RESEARCH PRACTICES OF PUBLIC HEALTH FACULTY SCHOLARS AT UIC

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Introduction

This report presents the results of a study conducted at the University of Illinois at Chicago (UIC) as one of a parallel suite of studies coordinated by Ithaka S+R, a not-for-profit research organization providing guidance to colleges and universities (http://www.sr.ithaka.org/about/). The liaison librarian to the School of Public Health (SPH) and the Head Librarian for the Information Services & Research department, from the Library of the Health Sciences (LHS) at UIC, conducted the study.

With this project, we aimed to explore the information habits, needs, and preferences of public health faculty when conducting research. This report will focus on UIC SPH faculty reflections surrounding four major themes related to research: Information Discovery, Data Management Practices, Research Dissemination, and Collaboration. We will discuss these themes in the context of library services and conclude with recommendations on how the library can best meet faculty needs. We hope that these findings may inform future development and improvement of library services and resources.

Ithaka S+R Research Support Services Project

The UIC Library was one of seven institutions participating in the nationwide study titled "Research Support Services for Public Health Faculty Scholars." This project, which focuses exclusively on faculty members in public health, is part of an ongoing series of related studies coordinated by Ithaka S+R. The studies are based in qualitative research methods and analyze the research practices and needs of faculty members, each report focusing on a different discipline, in order to reveal the resources and services that may best support their research (Ithaka S+R, 2017). Previous and in-progress studies include analyses of faculty researchers in Agriculture, Art History, Chemistry, History, and Religious Studies.

University of Illinois at Chicago

The University of Illinois at Chicago (UIC) is a large public research university (Carnegie classification: Doctoral University with Highest Research Activity) in Chicago, IL, with regional campuses in Peoria, Rockford, Urbana, Springfield, and the Quad Cities in Illinois. The campus in Chicago includes 15 colleges, spanning the liberal arts and sciences, social sciences, urban planning and public affairs, and health sciences. As of Fall 2016, a total of just over 29,000 students were enrolled in UIC's 280 degree programs (Board of Trustees of the University of Illinois, 2017).

University Library

The University Library at UIC consists of the Richard J. Daley Library and LHS. LHS serves faculty, staff, and students of the health sciences at UIC, as well as members of the general public seeking health information. The Library includes LHS locations in Chicago, Peoria, Rockford, and Urbana.

Librarians in the Information Services & Research department at LHS-Chicago are organized according to a liaison model, with one librarian assigned as official liaison to each of the Colleges of Medicine, Dentistry, Nursing, Applied Health Sciences, and Pharmacy, and the SPH. Each liaison librarian specializes in providing the information sources and assistance needed by faculty and students in each college and the SPH. This librarian leads educational sessions and meets with students and faculty individually, both in person and online, to provide instruction on finding, accessing, evaluating, and citing information.

Public Health at UIC

The School of Public Health at UIC admitted its first class of students in 1972 and currently awards degrees at the bachelor's, master's, and doctoral levels. The SPH is structured around four academic divisions: Community Health Sciences (CHS), Environmental and Occupational Health (EOHS), Epidemiology and Biostatistics (EPI-BIO), and Health Policy and Administration (HPA). Research is conducted across these four divisions and through multiple interdisciplinary research centers.

As of Spring 2015, there were 316 faculty appointments at the SPH, including 75 primary (100%) appointments, totaling 86.44 full time equivalent faculty members. The SPH is the second largest federally funded research college at UIC, after the College of Medicine. According to the UIC SPH (2015), over $24,000,000 in research grants and contracts were awarded to SPH faculty in the 2013-2014 academic year. Faculty research at the SPH is interdisciplinary and highly collaborative. Collaborators include faculty researchers from other colleges at UIC or other institutions, as well as individuals and groups outside of academia, including state and local health departments, community groups, and various other organizations.

Methods

Study design and subject selection

We conducted semi-structured interviews with 12 faculty members from the SPH, using an interview guide developed by Ithaka S+R [Appendix A]. Using purposive sampling, we gathered faculty names from the SPH website and emailed a subset of these individuals with a request for participation. We recruited subjects from all four academic divisions of SPH: CHS, EOHS, EPI-

BIO, and HPA. We also used convenience and snowball sampling to recruit additional participants beyond those who responded to our initial emails. A breakdown of interview subjects by rank and division is provided in Appendix B.

Interviews and transcription

Each subject agreed to participate in one 60-minute interview. We conducted the 12 interviews between January 23 and March 7, 2017. The interviews were recorded using an audio recorder and transcribed by a third party. Once the transcripts had been checked for accuracy and anonymized, the audio files were deleted. We sent the anonymized transcripts to Ithaka S+R, who synthesized data from all participating institutions for their report.

Following a grounded theory approach, we coded the transcripts in three stages using Dedoose software. Both authors open-coded three transcripts and then discussed and developed a list of core themes/codes. Using this list, we met to code an additional transcript together to discuss and resolve differences in how we interpreted and applied the codes. All 12 transcripts were then divided between the two authors and coded individually.

Data analysis

We selected four core themes on which to focus our analysis, based on the frequency with which these topics arose, as well as the depth of the information shared: Information Discovery, Data Management Practices, Research Dissemination, and Collaboration. We identified all codes related to these themes and aggregated the excerpts to which the codes had been applied.

A note on the text

Gender pronouns (he/him/his, she/her/hers) are used throughout the text. The pronouns we have used here to refer to a given participant may or may not correspond with that participant's

identified gender. For the sake of rhetorical simplicity, and because interview transcripts were de-identified, we often selected pronouns at random to correspond with a given excerpt.

Findings

Information Discovery

This section will address faculty members' stated preferences and habits when locating and utilizing secondary sources of information—information other than that which is produced by their research. This includes the use of secondary information to support their own research, as well as means of staying abreast of other scholars' research.

As needed

Faculty primarily described the process of information discovery in the context of something they did on an as-needed basis, i.e., actively seeking information to meet an immediate need. For example, when one faculty member was asked how he becomes aware of recently published research, he answered simply: "When I'm doing a search related to whatever I'm working on." Another acknowledged the possibility of overlooking potentially useful research because she does not regularly monitor the literature, saying, "It could be relevant and I won't see it because I wasn't doing a search." Still another said, "I don't go looking for what I'm interested in as a routine to see has anything come out this month? Does anything come out next month?"

Literature searches are conducted to meet the needs of the project at hand. The most common contexts in which faculty described searching for information, including formal literature

reviews, were during the processes of applying for grants and preparing papers for publication. Two participants expressed interest in funding additional staff positions to handle this responsibility. One of these individuals noted:

> I'm not very good in building in a lot of time into my grants. Just to have somebody to do literature searches for me to get background on whatever the topic is…I want to get better about doing that. I'm not very good about building that in up front, and I think it would help us get the lay of the land on things.

Global health research

Three faculty members that we interviewed work in global health and regularly conduct research in low- and middle-income countries. This setting poses unique challenges in locating and accessing secondary information sources. It was noted more than once that the countries in which they conduct research do not have large national databases containing public health surveillance and vital statistics data. One of these faculty members stated that "there are not huge data collection systems like we have in the U.S. that we can access." Another stressed that in the location where he conducts research, "they do have actually computers that do have the systems; it's just that the staff haven't been fully trained to know how to implement those things." He added, "in some cases they are in fact capturing data digitally," but the challenge lies in "taking it to the next step, where you are able to analyze or generate outputs of that."

As a result, when seeking secondary data to support their research in these countries, faculty often find that the information they need is stored on paper rather than electronically. One participant described the data collection process as follows:

> The clinical data that we're collecting … is put in a book. It's like a carbon copy, big book, that the health staff fills out, and not on a regular basis. That information is tabulated on another piece of paper. I'm not exactly sure, it goes to somebody in another

> office, and then at some point it rolls up to the Ministry of Health level. We don't feel terribly confident because all of these different layers. It's striking, how… there's not computer systems, there's not training on how to collect data, it just isn't there in the places that we're working.

Another participant who conducts research in a different part of the world echoed these concerns, explaining that when asked for data, hospital staff "open up an exercise book where they're still handwriting everything…it's not a situation where you can go into a computer, do a quick search, and generate all these things. It's much harder."

These faculty members described creative methods for capturing or collecting this information despite practical challenges. One of these methods is simply building networks in the countries where they are conducting research and asking these colleagues for information directly. One faculty member stated that information is not widely available for download from organizational websites, and accessing it often depends on knowing "someone who did that report and they have it on their desktop or are able to send it to me …I have spent enough time there where I've been able to know specific agencies where I can go to."

This same individual elaborated on methods for efficiently capturing data from print sources. These methods have been developed over the course of many years conducting research abroad:

> You've always got to be prepared to either find a means of getting the information very quickly from a hard document or, in some situations, I know individuals who have scanners that quickly can scan a document for me and send it to me. Those are things that I have always got to make sure I have around because it's never readily available. I don't get frustrated anymore if I'm looking for something and I don't see it on the Internet because it's just natural not to find it.
>
> In those circumstances, you've got to have multiple strategies for doing things. I've seen a couple times where I've also [gone] through those booklets taking pictures because I know I won't have all day to be able to go through everything, so using that as a means to being able to capture things is one way to do it.

Challenges in finding information

Faculty named several areas in which they regularly experience challenges and would like assistance when locating and accessing information.

Literature reviews

When conducting literature reviews, faculty in general expressed confidence in their abilities. Nonetheless, they mentioned a few obstacles. For some, the database searching process was a challenge. One faculty member described weeding through large numbers of irrelevant references, saying that "the number of hits that you get that are not useful at all" frequently causes frustration. Choosing search terms and the fear of missing things were also mentioned by another participant, who described the process of reviewing search results as "exhausting." He elaborated, "You get too specific and you don't find important stuff. Sometimes you actually do a search and you don't find stuff you know is there…It didn't show up with your keywords and you don't understand why."

Choosing search terms can prove difficult since terminology can vary across disciplines, and even from one researcher to another within the same discipline. Researchers sometimes initially use the literature search in an exploratory fashion to discover terminology. One faculty member said with respect to her interdisciplinary research team, "We are all actually struggling a lot in helping each—in finding common terminology. Finding literature that helps us identify that common terminology is really important." Another described the challenge of searching for literature when he was unsure of which search terms are commonly used by authors, saying, "You have to identify a set of terms that people commonly use…To start doing a literature review that is comprehensive, you can't do that unless you understand the vocabulary they use."

Two participants mentioned that they would like to delegate the task of reviewing the literature, but that many students and other members of their support staff did not have the knowledge or research skills to take this on. One faculty member explained, "I do a lot of the literature review myself. I have found it difficult to turn that work over to people, because…my students and research staff view literature a little differently, and they don't read my mind." She continued:

> I haven't been able to train my students to gather information in a way that helps me. I feel like they often kind of go on the wrong track, so I end up spending a lot of time additionally searching for literature. They look so narrowly that they don't see other relevant information, because we work in such a multidisciplinary area.

Another participant described a similar frustration:

> The problem that I find is, as you know, a lot of our students are not trained in doing literature reviews very well, and so unless they're trained, it doesn't do me a whole lot of good. Having people help me with the literature reviews or training people to do them would be really useful.

Even those who are comfortable in their ability to execute literature reviews noted that the lengthy process was a burden. One faculty member said, "it's always tedious to me…I mean, it's time-consuming." Another described regularly searching databases that focus on international literature to avoid introducing a Western bias into his work, but stated that doing so was "harder; it takes longer."

Grey literature

Several faculty members indicated that while they felt comfortable conducting literature reviews to find traditional scholarly articles, they and/or their students also rely heavily on data sets, research reports, and other types of non-traditional publications to support their research. The term "grey literature" is used to describe this wide-ranging category of information resources. Locating grey literature often proves more complicated than traditional literature searches, as illustrated in the following example:

> They have information about cardiovascular disease, but what about people that have had more than one stroke for example, where can I find that? That's a little bit more difficult, but we do rely on whatever data sets we can find. Certainly the [scholarly] literature, my research assistants, they know how to do literature reviews because it's a skill you need to have, just do it, kind of thing.

One faculty member, reflecting on the support needed for finding secondary information, stated that "besides just knowing all the available resources, being able to keep track of them all, it's not just about journals, but it's also about data." Another, speaking from a pedagogical perspective, stated that his students have similar needs, and scholarly journals are just a portion of the information they use. He explained that, when it comes to the information students frequently search for, "it might not be in the traditional peer-reviewed literature but in the grey literature where some of these things are emerging or reported." He continued by encouraging the library "to think beyond the literature review, like that one chapter in their dissertation. That's one thing [students] need to do."

Several participants stated that they would like assistance, possibly from the library, in locating grey literature resources, including data sets. One faculty member explained:

> I don't know if this is appropriate or not, but one of the things I feel would be incredibly helpful is if ... right now I'm struggling with finding data… It will take me a half a day to try to think through. I can tell my RAs to do it but they won't know exactly what I mean. So if there was a resource on the campus, it may not even be the library as being that resource. Maybe there's, I don't know, something here that could help researchers find that. I know we know how to do literature reviews and that kind of thing, so I'm more like with data is the thing that I'm trying to ... That would be something, from my perspective, helpful for my own research.

Two participants expressed a desire for the library in particular to provide support for finding data sets. One individual noted that "if we're zeroing in on what the library can do about this, having a library person talking about it, who's knowledgeable in the nitty gritty of all of these types of data sets, would be most useful." Another elaborated:

> That could be something really useful maybe that the librarians could work on, like an orientation to [grey literature] and examples of it so that people can understand what they want and need and where they should look because there's just so much… There may be more systematic ways that could be presented or people could be oriented to the types of grey literature, the types of reports, the expectations.

Keeping up with research

Email subscriptions

Multiple faculty members mentioned two established means of keeping up to date with recent research: (1) email listservs and (2) table-of-contents alerts for individual journals. Discussing listservs, one faculty member said, "They seem very out-of-date, but they still work." Faculty mentioned listservs including those stemming from professional organizations, such as the American Public Health Association (APHA), federal and other large organizations, such as the Centers for Disease Control & Prevention (CDC), and smaller organizations, such as advocacy groups.

The majority of participants indicated that they subscribe to at least one scholarly journal's table-of-contents alert emails. Multiple faculty members said that it can be challenging to keep up with the amount of information that reaches them through email, with one calling it "overwhelming." Another stated that she subscribed to many email lists, but the approach was not ideal, saying, "While it's stressful to have lots of unread emails, it's the only way that I can at least attempt to try and keep up with some things." Several individuals said that they usually only skim the emails and, less frequently, click through to the content if something catches their eye.

Conferences and conversation

Professional networks and conversations with colleagues are another major means of learning about new research developments. Five of the 12 interview subjects said that they regularly attend formal conferences and/or annual meetings. These include meetings of professional associations, including American Public Health Association (APHA) and Illinois Public Health Association (IPHA), and national organizations such as the National Institute for Occupational Safety and Health (NIOSH).

Several faculty members said that informal conversations and serendipitous encounters within professional networks were an equally significant contributor to discovering new research and fostering creative conversations. Some described attending conferences and workshops, but having more productive conversations outside of the formal, organized activities. One faculty member said, "I don't find presentations at conferences to be particularly exciting usually. I usually go to conferences to talk to people outside the presentations." She continued:

> I often feel like it's just kind of personal initiative. For example, I went down to [a workshop] last year…When I was there I met one of the CDC investigators. Then I was like, "Okay. Well, I'm going to come back and visit you, and I'm going to bring a friend of mine, and we're going to talk about research ideas."… Then I brought another friend. Then they brought some friends. Then we all really hit it off and had a wonderful day talking about vomit and diarrhea… It was just that we all have a shared interest that was by happenstance that I was there, and met that guy, and we hit it off.

Others described serendipitous conversations occurring during everyday activities. Hallways and restrooms were both mentioned as places where creative conversations take place. One participant noted that because "fortunately enough, a lot of the folks that I work with are also friends," he and his colleagues directly share articles and other resources with each other as they come across information relevant to their respective interests. Another reflected that the academic environment at UIC creates an organic culture of learning and sharing information among

colleagues. She said that she is "always hearing about new things…right before I met with you I was in a meeting with another colleague and he mentioned this article he just read that was very interesting, he knew I'd be interested in. So I feel like word of mouth is helpful."

One faculty member pointed out that contacting colleagues directly allowed more immediate access to their research findings, rather than waiting for research to be published, saying that "there seems to be… a two and a half year lag…between someone's idea and it actually being accessible through the literature." He noted that a benefit of building professional networks is that he has "access to that information in a more timely fashion."

Data Management Practices

In academia, the main components of data management can typically be broken down along the following stages of the research data lifecycle: creating, processing, analyzing, preserving, giving access to, and re-using data (UK Data Archive, 2017). Terminology might differ according to discipline and levels of expertise but the overarching concepts are consistently equivalent. Among our faculty participants, the main data management topics to emerge were storage and organization.

Data Storage

Faculty explained assorted aspects of data management with varying degrees of detail. However, everyone shared something about how they store their data. Almost all take advantage of web-based tools like Dropbox or Google Drive, essentially web-based file systems; or Box, which

provides an editing permissions system and a few other project management features that support real-time multi-user editing/documentation and communication. A few mentioned that Box was preferred due to its meeting their unit's requirements for data security. Box accounts are provided free of charge to all University of Illinois community members.

Some projects involve using web-based database applications, from citation management software such as RefWorks more sophisticated tools, including the REDcap application for building databases. Researchers also combine two or more of these resources according to function or familiarity. As a result, data is available to project team members or an independent researcher by enabling convenient accessibility regardless of location and without relying upon a specific computer or networked system drive. Without commenting on much more than centralized accessibility, for some participants, storing data seemed to comprise their entire data management strategy. During our interviews, discussion about the back-up function of cloud-based tools took a backseat to the convenience and collaborative benefits, if acknowledged at all.

The two researchers who raised the issue of struggling with storing data securely described unique situations. One was faced with an unreliable network connection in a developing country overseas. Another spoke about an experience that occurred perhaps over a decade ago:

> Yeah, external hard drive. I would have multiple of those backing up my computer system. Actually, I had a very horrible experience while doing my dissertation that prompted me to do that because in the midst of collecting data, my computer was stolen. After that moment, I've been very paranoid about making sure that I always have [it] stored in multiple places and in different locations as a way to make sure that I never lose it.

Predominantly, the research faculty we interviewed routinely store data via web-based systems (the cloud). One participant explained that Google Docs was used at times, but Box was the primary system used:

> Sharing and saving information, we use things like Box a lot…it seems to be kind of more popular with people across universities as a way to be able to share information. I mean it's just having some kind of central location where we can all be able to have access and upload different documents.

There were two notable exceptions to the preference for cloud or web-based storage methods. The first expressed doubts about the security or reliability of the cloud, and described a system of using flash drives and backing up files at different locations:

> I carry a flash drive with all the stuff I'm working on, cause I have to carry it from here, and work on it at home, and carry it back here, et cetera. So, I copy it back and forth, so I don't lose stuff, and it's backed up, et cetera. I have backups here. I have profound distrust for the cloud. I don't want to store anything, even if protected. I am suspicious of the University's network, let alone doing something out in Ohio, or wherever I…I'm suspicious both about the hardware, and I'm suspicious about access, et cetera . . . Having said that, yes, I like to keep the data. Fortunately, I usually am working on a small enough project, that I can keep everything on my flash drive, or on my laptop, with my own backups. So, I have my own backups, I don't back up on the cloud.

The second faculty member who did not express a preference for web-based storage did not mention the cloud, in either a negative or a positive way. Instead, this researcher seems to feel too pressed for time to change their established methods for storing information, which included both print and electronic resources:

> I do not have a systematic method. I have patterns that I follow. If I had a large amount of free time, I might have a systematic method. I find that I'm in a galloping kind of day almost all the time. Sometimes I'm lucky, if I have time, I'll start to move files into folders to make them more organized. If you look at my office, you'll see the current state after a very busy period. Then these piles will recede. There is no method to what you're seeing other than like on top is currently working on, and down below probably could have been filed long ago but can't get to it and won't until there's extra time . . . A lot of it gets stored as paper printed and then filed in cabinets. Sometimes it's not stored but just referenced and left in the internet ether. I have the reference to find it again when needed after I've already read it online.

These two individuals did not indicate if it was important for others to access with ease the information they described.

Even when web-based storage is embraced as the norm, new inconveniences inhibit smooth operations when a means of storage is not agreed upon in advance, and there are numerous options to choose from:

> …What challenges do I have with information that's not my own? I suppose in some strange way, storage is an issue, like getting them all in one place and knowing which place to put it. We have the shared drive, the Box, the Dropbox, it's just ... Then I need to share it with other collaborators. It's like, I just started to share some stuff with our program and I'm like, "There are five different ways I could share it. Which one's the best way?" We don't really have a system in our program yet, which is our own issue, but it's still a problem.

This implies the absence of a plan for storing data, thereby suggesting that even simple routines for organizing data are also nonexistent.

Data Organization

Whether or not terminology such as "data management plan" was explicitly used, the interviews featured discussion outlining some kind of scheme for organizing data. A complete absence of planning was uncommon and only expressed in the example quoted above. However, the wide range of approaches among our twelve interviewees was striking.

One end of the spectrum includes practices that are extremely basic: a set of files, generalized categories. This informal style contrasts starkly with the other end of the spectrum, which entails sophisticated systems that require some knowledge of computer coding to create or maintain. The following excerpts illustrate the range we encountered. First, on the simpler end of the spectrum:

> These are my ... I haven't had ... The answer's yes and it depends on the project. Just putting them in certain places with the name of the project and the date, like at least some kind of time stamp and number, a numbering system, a coding system, like a numbering system.

The following example illustrates a more complex point in the spectrum, in which a project team includes a full-time data manager. While establishing and/or enforcing a file naming protocol is typically a basic responsibility for a data manager, in this case, it is specifically stated that there is a lack of consistency in file naming:

> All of our projects are set up with an overall project name, usually it's more descriptive than number-based, but then within it, we have sub-folders for all of the sub-activities that we do within the project…We have the quantitative staff, we have the qualitative staff. We do linked analyses for what's in the…survey data. We have IRB protocols we put together. We have meetings, memos, things like that. Every single thing has its own sub-folder…Within the qualitative folder, there's separate sub-folders for each qualitative study we're doing or have done, and so on and so forth. Things are set up that way. In terms of file naming, I wish I could say we are much more consistent in how everything's named because I have so many people on so many projects who work across my projects. The data manager doesn't determine how files get named, and so usually it tends to be whoever is saving the file to the directory will save it whatever name they want.

In contrast, the next faculty member describes a detailed, systematic, and overarching approach for managing data, clearly indicating that organizing information is a priority. In this case, the individual acting as data manager has the title of research coordinator:

> In terms of data management, right now I have a really good research coordinator, so she and I work with the students to develop the data collection forms that they're going to use in the laboratory and the hospital and how they design their laboratory notebooks. Then she builds custom databases with data entry pages in Microsoft Access for them. We learned, in our first phase of this current study, that we have to do double data entry, and so she manages the logistics of that programming and maintaining the data quality components. Then for other kinds of things, like programming and statistical analysis, you know, students will work on that, and then I train them to create their coding scripts in ways that I evaluate it for accuracy.

In the next excerpt, the exchange was a bit opaque, but despite the use of vague language there are hints that data organization falls on the more sophisticated half of the spectrum:

> I always have a person in charge of [data management] but it's usually a graduate student and they come and go, so I don't have, I mean, I have a biostatistician that I work with who kind of ... you know, is involved in the data analysis, but when it comes to the data

> management, a lot of it is left up the RAs . . . a lot of it just tends to follow the survey number, like when we're collecting data out in the field . . . I find that sometimes that has worked better than coming up with individual names for variables. Yeah, I mean, it's just kind of evolved over time.

Enter the data manager. Sometimes following under the purview of a project coordinator, project manager, or another designation, faculty who spoke with us often relied upon individuals whose role was significantly anchored in data management or project management. Some were staff, some were students, and some were collaborating scholars; titles varied. Conversation among the faculty we interviewed never indicated that investigators resisted delegating data organization or maintenance.

Research Dissemination

When asked how their research is disseminated, faculty members discussed a wide variety of formats and processes. A major influencing factor is that many faculty researchers hope to reach and impact a variety of audiences with their research. These include a traditional academic audience, but also extend to public health practitioners, government agencies and policymakers, and community partners. Some of these groups collaborate with faculty on research projects and thus partner with them throughout the research process. The differences among these audiences translate to a variety of formats in which research data are described, visualized, and distributed.

Academia: scholarly journals

As we anticipated, the most common outlet for faculty research is in traditional scholarly peer-reviewed journals. Participants overall indicated that this is the standard expectation within their field. Some faculty members working in specific sub-disciplines, such as industrial hygiene,

indicated that there were just a few journals in which they would consider publishing their work. Others, whose work was self-described as more interdisciplinary than strictly falling within the borders of public health, published in a more diverse collection of journals. One participant noted that "it's quite variable as a result, which kind of journal it's going to be depending on the topic. The topics I publish on vary quite a bit." Another explained:

> Mainly most of my publications have been in public health related journals, but there have been a couple journals where I would say they're more interdisciplinary in the sense that…it's a convergence of both social sciences as well as public health and many other things…Some of my work is not necessarily towards public health interventions, but insights into way people go about identifying and making sense of their lives. I think sometimes a lot of academic public health journals are looking for you to be able to present results that are very much stringent based on that.

Faculty members publish in journals across the health sciences, some more clinically focused than public health journals, as well as in social science journals. Individuals who attempted to publish outside of traditional public health journals experienced some challenges. One participant described "starting to try to publish in the infection control literature, which are more clinically oriented" than other public health journals. She continued, "I've struggled to get my articles into those…because I don't normally write for that audience. I haven't figured out their jargon yet." Another faculty member described the challenge of getting a paper accepted into a journal from the field of medicine:

> That had to be done from the medical literature, well researched, rigorously approached, and conservatively approached, because there's a lot of stuff in the literature, of course, but one had to convince the clinicians that this may not have been their specialty area, that this in fact was well documented, and conservatively balanced.

A faculty member in health policy also expressed a desire to improve the visibility and discoverability of her studies that are published in public policy journals, since these journals are not indexed in PubMed or the other health sciences databases typically searched by public health scholars.

Publishing qualitative research studies

Faculty members who conduct research using qualitative methods indicated that it is often difficult to publish this type of research in scholarly journals. One individual noted that "there aren't a lot of journals in which you can publish this…It isn't easy research to publish, really, because it's so qualitative." He explained the inherent challenge:

> Not all journals are very receptive to accepting qualitative studies. There are some journals you don't even bother wasting your time…They won't overtly say it, but they do make it very hard for you to be able to do it, and one of the biggest challenges for qualitative is that oftentimes our sample size are very small. That's the immediate killer right there. If you publish a study, like my recent article that I published had a sample size of about nine. There's no way I could have sent it off to *Lancet* … and think that they would ever get it published because they would just look at it and say no.

This participant elaborated on what he believes to be a "larger issue within the sciences" that leads to these challenges with publishing qualitative research, noting that "in a lot of ways people still question the validity of qualitative work, in the sense that how can you make any inferences based on a small sample size like that?" He added that "fortunately enough…because of those challenges, now there are very specific CBPR [community-based participatory research] kind of related journals" that are receptive to qualitative research, so he and other qualitative researchers can focus their efforts on publishing in those outlets.

Promotion and tenure

The expectations for promotion and tenure did not factor significantly into our discussions about publication, as all but one of our interview subjects were either on a clinical (non-tenure) track or had already achieved tenure. The one tenure-track/pre-tenure faculty member who spoke with us acknowledged that this was a major influence on choosing a venue in which to publish:

> You have to be very strategic about where you publish, what you do… trying my best to get into really good, reputable journal outlets. I think for the publishing round, what I try

> to do is do a good balance of really high impact but also too, journals where I know it could go beyond the high impact…to have better influence on individuals.

A tenured professor with experience as a promotion and tenure committee member mentioned that the SPH has recently begun to "expand its definition" of what qualifies as a scholarly publication, explaining that

> Peer review is important, whatever it is. But—blogs, and webinars, and websites, I include all those sorts of things on my CV now. I think it's perfectly reasonable to include them in promotion packages. It shows reach. It shows impact and outcomes, especially when you're doing community-engaged kind of research.

Another participant said that having full tenure allows her more freedom to publish outside of traditional academic journals. She noted that scholarly journals are "not my primary outlet anymore…Of course, I sort of am fortunate in that I already have my full tenure and I'm a full professor. I don't really need to worry about that publishing record."

Beyond academia: practitioners, policymakers, and community partners

Practitioners

Participants consistently described the domains of academia and practice in public health as interrelated rather than mutually exclusive. Many faculty members expect that their research findings will impact public health practitioners in addition to fellow academics. One faculty member balked at calling himself a researcher, instead describing his work as a more pragmatically oriented "scholarly inquiry" because it is "more aligned with practice if you look on that continuum than research, which is more abstract…It's very much related to what do people use and need in practice."

Others did not mention the concept of scholarly inquiry but nonetheless had a strong orientation towards producing research that has impact beyond academia and can be applied to practice. For example, one individual reflected, “I’m a pretty applied person. I’m hoping it doesn’t just stay in the academic literature.” Another noted, “I always want to bring in what’s happening in practice that’s complex and unique into then, how can the academia support it? Really for my entire career, I’ve always danced between the two worlds.” For this reason, some individuals said that they seek feedback on their manuscripts from practitioners in lieu of—or in addition to—undergoing the traditional scholarly peer review process.

When partnering with local organizations and health departments, research findings are frequently translated into training materials for these organizations, including webinars, flyers, and websites. One participant indicated that her research team’s findings are typically disseminated via partner organizations’ websites, rather than being hosted by UIC or published in a scholarly journal.

Creating a research product that can be directly applied to public health practice, especially when created in addition to a scholarly journal article, can be a time-consuming process. Still, multiple participant mentioned the importance of ensuring that their research has an impact on practice. One faculty member reflected that her staff enjoyed creating “practitioner-oriented products. They love doing that because they’re talking with their field that way as opposed to just talking to academics.”

Another faculty member described a moral motivation behind creating products that are immediately useful to public health practitioners, saying “it’s the right thing to do, in my opinion, to take action, but it’s laborious and it’s more work…to make sure there’s some kind of resolution and action from what you’re doing.” She expressed a strong desire to “spend more time

making meaning out of" her research findings, adding that "it's not just to collect it for the information's sake."

Policymakers

Many public health faculty researchers aim to influence policy and legislation. To this end, they disseminate their findings in multiple formats. These include traditional scholarly journal articles but also extend to reports, policy briefs, and web documents, which are likely to reach a wider audience than are scholarly journals. Faculty members who conduct research in health policy create documents for policy influencers. One participant described the process in the context of writing for multiple audiences:

> We have so many kinds of writing that we do in public health. I will go next week to the Hill and meet with Congresspeople and I need something in my hand that resonates with them, that is framed from their perspective. That's different from the thing I write for whatever journal. It's different from what we're going to put on our website. Every single one of these things has different kinds of thinking about it and writing about it. I don't have a place to go that helps me with all of that.

Another faculty member said that "A lot of what we do is to bring the science to the policy debate," for example, writing "a review of coal health impact…for various advocacy groups, that will post it on their webpages, or whatever. They're not peer reviewed. Hopefully they are accurate and balanced, so that in that way, scholarly, but they're not the scholarly literature."

One major impetus for publishing research in multiple formats is the desire to meet decision makers where they are. For maximum impact, one participant explained, research must be disseminated outside of academic journals:

> We're increasingly finding that all of our academic papers, it doesn't matter what we put out there. Unless we translate them into manageable products, like short briefs, fact sheets, whatever, they're not going to get used by decision makers. Even if we are doing a manuscript, I always want a companion product to go along with it.

Further, this information can be published more rapidly than in the academic publishing cycle:

> It's becoming increasingly typical in the public health policy field, for sure. Anyone who's doing work with the foundations, the foundations in particular are much more keen on rapid dissemination. Again, getting information out in a rapid way to inform decision making and not wanting to wait for the academic publishing cycle.

This faculty member, who came to academia from a background in government work, even noted that "I've made more of an impact on policy at the highest levels as a researcher than I ever did working in the federal government as a policy analyst."

Community partners

Several faculty researchers described their involvement in community-based participatory research, an approach to research which focuses on collaboration and equal partnership with community members, rather than a more traditional investigator-subject relationship (Minkler & Wallerstein, 2008). These faculty members expressed a desire to incorporate their research findings into products that could be presented to community partners as a resource for their own use.

The practice of creating these community resources seems to stem from a moral motivation for these faculty members, who indicated that they feel it is the right thing to do. One individual described his perspective as "a little anti-academic," saying that

> If I'm spending time in the community, and they're spending time with me, me getting a publication out of this is not my goal…I have never actually been in a position where I simply wrote an article, and there wasn't anything back to the community. This is just not in my nature to do that.

Faculty have published myriad products, including flyers, infographics, presentations, and even an educational comic book, for community partners from their research data. A traditional

academic paper is often prepared alongside or after this community resource. At least one participant did not seem to find this process overly burdensome:

> I feel like it's so easy to build in this part where you can create the information that's more community-oriented, and more community friendly, in the process of that, you also [have] the parallel process of trying to get to the manuscript part.

She continued by describing the multiple formats in which her research team has provided community partners with information in the past, including "short one-page summary reports. More often than that, we will use, now the more the infographic kind of one-pager." She explained, "it's not just dot-point information, there's figures on there, and little graphics, and things like that, that people seem to feel more comfortable with."

Faculty noted that community partners are typically invited to review these products and provide feedback. One participant noted that "the target population [for a publication] is often the people who are participating in the process. It's a summary of their results, and they review it, and tell me whether…it's relevant or not." The process was described as follows:

> We'll ask them, "Is this meaningful to you? How else would be a better way?" We feel that we collaborate on our instruments, we get the information, we process it, and then we will give back the information in the format that the community tells us to. "We would like to see this more in pictures, or we would like to understand this…Can you make a chart for us?"

Another said that such feedback helps not only to ensure that the information presented is correct, but also to strengthen any scholarly article written from the findings. She said that this feedback helps "develop the recommendations that I would also write within an article, and through that process, I think it makes a much more solid piece." In some cases, community partners are invited to join as co-authors. One participant noted, "I always also extend the opportunity for individuals of those agencies and programs to also join as co-authors. I think that's really important to make sure that they feel as much invested in the process as I did."

Collaboration

All of the researchers that we interviewed rely upon some form of collaboration to do their work successfully, even if only a team of two, and even if not for the entire duration of a project. We considered significant contributions from the sophisticated to the mundane to be collaboration.

Collaborations across different fields of expertise

The study of public health is a health science-centric discipline that provides a flexible domain in which highly interdisciplinary and innovative collaborations take place. The public health faculty interviewed for this project described collaboration among scholars from diverse established disciplines and knowledge niches. Problem solving and the translation of research into real-world application are strong motivating factors for faculty researchers. Solution seeking seems to compel these faculty members to actively pursue the formation of useful and dynamic alliances.

Our interviews present examples of interdisciplinary partnerships that range from the conventional to the socially progressive and technologically innovative. No matter how these research agendas take shape, all stem from an intention to improve peoples' lives directly or indirectly. The following illustrates a collaborative study with the aim of increasing the likelihood of success for a public health intervention:

> We have a randomized control trial looking at if providing education and immediate provision of contraception to postpartum women during their baby's pediatrician visit improves uptake. So our primary outcomes are receipt of any contraception and then our secondary is really receipt of long acting reversible contraception. So we're collecting a lot of data from the women directly through surveys but also clinical data and looking at how effective this intervention is compared to usual care at allowing women to get the contraception they need.

Another participant described projects underway at a Respirator Research Lab and UIC's Center for Healthy Work, two of the many collaborative, interdisciplinary institutes and centers mentioned by faculty members:

> Well, I have a couple of different areas that I do research in. One is a lab-based research lab that I have, which is called the Respirator Research Lab. I'm looking at how well respiratory protection protects workers and how it performs, especially in terms of getting it on their face. We do a lot of human subjects with that . . . The other big piece of research that I do is I used to do interventions in small businesses with health and safety improvements, workplace health and safety improvements. I'm now at New Center for Healthy Work and that is interventions in communities related to precarious employment. There's a lot of human subjects with that. That's a lot of participatory research and interactions with organizations that are worker centers that are trying to organize workers.

Another participant elaborated upon three collaborative endeavors, each innovative in very different ways. The first recognizes the potential needs of an at-risk population that has been neglected in the past. Another refers to the potential application of gaming and apps (currently trending) in the public health sphere. The last hints at an attempt to harness technology for solving a pervasive but matter-of-fact challenge faced by many people when managing medication:

> I've recruited a number of different people with complementary skills or kinds of access that they may have to certain patient populations to be partners on these projects. For example, there's somebody at Lurie Children's who's an expert on HIV prevention in youth including transgender youth. There's somebody else who's doing technology-based interventions in HIV-infected populations. Somebody else who is from here who is the head of CADE [Center for the Advancement of Distance Education], which she has experience with things like gaming. I have a computer scientist, for example, who helps with the app development. On another project, I've got a partner who has had experience with an electronic pill bottle that's being used for a different project.

Collaboration challenges for our faculty were usually external issues like technology limitations, as well as project logistics and communication. One of the interview participants reflected upon the conflict that can arise from collaboration:

> I think that I've not really been in a team where there's been a lot of factions or conflicts, or anything like that. I've been fortunate in that, because I've heard of situations where that's happened before. Particularly between quantitative and qualitative people, not exactly feeling comfortable with perhaps the amount of rigor or the amount of evidence that was brought to bear on something. Myself, I haven't experienced that but I've heard those kinds of war stories from other people. So I would think that in my own experience in terms of collaboration, you have to [be] flexible, you have to be open, you have to have, I'd say a loose sense of guiding principles of how a collaborative is going to work in an academic sense.

Collaborations in research dissemination

As detailed above, the academic journal is at times an unsatisfactory venue for sharing ideas with various stakeholders. In order to reach their desired audiences with maximum impact, some faculty researchers hire individuals for the purpose of addressing this challenge. Just as some faculty have discovered the value of bringing project managers on board, a research team may hire a consultant or contractor who can take their findings and craft a customized message tailored specifically for their intended audience.

One example of this type of collaboration is the researcher who hired an artist to collaborate on an educational comic book. Another participant described the process of hiring an illustrator when her project needed meticulously realistic images, which was beyond the abilities of her team:

> One piece of support that I've asked for, and I've been told is not available, is editorial and illustrations…We ended up hiring somebody who was a medical illustrator and who did a variety of things. She was familiar with anatomy, and she already had templates and silhouettes that she could apply to our problem.

This faculty member shared as another example the collaboration that arose from the challenge of reducing a large volume of text into something more likely to be easily digestible by a variety of audiences:

> My colleague…went to meet with a communications specialist, because we're going to be working closely with this advisory group and we don't want to provide them with a 100-page report. We're looking for a communications specialist who can help us to figure out how most effectively to present the material to get what we want from them.

Another participant described working with a graphic designer to ensure that a complex document, intended for a local health department, had a "standard look and feel." Her team first collaborated with the health department on the report "to get it to their satisfaction, but then…had a graphic designer help us with the formatting. We did it ourselves in Word initially…thinking of the target audience, all that kind of stuff."

Discussion

Implications for library practice

Grey literature use

Librarians who serve public health faculty, students, and other researchers should bear in mind the diverse array of information formats both consumed and produced by this group. While they read and publish heavily in scholarly journals, their information needs extend far beyond traditional outlets. Most faculty members indicated that they were comfortable searching the scholarly literature but wanted help finding grey literature, including data sets and research reports. Searching for grey literature should be built into information literacy instruction sessions for graduate students, so that they are prepared with this skill in their future careers, whether in academia or in public health practice. Further, these findings underline the need to explore how to improve the discovery of grey literature for public health researchers at a broader level, through

development of specialized databases, websites, or other discipline-specific resources (Keeling et al., 2011).

Beyond using grey literature as secondary sources to support their work, faculty also indicated that they produce several types of information products besides journal articles. These include infographics, research reports, websites, and flyers. This has direct bearing on the work of librarians, especially those who work in scholarly communications. Librarians could help address this need, for example, by providing instruction on data visualization and infographics creation. They should also bear these needs in mind when developing library collections and purchase books or other non-journal resources that support or exemplify such endeavors.

Data management support

The majority of faculty that we interviewed indicated that they do not follow established protocols for data management, and all varied in sophistication in their respective approaches to data management. The use of cloud-based storage systems is widespread. Previous research examining the adoption of cloud-based back-up systems in academic settings validates this tendency, finding convenience to be the over-riding motivation, followed by security (Menard, Gatlin, & Warkentin, 2014).

Attitudes and practices observed among scholarly researchers in a previous Ithaka S+R report (Wolff-Eisenberg, Rod, & Schonfeld, 2015) revealed that approximately 40% of faculty in public health-related fields used cloud storage to collect and manage data. This report did not assess collaboration. All but two of our interview subjects indicated that they regularly use the cloud for data storage and collaboration. While web-based tools were originally adopted in higher education because they were deployed as dependable data back-up systems, not necessarily vehicles for improving collaboration, our findings potentially indicate an increasing shift towards

dependence on cloud-based systems, especially in the context of sharing information. It merits further investigation.

While several participants seemed to indicate that their entire data management plan consists exclusively of data storage, additional probing questions might have proved otherwise. When asked if they had ever deposited their data in a repository, only a small minority of faculty members said they had, and several were completely unfamiliar with the concept. None mentioned working with the library on data management. Again, since this question was not directly asked of participants, we cannot conclude for sure that none has worked with the library in this capacity. However, we believe that overall, faculty responses indicate a need for education on both data principles and the ways that the library can support data management.

Keeping up with research

Beyond listservs and table-of-contents alerts, faculty did not describe systematic methods for staying apprised of recent research in their field. Several indicated that this was an area in which they would like to improve, but had trouble finding the time to do so. While it would likely be too burdensome for librarians to create personalized research updates for individual faculty members, as one participant proposed, we can provide education on the myriad resources that aid in the discovery of new articles of interest to the reader. These include email alerts for new search results from databases such as PubMed, Web of Science, and Scopus; dedicated journal reader tools such as Browzine; RSS feed readers; and the Alerts and My Updates features in Google Scholar. Further ideas for helping faculty and students to more easily and systematically discover recently published research should be explored.

Limitations

We attempted to recruit faculty from all ranks; however, only one of our interview subjects was an assistant professor on the tenure track. All other subjects either had already been awarded tenure or were in non-tenure-track positions. It is possible that this may have influenced our findings, especially concerning research dissemination practices. While the faculty interviewed here expressed strong interest in disseminating their research in myriad formats other than the scholarly journal article, pre-tenure faculty may in fact favor this more traditional format due to the requirements imposed by promotion and tenure norms.

The scope of public health as a field is wide-reaching, spanning disciplines from medicine and nursing to anthropology, education, and public policy. As such, it was not possible to interview faculty researchers from all the varied sub-disciplines within public health. Our analysis is not generalizable to all public health researchers but is an exploration of those sub-disciplines represented by our interview subjects.

Major recommendations

- Instruct students, faculty, and other researchers on best practices for locating grey literature;
- Investigate ways to improve discovery of grey literature for health sciences researchers through the development of specialized databases and/or websites;
- Provide support for the publication of research findings beyond the scholarly journal:
    - Instruction on data visualization, e.g. infographics;
    - Develop library collections to support these endeavors, e.g. resources on writing for diverse audiences;
- Continue to deliver and expand education on data management principles;
- Facilitate the discovery of recently published research.

Conclusion

Public health is a highly collaborative and interdisciplinary field. The research partners of public health faculty, as well as the audiences for their research findings, range far and wide. Consequently, the information needs of public health faculty researchers span far beyond the traditional formats that immediately come to mind for many librarians. As always, faculty members find themselves continually pressed for time, seeking ways to improve efficiency in their research and in communication with collaborators. The library must bear in mind this complex array of practices and preferences when designing library resources and services that might best meet the needs of faculty researchers.

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Appendix A. Semi-structured interview guide

Research focus

1. Describe your current research focus/projects:
    a. How is your research situated within the field of Public Health?
    b. [Probe for which sub-discipline(s) their work aligns with and whether they engage in inter-disciplinary work within Public Health and/or with other fields]
    c. What led you to this? (What is your background?)

Research methods

2. What research methods do you currently use to conduct your research?
   [Probe for whether these methods are typical for Public Health scholars]
   Is this methodology common for this line of research?
   Have you conducted systematic reviews, rapid reviews, or other types of literature reviews as part of your research?

   Do you collaborate with others as part of your research?
   [If yes, probe for what these collaborations entail, who typically works on them, what the division of work is and how information pertaining to the project's research is created and stored]
   What does this collaboration look like? What are the logistics?
   Do you employ research assistants? If so, can you talk about how delegation works?

3. Does this project involve collecting data?
   What is it you're trying to learn?
   What are you trying to reveal/discover?
    a. What kinds of data does your research typically elicit?
    b. How do you incorporate these data into the papers or presentations that come out of your research?
       [Probe for whether they use data visualization tools] Examples?
    c. How do you manage and store this data for your ongoing use?
       Is anyone in particular in charge of this?
       If you have a specific protocol or system for naming, organizing and storing data, is it one you adopted or developed for yourself?

4. Beyond the data your research produces, what kinds of information do you rely on to do your research?
   Are you building upon previously presented research—either yours or someone else's?
    a. How do you locate this information?
       [If not explicitly stated, probe for where they locate the information]
    b. How do you manage and store this information for your ongoing use?
    c. Do you experience any challenges working with this kind of information?

5. Can you tell me about a past or ongoing research project where you faced challenges in the process of conducting the research?
    a. Describe these challenges. What does that look like?
    b. What could have been done to mitigate these challenges?
    c. Are there any other challenges you regularly experience when conducting your research?

6. How do you keep up with trends in your field more broadly?
   How do you become aware of recently published research?
   How do ideas get shared across collaborating researchers?
   Where do creative discussions happen that help you develop ideas?

Dissemination Practices

7. Where do you typically publish your research in terms of the kinds of publications and disciplines?
    a. Do you disseminate your research beyond scholarly publications?
       [If so, probe for where they publish and why they publish in these venues]
       Do expectations for promotion and tenure influence these decisions?
       i.e. to publish, where to publish, or to disseminate research other than in publications, such as presenting papers or posters at conferences

    b. How do your publishing practices relate to those you consider typical to your discipline?

8. Have you ever deposited your data or final research products in a repository?
    a. If so, which repositories and what have been your motivations?
       (i.e. required, for sharing, investment in open access principles)
    b. If no, why not?

   Does your research have more of an application to the work of academics, practitioners, or both? (Or another group?)

Future and State of the Field

9. What future challenges and opportunities do you see for [your research area and] the broader field of Public Health?
   Potential interdisciplinary collaboration?

10. If I gave you a magic wand that could help you with your research and publication process – what would you ask it to do?

Follow-up

11. Is there anything else about your experiences as a scholar of Public Health and/or the Public Health discipline that you think it is important for me to know that was not covered in the previous questions?

Appendix B. Division and rank of UIC SPH interview subjects

	CHS	EOHS	EPI-BIO	HPA
Assistant Professor (tenure-track)	1			
Associate Professor (tenured)	1	1		
Professor (tenured)		2	2	1
Research Assistant Professor (non-tenure-track)		1		
Clinical Assistant Professor (non-tenure-track)	2			
Clinical Associate Professor (non-tenure-track)				1