used in the future SCORE workshops. However, feasibility components may have to be contextualized since it did not have consistency in India and Tanzania indicated by a Cronbach Alpha of 69% (>70% is acceptable). (Paper 1, Table 3).

When overall median scores were compared, we observed no statistically significant differences between India and Tanzania, overall (Paper 1, Table 4) for majority of the components measuring acceptability and feasibility. The acceptability component indicating SCORE workshop supported obtaining skills & knowledge for TB & HIV was statistically significant (Paper 1, Table 5). However, it is worth noting that the component indicative of SCORE workshop helping gain skills & knowledge applicable for evaluation efforts in general approached statistical differences (Paper 1, Table 5). For feasibility, there was statistically significant difference between large group report out discussions. It is worth noting that while the SCORE workshop in India spanned for 16 hours over 2 days whereas the SCORE workshop in Tanzania spanned across 10 hours over 2 half days, thus allocating less time for large group report outs, thus explaining a potential reason for this difference.

When stratified by roles within India, there is statistically significant differences noted for median scores for Health care providers (HCP) as compared to Decision Makers (DM) and subject matter experts (SME) for the following 3 components related to components of acceptability (SCORE workshop allowed discussions on measures of success, provided opportunity to share personal experiences, provided a forum to obtain skills that could be applied to their TB and HIV work). This could be explained by the fact that different stakeholder groups within a country will have different knowledge and expertise and SCORE would have addressed them differently. For feasibility, the only component that was statistically different was pre-workshop coordination for India (Paper 1, Table 6a). This could be explained by the hierarchical

organizational structure of the Indian ECHO program where communication and information sharing is fraught with differences, thus explaining this difference.

When stratified by roles within Tanzania, the only component for statistically significant differences in acceptability component indicated by SCORE workshop supported obtaining skills & knowledge for TB & HIV work. None of the feasibility components had any statistically significant relationships among stakeholder breakout groups within Tanzania (Paper 1, Table 6b). Essentially, there may be within country contextual stakeholder level differences in perspectives of how SCORE may be conducted logistically or how knowledge obtained during SCORE workshops could be used for routine work, but the small sample size may limit detecting such small differences statistically. Being able to contextualize the evaluation tools for SCORE workshop may be needed especially to access acceptability.

D. Triangulation

A noteworthy strength of this dissertation is the triangulation process. Triangulation was used to validate the AI-SCORE constructs for defining high-quality ECHO implementation by exploring the experiences of KI and document reviews as part of the content analysis. From the evidence gathered from the study, minimum elements for measuring high-quality ECHO should include: 1.) capacity building; 2.) participation; 3.) administrative, infrastructure, resources, and communication; 4.) internet connectivity and IT assessments; 5.) scale-up and replication for sustainability; 6.) and emergent codes suggest assessing the use of Zoom beyond ECHO as a potential ‘ripple effect’, as well as, the use of motivators and incentives, such as, CPD/CNE/CME etc. (See more in Chapter 6 on potential for PDA).

Even though benefits of CoP can be direct (Wenger, 2002) as indicated by the KII, they were not evident in the documents reviewed, hence in red font on the right side below the “document review” box

(Figure 13). As explained previously in the CoP session, resolving a problem by learning from what someone else has done, be it a SME or a fellow participant was emphasized by KII as very valuable but did not get measured systematically in any of the evaluation reports or document reviews. Only 1 KI had experience with session content reviews while others were very enthusiastic about it and none of the evaluation reports had assessed ECHO sessions, thus indicated with the red font. None of the KII, nor the documents had any assessments on M&E or setting up documentation for routinely monitoring the ECHO implementation, hence in red font on both sides of the data source boxes. Similarly, in red font shown that KIs had no plans to systematically measure public health impact for their respective ECHO programs. Some KI did mention qualitative anecdotal approaches to capturing formally or informally the benefits of ECHO as a qualitative evaluation data point. Careful consideration of which elements to evaluate will be key to influence the evaluation framework design. While measuring interaction was key, only couple of the KI's were proactively interacting or designing initiatives to promote interaction among participants, and not just the SME and participants. Engagement of leadership and political will (red font on both sides), even though a basic pre-requisite and an important element to assess high-quality ECHO was one of the key determining factors for either a successful launch or failure of an ECHO program implementation.

Triangulation

Elements for High-Quality ECHO implementation

- 1.) Capacity Building and workforce development
- 2.) Participation and engagement
- 3.) Building and expanding Communities of Practice
- 4.) Infrastructure, logistics, resources, administrative, communication
- 5.) Information Technology, Internet connectivity

- 6.) ECHO session related
- 7.) Monitoring and Evaluation, policies, documentation
- 8.) Public health impact
- 9.) Political will and leadership engagement
- 10.) Scale-up and replication for sustainability
- 11.) Emergent codes: zoom related, CPD/CNE/CME credits



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Figure 11. Alignment between elements of High-Quality ECHO from triangulation of results from 3 data sources (AI-SCORE, KII, Document Review)

E. Limitations

For the FGD for the appreciative inquiry-based SCORE workshops, the selection of the participants was based on a convenient sample. Coordinators of the ECHO projects in India and Tanzania selected those who were invited and those who accepted the invitations. Since there were no incentives or motivators offered other than lunch and snacks, participants who offered their opinions and interacted during the facilitation process were implicitly more engaged and vocal participants may have been more enthusiastic about vocalizing their opinions. Nevertheless, the appreciative philosophy accepts flexibility to adapt, contextualize, and be organic in the nature (Yudarwati, 2019).

Homogeneity of the groups helped achieve the objectives to freely and openly, share new ideas, dreams and perspectives that will lead change during a social innovation. Since the SCORE workshop was an add-on at the last minute to accommodate at the end of a 3-day ECHO immersion workshop, unlike the workshop in India, which was an exclusive event, only Thursday afternoon post-lunch to a Friday half day session until lunch was the available time. So, the workshop in Tanzania was a total of 10 hours instead of 16, which is the time allocated in India. Due to the lack of similar availability of time to conduct the AI workshop in Tanzania, the large group reflection session to gather reflection from each of the workgroups had to be excluded. However, to our knowledge, ideal amount of time to conduct an AI has not been published. Nonetheless, Tanzania had a larger number of quotations than India (367 vs 214, respectively).

Evaluating the SCORE workshop detected no difference overall in acceptability and feasibility. However, since some differences were noted within and between countries of similar components of acceptability and feasibility (ECHO workshop enabled discussing measures of success, SCORE provided a forum to share personal experiences, SCORE provided an opportunity to obtain skills that could be applied to their TB and HIV work). But since these differences may be so small, with small cell sizes that may have lacked power to detect such small differences, hence having no effect on overall acceptability

and feasibility. Multitude of perspectives, skills and expertise may explain within country differences that may be practical to consider for contextualizing the acceptability components of the SCORE workshop.

Recruitment related to semi-structured interviewees as my key-informants was challenging. The country was in the verge of a shutdown due to the COVID-19 pandemic the week before invitations were sent for participation. Since the invitees were from different parts of the world, zoom was the mode for interaction. Even though the advantage was that the interviews could be recorded, it was remote, not an in-person interview. Also, all countries (and key informants) were preparing to respond to the pandemic on behalf of their respective organizations, they may have been pre-occupied, which were beyond control. Utility of zoom technology was an added benefit, since this is the platform used for ECHO.

Document reviews are usually conducted to gather background information as reviewing existing documents helps you understand the history, philosophy, and operation of the programs that are being evaluated. ECHO evaluations have been very organic without any standardized approach or process recommendations. Reviewing the various documents and analyzing the contents, different ECHO programs all over the world have different designs for their evaluation. It was difficult to determine if implementation of the program reflected the program's plans or was a requirement of the sponsor. The review of program documents may reveal a difference between formal statements of program purpose and the actual program implementation. Documents reviewed had to be within the scope of my analysis, hence the selection criteria had to be too strict (i.e., 50% of the constructs of interest had to be found in the documents). It is important to acknowledge that a more liberal criteria could have led to inclusion of a larger number of documents for content analysis. Keeping the selection strict did help in assessing concordance or discordance of the research findings, which was reassuring.

Reviewing existing documents to better understand the program and organization did help in confirming the main constructs that are not being assessed routinely in ECHO programs. However, we cannot generalize the findings since this is a qualitative assessment, and not an intervention. Also, document review does not include primary data sources designed specifically for this research; these

documents were generated for a different purpose, however majority of them were evaluation reports. Also, having more time available to gather additional documents or key-informants may have elaborated this research, however COVID-19 related uncertainties did not allow for this.

F. Implications for Public Health Leadership and Practice

This study has several implications for public health practice. Public health leaders and evaluators considering development or design of an evaluation for their respective ECHO programs may use the proposed evaluation framework and protocol as a starting point that could easily be contextualized. Policy makers, MOH officials, funders as well as program planners have several considerations including leadership implications discussed below:

Relationship between Sustainability Framework and ECHO evaluation framework

This study was conceptualized in the early stages on the assumption that ECHO was so beneficial that sustainability was the concern that needed to be the focus (Schell *et al.*, 2015). After the SCORE workshop, it became evident that the elements to define high-quality ECHO implementation was the first step to understanding sustainability, which was defined as one of the key elements. Interestingly, most of the constructs that emerged from the SCORE approach aligned with the constructs in the sustainability framework such as funding stability that was similar to the administrative and logistics construct in the proposed framework, political support was similar to political will and leadership engagement, partnerships in the sustainability framework related to building and expanding communities of practice; communication was another element for assessing high-quality ECHO. Monitoring and evaluation as well as public health impacts exists in both the frameworks. Strategic planning was the only construct not included in the proposed framework. Since strategic planning (Bryson, 2011) is an internal activity that

defines program direction, goals and strategies, this was not probed for during the FGD at the SCORE workshop and fell beyond the scope the evaluation framework.

The SCORE workshop in India did not reveal political will and leadership engagement, as well as, incentives and motivating factors that were emphasized by Tanzanian stakeholders. Note that due to optics and circumstances beyond control, lack of an ECHO champion at the MOH (political will and engagement from the Indian government), external evaluators were forbidden from implementing the TB ECHO

Also relatable is the same lack of an ECHO champion and or political will that was cited by a KI about ECHO being unable to be implemented in a different African country. Measuring political will and leadership engagement has important public health leadership implications that should be considered strongly for assessing high-quality implementation. Recommendations can be found below in Chapter 6.

Notably expansion of partnerships, similar to expanding communities of practice, discussed below seemed to be an important element for consideration. Replication, a key principle of assessing success for the ECHO model entails scale-up, and scale-out while maintaining fidelity was a predominant focus discussed by both countries. So much so that , 17% of the quotations in India related to scale-up and 21% of the quotations for Tanzania related to expansion and scale-up. However, scaling up seemed to be challenging without an expansion plan, which was the case in both India and Tanzania. Some stakeholders in Tanzania were concerned about not having enough resources for expansion to both multiple spoke sites (scaling-up or replication) as well as scaling-out meaning expanding to different states in India and Tanzania. TB ECHO has now scaled-out from New Delhi hub at NITRD to setting up hubs in 5 other states namely Assam, Bihar, Gujarat, Karnataka and Uttar Pradesh (India TB Report, 2020). India has also scaled-up to adding 13 medical colleges from the NITRD hub. Similarly, Tanzania has expanded to scaling-out to 5 hubs with 200 spokes from 2 hubs with 35 spokes at the time of the

SCORE workshop almost a year ago (Personal communication with the Tanzania ECHO coordinator in July 2020). The decision-maker group encouraged development of a transition plan in place within two to three years to ensure that the MoH of Tanzania is able to assume management and implementation of ECHO programs completely and integrate them within the government health system. One Decision maker from Tanzania noted, *“This would ensure funding and resources dedicated to ECHO as it would be part of the national strategic plan, within the country’s health budget, and not an Annex.”* (Details in Chapter 4, Paper 3)

There seems to be a spontaneous unplanned expansion without systematic evaluation to assess capacity for expansion or scope of expansion. Proposed evaluation framework could identify gaps and address them. Plans for scale-up, and expansion with expanding partnerships would be necessary. Readiness assessment tool as well as the survey proposed in the evaluation framework does assess for several elements of sustainability including organizational capacity, political and administrative support.

Communities of Practice (CoP)

Virtual Communities of Practice (VCoP) such as the Project ECHO model goes beyond the massive open online courses such as Coursera, to online learning platforms (eg, Khan Academy) and continuing education resources (eg, the University of Washington’s HIV Web Study) by building knowledge networks that promote a multipronged approach to mentorship, peer-to-peer knowledge sharing and problem solving on top of the usual knowledge networks and mass information dissemination. Wenger *et al* defined CoP as *“a group of people who share a concern, set of problems, or a passion about a topic, interacting on an ongoing basis to share knowledge and expertise about common practices to discuss solutions or experience”* (Wenger *et al.*, 2002). However, evaluating influence and effectiveness of CoP, especially for knowledge networks for capacity building settings, has been known to be challenging due it’s dynamic structures and functions (McKellar *et al.*, 2014). Changing members and shifting priorities adds to this complexity (Bertone *et al.*, 2013). A majority of the published frameworks

depend on defined context of the CoP or performance of CoP (Braithwaite, 2009). Despite CoP offering new ways of structuring collaboration to address CAS, various frameworks intend to measure various elements of CoP. A review of various studies indicate evaluation of a CoP could address multiple aims: goals and strategies adopted by the CoP to measure performance, trace pathways between dimensions that lead to CoP success, and provide a series of indicators and suggestions for evaluation data collection and analysis (Bertone *et al.*, 2013). Having and maintaining a CoP goes beyond participation or attendance. When asked whether the evaluation framework is able to measure elements of a successful CoP, one of the KIs said,

“In my brain, it’s like a spider web. Not sure how you would measure this. We were much smaller starting off, we knew everyone and had one on one consults even after the ECHO session and then we grew from 5 spoke to 10 signing in weekly. The feeling of I know these people and if I have a problem with a case, I can ask on the ECHO call has stopped as we grew. How to continue interaction and mentorship while scaling-up?”

When asked about this to other KIs, one of the KIs provided a recommendation that worked for them to sustain effective CoP while scaling up. The KI mentioned that their ECHO program has been using the “Breakout group” function in Zoom that promotes managing multiple groups of focused interest while scaling up or having to travel to physical clinical locations.

Another KI seemed to recollect, *“There seem to be a correlation with the number of people that speak up and the sessions being interactive, so interactions between participants who are not presenters (SME) or ECHO coordinators. This KI continued with their experience in the U.S, “For a couple of months, for our ECHO program, our evaluation specialist actually measured whether five or more people in a particular ECHO session actually spoke up cause we wanted to avoid an ECHO session where it’s a lecture; where you basically have the facilitator, didactic and a case presenter.”*

Various KIs mentioned how successful ECHO implementation is defined by peer sharing and interactivity by having non-faculty members speak up is probably a critical element. Having a dedicated evaluator then gives an update of what has been done and how we should do things differently to improve the ECHO sessions.” *Monitoring the number of interaction metric helps maintain relationships and keeps participants attentive and engaged.* The KI continued, *“I think monitoring and encouraging interactions should be done during a live session and then outcomes shared and discussed within 24 hours after the session with the presenter, faculty, then whoever's appropriate. I think if the feedback loop is not immediate, then we lose the momentum.”* KI continued, *“There is no magic number, but we have used 5, so the facilitator, mostly knowing their audience often ends up calling names to seek interaction.”*

However, other dimensions to consider in the context of ECHO may be most comprehensively captured through a people, organization, and system model, as suggested by Grootveld and Helms, 2008. The size of the network, and type of participants in the network, is currently being captured in 100% of the ECHO programs as evidenced from the KII and document review. The proposed framework intends to measure interaction during ECHO sessions during the objective review of ECHO sessions and during focus group discussions in the proposed toolkit. Perceptions of trust, competency, knowledge sharing, and role of leadership at the organization and at the country level through the proposed survey, readiness assessment checklist, and the key-informant interviews in the proposed toolkit.

Global Implications of my research for other Project ECHO Programs

My dissertation has implications beyond HIV and TB for more than 400 partner organizations implementing >800 ECHO programs in >40 countries globally ([ECHO Data](#)).

- ECHO programs that are getting started in Uganda and Zambia have approached me about the appreciative inquiry work, the evaluation framework and toolkit. I have been consulting them on their plans and use of these approaches.

- Since I am the CDC Monitoring and Evaluation Strategic Information Subject Matter Expert supporting Ethiopia, my work has influenced the launch of Data Quality Improvement Project ECHO in October 2020. Application of the evaluation framework and toolkit as well using the appreciative inquiry approach to evaluate the pilot ECHO shall lead to expansion and implementation of DQI Project ECHO for Ethiopia.

- Since Central American Region (CAR) comprising of 7 countries, El Salvador, Costa Rica, Belize, Guatemala, Honduras, Nicaragua and Panama have had experience with HIV and TB ECHO already, they are planning to launch a Strategic Information ECHO to improve their PEPFAR indicators and improve data quality overall. Information/Experience sharing between Ethiopia and CAR are underway with interest in using AI approach as well.

- One of the KI was enthusiastic about the session content review tool and wanted to use the score sheet to assess their own ECHO sessions immediately. Another KI expressed interest about signing up to be one of the international expert objective reviewers for the Tanzania HIV ECHO session evaluation when data collection for the evaluation begins.

- One of the KIs from American Society for Microbiology (Washington DC) who are working with laboratories in Kenya and Ethiopia in collaboration with the CDC's Division of Healthcare Quality Promotion is considering using the appreciative inquiry approach and contextualize some of the data collection tools as they develop their evaluation.

- Infection Prevention Control group from Division of Healthcare Quality Promotion at CDC are also considering using the AI approach virtually to conduct an interim evaluation of their 12-week, 90-minute sessions titled "*Practical Infection Prevention and Control (IPC) considerations in the Fight Against COVID-19*". Speakers from CDC, WHO, and IPC professional societies around the world focus on practical advice and implementation considerations for IPC for COVID-19. Ministry of Health staff, IPC professionals, partner organizations, and any interested healthcare workers are

encouraged to participate. Simultaneous translation was available in Spanish, French, and Portuguese. CME credit is also available for this session. Over 350 participants have been attending these weekly ECHO sessions globally. These 90-minute sessions have enough time for presentations and for answering questions fostering a true CoP.

During this time of global crisis, ECHO model has been playing a special role leveraging existing networks to disseminate knowledge to connect experts and frontline healthcare professionals globally. A variety of ECHO program sessions are helping create numerous resource lists of our COVID-19 activity around the world. Almost 200 ECHO sessions have been conducted since Feb 2020 as part of the COVID-19 responses leveraging existing CoP globally ([ECHO and COVID-19 response](#))

Ripple effects or unintended consequences

Ripple effects or unanticipated or unintended consequences are usually a result of community-based participatory research (Jagosh et al, 2015). Population outcomes are usually impacted, e.g., sustaining collaborative partnerships towards health improvements, generating spin-off projects, or achieving systematic transformations. What emerged out of the AI-based SCORE process led to a variety of activities.

- Use of Zoom platform: It was evident from the SCORE workshops in both countries that use of Zoom as a platform was rampant, not just for ECHO but as a mode to interact and create communities of practice beyond the ECHO sessions. Select quotes from India and Tanzania about use of Zoom beyond ECHO sessions were:

“Zoom apps on phone could be available to initiate Q&A from patients while they are on TB treatment and management,” “DOT Workers can follow-up [with patients] using Zoom.”

“Zoom could be used for video DOT, especially for well educated people with zoom who can be connected with the Indian government”, “Patient feedback will help in retention and cure rates.”

“Zoom could be used with DTO/MO to bridge between State TB officers/Health Volunteers/Laboratory Technicians because to address communication gaps between ECHO, National TB program and District TB Officers.” A Tanzanian medical officer added, *“Sometimes instructions from ministry are delayed, we get this information from ECHO sessions and we can ask questions and engage in negotiations.”*

- Having sessions be interactive was another recommendation from a community health worker at the SCORE workshop in India. A recent NITRD ECHO attended on TB and COVID-19 was much more interactive as there were poll questions spread throughout for knowledge and satisfaction checks.

G. Implications for Research

Collecting, analyzing, and cross-checking a variety of data on a single factor or aspect of a question from multiple sources, and perhaps perspectives is termed triangulation and is a way to heighten a qualitative study’s credibility and confirmability (Buchwald, 2000). Triangulation was used to validate the evaluation framework and tools primarily for process evaluation indicators. If this system is established routinely, opportunities for further outcome research for patient and programmatic outcomes (using PEPFAR indicators or others) may help build evidence base as suggested by the Rand evaluation report (Fisher et al, 2019).

Since one of the main pillars of ECHO is virtual CoP (vCoP), additional insight on evaluating vCoP should be considered. Attribution of ECHO vs. other factors leading to a successful vCoP will be hard to tease out. Distinction between horizontal, vertical or hierarchical structures or trust or cost savings incorporated in the proposed design. More granular and systematic mixed method design could be proposed to measure effectiveness of CoP. Neither cultural and social values of collaboration vs.

individual success nor power structures and role of local vs expert knowledge is being captured in the proposed evaluation framework.

Future research could focus on how knowledge may be translated into practice since none of vCoP models have demonstrated this. One possible approach could use a prospective cohort design, whereby two arms – an intervention arm using ECHO is compared to a control arm that use routine standards of care to investigate patient- or program-based outcomes. However, such an approach may be complicated to implement, subject to potential bias, and would be resource intensive. Qualitative techniques of observations can produce anecdotal information. As demonstrated through the document review, one of the evaluation reports did present cost to implement ECHO, however effectiveness or impact was not measured. Economic evaluations include cost-effectiveness analyses and return on investment calculations should be strongly encouraged. These types of evaluations can be particularly useful when “making the case” for the program to stakeholders (e.g., funders, insurers, and health care delivery systems), and when working to achieve a sustainable model for covering the costs of a program (The NYAM, 2017). Rand document has encouraged generating such evidence base as well (Fisher *et al*, 2019).

After the SCORE workshop in India, when the perspectives from stakeholders were coded, elements of high-quality ECHO implementations were identified. Main constructs or elements defined by Indian stakeholders included the 10 constructs visualized in Figure 12. visualizes 11 elements that emerged from AI-based SCORE workshop in Tanzania. As we see in Figure 12 elements that combine elements from both India and Tanzania reveals ensuring "clear communication and using appropriate language" for conducting ECHO sessions was in India but not Tanzania. Conversely, “political will and leadership engagement” and “incentives and motivating factors” were new in Tanzania, not shared by Indian stakeholders. While elements of ECHO including "building capacity", “participation” and others are in green colored circles indicative of strengths needing enhancements, were identical for both

India and Tanzania, orange circles depicted challenges and yellow indicated potential barriers to success.

One potential research idea with programmatic implications could be to develop a dashboard that identifies, monitors and assesses each of the elements for high-quality implementation. There would have to be 2 prerequisites: (i) Obviously, the interested Project ECHO program would have to conduct a SCORE process/workshop (virtually or on-site) by gathering perspectives through facilitated discussions among homogenous group of select key stakeholder 9-12 months after this Project ECHO program has been-launched. (ii) Qualitative data analyzed would have to include at least 9 out of the 12 themes (75%) that assess high-quality implementation (Figure 11).

As we saw capacity building, participation, CoP, administrative/logistics/resources, session content, technology and connectivity, scale-up and replication, logistics and infrastructure, public health impact were common themes that emerged from the SCORE workshops in India and Tanzania (Figure 12). Once these and any new themes from the new Project ECHO program are identified, and the status of these assessed (strengths needing enhancement, or potential barriers to success or challenges), developing and monitoring a dashboard could monitor progress for when an element in a yellow circle becomes green. If incentives and motivators are identified as a potential barrier to success (yellow circle). Once MOH introduces some sort of attestation or incentive program, then the circle could become green showing progress. Or when a challenge in orange circles, such as developing an M&E plan for ECHO is addressed, this ECHO program could graduate to converting this orange circle into a green circle.

This could be a tool designed and assessed by UNM or a global third-party program that is responsible for evaluation, accountability and assessment of progress of global Project ECHO programs in a standardized systematic way.

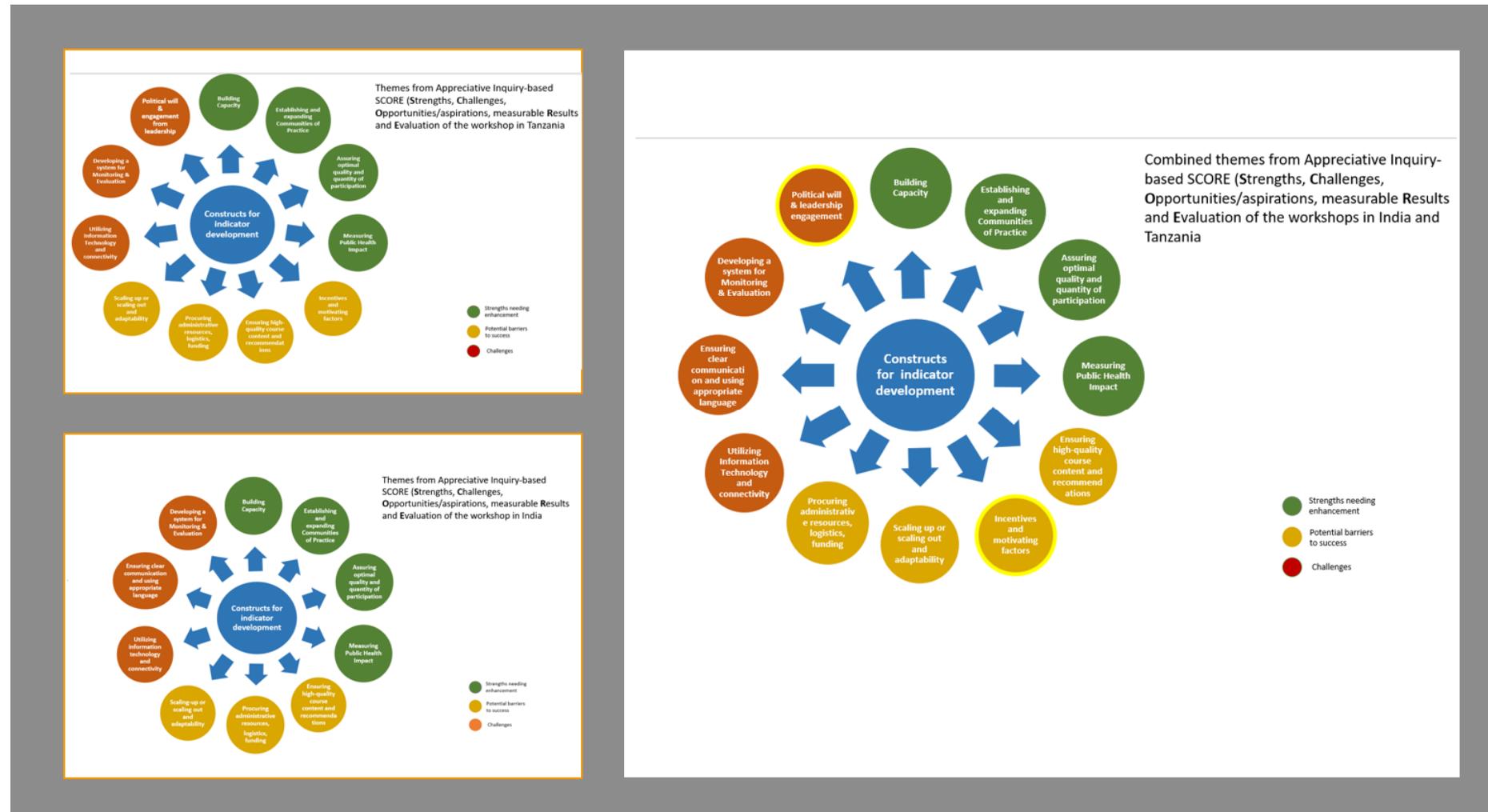


Figure 22. Monitoring tool to assess elements of high-quality ECHO implementation for global ECHO programs

H. Lessons Learned

There were several lessons learned through this research.

LESSON 1: Value of listening and believing in “The danger of a single story”

It was important to understand the perception of participants on what was working as well as the different challenges and aspirations to be able to co-create an evaluation framework. Being able to hear the variety of perspectives, and not believing in one story led to the stakeholders becoming agents for change. The value of listening led to a rich collection of information and to a new approach applying appreciative inquiry. The SCORE methodology was a novel and innovative approach to co-create an evaluation framework that promotes ownership, buy-into evaluation to build ownership by facilitating revelation of a multitude of perspectives from diverse stakeholders. It is hoped that the insights from this process shed light for evaluators, strategic thinkers, and planners to determine when to best conduct SCORE in the implementation life cycle. Given public health system’s conundrum to manage and plan for evaluation resources in an era of shrinking economy, demonstrating the value of engaging stakeholders to maximize limited resources right at the beginning of program implementation is timely and relevant. SCORE approach has the potential to be implemented as a best practice that should be beneficial for programs and implementers, funders and donors. The ability to initiate, inquire, imagine, innovate, and inspire should be an integral recommendation for quality improvement process and stimulate change.

LESSON 2: Importance of Context and Culture in Evaluation

Culture is a set of socially transmitted and learned behavior patterns, beliefs, institutions and a product of human work and thought that characterizes the functioning of a particular population, organization, or community (WKKF’s Step by Step Guide to Evaluation, 2017). Culture is continually evolving, especially in

the field of global health, and imperative to include in qualitative research. Culture plays a role in program implementation, stakeholder dynamics (interrelationships), and boundary setting in terms of systems thinking, (Williams & Imam, 2007) and should not be an after-thought in an evaluation design, but rather integrated from the beginning.

It is important to acknowledge that culture change does not happen quickly and requires that changes occur at multiple levels (Stevens, 2000). Cultural competency training of the facilitators of the ECHO sessions, and evaluators would help identify knowledge and skills required to respect and engage with individuals and communities in specific countries. Increasing requests of ECHO sessions translated into different languages that has opened up a variety of opportunities to promote the ‘ECHO culture.’ Local partners in Tanzania helped with translation of data collection instruments and data collection tools into Kiswahili. One of the key informants commented on how they had a HIV person with a “shared lived experience” serve as a SME or facilitator in the CoP who would promote the culture of learning through personal experiences. As an Indian American evaluator, I was familiar with Indian culture and language, but I was not familiar with the Tanzanian culture and language. While in India, I was able to translate and relate to the SOAR workshop participants, contrast in Tanzania, I was dependent on in-country colleagues, a reflection and influence that become evident and important. To be able to trust one of the local partners to transcribe data collection instruments for the protocol, the consent forms, the focus group discussion guides led to relationship building and mutual appreciation for collaboration promoting learning.

In India, having the knowledge of the local language and being able to extemporaneously translate in real time helped in build immediate credibility and connection with local partners; however due to lack of political engagement, the evaluation was not commissioned by the MOH.

Another lesson learned was that public health and leadership is practiced differently in different countries (Rowitz, 2014). In Asia and Africa, public health leaders are almost always physicians, focusing on clinical aspects, may or may not have training in principles of leadership or evaluation. Due to globalization of

economies, and technological reforms, there was an opportune time to leverage virtual CoP through ECHO platforms to transcend across barriers of communication or collaboration opportunities. There was a huge opportunity to develop relationships and mentorships to develop world leaders in public health. This has become evident during these recent COVID-19 ECHO sessions where we have witnessed emergent global public health leaders who have shared their TB/HIV PEPFAR program experiences in HIV/TB program delivery experiences or their crisis response and mitigation efforts through Project ECHO sessions. To summarize, the underlying cultural norms globally must be acknowledged during development of evaluation initiatives.

LESSON 3: Value of political will and engaging leadership

The leadership framework as proposed by Uhl-Bien complexity leadership theory (CLT) leverages dynamic capabilities of complex adaptive systems (CAS) (Uhl-Bien, 2007). Three broad types of leadership has been explained as (i) Leadership grounded in traditional, bureaucratic socio-cultural hierarchy, alignment and control (administrative leadership), (Hunt, 1999, Osborne *et al*, 2002), such as what was seen in the proof of concept countries as well as mentioned during at least 2 other KII (ii) Leadership that structures and enables condition such as CAS that optimally addresses problems with innovation, creativity, adaptability, and learning (enabling leadership) (Osborne & Hunt, 2007) enables conditions that foster complex networks, interdependencies, and interactions, that motivate a successful CoP (iii) leadership that is dynamic that underlies emergent change activities and is what defines an adaptive leader (Heifetz, 1994, Heifetz & Linsky, 2002). An adaptive leader is able to influence, yet foster autonomy for informal behavior that promotes interaction without constraints and interference from authorities (Jaques, 1989). This leads to generation of ideas, problem solving, and mutual collaboration (Uhl-Bien, 2007). Adaptive leadership serves to influence the policies and decisions of administrative leadership, including planning resource allocation to adapt to adaptive structures for sustainability (Uhl-Bien, 2007).

Political will in context is the “*commitment of political leaders and bureaucrats to undertake action to achieve a set of objectives and to sustain the costs of those actions over time*” (Brinckerhoff, 2000). This term has been used without sufficient specificity as it is a complex and difficult concept to measure (Tilley, 2018). This sentiment was revealed by KIIs and document review. Leadership engagement and political will were contextual constructs that emerged as deficient in the assessed ECHO programs as independently revealed by 4 KI. Document review revealed absence of measure of political will; there was no reference to political will or leadership engagement in any of the documents. Despite the challenges in measuring this construct routinely, unpacking some of the key components may help assess some sort of measure for political will and leadership engagement for assessing ECHO implementation quality. Tilly *et al.*(2018) reviewed various frameworks and political will tools (Coffman & Beer, 2015; Malena, 2009) and recommended a few that may be suitable in the ECHO context.

LESSON 4: Cherishing, flourishing and nourishing an ECHO champion

Similar to quality improvement program champions, identifying and leveraging an ECHO champion with the following characteristics would play an important role in sustaining high-quality ECHO implementation: persuasive communication, proactivity, adaptable leadership style who encourages idea generation and promotes building and expanding CoP, dedication and motivation, ability to inspire and lead by example to encourage learning and vision to demonstrate impact (Demes *et al*, 2020). Humility, is another characteristic encompassing the perspective of a servant leadership who is able to serve and help achieve organizational goals, share experiences, mentor, and advice to move things forward. Accountability and leading by example are another characteristic much required to inspire a sense of leadership and authority to achieve common goals and vision. Another characteristic much like a quality improvement champion would be to be for an ECHO champion to be tenacious and willing to try new things and not be afraid of failure. This person would be eager to make a difference and leave a legacy, acting with empathy and a constant encourager of learning and

improvement. All KIs were ECHO champions in their respective organizations, and they cited at least couple of the countries where ECHO was not a success for not having an ECHO champion as one of the reasons for failure to launch.

I. Recommendations

Various recommendations can be made from my research.

1. **Evaluation Checklist:** Including an evaluation checklist will help determine the evaluation activities and resources in context of the Project ECHO and its focus. It will help determine stakeholders and how success of Project ECHO shall be measured and disseminated.

ECHO Evaluation Checklist to assess high-quality ECHO implementation

- 1.) **Establish boundaries of the evaluation to assess high-quality implementation**
 - 1.1 Identify key stakeholders and stakes who represent hub and spokes of the ECHO model
 - 1.2 Clarify the organizational domain to be evaluated (e.g., impact of ECHO, process of ECHO implantation, outcome of ECHO on patients or data quality)
 - 1.3 Clarify why evaluation is being requested (e.g., evaluator vs client perspectives of ECHO)
 - 1.4 Clarify the timeframe of evaluation planning, implementation, result dissemination, and routinizing monitoring and evaluation efforts (e.g., often based on resources and priorities of the program)
 - 1.5 Clarify the resources available to assess high-quality implementation (e.g., hub and spoke points of contact, ECHO champion, MOH, budget)
 - 1.6 Identify primary beneficiaries, internal and external participants
- 2.) **Conduct an appreciative inquiry process to assess performance status**
 - 2.1 Assess internal and external stakeholder perception of high-quality (e.g., funders, MOH, ECHO champion perceptions may be different)
 - 2.2 Assess internal and external knowledge needs and gaps (e.g., learning strengths, challenges, opportunities, and aspirations using appreciative inquiry process would help align short-, intermediate- and long-term goals for high-quality implementation)
- 3.) **Define criteria to be used to assess high-quality implementation**
 - 3.1 Add contextual criteria to explain the boundaries and outcomes of Project ECHO's focus (e.g., integrating various aspects of HIV ECHO, MDR-TB ECHO may include a session on HIV for MDR-TB patients)
 - 3.2 Determine process, impact or outcome evaluation scope of Project ECHO (e.g., Would evaluation results show impact on participation increase? Disruption in connectivity during ECHO sessions? [Process evaluation indicators] or Would results show knowledge gain? Or Would results show better treatment outcomes or program/SI indicators as proxy for better program outcomes or service delivery [Outcome indicators])
- 4.) **Plan and implement the evaluation**
 - 4.1 Identify data sources (e.g., quantitative or quality data, routinely collected data or newly collected data from reports or program registers)

- 4.2 Identify data collection methods (e.g., mixed methods with surveys, FGD, semi-structured interviews, routinely collected data)
- 4.3 Collect and analyze data (data analyses plan, statistical methods, who will be responsible for collecting, analyzing, dissemination of results)
- 5.) Triangulation of data from various data collection sources, synthesis and sense-making in context**
 - 5.1 Tools/visuals/result dissemination plan for data use to implement change or decision making on expansion/scale-up/scale-out or attrition (e.g., presentation at ECHO sessions, conferences)
 - 5.2 Identify Project ECHO strengths and opportunities for improvement (e.g., if hub or spoke commitment is inconsistent, may be worth exploring other sites for spokes or hubs, if MOH collaboration is lacking, perhaps better to start small and pilot test or have a demonstration project instead)
- 6.) Communicate and report evaluation activities**
 - 6.1 Distribute a plan and a method for regular communication about ECHO implementation and evaluation progress (e.g., some programs are using Whatsapp for this)
 - 6.2 Draft report or results discussed and disseminated widely to get feedback on feasibility of routinizing monitoring and evaluation of ECHO implementation
 - 6.3 Continued sustained mentorship and CQI to expand and improve current operations

2. Exploring new technology and options to monitor participation and accreditation information: It

became obvious from SCORE discussions and KIIs that iECHO, the 4th pillar of ECHO that monitors participation of ECHO sessions was inefficient. Stakeholders and KI suggested that iECHO was cumbersome for data entry, and ineffective tool for communicating performance, as managers of this information were not sharing it with decision makers. Nor was the information being used to change course or make improvements to participation or conducting ECHO sessions. A potential solution is a new digital technology called ‘Participatory Digital Attestation (PDA). This platform would enable (i) Organizing training content, track session activity, and review participation across sessions (ii) Empower staff or partners to set up new sessions in the field, efficiently share content with participants that would avoid cumbersome attendance sheets or data entry applications, (iii) Engage frontline workers by making it easy to acknowledge their presence in each session (even when offline), and motivate them to track the trainings that they have attended, (iv) Access to real-time learning content to review and share with peers and community of practice post-session. (v) Incentive participants to update, verify, share their certifications and attestations such as CPD/SNE/SME or to promote professional satisfaction, growth, and added skill (www.socion.io)..This technology began last year and is being pilot tested at multiple sites in (2–3 countries) over the past 3–6 months with partners (Tanzania is one

of them). Personal communication with the Tanzania coordinator informed that out of 12 out of 150 sites where this was piloted earlier in 2020, there has been a low uptake (5%) of the participants used PDAP. One challenge was using both paper forms and PDA instead of replacing iECHO with PDA completely. Another Sub-Saharan country experience related to success of PDA for French speakers as compared to English speaking participants. Another tip shared was taking time to explain and help participants start using it by repeating the application and process as well as data from time to time that can serve as an incentive to sign up and use PDA. One challenge that the SOCION director reflected on was that MOH was not included in this pilot roll out again substantiating the role of leadership engagement and political support of any new technology for a national initiative.

This technology holds promise for UNM and MOH's that are considering adopting digital attestation and incentives for motivators and sustainability that was revealed during the AI-SCORE workshop and by the KIIs could consider such an innovative technology to build a single platform to build and nurture human capacity at scale..

3. Political will and leadership engagement: A summary table summarizing select recommendations and agencies that are suggested for accountability to monitor or evaluate some of these recommendations to assess political will and leadership engagement:

- (a) *ECHO champion:* Having an ECHO champion at the national MOH level helps. UNM could monitor as part of their global efforts, how many of their ECHO programs have an ECHO champion at the MOH level?
- (b) *Government initiation/support of a policy:* This component concerns the driver of the program and demonstrates leadership engagement from inception. Monitoring indicator for UNM or a country could be: e.g., How many national strategic plans have mention of ECHO, it's coverage, or its impact on

national health programs? Perhaps additional kudos for including ECHO evaluation or ECHO evaluation results on national agendas?

- (c) *Participation of a MOH leader or SME:* Regularity of attendance shows support and leadership engagement and political support. This can be monitored through attendance logs routinely. Assessment of this information (along with routine monitoring of participants) can help advocacy or forums to re-engage MOH and government officials to maintain momentum. Monitoring indicator could be: e.g., How many times did the Chief Medical Officer present a didactic ECHO session on a national policy or guideline or facilitate/participate in an ECHO discussion or problem solve as part of the CoP?
- (d) *Continuity of effort for sustainability:* Committed resources and effort over a long period of time and a mandate and accountability to sustain implementation of an intervention. A sporadic support or one-off pilot test support is usually a weak signal and a sign of wavering political will. e.g., An official from MOH in a high position appearing at the first ECHO session and never showing up again for any of the sessions.
- (e) *Mobilization of stakeholders:* This assesses if the MOH involvement translates into additional partnerships or expansions of partnership. One way to monitor/evaluate this would be to assess, e.g., Did a MOH ECHO champion engage and/or recruit additional partners/agencies, e.g., medical colleges or private providers or additional states? National medical society advocacy groups engage and recruit additional SME/Hub or spoke partners of ECHO.
- (f) *Re(allocation) of resources:* This would capture any changes in government budgets that support ECHO activities, equipment or personnel. Financial support or if MOH national evaluation teams have members or policies that support evaluating ECHO programs, it shows commitment to the cause, helps in sustainability of a national initiative/intervention. One way to monitor would be to assess what proportion of the national budget is utilized for ECHO implementation and/or evaluation?
- (g) *Setting targets or a vision for ECHO in a country:* While indicators measure change over time, a target

reflects a vision and aspiration to achieve. Setting up a desired, feasible, realistic target at inception of ECHO implementation, e.g., High-quality ECHO implementation should have occurred in every state, or 100% coverage achieved in 5 years or all urban hospitals in a health district participating in ECHO in a year.

Table 4. Recommendation Summary by suggested responsible Agencies that could promote/lead implementation of recommendation

Recommendation	Suggested Agencies that could monitor/evaluate the recommendations		
	University of New Mexico's ECHO Institute	CDC/PEPFAR	Country MOH/Implementing Partners*
Presence of an ECHO Champion at the national level	Yes	Yes	Yes
Participation of MOH ECHO official at ECHO sessions	Yes	Yes	Yes
ECHO on the national agenda/National Strategic Plans	Yes	Yes	Yes
Allocation of resources	Yes	Yes	Yes
Continuity of effort		Yes	Yes
Public Awareness	Yes	Yes	Yes
Setting targets/vision for ECHO in collaboration with MOH	Yes	Yes	Yes
Utilization of ECHO evaluation framework and/AI-SCORE technique	Yes	Yes	Yes
iECHO replacement with SOCION or other electronic monitoring	Yes		Yes

*Implementing partners can do it short-term for some of the PEPFAR countries that get funded through CDC but eventually transition to MOH ownership

J. Conclusions and Next Steps

I was able to demonstrate relationships between action research, developmental evaluation for agile complex adaptive systems, and how they can be harnessed to provide a feasible and useful method for supporting high quality Project ECHO implementation.

To my knowledge, this was the first time the SCORE methodology has been utilized for a TB or HIV ECHO program to co-create a self-sustaining evaluation framework, to build ownership by facilitating revelation of a multitude of perspectives from diverse stakeholders. It is hoped that the insights here shed light for evaluators and strategic thinkers and planners to determine factors to conduct the appreciative inquiry-based SCORE process in their context. SCORE approach has the potential to be implemented as a best practice that should be beneficial for interim course corrections, especially relevant for agile, complex adaptive systems such as Project ECHO. The ability to initiate, inquire, imagine, innovate, and inspire should be an integral recommendation for quality improvement process that stimulate change.

Considering that communities of practice (virtual or otherwise) is an important pillar of Project ECHO, to my knowledge, this was the first time an approach such as SCORE supported the development of a community of practice. Not only did SCORE approach convene stakeholders to gather their perspectives, my dissertation embarks on development of an evaluation approach to examine the impact of a community of practice in context of Project ECHO. It is hoped that the insights here shed light for evaluators and strategic thinkers and planners to determine factors to conduct the appreciative inquiry-based SCORE process in their context. SCORE approach has the potential to be implemented as a best practice that should be beneficial for interim course corrections. The next step is to identify facilitators and barriers of a successful CoP and to develop key metrics and data sources that would highlight why a CoP may be functional or not, beyond the Project ECHO sessions themselves.

The ability to initiate, inquire, imagine, innovate, and inspire should be an integral recommendation for quality improvement process that stimulate change. The knowledge generated from this research was used in the development of a set of recommendations that hopefully will inform changes in evaluation considerations as both PEPFAR and non-PEPFAR countries plan and design their Project ECHO implementation. It is hoped that these will result in broader and enhanced evidence base to assess quality of ECHO implementation, creating an evidence base to set up a system of routine monitoring, evaluation, and documentation of process indicators that would eventually help in designing patient-level outcomes.

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APPENDICES

Appendix A: Code Book for Appreciative inquiry-based SCORE, key informant interviews, and Document Review

Code	Memo	Data collection tool	Example (Data collection tool)
Capacity building\Engagement	Engaging partners and colleagues	SCORE, KII, Document Review	Medical colleges and private sector being invited to join ECHO (SCORE)
Capacity building\Knowledge gain	Gaining knowledge and expertise to manage HIV patients	SCORE, KII, Document Review	Great opportunity to learn new topics (SCORE)
Capacity building\Training	Gaining training to care and treat HIV patients	SCORE, KII, Document Review	It's benefiting hospital and staff (SCORE)
Capacity building\Learning	Learning new information and updates on national guidelines	SCORE, KII, Document Review	Increasing my knowledge on IPT guidelines that were new (SCORE)
Capacity building\Self-Confidence	Increase in knowledge leads to increase in self-confidence	SCORE, KII, Document Review	Recognition as a national expert (SCORE)
CoP\Interaction	Interacting during ECHO sessions with colleagues/peers/faculty	SCORE, KII, Document Review	National and international expert's interaction helps build confidence (SCORE)
CoP\Learning	Learning new information from each other	SCORE, KII, Document Review	
CoP\Self-Confidence	Building self-confidence and becoming comfortable to ask questions	SCORE, KII, Document Review	Help ECHO champions build confidence e in presenting at ECHO sessions (SCORE)

CoP\Expanding partnerships	Expanding partnerships through ECHO sessions	SCORE, KII, Document Review	Medical colleges beginning to participate, Regional hubs (SCORE)
Participation	Any comments related to participation in ECHO	SCORE, KII, Document Review	Number of participants from hubs or spokes (Document review)
Logistics	Logistical challenges such as ECHO session timing, not long enough, not managed	SCORE, KII, Document Review	Accessibility of services for key population, Time saving for patients and providers (SCORE)
IT related	IT connections disrupted, cannot hear or see issues, cannot connect to ECHO sessions	SCORE, KII, Document Review	Technical glitches and audio/video quality really need to be addressed (SCORE)
Others	Uncategorized emergent facilitators	SCORE, KII, Document Review	
Resources	Having resources that help promote ECHO	SCORE, KII, Document Review	Dedicated full time coordinator (SCORE)
Political will	Politically supportive	SCORE, KII, Document Review	Capitalizing on support from MOH in Tanzania, capitalizing on the advisory committee that meets regularly in Tanzania (SCORE)
Communication	Communication channels between the different implementers and participants about ECHO session	SCORE, KII, Document Review	WhatsApp group is coordinated (SCORE)

Language	Any comments related to language ECHO sessions are conducted in	SCORE, KII, Document Review	Lack of interest due to language barrier (SCORE)
Leadership engagement	Engaging leaders to promote ECHO	SCORE, KII, Document Review	Leadership at all levels supporting ECHO would be great (SCORE)
Session content\curriculum	Curriculum related factors	SCORE, KII, Document Review	Didactics and cases are not related (SCORE)
Session content\Facilitation	facilitation by faculty or implementers and administrators	SCORE, KII, Document Review	Help ECHO SME improve on facilitation skills (SCORE)
Session content\Interaction during sessions	Public health or patient outcomes	SCORE, KII, Document Review	Interaction is key to keep ECHO as a vibrant CoP (KII)
Session content\Engagement	engaging content and curriculum	SCORE, KII, Document Review	We can plan our calls around ECHO (SCORE)
Motivators and incentives	CPD credits or monetary incentives that will help participate or facilitate in ECHO sessions	SCORE, KII, Document Review	Incentive for presenter - at least 20,000 Schillings per session will motivate to present next session (SCORE)
Change in practice	Knowledge gain changed practice that improved patient outcomes	SCORE, KII, Document Review	How recommendations affect patient outcomes will be important aspiration (SCORE), (KII)
Recommendation review and follow-up	Recommendations were followed-up on	SCORE, KII, Document Review	There is follow-up. SMEs give written recommendations after case is presented (SCORE)

Procedures and policies	policies and procedures are followed and systematically documented	SCORE, KII, Document Review	Developing a library with easy access to previous recordings (SCORE)
Impact	impact of ECHO could be shared in many ways such as helped learn, manage patients, share with peers, increased learning and self-confidence	SCORE, KII, Document Review	Increase in notifications from spokes (SCORE), Navigator was able to find patient who was lost to follow-up (KII)
M&E	M&E elements or indicators	SCORE, KII, Document Review	Increase in treatment success rates (SCORE), M&E Plan (Document review)
Other emergent codes	any other codes that do not fit into any of the previous coding buckets	SCORE, KII, Document Review	Use Zoom for sharing national guidance (SCORE)
Scale up and expansion	replication and expansion of ECHO to other regions/programs etc.	SCORE, KII, Document Review	Scale up has been a burning issue (SCORE)
Sustainability	Sustainability factors	SCORE, KII, Document Review	Having spokes eventually become a hub would be a true sign of sustainability and scale up (SCORE)
Evaluation Framework (EF)	Overall comments on proposed evaluation framework - comments on it being comprehensive, resource intensive etc.	KII, Document Review	I thought the whole thing is a lot to do (KII)

Administrator of Evaluation/EF	Comments on who should be conducting evaluation for their ECHO programs	KII, Document Review	MOH should be involved (KII)
Frequency of EF	How often should evaluations be done? Any of the tools implemented? How often should an EF be conducted? Routinely, annual, or other frequencies	KII, Document Review	Could be a onetime thing (KII)
Acceptability and Feasibility of EF	Comments related to acceptability and feasibility of implementing EF or other evaluations	KII, Document Review	It's super helpful and I may use some of the tools already (KI)
Challenges related to the EF	Perceptions or comments related to challenges (anticipated) challenges related to conducting an evaluation or implementing proposed EF	KII, Document Review	I thought it was a lot to do the whole thing and then do often (KII)
Other comments on EF	Other comments/emergent codes on EF or anything related to evaluation of ECHO programs	KII, Document Review	Incremental changes made is good thing (KII)
Survey	General or specific comments on survey content, acceptability or feasibility	KII, Document Review	Echo implemented a survey to all spokes and hubs (Document Review)
Survey\Administrator	Who should be conducting the survey?	KII, Document Review	I think survey is reasonable (KI)

Survey\Frequency	How often or when should survey be conducted?	KII, Document Review	At least annually if not quarterly to monitor trends in participation and learning (KI)
FGD	General or specific comments on FGD content, acceptability or feasibility	KII, Document Review	FGD are useful but hard to do (KI)
FGD\Administrator	Who should conduct the FGD?	KII, Document Review	external person or someone not in the program (KI)
FGD\Frequency	How often or when should FGD be conducted?	KII, Document Review	once a year (KI)
Session content (SC) review	General or specific comments on SC review tools, score cards, content and process acceptability or feasibility	KII, Document Review	Facilitation score card is an important too (KII)
SC\Administrator	Who should conduct the SC reviews?	KII, Document Review	Discussions are happening and providers are assessing interaction real time (KII)
SC\Frequency	How often or when should SC reviews be conducted?	KII, Document Review	Definitely first 6 months after ECHO is launched to assess course correction needs (KII)
Readiness assessment (RA)	General or specific comments on readiness assessment content, format acceptability or feasibility	KII, Document Review	Should be a checklist (KII)
RA\Administrator	Who should be conducting the readiness assessment?	KII, Document Review	ECHO coordinator and eventually MOH should do this (KII)

RA\Frequency	How often or when should readiness assessment be conducted?	KII, Document Review	When any new ECHO starts (KII)
iECHO	General or specific comments on iECHO use and utility, their involvement, acceptability or feasibility	KII, Document Review	Hard one because it needs data cleaning (KII)
iECHO\Administrator	Who should be conducting iECHO and how should the information be used?	KII, Document Review	IP or MOH coordinators (KII)
iECHO\Frequency	How often or when should iECHO or routine review assessment be done?	KII, Document Review	Quarterly reviews and data sharing are important (KII)
KII	General comments on KII at the end, it's use, acceptability and feasibility	KII, Document Review	KII are imperative and important for triangulation (KII)
KII\Administrator	Who should be conducting KIIs?	KII, Document Review	Good qualitative analysis skills are needed (KII)
KII\Frequency	How often should KII be done?	KII, Document Review	KII could be done once a year for sure perhaps more (KII)
Appreciative Inquiry (AI)	General comments on AI process, methodology in their settings. Have the KII been involved in similar processes?	KII, Document Review	I think it should be done (KII)
AI\Administrator	Who could conduct AI sort of methodology in their setting?	KII, Document Review	MOH should be involved (KII)

	Perceptions of what skills or needs would be for facilitators to conduct AI		
AI\Frequency	When should AI sort of process be used?	KII, Document Review	After 6-9 months of launch of an ECHO (KII)
AI\ Challenge	Challenges related to anticipated or experiences related to implementation of AI workshop/approach	KII, Document Review	Special skills of facilitator needed to conduct AI workshop (KII)
AI\acceptability	Comments related to KI's perception of acceptability and use of AI in their ECHO setting	KII, Document Review, SCORE	More time needed (SCORE)
AI\logistics	Logistics of the SCORE workshop	KII, Document Review, SCORE	Excellent time management (SCORE)
AI\feasibility	Comments related to KI perception of feasibility of conducting AI in their ECHO setting	KII, Document Review	Need a dedicated room for ECHO (KII)
Alternative data collection	Comments related to alternative data collection tools, systems or processes	KII, Document Review	Pre-post knowledge checks (Document Review), (KII)

Appendix B: Data Measurement Table

Co-creating and validating a Monitoring and evaluation framework to assess quality of Extension of Community Healthcare Outcomes (ECHO™) implementation			
PAPER 1: AIM 1	Describe perceptions of high-quality ECHO implementation by stakeholders and their acceptability and feasibility of Appreciative inquiry approach (AI)-based SCORE approach in development of an evaluation framework		
RESEARCH QUESTION 1.	3.) What are the stakeholders’ perceptions of high-quality ECHO implementation? <p>(iii) What are the stakeholders’ perceptions of high-quality ECHO implementation in India and Tanzania (proof of concept countries)?</p> <p>(iv) How do stakeholders’ perception of high-quality ECHO implementation compare within and between stakeholder groups in India and Tanzania?</p>		
CONSTRUCTS (a priori codes)	SUB-CONSTRUCTS	DATA SOURCES	ANALYSIS STRATEGY
1.) Capacity building 2.) Community of Practice (CoP) 3.) Participation 4.) Administrative resources, logistics, funding, communication 5.) Information Technology related	Knowledge dissemination, Learning, Access to SME, interaction, asking questions Engagement Dedicated room/computer, Resources, Funding, Logistics (timing of ECHO), communication about sessions, Language Internet connection related, audio, visual	Phase 1: AI-based SCORE workshop notes 1. Meeting notes, flip chart notes, audio recordings transcribed from appreciative inquiry workshops in India and Tanzania 2. Field notes and analytical memos in MAXQDA	Phase 1: Analysis of appreciative inquiry (AI) workshop results using MaxQDA: (i) Coding concepts to many codes that were then organized into <i>a priori</i> big bucket codes (constructs and sub-constructs – see Appendix A for code list), followed with emergent codes to determine key themes (ii) Chi-Sq statistics will determine if the difference between the predominant themes are statistically significant. Qualitative analysis, quantifying qualitative analysis and visualization of results of AI workshops in both countries using MAXQDA code matrix, co-occurring codes, visual, MAXMaps and other analytic tools. (iii) Results shall be compared across overall,

<p>6.) ECHO Session related</p> <p>7.) Political will</p> <p>8.) Public health impact</p> <p>9.) Scale-up, expansion</p> <p>10.) Monitoring and evaluation</p> <p>11.) Emergent codes</p>	<p>Course content, interaction between participants and organized facilitators</p> <p>Leadership support, leadership engagement, support from MOH</p> <p>Treatment outcome, patient outcomes, documentation</p> <p>Scale-up and</p> <p>M&E documentation of outcome or impact</p> <p>Other emergent codes</p>		<p>analysis within countries and across countries, within participant roles and across participant roles.</p> <p>(iv) Emergent themes shall be identified</p>
<p>RESEARCH QUESTION 2.</p>	<p>2.) What is the acceptability and feasibility of using a modified appreciative inquiry-based SCORE approach?</p> <p>(v) How reliable is the evaluation form to measure acceptability and feasibility items for SCORE workshop evaluation (Appendix D includes evaluation form)?</p> <p>(vi) How do stakeholders' acceptability and feasibility of using a modified appreciative inquiry-based SCORE approach compare within and between stakeholder groups in India and Tanzania?</p>		
<p>Acceptability of the SCORE workshop was defined on the 9 items in sub-constructs to assess whether objectives were met on the 4-point Likert scale:</p>	<p>Acceptability items</p> <p>i. Diverse perspectives on Strengths of ECHO</p> <p>ii. Diverse perspectives on Challenges of ECHO</p> <p>iii. Diverse perspectives on</p>	<p>Phase 1: Evaluation forms collected from</p> <p>Ordinal scale data from evaluation forms</p>	<p>Quantitative analysis of participants description. Since the evaluation form includes ordinal scale data, descriptive statistics and normality tests including t-tests and box plots shall be generated to assess normality of distribution of the evaluation</p>

<p>Completely met=4 Mostly met=3 Minimally met=2 and Not met=1</p> <p>Feasibility of the SCORE workshop was defined on the 6 items in sub-construct column to assess whether there was satisfaction based on a 4-point Likert scale:</p> <p>Completely satisfied=4 Mostly satisfied=3 Minimally satisfied=2 and Not satisfied=1</p>	<p>iv. Opportunities of ECHO</p> <p>v. Diverse perspectives on Aspirations of ECHO</p> <p>vi. Diverse perspectives on measures of Success for ECHO</p> <p>vii. Opportunities to contribute knowledge and personal experience at the SCORE workshop</p> <p>viii. Opportunities to gain skills and knowledge to support TB/HIV work</p> <p>ix. Opportunities to gain skills and knowledge to apply evaluation efforts in general</p> <p>x. Avenues to build relationships and contact to help with TB/HIV ECHO related work</p> <p>Feasibility items</p> <p>x. General structure and breaks</p> <p>xi. Presentations</p> <p>xii. Breakout group discussions</p> <p>xiii. Large group report outs</p> <p>xiv. Logistics (space, food, seating)</p> <p>xv. Pre-workshop coordination and information</p>	<p>Open-ended qualitative responses were obtained and analyzed as well.</p> <p>Phase 2: Key-Informant Interviews (KIIs) shall be conducted by inviting 15 ECHO champions based on purposeful sampling (2 each from India and Tanzania and then 11 from ECHO programs in different parts of the world.</p> <p>Perception of KII on acceptability and feasibility of SCORE workshop shall be elicited from KII</p>	<p>form results. Evaluation results of the AI workshop shall be analyzed in SAS.</p> <p>(i) Cronbach Alpha statistics shall be performed to assess internal reliability of items that measure acceptability and feasibility of evaluation form</p> <p>(ii) Since scaled data may not be normally distributed, non-parametric tests (Kruskal Wallis test of significance shall be used to test for significant difference between the 3 breakout groups for the 2 countries.</p> <p>Qualitative analysis Comments and open-ended responses from the evaluations as well as the KII shall be analyzed in MaxQDA.</p> <p>(i) KII transcript analysis specifically on AI workshop to assess usefulness and feasibility of the AI.</p> <p>(ii) Concordance or discordance between feasibility and acceptability of evaluation framework and data collection tools between the KII and SCORE workshop shall be discussed</p> <p>Reflection Notes and reflection after each of the KII, my impressions and analytic memos in MAXQDA that will help in interpretation.</p> <p>Triangulation of results from evaluation forms and the KII results shall be interpreted to integrate findings from qualitative and quantitative results.</p>
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PAPER 2: AIM 2	Develop a protocol to implement an evaluation framework and data collection tools to assess quality of ECHO implementation		
RESEARCH QUESTION 3.	3.) What does a comprehensive evaluation protocol and compendium of tools entail that assesses ECHO implementation quality?		
CONSTRUCTS	SUB-CONSTRUCTS	DATA SOURCES	ANALYSIS STRATEGY
Protocol describing evaluation framework	Data collection tools to assess the 10 constructs to assess high-quality implementation	9 evaluation activities 1. SCORE workshop 2. ECHO participant survey 3. Focus Group Discussion (Health care providers, SME, implementers) 4. Objective review of ECHO sessions 5. Readiness assessment 6. iECHO review 7. Key informant interviews 8. Triangulation of results 9. Presentation of findings to a large group of representative stakeholders	Data collection and analysis are beyond scope of the dissertation
PAPER 3: AIM 3	Validate usability and acceptability of an evaluation framework and toolkit to assess high-quality ECHO implementation		
RESEARCH QUESTION 4.	4.) What is the validity and acceptability of a proposed adaptable comprehensive evaluation framework, including a modifiable toolkit, designed to assess the quality of an ECHO implementation? (i) How well are the a priori constructs and data collection tools actually measuring what they are supposed to measure programmatically (Construct validity)? (ii) What is the feasibility and acceptability of the evaluation framework and compendium of tools that assess quality of ECHO implementation? (iii) What are the recommendations to improve acceptability and usability of the evaluation framework and compendium of tools that assess quality of ECHO implementation?		

CONSTRUCTS	SUB-CONSTRUCTS	DATA SOURCES	ANALYSIS STRATEGY
<p>Usability and acceptability of appreciative inquiry to convene/engage stakeholders to co-create an evaluation framework</p> <p>Overall proposed evaluation framework (EF) acceptability, usability, administrator, and frequency</p> <p>SCORE acceptability, usability frequency and administrator</p> <p>Survey acceptability, usability, administrator, frequency</p> <p>FGD acceptability, usability, administrator, frequency</p> <p>Objective session content review acceptability, usability, administrator, frequency</p> <p>Readiness assessment usability, acceptability, frequency and administrator</p> <p>iECHO review usability, acceptability, frequency and administrator</p> <p>KII to triangulate results acceptability, usability, frequency and administrator</p>	<p>Acceptability, Reliability of constructs, feasibility of use of protocol</p> <p>Feasibility and usability of proposed data collection tools</p> <p>Missing constructs to define high-quality ECHO implementation, tools or gaps in the EF</p>	<p>Phase 2: Key-Informant Interviews (KIIs) shall be conducted by inviting 15 ECHO champions based on purposeful sampling (2 each from India and Tanzania and then 11 from ECHO programs in different parts of the world. The first 9 who accept the invitations shall be interviewed using a structured KII guide.</p> <p>Inclusion eligibility is based on experts being involved with ECHO implementation for more than 2 years. Experience and expertise from ECHO champions shall be leveraged to obtain their perception of high-quality ECHO implementation. Transcribed notes from Key-Informant Interviews (KIIs), observations on zoom from video/audio recordings.</p> <p>Phase 3: Latent content analysis of select key evaluation reports and/or documents from key-informants. Selection criteria for documents include referral documents from KI themselves and also literature review of peer-reviewed and non-peer reviewed documents.</p>	<p>Qualitative analysis using MAXQDA shall describe the perceptions of high-quality ECHO among KII.</p> <p>Assessment of how the ECHO champions' perceptions align (or not) with this protocol and data collection tools and SCORE findings.</p> <p>Document review will include latent content analysis of select evaluation documents for a specified content criterion. And based on assessment, summary notes shall be available on reasons and interpretation for inclusion and relevance</p> <p>Consensus or discordance between KII, SCORE and document review findings shall be discussed.</p> <p>Triangulation of results from SCORE, KII and content analysis will help finalize elements for high-quality ECHO implementation.</p> <p>Missing tools and gaps in the evaluation framework or data collection tools shall be identified that will help develop recommendations for a revised evaluation framework and toolkit.</p>

Appendix C: Output from MAXQDA on distribution of codes and subcodes (overall)

<i>A priori</i> Codes (themes)	#	Subcodes	India		Tanzania		Total
			Number of times codes were identified	%	Number of times codes were identified	%	
1.) Capacity Building	1	Capacity building	11	5.14	16	4.36	27
	2	Building self-confidence	6	2.80	2	0.54	8
	3	Knowledge gain, learning, training	18	8.41	24	6.54	42
2.) Participation	4	Participation/Engagement/interaction	16	7.48	12	3.27	28
3.) CoP	5	Communities of practice	7	3.27	29	7.90	36
4.) Administrative resources, logistics	6	Resources, funding	12	5.61	29	7.90	41
	7	Logistics	12	5.61	10	2.72	22
	8	Communication/Language	3	1.40	8	2.18	11
5.) IT related	9	IT related	9	4.21	12	3.59	21
6.) Political will	10	Political will	3	1.40	13	3.54	16
	11	Leadership engagement	2	0.93	14	3.81	16
7.) Scale-up and expansion	12	Expanding partnerships	22	10.28	13	3.54	35
	13	Sustainability	3	1.40	23	6.27	26
	14	Scale up and expansion	11	5.14	42	11.44	53
8.) ECHO Session	15	Session engagement	5	2.34	7	1.91	12
	16	Session facilitation	3	1.40	6	1.63	9
	17	Interaction during sessions	6	2.80	3	0.82	9
	18	Session content	11	5.14	20	5.45	31
9.) Public health Impact	19	Change in practice	2	0.93	3	0.82	5
	20	Recommendation review and follow-up	3	1.40	4	1.09	7
	23	Acceptable, usable, feasible	1	0.47	5	1.36	6
	21	Procedures and policies	2	0.93	4	1.09	6
	22	Impact/Outcome	20	9.35	15	4.09	35
	23	Documentation	4	1.87	2	0.54	6
10.) M&E	24	M&E	12	5.61	7	5.45	19
Emergent codes	25	Other emergent codes -Motivators and Incentives	1	0.47	20	5.45	21
	26	Other emergent codes - Zoom utility, ripple effect	7	3.27	3	0.82	10
	27	Others - Research, integration of QI into ECHO, have 1 IP coordinate	2	0.93	21	5.72	23
	28	Total	214	100	367	100	581

Strengths

Themes	Codes	India			Tanzania			Total number of codes	A priori codes
		Decision Makers (%)	SME (%)	Health care provider (%)	Decision Makers (%)	SME (%)	Health care provider (%)		
1.) Capacity Building	1	Capacity building	5	3	1	3	4	8	24
	2	Building self-confidence	1	1			7	16	24
	3	Knowledge gain, learning, training	1		1	2	4	6	14
2.) Participation	4	Participation/Engagement/interaction	9	5	2	2	4	12	22
3.) CoP	5	Communities of practice	2			3	3		8
4.) Administrative resources, logistics	6	Resources, funding	2		1	4	2	5	14
	7	Logistics/infrastructure				2	1	3	6
	8	Communication/Language				2	3	4	9
5.) Internet Technology related	9	IT related	1	1		1	1	1	5
6.) Political will	10	Political will				10	5		15
	11	Leadership engagement	2	1		2			5
7.) Scale-up and expansion	12	Expanding partnerships				3	1	1	5
	13	Sustainability				6	1		7
	14	Scale up and expansion				8	5		13
8.) ECHO Session	15	Session engagement							0
	16	Session facilitation							0
	17	Interaction during sessions				1	4	1	6
	18	Session content		4			5		12
9.) Public health Impact	19	Change in practice	3				1	6	10
	20	Recommendation review and follow-up					5	1	6
	21	Acceptable, usable, feasible				2	1	1	4
	22	Procedures and policies	1			1	2	5	9
	23	Impact/Outcome				5	1	5	11
	24	Documentation					1		2
10.) M&E	25	M&E					2		2
Emergent codes	26	Other emergent codes -Motivators and Incentives							
	27	Other emergent codes - Zoom utility, ripple effect							
	28	Others - Research, integration of QI into ECHO, have 1 IP coordinate				3		1	4
			25	15	5	59	55	78	237
									237

Challenges

Themes	Codes	India			Tanzania			Total number of codes	A priori codes	
		Decision Makers (%)	SME (%)	Health care provider (%)	Decision Makers (%)	SME (%)	Health care provider (%)			
1.)Capacity Building	1	Capacity building	1	1			1	1	4	4
	2	Building self-confidence								
	3	Knowledge gain, learning, training								
2.)Participation	4	Participation/Engagement/interaction	3	3			1	3	10	20
3.)CoP	5	Communities of practice	1						1	
4.)Administrative resources, logistics	6	Resources, funding	1	5	3	3	3	3	18	30
	7	Logistics/infrastructure					6	4	10	
	8	Communication/Language				1		1	2	
5.) Internet Techno	9	IT related	1	3	1	1	1	2	9	
6.) Political will	10	Political will	3				2		5	6
	11	Leadership engagement						1	1	
7.) Scale-up and expansion	12	Expanding partnerships	1						1	11
	13	Sustainability		2		1	1	4	4	
	14	Scale up and expansion				3		3	6	
8.) ECHO Session	15	Session engagement								15
	16	Session facilitation								
	17	Interaction during sessions								
	18	Session content	4	7	1	4	2	1	15	
9.) Public health Impact	19	Change in practice						1	1	8
	20	Recommendation review and follow-up	2		1				3	
	21	Acceptable, usable, feasible								
	22	Procedures and policies		1					1	
	23	Impact/Outcome		1	1				2	
24	Documentation						1	1		
10.) M&E	25	M&E								
Emergent codes	26	Other emergent codes -Motivators and Incentives		1					1	5
	27	Other emergent codes - Zoom utility, ripple effect								
	28	Others - Research, integration of QI into ECHO, have 1 IP coordinate					3	1	4	
			17	26	7	9	22	18	99	99

Opportunities/Aspirations

Themes	Codes	India			Tanzania			Total number of codes	A priori codes
		Decision Makers (%)	SME (%)	Health care provider (%)	Decision Makers (%)	SME (%)	Health care provider (%)		
1.)Capacity Building	1 Capacity building	5	4		1	1	2	13	18
	2 Building self-confidence								
	3 Knowledge gain, learning, training	2	1	2				5	
2.)Participation	4 Participation/Engagement/interaction		1		1	1	8	10	10
3.)CoP	5 Communities of practice	3	1		4	4	1	13	13
4.)Administrative resources, logistics	6 Resources, funding		5	3	1		6	15	32
	7 Logistics/infrastructure				1	3		15	
	8 Communication/Language	1		1				2	
5.) Internet Techn	9 IT related	2	3			2		7	7
6.) Political will	10 Political will	1	1		1	1	3	7	10
	11 Leadership engagement	1				1	1	3	
7.) Scale-up and expansion	12 Expanding partnerships	4	7	4	1	1	3	20	29
	13 Sustainability				1	2	3	6	
	14 Scale up and expansion					2	1	3	
8.) ECHO Session	15 Session engagement								8
	16 Session facilitation		1					1	
	17 Interaction during sessions								
	18 Session content	2	4	1				7	
9.) Public health Impact	19 Change in practice	1		5				6	19
	20 Recommendation review and follow-up			1			1	1	
	21 Acceptable, usable, feasible								
	22 Procedures and policies				1		6	6	
	23 Impact/Outcome				1	1	4	6	
24 Documentation									
10.) M&E	25 M&E	1	2			1		4	4
Emergent codes	26 Other emergent codes -Motivators and Incentives								4
	27 Other emergent codes - Zoom utility, ripple effect								
	28 ECHO, have 1 IP coordinate					4		4	
		24	35	18	14	32	29	154	154

Appendix D: SCORE to a priori codes

A priori Codes	Strengths	Challenges	Opportunities/Aspirations
1.)Participation	X	X	X
2.)CoP	X	X	X
3.)Administrative resources, funding logistics, infrastructure		X	
4.) IT connectivity related		X	X
5.)Political will		X	
6.)Scale-up and expansion	X		X
7.)ECHO Sessions	X	X	X
8.)Public health Impact		X	X
9.)M&E		X	X
10.)Emergent codes		X	X

Appendix E: Appreciative Inquiry-based SCORE Evaluation Form

**TANZANIA ECHO EVALUATION FRAMEWORK PLANNING WORKSHOP
Participant Evaluation**

A. Please identify your role in ECHO (*Circle one*): Provider (clinician) Nurse Laboratorian
Other (*write-in*)_____

B. Do you participate from (*Circle one*):

Hub:_____ (name of hub) Site (Spoke):_____ (name of site)

C. How many ECHO sessions have you attended? (*Circle one*)

Less than 5	5-10	10-20	20-40	40-60	60-100	I have not missed a single ECHO session
-------------	------	-------	-------	-------	--------	---

1. To what extent did the workshop meet the following objectives?

	Completel y met (4)	Mostly Met (3)	Minimally Met (2)	Not met (1)	N/A
a. The workshop discussion identified measures for success of Tanzania ECHO for future use.	4	3	2	1	
b. The workshop revealed diverse perspectives on Tanzania ECHO strengths.	4	3	2	1	
c. The workshop revealed diverse perspectives on Tanzania ECHO challenges.	4	3	2	1	
d. The workshop revealed diverse perspectives on Tanzania ECHO opportunities.	4	3	2	1	
e. The workshop revealed diverse perspectives on Tanzania ECHO aspirations.	4	3	2	1	
f. The workshop provided an opportunity to contribute using personal knowledge and experience.	4	3	2	1	
g. I gained skills or knowledge from this workshop that may help my Tanzania ECHO related work.	4	3	2	1	

h. I gained skills or knowledge from this workshop that may apply to my evaluation efforts in general.	4	3	2	1	
i. I had an opportunity to build relationships and contacts that will help my Tanzania ECHO related work.	4	3	2	1	

2. How satisfied were you with the following components and sessions of the workshop?

	Completely Satisfied (4)	Mostly satisfied (3)	Minimally Satisfied (2)	Not met (1)	N/A
a. General Structure and Breaks	4	3	2	1	
b. Presentations	4	3	2	1	
c. Breakout Discussions	4	3	2	1	
d. Large Group Report outs	4	3	2	1	
e. Logistics (space, food, seating, etc.)	4	3	2	1	
f. Pre-workshop coordination and information	4	3	2	1	

Please add any comments you have on the above:

3. How similar were the format and process used in this workshop to other workshops you have previously attended? (Please place an 'X' in the appropriate box).

Very similar	Somewhat similar	Not similar at all	N/A
3	2	1	

If not similar, please describe and give your reaction to the differences:

4. Please give your feedback on the SCORE (Strengths, Challenges, Opportunities, Aspirations, Results) framework – if you thought this was a useful framework or not, and what aspects of the framework were useful or not.

5. Any other comments about what was valuable or not valuable about the workshop?

6. Do you believe there were any partners that did not attend the workshop, but should have? Please describe.

Appendix F. Key Informant Interview Guide to assess construct validity and usability of an evaluation framework with data collection tools to assess high-quality ECHO implementation

Introduction, explanation of the process: (5 minutes)

As you are aware, we are developing a comprehensive framework to assess and monitor high-quality ECHO implementation. I hope you have been able to review the framework and tools that have been shared previously. We are hoping to get your feedback on this framework and tools. This interview will help us better understand your opinion and reflection about what high-quality ECHO implementation entails. This semi-structured interview may take approximately an hour or so. All feedback will be kept confidential and findings shall be reported without naming or uniquely identifying the interviewees.

If you are unable or unwilling to respond to a specific question, please make me aware and we will move on to the next. I will stop the interview at any time, should you become uncomfortable. I will be audio recording this interview to ensure that I accurately and completely capture your responses. Once the interview is complete, I will transcribe the recording into a word document, which I will share with you so that you can validate the accuracy. Once the transcript is complete, I will destroy today’s recording. Names or other identifying information will not be shared beyond the research team and will be removed once the information is analyzed.

Do you have any questions for me?

Date of Interview:

Before I begin to collect feedback and your reflection on the them, can you tell me a little bit about your role in ECHO implementation and how you got involved with ECHO?

Research Question	Concept	Questions
1	Factors for high-quality ECHO (10 minutes)	<ol style="list-style-type: none"> 1. In your experience, can you think of a most recent ECHO you attended that made you feel like it was “High-quality”? What were the criteria or factors that made it a “high-quality” ECHO for you? 2. And perhaps another experience where you may have been concerned about it not being such a “high-quality” ECHO? What were the criteria or factors that that you experienced were concerning?
1	Acceptability, construct validity, and	<ol style="list-style-type: none"> 3. From your perspective, what are some of the factors for high-quality ECHO implementation?

<p>4</p>	<p>feasibility of framework and toolkit (5 minutes)</p>	<p>Again, thanks so much for your time to review the protocol and tools.</p> <p>4. From the tools that you have reviewed, I will go through each of the tools and ask you for feedback on usefulness, feasibility to implement, and alignment with your ideas about criteria to assess high-quality ECHO implementation. I will name each of the tool now, if you could please tell me your thoughts about</p> <p>(i) When should this information be collected? (ii) How often should this tool be administered? (iii) Who should be responsible for conducting?</p> <p>GO THROUGH EACH OF THE TOOLS BELOW AND WAIT FOR RESPONSES ON WHEN SHOULD TOOL BE ADMINISTERED, FREQUENCY, AND RESPONSIBLE PARTY FOR CONDUCTING THIS DATA COLLECTION TOOL?</p> <ul style="list-style-type: none"> • Appendix 2: Survey • Appendix 3A-C:FGD • Appendix 4A-C: Objective Session Review • Appendix 5: iECHO analysis • Appendix 6: Readiness Assessment • Appendix 7: Triangulation results • Appendix 8: KII <p>PROBE BY REMINDING THEM OF ALL THE TOOLS</p>
<p>3</p>	<p>Acceptability, usability, and feasibility of AI (5 minutes)</p>	<p>5. What were your thoughts on the appreciative inquiry approach that was conducted in India? This was an asset-based approach based on gathering strengths, opportunities, aspirations, and measurable results - SOAR) instead of SWOT (Strengths, weaknesses, opportunities, and strengths) that you may be used to. This was a way to engage stakeholders from various levels to gather a variety of perspectives for self-determined change. As you may have noticed in the report, this helped identify quick mid-course corrections.</p> <p>5 (i) Have you engaged in such appreciative inquiry process of engaging a variety of stakeholders or some sort of a participatory approach to gather feedback or for a mini evaluation?</p> <p>PROBE FOR THE ONES WHO PARTICIPATED IN AI IN INDIA/TANZANIA OR ANY OTHER PARTICIPATORY</p>

		<p>(ii) What other formats have you used in a strategic planning meeting or workshop to engage stakeholders who participate across different levels? (as you saw decision makers, health care providers, facilitators).</p> <p>(iii) Do you think having mini-evaluation or check-in processes to help identify mid-course corrections are useful and should be done? Do you do those in your ECHOs?</p> <p style="text-align: center;">PROBE WHY OR WHY NOT</p> <p style="text-align: center;">(FOR PARTICIPANTS FROM INDIA AND TANZANIA)</p> <p>(iv) What did you think about the format of the AI workshop?</p> <p>(v) Do you think AI was a helpful and participatory process? What was most valuable (for India/Tanzania – what worked the best?)</p> <p>(vi) Any other aspects that were useful? What was valuable? What were some drawbacks of AI approach?</p> <p style="text-align: center;">PROBE FOR RECOMMENDATIONS FOR TWEAKING THE AI FORMAT</p> <p style="text-align: center;">FOR ALL PARTICIPANTS</p> <p>6. When should such AI like participatory processes be done ideally? How often should such workshops or meetings be undertaken? Who should be responsible for conducting such processes as an AI workshop to engage stakeholders?</p>
<p>Now I will ask you about the various criteria that can assess high-quality ECHO implementation</p>		
<p>4</p>	<p>I. KNOWLEDGE GAIN, LEARNING, AND CAPACITY BUILDING</p> <p>Construct validity</p> <p>(5 mins)</p>	<p>7 (i) In your opinion, how well does the protocol assess knowledge gain, knowledge dissemination, building workforce capacity to manage and treat complicated cases of TB or HIV, laboratory, or other health conditions, and learning?</p> <p>7 (ii) In your opinion, how well does the focus group discussion guide support collection of this information?</p> <p>7 (iii) Are you able to suggest other ways by which capacity building, knowledge gain and/or learning be evaluated?</p> <p style="text-align: center;">PROBE TO UNDERSTAND CONSTRUCT VALIDITY, FREQUENCY OF DATA COLLECTION, RESPONSIBLE PARTY, GAPS IN DATA COLLECTION TOOLS</p>

4	<p>II. EXPANDING COMMUNITIES OF PRACTICE (CoP)</p> <p>(5 mins)</p>	<p>8 (i) As you know Project ECHO promotes Communities of Practice? By CoP, I mean interchange between different types of health professionals and SMEs? Sharing knowledge about lessons learned with a group? Asking questions. Do you feel your ECHO promotes CoP?</p> <p>PROBE to get responses</p> <p>8 (ii) Do you think the provider survey assesses goals of a well-functioning CoP and how would you assess progress towards those goals? Interchange between different types of health professionals and paraprofessionals? Sharing knowledge about lessons learned with a group? CoP?</p> <p>8 (iii) In your opinion, how well does the focus group discussion assesses CoP?</p> <p>8 (iv) Do you think the readiness factors are relevant for assessing readiness? Sharing knowledge about lessons learned with a group?</p> <p>8 (v) What do you think the goals of a well-functioning CoP are? How can you assess progress towards those goals?</p> <p>8 (vi) Are you able to suggest other ways by which building or expanding CoP can be assessed effectively?</p> <p>PROBE TO UNDERSTAND CONSTRUCT VALIDITY</p>
4	<p>III. ADMINSTRATIVE/ RESOURCES/ LOGISTICS/INFRA STRUCTURE</p> <p>(5 minutes)</p>	<p>9 (i) What administrative and infrastructure issues do you think are important to assess high quality ECHO implementation?</p> <p>9 (ii) What are your thoughts on how well the administrative, resources, logistical and infrastructure issues such as dedicated space etc. to implement ECHO gets assessed through the protocol and data collection tools?</p> <p>9 (iii) Specifically the provider surveys – does it capture it adequately?</p> <p>9 (iv)How about the readiness assessment survey -- do you think it assess administrative planning adequately?</p> <p>9 (v) In your opinion does iECHO analysis capture any of these adequately?</p>

		<p>9 (vi) Are you able to suggest other ways by which status of resources/administrative or infrastructure be monitored/evaluated?</p> <p>PROBE TO UNDERSTAND CONSTRUCT VALIDITY</p>
4	<p>IV. POLITICAL WILL AND LEADERSHIP ENGAGEMENT</p> <p>(5 minutes)</p>	<p>10 (i) In your opinion, how important do you think political will and leadership engagement for high quality ECHO implementation.</p> <p>Can you share examples to exemplify this?</p> <p>Is it important to assess? How best could this be assessed?</p> <p>10 (ii) What is your opinion on how well does political will, and leadership engagement gets assessed through the protocol and data collection tools?</p> <p>10 (iii) Specifically the provider surveys – does it assess political will adequately?</p> <p>10 (iv) Specifically does the FGD assess political will?</p> <p>10 (v)How about the readiness assessment survey? In your opinion does it assess adequately?</p> <p>10 (vi) Are you able to suggest other ways by which political will and engagement of leadership can be monitored/evaluated?</p> <p>PROBE TO UNDERSTAND CONSTRUCT VALIDITY</p>
4	<p>V. SESSION CONTENT</p> <p>(5 minutes)</p>	<p>11 (i) In context of ECHO session contents, what are your thoughts about what criteria are required for high quality implementation?</p> <p>11 (ii) In your opinion, how well does the facilitator score sheet assess ECHO session content and facilitation information?</p> <p>11 (iii) In your opinion, how well does the content assessment evaluation capture the data to assess quality ECHO implementation?</p> <p>11 (iv) How well in your opinion does the recommendation review tool assess capture and follow-up of recommendation?</p> <p>11 (v) What other ways are you able to suggest assessment of ECHO sessions?</p> <p>PROBE TO UNDERSTAND CONSTRUCT VALIDITY</p>

4	<p>VI. PUBLIC HEALTH IMPACT/SCALE-UP/EXPANSION</p> <p>(5 minutes)</p>	<p>12 (i) As you know Project ECHO is expanding in all the countries. The belief is that ECHO may be having public health impact. In your opinion, do you think it is important to assess public health impact into asses high quality implementation?</p> <p>12 (ii) What components of public health impact could be included for assessments?</p> <p>12(iii) How well do you think the provider surveys assess measuring public health impact or assess scale-up and expansion potential?</p> <p>12(iv) Specifically, does the FGD assess measuring impact and scale-up and expansion related factors?</p> <p>12(v) How well does the readiness assessment measure public health impact as well as expansion potential?</p> <p>12(vi) How about the readiness assessment survey? In your opinion does it assess adequately?</p> <p>12 (vii) How well does the iECHO analysis tool measure public health impact routinely?</p> <p>12 (viii) Is there any other way public health impact could be assessed? How about scale-up and expansion plans?</p> <p>PROBE TO UNDERSTAND CONSTRUCT VALIDITY,</p>
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(5 minutes)

13. What changes could you recommend for improvements to the evaluation framework or toolkit? Are we missing anything?

14. Do you have any other concluding reflections you would like to share with me?

Thank you very much for your time and sharing your invaluable experience with me. This will help validate this evaluation framework. I hope to publish the protocol and revise it based on the results from your recommendations that will help the ECHO community as they design or adapt some of these evaluation tools.

Appendix G: List of Documents for Document Review

#	Type of document (Internal or widely available)	Title of document	Country (Continent) Stakeholder involved	Date of Report/Publication	Eligible (Yes/No)	Public Health Program Focus	No of pages	Data Collection methods described in the documents reviewed
1	Evaluation Report and slides (Internal)	Strengthening the Quality, Accessibility and Sustainability of the National Health Laboratory Services (NHLS): Report on assessment of implementation of pilot phase of Project ECHO in Tanzania	Tanzania (Africa) Tanzania Health Promotion Services, MOH, CDC-TZ, US CDC, UNM	September 2018	Yes	HIV Point of Care (POC) Testing or a Lab ECHO (5 sites)	28 pages, 31 slides	(i)Literature review (ii) KII
2	Evaluation Report (Internal)	Evaluation of pilot implementation of Project ECHO Tanzania: A model of tele mentoring to build healthcare worker capacity in HIV care and treatment (3 sites)	Tanzania (Africa) Columbia University's ICAP, MOH, CDC-TZ, NCACP	October 2019	Yes	HIV Clinical ECHO (12 sites)	86 pages	(i)Quantitative surveys (ii) focus group discussions (FGD) and in-depth interviews (IDIs) with participating health providers; and(iii) assessments of knowledge, self-efficacy and professional satisfaction using standardized questionnaires. Cost assessment
3	Secondary data analysis on routinely collected QI data	Quarterly Survey to assess participant satisfaction with clinical ECHO	Tanzania (Africa) University of Maryland, US CDC	December 2019	Yes	HIV clinical ECHO (30 sites)	2 pages, 18 slides	Comparing 2 quarter survey (15 questions) on satisfaction (Moore's Level 1 and 2) conducted in Aug and Nov 2018
4	Evaluation planning meetings	Notes and minutes from 14 steering committee meetings	Tanzania (Africa)	July 2019-March 2020	No	HIV Clinical ECHO (70 sites)	14 meetings	NA

#	Type of document (Internal or widely available)	Title of document	Country (Continent) Stakeholder involved	Date of Report/Publication	Eligible (Yes/No)	Public Health Program Focus	No of pages	Data Collection methods described in the documents reviewed
	minutes (internal)		CDC-TZ, UNM, MOH, USCDC					
5	Evaluation planning meetings minutes (internal)	Notes and minutes from 9 steering committee meetings	India (Asia) CDC-IN, US CDC, NITRD, UNM	Aug 2017- December 2019	No	TB ECHO (3 sites)	9 meetings	NA
6	Peer-reviewed <i>Journal of Cancer Education</i> https://doi.org/10.1007/s13187-019-01589-0 (widely available)	Capacity Building of Gynecologists in Cancer Screening through hybrid training approach	India (Asia) National Institute of Cancer Prevention and Research, Indian Council for Medical Research	July 2019	Yes	Cancer screening	7 pages	Online and face-face training comparison. 32 gynecologists were trained through a 14-week training module via zoom (April - July 2018) that followed with a 3-day in-person training. Pre-post knowledge check (5 cervical + 5 breast cancer related questions) on effectiveness of ECHO vs. hands on training.
7	Peer-reviewed <i>Journal of Cancer Education</i> https://doi.org/10.1007/s13187-019-01549-8 (widely available)	Project ECHO: a Potential Best-Practice Tool for Training Healthcare Providers in Oral Cancer Screening	India (Asia) National Institute of Cancer Prevention and Research, Indian Council for Medical Research	May 2019	Yes	Oral cancer screening and Tobacco cessation	7 pages	Pre-post intervention knowledge assessment

#	Type of document (Internal or widely available)	Title of document	Country (Continent) Stakeholder involved	Date of Report/Publication	Eligible (Yes/No)	Public Health Program Focus	No of pages	Data Collection methods described in the documents reviewed
8	Evaluation report. https://www.pedaids.org/resource/replicating-the-echo-model-for-mentorship-in-cote-divoire/ (widely available)	Replicating the ECHO model for HIV/AIDS mentorship in Cote d'Ivoire	Côte d'Ivoire (Africa) MOH, CDC Côte d'Ivoire (CDC Mission), USCDC, Elizabeth Glaser Pediatric AIDS Foundation (EGPAF)	Sep 2019	Yes	HIV care and treatment (PEPFAR)	99 pages	Pre- and post-evaluation using quantitative and qualitative methods of a six-month pilot of the Tele ECHO. Distance Learning Model in Côte d'Ivoire. The aim of the evaluation was to determine if the ECHO model (i) improved the knowledge and skills of health care providers and teams to provide high-quality HIV care
9	Evaluation Report (internal)	The Namibian Extension for Community Healthcare Outcomes (ECHO) Pilot Evaluation Report	Namibia (Africa) MOH, US CDC, CDC Namibia, EGPAF, UNM, International Training and Education Center for Health (I-TECH), Namibia Institute of Pathology (NIP), and the University of Washington (UW)	March 2017	Yes	HIV care and treatment (PEPFAR)	115 pages	Survey Focus groups Individual in-depth interviews
10	Evaluation Report (Dissertation) (widely available)	Impact of HIV Project ECHO (Extension for Community Healthcare Outcomes) in Kazakhstan	Kazakhstan (Asia)	May 2018	Yes	HIV Care and Treatment (PEPFAR)	126 pages	Participant surveys, FGD, KII

#	Type of document (Internal or widely available)	Title of document	Country (Continent) Stakeholder involved	Date of Report/Publication	Eligible (Yes/No)	Public Health Program Focus	No of pages	Data Collection methods described in the documents reviewed
	through Scopus)		Kazakh Medical University for Continuous Education (KazMUCE), Columbia University ICAP, US CDC					
11	Evaluation protocol (internal)	Evaluating the effect of the Zambia “Extension for Community Healthcare Outcomes (ECHO)” Tele-mentoring program on health worker knowledge, skills and practice for HIV service delivery	Zambia (Africa) MOH, JHPIEGO, CDC	Dec 2019	Yes	HIV and TB ECHO	9 pages	EMR rapid assessment, Health survey, Health worker FGD, Manager FGD, Patient outcome, Data abstraction to compare outcomes
12	Report to Congress (Widely)	Report to Congress: Current State of Technology-Enables Collaborative Learning and Capacity Building Models	All Project ECHO HHS, ECHO UNM, U.S. states and global countries who are adopting ECHO and ECHO like models (EELM)	Feb 2019	Yes	Variety of ECHO and ECHO like models	202 pages	Review of peer-reviewed journal articles, KII, Expert panel discussion
13	Slides to report evaluation, conceptual framework and indicators (internal)	ECHO's evaluation of the ECHO in South Sudan, findings of DoD HIV ECHO slide set	South Sudan (Africa) MOH, RTI, ICAP, CDC, ITEC (Washington State	Feb 2019	Yes	HIV ECHO (10 sites)	29 slides	Outcome assessment pre-post ECHO of 6 key PEPFAR Monitoring indicators , satisfaction surveys, FGD, WhatsApp assessments

#	Type of document (Internal or widely available)	Title of document	Country (Continent) Stakeholder involved	Date of Report/Publication	Eligible (Yes/No)	Public Health Program Focus	No of pages	Data Collection methods described in the documents reviewed
			Univ), DOD					
14	Evaluation report not received	Evaluation findings from the Central America Region	MOH, CDC, Le Comisca	-	No	-	-	-
15	HRSA Skills Sharing program Interim Evaluation Report (internal)	Qualitative findings for year 2 on HRSA's Skills Sharing Program using ECHO in Uganda	Uganda (Africa) Center for AIDS prevention studies, UCSF, MOH, HRSA	Nov 2019	Yes	HIV ECHO Skills sharing and expertise for QI	22 pages	Qualitative discussion to gather perspectives on experiences of the skill sharing experiences, and observations

Appendix H: MAXQDA analysis output

Figure 1: Co-occurrent code

Code System	CoP	Facilitators	Barriers	Capacity Building	Engagement	Knowledge gain	Training	Self-Confidence	Interaction	Exp
CoP										
Facilitators										
Barriers										
Capacity Building										
Engagement										
Knowledge gain										
Training										
Self-Confidence										
Interaction										
Expanding partnerships										
Resources										
communication										
Logistics										
IT										
Political will										
Language										
Leadership engagement										
Session content										
Session Facilitation										
Session Interaction during sessions										
Session Engagement										
Motivators and incentives										
Change in practice										
Recommendation review and follow-up										
Acceptable, usable, feasible										
Procedures and policies										
Impact										
Documentation										
M&E										
Other emergent codes										
zoom utility										
Ripple effect										
Scale up and expansion										
Sustainability										
Others										
SUM	281	260	230	172	112	237	58	46	60	

Figure 2: MAXMap to compare and contrast themes from India and Tanzania

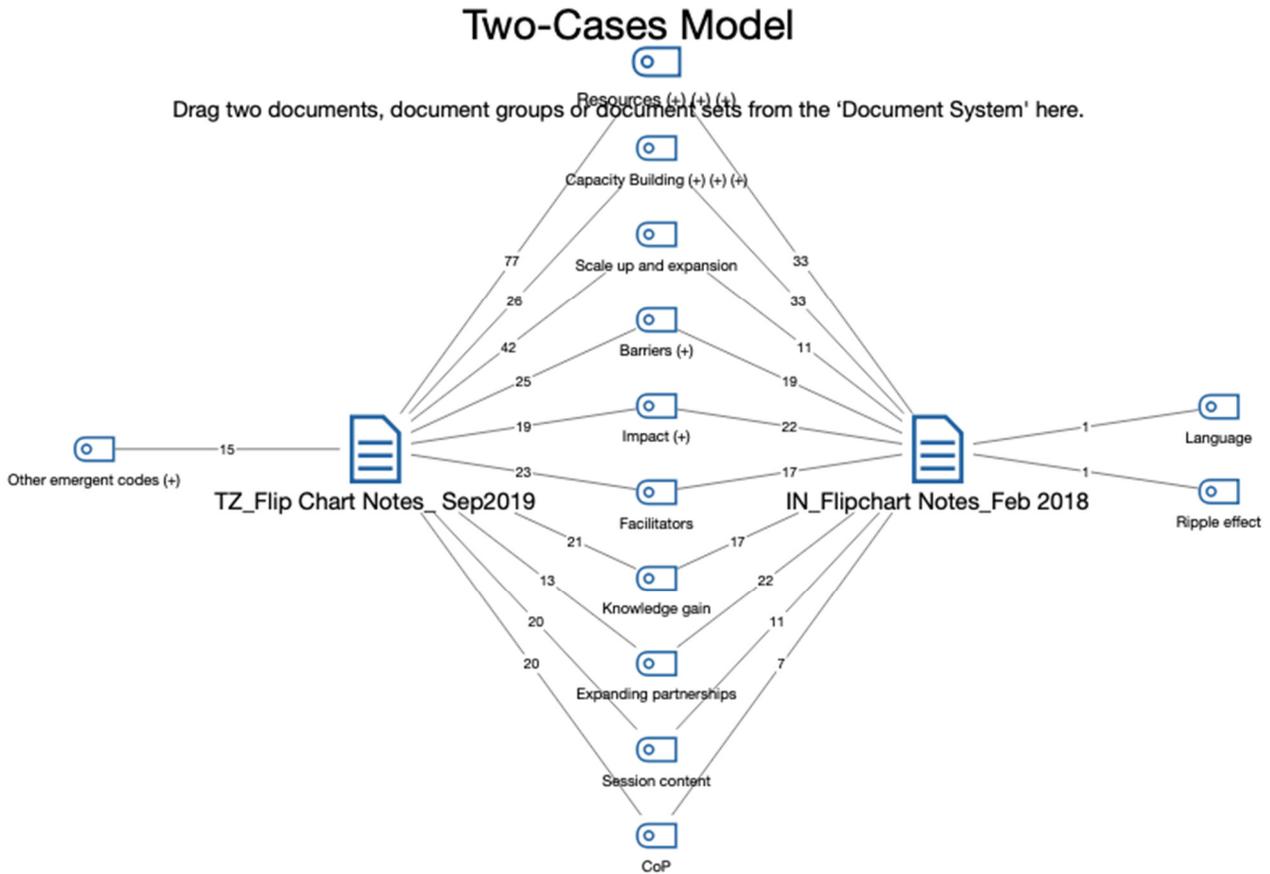


Figure 3: Code maps to enable focusing on main constructs of interest

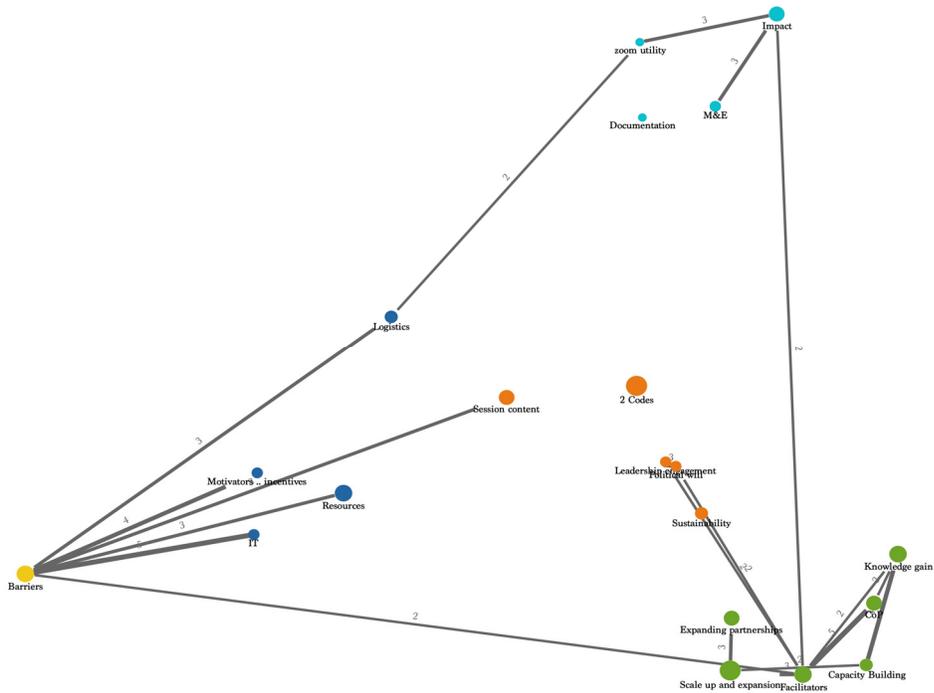


Figure 4. . Inter-coder reliability for Key-Informant Interviews

Document	Agreements	Disagreements	Percent	Kappa (RK)
KI-6	65	25	72.22	0.72
KI-5	63	27	70.00	0.70
<Total>	128	52	71.11	

Document	Agreements	Disagreements	Percent	Kappa (RK)
KI-6	99	25	79.84	0.80
KI-5	101	23	81.45	0.81
<Total>	200	48	80.65	

Code	Agreements	Disagreements	Total	Percent
Evaluation Framework (EF)	0	2	2	0.00
Frequency of EF	2	0	2	100.00
Acceptability and Feasibility of EF	1	1	2	50.00
Other comments on EF	2	0	2	100.00
Survey	2	0	2	100.00
Survey/Administrator	1	1	2	50.00
Survey/Frequency	2	0	2	100.00
Session content (SC) review	2	0	2	100.00
SC	0	2	2	0.00
SC/Administrator	2	0	2	100.00
SC/Frequency	2	0	2	100.00
Readiness assessment (RA)	1	1	2	50.00
iECHO	2	0	2	100.00
iECHO/Administrator	1	1	2	50.00
Appreciative Inquiry (AI)	2	0	2	100.00
AI/Frequency	2	0	2	100.00
AI/Challenge	2	0	2	100.00

Figure 5. Code Relation Matrix to analyze the 9 KIIs

Code System	KI-1	KI-2	KI-3	KI-4	KI-5	KI-6	KI-7	KI-8	KI-9	SUM
Challenges of the framework										13
Evaluation framework										28
Other										12
Definition of ECHO										5
gaps in framework or data collector										6
other tools or indicators or assessm										4
iECHO review tool										14
M&E										8
KII										7
Participation Incentives										1
Administrator										0
Frequency										0
Session content review										24
Session reviews who conducts it										10
Readiness Assessment										11
FGD										27
survey										22
who conducts survey										3
Factors defining HQ ECHO										15
AI_challenge										3
AI_implementer										4
AI_timing and frequency										9
AI_feasibility										10
SUM	65	19	18	19	27	27	20	10	31	236

Figure 6. Code Matrix Browser to examine patterns between 2 different data sources such as the SCORE FGD and KII

Code System	TZ_Flip Chart Notes...	IN_Flipchart Note...	KI-1	KI-2	KI-3	KI-4	KI-5	KI-6	KI-7	KI-8	KI-9	SUM
Expanding partnerships	■	■										35
Resources (+) (+) (+)	■	■										110
Internet connection related (+)	■	■		●						●		21
Political will	■	■	●		●	●	●	●	●	●		30
Leadership engagement	■	■					●					16
Session content	■	■					●					32
Session Facilitation	■	■					●					10
Session Interaction during sessions	■	■		●		●	●				●	17
Session Engagement	■	■					●					13
Motivators and incentives	■	■			●			●				23
Change in practice	■	■		●			●					7
Recommendation review and follow-up	■	■		●								8
Impact (+)	■	■	●	●			●	●		●	●	48
M&E	■	■									●	25
Capacity Building (+) (+) (+)	■	■			●		●					62
Scale up and expansion	■	■	●	●					●			55
Sustainability	■	■							●			28
SUM	309	177	5	7	4	3	16	3	4	3	9	540

APPENDIX I: Paper 2 Appendices

Appendix 2: ECHO Participant survey

What is this survey? What are the possible risks and benefits to participating in this survey?

We are interested in your experience with the Tanzania HIV ECHO program. This is an anonymous online survey including 80 questions. This survey is part of a larger effort to pilot test data collection tools for a framework to monitor and evaluate HIV ECHO program implementation, assess program impact through the development of a community of practice, and assess individual satisfaction and learning. You are invited to participate since you have attended at least one HIV ECHO session in 2018 or 2019. Your participation is voluntary. If you choose not to participate, it will not affect your ability to attend current or future ECHO sessions. There are no potential risks to participating in this survey.

The survey will take approximate 30 minutes to complete. You may also save this survey if you are unable to complete it in one sitting and submit after you complete it. You can choose to stop at any time, even if the survey is not complete. We will not collect any personally identifiable information; all information provided will be protected by the survey team. Only members of the independent study team will have access to your responses. We will not share any individual responses with anyone for any reason. Your responses will help inform our recommendations to improve the quality of Tanzania HIV ECHO program and services. An aggregated summary of all participant responses will be available at the conclusion of the analysis. If you have any questions about this survey, or your participation, please contact the study principle investigator:

PI details

Participant Consent:

Signature (enter your initials)

Name of your organization:

By clicking the “Accept” icon below, you are acknowledging you understand the purpose of the survey and accept the potential risks of participating in the survey. Your participation is voluntary. If you choose not to participate, it will not affect your ability to attend current or future ECHO sessions.

Survey Format and Questions:

Thank you for agreeing to participate! We deeply appreciate your frank and honest responses to the following questions. Your opinion matters. Your responses will help inform our recommendations to improve the quality of Tanzania HIV ECHO program.

1. What is your involvement in the HIV ECHO program?

- Participant only
- Participant faculty (Personally presented at least one case or didactic material)
- ECHO Subject Matter Expert who has facilitated at least one case presentation or presented a didactic presentation

2. Where do you typically attend ECHO sessions?

- In an enclosed space (e.g., walled office, meeting room, conference hall)
- In an open space (e.g. cubicle, other structure without a door)

3. When you attend ECHO sessions at your facility, how many persons accompany you in the same room?

- I attend alone
- 1 – 5 people
- 6 – 10 people
- 11 – 15 people
- more than 15 people

4. What equipment do you typically use when participating in ECHO sessions?

- Professionally installed video conferencing equipment (e.g. high-quality web-camera, high-definition screen)
- Video-enabled computer with external projection screen
- Video-enabled computer individual screen
- Computer without video capability (i.e., I can see and hear session material, but others cannot see me)
- Dial in using a smart phone (i.e., I can see and hear session material, and others cannot see me)

Dial in using a phone (i.e., listening only; I cannot see material; others cannot see me)

5. Approximately how many ECHO sessions have you attended?

1

5b.) Please share why you were not able to join more than 1 session:

- My facility just joined ECHO
- Not interested
- Not applicable to my work
- No time to participate
- No equipment to connect
- Not supported by my boss
- Other: _____

2-5

6 – 10

11 – 20

21 – 50

>50

I never missed a single session! :)

6. Please identify the challenges that keep you from attending the HIV ECHO sessions. (Check all that apply)

- Busy patient schedule
- Other professional activities such as conferences, lectures
- Family commitments
- Traffic delays during the commute to work
- I forget/I do not receive reminders
- Other _____

Please describe and comment on ways to address the barriers, if any, that you encounter:

7. What best describes your current position? (Choose only one)

- a. Physician
- b. Medical officer
- c. Assistant medical officer
- d. Clinical officer
- e. Assistant clinical officer
- f. Medical attendant
- g. Registered nurse
- h. Enrolled nurse
- i. Assistant nursing officer
- j. Pharmacist
- k. Pharmacy technician
- l. Laboratory assistant
- m. Laboratory technician
- 1) Assistant laboratory technician
- 1) Physiotherapist
- p. Peer educator
- q. Data officer
- r. Community health worker
- s. Information technology
- t. Student

8. For how long have you been working in this position?

- Less than one year
- 1 – 5 years
- 6 – 10 years
- More than 10 years

9. For how long have you been working in the field of HIV care and treatment?

- Less than one year
- 1 – 5 years
- 6 – 10 years
- More than 10 years

10. How did you obtain your HIV education and training? (Check all that apply)

- Medical or Nursing College
- On-the-job training
- Instructor-led seminars and workshops
- Self-study modules
- Online coursework
- Clinical mentor
- Professional conferences and meetings
- Other; please describe: _____

11. Have you obtained specialized training for HIV treatment, prevention, and care in the last 2 years, aside from participation in the HIV ECHO program?

- Yes
- No

11 b.) If yes, please provide information about the name/type and length of the training, and the name of the institution that provided the training.

12. What best describes your level of supervision?

- I have no supervisory responsibilities
- I supervise others

13. What best describes your professional practice?

- Public practice only
- Private practice only
- Both public and private practice

14. On an average day, how many HIV patients do you provide service for?

- None

- 1 – 5
- 6 – 10
- 11 – 20
- 21 - 50
- 50 – 100
- 100+

15. Do you have access to a video-enabled computer or laptop that you can use regularly?

- Yes, computer/laptop
- No

16. Do you own or have access to a smart phone or tablet that you can use regularly?

- Yes
- No

17. At your institution, do you have access to the following facilities (Check all that apply):

- Professionally installed video conferencing equipment (e.g. high-quality web-camera, high-definition screen)
- Video-enabled computer with external projection screen
- Video-enabled computer individual screen
- Computer without video capability (i.e., I can see and hear session material, but others cannot see me)
- I don't have access to technology at my institution, I travel to other places to participate in ECHO

18. Check the option that best applies to your interaction with computers

- I have very little or no experience with computers (no experience)
- I can operate computers with assistance from others (novice user)
- I can operate without assistance from others (average user)
- I am the one usually assisting others who have trouble with computers (expert user)

19. How often do you check email?

- I do not use/check email
- At least monthly
- Once or twice week
- At least once a day
- At least once an hour
- As soon as I receive a message

20. Have you ever participated in an on-line or distance learning course other than HIV ECHO?

- Yes
- No
- Not sure/Don't know

21. In the past 12 months, how did you access professional development activities? (Check all that apply)

- Attending in-person training within my facility
- Attending virtual trainings such as ECHO within my facility
- Attending virtual trainings such as ECHO outside my facility but within my region, so I have to travel off-site
- Attending in-person courses outside my facility but within my region, so I have to travel off-site
- Traveling outside my region to attend in-person trainings/courses/lectures
- Comment on other trainings attended _____

Please reflect on professional development, learning in the context of the HIV ECHO sessions that you attended. Choose the option that best reflects your opinion.

22. I attend ECHO sessions to learn new information

Strongly Agree Agree Not sure Disagree Strongly

Disagree

23. I attend ECHO sessions to interact with my colleagues

Strongly Agree Agree Not sure Disagree Strongly

Disagree

24. I attend ECHO sessions because I am required to participate

Strongly Agree Agree Not sure Disagree Strongly

Disagree

25. I attend ECHO sessions because my institution/supervisor asked me to represent them

Strongly Agree Agree Not sure Disagree Strongly

Disagree

26. I attend ECHO sessions for my personal growth

Strongly Agree Agree Not sure Disagree Strongly

Disagree

27. I attend ECHO sessions because my colleagues attend it

Strongly Agree Agree Not sure Disagree Strongly

Disagree

28. I usually learn something new during an ECHO session

Strongly Agree Agree Not sure Disagree Strongly
Disagree

29. ECHO sessions are repetitive

Strongly Agree Agree Not sure Disagree Strongly
Disagree

30. During ECHO sessions, Subject Matter Experts (SMEs) and participants are equals

Strongly Agree Agree Not sure Disagree Strongly
Disagree

31. ECHO faculty are well-prepared for each session

Strongly Agree Agree Not sure Disagree Strongly
Disagree

32. I feel comfortable asking questions during ECHO sessions

Strongly Agree Agree Not sure Disagree Strongly
Disagree

33. ECHO faculty are engaging and encourage interactions between participants during each session

Strongly Agree Agree Not sure Disagree Strongly
Disagree

34. I feel I can contact ECHO SMEs outside of ECHO sessions for clinical support or assistance

Strongly Agree Agree Not sure Disagree Strongly
Disagree

35. ECHO sessions take away time from other important activities

Strongly Agree Agree Not sure Disagree Strongly
Disagree

36. Since participating in ECHO, I am more likely to discuss my HIV clinical experience with my colleagues on a regular basis

Strongly Agree Agree Not sure Disagree Strongly
Disagree

37. I enjoy learning from the experiences of my peers

Strongly Agree Agree Not sure Disagree Strongly
Disagree

38. HIV ECHO has improved my confidence in treating HIV patients

Strongly Agree Agree Not sure Disagree Strongly
Disagree

39. The short presentations (termed as didactic portions) during the ECHO sessions are an effective way for me to learn about best practices in patient care

Strongly Agree Agree Not sure Disagree Strongly
Disagree

40. The didactic presentations during the HIV ECHO sessions provide me with useful up-to-date knowledge

Strongly Agree Agree Not sure Disagree Strongly
Disagree

41. The case-based discussions during the HIV ECHO sessions are relevant to my clinical practice

Strongly Agree Agree Not sure Disagree Strongly
Disagree

**42. I have changed my treatment plan for at least one patient based on the information learned during
a HIV ECHO session**

Strongly Agree Agree Not sure Disagree Strongly
Disagree

**43. I use the knowledge gained during HIV ECHO sessions to improve the quality of care of my
patients**

Strongly Agree Agree Not sure Disagree Strongly
Disagree

44. I think my patients are benefiting from what I learn during ECHO sessions

Strongly Agree Agree Not sure Disagree Strongly
Disagree

45. Please describe how your patients benefit from what you learn during ECHO sessions:

46. I am interested in joining other Project ECHO sessions outside of HIV

- Strongly Agree Agree Not sure Disagree Strongly Disagree

Please reflect on logistics of ECHO sessions that you have attended. Choose the option that best fits your opinion.

47. Which segment of the HIV ECHO sessions do you like the most? (Select best option)

- Didactic lecture presentation
 Case presentation
 Discussion
 No preference

48. The HIV ECHO sessions usually last about an hour. What do you think about the length of each session?

- Too long Just right Too short

49. Please circle two best days/times (AM/PM) you would like to attend the ECHO sessions.

- Monday AM Monday PM Tuesday AM Tuesday PM
 Wednesday AM Wednesday PM Thursday AM Thursday

PM

- Friday AM Friday PM

50. Please suggest session topics that would be helpful for your clinical practice.

TOPICS:

1. _____ 2. _____ 3. _____ 4. _____

51. How frequently do you share the information from HIV ECHO sessions with colleagues who are unable to attend ECHO sessions? (Select best option)

Always Frequently Sometimes Seldom Never

52. How frequently would you like the HIV ECHO sessions to take place?

- Once a week
 Once a month
 Twice a month
 Quarterly
 Other _____

53. Do you think HIV ECHO sessions should continue?

Yes No Not sure

53 b.) Please explain why not/not sure: _____

When you think of high-quality ECHO implementation, choose the option that best reflects your opinion.

54. My institute has ECHO champions who support my participation

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

55. MOH has leadership support to improve HIV ECHO implementation

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

56. UMB has leadership support to improve HIV ECHO implementation

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

57. NACP has leadership support to improve HIV ECHO implementation

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

58. UMB requires external support to implement the HIV ECHO programme

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

59. MOH has stable and sustainable funding support to implement HIV ECHO

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

60. UMB has stable and sustainable funding support to implement HIV ECHO

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

61. MOH provides technical assistance to help me manage my complicated HIV cases

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

62. UMB provides technical assistance to help me manage my complicated HIV cases

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

63. MOH encourages HIV ECHO participation from a variety of stakeholders, such as private colleges, private hospitals or other partners outside the public sector

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

64. UMB encourages HIV ECHO participation from a variety of stakeholders, such as private colleges, private hospitals or other partners outside the public sector

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

65. HIV ECHO sessions demonstrate commitment towards HIV epidemic control, through improved treatment outcomes of complicated HIV or HIV-TB co-infected cases

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

66. MOH has appropriate logistics and infrastructure to coordinate and expand ECHO sessions to all districts in Tanzania

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

67. UMB has appropriate logistics and infrastructure to coordinate and expand ECHO sessions to all facilities in Tanzania

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

68. UMB documents and follows up with recommendations that were shared during HIV ECHO sessions

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

69. Results from quarterly surveys at ECHO sessions inform ECHO implementation

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

70. UMB has effective communication strategies in place to maintain support of partners

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

71. MOH has effective communication strategies in place to maintain support of partners

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

72. UMB's goals and objective for ECHO are clear to all stakeholders

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

73. MOH's goals and objective for ECHO are clear to all stakeholders

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

74. UMB has long-term vision and plans for ECHO that are shared with all stakeholders

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

75. MOH has long-term vision and plans for ECHO that are shared with all stakeholders

Strongly agree Agree Not sure Disagree Not Applicable/Don't know

76. In your opinion, are there other considerations that make ECHO implementation high quality?

Please list 3 important ones that come to mind:

- 1.)
- 2.)
- 3.)

Appendix 3A: Focus Group Discussion Guide for Facility HIV ECHO Health Care Providers (HCPs)

Date	__ __ / __ __ / __ __ (mm/dd/yy)
Facilitator initials	
Co-facilitator initials	
Start Time	__ __ : __ __ (hour/min)
End Time	__ __ : __ __ (hour/min)
Number of participants	__ __

Good morning/afternoon/evening. My name is _____. I am from University of Illinois, Chicago and am here to learn from you about the HIV ECHO program. My co-facilitator _____ is also with us today and will be assisting with our discussion and taking notes. We will also be audio recording the sessions. I would like to assure you that all responses and results will remain anonymous when we report the findings, so feel free to share openly and honestly. We ask all participants to respect the views and perspectives of their colleagues. There are no “right” or “wrong” answers, and everyone’s opinions are equally valuable to our study. Please refrain from interrupting others while they are speaking. If you want to add to a particular point, please raise your hand, I will do my best to call on you at an appropriate time. We ask that all present not share items discussed in the focus group outside the group.

There have been over 50 HIV ECHO sessions to date, please share:

- 1. Approximately how many ECHO sessions have you attended?**

- 2. Why do you participate in the HIV ECHO sessions? [7–10 mins]**

- 3. Please think about the last ECHO session you attended [20–30 mins]:**
 - a) How well did the brief lecture address your needs?

- b) In what ways do you see yourself using the knowledge you learned in the lectures?
- c) What do you think about the content, relevance, usefulness, and clarity of the presentation?
- d) How do you think what you learned may be applicable in-patient care and management?
- e) Can you think of your favorite part of the lecture? What did you like most about it?
- f) Can you give an example of one of the least favorite parts of the didactic presentation? What did you not like about it?

4. Please think about the last case study or didactic presentation you gave to share your expertise:

- a) What did you present? Case study or didactic presentation?**
- b) How long before your presentation were you contacted by UMB staff? Was this sufficient time to prepare?**
- c) How much time and effort did it take for you to prepare for the presentation?**
- d) Were you given any guidance or pointers on how to prepare your presentations? If so, please explain.**
- e) Were you able to include learning objectives for your didactic presentations?**
- f) For didactic presentations, what did you do to ensure high-quality course content?**
- g) How did you interact or engage with your audience during the ECHO session?**

4. Were you asked any questions DURING the session?

5. Did anyone reach out to you with questions or clarifications AFTER your presentation session?

6. Did you have a favorite part of the presentation? If yes, what? If no, why not?

7. Did you have a least favorite part of the didactic presentation? What did you not like about it?

8. How do you suggest recommendations that either you or others provide at these ECHO sessions be documented? How were your recommendations documented and shared?

9. In your opinion, where do you think these recommendations could be documented? Stored? How should they be shared and with whom?

10. Should it be anyone's responsibility to document or follow-up with the recommendations that are provided at these ECHO sessions? If yes, who?

11. How often should there be follow-up in your opinion?

12. What words of advice do you have for a colleague who is planning to present a didactic presentation at an upcoming ECHO session?

13. What words of advice do you have for your UMB colleagues who are coordinating these ECHO sessions to implement high-quality HIV ECHO sessions?

14. As you know, there are plans to expand HIV ECHO to cover a larger number of facilities in Tanzania and/or becoming a super hub with zonal or regional hubs. In your opinion from your current experience, what are the 3 most important things that should be prioritized as this program is scaled up?

1.

2.

3.

15. Do you feel HIV ECHO may play a role in Tanzania's plan towards HIV-TB epidemic control? If yes, how? If not, why not?

16. Do you have additional comments or suggestions that you would like to share about HIV ECHO?

Appendix 3B: Focus Group Guide for HIV ECHO session participants

Good

Date	__ __ / __ __ / __ __ (mm/dd/yy)
Facilitator initials	
Co-facilitator initials	
Start Time	__ __ : __ __ (hour/min)
End Time	__ __ : __ __ (hour/min)
Number of participants	__ __

morning/afternoon/evening. My name is _____. I am from University of Illinois, Chicago and am here to learn from you about the HIV ECHO program. My co-facilitator _____ is also with us today and will be assisting with our discussion and taking notes. We will also be audio recording the sessions. I would like to assure you that all responses and results will remain anonymous when we report the findings, so feel free to share openly and honestly. We ask all participants to respect the views and perspectives of their colleagues. There are no “right” or “wrong” answers, and everyone’s opinions are equally valuable to our study. Please refrain from interrupting others while they are speaking. If you want to add to a particular point, please raise your hand, I will do my best to call on you at an appropriate time. We ask that all present not share items discussed in the focus group outside the group.

[Ice breaking exercise]: Before we start, let us go around the session and introduce ourselves and tell us 1 favorite place you have visited recently and why? [5 –10 mins]

There have been over 50 ECHO sessions to date, please share:

1. Why do you participate in the HIV ECHO sessions? [7–10 mins]

2. Please think about the last ECHO session you attended [20–30 mins]:

- a) How well did the brief lecture address your needs?
- b) In what ways do you see yourself using the knowledge you learned in the lectures?
- c) What do you think about the content, relevance, usefulness, and clarity of the presentation?
- d) How do you think what you learned may be applicable?
- e) Can you think of your favorite part of the lecture? Why?
- f) Can you give an example of one of the least favorite parts of the didactic presentation? What did you not like about it?

3. Please think about a recent patient case presentation where your colleagues presented [20–30 mins].

- a) Are the case presentations applicable to your practice? Do you encounter similar cases?
- b) How well does the case presentation and recommendation format address your needs to learning about HIV patient treatment, care and management?
- c) Have you used what you have learned from the ECHO session? In what ways did you use what you learn from the case-scenarios?
- c) What do you think about the content, relevance, usefulness, and clarity of the case-scenario presentations?

- d) Can you think of your favorite case scenario presentation? What did you like most about it?
- e) Can you give an example of one of your least favorite case presentations? What did you not like as much?
- f) In your opinion, what could be improved in the case presentations and discussions?

4. Do you feel comfortable asking questions during the ECHO clinic? If no, why not? How do you think this could be improved? [7–10 mins]

5. How have you been able to apply concepts or knowledge you learned during the HIV ECHO sessions to patients with similar problems in your practice? [7–10 mins]

6. How do you feel participating in the UMB HIV ECHO program has changed the way you work? Manage patients? If so, how? If not, why not?

7. How do you share “lessons learned” from HIV ECHO sessions with other colleagues? [15–20 mins]

- a) Please describe what facilitates or inhibits sharing information and practices that you learn at HIV ECHO with your colleagues

Probe: What forum do you use to share information with your team or other clinical staff in your health care facility? What are the obstacles in sharing information?

- b) Do you think other providers in your clinic would benefit from participation in the HIV ECHO?

8. What do you see are the advantages and disadvantages of the current ECHO sessions? [7–10 mins]

9. How do you document the recommendations? [7–10 mins]

10. In your opinion, where do you think these recommendations should be documented? And followed-up on? How often should there be follow-up? Who should be responsible for follow up in your opinion? [10–12 mins]

11. As you know, there are plans to expand HIV ECHO to states all over India. In your opinion from your current experience, what are the 3 most important things that should be considered or prioritized as this program is expanded? [15 – 20 mins]

1.

2.

3.

12. If you could redesign HIV ECHO? What aspects would you change? What aspects would you improve? What aspects would you remove? What aspects would you keep? [7–10 mins]

13. Do you feel HIV ECHO may play a role in HIV epidemic control in Tanzania? If yes, how? If no, why not? [7–10 mins]

14. Do you have additional comments or suggestions that you would like to share? [5–7 mins]

Appendix 3C: Focus Group Discussion Guide for TB ECHO Didactic/Case presenters/experts

Date	__ __ / __ __ / __ __ (mm/dd/yy)
Facilitator initials	
Co-facilitator initials	
Start Time	__ __ : __ __ (hour/min)
End Time	__ __ : __ __ (hour/min)
Number of participants	__ __

Good morning/afternoon/evening. My name is _____. I am from University of Illinois, Chicago and am here to learn from you about the NITRD TB ECHO program. My co-facilitator _____ is also with us today and will be assisting with our discussion and taking notes. We will also be audio recording the sessions. I would like to assure you that all responses and results will remain anonymous when we report the findings, so feel free to share openly and honestly. We ask all participants to respect the views and perspectives of their colleagues. There are no “right” or “wrong” answers, and everyone’s opinions are equally valuable to our study. Please refrain from interrupting others while they are speaking. If you want to add to particular point, please raise your hand, I will do my best to call on you at an appropriate time. We ask that all present not share items discussed in the focus group outside the group.

There have been over 50 ECHO sessions to date, please share:

- 4. Approximately how many ECHO sessions have you attended?**

- 5. Approximately how many patient case/didactic presentations have you prepared and presented?**

3. Please think about the last patient case presentation or didactic presentation you gave to share your expertise:

a) What did you present? Patient case or didactic presentation?

b) How long before your presentation were you contacted by UMB staff? Was this sufficient time to prepare?

c) How much time and effort did it take for you to prepare for the presentation?

d) Were you given any guidance or pointers on how to prepare your presentations?

e) Were you able to include learning objectives for your didactic presentations?

f) For didactic presentations, what did you do to ensure high-quality course content?

g) How did you interact or engage with your audience during the ECHO session?

4. Were you asked any questions DURING the session?

6. Did anyone reach out to you with questions or clarifications AFTER your presentation session?

6. Can you think of your favorite part of the presentation? Why? What did you like and dislike about this learning model? Thoughts about connecting via videoconference, thoughts about the case-study approach, thoughts about the brief didactic approach, thoughts about the community of practice interactive learning approach?

7. Can you give an example of one of the least favorite part of the didactic presentation? What did you not like about it?

8. How do you suggest recommendations that either you or others provide at these ECHO sessions be documented?

9. In your opinion, where do you think these recommendations should be documented? Stored? Shared with whom?

10. Should it be someone's responsibility to document or follow-up with the recommendations that are provided at these ECHO sessions? If so, who?

11. How often should there be follow-up in your opinion?

12. What words of advice do you have for your colleague who is planning to present the didactic presentation at the next ECHO session?

13. What words of advice do you have for your UMB partners who are coordinating these ECHO sessions to implement high-quality ECHO sessions?

14. As you know, there are plans to expand HIV ECHO to larger number of spokes, Tanzania ECHO becoming a super hub, scaling up to zonal/regional hubs. In your opinion from your current experience, what are the 3 most important things that should be prioritized as this program is expanded?

- 1.
- 2.
- 3.

15. Do you feel HIV ECHO may play a role in HIV epidemic control in Tanzania? If yes, why? If no, why not?

16. Do you have additional comments or suggestions that you would like to share?

Appendix 4A: ECHO Session Facilitation Scorecard to completed by Objective Reviewer after viewing each of the 3 session recordings

Date: _____

Observer/Scorer: _____

ECHO Session Date: _____

Facilitator Name: _____

Please rate the following statements based on the observed session: 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always 9 = Not Applicable	Never	Rarely	Sometime	Often	Always	Not Applicable
1. Hub facilitator identifies himself/herself						
2. Starts clinic on time (5 minutes flexibility)						
3. Hub facilitator ensures that all faculty: didactic and/or case presenter introduce themselves						
4. Identifies participants as they sign in						
5. Hub facilitator reminds participants to maintain confidentiality (HIPAA) – uses ECHO ID for case presentations						
6. Hub facilitator briefly reviews agenda						
7. Learning objectives for the session were clearly stated.						
8. Eliminates environmental distractions (avoids side conversations, rustling of papers, whispering, unnecessary gestures)						
9. The facilitator engages all group members						
10. Invites others to share experiences						
11. Summarizes patient case presentation in 5 to 6 sentences						
12. Provides evidenced-based peer-reviewed publications or national/international guidelines as needed to support recommendations given or to support discussion						
13. Shares his/her own experience in relation to the topic or case presented						

Please rate the following statements based on the observed session: 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always 9 = Not Applicable	Never	Rarely	Sometime	Often	Always	Not Applicable
14. Ensures some HIV related concepts or topics are imparted when providing recommendations						
15. Requests feedback from participants who are attending clinic via telephone and video						
16. Is encouraging and never makes negative, offensive, or disrespectful comments						
17. Encourages participants to introduce themselves prior to speaking						
18. Encourages participation by asking open-ended questions						
19. The facilitator keeps the clinic on track by managing time, providing coaching or guidance as needed						
20. Facilitator gently re-directs when someone is critical or confrontational to a colleague						
21. Hub facilitator is supportive, engaging, and listens to peers						
22. Creates a supportive learning environment by allowing participants the opportunity to answer questions and contribute to the discussion						
23. When addressing the participants, he/she faces the camera and makes eye contact.						
24. He/she uses clear and simple language						
25. Uses inappropriate responses as teachable moments						
26. Facilitator repeats questions/comments asked by participants when needed						

Additional comments from observations:

Appendix 4B – Didactic Content Review by Objective Reviewers

Please complete after viewing each of the 3 HIV ECHO sessions

Name of Reviewer: _____	Date Review Completed: _____
Presenter's Name: _____	ECHO Session Name: _____
Date of ECHO Session: _____	Start of review time: _____ End of review time: _____

Please rate the following statements based on the observed session: 1 = Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Not Applicable
Applicability and Clarity						
1.) The presentation learning objectives were clearly stated						
2.) The presentation was delivered simply and clearly						
3.) The slide content was free from errors						
4.) The presenter's narration was easy to follow						
5.) The presenter's narration matched the slide content						
Content validity						
6.) Didactic material was consistent with national/international standards of care						
7.) Didactic material was timely to current national/international standards of care						
8.) References and systematic evidence were cited as evidence for the Didactic material.						
Stakeholder Engagement						
9.) Responses to comments and questions from the audience were accurate and appropriate						
10.) The presenter was effective at engaging the audience						
11.) The presenter appeared well-prepared						
12.) The learning objectives were achieved						

Please rate the following statements based on the observed session: 1 = Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree				Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Not Applicable
	Very poor	Poor	Fair	Good	Excellent				
13.) Rate the overall quality of this didactic session									

Additional comments from observations:

Appendix 4C – Recommendation Review by Objective Reviewers

Please complete after viewing each of the 3 HIV ECHO sessions

Name of Reviewer: _____	Date Review Completed: _____
Presenter's Name: _____	ECHO Session Name: _____
Date of ECHO session: _____	Start of review time: _____ End of review time: _____

Please rate the following statements based on the observed session: 1 = Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Not Applicable
Applicability and Clarity						
10.) Recommendations offered to the case-presentation were delivered simply and clearly						
11.) Recommendations offered were applicable and relevant to the case-presentation						
12.) Recommendations offered were specific						
13.) Recommendations were unambiguous (e.g., not open to interpretation)						
14.) Recommendations offered were “actionable” (e.g., within the scope of responsibility of treating clinician)						
15.) Potential resource implications of applying the recommendations have been considered						
Content validity						
16.) Specific recommendations offered were consistent with national/international standards of care						
17.) Recommendations were timely to current national/international standards of care						
18.) References and systematic evidence were cited as evidence for recommendations.						

Please rate the following statements based on the observed session: 1 = Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree				Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree	Not Applicable
19.) Strengths and limitations of the recommendations are clearly described									
Stakeholder Engagement									
20.) The views and preferences of colleagues and other experts in the panel were sought when recommendations were presented									
12.) Encourages participation and questions from audience after recommendations are presented and discussed (e.g., "Are there any questions from audience?")									
Documentation and follow-up plan									
13.) A plan to follow-up and monitoring of the recommendations are shared with the audience/written notes									
	Very poor	Poor	Fair	Good	Excellent				
14.) Rate the overall quality of these recommendations									

Additional comments from observations:

Appendix 5

Routine HIV ECHO program and iECHO Review Data Collection Sheet

External objective (non-CDC Tanzania/UMB/MOH) evaluator will analyze data dump from iECHO sites and tracker tool

Objective for this analysis is to ascertain information collected currently, determine content, audience, need, reason, and frequency of use of this data. This tool will help synthesize quarterly participant barrier and satisfaction with ECHO.

- 1.) Number of HIV ECHO sessions conducted (Trends? Patterns of users – attended once, vs all):**
- 2.) Time period of analysis:**
- 3.) Number of topics covered:**
- 4.) Obtain list of all topics:**
- 5.) Number of participants attending each session:**
- 6.) Number of core faculty:**
- 7.) Number of guest/expert faculty:**
- 8.) Number of geographic locations of participation**
- 9.) Number and type of specialties**
- 10.) Number of Health center names**
- 11.) How is this information being shared currently?**
- 12.) With who is this data being shared? How often?**
- 13.) What would be useful to share? How often?**

14.) How is the communication via tracker correlating participants and topics on iECHO?

Benefits and Barriers Assessment:

Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The information presented has been relevant to my work	1	2	3	4	5
The information presented has increased my knowledge about HIV care and treatment	1	2	3	4	5
The information presented has increased my ability to better manage the care of my patients with HIV	1	2	3	4	5
The information presented has led me to make changes in my practice	1	2	3	4	5
Clinic duties do not prevent me from attending HIV ECHO	1	2	3	4	5
I get reminders to attend HIV ECHO	1	2	3	4	5
I am available to attend at the time of the HIV ECHO clinic	1	2	3	4	5
I feel comfortable speaking during an HIV ECHO session	1	2	3	4	5
I feel comfortable asking questions during and HIV ECHO session	1	2	3	4	5
I feel comfortable presenting a case during HIV ECHO	1	2	3	4	5

Professional Satisfaction Assessment:

Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel professionally isolated at work	1	2	3	4	5
I can connect with professional peers easily	1	2	3	4	5

I can easily access clinical specialists when I need professional feedback/assistance	1	2	3	4	5
I have an opportunity to share clinic experience with colleagues on a regular basis	1	2	3	4	5
I feel satisfied with my job	1	2	3	4	5
I am confident that I can improve the overall quality of services at my health facility	1	2	3	4	5

Appendix 6: Readiness Assessment Questionnaire

Semi-structured Interview to assess HIV ECHO Implementation readiness

(To be completed by a new HIV ECHO coordinator who is planning to implement HIV ECHO outside of Dar es salaam)

Completed by _____

on / / _____

(Date)

State: _____

(Please circle the correct responses)

1. Are you planning to start a HIV ECHO this year? **Yes/No/Not sure**

2. Did you engage with other HIV ECHO implementers prior to the launch of your HIV ECHO programme? **Yes/No/Not sure**
3. Who was/were they?
4. How did you communicate with these implementers?

5. Have you identified a target audience for your ECHO sessions? **Yes/No/Not sure**
 - a. If yes, are there varying skill sets and competencies within the target audience? **Yes/No/Not sure**
 - b. If not, how are you planning to develop the topics for your target audience?

6. Have you developed a curriculum for your programme? **Yes/No/Not sure**

7. If skills of target audience vary, have you developed a separate curriculum for each skill set and competency?

8. Have you identified “core faculty” to facilitate and implement your ECHO sessions? **Yes/No/Not sure**

9. If yes, have you developed a schedule for HIV ECHO sessions? **Yes/No/Not sure**
 - a. Case studies **Yes/No/Not sure**
 - b. Didactics? **Yes/No/Not sure**
 - c. Are the case studies related to the didactics? **Yes/No/Not sure**

(Please write the selected number in the boxes next to the questions)

	Assessment element	Strongly Agree 1	Agree 2	Neutral 3	Disagree 4	Strongly Disagree 5	Notes
10.	Do you believe that the ECHO model aligns with the broader HIV prevention and care activities of MOH to reach Tanzania HIV epidemic control strategy of 2022?						
11.	Do you believe that there may be funds/resources available outside your office to help implement and sustain HIV ECHO?						
12.	Do you believe that the ECHO model promotes partnerships for healthcare in Tanzania?						
13.	Do you believe that your organization's approach matches ECHO's philosophy of democratization of knowledge, bidirectional knowledge exchange, and removal of hierarchical learning?						
14.	Do you believe that the ECHO model will be seen as an important and valuable intervention for your program?						
15.	Could your organization easily integrate the ECHO model within existing organizational structures, workflows, and systems?						
16.	Do you believe that your team members (operations and hub) are aligned with the ECHO learning philosophy?						
17.	Do you believe you will be able to recruit experts in the field, who can serve as mentors to others during this intervention?						
18.	Do you believe your organization is sufficiently connected to other partners to support complex networks,						

	Assessment element	Strongly Agree 1	Agree 2	Neutral 3	Disagree 4	Strongly Disagree 5	Notes
	communications, and relationships required to sustain ECHO implementation?						
19.	Is your organization flexible, willing to make mid-course adjustments to ECHO implementation, as new tools, regimens and approaches emerge?						
20.	Are you financially able to pilot an ECHO project without external funding?						
21.	After reviewing a sample ECHO budget, do you believe your organization is willing and able to support the costs (staffing, financial, infrastructure, and opportunity costs) associated with the ECHO model through either personal, organizational, or external funding?						
22.	Have you attended an ECHO immersion-training program conducted by UNM?						
23.	Do you believe that the ECHO immersion training helps support training and implementation?						
24.	What is your plan to document recommendations provided during HIV ECHO sessions?						
25.	Is there a plan that recommendations given at a HIV ECHO session will be followed-up on?						
(i)	How?						
(ii)							

	Assessment element	Strongly Agree 1	Agree 2	Neutral 3	Disagree 4	Strongly Disagree 5	Notes
(iii)	Where will the recommendations be documented? How often are you planning to follow-up on the recommendations?						

26. Any other key considerations or concerns that is bothering you as you think about ECHO implementation?

27. What barriers do you anticipate before starting your ECHO sessions?

- | | |
|---|------------------------|
| (i) Cost | Yes/No/Not sure |
| (ii) Time spent on planning/coordination/implementation? | Yes/No/Not sure |
| (iii) ECHO equipment | Yes/No/Not sure |
| (iv) Broadband connection | Yes/No/Not sure |
| (v) IT support and training | Yes/No/Not sure |
| (vi) Available staff | Yes/No/Not sure |
| (vii) Training of staff | Yes/No/Not sure |
| (vii) Motivation of participants | Yes/No/Not sure |
| (ix) Knowledge need and understanding from participants (Stakeholder meeting) | Yes/No/Not sure |
| (x) Interest from participants | Yes/No/Not sure |

28. Do you have plans to routinely monitor or evaluate your HIV ECHO programs once they are implemented?

Yes/No/Not sure

28. (i) If there are plans, please elaborate:

29. Anything else that is worrying you that has not been mentioned previously?

30. Other comments: Anything that you wish you knew before you committed to initiating HIV ECHO program?

Thank you! (Asante!)

Appendix 7: Key-informant interview Guide

Assess feasibility of implementing the evaluation framework with compendium of tools to measure high-quality ECHO implementation routinely

Introduction, explanation of the process and consent review:

As you are aware, we are developing an objective framework to assess and monitor high-quality HIV ECHO implementation. This format will help us better understand your personal opinion of the process and tools we created, give you an opportunity to respond in greater detail, and offer suggestions for improvement. This semi-structured interview may take approximately 90 minutes. All of your responses will be kept confidential. Your participation has minimal risk and shall not affect your employment status, or relationship or collaboration with any of the ECHO programs and partners.

Your participation is completely voluntary. You need not respond to all questions. If you are unable or unwilling to respond to a specific question, please make me aware and we will move on to the next. We may stop the interview at any time should you become uncomfortable. I will be audio recording this interview to ensure that I accurately and completely capture your responses. Once the interview is complete, I will transcribe the recording into a word document, which I will share with you so that you can validate the accuracy. Once the transcript is complete, I will destroy today's recording. No names or other identifying information will be recorded.

Do you have any questions for me? Are you willing to participate in today's interview?

Signature:

Name:

Great, if you are ready to ready to begin, the first question is...

Date of Interview:

Role in ECHO implementation (UMB Implementer/ MOH/CDC-Tanzania staff):

Overall framework feedback	Questions	Responses

Factors to validate high-quality HIV-ECHO implementation

1.) Capacity building and knowledge dissemination

- 1.) Can you share an example of how you think HIV ECHO is building capacity by sharing knowledge on how to diagnose, treat, and manage complex HIV cases?
- 2.) What are some of the ways you promote knowledge dissemination to engage partners?
- 3.) Tell me what you think is the best way to routinely measure and monitor impact of the capacity building activities?
- 4.) In your opinion, which tools from the compendium could be used to measure knowledge dissemination and capacity building?
- 5.) The provider survey included some questions to measure impact. In your opinion, to what extent did the survey measure impact? What would you add to the survey that could measure impact of capacity building activities? What would you remove from the survey?
- 6.) How well do you think the FGD captures the results of probing questions on capacity building activities?
- 7.) Can you share your ideas on how capacity building activities should be monitored and evaluated as the national HIV ECHO expansion evaluation strategy?
- 8.) How often do you think capacity building should be measured? Continued Medical Education (CME) credit related questionnaires are usually administered after ECHO sessions end in other countries. Would you consider the standard 5-10 question CME survey a capacity building measurement [Probe: Every session, Quarterly, Semi-annually, Annually]
- 9.) How often should the survey be administered? And the FGD?
- 10.) Who should lead this effort? MOH? CDC Tanzania? UMB? Other?

<p>2.) Engaging partners</p>	<p>11.) What can you tell me about the partnerships you have built or expanded through HIV ECHO? [Probe: Who are these partners?]</p> <p>a. Are you satisfied with them? b. How did you recruit or engage them?</p> <p>12.) What does high-quality partnerships mean to you?</p> <p>13.) In your opinion, how would you measure establishment of such relationships with partners?</p> <p>14.) Can you give me an example of ways you could monitor quality of these partnerships, and who have been involved in these partnerships?</p> <p>15.) Can you share an example of how you think you can sustain these partnerships?</p> <p>[Probe: Since inception of ECHO, what are some of the ways you have been able to expand partners, and with who?]</p> <p>16.) Can you give an example of how you would measure the impact of partnerships routinely?</p> <p>17.) Who should be responsible for establishing partnerships? And measuring impact of such relationships?</p> <p>18.) The provider survey includes some questions to measure establishing partnerships. To what extent did the survey capture this?</p> <p>19.) How often should quality of partnership interactions partnerships be measured for M&E purposes? [Probe: Every session, Quarterly, Semi-annually, Annually]</p> <p>20.) What indicators do you think national HIV ECHO expansion evaluation strategy should include to measure impact of partnerships?</p>	
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<p>3.) Establishing communities of practice (CoP)</p>	<p>21.) Who should be responsible for monitoring this routinely?</p> <p>22.) What can you tell me about the establishment of communities of practice through HIV ECHO? <i>By community of practice, I mean a group of people who share a concern or a passion for something, so in this situation, HIV/TB, share knowledge and experience and learn how to do it better as they interact regularly through these HIV ECHO Sessions</i></p> <p>23.) What would such a community of practice look like?</p> <p>Probe: Membership? Activities?</p> <p>Probe: Do you consider yourselves building such communities of practice? Do you consider the current HIV ECHO a CoP?</p> <p>a. Are you satisfied with this CoP? Why? Why not?</p> <p>b. If not, what could you do differently?</p> <p>24.) What you think is the best way to measure and monitor ECHO communities of practice? In your opinion, how would you best monitor and sustain communities of practice?</p> <p>25.) How would you measure the <u>impact</u> of communities of practice?</p> <p>26.) In your opinion, which tools from the compendium could be used to measure community of practice and engage partners?</p> <p>27.) The provider survey and focus group guide included some questions aimed at measuring the impact of communities of practice. To what extent did the survey capture this? FGD?</p> <p>28.) How often do you think the impact of communities of practice should be measured? [Probe: Every session, Quarterly, Semi-annually, Annually]</p>	
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	<p>29.) Usually an effective ECHO program builds CoP. Who, in your opinion should be responsible for building communities of practice as ECHO is expanded?</p> <p>30.) Do you think national HIV ECHO evaluation strategy should include indicators to measure the impact of Communities of Practice?</p> <p>31.) Who should lead the effort to measure impact of CoP routinely?</p>	
<p>4.) Administration and Resources</p>	<p>32.) From your experience, about how much time, resources, and people are needed to implement a high-quality HIV ECHO?</p> <p>33.) How much time is spent coordinating individual sessions?</p> <p>34.) How much time is spent developing course content?</p> <p>35.) In your experience, who is coordinating/leading the administration and logistics of the ECHO sessions?</p> <p>36.) How much time do you think the experts (case presenters and didactic presenters) are spending on preparing for the sessions?</p> <p>37.) How much time is time spent recruiting faculty to present?</p> <p>38.) Can you give an example of when you have observed or heard about participants integrating lessons learned into practice?</p> <p>39.) Approximately how much time is spent on administrative aspects of ECHO activities?</p> <p>40.) How much time is spent on routine monitoring and evaluation activities?</p> <p>41.) How much time is spent on debriefing after ECHO sessions?</p> <p>42.) What resources would you wish you had for high-quality ECHO implementation?</p>	

	<p>43.) How important is it to monitor administrative and financial resources routinely?</p> <p>44.) Who should lead this effort for HIV ECHO management and administration of resources?</p>	
5.) Measuring public health impact	<p>45.) Give me an example of how you could measure the overall public health impact of ECHO? (E.g., measure if the sessions are improving patient care and outcomes)</p> <p>46.) How can some of these indicators be collected routinely?</p> <p>47.) What resources would we need for that?</p> <p>48.) How often should measuring public health impact be monitored in your opinion? [Probe: Every session, Quarterly, Semi-annually, Annually]</p> <p>49.) Who should lead this effort for measuring public health impact routinely?</p>	
6.) Course Content	<p>50.) Now that you have reviewed the results of the objective review of the course content, what are some of the things that resonated with you from that objective exercise?</p> <p>51.) What can be done to improve that process? What would you do differently?</p> <p>52.) What are your thoughts about next steps needed to improve and maintain the quality of your course content?</p> <p>53.) Does it make sense to do this objective review routinely?</p> <p>54.) In your opinion, how often should the course content get evaluated by third party, objective reviewers? [Probe: Semi-annually, Annually]</p>	

	<p>55.) How much do you think the medical community values continuing medical education (CME) credits for participants or certificates of appreciation to experts or case presenters?</p> <p>56.) Who would most value receiving official certificates or CMEs?</p> <p>57.) To what extent is such a CME system already established or how feasible would it be to establish one for this group?</p> <p>58.) What resources would need to be put in place for this system?</p> <p>59.) Who should lead this effort to manage quality and delivery of high-quality ECHO sessions?</p>	
<p>7.) IT and logistical support</p>	<p>60.) How would you rate on a 1 to 10 scale (1 being least and 10 being the best), the IT and logistical support from UMB?</p> <p>61.) What kinds of IT or logistical support have you sought assistance for?</p> <p>62.) How satisfied were you with the help you received?</p> <p>63.) What recommendations can you give for it to be improved?</p> <p>64.) What would be your advice for new HIV ECHO sites beginning implementation with regards to IT and logistic challenges?</p> <p>65.) How can they best remedy this challenge?</p> <p>66.) Are you familiar with the iECHO software?</p> <p>67.) Can you share your thoughts on how iECHO impacts your work or ECHO experience?</p>	

8.) Conclusion	Anything else you would like to comment on about HIV ECHO that I have not asked about?	
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STOP
unless interviewing an implementer

Preparation for HIV ECHO sessions (Ask implementers)

Pre-session preparation Activities	<p>Think back to a HIV ECHO session that you were particularly satisfied with:</p> <p>A. Tell me about the process of how you recruited the presenter?</p> <p>B. What information is shared with the case presenter to ensure integrity and relevance of the sessions?</p> <p>C. How long before a HIV ECHO session do you identify a case presenter to present a case from their practice?</p> <p>D. What information is shared with the didactic presenter to ensure integrity and relevance of the topics between sessions?</p> <p>E. Does someone from your team review the presentations prior to the session to ensure quality? That the content is accurate? Current and consistent with national guidelines? Free from commercial bias or other conflict of interest?</p> <p>F. Does someone from your team review the case presentations prior to the session to ensure quality? That the content is sufficient for others learning?</p>	
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	<p>G. In preparation for the session, does the course facilitator do any “prep work”? Reviewing guidelines? Conduct literature reviews? Become familiar with the didactic presentation? The case presentation?</p> <p>H. In preparation for the session, do the faculty mentors (experts) do any “prep work”? Reviewing guidelines? Conduct literature reviews? Become familiar with the didactic presentation? The case presentation?</p> <p>I. What are the most difficult parts of making all ECHO sessions go this well?</p>	
	<p>J. Thoughts on how iECHO or a system to monitor outcomes could be implemented in India?</p>	
Recommendations and Follow-up from ECHO sessions		
After ECHO sessions	<p>K. What kinds of processes are in place for systematically following up with recommendations?</p> <p>L. With respect to the individual case recommendations provided by faculty mentors, are there processes in place to systematically document the clinical recommendations? Are these recommendations added to the patient records in any way? If so, where? Are the recommendations only shared with the case presenter, or also with the entire community of practice?</p> <p>M. Can you think of an example of changes practice or policy following an ECHO session or recommendation? Do you think individual recommendations are applied to other patients or to future patients?</p>	
	<p>N. In your opinion, is there a way to ensure that individual recommendations given at a HIV ECHO clinic are acted upon?</p> <p>O. How often does your team follow-up on a previously presented case? If not happening now, do you think monitoring individual cases presented is important? If so, is it feasible? How often would case follow-up be reasonable?</p>	

	<p>P. Who should be responsible for following up and documenting after ECHO sessions?</p> <p>Q. What kinds of quality improvement processes do you have in place for any of the activities we have just discussed?</p> <p>R. Are there any grand rounds of presentation of problem cases or cohort review style in ECHO sessions?) Problems encountered and how they are being solved?</p>	
Conclusion	68.) Anything else you would like to comment on about HIV ECHO that I have not asked about?	
Design of the evaluation framework	<p>69.) Now that you have thought about the different concepts that were identified in the environmental scan workshop, what feedback do you have on the evaluation framework, compendium of tools, and some of the preliminary results, what is your impression of the evaluation framework (Appendix 1)? [Show Appendix 1]</p> <p>a.) What's your overall impression?</p> <p>b.) What changes would you recommend?</p>	

Summary Checklist (so to summarize what I heard from you are the following):

Factors to measure high-quality ECHO implementation	Tool(s)	Frequency of assessment	Who should be responsible?
Capacity building and knowledge dissemination	<ul style="list-style-type: none"> • SOAR Appreciative inquiry process to check-in six-month post HIV ECHO implementation • Provider survey • FGD 		
Engaging partners	<ul style="list-style-type: none"> • Provider survey 		

	<ul style="list-style-type: none"> • FGD • iECHO analysis 		
Expanding communities of practice	<ul style="list-style-type: none"> • SOAR process to check-in six-month post HIV ECHO implementation • Readiness assessment 		
Administration and resources	<ul style="list-style-type: none"> • Provider survey • SOAR Appreciative inquiry process to check-in six-month post HIV ECHO implementation • Readiness Assessment 		
Political will and support	<ul style="list-style-type: none"> • Provider survey • Readiness assessment 		
Content Review	<p>Objective content review tools:</p> <ul style="list-style-type: none"> • Facilitator session assessment • Content assessment • Recommendation review 		
Measuring public health impact	<ul style="list-style-type: none"> • Provider survey • Readiness assessment • iECHO analysis 		
Documentation of long-term outcomes	<ul style="list-style-type: none"> • FGD • Readiness assessment • Objective content review 		

70. What do you think should be the priority for the next steps?

Other comments?

APPENDIX J: CURRICULUM VITA

SMITA GHOSH, M.S.

KEY ACCOMPLISHMENTS

- Deployed to support CDC's COVID-19 State Health Department Section response to conduct case investigations to support an overwhelmed Arizona Department of Health Services during their recent surge in cases with SARS-CoV-2.
- Detailed as an epidemiologist for [CDC's 2014 Ebola response](#) activities where responsibility was to set up a system to coordinate pre-deployment epidemiologic and surveillance orientation for international deployers, and translating debriefing findings to impact surveillance/data management activities for the heavily affected countries of Liberia, Sierra Leone and Guinea.
- Support monitoring and evaluation (M&E) initiatives related to capacity building, systems strengthening, TB/HIV cascade analysis, data quality assessments/improvement, data analysis and visualization activities, and evaluation projects for United States' President's Emergency Plan for AIDS Relief ([PEPFAR](#)) countries.
- Led data quality, analysis, and capacity building activities related to case-based National Tuberculosis Surveillance System ([NTSS](#)), molecular surveillance, TB, HIV data quality, monitoring and evaluation with partners at global, federal, state and local health departments.
- Led the design, development, and implementation of U.S. Centers for Disease Control and Prevention's web-based Tuberculosis Genotyping Information Management System ([TB GIMS](#)).
- Led and co-authored several peer-reviewed abstracts and manuscripts.

EDUCATION

- | | |
|--------------------------|--|
| 08/2015 – Present | University of Illinois, Chicago, IL, USA
Doctor of Public Health candidate (Anticipated graduation - 2020)
Major: Public Health Leadership
Dissertation title: “ <i>Co-creating a comprehensive evaluation framework with compendium of tools to assess quality of Extension for Community Healthcare Outcomes (ECHO) implementation</i> ” |
| 01/1998 – 05/2000 | Tufts University, Boston, MA, USA
Master of Science
Major: Food Policy and Applied Nutrition
Minor: World Hunger, Malnutrition and Development
Other: Epidemiology, Biostatistics, Monitoring and Evaluation, Design, Operation and Management of Public Health Interventions |

07/1994 – 05/1997 **Delhi University, New Delhi, India**
Bachelor of
Science
(Honors)

WORK EXPERIENCE

01/2019 – Present **U.S. Centers for Disease Control and Prevention**
Center for Global Health
Division of Global HIV and
Tuberculosis Monitoring, Evaluation,
and Data Analytics Branch 1600
Clifton Rd NE
Atlanta, GA 30333 USA
Title: Epidemiologist (601 Series)

- Provide technical assistance and support for strengthening routine M&E systems, data quality, and data use at HIV clinics to establish data quality activities for HIV, TB disease and latent TB infection (LTBI) for HIV patients.
- Collaborate with multiple branches at DGHT, and Ministries of Health and implementing partner organizations in various countries for development and implementation of data quality improvement (DQI) activities and site level monitoring for HIV/TB indicators to improve HIV services.
- Lead development and delivery of trainings and capacity building activities for strategic information officers, M&E officials, implementing partners, site level health care workers on monitoring, evaluation, data quality and data analysis, and visualization activities.
- Coordinate efforts with Global TB Branch to develop strategies and DQA tools to monitor site level activities for Tuberculosis Preventive Therapy (TPT) implementation and scale-up.
- Work with designated country teams on M&E/strategic information related issues, to provide in-country support to identify, and address routine DQI challenges in Zambia and Botswana.
- Assist team lead and branch chief for obtaining funding opportunities for strategic information (SI) (P-NOFO) application.
- Review and support development of tools and procedures for program implementation related to HIV/TB prevention, including standard operating procedures, data collection tools, monitoring and evaluation materials, and training tools as needed.
- Review DGHT protocols related to TB/HIV related M&E activities in various countries.
- Provide support for the development of strategic M&E/data frameworks including indicators and logic models.
- Promote use and technical assistance for PEPFAR related data systems, e.g. Panorama, DATIM, and other ICPI Excel dashboard tools for data visualization and analysis activities.

03/2008 – 12/2018 **U.S. Centers for Disease Control and Prevention**
National Center for HIV/AIDS, Hepatitis, STD,
and Tuberculosis Division of Tuberculosis
Elimination

**Surveillance, Epidemiology and Outbreak
Investigations Branch 1600 Clifton Rd NE
Atlanta, GA 30333 USA
Title: Epidemiologist (601 Series)**

- Leading an analytic project to understand epidemiologic and laboratory factors for low sputum culture confirmation in six United States Affiliated Pacific Island jurisdictions (American Samoa, Commonwealth of Northern Mariana Island, Federated States of Micronesia, Guam, Palau, Republic of Marshall Islands),
- Serve as a national molecular surveillance expert to promote the application of molecular Tuberculosis (TB) surveillance for routine TB control and outbreak detection activities.
- Led the conceptualization, design, and implementation of a multiyear, multimillion-dollar project, Tuberculosis Genotyping Information Management System (TB GIMS) that enhances TB surveillance.
- Led development of instructional and training materials about molecular epidemiology data management and interpretation for the education and training of local, state, federal, and international TB control programs. Coordinate daily operations and long-term development of national molecular TB surveillance through Tuberculosis Genotyping Information Management System (TB GIMS).
- Coordinate and actively participate in outbreak detection and methodology activities related to system development, enhancements, user training and access activities. Perform data cleaning and analyses; produce summary reports and other ad hoc data requests of the national molecular TB surveillance system for internal and external partners.
- Serve as a national and international subject matter expert for molecular TB surveillance.
 - Provided mentorship and technical support for the annual Operations Research Course in India funded by United States Agency for International Development; train TB physicians in India to **develop of research protocols – to conceptualize, design, conduct, analyze data and ultimately publish research studies results in peer-reviewed journals.**
 - Conceptualized the design and implementation of a national latent tuberculosis infection (LTBI) surveillance system (STEMS) for Surveillance for TB Elimination Management System.
 - Developed and coordinated the implementation of analytic plan by analyzing data to evaluate diagnostic tests for detecting latent TB infection, namely tuberculin skin test (TST), the interferon- gamma release assays (IGRAs): QuantiFERON-TB Gold In-Tube® (QFT-GIT), and T-SPOT.TB® test (T- Spot).
 - Detailed as an epidemiologist for the Epidemiology Task Force during CDC's 2014 Ebola international outbreak's response
 - Coordinated pre-deployment trainings for epidemiologists who would fulfil data manager, surveillance or contact tracing responsibilities in West Africa.
 - Debriefed with returning epidemiologists about surveillance and data management activities/experiences in Sierra Leone, Liberia and Guinea to inform discrepant data cleaning, management, analyses, and interpretation.
 - Performed ad-hoc data requests to support epidemiologists in-country and answer information queries for leadership at CDC

- Past accomplishments:
 - Co-chaired “Translating Research into Practice” workgroup to ensure research findings are disseminated to practical applications in the field.
 - Provided expert technical support to several consortium sites of the Tuberculosis Epidemiologic Studies Consortium (TBESC) participate in epidemiologic analyses, manuscript drafting, editing and writing for peer-review publication.

**07/2005 – 02/2008 Texas Department of State Health Services
 Tuberculosis
 Services Branch
 1100 West 49th
 Street
 Austin, TX 78745
 USA
 Title: Epidemiologist**

- Coordinated all administrative and research-related activities of Tuberculosis Epidemiologic Studies Consortium for the State of Texas (a research initiative funded by Centers for Disease Control and Prevention) by assisting Principal Investigator (PI) in developing research proposals and budgets in response to funding announcements
- Organized, administered and coordinated annual Texas TBESC meeting to update Texas consortium members on TBESC research activities as well as foster collaborative efforts among State-level TB experts.
- Led development and dissemination of instructional and training materials on molecular epidemiology data management and interpretation to state and local nurses, epidemiologists and disease investigators.
- Provided epidemiologic consultation to local city, county, and regional health departments with regards to genotyping, tuberculosis disease transmission and outbreak management.
- Served as state-level subject matter expert for molecular TB surveillance and promoted the application of molecular TB surveillance and outbreak detection. Coordinated daily operations and long-term development of state-based molecular TB surveillance activities to laboratory-based records/results.
- Performed data cleaning and analyses; produce summary reports and other ad hoc data requests of the state molecular TB surveillance system for internal and external partners. Served as the primary liaison between CDC and DSHS for responding to genotype clusters, local genotype requests and sharing national genotype reports with all regional and local partners.
- Active member of DSHS Incident Report Response Team – ensured all reported TB cases were genotyped; once genotyped interpreted results were available, coordinated appropriate public health action to interrupt potential community transmission.
- Board member of DSHS Process Evaluation Committee to assist local TB control programs with program evaluation activities within Texas.
- Participated in Katrina and Rita public health emergency response activities as part of the Texas Incident Response Operations Center.
- Mentored students from University of Texas, Austin’s Public Health Internship Program as well as students who were part of CDC’s Disease Detective internship initiative.

**06/2003 – 06/2005 Texas Department of State Health Services
Regional Epidemiology Response Team – Health
Service Region 7 2408 South 37th Street
Temple, TX 76504 USA
Title: Epidemiologist**

- Functioned as a team lead for bioterrorism and public health preparedness for the Regional Epidemiology Response Team.
- Supervised a 3-member team (Public Health Nurse, Public Health Technician and Administrative Technician) supporting 30 counties – 23 served as the primary surveillance and epidemiology unit.
- Provided expert epidemiologic technical support and assistance to the 7 local health departments.
- Proposed, designed, initiated and, responded to infectious disease surveillance and outbreak investigations and studies (e.g. Influenza, *Shigella*, *Norovirus*, *E.Coli*, *Salmonella*).
- Coordinated outbreak investigations. Analyzed data, reported and presented recommendations and findings to affected communities/partners e.g. schools, long-term care facilities.
- Conducted active and passive disease surveillance and monitored disease trends within the region.
- Led influenza surveillance in the region during the influenza season.
- Provided training in “Disease surveillance, investigation and reporting” to infection control practitioners and public health nurses at rural hospitals.
- Coordinated regional disease and syndromic surveillance data
- Obtained training in Incident Command System (ICS) and participated in several public health preparedness related state and regional exercises. Assisted in emergency preparedness related activities for hospitals in the region.

**06/2002 – 12/2002 International Food Policy Research
Institute
Division: Poverty, Health
and Nutrition 2033 K Street
NW

Washington D.C. 20006-
1002 USA Title:
Research Analyst**

- Managed and analyzed large country datasets to produce country profiles on food security status to influence policies related to nutritional issues.
- Performed data cleaning and created documentation for reporting purposes.
- Created and maintained several databases to monitor progress of the project and assisted in report writing.
- Compiled a nutrition assessment table to calculate caloric intake for foods around the world.

**03/2002 – 5/2002 University of Massachusetts Medical School
Center for Health Policy
and Research 222 Maple
Avenue
Shrewsbury, MA
01545 USA Title:
Biostatistician**

- Designed, maintained and prepared documentation of research databases from various sources.
- Managed variety of databases including merging and updating existing databases.
- Collaborated with program staff and senior researchers on the design and analyses of various research projects.
- Provided tabular and written summaries and interpretation of analyses for project reports and deliverables.
- Analyzed large datasets on UNIX operating system by performing both descriptive and rigorous statistical analysis using SAS and SPSS.
- Trained program staff on the basics of the design and variables of the dataset

**06/2000 – 02/2002 Massachusetts Department of Public Health
Health and Addictions
Research Inc. 100
Boylston Street
Boston, MA 02116 USA
Title: Research Associate**

- Analyzed a large substance abuse management information system (SAMIS) database for Massachusetts Department of Public Health to produce public reports and fact sheets on high-risk populations such as adolescents, pregnant women, homeless children and injection drug users.
- Trained outreach workers for a federally funded, community-based, culturally specific approach to enhance substance abuse and HIV/AIDS prevention and treatment services for recently arrived refugee and immigrant populations.
- Responded to information requests from various governmental and non-governmental agencies, track and coordinate qualitative and quantitative data collection through focus groups and surveys.
- Led the publicity booth at American Public Health Association

**01/1999 – 05/2000 Tufts University
Human Nutrition Research
Center for Aging 711
Washington Street
Boston, MA 02111 USA
Title: Research Assistant**

- As part of the federal USDA project, managed a large dataset for the Massachusetts Hispanic Elderly Study analyzing relationship between food security indicators and outcomes among

Hispanic elderly in Massachusetts.

- Performed literature reviews on association of health and nutrition as it relates to nutritional guidelines in five Latin American countries.
- Maintained a bibliographical library of scientific publications and reports using Endnotes to facilitate proposal and publication writing.

INTERNSHIPS

06/1999 – 08/1999 **World Bank**
South Asia Regional Office
Health, Nutrition and
Population Unit 70 Lodi
Estate
New Delhi, INDIA

- Conducted literature review to assess food security status in India.
- Generated a report discussing the issues and suggesting recommendations related to the Integrated Child Development Services (ICDS) in Uttar Pradesh, India.
- Explored the correlation between food security issues, nutrition knowledge and practices focusing on intra-household food distribution and gender roles in the Indian context.

05/1998 – 08/1998 **Bangladesh Rural Advancement Committee**
Non-formal Primary Education and Research and
Evaluation Division 75 Mohakhali
Dhaka, 1212, BANGLADESH

- Assessed the outcomes of a health and nutrition education curriculum for adolescents attending non- formal primary schools.
- Designed survey instruments, trained and supervised local interviewers, administered data collection in the field. Entered and analyzed data using SPSS and presented findings to BRAC employees
- Generated a report highlighting the key findings and suggesting improvements to the curriculum.

01/1999 – 12/1999 **Tufts University**
Gerald J. and Dorothy R. Friedman School of Nutrition
Science and Policy 150 Harrison Avenue
Boston, MA 02111 USA

Graduate Teaching Assistant

Courses taught: Introduction to Nutrition (2 Semesters)

- Prepared lectures
- Graded homework assignments and research papers
- Held office hours for advising and tutoring

03/1998 – 05/1998 **Tufts University**

**Gerald J. and Dorothy R. Friedman School of Nutrition
Science and Policy International Food and Nutrition
Center
150 Harrison
Avenue
Boston, MA
02111 USA**

- Created a micronutrients matrix for 120 countries, highlighting fortification options and opportunities.
- Compiled data on various fortification methods detailing utilization and cost effectiveness of those methods and their nutritional implications in each of the countries.

AWARDS AND RECOGNITION

- CDC's National Center for HIV/AIDS, Viral Hepatitis, STD, and Tuberculosis Prevention's Director's Recognition Awardee, 2016 – Tuberculosis Epidemiologic Studies Consortium's Latent Class Analysis Group
- U.S. CDC's National Center for HIV/AIDS, Viral Hepatitis, STD, and Tuberculosis Prevention's Director's Recognition Awardee, 2015 – Large Tuberculosis Outbreak Surveillance in the United States.
- U.S. Centers for Disease Control and Prevention Division of Tuberculosis Elimination's Director's Quarterly award recognition - Tuberculosis Surveillance Quality Assurance Training Team – March 2014
- Charles C. Shepherd Science Award nominee – Excellent in Science in the category for Assessment as a co-author for “Transmission of Multidrug resistant tuberculosis in the United States”, *Lancet Infect Dis.* 2013 Sep; 13(9):777-84, 2014 - 2013.
- U.S. Department of Health and Human Services – Honor Award. Excellence in Surveillance and Health Monitoring – Domestic, 2011
- U.S. Centers for Disease Control and Prevention – Excellence in Frontline Public Health Service, Division of Tuberculosis Elimination's Outbreak Responders Group, 2011
- U.S. Centers for Disease Control and Prevention – Excellence in Epidemiology, Division of Tuberculosis Elimination's Outbreak Responders Group, 2010
- U.S. Centers for Disease Control and Prevention – Outstanding Field Investigator, Division of Tuberculosis Elimination's Outbreak Responders Group Response Award, 2009
- Texas Department of State Health Services – Certificate of Appreciation, Hurricane Response, 2005

PEER-REVIEWED MANUSCRIPTS

- 1) Moonan PK, (**Chatterjee**) SG, LoBue PA. The molecular epidemiology of human and zoonotic *Mycobacterium bovis*: The intersection between veterinary medicine and public health. *Prev Vet Med* 2009 Mar 1; 88: 226 – 227.
- 2) U.S. Centers for Disease Control and Prevention [contributor], Launch of TB

Genotyping Information Management System (TBGIMS) 2010. *MMWR*. 2010;59:300.

- 3) Horsburgh CR Jr, Goldberg S, Bethel J, Chen S, Colson PW, Hirsch-Moverman Y, Hughes S, Shrestha- Kuwahara R, Sterling TR, Wall K, Weinfurter P; Tuberculosis Epidemiologic Studies Consortium [McAuley J, Beison J, Wilson F, LeDoux C, Flood J, Sun S, Ortega H, Reves R, Blumberg HM, Tapia J, Wing J, Jacobson S, Endyke-Doran C, Etkind S, Sharnprapai S, Sutherland WM, Guled H, Grabau J, Miranda W, Royce R, Dukes-Hamilton C, Sanchez JM, Haley C, Chavez-Lindell T, Graviss E, Chatterjee (Ghosh) S, Griffith DE, Kimerling M, Tamhane A, Naus M, Fitzgerald M, Cook V, Nakajima M, Hershfield E, Roche B, Selvam N, Weis S, Munguia G, Yan J, Venegas HL, Brown S, Jones M]. Latent TB infection treatment acceptance and completion in the United States and Canada. *Chest*. 2010 Feb;137(2):401-9.
- 4) Moonan P, **Ghosh S**, Oeltmann J, Kammerer S, Cowan L, Navin, T. Estimating recent transmission of Mycobacterium tuberculosis in the United States based on genotyping and geospatial scanning. March 2012. *Emerg Infect Dis*. 2012 Mar; 18(3):458-65.
- 5) **Ghosh S**, Moonan P, Cowan L, Grant J, Kammerer S, Navin T. Tuberculosis Genotyping Information Management System: Enhancing Tuberculosis Surveillance in the United States. *Infect Genet Evol*. 2012 Jun;12(4):782-8
- 6) Lindquist S, Allen S, Field K, **Ghosh S**, Haddad MB, Narita M, et al. Prioritizing tuberculosis clusters by genotype for public health action, Washington, USA. *Emerg Infect Dis*. 2013 Mar;19(3):493-6
- 7) Moonan PK, Teeter LD, Salcedo K, **Ghosh S**, Ahuja SD, Flood J, Graviss EA. Transmission of Multidrug resistant tuberculosis in the United States. A cross-sectional study, *Lancet Infect Dis*. 2013 Sep; 13(9):777-84.
- 8) Bamrah S, Yelk Woodruff R, Powell K, **Ghosh S**, Kammerer JS, Haddad MB. Tuberculosis among the homeless, United States, 1994–2010 *Int J Tuberc Lung Dis*. 2013 Nov;17(11):1414-9
- 9) Colson PW, Couzens GL, Royce RA, Kline T, Chavez-Lindell T, Welbel S, Pang J, Davidow A, Hirsch- Moverman Y; the Tuberculosis Epidemiologic Studies Consortium [Wafaa El-Sadr W, Hirsch- Moverman Y, Reves R, Wall K, Yun L, Blumberg H, Tapia J, Wing J, Venkatappa T, Nash T, Hershfield E, Roche B, Cronin W, Collins S, Rutz H, Horsburgh CR, Etkind S, Sharnprapai S, Sutherland W, Solarz S, Guled H, Driver C, Li J, Anger H, Oxtoby M, Hughes S, Miranda W, Royce R, Munoz J, Welbel S, McAuley J, Beison J, Pang J, Rao V, Graviss E, **(Chatterjee) SG**, Teeter LD, Naus M, Cook V, Berger D, Abernethy N, Djojonegoro B, Davidow A, Sevilla A, Selvam N, Weis SE, Moonan PK, Munguia-Bayona G]. Examining the Impact of Patient Characteristics and Symptomatology on Knowledge, Attitudes, and Beliefs Among Foreign-born Tuberculosis Cases in the US and Canada. *J Immigr Minor Health*. 2014 Feb;16(1):125-35
- 10) Bamrah S, Desmond E, **Ghosh S**, France AM, Kammerer JS, Cowan LS, Heetderks A, Forbes A, Moonan PK. Molecular Epidemiology of *M. tuberculosis* in the United States-

- 11) Pang J, Teeter, L, Katz D, Davidow A, Miranda W, Wall K, **Ghosh S**, Stein-Hart T, Restrepo B, Reeves R, Graviss E on behalf of the Tuberculosis Epidemiology Studies Consortium. Epidemiology of tuberculosis in Young Children in the United States. *Pediatrics*. 2014 Mar;133(3):e494-504.
- 12) Duraisamy K, Mrithyunjayan S, Ghosh S, Nair SA, Balakrishnan S, Subramoniapillai J, Oeltmann JE, Moonan PK, Kumar AM. Does Alcohol consumption during multidrug-resistant tuberculosis treatment affect outcome? A population-based study in Kerala, India. *Ann Am Thorac Soc*. 2014.Jun;11(5):712-8.
- 13) Shelke SC, Adhav PS, Moonan PK, Willis M, Parande MA, Satyanarayana S, Kshirsagar VD, **Ghosh S**. Photovoice: A novel approach to improving anti-tuberculosis treatment adherence and outcomes among patients in Pune, India. *Tuberculosis Research and Treatment*. 2014;2014:302601
- 14) Davidow A, Katz D, **Ghosh S**, Blumberg H, Tamhane A, Sevilla A, Reves R. Preventing infectious pulmonary tuberculosis among foreign-born residents of the United States. *American Journal of Public Health*. 2015 Sep;105(9):e81-8.
- 15) Pathak RR, Mishra BK, Moonan PK, Nair SA, Kumar AM, Gandhi MP, Mannan S, **Ghosh S**. Can Intensified Tuberculosis Case Finding Efforts at Nutrition Rehabilitation Centers Lead to Pediatric Case Detection in Bihar, India. *Journal of Tuberculosis Research*. 2016; 4:46-54.
- 16) Teeter LD, Vempaty P, Nguyen DT, Tapia J, Sharnprapai S, **Ghosh S**, Kammerer JS, Miramontes R, Cronin WA, Graviss EA; Tuberculosis Epidemiologic Studies Consortium. Validation of genotype cluster investigations for Mycobacterium tuberculosis: application results for 44 clusters from four heterogeneous United States jurisdictions. *BMC Infect Dis* 2016;16:594.
- 17) Teeter LD, Kammerer JS, **Ghosh S**, Nguyen DTM, Vempaty P, Tapia J, Miramontes R, Cronin WA, Graviss EA. Evaluation of 24-locus MIRU-VNTR genotyping in Mycobacterium tuberculosis cluster investigations in four jurisdictions in the United States, 2006-2010. *Tuberculosis*. 2017; 106: 9-15.
- 18) Stout J, Wu Y, Ho C, Petit A, Feng P, Katz D, **Ghosh S**, Venkatappa T, Luo R. Evaluating Latent Tuberculosis Infection Diagnostics Using Latent Class Analysis. *Thorax*. 2018; 0:1–9. doi:10.1136/ thoraxjnl-2018-211715
- 19) Sagili K, Satyanarayana S, Chadha S., Wilson NC, Kumar AM, Moonan PK, Oeltmann JE, Chadha VK, Nagaraja SB, **Ghosh S**, Lo TQ, Volkmann T, Willis M, Shringarpure K, Reddy RC, Kumar P, Nair SA, Rao R, Yassin, Mwangala MP, Zachariah R, Tonsing J, Harries AD, Khaparde S. Operational Research within a Global Fund supported tuberculosis project in India: Why, how and its contribution towards change in policy and practice? *Global Health Action*, 2018.Vol. 11, 1445467.<https://doi.org/10.1080/16549716.2018.1445467>
- 20) Wansaula Z, Wortham, JM, Mindra G, Haddad MB, Salinas JL, Ashkin D, Morris SB,

Grant GB, Ghosh S, Langer AJ. Bacillus Calmette-Guérin Cases Reported to the National Tuberculosis Surveillance System — United States, 2004–2015. *Emerg Infect Dis.*, 2019 March. Volume 25 (3)

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- 1) Morris SA, Brown LJ, (Chatterjee) SG. Public health response and treatment of a pediatric *M. tuberculosis* case, National TB Controllers Association, Atlanta, GA, June 2006.
- 2) Wallace C, (Chatterjee) SG, Reyes J, Ramirez J. Managing multi-drug resistant tuberculosis in Texas, National TB Controllers Association, Atlanta, GA, June 2006.
- 3) (Chatterjee) SG, Schoepf D, Tyree A. Multigenerational transmission of tuberculosis in an African- American community in rural Texas, National TB Controllers Association, Atlanta, GA, June 2007.
- 4) (Chatterjee) SG, Reyes, J, Wallace, C. Managing multi-drug resistant tuberculosis in Texas. American Public Health Association 135th Annual Conference, Washington DC, November 6, 2007.
- 5) (Chatterjee) SG, Kammerer, JS, Moonan, PK. Does race/ethnicity contribute to recent tuberculosis transmission? National TB Controllers Association Meeting (NTCA), Atlanta, GA, June 2008.
- 6) (Chatterjee) SG, Jost K, Wallace C, Kammerer JS, Heath B, Cruise P, Moonan PK. Identifying transnational *M. tuberculosis*: the Texas-Mexico experience 2004 – 2007 at the 39th World Conference on Lung Health of the International Union Against Tuberculosis and Lung Disease, Paris, France, October 18, 2008.
- 7) (Chatterjee) SG, Navin TR, Moonan PK. Tuberculosis Genotyping Information Management System (TB-GIMS): Translating Molecular Surveillance into Public Health Action. North American Regional Meeting of the International Union against Tuberculosis and Lung Disease, Vancouver, B.C., Canada, February 26, 2009.
- 8) Moonan PK, Kammerer JS, Shang N, (Chatterjee) SG, Becerra JE, Navin TR. Discovering Transmission Events Using Universal Tuberculosis Genotyping and Surveillance. North American Regional Meeting of the International Union Against Tuberculosis and Lung Disease, Vancouver, B.C., Canada, February 26, 2009.
- 9) (Chatterjee) SG, Kammerer JS, Cowan LS, Navin TR, Moonan PK. Molecular Epidemiology of the Beijing Genotype Family in the United States at the American Thoracic Society 2009 International Conference, San Diego, CA, USA, May 16, 2009.
- 10) Miramontes R, Haddad MB, Mitruka K, Chatterjee SG, Kammerer JS, Navin TR, Moonan

PK.

Use of National Tuberculosis Genotype Service in Surveillance for Ongoing Transmission after Known Tuberculosis Outbreaks -- United States, 2002--2006 at the American Thoracic Society 2009 International Conference, San Diego, CA, USA, May 19, 2009.

11)Teeter LD, Moonan PK, Flood JM, Anger H, Salcedo K, Chatterjee SG, Graviss EA. Molecular Epidemiology of Multidrug Resistant *M. Tuberculosis* in the United States. 40th World Conference on Lung Health of the International Union Against Tuberculosis and Lung Disease, Cancun, Mexico, December 6, 2009.

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13) (Chatterjee) SG, Cowan L, Kammerer JS, Chrismon J, Adhimurthy J, Moonan PK, Navin TR. Tuberculosis Genotyping Information Management System (TB GIMS: Establishing a molecular surveillance system for Tuberculosis in the United States – 41st World Conference on Lung Health of the International Union Against Tuberculosis and Lung Disease, Berlin, Germany, November 2010.

14) Baker B, Langer A, Cowan L, Ghosh S, Grant J. Evaluation of the use of TB genotyping and TB Genotyping Information Management System (TB GIMS) in state and local health departments. Poster presentation at 60th annual Epidemic Intelligent Service (EIS) Conference Program, Atlanta, GA, 2010.

15) Karthickeyan DSA, Sunilkumar M, Ghosh S, Sreenivas A, Shibu B, Jayasankar S, Moonan PK, Ajay MV Kumar. Treatment outcomes of persons with multidrug resistant tuberculosis (MDR-TB) – Kerala, India, 2009–2010. *Int Tuberc Lung Dis* 2013; 17(12) Supplement 2:S483.

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17) Pathak RR, Mishra BK, Ghosh S, Sreenivas A, Ajay MV Kumar, Gandhi MP, Moonan PK, Mannan S. Opportunities to detect tuberculosis among severely acute malnourished children admitted to Nutritional Rehabilitation Centres in Bihar, India – 2012. *Int Tuberc Lung Dis* 2013; 17(12) Supplement 2:S251.

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46th World Conference on Lung Health of the International Union Against Tuberculosis and Lung Disease, Cape Town, South Africa, December 2015. http://www.theunion.org/what-we-do/journals/ijtld/body/Abstract_Book_2015-Web.pdf

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21) McDaniel C, Marks K, Ghosh S, Kammerer S, Althomsons S, Silk B. A Comparison of Methods for Detecting Tuberculosis Transmission — United States, 2012–2015. Presented at International Union Against Tuberculosis and Lung Disease, North American Regional Meeting, Vancouver, Canada. February 2017

(22) Ghosh S, Singla N, Risley K, Pinsker E, Damle R, Struminger B, Sarin R, Moonan PK. Co-creating an evaluation framework for Tuberculosis ECHO® – New Delhi, India. Accepted for an e-poster presentation at the 49th World conference, International Union Against Tuberculosis and Lung Disease, Hague, Netherland. October 2018.

(23) Ghosh S. Leveraging a community of practice learning model to strengthen TB and HIV data quality and use for action. Symposium presentation, 50th World conference, International Union Against Tuberculosis and Lung Disease, Hyderabad, India. October 2019.

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LANGUAGE SKILLS

Primary Language: English
Secondary Languages: Bengali (Spoken: Advanced; Written: Novice; Read: Intermediate)
Hindi (Spoken: Advanced; Written: Advanced; Read: Advanced)

ADDITIONAL INFORMATION

- Responder Readiness experience: NIMS-700a, ICS -100, ICS-300, ICS-400, Hurricanes Rita and Katrina response, Ebola 2014 response
- Quantitative and Qualitative Software Packages: SAS, SPSS, Epi-Info, Epi-Info-VHF, JMP, EpiData , R, STATA, ArcGIS, Atlas ti4, MAXQDA2020
- Syndromic surveillance packages: RODS and ESSENCE
- Computer Applications: End Notes, all the applications of Microsoft Office (Word, Excel, PowerBi, PowerPoint, Access, Office Manager, Calendar and Outlook, Lync)

Appendix K: IRB Approvals from CDC and UIC

1.) CDC-IRB: India TB ECHO

CGH HSR Tracking # ²⁰¹⁹⁻¹⁵⁶ _____



Request for Project Determination & Approval – Center for Global Health (CGH)

Use this form to submit proposals to the CGH Office of the Associate Director for Science/Laboratory Science (ADS/ADLS) for research/nonresearch determination and requirements for IRB review/approval.
Approval Chain: Investigator → Branch Chief/Country Director → Division ADS → CGH Human Subjects Mailbox

<input checked="" type="checkbox"/> New Request		<input type="checkbox"/> Amendment		<input type="checkbox"/> Laboratory Submission	
Project Title: Developing a comprehensive monitoring and evaluation framework with a compendium of tools for high-quality TB-ECHO implementation - New Delhi			Project Location/Country(ies): India		
CDC Principal Investigator's name and SEV#: Patrick Moonan (SEV 10847) Christine Ho (SEV 12721)		CDC Primary Contact's name and SEV# (Leave blank if same as PI): Patrick Moonan (SEV 10847)			
Division: _____		CDC PI or PC Email: pmoonan@cdc.gov		Telephone: 404-639-5310	
Project start date (mm/dd/yyyy): 01/01/2019			Project end date (mm/dd/yyyy): 12/31/2019		

Collaborating Institutions (List other collaborating institutions in the protocol or in a separate document)		
<input checked="" type="checkbox"/> CoAg	<input type="checkbox"/> Grant	contract #: GH01812
Original Award Year if CoAg: 2015		Current Budget Year if CoAg: 2019
Title (CoAg, Grant, or Contract): Global Health Security Partnership Engagement: Expanding Efforts and Strategies to Protect and Improve Public Health		
Supported Institution Name: Program for Appropriate Technology in Health (PATH)		
Supported Institution FWA# (if applicable): FWA00007038		FWA Exp. Date (if applicable): 07/19/2023

Check appropriate category and subcategory

- I. Activity is NOT human subjects research. Primary intent is public health practice or a disease control activity (Check all that apply)**
- A. Epidemic or endemic disease control activity; if applicable, Epi-AID #
 - B. Routine surveillance activity (e.g., disease, adverse events, injuries)
 - C. Program evaluation activity*
 - D. Public health program activity^α
 - E. Laboratory proficiency testing

* Evaluation of a new intervention for effectiveness and comparison of different interventions are research under CDC policy.
^α e.g., service delivery; health education programs; social marketing campaigns; program monitoring; electronic database construction and/or support; development of patient registries; needs assessments; and demonstration projects intended to assess organizational needs, management, and human resource requirements for implementation.

- II. Activity is research but does NOT involve human subjects (Check all that apply)**
- A. Activity is research involving collection or analysis of data about health facilities or other organizations or units (NOT persons).
 - B. Activity is research involving data or specimens from deceased persons.
 - C. Activity is research involving unlinked or anonymous data or specimens collected for another purpose.
 - D. Activity is research involving data or specimens from animal subjects. ^β

[§]Note: Approval by CDC Institutional Animal Care and Use Committee (IACUC) may be required for certain animal research. Institution must also have assurance with the Office of Laboratory and Animal Welfare at NIH.

- III. Activity is research involving human subjects but CDC involvement does not constitute "engagement in human subject research."** CDC employees or agents will not intervene or interact with living individuals or have access to identifiable information for research purposes. Appropriate IRB or ethics committee approval is required prior to approval. (Check all that apply)
- A. This project is funded under a grant/cooperative agreement/contract award mechanism.
 - B. CDC staff provide technical support that does not involve possession or analysis of identifiable data or interaction with participants from whom data are being collected (No CDC Support[¶]).
 - C. CDC staff are involved only in manuscript writing for a project that has closed. For the project, CDC staff did not interact with participants and were not involved with data collection (No CDC Support).
 - D. Activity is research involving linked data, but CDC non-disclosure form 0.1375B is signed.[¶]

^β See definition of support on page 3.
[¶] CDC form 0.1375B agreement is required for all subcategories (A-D) if CDC has access to linked data. This agreement prohibits the release of identifying key to CDC investigators under any circumstances. The purposes of the planned research do not contradict the terms of consent under which the information or specimens were collected, whether that consent was documented or not documented.

- IV. Activity is research involving human subjects that requires submission to CDC Human Research Protection Office (Check one)^α**
- A. Full Board Review (Use forms 0.1250, 0.1370-research partners)
 - B. Expedited Review (Use same forms as A above)
 - C. Exemption Request[§] (Use forms 0.1250X, 0.1370-research partners)
 - D. Reliance[§]
 - 1. Request to allow CDC to rely on a non-CDC IRB (Use same forms as A above, plus 0.1371)
 - 2. Request to allow outside institution to rely on CDC IRB (Use same forms as A above, plus 0.1372)

^α There are other types of requests not listed under category IV, e.g., continuation of existing protocol, amendment, incident reports.
[§] Exemption and reliance request is approved by CDC Human Research Protection Office (HRPO).

Public Access and Data Sharing

2. By non-CDC staff, supported by CDC

A. Type of data collected or generated:

Instructions: From the dropdown list, select the types of data that will be collected that best fits this project. Categories 1, 2, and 3 are data covered by CDC Policy (<http://aops-mas-iis/Policy/Doc/policy385.pdf>). Categories 4 and 5 are data covered by CDC Policy but release or sharing may be restricted or limited. Categories 6, 7 and 8 are data NOT covered by CDC Policy and no further information is needed under this section. Use the lowest number when the data falls under more than one type. See Box below for more information on the categories.

Provide a 2-3 sentences description of the data that will be collected in this project:

Anonymous online survey. Focus Group Discussions. Key informant interviews. No patient or public health data will be collected.

B. Data ownership:

Instructions: Provide the name of the organization that will own the public health data for this project. If there are multiple organizations involved, provide the name of the organization that will retain and provide long-term control over the access and use of the data. Provide data steward's name and contact information if available.

C. Public access level:

Instructions: From the drop-down list, select the data release category that will best fits how data will be available after data availability date.

Justifications:

Instructions: From the dropdown list, select the option that best fits the justification for restricted access or unavailability of data.

Provide a brief description (1-3 sentences) if "Other reason" is selected:

D. Anticipated data availability date (if applicable):

Instructions: Provide the anticipated date (mm/yyyy) that the public health data will become available.

Box: Type of data collected or generated

1. *By CDC staff, supported with CDC funding* – CDC funds the activity and data are collected by CDC staff.
2. *By non-CDC staff, supported with CDC funding* – CDC funds or co-funds the data collection through mechanisms such as grants, cooperative agreements, contracts, or other funding mechanisms. Data is collected by non-CDC staff. When CDC funds another federal agency, an interagency agreement should indicate who would be responsible for the data.
3. *Provided to CDC and becomes part of a CDC data system* – Data is reported to CDC by another entity, e.g., by local health departments, that become a part of a CDC data collection system, e.g., CDC surveillance systems.
4. *Owned by partner and protected from release by laws or regulations* – CDC funds or co-funds the data collection. Data may be collected by CDC or non-CDC staff as in #1 and 2 above, but applicable US or country laws and regulations limit or restrict disclosure of data. Examples of US laws limiting disclosure include: the Privacy Act, Trade Secrets Act, or Section 308(d) of the US Public Health Service Act. When CDC funds activities in other countries, foreign laws and/or regulations may also apply.
5. *Not sharable due to potential dual-use research of concern* – Dual use research of concern is life sciences research that, based on current understanding, can reasonably be anticipated to provide knowledge, products, or technologies that could be directly misapplied by others to pose a threat to public health, agriculture, plants, animals, the environment, or material (<http://intranet.cdc.gov/oadlss/manuals-and-policies/dual-use-research/>). Data pertaining to DUR may not be sharable because of the potential threats.
6. *Owned by partner and shared with CDC, but no CDC funding* – CDC does not fund, collect, or own the data. Data may be shared with CDC.
7. *Owned by partner and has an agreement restricting data sharing* – CDC does not fund, collect, or own the data. Data may be shared with CDC under data sharing agreement.
8. *By another federal agency* – Another federal agency shares data with CDC under restricted terms agreement. The other federal agency is responsible for data release and sharing.

2.) CDC-IRB: Tanzania HIV ECHO

CGH HSR Tracking #: 2018-507



Request for Project Determination & Approval -- Center for Global Health (CGH)

Use this form to submit proposals to the CGH Office of the Associate Director for Science/Laboratory Science (ADS/ADLS) for research/nonresearch determination and requirements for IRB review/approval.
 Approval Chain: Investigator → Branch Chief/Country Director → Division ADS → CGH Human Subjects Mailbox

<input type="checkbox"/> New Request	<input checked="" type="checkbox"/> Amendment	<input type="checkbox"/> Laboratory Submission
Project Title: Evaluation of Pilot Implementation of Project ECHO		Project Location/Country(ies): Tanzania
CDC Principal Investigator's name and SEV#:		CDC Primary Contact's name and SEV# (Leave blank if same as PI): Eunice Mmari SEV #17346
Division: DGHT	CDC PI or PC Email: hqw9@cdc.gov	Telephone: +255 685 677 574
Project start date (mm/dd/yyyy): 07/01/2018		Project end date (mm/dd/yyyy): 06/30/2019

Collaborating Institutions (List other collaborating institutions in the protocol or in a separate document)

<input checked="" type="checkbox"/> CoAg	<input type="checkbox"/> Grant	<input type="checkbox"/> contract #: 5U2GGH000994-03	Original Award Year if CoAg:	Current Budget Year if CoAg: 2018
Title (CoAg, Grant, or Contract): Global Technical Assistance Services to Countries Supported by the President's Emergency Plan for HIV/AIDS Relief (
Supported Institution Name: Columbia University				
Supported Institution FWA# (if applicable): 00002636			FWA Exp. Date (if applicable): 01/21/2021	

Check appropriate category and subcategory

- I. Activity is NOT human subjects research. Primary intent is public health practice or a disease control activity (Check all that apply)
- A. Epidemic or endemic disease control activity; if applicable, Epi-AID #
 - B. Routine surveillance activity (e.g., disease, adverse events, injuries)
 - C. Program evaluation activity*
 - D. Public health program activity^Ω
 - E. Laboratory proficiency testing

* Evaluation of a new intervention for effectiveness and comparison of different interventions are research under CDC policy.
 Ω e.g., service delivery; health education programs; social marketing campaigns; program monitoring; electronic database construction and/or support; development of patient registries; needs assessments; and demonstration projects intended to assess organizational needs, management, and human resource requirements for implementation.

- II. Activity is research but does NOT involve human subjects (Check all that apply)
- A. Activity is research involving collection or analysis of data about health facilities or other organizations or units (NOT persons).
 - B. Activity is research involving data or specimens from deceased persons.
 - C. Activity is research involving unlinked or anonymous data or specimens collected for another purpose.
 - D. Activity is research involving data or specimens from animal subjects.[§]

§Note: Approval by CDC Institutional Animal Care and Use Committee (IACUC) may be required for certain animal research. Institution must also have assurance with the Office of Laboratory and Animal Welfare at NIH.

III. Activity is research involving human subjects but CDC involvement does not constitute "engagement in human subject research." CDC employees or agents will not intervene or interact with living individuals or have access to identifiable information for research purposes. Appropriate IRB or ethics committee approval is required prior to approval. (Check all that apply)

- A. This project is funded under a grant/cooperative agreement/contract award mechanism.
- B. CDC staff provide technical support that does not involve possession or analysis of identifiable data or interaction with participants from whom data are being collected (No CDC Support^β).
- C. CDC staff are involved only in manuscript writing for a project that has closed. For the project, CDC staff did not interact with participants and were not involved with data collection (No CDC Support).
- D. Activity is research involving linked data, but CDC non-disclosure form 0.1375B is signed.^α

β See definition of support on page 3.

α CDC form 0.1375B agreement is required for all subcategories (A-D) if CDC has access to linked data. This agreement prohibits the release of identifying key to CDC investigators under any circumstances. The purposes of the planned research do not contradict the terms of consent under which the information or specimens were collected, whether that consent was documented or not documented.

IV. Activity is research involving human subjects that requires submission to CDC Human Research Protection Office (Check one)^α

- A. Full Board Review (Use forms 0.1250, 0.1370-research partners)
- B. Expedited Review (Use same forms as A above)
- C. Exemption Request^γ (Use forms 0.1250X, 0.1370-research partners)
- D. Reliance^γ
 - 1. Request to allow CDC to rely on a non-CDC IRB (Use same forms as A above, plus 0.1371)
 - 2. Request to allow outside institution to rely on CDC IRB (Use same forms as A above, plus 0.1372)

α There are other types of requests not listed under category IV, e.g., continuation of existing protocol, amendment, incident reports.

γ Exemption and reliance request is approved by CDC Human Research Protection Office (HRPO).

Public Access and Data Sharing

A. Type of data collected or generated:

Instructions: From the dropdown list, select the types of data that will be collected that best fits this project. Categories 1, 2, and 3 are data covered by CDC Policy (<http://aops-mas-its/Policy/Doc/policy385.pdf>). Categories 4 and 5 are data covered by CDC Policy but release or sharing may be restricted or limited. Categories 6, 7 and 8 are data NOT covered by CDC Policy and no further information is needed under this section. Use the lowest number when the data falls under more than one type. See Box below for more information on the categories.

Provide a 2-3 sentences description of the data that will be collected in this project:

Qualitative as well as quantitative data will be collected as part of program evaluation. Data collected will be from focus group discussion and interviews on ways of improving the project, client satisfaction and knowledge assessment.

B. Data ownership:

Instructions: Provide the name of the organization that will own the public health data for this project. If there are multiple organizations involved, provide the name of the organization that will retain and provide long-term control over the access and use of the data. Provide data steward's name and contact information if available.

C. Public access level:

Instructions: From the drop-down list, select the data release category that will best fits how data will be available after data availability date.

Justifications:

Instructions: From the dropdown list, select the option that best fits the justification for restricted access or unavailability of data.

Provide a brief description (1-3 sentences) if "Other reason" is selected:

D. Anticipated data availability date (if applicable):

Instructions: Provide the anticipated date (mm/yyyy) that the public health data will become available.

Box: Type of data collected or generated

1. *By CDC staff, supported with CDC funding* – CDC funds the activity and data are collected by CDC staff.
2. *By non-CDC staff, supported with CDC funding* – CDC funds or co-funds the data collection through mechanisms such as grants, cooperative agreements, contracts, or other funding mechanisms. Data is collected by non-CDC staff. When CDC funds another federal agency, an interagency agreement should indicate who would be responsible for the data.
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4. *Owned by partner and protected from release by laws or regulations* – CDC funds or co-funds the data collection. Data may be collected by CDC or non-CDC staff as in #1 and 2 above, but applicable US or country laws and regulations limit or restrict disclosure of data. Examples of US laws limiting disclosure include: the Privacy Act, Trade Secrets Act, or Section 308(d) of the US Public Health Service Act. When CDC funds activities in other countries, foreign laws and/or regulations may also apply.
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3.) UIC IRB



**Notice of Determination
Activity Does Not Represent Human Subjects Research**

June 19, 2019

Smita Ghosh
Doctor of Public Health in Leadership

RE: **Protocol # 2019-0654**
“Developing a Monitoring and Evaluation Framework for Tuberculosis Extension for Community Health Outcomes (TB ECHO) Implementation in India”

Sponsor: Center for Disease Control and Prevention / NIOSH
Institutional Proposal (IP) #: Not applicable - no funding to UIC
Grant/Contract No: Not applicable – no funding to UIC
Grant/Contract Title: Not applicable – no funding to UIC

Dear Ms. Ghosh:

The UIC Office for the Protection of Research Subjects received your application, and has determined that this activity **DOES NOT meet the definition of human subject research** as defined by 45 CFR 46.102(e)/ 21 CFR 50.3(g) and 21 CFR 56.102(e).

Specifically, CDC is the lead site for this project done in collaboration with the National Institute for Research of TB (NIRT) in India; the CDC Center for Global Health has determined this to be a non-research program evaluation project.

You may conduct your activity without further submission to the IRB.

Please note:

- If this activity is used in conjunction with any other research involving human subjects, prospective IRB approval or a Claim of Exemption is required.
- If this activity is altered in such a manner that may result in the activity representing human subject research, a NEW Determination application must be submitted.
- *The results of activities conducted as non-research related QA/QI projects may NOT be published, presented or otherwise disseminated as being “research” as defined under 45 CFR 46.102(l). Such publications/presentations must clearly be identified as being QA/QI projects.*



Sincerely,

Sandra Costello
Assistant Director, IRB # 7
Office for the Protection of Research Subjects

cc: Patrick Lenihan, Doctor of Public Health in Leadership, M/C 923
Eve C. Pinsker (faculty advisor), School of Public Health, M/C 923

Page 2 of 2

UNIVERSITY OF ILLINOIS AT CHICAGO
Office for the Protection of Research Subjects

201 AOB (MC 672)
1737 West Polk Street
Chicago, Illinois 60612

Phone (312) 996-1711