

The Public Health Value of Health Care Claims for Understanding Chronic Disease

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THESIS

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To my parents, for always encouraging me to pursue my dreams.

To my wife and soul mate, Kristen, for her unconditional love and patience throughout this journey.

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LIST OF ABBREVIATIONS

APCD	All-Payer Claims Database
CAD	Coronary Artery Disease
CPT	Current Procedural Terminology
DOI	Diffusion of Innovation
DRG	Diagnosis Related Group
EHR	Electronic Health Record
HEDIS	Health Care Effectiveness Data and Information Set
HIE	Health Information Exchange
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
IOM	Institute of Medicine
LOS	Length of Stay
MDC	Major Diagnostic Categories
NDC	National Drug Code
PPACA	Patient Protection and Affordable Care Act
PMPM	Per Member Per Month
PTMPY	Per Thousand Members per Year
PII	Personally Identifiable Information
RHIO	Regional Health Information Organization
WIC	Women, Infants, and Children

SUMMARY

Chronic disease is a major problem for public health and the health care system. Public health does not have robust data on the burden of chronic disease in the population. Evidence suggests that health care administrative claims data can be a valuable source of data for population-level chronic disease research, surveillance, and epidemiology. Although there is important value contained within health care administrative claims data, public health has not widely adopted health care administrative claims data for supporting chronic disease epidemiology. This study aimed to demonstrate the analytic utility of health care administrative claims data to support chronic disease epidemiology, to explore public health's attitudes regarding the value of health care administrative claims data, to understand public health's experience accessing and using claims data, and to understand the factors influencing public health's access and use of claims data.

Using an exploratory sequential mixed methods research design, the first phase of the study used a quantitative population-based retrospective database design to demonstrate a variety of chronic disease-related analyses that can be performed using health care administrative claims data. The second phase of the study used a focus group data collection methodology of key informants to explore public health's interest and ability (barriers and enabling factors) to access and use health care administrative claims data and All-Payer Claims Databases (APCDs) for chronic disease epidemiology.

The findings from the first phase of the study suggest that meaningful information about chronic disease morbidity and its effect (utilization and costs) on the health care system can be gleaned from health care administrative claims data when appropriate analytic techniques are applied to the data.

The findings from the second phase of the study suggest that public health does recognize the value of health care administrative claims data and APCDs for supporting overall public health activities and chronic disease epidemiology. Case studies and demonstration projects that showcase the value of claims and APCDs would be useful to help support public health's efforts to gain access to the data and provide reassurance that public health knows how to work with and define opportunities with the data.

SUMMARY (continued)

Resources, capacity, experience, training, APCD vendors, data quality, data completeness, and lack of standard methods were identified as major barriers to public health using claims data. As for APCDs, public health has been an advocate for their development but have not a visible lead pushing for implementation. This may be a function of public health's interest and anticipation for health information exchange and limited political clout. The lack of federal support for APCD initiatives from a leadership, funding, and methodological perspective has also been a barrier.

Unless public health makes a real commitment to developing strategies for overcoming the barriers to accessing and using health care administrative claims data for supporting chronic disease epidemiology, it is likely that the adoption of this data source for chronic disease epidemiology will remain low.

I. INTRODUCTION TO STUDY

A. Study Objectives

Chronic disease has emerged as a major public health problem in the United States, affecting population health along with social and economic welfare (Institute of Medicine [IOM], 2012a). Much of the focus of the U.S. health care system had been on the treatment of chronic disease, which represents 75% of all health care spending in the United States (The Kaiser Family Foundation, 2012). In addition, projected increases in health care spending over the next 25 years suggest an unsustainable trajectory for the United States (Emanuel et al., 2012). Although no single factor is completely responsible for the increase in health care costs over time, increases in the rates of obesity and chronic disease in the population are significant contributing factors (Thorpe & Philyaw, 2012).

In response, it has been suggested that the health care system needs to become more prevention oriented. Consequently, public health could play a meaningful role in shaping the health care system toward a prevention focus. It has been suggested that making the health care system more efficient and more prevention oriented, reducing health care spending, and improving the health and outcomes of patients and populations will require public health to become aligned once again with medicine (Gostin et al., 2011; IOM, 2012b).

In 2012, the IOM published a framework of five essential principles for the successful integration of public health and medicine. One of these principles is the sharing and collaborative use of data and analysis (IOM, 2012b). Comprehensive chronic disease epidemiology, which provides information on the scope, magnitude, and cost of a chronic disease, is essential for helping to execute and monitor strategies used to reduce the burden of chronic disease.

Unfortunately, although several sources of chronic disease data are available to public health today, no organized surveillance system exists, which provides the information needed to analyze how chronic disease affects various U.S. populations by race, ethnicity, and locale; to identify public health priorities; or to track the progress of preventive efforts (IOM, 2011). Robust data on chronic disease

morbidity remain scarce to public health (California Conference of Local Health Officers, 2007; Cossman et al., 2010; Frieden, 2004; McKenna & Collins, 2010). The gaps in chronic disease data have limited the public health's ability to target focused and effective local and national initiatives to improve health. Consequently, Brownson and Bright (2004) suggested that public health should increase its effort to leverage both emerging and existing data sources to more effectively address chronic disease. Specifically, sources of population-level clinical and health care–related data would be particularly helpful for supporting chronic disease prevention activities.

One emerging data source with the potential to fill the gap in chronic disease data is health information exchange (HIE). Although HIE is intriguing and potentially transformative for public health, the universal adoption and meaningful use of HIE is still several years away. On the other hand, existing data may provide public health with needed information to better understand the effect of chronic disease in the population. One such existing data source is health care administrative claims data. Evidence suggests that health care administrative claims data, a by-product of the health care system, can be valuable for population-level chronic disease research, surveillance, and epidemiology (Yiannakoulis, Schopflocher, & Svenson, 2009). Health care administrative claims data capture health care service interactions not only in the hospital inpatient setting but also in ambulatory care settings (e.g., emergency room [ER], physician office, urgent care, and clinics) where most health care interactions take place (National Association of Health Data Organizations, 2011). These data can provide public health with valuable insight into the processes, outcomes, and costs of care of people with various chronic diseases (James & Fine 2008; Margolis, Barron, & Grochulski, 2005; Priest, Cantrell, Fincham, Cook, & Burch, 2011; Ramsey, Summers, Leong, Birnbaum, Kemner, & Greenberg, 2002).

There is important value contained within health care administrative claims data; however, public health has not widely adopted this data source for supporting chronic disease epidemiology.

Although some potential barriers to adoption have been identified in the literature, overall there is a paucity of research exploring the barriers and enabling factors influencing public health's adoption of this data source for chronic disease epidemiology. The purposes of this study were to demonstrate the analytic utility of health care administrative claims data to support chronic disease epidemiology, to explore public health's attitudes regarding the value of health care administrative claims data, to understand public health's experience accessing and using claims data, and to understand the factors influencing public health's access and use of claims data.

B. Background and Context

Overview of the Issue

Chronic diseases impose an enormous financial and quality of life burden on American society and are a major public health challenge in the twenty-first century (Hardy, 2004). In 2005, approximately 133 million or 45% of all Americans had at least one chronic disease (Wu & Green 2000) and more than 25% had multiple chronic diseases (Anderson, 2007). Seven of every ten deaths in the United States are attributable to a chronic disease (Centers for Disease Control and Prevention [CDC], 2010). Heart disease, cancer, hypertension, stroke, and diabetes are responsible for approximately 80% of all deaths annually (Freudenberg & Olden, 2011). Between 2003 and 2023, the incidence of chronic disease is projected to rise with a greater than 50% increase in the rate of cancer, mental disorders, and diabetes and a greater than 40% increase in heart disease (DeVol et al., 2007). In addition to the mortality attributable to chronic disease, quality of life is also compromised. Models estimate that the number of Americans who will suffer functional disability due to arthritis, stroke, diabetes, coronary artery disease (CAD), cancer, or cognitive impairment is expected to increase at least 300% between the years 1993 and 2049 (Boult, Altmann, Gilbertson, Yu, & Kane, 1996).

Much of the focus of the U.S. health care system has been on the treatment of chronic disease. It is estimated that 75% of the 2.6 trillion dollars in annual health care spending is for the treatment of

chronic disease (CDC, 2011d; Centers for Medicare and Medicaid Services [CMS], 2012). National health spending in the United States is projected to increase from 18% to 27% of gross domestic product by 2037, and federal health spending is expected to increase from 25% to 40% of total federal spending by 2037 (Emanuel et al., 2012).

Although several factors have been identified as contributing to the growth in health care costs in the United States (e.g., health care pricing, medical technology, population demographics, prescription drug spending, reimbursement models, administrative costs, health insurance coverage, income elasticity, and medical malpractice liability), one critical factor is the rising burden of obesity and chronic disease in the population (Emanuel et al., 2012; Health Care Cost Institute [HCCI], 2012b; Social Security Advisory Board, 2009; The Kaiser Family Foundation, 2012). Thorpe and Philyaw (2012) found that the health care spending growth since 1990 has been significantly driven by the increase in obesity and obesity-related chronic diseases. The average health care costs for an individual with one or more chronic diseases is approximately five times greater than an individual without chronic disease (Partnership for Solutions, 2004).

Although most chronic diseases are prevalent and costly, they are also among the most preventable health problems (CDC, 2008). There is broad consensus that the continued rise in health care costs is unsustainable. The health care system has focused too much on the treatment of disease rather than addressing the underlying causes of disease (Miller, Roehrig, Hughes-Cromwick, & Turner, 2012). Although the United States spends more per capita on health than any other country in the world, more than 85% of all counties in the United States have life expectancies less than the top 10 nations with the highest life expectancy (Kulkarni, Levin-Rector, Ezzati, & Murray, 2011). Consequently, there is an increasing acknowledgment that the health care system needs to become more prevention oriented. This is evidenced within elements of the Patient Protection and Affordable Care Act (PPACA) in 2010. PPACA includes provisions expanding the coverage of wellness and preventive care services among

public insurance programs, promotes workplace wellness programs, strengthens the role of communities in promoting prevention, and elevates prevention as a national priority (Koh & Sebelius. 2010). PPACA represents a national health care policy that emphasizes wellness and prevention as important components in the strategy to reduce health care spending and improve the health status of the population.

The need to make the health care system more efficient and more prevention oriented, to reduce health care spending, and to improve the health and outcomes for patients and populations suggests that public health needs to become aligned once again with medicine (Gostin et al., 2011). The meaningful effect on chronic disease and population health will require both public health and medicine to work in a more integrated manner. In 2012, the Institute of Medicine (IOM) examined the topic of primary care and public health integration and suggested that successful integration “could enhance the capacity of both sectors to carry out their respective missions and link with other stakeholders to catalyze a collaborative, intersectoral movement toward improved population health (IOM, 2012b).”

There are several advantages in having a more integrated health care system where public health has a more prominent and visible role. These advantages include a health care system with a greater focus on health promotion, an improved alignment between medicine and public health from a health policy perspective, a realignment of resources between medicine and public health for medical care, a mix of methods and bodies of knowledge, and an integrated information system that can provide a shared awareness of public health threats, information on the availability of resources, and options for a swift and effective health protection intervention (Gostin et al., 2011; Hardcastle, Record, Jacobson, & Gostin, 2011). The IOM published a framework of five essential principles for successful integration between public health and medicine, and these principles include a shared goal of population health improvement, community engagement, aligned leadership, and sustainability and the sharing and collaborative use of data and analysis (IOM, 2012b).

With a mutual goal of reducing the effect of chronic disease, the sharing and collaborative use of data could allow public health and medicine to make meaningful progress toward this goal. Data that provide information on the scope, magnitude, and cost of a health problems are valuable for helping to assess, execute, and monitor strategies to reduce the burden of chronic disease. Unfortunately, although several sources of chronic disease data are available to public health today, no organized surveillance system exists, which provides the information needed to analyze how chronic disease affects various U.S. populations by race, ethnicity, and locale; to identify public health priorities; or to track the progress of preventive efforts (IOM, 2011). Robust data on chronic disease morbidity remains scarce to public health (California Conference of Local Health Officers, 2007; Cossman et al., 2010; Frieden, 2004; McKenna & Collins, 2010). Chronic disease data, which include information on chronic disease prevalence, morbidity, prevention activities, and use of outpatient health care, are rarely available to communities for local health planning and policy development (Luck, Chang, Brown, & Lumpkin, 2006).

To help overcome the gap in chronic disease data, it has been suggested that public health should increase its effort to leverage both emerging and existing data sources (Brownson & Bright, 2004). Specifically, sources of population-level clinical and health care-related data would be particularly helpful for supporting chronic disease prevention activities. One emerging data source with this type of information is the health information exchange (HIE). HIE is the process of electronically transmitting patient-level information between various health care organizations (Vest & Gamm, 2010). HIE has the potential to transcend the barriers of institutionally siloed data and to enhance public health's capability to monitor the health of populations across entire communities (Shapiro, 2007). Some of the touted public health benefits of HIE include automated laboratory reporting of mandated and nonmandated diagnoses to public health departments, automated reporting of mandated and nonmandated physician-based information to public health departments, population-level quality of care monitoring, and patient-

and population-level public health alerting (Shapiro, Mostashari, Hripcsak, Soulakakis, & Kuperman, 2011).

Although HIE offers an exciting and potentially transformative source of data for public health, the universal adoption and meaningful use of HIE is still several years away. The adoption of electronic health record (EHR) systems among health care providers and organizations is a prerequisite for HIE. Between 2006 and 2011, the percentage of office-based physicians having any EHR system increased from 29.2% to 57.0%, and the percentage having a basic EHR increased from 10.5% to 33.9% during the same period (Hsiao, Hing, Socey, & Cai, 2011). The number of nonfederal acute care hospitals with at least a basic EHR increased from 13.4% to 34.8% between 2008 and 2011 (Charles, Furukawa, & Hufstader, 2012). Despite the encouraging progress in EHR adoption, many EHR systems do not currently support stage 1 “meaningful use” functionalities as defined by the CMS. This is illustrated in a 2011 survey of office-based physicians, which found that only 11% of all physicians surveyed reported both intending to apply for meaningful use incentives and having the computerized capabilities to support 10 of the 15 stage 1 meaningful use core objectives (Hsiao, Decker, Hing, & Sisk, 2012).

Many EMRs do not have the HIE capabilities required as part of meaningful use. Regional health information exchanges (RHIOs) are intended to help bridge this gap. RHIOs are organizations that support state or other regional projects to help synchronize the privacy and business rules for HIE (Adler-Milstein, McAfee, Bates, & Jha, 2008). Although RHIOs seem to have promise, a 2011 study found that only 17% of RHIOs supported stage 1 meaningful use criteria and 8% support both core and menu set measures (Adler-Milstein, Bates, & Jha, 2011).

All these findings suggest that robust HIE across the United States will take time. Ubiquitous stage 1 meaningful use adoption is still years away. Stage 1 adoption only includes basic HIE objectives, and fully leveraged HIE will not be realized until stage 2 and stage 3 criteria is achieved

across the country (HIMSS Health Information Exchange Committee, 2010). The broad adoption of stage 2 and stage 3 criteria is even further into the future.

As suggested previously by Brownson and Bright (2004), in addition to emerging data sources, existing data sources could help support chronic disease prevention activities. One existing data source with the potential to help fill the gap is the health care administrative claims data (also known as insurance billing claims). It is a by-product of the health care system and an electronic version of the bills submitted by physicians, hospitals, pharmacies, or other medical providers for the reimbursement of health care interactions such as physician office visits, hospital stays, and sale of drugs and supplies (Wyant & Parente, 2003). It captures health care service interactions not only in the hospital inpatient setting but also in ambulatory care settings (e.g., ER, physician office, urgent care, and clinics) where most health care interactions take place (National Center for Health Statistics, 2011).

Evidence suggests that health care administrative claims data can be a valuable resource for supporting population-level chronic disease research, surveillance, and epidemiology (Yiannakoulis et al., 2009). Administrative claims data are an intriguing data source for understanding chronic disease because contained within the data are the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes and health care service procedure codes used for coding and classifying disease morbidity data from the inpatient, outpatient, and physician office records. This coding system is a key diagnostic tool for epidemiology to analyze the general health situation of populations and to monitor the incidence and prevalence of diseases and other health problems (World Health Organization, 2013). Health care administrative claims data can be used by epidemiologists to analyze the types of services chronic disease patients receive and the social characteristics of people who receive services for the condition. It can also include geographic identifiers for persons or service providers and may be used to map the geographic patterns of the incidence of hospitalizations, other services provided, and health care costs, which can be used in

analyses of health care disparities (IOM, 2011). Evidence also suggests that health care administrative claims data can be used to examine the processes, outcomes, and costs of care among persons with chronic disease (James & Fine, 2008; Margolis et al., 2005; Priest et al., 2011; Ramsey et al., 2002).

C. Problem Statement

Public health has insufficient data to fully understand the burden of chronic disease in the population, which is a barrier for public health in becoming more effective in guiding population – and policy – level chronic disease prevention and in helping to shape the medical system toward a more prevention focus. Evidence suggests that health care administrative claims data have the potential to help fill this gap. Although there is seemingly important value contained within health care administrative claims data, public health has not widely adopted this data source to support chronic disease epidemiology. This suggests that either public health does not fully understand the value contained within health care administrative claims data or barriers exist, preventing a wider acceptance and adoption of this data source for supporting chronic disease epidemiology.

D. Purpose of Study

The literature review, as described in Chapter II, cites some potential barriers to a wider adoption of health care administrative claims data, including issues with data accuracy/validity, lack of clinical data, data access issues, and shortage of use cases demonstrating the value of the data. Nonetheless, there is a gap in the research examining the factors influencing public health's adoption of health care administrative claims data for supporting chronic disease epidemiology. Consequently, the purposes of this study were to contribute to the evidence demonstrating the value of health care administrative claims data for supporting chronic disease epidemiology, to explore public health's perception of the value of health care administrative claims data for supporting chronic disease epidemiology, and to assess the barriers and enabling factors potentially influencing the diffusion of health care administrative claims data for supporting chronic disease epidemiology into public health practice.

E. Study Questions

- What is the analytic utility of administrative claims data to support chronic disease epidemiology?
- What is public health's perception of the value of administrative claims data for supporting chronic disease epidemiology?
- What are the barriers and enabling factors potentially influencing the diffusion of health care administrative claims data for supporting chronic disease epidemiology?

F. Research Design

This study used an exploratory sequential mixed methods research design. In the first phase of the study, a quantitative population-based retrospective database design was used to demonstrate a variety of chronic disease-related analyses that can be performed using health care administrative claims data. This served as a “demonstration project” to showcase the analytic utility of health care administrative claims data to inform public health about the prevalence, health care costs, and health care utilization of a population with various chronic diseases. The findings from the first phase were then used as a springboard for the second qualitative phase of the study. The second phase of the study used a focus group data collection methodology. The findings from the first phase were showcased to a group of key informants to help facilitate discussions about public health's interest and ability (barriers and enabling factors) to access and use health care administrative claims data for chronic disease epidemiology.

G. Leadership Implications and Relevance

If health care administrative claims data are shown to have significant public health value for chronic disease epidemiology, the findings from this study may suggest that public health and its leaders need to become more aggressive in gaining access to and using health care administrative claims data for chronic disease epidemiology. The findings from the exploration of the barriers and enabling factors

influencing public health's adoption of health care administrative claims data for chronic disease epidemiology may provide insights into the type of strategies needed to foster adoption of the data source.

Several of the questions addressed in this study transcend the health care administrative claims data source. Public health's needed orientation and prospective use of health care administrative claims data for understanding chronic disease and connecting with medicine could serve as an illustration of what could potentially be achieved in the future when HIE is more widely available. The findings from this study could serve as a catalyst for public health and its leaders on how to better prepare for and engage with HIE initiatives across the country. The study may also serve as a demonstration of how health care administrative claims data, which primarily track utilization and reimbursement within the health care system, can be a tangible bridge between public health and medicine in facilitating a more integrated relationship. All of this has broad public health and health policy implications.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The literature review begins with an overview of the advantages and disadvantages of the traditional sources of chronic disease data used in public health. The review then provides a description of health care administrative claims data and evidence of its potential to help fill gaps in chronic disease data. The next section outlines the major sources of health care administrative claims data, including the All-Payer Claims Databases (APCDs). The remaining two sections describe how health care administrative claims data have been used for health services, quality, and cost of care research and provide a summary and examples of the various public health applications of health care administrative claims data. The theoretical framework section of this chapter provides a detailed description and rationale for the theoretical framework used to guide this study.

A. Literature Review

1. Public Health's Sources of Data on Chronic Disease

Public health's ability to have a meaningful effect on reducing the burden of chronic disease in the population is dependent on having a comprehensive epidemiological surveillance to monitor patterns and trends in chronic disease in the population (Brownson & Bright, 2004). Effective chronic disease surveillance and community health assessment are needed to monitor the chronic disease burden and preventive care practices, to understand health risk behaviors, to develop health policy, to monitor health goals and objectives, and to target and evaluate population-based health promotion and disease prevention interventions (CDC, 2004; Mokdad, Annett, Ikeda, & Mai, 2010).

There is no single data source that can appropriately support all chronic disease surveillance and community health assessment activities (Thacker, Stroup, & Rothenberg, 1995). Public health uses several different data sources for monitoring patterns of chronic disease and its associated health risk factors. These sources include vital statistics (e.g., death certificates), disease registries (i.e., cancer registry), population health surveys (e.g., Behavioral Risk Factor Surveillance System [BRFSS] and National Health Interview Survey [NHIS]), and administrative data collection systems (e.g., hospital

discharge data and emergency department data). The following sections provide an in-depth description of each of these primary data sources.

Vital Statistics

Vital statistics data from death certificates are one of the oldest and most readily available sources of information on cause, contributing cause, and underlying cause of mortality in the population (Council of State and Territorial Epidemiologists, 2010; Hatzell, Aldrich, Cates, & Shin, 2001). Data on mortality are maintained by state-specific vital statistics departments in a standard format and are reported to the CDC and aggregated nationally through the National Vital Statistics System (CDC, 2012; Wegner, Rohan, & Remington, 2010). Vital statistics are an inexpensive source of population-level data, which can be used to identify trends in chronic disease-related mortality by various sociodemographic and geographic distributions (Wegner et al., 2010). However, mortality data are not useful in providing estimates of chronic disease morbidity, which is a more relevant measure of chronic disease burden (McKenna & Collins, 2010). Mortality data are also not useful for monitoring chronic diseases with low rates of mortality such as depression and arthritis (Lix & Shaw, 2006), and some chronic health conditions such as diabetes are often underreported as an underlying or contributing cause of death (Cheng, Wingard, Kritz-Silverstein, & Barrett-Connor, 2008). In addition, death certificates are subject to having incomplete or inaccurate information regarding cause of death (Wegner et al., 2010).

Chronic Disease Registries

Chronic disease registries are clinic, physician, hospital, or population-based databases that typically contain detailed information about people diagnosed with specific chronic diseases (Prevention and Chronic Care Management Advisory Council, 2010). These diagnostically accurate registries provide a method by which providers can identify individuals in greatest need of follow-up or referral and allow providers and public health to track conditions in the population over time (Chamany et al., 2009).

The most prominent chronic disease registries are cancer registries that collect information on cancer patients, including demographics, tumor information (e.g., histology and date of diagnosis), and treatment information (e.g., date and type of treatment) (Wegner et al., 2010). There are two primary population-based central cancer registries in the United States: the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) program and the CDC's National Program of Cancer Registries (NPCR). The SEER registry is composed of eighteen individual registries that represent approximately 26% of the U.S. population, and the NPCR is composed of primarily state-based cancer registries representing approximately 96% of the U.S. population (Merrill, Sloan, Anderson, & Ryker, 2011; Wegner et al. 2010). The data from these registries are used to monitor cancer trends and patterns in populations, to guide the planning and evaluation of cancer control interventions, to set priorities for health resource allocation, and to conduct clinical, epidemiological, and health services research (CDC, 2011c). An important non-population-based central cancer registry is the National Cancer Data Base (NCDB). The NCDB is a voluntary national database of more than 1,400 accredited cancer programs representing approximately 70% of all incident cancer diagnoses in the United States. NCDB is used to study the clinical outcomes, the standard of cancer care, and the quality of cancer care among accredited cancer centers (Bilimoria, Stewart, Winchester, & Ko, 2008).

With the exception of central cancer registries, most chronic disease registries do not have full national representation. Most are specific to certain geographic areas, clinical practices, or facilities and often do not provide estimates of condition incidence and prevalence generalizable to larger populations (Lix & Shaw 2006). Rittenhouse et al. (2010) analyzed data from a nationally representative survey and estimated that 70.2% of all large physician groups maintain an electronic registry or patient list of diabetics, 62.4% for asthmatics, 58.5% for heart failure patients, and 40.8% for patients with depression. There are several examples of state, local, or semination registries for several different chronic diseases, including Alzheimer's disease (Dennehy, Kahle-Wroblewski, Sarsour, & Milton, 2012;

Schreurs, 2011), diabetes/A1c reporting (Chamany et al., 2009; Littman, 2011), stroke (Reeves, Mullard, & Wehner, 2008), chronic kidney disease (Navaneethan et al., 2011), asthma (Reid, Hoppin, Jacobs, & Ostrem, 2005), and hypertension (Burke, Nelson, Caulin-Glaser, & Snow, 2010). Although chronic disease registries can provide important data for monitoring disease trends and quality of care, chronic disease registries are also expensive to implement and maintain, are subject to patient migration, and are only available for a narrow set of chronic health conditions (Wegner et al., 2010).

Population Surveys

Population health surveys are instruments that gather self-reported information on health risk behaviors and health practices in the population (Wegner et al., 2010). Surveys such as the Behavioral Risk Factor Surveillance System (BRFSS) are well established and highly accessible surveys providing state and some county/metropolitan-level estimates of health risk behaviors, chronic disease prevalence, and estimates of preventive health service use (Chowdhury et al., 2007; Council of State and Territorial Epidemiologists, 2010). The Youth Risk Behavior Surveillance System (YRBSS) is a set of surveys that provide data on unhealthy behaviors and the prevalence of obesity and asthma among youth and young adults (Eaton et al., 2012).

Although the BRFSS provides valuable data on health risks and chronic condition morbidity, it only includes a narrow set of chronic health conditions (Booske, Remington, & Kindig, 2007). The BRFSS, the YRBSS, and other similar surveys such as the National Health Interview Survey (NHIS) cannot produce valid estimates of condition prevalence at the local level due to sampling design and weighting limitations (Goodman, 2010). Conducting local-level surveys to produce estimates is very expensive and usually impractical (Wegner et al., 2010). Population health surveys are also subject to validity issues such as noncoverage, sampling, nonresponse, and measurement errors (Utah Department of Health, 2011; Wegner et al., 2010).

Administrative Data Systems

Administrative data systems are another source of data for public health to assess the burden of chronic disease. Administrative data are the data created as part of health care organizations operations (Studnicki, Berndt, & Fisher, 2008). Hospital discharge data are the primary source of administrative data for public health (Council of State and Territorial Epidemiologists, 2010; Love, Rudolph, & Shah, 2008). As of 2011, 96% of all states have comprehensive statewide data on all inpatient hospital stays (Love, Custer, & Miller, 2010; National Association of Health Data Organizations, 2012). Hospital discharge data are a reliable, accessible, population based, and cost-effective source of information on hospitalizations associated with chronic health conditions (National Association of Health Data Organizations, 2011; Schoeman, Sutton, KIntala, Love, & Maw, 2005). Hospital discharge data are one of the few sources of chronic disease morbidity data, which allows for valid trend, small area, and subgroup analysis (Love et al., 2008; Wegner et al., 2010).

A limitation of hospital discharge data is that it only captures events in the hospital setting. In response to this limitation, several states have expanded to include emergency department and ambulatory surgery center data (Love et al., 2010). As of 2011, 62% of all states have emergency department and 68% have ambulatory surgery center reporting (National Association of Health Data Organizations, 2012). Even with the inclusion of emergency department and ambulatory surgery center data, only a minority of all health care interactions in the population are represented. Most health care utilization takes place in primary care and other ambulatory care settings with that trend increasing in recent years (Hall, DeFrances, Williams, Golosinskiy, & Schwartzman, 2010; Schappert & Rechtsteiner, 2008). In 2008, an estimated 71.8% of the U.S. population had at least one office-based medical provider visit as compared with 14.7% having a hospital inpatient event, 12.3% having an ER event, or 2.2% having a home health care visit (Kashihara & Carper, 2010).

Another commonly cited limitations of administrative data systems are the lack of clinical detail and reliable patient identifiers and the periodic exclusion of patient addresses, which are useful for geographic information system (GIS) analysis (National Association of Health Data Organizations, 2011).

Table I is a summary of the key advantages and gaps among the existing data sources available to public health for monitoring chronic disease in the population. Although all these public health data sources provide important information on chronic disease in the population, each data source has its limitations and provides an incomplete picture of the chronic disease burden. Unfortunately, gaps continue to exist in public health's ability to assess the burden of chronic disease in populations.

2. Health Care Administrative Claims Data

With the understanding that public health's traditional sources of chronic disease data have key gaps, there is a need to look at a broader set of data sources to help fill these gaps. Health care administrative claims data, which originate from administrative data systems, are an intriguing source of data with the potential to help fill some of these existing gaps in the current sources of data on chronic disease. Health care administrative claims data are electronic billing records of health care interactions submitted by health care providers (e.g., hospitals, clinics, and pharmacies) to public and private health insurers for the reimbursement of medical services rendered (Ferver, Burton, & Jesilow, 2009). Health care administrative claims data capture health care service interactions not only within the hospital inpatient setting but also within ambulatory care settings (e.g., ER, physician office, urgent care, and clinics) where most health care interactions take place (National Center for Health Statistics, 2011).

Table I

Summary of Existing Data Sources

Data Source	Focus	Advantages	Gaps
Vital statistics (e.g., death certificates)	Provides population-level demographic and geographic data on cause and contributing cause of death	Readily and publicly available, inexpensive, can be used to examine trends, and public health has many experience using this data source	Not useful in providing estimates of chronic disease morbidity, not useful for monitoring conditions with low mortality (e.g., depression), and incomplete or inaccurate data on cause of death
Chronic disease registries	Clinic, physician, hospital, or population-based databases that typically contain detailed information about people diagnosed with specific chronic diseases	Diagnostically accurate, provide a method by which providers can identify individuals in greatest need of follow-up or referral, and allow providers and public health to track conditions in the population over time	Expensive to implement and maintain, subject to patient migration, and only available for a narrow set of chronic health conditions
Population surveys	Instruments that gather self-reported information on health risk behaviors and health practices in the population	Well established and highly accessible, provide state and some county or metropolitan-level estimates of health risk behaviors, chronic disease prevalence, and estimates of preventive health service use	Local-level surveys are very expensive and usually impractical, population surveys are subject to validity issues such as noncoverage, sampling, nonresponse, and measurement errors
Administrative data systems	Data created as part of health care organizations operations	A relatively cost-effective source of reliable, accessible, and population-based data; useful for producing valid trend, small area, and subgroup analyses	Data can lack important clinical detail and consistently reliable patient identifiers and frequently lack address data to conduct GIS analysis

Health care administrative claims data originate from claim forms submitted to insurers for the reimbursement of health care services. There are three standardized claims forms currently in use for medical billing. The first form called *HCFA-1500* (also known as CMS-1500) is used for noninstitutional billing such as physician visits. The second form called *UB-92* is used primarily for hospitals and facility billing. The third form called *UB-04* is also used primarily for hospitals and facility billing. In 2007, the *UB-04* form replaced the *UB-92* form. However, many insurers still accept the *UP-92* form. Pharmacy billing typically uses the universal claim form of the National Council for Prescription Drug Programs (NCPDP).

In general, administrative claims data contain information on date and location of health care service, type and cost of service, diagnoses (diagnosis codes), procedures performed (procedure codes), prescriptions filled, extent of service (e.g., hospital days), beneficiary demographics (e.g., age and gender), program information for the beneficiary (e.g., type of coverage and dates of coverage), and information needed for billing and mailing purposes (e.g., residential address and phone number) (Wyant & Parente, 2003).

Health care administrative claims data are the overarching terminology used to describe three distinct data files: insurance eligibility file, medical claim file, and pharmacy claim file. The first of these files, the insurance eligibility file, typically contains information about the member, including name, insurance subscriber identifier, date of birth, gender, relationship (e.g., subscriber and spouse), contract information (i.e., e-mail and phone), address, insurance plan type, insurance group number, and insurance eligibility start and end dates.

Medical claim files generally contain information on the member, service provider, facility of service, dates of service, diagnosis and/or injury, and costs of service (i.e., allowed amount, paid amount, co-pay amount, and coinsurance amount) (APCD Council, 2011a). Medical claims data usually include clinical, diagnostic, procedural, and classification codes, including the International

Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), the Current Procedural Terminology (CPT), the Major Diagnostic Categories (MDCs), the diagnosis related group (DRG), and the National Drug Code (NDC). ICD-9-CM is an internationally recognized classification system primarily used for reporting health conditions and some health care procedures (Moriyama, Low, & Robb-Smith, 2011). CPT codes are similar to ICD-9-CM except they are a classification system to identify medical services and procedures rendered rather identifying a diagnosis. MDCs are a classification system based on dividing all possible principal diagnoses into 25 mutually exclusive diagnosis areas, which represent major organ systems or disease etiologies (Utah Department of Health, 2005). MDCs are usually the first step in the process of assigning patients to specific DRGs. Averil et al. (2003) defined DRGs as a classification system intended to provide hospitals with a way of linking the type of patients treated to the costs incurred by the hospital. Averil et al. also indicated that the classification of patients into a specific DRG group is based on a variety of considerations, including the principal diagnosis, the ICD-9 diagnoses, the age, the gender, the treatment procedure, the discharge status, and the presence of complications or comorbidities.

Pharmacy claim files typically contain information about the member, payer, physician, pharmacy, indicators of prescription type (new vs. refill), number of medication days' supply, and costs (i.e., dispensing fee, co-pay amount, and paid amount) (Minnesota Department of Health, 2009). Pharmacy claims will also include an NDC code that is used to uniquely identify commercially available drug products and is often used for inventory control, drug claims processing, drug utilization review, and physician order entry (Florida's Medicare Quality Improvement Organization, 2011). The NDC is a ten- to eleven-digit code composed of three distinct segments: the first segment called the *labeler* is assigned by the Food and Drug Administration to the supplier, manufacturer, or repackager of the product; the second segment called the *product segment* identifies the specific drug product (e.g.,

strength, dosage form, and formulation); and the third segment called the *package segment* identifies the package form and size (Simonaitis & McDonald, 2009).

Several strengths of health care administrative claims data include the following: it has an individual level of analysis; it is often less costly than conducting population health surveys; it represents large well-defined populations and spans multiple years and health care settings; it typically follows a standardized and documented format; it reflects activities of clinical care, making it possible to study real-world effectiveness and utilization patterns; it contains clinically relevant information such as procedures and diagnoses and provides good information on transaction costs; and it is useful for finding sizable populations of individuals with rare conditions (Ferver et al., 2009; Riley, 2009; Sarrazin & Rosenthal, 2012; Schneeweiss & Avorn, 2005; Studnicki et al., 2008; Tu, Campbell, Chen, Cauch-Dudek, & McAlister, 2007).

Evidence suggests that health care administrative claims data are a valuable resource for supporting population-level chronic disease research, surveillance, and epidemiology (Yiannakoulis et al., 2009). Administrative claims data can be used to examine the processes, outcomes, and costs of care among persons with chronic disease (James & Fine, 2008; Margolis et al., 2005; Priest et al., 2011; Ramsey et al., 2002). There is also evidence validating the use of administrative claims data, particularly the diagnostic and procedural coding within claims to provide cross-sectional and longitudinal chronic disease prevalence and incidence estimates within the population (Dombkowski et al., 2009; Lix et al., 2006; Quan et al., 2009; Shaya et al., 2009; Southern et al., 2010). This coding system is a key diagnostic tool for epidemiology to analyze the general health situation of populations and to monitor the incidence and prevalence of diseases and other health problems (World Health Organization, 2013). For example, Wendt, Symanksi, and Du (2012) used the presence of an asthma ICD-9 diagnosis code or three or more asthma medication dispensing events within Medicaid medical and pharmacy claims data to estimate the incidence of asthma among low-income children in Texas. In

a separate epidemiological study, Smoyer-Tomic, Amato, and Fernandes (2012) used Medicare, Medicaid, and commercial health care administrative claims data to estimate the incidence and prevalence of idiopathic inflammatory myopathies in the population.

Despite the strengths of health care administrative claims data, there are some recognized limitations. Some commonly cited limitations include the following: the data are primarily collected for administrative purposes; there can be issues with the accuracy and validity of coding, especially when coding is driven by reimbursement; secondary diagnoses could be under reported; there is a lack of clinical detail, such as biometric or diagnostic testing data; there are incomplete claims data; payments are subject to benefit design; they are limited to covered services; and there are issues of access due to privacy or proprietary ownership (Riley, 2009; Sarrazin & Rosenthal, 2012; Schneeweiss & Avorn, 2005; Tyree, Lind, & Lafferty, 2006).

In summary, health care administrative claims data are electronic billing records of health care interactions submitted by health care providers not only within the hospital inpatient setting but also within ambulatory care settings. Health care administrative claims data are primarily used to facilitate the billing of health care services generally containing information on the location of health care service, the type and cost of service, the diagnoses, the procedures performed, the prescriptions filled, the extent of service, the beneficiary demographics, the program information for the beneficiary, and the information needed for billing and mailing purposes. Health care administrative claims data have several advantages, including being less costly than surveys, having a standardized format, containing clinically relevant information, and providing good information on transaction costs. Health care administrative claims data have been used to support population-level chronic disease research, surveillance, and epidemiology. This diagnostic coding system with health care administrative claims data is an important tool for epidemiology to analyze the general health of populations and to monitor the incidence and prevalence of diseases. Some cited limitations of health care administrative claims

data include the following: being a secondary data source, the accuracy and validity of claims coding, the lack of clinical data, and the issues of data access due to privacy or proprietary ownership of the data.

3. Sources of Health Care Administrative Claims Data

There are several sources of health care administrative claims data in the United States. As indicated previously, this is primarily a function of the multiple health care payers in the United States. Approximately 84% of the U.S. population is covered under private health insurance (includes employment based and individual) or public insurance (includes Medicaid, Medicare, Children's Health Insurance Program (CHIP), and military-sponsored insurance) (DeNavas-Walt, Proctor, & Smith, 2012). The following is a detailed description of the major sources of health care administrative claims data in the United States.

Private Health Insurers

In 2011, an estimated 63.9% of the U.S. population had at least partial coverage under a private health plan, and an estimated 52.0 percent of the population had exclusive coverage under a private health plan (DeNavas-Walt et al., 2012). There are more than 900 private health insurance companies in the United States (IBISWorld, 2012; O'Hara & Caswell, 2012). However, most of the private health insurance market is concentrated among several large insurers. Table II is a list of the top 25 private health insurers in the United States by medical plan enrollment in 2011 based on the directory of health plans of the Atlantic Information Services.

Table II

Top 25 U.S. Health Plans by Medical Enrollment

Rank	Company	2011 Enrollment	Rank	Company	2011 Enrollment
1	UnitedHealthcare	34,675,651	14	CareFirst BlueCross BlueShield	3,496,446
2	WellPoint, Inc.	29,576,763	15	Blue Cross and Blue Shield of Alabama	3,043,985
3	Aetna	18,636,285	16	Medical Mutual of Ohio	2,811,059
4	Health Care Service Corporation	12,783,198	17	Blue Cross and Blue Shield of Florida, Inc.	2,801,087
5	Cigna	11,499,083	18	Blue Cross Blue Shield of Massachusetts	2,750,000
6	Kaiser Permanente	8,959,294	19	Blue Shield of California	2,731,983
7	Humana Inc.	6,741,375	20	Blue Cross and Blue Shield of North Carolina	2,422,499
8	Health Net, Inc.	5,584,000	21	Blue Cross and Blue Shield of Minnesota	2,415,472
9	Blue Cross Blue Shield of Michigan	4,436,836	22	EmblemHealth, Inc.	2,305,015
10	Highmark, Inc.	4,387,427	23	Wellmark, Inc.	2,112,949
11	Coventry Health and Life Insurance Company	3,609,930	24	Amerigroup Community Care	1,997,000
12	Amerihealth Mercy/Independence Blue Cross	3,528,574	25	The Regence Group	1,986,300
13	BlueCross BlueShield of Tennessee	3,499,743			

Some of these private health insurers have amassed huge administrative claims databases. Two of the largest are Blue Cross Blue Shield Association's Blue Health Intelligence and Humana's administrative claims database. Blue Health Intelligence is the one of the largest databases of health care administrative claims data, encompassing 110 million unique lives since 2005 across the country (Blue Health Intelligence, 2012). Blue Health Intelligence is a for-profit organization that provides analytic services for its internal and external customers using the database. In 2012, the Blue Health Intelligence and the Dartmouth Health Atlas announced a collaboration to investigate geographic variation in pediatric health care using the database (the Dartmouth Atlas Project, 2012). Humana, a

large national for-profit health insurer, has a Competitive Health Analytics division that maintains a medical, pharmacy, and laboratory administrative claims database for 11.3 million commercial and Medicare Advantage lives since 2006 (Humana, 2012).

Given the fragmentation of private insurers across the country, there is no single centralized source of all private health care administrative claims data for researchers and public health to access. Unfortunately, most private health insurers have been reluctant to voluntarily share their health care claims data with researchers because they do not want the details of their contracts disclosed (Mathews, 2011). Consequently, nearly all public health research has been based on public payer claims data or, on rare occasions, data from individual insurers though typically a few years old (Berry, 2012).

Claims Aggregators

Besides the databases that private insurers maintain on their own populations, there are several private and nonprofit organizations that have amassed large databases of primarily commercial and Medicare Advantage health care administrative claims data across different payers. These claims aggregators have developed administrative claims databases focused on data across multiple organizations for health care analytic services, costs of care analysis, quality of care monitoring, and research. Although nonprofit organizations have been more open to allowing access to their databases, access to private health care administrative claims databases are typically costly (Mathews, 2011). Access to these aggregator databases is desirable, given that the organization has already spent time and resources to combine data across multiple payers. The following is a list and description of some of the major aggregator databases across the country:

- **FAIR Health Claims Database**—FAIR Health is a nonprofit organization whose mission is to bring transparency to health care costs and health insurance information. The FAIR Health National Private Insurance Claims database is the largest collection of private medical and

- dental claims data, which includes nearly 80 data contributors and contains more than 125 million lives covered by private health insurance (FAIR Health, 2012).
- **Health Care Cost Institute Database**—The Health Care Cost Institute (HCCI) is a nonprofit organization dedicated to developing the most comprehensive source of information on health care costs and utilization in the United States. HCCI has health care administrative claims data for more than 40 million members covered by employer-sponsored insurance between 2007 and 2011 (HCCI, 2012a). Several major health insurers contribute claims data to the database, including UnitedHealth, Kaiser Foundation, Aetna, and Humana (Abelson, 2011).
 - **Truven Health Analytics MarketScan Claims Databases**—Truven Health Analytics is a for-profit health care analytics company with a proprietary health care administrative claims database called MarketScan databases. The MarketScan databases included commercial, Medicare supplemental, and Medicaid claims of more than 122 million individuals since 1996 and annually contain data on 50 million covered lives (Hansen & Chang, 2011).
 - **Express Scripts (Medco) National Integrated Database**—Express Scripts is one of the largest pharmacy benefit management companies in the United States. Express Scripts owns the Medco National Integrated Database, which contains more than 26 months of pharmacy claims for more than 60 million lives as of 2010, and it has medical claims from more than 450 insurance plans for approximately 13 million lives (Garg, Chen, & Pendergrass, 2010).
 - **HealthCore Integrated Research Database**—HealthCore is a for-profit health care analytics organization with a large proprietary health care administrative claims database available for research. The HealthCore Integrated Research Database contains medical and pharmacy claims for approximately 43 million members of Blue Cross and Blue Shield health plans across 14 states (HealthCore, 2011).

- OptumInsight Normative Health Information Database—OptumInsight is a for-profit organization with a large proprietary health care administrative claims database available for research. In 2011, OptumInsight Normative Health Information Database contained 20.8 million unique commercial members and Medicare Advantage members and a cumulative 85.6 members since 1993 (OptumInsight, 2012).
- IMS PharMetrics Integrated Database—IMS is a for-profit health analytics company that maintains one of the largest non-payer-owned integrated claims database of commercial insurers in the United States called the PharMetrics Integrated Database. The PharMetrics Integrated Database contains medical and pharmacy claims for more than 70 million members from more than 100 health plans across the United States (IMS, 2012).

Medicaid

The next category of administrative claims data sources are public payers. Medicaid is a public insurance program that provides coverage for lower-income individuals, families, and children; the elderly; and individuals with disabilities. In 2011, an estimated 15.8% of the U.S. population had at least partial coverage under Medicaid, and an estimated 11.5% of the population had exclusive coverage under Medicaid (DeNavas-Walt et al., 2012). All states maintain their own beneficiary, provider, inpatient, outpatient, physician, pharmacy, and skilled nursing services claims data as part of the facilitation of their Medicaid programs (Studnicki et al., 2008). Since 1999, states have been required to report on a quarterly basis to complete Medicaid enrollment and claims data to the Centers for Medicare and Medicaid Services (CMS) through the Medicaid Statistical Information System (MSIS) (Byrd & Verdier, 2011). MSIS is a national eligibility and claims database maintained by CMS. Overall, states have routinely submitted eligibility and fee for service claims data; however, some states have not consistently submitted claims encounters paid by managed care organizations (Byrd & Verdier, 2011).

For supporting research, evaluation, and policy analysis studies, CMS annually compiles all state MSIS data into a uniform person-level file structure called the Medicaid Analytic eXtract (MAX) files. Requesters can submit requests for MAX data files from CMS through a third-party organization called ResDAC. All requests are formally reviewed to determine if the request meets a rigorous set of predefined criteria by CMS and if approved requires an agreed upon data use agreement (Schneider, Roozeboom, & Brenton, 2012). There is a charge for MAX data files, which can be quite costly depending on the number of file types, number of states, and number years being requested (Bradley, Dahman, Bataki, & Koroukian, 2010; ResDAC, 2012). MAX data files also have a significant time lag, and variables are not consistent across states (Mor, 2009).

In regard to public health's access to Medicaid claims data, it is not completely clear how consistent access is across states. There is evidence which suggests that Medicaid data sharing with public health needs improvement (Lichter, 2004; Optum, 2012). A national survey of chronic disease epidemiologists (CDEs) indicated that only 35.3% of epidemiologists surveyed had unfettered access to state Medicaid data (Council of State and Territorial Epidemiologists, 2010). This finding suggests that public health is not using Medicaid data extensively to conduct epidemiological analysis and access is likely one of the major barriers.

Children's Health Insurance Program

The Children's Health Insurance Program (CHIP) is a state-facilitated, federally matched public insurance program for children of lower-income families. There are three different CHIP program design options for states, including Medicaid expansion (M-CHIP), separate CHIP program, or a combination of both. As with the Medicaid program, states have been required since 1999 to report Medicaid CHIP enrollment and claims data to MSIS. However, states with separate CHIP programs have only been able to report data since October 2010. Unfortunately, only three of the 43 states with separate CHIP programs are currently reporting enrollment and claims data to MSIS (Camillo, Hodges,

Kuncaitis, Montebello, & Zlatinov, 2012). Requesters can submit CHIP claims request to CMS through ResDAC using the same process for requesting Medicaid data.

Medicare

Medicare is a public insurance program that provides coverage to individuals sixty-five years and older, to younger individuals with disabilities, or to individuals with certain medical conditions. In 2011, an estimated 15.2% of the U.S. population had at least partial coverage under Medicare, and an estimated 4.9% of the population had exclusive coverage under Medicare (DeNavas-Walt et al., 2012). Unlike the Medicaid program, the Medicare program is facilitated directly by the federal government instead of through states. Consequently, states do not maintain their own Medicare administrative claims databases. In terms of access, only 5.9% of state chronic disease epidemiology programs reported having unfettered access to state Medicare data (Council of State and Territorial Epidemiologists, 2010).

Similar to Medicaid, states, organizations, and researchers can request individual-level Medicare data from ResDAC at a cost and as long the request meets other CMS criteria. However, CMS has put strict limits on access to Medicare data due to a legal injunction preventing the disclosure of annual Medicare reimbursement payments made to individual physicians in a manner that could identify individual physicians.¹

With the passage of PPACA, more entities have been interested in accessing Medicare data to help increase health care efficiency, to reduce costs, and to improve quality of care. States in particular have requested access to Medicare claims data to help improve the coordination of Medicare and Medicaid dual eligible population. In addition, states would like full access to Medicare Part C data, Part D cost information, access to Common Medicare Enrollment data, and the Medicare Beneficiary Database. They would also like CMS to streamline multiple data use agreements, equalize data security

¹*Florida Medical Ass’n, Inc. v. Department of Health, Education, and Welfare*, 479 F. Supp. 1291.

policies, and eliminate fees for data beyond the dual eligible population (National Association of Medicaid Directors, 2012).

Although CMS has focused its efforts to improve the access of states to Medicare data for dual eligible coordination, access to the data for purposes beyond this use has been limited. A provision in the PPACA does permit Medicare claims data to be released to qualified entities to create publicly available performance reports of providers (Toussaint & Berwick 2013). However, the reuse of these data for other purposes is strictly prohibited by CMS.

In an attempt to support research initiatives to improve the quality of care and to reduce the cost of care for the chronically ill, CMS has developed the Chronic Condition Data Warehouse (CCW). The CCW is a national Medicare and Medicaid research database containing 100 percent of Medicare and Medicaid enrollment and fee-for-service claims. Using the CCW claims data and diagnosis-based algorithms CMS has developed an interactive dashboard to provide information on the prevalence, utilization, and Medicare spending for Medicare beneficiaries with chronic conditions at the national, state, and hospital referral region levels. CMS researchers have also used the CCW data to estimate the prevalence of multiple chronic conditions among Medicare beneficiaries (Lochner & Cox, 2013). The development of the CCW and the efforts of the CMS to examine these data to understand chronic disease suggest that the government also sees the value of this data for epidemiological purposes.

Military Health Care

The next major category of administrative claims data sources is military health care. There are three components of the military health system: the TRICARE, the Department of Veterans Affairs (VA) health system, and the Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA). In 2011, an estimated 4.4% of the U.S. population had at least partial coverage under government-sponsored military health care, and an estimated 1.3% of the population had exclusive coverage under government-sponsored military health care (DeNavas-Walt et al., 2012).

TRICARE is the largest provider of health care services through both military and nonmilitary hospitals, clinics, and other providers. TRICARE is administered by TRICARE Management Activity, which uses regionally based managed care support contractors to create networks of civilian providers and to process beneficiary claims in each of its north, south, and west regions (Panangala & Jansen, 2010). The health care administrative claims data of TRICARE are maintained within a single integrated Military Health System Data Repository (Defense Health Services Systems, 2009). Researchers and entities may request various levels of health care administrative claims data extracts from TRICARE via a data-sharing agreement application; however, it is unclear how frequently and under what circumstances permission is granted (Tricare Management Activity, 2011).

The VA through the Veterans Health Administration operates the largest integrated direct health care delivery system in the United States. Veterans meeting the specific eligibility criteria can access care directly in the system (Panangala & Jansen, 2010). The health care administrative claims data for the VA health care system are maintained within the VA's Corporate Data Warehouse (VA Information Resource Center, 2012b). Researchers and entities with projects approved by the institutional review board can apply for access to health care administrative claims data through an online Data Access Request Tracker (VA Information Resource Center, 2012a).

The Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA) is a VA-sponsored program providing insurance benefits to dependents and survivors of certain veterans (Panangala & Jansen, 2010). The health care administrative claims data of CHAMPVA can be found within the Corporate Data Warehouse (Department of Veterans Affairs, 2011) and can be requested through the Data Access Request Tracker using the same process for requesting VA data.

All-Payer Claims Databases

The last major source of administrative claims data is the All-Payer Claims Databases (APCDs). Driven by the need for transparency about health care costs and health care quality and to support the

policy, planning, and evaluation processes required with the reform of the health insurance marketplace, there has been strong interest among many states to develop a centralized source of comprehensive population-level data that encompasses all health care interactions across all health care settings and payers (APCD Council, 2011b; Colmers, 2007; Davis, Schoen, & Stremikis, 2010; IOM, 2001, 2010; Love et al., 2010; Napel et al., 2011). In response, several efforts have emerged to develop APCDs. APCDs are databases that systematically collect and aggregate health care claims data from public and private payers of health care (Miller, Love, Sullivan, Porter, & Costello, 2010). APCDs are typically created by legislative mandate and are intended to overcome the gap in having availability of population-level administrative claims data (Love et al., 2010; Wenmoth & Samples, 2010).

In 1993, the Maryland General Assembly mandated the development of the Maryland Medical Care Data Base (MMCDB) to compile data on health care services provided by health care practitioners to Maryland residents. The intention of this database was to support the development of health care cost containment strategies and to assist payers, policy makers, practitioners, and the public in health care decision making (Wilensky & Cowdry, 2007). The MMCDB database went live in 2000 and is considered the first state-sponsored APCD (Love et al., 2010). Since the development of MMCDB, several other states have either developed or are in the process of developing APCDs. As of March 2013, a total of 12 states have existing state-sponsored or voluntary APCD efforts.

In addition to state-level APCD efforts, the Centers for Medicare and Medicaid Services (CMS) has embarked on a project to develop a Multi-Payer Claims Database (MPCD) as part the American Recovery and Reinvestment Act of 2009. The goal of the project is to consolidate longitudinal claims data from both public and private payers to support comparative effectiveness research. The first stage of the MPCD will include data from the CMS Chronic Condition Warehouse, the OptumInsight Normative Health Information Database, the states with All-Payer Claims Databases (APCDs), and other commercial data contributors (Chappel, 2011).

The overarching value of APCDs is being a central source of comprehensive data on the delivery and utilization of health care and its associated costs. APCDs can provide more data on health care utilization and costs than any other currently available public data source (Bowman, 2011). The broad value of APCDs is summarized in a 2009 State of Tennessee bill (HB2289), which states that APCDs can be used to support the following activities: improving the accessibility, adequacy, and affordability of patient health care and health care coverage; identifying health and health care needs and informing health and health care policy; determining the capacity and distribution of existing health care resources; evaluating the effectiveness of intervention programs on improving patient outcomes; reviewing costs among various treatment settings, providers, and approaches; and providing publicly available information on health care providers' quality of care.

Although there is wide interest in APCDs, the adoption of APCDs has been slow. A major barrier to the proliferation and sustainability of APCDs across the country is the significant funding needed for their development and maintenance (Miller et al., 2010; National Conference of State Legislatures, 2010). It is estimated that the cost to establish a state-sponsored APCD ranges between approximately 350,000 and 2 million dollars, and the maintenance and analytic costs are more than 1 million dollars annually, depending on the number of lives covered in the state (Bowman, 2011; Love & Sullivan, 2011). APCD projects are primarily being funded through state governments (general appropriations), fee assessments on public and private payers, Medicaid matching dollars, data sales, and grants from private entities (Love & Sullivan, 2011).

A wide range of stakeholders including state government policy makers, consumers, employers, health plans, providers, and researchers can benefit from the data collected within APCDs (Napel et al., 2011; Wenmoth & Samples, 2010). Public health has been cited as another important beneficiary of APCDs. APCDs have the potential to help fill gaps that exist in community health assessment, surveillance, and program evaluation (Miller et al., 2010; Porter, 2011). It has been suggested that

because of the large scope and cost of APCDs, used cases and demonstration projects showing the value of administrative claims data are needed to increase the proliferation of APCDs and to encourage their use for public health purposes (Love et al., 2010).

Table III provides a summary of the major administrative claims databases, including the populations of focus and the usefulness of each data source for public health purposes.

Table III

Summary of Administrative Claims Data Sources

Data Source	Focus	Usefulness for Public Health
Private health insurers	Represents the proportion of the U.S. population that has individual or employer-sponsored health insurance which constitutes over 63 percent of the population	This is a population that public health does not typically focus on. However, given that it encompasses such a large percentage of the U.S. population, this data source would provide valuable data on population health and disease trends.
Claims aggregators	Represents private and nonprofit organizations that aggregate claims data across multiple payers (typically commercial insurers)	Desirable source of data for public health because the work has been already done to aggregate across multiple payers creating a data set with wider representation of the population.
Public payer—Medicaid	Represents lower-income individuals, families, and children; the elderly; and individuals with disabilities	Typically a more readily available data source for public health, these data have many values to examine disease trends within vulnerable populations.
Public payer—Children's Health Insurance Program (CHIP)	Represents state-facilitated, federally matched insurance program for children of lower-income families	As with Medicaid, this is a more readily available data source for public health, which provides valuable data on the health of children.

Public payer—Medicare	Represents individuals sixty-five years and older, younger individuals with disabilities, or individuals with certain medical conditions	This is a more difficult public payer data source for public health to access. It provides useful information on individuals who have developed chronic disease or have lived with chronic disease for many years.
Military health care	Represents individual and families covered under the military health system, which includes TRICARE, the Department of Veterans Affairs (VA) health system, and the Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA)	This is a large integrated health and insurance system that provides the ability to track cohorts of individuals over time especially for public health research purposes.
All-Payer Claims Databases (APCDs)	Represents a centralized source of individuals data systematically aggregated across several different public and private payers	This is a desirable source of data for public health because the work has been already done to aggregate across multiple payers, creating a data set with wider representation of the population.

Because of the multipayer system in the United States, public health would require access to several different administrative claims data sources to get a truly representative picture of the chronic disease burden across the entire population. Given all the barriers and logistical challenges in gaining access to all these data sources, both claims aggregators and APCDs are appealing sources for public health to focus on due to the inherent data aggregation already done.

4. Use of Health Care Administrative Claims Data for Health Services, Quality, and Cost of Care Research

The following section provides the history of the use of health care administrative claims data for health services, quality, and cost of care research. This background will highlight the valuable information contained within health care administrative claims data, support the case that these data

have important epidemiological value, and support the plausibility that these data can be used for wider application specifically in the area of chronic disease.

There is a long history of using health care administrative claims data for health services, quality, and cost of care research. Beginning in the late 1950s, health insurers and researchers began recognizing the value of health care administrative claims data beyond the facilitation of health care reimbursement. In 1958, Densen, Balamuth, and Shapiro (1958) were among the first to use health care administrative claims data to examine differences in hospital admission rates across different Blue Cross insurance coverage plans. Additional studies were published throughout the 1960s using Blue Cross administrative claims data to examine the effect of insurance plan coverage and deductibles on hospital utilization patterns (Kaplan & Lave 1971).

With the creation of the Medicare and Medicaid programs in the mid-1960s, Anderson (1969) and Lewis (1969) were among the first to recognize that administrative claims data being collected by government entitlement programs had potential health services research applications. About the same time, John Wennberg and Alan Gittelsohn began conducting research to examine the performance of hospitals and doctors using Medicare claims data. In 1973, Wennberg and Gittelsohn published a seminal article demonstrating that variation existed in hospitalization patterns among geographically neighboring communities. This pioneering work introduced the method of small area analysis, which is considered to be the foundation of medical care outcomes research (Mullan 2004). Since the publication of the Wennberg and Gittelsohn's article, the availability and use of administrative claims data has increased over time (Ferver et al., 2009).

By the early 1970s, the use of administrative claims data expanded into the areas of cost containment and quality of care. In 1971, Congress authorized the creation of Experimental Medical Care Review Organizations (EMCROs) in response to concerns regarding escalating Medicare and Medicaid expenditures. EMCROs were voluntary associations of physician groups tasked to review

inpatient and ambulatory services and to develop and test practical methods to evaluate quality of care (IOM 1990). EMCROs advocated for the use of health insurance billing claims as a tool for reviewing the process and outcomes of health care (Goldstein, Roberts, Stanton, Maglott, & Horan, 1975).

EMCROs served as the model for the creation of professional standards review organizations (PSROs), which were authorized by Congress in 1972 (Congressional Budget Office, 1979). PSROs were responsible for reviewing services reimbursed by Medicare and Medicaid to determine if services were medically necessary, met current quality standards, and were delivered in the most effective and economical manner (Bhatia et al., 2000). In the mid to late 1970s, the Centers for Medicare and Medicaid Services (CMS) (previously known as the Health Care Financing Administration [HCFA]) developed hospital utilization and cost metrics from Medicare administrative claims data to evaluate the effectiveness of PSROs (Davis, 1982).

During the mid-1970s, administrative claims data were also being used by Yale University researchers to conduct research that would become the foundation of Medicare's prospective payment system (PPS). Using administrative claims data from multiple hospitals in Connecticut, researchers developed an interactive computer program (AUTOGRP) to help physicians classify hospital patients into DRGs (Fetter, Thompson, & Mills, 2000; Mayes, 2007; Mills, Fetter, Riedel, & Averill, 1976). DRGs are a classification system of human diseases according to organ system, surgical procedures, morbidity, age, and gender of a patient. The development of DRGs quickly led Congress to change the Medicare inpatient reimbursement from a retrospective payment model to a PPS model in 1983 (Office of Inspector General, 1992). The PPS model would have not developed without the availability of administrative claims data.

Beginning in the 1980s, researchers started using health care administrative claims data to develop episodes of care (EOC) for various events and conditions (Lohr & Brook 1980; Mitchell et al., 1994). EOC is the period from when the individual is diagnosed with a clinical condition to when the

condition is resolved (Schulman et al., 1999). EOCs allow for clinical correlation to assess the appropriateness of services, better define denominators for quality metrics, improve coding uncertainty, improve coding variation, allow for the examination of clinical trade-offs across the entire period of care, and allow for case-mix adjustment (Greene, 2007). The development of EOC using health care administrative claims data spurred the development of proprietary commercially available grouping software. Episode Treatment Groups developed by OptumInsight and Medical Episode Groups (MEGs) developed by Truven Health Analytics are the most popular EOC software solutions in the market (Rosen, Liebman, Aizcorbe, & Cutler, 2012). There has also been expanding interest in the use of EOC for defining health care reimbursement and improving the cost and quality of care. As a result of PPACA, CMS will launch a pilot episode-based payment initiative in 2013 (Mechanic, 2011).

Throughout the 1980s, the use of health care administrative claims databases expanded into the evaluation of outcomes of care (Lezzoni, 1997; Mitchell et al., 1994; Whittle, Steinberg, Anderson, & Herbert, 1991a). Examples include the use of administrative claims to identify complications and predictors of readmissions after hysterectomy, cholecystectomy, and prostatectomy (Roos, Cageorge, & Rose, 1985; Roos, Cageorge, Roos, & Danzinger, 1986; Roos, Roos, & Sharp, 1987) and reoperation following prostatectomy (Wennberg, Roos, Sola, Schori, & Jaffe, 1987). Health care administrative claims data continue to be a frequently used and valuable source of information for health care outcomes evaluation (Boswell, Cook, Burch, Eaddy, & Cantrell, 2012; Klein, Greenhouse, Stein, & Seltman, 2011; Krumholz et al., 2011; Stowell et al., 2012).

In the 1983, to increase constancy and effectiveness of quality review organizations, Congress replaced PSROs with peer review organizations (PROs). PROs differed from PSROs in that they were financed with fixed period performance-based contracts, expanded eligibility to include for-profit organizations and payers, were less regulated by the government, and had the ability to sanction providers (Lohr, 1985). PROs used electronic hospital billing claims submitted for Medicare

reimbursement to randomly select cases from the claims to perform medical record review to insure cases met quality and utilization criteria (Weinmann, 1998).

By the early 1990s, in response to both criticisms that PRO quality improvement case review was not systematic, measurable, and reliable and in response to recommendations by the IOM, the Health Care Financing Administration (HCFA) created the Health Care Quality Improvement Program (HCQIP) (CMS, 2006; Laine, 1995). HCQIP was an initiative to develop health and safety standards with improved surveillance methods and to execute quality of care improvement projects (Gagel, 1995). HCQIP changed the focus of PRO contracts from policing providers for quality lapses into a driver of broad quality improvement (Laine, 1995). State-based PROs began using Medicare part A and part B beneficiary and claims data supplied by HCFA to identify patterns of care, to improve care, and to increase cost-effectiveness and invited providers to collaborate with them to develop interventions to achieve quality of care goals (Grant, Hayes, Pates, Elward, & Ballard, 1996; Laine, 1995). In the early 2000s, PROs were renamed to quality improvement organizations (QIOs). Health care administrative claims data continue to be an important source of data for QIOs to assess the effect of various quality improvement initiatives (Ballard et al., 2002; Schulke, Krantzberg, & Grant, 2007).

Researchers also began using administrative claims data for patient quality and safety research initiatives in the early 1990s. Examples include the investigation of Lezzoni et al. (1992) about administrative claims to screen for preventable inpatient complications, the research of Riley et al. (1993) on identifying readmissions from adverse events readmissions, Agency for Healthcare Research and Quality's (AHRQ) development of avoidable adverse event and complication indicators based on administrative claims (Johantgen, Elixhauser, Bali, Goldfarb, & Harris, 1998), and AHRQ's patient safety indicators (University of California at San Francisco–Stanford University Evidence-Based Practice Center, 2002).

During the same period, an effort was launched to develop a standardized approach to assessing health plan performance and quality. The National Committee for Quality Assurance (NCQA), Kaiser Permanente, and six large health employers created a set of performance metrics called the Health Plan Employer Data and Information Set (HEDIS) (McPartland, 2012). First published in 1991, HEDIS measures focused on the assessment of quality, access, satisfaction, utilization, and finance (Mainous & Talbert, 1998). HEDIS measures are a combination of survey, medical record review, and administrative claims data (NCQA, 2012). HEDIS measures have evolved and expanded over time and are the industry standard for health care performance measurement.

In the mid-1990s, extending the pioneering work of Wennberg and colleagues, the Dartmouth Health Atlas Project was created to use Medicare data to document variations in how medical resources are distributed and used in the United States. The Dartmouth Health Atlas was first published in 1996 and examines hospital and outpatient care from Medicare administrative claims data to provide information about the distribution and use of health care resources in 306 hospital referral regions and 3,436 hospital service areas nationwide (Geisz, 2011). The Dartmouth Health Atlas Project has produced many important health services research findings, including the demonstration of variations in end-of-life care (Mitchell, 2011), the regional variations in diagnostic practices (Song et al., 2010), and the regional and racial variations in primary care (Goodman, Brownlee, Chiang-Hua, & Fisher, 2010).

For the past several years, health care administrative claims data have also been used to assess health care costs. Health care administrative data are an alternative to the gold standard sample-based surveys such as the Medical Expenditure Panel Survey and the National Ambulatory Medical Care Survey. These surveys are expensive to conduct and lack the necessary sample size to provide accurate cost estimates for less prevalent conditions (Aizcorbe et al., 2012; Olin, Machlin, & Rhoades, 2008). Health care administrative claims data on the other hand are a comprehensive source of utilization and medical expenditures data for large numbers of individuals, typically covering long periods of time, and

are ideal for assessing rare conditions and outcomes (Riley, 2009; Tyree et al., 2006; Vinet, Kuriya, Widdifield, & Bernatsky, 2011). Both Medicare (Dinan et al., 2010; Donohue et al., 2012; Thomas et al., 2012; Yabroff et al., 2009) and Medicaid (Garis & Farmer, 2002; Gilmer & Kronick, 2011; Li et al., 2009; Mullins, Snyder, Wang, Cooke, & Baquet, 2004) data have been used to examine patterns of health care costs and condition-specific health care costs. There are several examples of commercial claims data (Aizcorbe et al., 2012; Asche, Singer, Jhaveri, Chung, & Miller, 2010; Durden, Alemayehu, Bouchard, Chu, & Aagren, 2009; Hawkins, Wang, & Rupnow, 2008), including recent efforts by organizations such as the HCCI and the state-based APCDs, having used aggregated commercial claims data to produce reports on health care utilization and costs (HCCI, 2012c; Masheter, Gaskill, Vanous, & Cofrin, 2010; New Hampshire Insurance Department, 2011).

There is also growing interest in the use of administrative claims data to support comparative effectiveness research (Fung, Brand, Newhouse, & Hsu, 2011). For example, Curtis et al. (2011) developed an algorithm based on administrative claims for evaluating the effectiveness of medications for rheumatoid arthritis. CMS is also in the process of developing a national MPCD to support comparative effectiveness research efforts (AcademyHealth, 2012).

In summary, there is a long and rich history for the use of health care administrative claims data for health services, quality, and cost of care research. Applications in these areas include the examination of patterns of health care utilization variation, the examination of medical quality of care, the examination of health care reimbursement models, the containment of cost, the evaluation of outcomes of care and patient safety, the assessment of health care costs, and the comparative effectiveness research.

5. Public Health's Use of Health Care Administrative Claims Data

The following section describes public health's use and experience with health care administrative claims data to support public health activities. This overview will demonstrate that

public health has experience using this data source and provide examples of public health using health care administrative claims data for various epidemiological purposes.

One of the first uses of health care administrative claims data for epidemiological research was in the late 1970s when Medicare administrative data were used to identify a random sample of individuals to serve as a control group in a case control study examining artificial sweeteners and human bladder cancer (Hoover & Strasser, 1980). The following are several examples of the use of health care administrative claims data in a public health context.

Women, Infants, and Children Program

Health care administrative claims data have been used extensively to examine the effect of the Women, Infants, and Children (WIC) program. In the mid-1980s, Wayne Schramm was the first to use Medicaid administrative claims data to examine the influence of WIC program participation on Medicaid costs (Schramm, 1985; Schramm, 1986). In the early 1990s, Medicaid administrative claims data were used to demonstrate the cost-benefit of WIC prenatal care on Medicaid cost savings (Buescher, Larson, Nelson, & Lenihan, 1993; Devaney, Bilheimer, & Schore, 1992; Schramm, 1992). Medicaid data were used to demonstrate the effect on children WIC participation on Medicaid costs and use of health care services (Buescher et al., 2003). Lee, Rozier, Norton, Kotch, & Vann (2004a, 2004b) also used Medicaid claims data to examine the effect of WIC participation on children's use of oral health services and dental-related expenditures.

Well-Child Visits

Well-child visits (WCVs) are preventive care visits used to screen for health problems and maintain childhood health through physical examinations, laboratory tests, hearing and vision screenings, behavioral assessments, education, and immunizations (Goedken, 2011). The health benefits of WCV has been recognized by the American Academy of Pediatrics and promoted within various entitlement programs including the Maternal and Child Health Services Block Grant and the Title XIX

Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program (Chung, Lee, Morrison, & Schuster, 2006). Health care administrative claims data have been used to assess the frequency of WCVs (Byrd, Hoekelman, & Auinger, 1999; Gavin, Farrelly, & Simpson, 1998; Hakim & Bye, 2001; Lo Sasso, Gavin, & Freund, 1998; NCQA, 2011a), to evaluate the effect of WCVs on health care utilization (Hakim & Bye 2001; Pittard, 2011b; Pittard, Laditka, & Laditka, 2007) and health care costs (Pittard, 2011a), and to assess the relationship between prenatal care and WCVs (Cogan, Josberger, Gesten & Roohan, 2012).

Children's Health Insurance Program

The Children's Health Insurance Program (CHIP) is a state-facilitated, federally matched insurance program for children of lower-income families (CMS, 2012). The use of health care administrative claims data has been recommended to assess quality of care among children participating in CHIP (Shenkman, 2003) and has specifically been used to evaluate the effect of CHIP on the care of children with asthma (Menachemi et al., 2012; Szilagyi et al., 2006). Claims have also been used to examine the effect of co-payment changes on utilization (Sen et al., 2012), to evaluate various methods of defining dental utilization rates (Domiano, Momany, & Crall, 2006), and to determine if structure of a dental plan is related to improved access to care (Damiano, Momany, Carter, Jones, & Askelson, 2008).

Medicaid

Health care administrative claims data have been used to examine a variety of components of the Medicaid program. Much of the use of claims data has focused on maternal and child health. Examples include using Medicaid claims to estimate asthma prevalence and incidence (Buescher & Jones-Vessey, 1999; Dombkowski, Wasilevich, & Lyon-Callo, 2005; Lichter, 2004; Wendt, Symanski, & Du, 2012) and effect of a Medicaid primary care provider and preventive care on pediatric hospitalizations (Gadomski, Jenkins, & Nichols, 1998), to evaluate the effect of Medicaid managed care on preventive care among minority children and adolescents (Eberly, Davidoff, & Miller, 2010) and the quality of

preventive care for the chronically ill children in Medicaid managed care (Morris, Schettine, Roohan, & Gesten, 2011), and to identify preterm infants (Eworuke, Hampp, Saidi, & Winterstein, 2012), effect of maternity care coordination (Buescher, Roth, Williams, & Goforth, 1991), racial health disparities (diabetes) in health care costs (Buescher, Whitmire, & Pullen-Smith, 2010), and doctor switching children fee for service (Joffe, Rodewald, Herbert, & Szilagyi, 1999).

Medicaid administrative claims data have also been used to examine issues of oral health among primarily Medicaid children. Robinson, Rozier, and Weintraub (1997, 1998) was among the first to use Medicaid claims to examine patterns of dental treatment among children covered under Medicaid. Medicaid claims data have been used to evaluate the effect of early preventive dental visits on future utilization and costs (Beil, Rozier, Preisser, Stearns, & Lee, 2012; Savage, Lee, Kotch, & Vann, 2004), to assess patterns of restorative and preventive care (Taichman, Sohn, Lim, Eklund, & Ismail, 2009), and to measure the influence of dental sealants on the outcomes, utilization, and costs of dental care (Dasanayake et al., 2002; Weintraub, Stearns, Rozier, & Huang, 2001). Claims have been used to examine the effect of coverage type (Medicaid FFS vs. CHIP) on the use of dental services (Brickhouse, Rozier, & Slade, 2006, 2008) and to assess reimbursement interventions on use of preventive oral health services (Rozier, Stearns, Pahel, Quinonez, & Park, 2010). There has also been specific focus on dental care of special populations including children with developmental disabilities (Chi, Momany, Kuthy, Chalmers, & Damiano, 2010a; Chi, Momany, Jones, Kuthy, & Damiano, 2012; Kenney, 2009; Mitchell & Gaskin 2008), adults with developmental disabilities (Brister, Damiano, Momany, Chalmers, & Kanellis, 2008; Chalmers et al., 2011), and children with chronic disease (Chi et al., 2010b, 2011).

Federally Qualified Health Centers

Federally qualified health centers (FQHCs) are public or private nonprofit health organizations that provide health services to poor and underserved populations regardless of their ability to pay. Health care administrative claims data have been a valuable resource to evaluate the effectiveness of

FQHCs. In terms of cost of care, Duggar, Balicki, Keel, and Yates (1993) and Duggar, Keel, Balicki, and Simpson (1994) used Medicaid administrative claims data to demonstrate that total Medicaid payments were less among recipients of the Temporary Assistance for Needy Families program who received most of their physician care at a community health center as compared with recipients who did not. In 2006, McRae and Stampfley used Medicaid administrative claims data to show that disabled and nondisabled children who accessed FQHCs had lower overall costs as compared with FQHC nonusers.

In terms of utilization, Falik et al. (2001, 2006) used Medicaid claims data to show beneficiaries with ambulatory care sensitive conditions (ACSCs) who accessed care from an FQHC were less likely to be hospitalized or have an ER visit as compared with a group not receiving care from an FQHC. Using county-level inpatient discharge database for eight states, Probst, Laditka, and Laditka (2009) found a correlation between the presence of an FQHC or rural health clinic and lower ACSC hospitalization rates for adults. Rothkopf, Brookler, Wadhwa, and Sajovetz (2011) used Medicaid claims data to show that Medicaid patients using FQHCs were less likely to have emergency department visits, inpatient hospitalizations, or preventable hospital admissions than patients seen by private, fee for service providers.

Birth Defects and Developmental Disabilities

The passage of the Children's Health Act of 2005 elevated the visibility of birth defects and developmental disabilities as an important public health issue (Boyle & Cordero 2005). Health care administrative claims data have been used to examine health care expenditures among children with various birth defects and developmental disabilities such as spina bifida (Cassell, Grosse, Thorpe, Howell, & Meyer, 2011; Ouyang, Grosse, Armour, & Waitzman, 2007), orofacial clefts (Boulet, Grosse, Honein, & Correa-Villasenor, 2009; Cassell, Meyer, & Daniels, 2008), cerebral palsy (Balkrishnan, Naughton, Smith, Manuel, & Koman, 2002; Ireys, Anderson, Shaffer, & Neff, 1997; Kancherla, Amendah, Grosse, Yeargin-Allsopp, & Van Naarden, 2012; Waitzman, Scheffler, & Romano, 1996),

Down syndrome (Boulet, Molinari, Grosse, Honein, & Correa-Villasenor, 2008), fetal alcohol syndrome (Amendah, Grosse, & Bertrand, 2011; Klug & Burd 2003), and sickle cell disease (Amendah, Mvundura, Kavanagh, Sprinz, & Grosse, 2010; Bilenker, Weller, Shaffer, Dover, & Anderson, 1998; Kauf, Coates, Huazhi, Mody-Patel, & Hartzema, 2009; Mvundura, Amendah, Kavanagh, Sprinz, & Grosse, 2009). Claims data have also been used to examine prevalence (Mandell et al., 2010a, 2010b), health care utilization, and expenditures among children with autism spectrum disorders (Cidav, Lawer, Marcus, & Mandell, 2012; Leslie & Martin, 2007; Mandell, Cao, Ittenbach, & Pinto-Martin, 2006; Mandell et al., 2012; Peacock, Amendah, Ouyang, & Grosse, 2012; Shimabukuro, Grosse, & Rice, 2008; Wang & Leslie, 2010; Wang, Mandell, Lawer, Cidav, & Leslie, 2012).

Blood Lead Screening

Blood lead screening is an important component of a comprehensive program to eliminate childhood lead poisoning. Medicaid claims data have been used to estimate rates of blood lead screening in children (Keyser, Firth, Richardson, & Townsend, 2006; Polivka, Salsberry, Casavant, Chaudry, & Bush, 2006). The measurement of blood lead screening rates among the Medicaid children using health care administrative claims data are a standard HEDIS quality metric (NCQA 2011b).

Vaccination

Both Medicaid and commercial health care administrative claims data have been used to track rates of vaccination among children (Anderson, 2011; Cotter, Smith, Rossiter, Pugh, & Bramble, 1999; Toback, Herley, Edelman, & Ambrose, 2011) and rates of influenza vaccination among children with asthma (Dombkowski et al., 2006). Health care administrative claims data are also an integral part of HEDIS commercial and Medicaid vaccination quality reporting metrics for children, adolescents, and older adults (NCQA, 2011b). Rates of human papillomavirus vaccination among female adolescents have also been estimated using claims data (Cook et al., 2010; Hirth, Tan, Wilkinson, & Berenson, 2012; NCQA, 2011b).

Vaccine Safety

With the dissemination of new vaccines into the population, public health needs systems to monitor adverse events from vaccination. The CDC's active vaccine surveillance system called Vaccine Safety Datalink program uses administrative data and electronic medical records of approximately 9.2 million children and adults to collect information on vaccinations and health care interactions to monitor vaccine safety (Chen et al., 1997; Davis et al., 2005; Lee et al., 2011). Brown et al. (2009b) provided evidence suggesting that administrative claims data could be used to monitor vaccine safety and could be deployed across several health plans to monitor a larger portion of the population (Brown et al., 2009b). This concept was realized in 2009 when the Food and Drug Administration launched the Post-Licensure Rapid Immunization Safety Monitoring (PRISM) system to improve the timeliness and scope of adverse events surveillance from pandemic H1N1 influenza vaccinations (Yih et al., 2012). PRISM uses health care administrative claims data from several national health insurers combined with data from nine state immunization registries (Nguyen, Ball, Midthun, & Lieu, 2012). In a separate demonstration, Burwen et al. (2012) used Medicare claims data to perform an active surveillance of the Guillain-Barré syndrome after seasonal or H1N1 influenza vaccination.

Drug Safety

The post approval drug surveillance of adverse drug reactions is an important public health activity. It has been suggested that health care administrative claims may be a valuable source of data for monitoring adverse events (AEs) because it contains person-level longitudinal data on AEs, concomitant medications, and comorbid diagnoses both before and after the drug exposure, and populations are usually large enough to study even the rarest of events (Gibbons et al., 2010). Brown et al. (2007, 2009a) were among the first to use historical administrative claims data from multiple health plans to demonstrate the proof of concept of an active surveillance of AEs. Dore, Seeger, and Arnold (2009) and Dore, Seeger, and Chan (2012) used commercial claims data and an active drug safety surveillance

system to assess the risk of acute pancreatitis among patients who received different diabetes drug therapies and to assess the risk of thyroid and pancreatic cancer among users of exenatide. A study by Hartzema, Racoosin, Macurdy, Gibbs, and Kelman (2011) examined the feasibility of Medicare claims data for real-time drug safety evaluations, and a study by Wahl et al. (2012) used a large integrated commercial database to demonstrate an active surveillance of three different drug-related AEs.

Cancer

Health care administrative claims data play an important role in cancer surveillance and research on outcomes of care. Whittle et al. (1991a, 1991b) was among the first to use Medicare claims data to estimate the incidence of and resection rates for breast, colon, and lung cancer and to examine the perioperative mortality and survival of elderly lung cancer surgery patients. Medicare claims data have been used to identify incident cases of breast, colorectal, lung, and prostate, leukemia, lymphoma, skin, and stomach cancer (Barzilai et al., 2004; Freeman, Zhang, Freeman, & Goodwin, 2000; Gold & Do, 2007; McBean, Babish, & Warren, 1993; McBean, Warren, & Babish, 1994; McClish et al. 1997; McClish & Penberthy, 2004a, 2004b; Nattinger, Laud, Bajorunaite, Sparapani, & Freeman, 2004; Penberthy et al., 1999; Penberthy, McClish, Manning, Retchin, & Smith, 2005; Warren, Riley, McBean, & Hakim, 1996; Warren, Feuer, Potosky, Riley, & Lynch, 1999). In addition to Medicare claims, both Medicaid (Koroukian, Cooper, & Rimm, 2003; Wang et al., 2001) and commercial claims (Doebbeling et al., 1999; Eide et al., 2012) have been used to identify various cancers.

One of the most valuable population-level data sources for cancer-related epidemiological and health services research data is the Surveillance Epidemiology and End Results (SEER) Medicare database. The SEER-Medicare databases were completed in 1991 through collaboration between the National Cancer Institute (NCI), the SEER registries, and the Centers for Medicare and Medicaid Services (CMS). The SEER registries are matched by individual identifiers to the Medicare master enrollment file. The SEER-Medicare databases provide population-based estimates of cancer testing,

treatment, and costs. The database also allows investigators to look at services before, during, and after diagnosis; comorbidities; all procedures; use of adjuvant chemotherapy; and long-term outcomes such as rehospitalization. Also, it facilitates finding a convenient control group within the Medicare data (Warren, Klabunde, Schrag, Bach, & Riley, 2002). As of November 2012, a total of 783 studies have been published using SEER-Medicare data (National Cancer Institute, 2012).

In summary, public health has a history of using health care administrative claims data to support various programmatic and epidemiological needs. Some applications of the data include the examination of Medicaid expenses, supporting the value of public health programs such as WIC, exploring access to care and services, analyzing the use of preventive and vaccination services, and monitoring drug safety.

6. Summary

In summary, there are several different sources of chronic disease data available to public health. Although these sources provide important information on chronic disease, each source has its limitations and provides an incomplete picture of the chronic disease burden. Health care administrative claims data have been suggested as a potential source of data to help fill the gap. An in-depth description of health care administrative data was provided along with evidence of its strength for supporting chronic disease epidemiology. In particular, the value of the diagnostic coding system within claims allows epidemiologists to analyzing the general health of populations and to monitor the incidence and prevalence of diseases. The review also described some of the potential limitations of health care administrative claims data source.

The sources of health care administrative claims data were explored, highlighting the challenges of access and representativeness due to claims data fragmentation inherent to the U.S. multipayer health care system. However, APCDs were highlighted for its potential to overcome the barrier of fragmentation due to being a central source of comprehensive data across payers.

Evidence was also presented demonstrating the analytic utility of health care administrative claims data for conducting health services, quality, and cost of care research. This evidence lends credibility to the argument that health care administrative claims data have important epidemiological value and have the potential for wider application specifically in the area of chronic disease. Lastly, evidence was presented showcasing the use of health care administrative claims data to support various public health activities, suggesting that public health already has experience using these data for other purposes.

B. Theoretical Framework

Despite the strengths of health care administrative claims data identified in the literature review, public health has not widely adopted these data as a major tool for supporting chronic disease epidemiology. This suggests that either public health does not fully understand the value contained within health care administrative claims data for supporting chronic disease epidemiology or barriers exist, preventing a wider adoption of this data source for supporting chronic disease epidemiology. The literature review suggests that some possible barriers to a wider adoption of health care administrative claims data may include issues with data accuracy and validity and challenges with access due to the multiple payers, privacy, and data ownership issues. Nonetheless, there is a paucity of literature, which has examined the possible factors influencing public health's adoption of health care administrative claims data for supporting chronic disease epidemiology.

To more effectively understand the process by which public health would potentially adopt health care administrative claims data for supporting chronic disease epidemiology, a theoretical model that provides a framework for describing the process of adoption is critical. At the highest level, the widespread use of health care administrative claims data for supporting chronic disease epidemiology would require a change in current public health practice. In adopting something new, the approach to implementing and managing change is called *change management*. Change management “is the

systematic approach and application of knowledge, tools and resources to leverage the benefits of change, managing an as-is process or function moving toward a better or more efficient process or function in hopes to positively impact performance” (Metre, 2009). There are several change management theories in the literature including and not limited to Kotter’s (1995) eight-step change management theory, Lewin’s (1951) change management model, Jick’s (1991) ten-step change model, the ADKAR change model (Hiatt, 2006), McKinsey’s 7S model (Waterman, Peters, & Phillips, 1980), and the diffusion of innovation (DOI) theory (Rogers, 2003; Ryan & Gross, 1943; Toews, 2003).

On the surface, the adoption of health care administrative claims data for supporting chronic disease epidemiology seems to be best framed as a DOI problem. Generally speaking, the DOI theory refers to the process in which individuals adopt a new idea, product, practice, or philosophy (Kaminski, 2011). The use of health care administrative claims data to support the practice of chronic disease epidemiology can be considered a new technological innovation. The DOI is particularly valuable for studying the adoption of health care administrative claims data for supporting chronic disease epidemiology because the theory seeks to describe how, why, and at what rate new ideas and technology spread through cultures (Al-Jabri & Sohail, 2012).

There have been several major authorities on the DOI theory, including and not limited to Gabriel Tarde (Toews, 2003), Bryce Ryan and Neal Gross (1943), and Everett Rogers (2003). Among these various authorities, Rogers’ DOI theory is a particularly useful framework for studying the adoption of a new technology (in this case health care administrative claims data for supporting chronic disease epidemiology) because it is well developed and is the most widely tested and implemented model not only as a theoretical framework but also as a practical application framework (Engel, Blackwell, & Miniard, 1995). Rogers’ DOI theory is particularly appropriate for examining the process of technology acceptance, which is consistent with the innovation of interest in this study. In addition, Rogers’ DOI theory has a history of use within the discipline of public health (Becker, 1969; Moseley,

2004). For these reasons, Rogers' DOI theory was used to help frame the thinking around the process public health and epidemiologists would take in adopting health care administrative claims data to support the practice of chronic disease epidemiology. The following section provides an overview of Rogers' DOI theory.

1. Rogers' DOI Theory

The prevailing theoretical framework describing the process of adopting new ideas, practices, or technologies into a social system is Rogers' DOI (Rogers, 2003). Rogers describes diffusion as "the process in which an innovation is communicated through certain channels over time among members of a social system." In addition to focusing on the awareness and knowledge of the innovation, the theory explains the attitude change and the decision-making process that leads to the adoption of an innovation (Rogers & Singhal, 1996). Rogers (2003) asserts that there are four main components of the diffusion process: the innovation, the communication channels by which the innovation is diffused, the time, and the social system.

Rogers (2003) defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." Even if an idea, practice, or object was developed long ago, it is still considered innovative if the individual or unit perceives it to be new.

The second component of innovation diffusion, communication channels, is "a process in which participants create and share information with one another to reach a mutual understanding" (Rogers, 2003). The two common types of communication channels are mass media and interpersonal communications. Mass media channels enable one or a few individuals to reach a broad audience and include media such as radio, television, and Internet news sites. Interpersonal communications consist of a two-way communication between two or more individuals. Rogers argues that mass media channels are more effective in creating knowledge of innovations, where interpersonal channels are more influential in shaping and changing attitudes about a new innovation.

The third component of innovation diffusion, time, is a meaningful element for the information-decision process (the interval from first knowledge of an innovation through adoption or rejection), the earliness or lateness in which an innovation is adopted, and the speed an innovation is adopted by members of a social system (Rogers, 2003).

The final component of innovation diffusion is the social system. Rogers (2003) defines the social system as “a set of interrelated units engaged in joint problem solving to accomplish a common goal.” The social system is the environment within the innovation diffuses. The social system affects diffusion through its structure, the norms (the existing behavior patterns of the members within the system), the influence of opinion leadership (the extent to which an individual is able to influence other individuals’ attitudes or behavior in a desired way with relative frequency), and the change agents who are individuals who try to influence clients’ innovation decisions in a direction deemed desirable by a change agency (Rogers, 2003).

Attributes of Innovation

Rogers (2003) also identifies five primary attributes of an innovation, which influence the rate of diffusion within a population to whom the innovation is relevant. These attributes include relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to which an idea is perceived to be an improvement than the idea before it. The components of relative advantage can include the social prestige associated with the innovation, time and cost efficiencies, low barrier to entry, degree of economic profitability, effect on comfort, and propinquity of the output (Askarany, Smith, & Yazdifar, 2007). Compatibility is the degree to which an innovation is perceived as being consistent with the expected values, experiences, and needs of potential adopters (Rogers, 2003). Innovations that are already aligned with the values and the norms of potential adopters and their social systems are expected to be adopted much more quickly.

Complexity refers to the degree to which an innovation is perceived to be difficult to understand or use (Rogers, 2003). Complexity is negatively correlated with rate of diffusion. Trialability is the degree to which the innovation can be tested on a limited basis prior to a commitment of full adoption (Rogers, 2003).

The final attribute of an innovation is observability. Rogers (2003) defines observability as “the degree to which the results of an innovation are visible to others.” If the observability of the innovation is greater, there is a positive correlation with the rate of adoption (Rogers, 2003).

For this study, Rogers’ (2003) attributes of an innovation were used as a framework to help examine how public health perceives the use of health care administrative claims data for supporting chronic disease epidemiology and to assess the barriers and enabling factors to the innovation diffusing into public health practice. Specifically, the five attributes of innovation were used to help guide a discussion with public health practitioners and subject matter experts on their viewpoints about the potential use of health care administrative claims data for chronic disease epidemiology.

2. Diffusion of Geographic Information Systems into Public Health Practice

In addition to the guidance from Rogers’ (2003) DOI theory, it is also useful to study examples of how technological innovations have previously diffused into public health practice. Examining historic examples within the field of public health can provide insights into the characteristics of the innovations and the processes of diffusion that enabled or were obstacles to innovation adoption. This information was used to help shape the inquiry and understanding of the potential diffusion of health care administrative claims data for supporting chronic disease epidemiology.

A good example of technological innovation diffusion into public health practice is the geographic information system (GIS). GIS is a “system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling, and display of spatially referenced data for solving complex planning and management problems” (Heikkila, 1998). GIS has

been broadly adopted by the public health community and is being used extensively in the areas of disease surveillance, risk analysis, health access and planning, and community health profiling (Nykiforuk & Flaman, 2009). Specific examples of public health's use of GIS include the Dartmouth Atlas of Health Care (Berke, 2010), which documents the variation in medical resource allocation; the examination of the geographic patterns of colorectal cancer incidence (Rushton, Peleg, Banerjee, Smith, & West, 2004); and the linkage of outdoor air pollution data, traffic density data, and health survey data to understand asthma morbidity (Wilhelm et al., 2008).

Multiple factors influenced the adoption of GIS by public health in the late 20th and early 21st centuries. The first recognized driver of GIS adoption in public health was advances in computer technology during the late 1980s and early 1990s. Hardware, software, and database developments such as increased computer memory and improved graphical performance of workstation and desktop computers made broader adoption of GIS more realistic (Cromley & McLafferty, 2002). These advances in computer technology also made the needed computing much more affordable than in previous periods (Nedovic-Budic & Godschalk, 1996).

Around the same time, developments in spatial databases such as the TIGER/Line files of the U.S. Census Bureau accelerated the expansion of GIS technology with the social sciences and public health research communities. GIS and public health were seen as a good match because public health possessed several large databases containing geographic information that could be integrated based on location data (Cromley & McLafferty, 2002).

Another factor that was influential in driving interest in GIS adoption by public health was the adoption of GIS by other government agencies. Between 1990 and 1997, local government use of GIS technology among jurisdictions increased from 20% to 87% (Warnecke, Beattie, Kollin, & Lyday, 1998). The use of GIS by local government agencies primarily for planning assessment provided a tangible use case for public health.

One of the most important drivers of GIS technology diffusion into public health was the federal government. In 1976, the National Center for Health Statistics organized a workshop on automated cartography and epidemiology that brought together representatives from various federal agencies and research community in response to the increasing awareness of computer-based mapping and geographic analysis (Cromley & McLafferty, 2002). Subsequently, various federal agencies continued to expand their use of GIS technology to support public health activities. For example, the Agency for Toxic Substances and Disease Registry (ATSDR) held a workshop session demonstrating the use of GIS technology as a valuable tool for environmental risk assessment in response to the growing interest in environmental health and risk assessment (Cromley & McLafferty, 2002). In addition to environmental health and risk assessment, government agencies began using GIS as a tool to help address vector-borne infectious disease (Cromley & McLafferty, 2002).

Federal agencies through state- and local-level cooperative agreements also began funding the development of GIS applications for public health and help to bring together collaborations between the research community and the public health agencies (Cromley & McLafferty, 2002). Agencies such as ATSDR and academic researcher began developing GIS training program for public health professionals (Cromley & McLafferty, 2002).

Despite these enabling factors supporting the diffusion of GIS, local health departments in the late 1990s and early 2000s were limited by the lack of resources for GIS hardware and software as well as the lack of support in GIS-related activities such as training, staff experience, budget in support of geocoding and other geospatial data activities (Croner, 2003).

Two studies examined the environmental, organizational, and interpersonal correlates of GIS adoption among local government agencies. The first study by Onsrud and Pinto (1993) focused on the factors most predictive for the high utilization of GIS in an organizational setting. In general, factors significantly correlated with the high utilization of GIS included utility (advantages of new system),

history of failure (the organizations previous experience with unsuccessful computer system experiences), ease of use, availability of fall back options, and costs (Onsrud & Pinto, 1993).

In a second study, Nedovic-Budic and Godschalk (1996) explored the influence of human factors, internal organizational context, external organizational context, external organizational environment, and GIS management activities on the adoption of GIS. Findings suggested that human factors of the perceived relative advantage of the technology, compatibility of GIS with current computer experience, previous exposure to GIS technology, and communication behavior (networking) were associated with GIS acceptance (Nedovic-Budic & Godschalk, 1996). On the other hand, organization conflict and instability were the most detrimental internal organizational-level attributes to the adoption process. State mandates, provisions of external funding, political support, and jurisdiction size were the most influential external organizational environmental factors. GIS user training, user involvement in system design and implementation, and support and commitment of administrative-level management increased the likelihood of GIS implementation success (Nedovic-Budic & Godschalk 1996).

A 2006 study looked at GIS adoption specifically in health departments, focusing on the management and diffusion of the technology within an organization. Commonly cited challenges to GIS adoption included training, application development, leadership and IT commitment, obtaining sustainable sources of GIS funding, bureaucratic challenges, and IT turnover (Alfred, Claudio, Chalmers, & Gibb, 2006).

In summary, GIS diffusion within public health practice was aided by advances in computer technology, and spatial databases lowered the barrier and cost of adoption. The federal government also provided significant leadership in promoting, using, training, and funding the use of GIS technology. Other enabling factors associated with GIS adoption include the relative advantage of GIS, experiences with other computer systems, compatibility with current computer experience, ease of use, availability

of fall back options, costs, funding, state mandates, jurisdiction size, political support, previous exposure to GIS, communication behavior (networking), user involvement in system design and implementation, and support and commitment of administrative-level management. Barriers to adoption include training, application development, leadership and IT commitment, obtaining sustainable sources of GIS funding, bureaucratic challenges, and IT turnover.

3. Summary

In summary, to more effectively understand the process by which public health would potentially adopt health care administrative claims data for supporting chronic disease epidemiology, Rogers' attributes of an innovation were used as a framework to help examine how public health perceives the use of health care administrative claims data for supporting chronic disease epidemiology and to assess the barriers and enabling factors to the innovation diffusing into public health practice. In addition, insights from how GIS technology diffused into public health practice were used to help shape the inquiry and understanding of the potential diffusion of health care administrative claims data for supporting chronic disease epidemiology.

III. STUDY DESIGN, DATA AND METHODS

This chapter details the study methods used to examine the study questions introduced in chapter

I. This chapter details the overall study design, data sources, data collection procedures, data management, study sample, data preparation, and analysis plan.

A. Overall Study Design

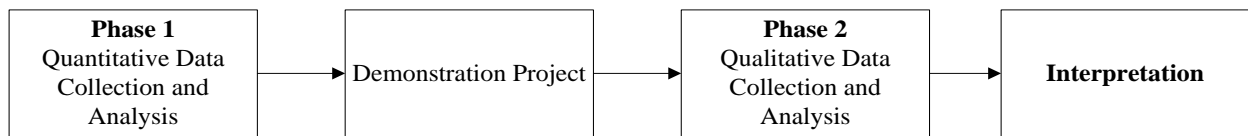
This study used a mixed methods research design. Mixed methods research collects and analyzes both qualitative and quantitative data, mixes the data concurrently or sequentially, is conducted within a single study or multiple phases of a program of study, is framed within philosophical worldviews and a theoretical lens, and is combined into a specific research design (Creswell, 2011). The value of a mixed methods approach is that it allows the researcher to enhance findings in ways that a single form of data does not allow (Brewer & Hunter, 1989; Tashakkori & Teddlie, 1998).

There are several different types of mixed methods designs. For this study, an exploratory sequential design was used. Traditionally, exploratory sequential designs are two-staged, with a qualitative methodology first used to investigate a phenomena (exploratory phase) and the findings then used to inform a second quantitative methodology (Creswell & Plano-Clark, 2011). In this study, the methods were reversed with a quantitative methodology used for the exploratory phase, and the findings were used to enhance a second qualitative methodology. Specifically, in the first phase of the study, a quantitative methodology was used to demonstrate a variety of chronic disease-related analyses that can be performed using health care administrative claims data. This served as a “demonstration project” to showcase the analytic utility of health care administrative claims data to inform public health about the prevalence, health care costs, and health care utilization of a population with various chronic diseases.

The findings from the first phase were then used as a springboard for the second qualitative phase of the study. In phase 2, the analytic findings from the first phase were showcased to a group of key informants to help facilitate discussions about public health’s interest and ability (barriers and enabling factors) to access and use health care administrative claims data for supporting chronic disease

epidemiology. The overall design of the study is illustrated in Figure 1. The findings from both phases of the study were summarized, integrated, and interpreted in Chapter V.

Figure 1. Modified Exploratory Sequential Design



B. Phase 1

1. Study Design

Phase 1 of the study used a population-based retrospective database study design. The population-based retrospective analyses of health care administrative claims data are a commonly used epidemiological approach for analyzing the prevalence of health conditions (Cazzola, Bettoncelli, Sessa, Cricelli, & Biscione, 2010; Dombkowski, Wasilevich, & Lyon-Callo, 2005; Gershon et al., 2009; Moore, Lix, Yogendran, Martens, & Tamayo, 2008; Powell et al., 2003) and examining health care costs and utilization (Birnbaum, Pike, Banerjee, Waldman, & Cifaldi, 2012; Korves et al., 2012; Mirkin, Murphy-Barron, & Iwasaki, 2007). Using a sample of three calendar years of de-identified health care administrative claims data, this study demonstrated various analyses that can be performed with health care administrative claims data.

2. Data Sources, Data Collection, and Data Management

a. Data Source and Description

The data for this phase of the study was a sample of de-identified health care administrative claims data from Alere Health. Alere Health is a provider of personal health solutions including disease

management, complex case management, wellness and prevention services, and home monitoring. Alere Health maintains health care claims data for facilitating contracted health management services. A data use agreement with Alere Health was secured, authorizing the use of a sample of de-identified health care administrative claims for the study. A claim of exemption application for the study was submitted to the institutional review board of the University of Illinois at Chicago and was approved. A copy of the approved claim of exemption can be found in Appendix A.

The health care administrative claims data consist of three separate file types: membership, medical, and pharmacy. The membership data files contain demographic (e.g., age, gender) and insurance eligibility information (e.g., insurance eligible member months). A detailed description of the eligibility fields accessed for this study can be found in Table IV.

Table IV

Membership File Field Description

Field Name	Description
ID	The identifier that uniquely represents the member
Elig_Age_Yr1	Member's age at end of insurance eligibility in year 1
Elig_Age_Yr2	Member's age at end of insurance eligibility in year 2
Elig_Age_Yr3	Member's age at end of insurance eligibility in year 3
MM_Yr1	Member's insurance eligible member months in year 1
MM_Yr2	Member's insurance eligible member months in year 2
MM_Yr3	Member's insurance eligible member months in year 3
MM_Total	Member's total insurance eligible member months across all three years
Elig_Gender_Code	Member's gender
Elig_RecordType_Code	Identifies if member is an insurance qualifier or a dependent
Elig_Relationship_Code	Identifies if member is an insurance qualifier, spouse, or child

Medical claim files contain information regarding the provision and costs of health care services. The medical claim files include information such as claim type, place of service (e.g., inpatient and outpatient), year of service, amount charged and paid, and diagnostic and procedural billing codes (e.g., DRGs, ICD-9-CM, and CPT). A detailed description of the medical claim fields accessed for this study can be found in Table V.

Pharmacy claims contain information on the cost and type of pharmaceutical prescriptions dispensed. Pharmacy claim files include information such as medication name and type, quantity, therapeutic use, amount charged and paid, and NDC product identifier. A detailed description of the pharmacy claim fields accessed for this study can be found in Table VI.

Table V

Medical Claim File Field Description

Field Name	Description
ID	The identifier that uniquely represents the member
Line_ID	The claim line number
Claim_Type	The claim type identifier (e.g., hospital, ER, and professional)
Grouper	The identifier to group claims together
Service_Year	The year the service was provided
Admit_Year	The year the member was admitted to the hospital
Discharge_Year	The year the member was discharged from the hospital
LOS	The length of the inpatient admission.
Claim_PlaceOfSvc_Code	The HCFA-defined place where the service was provided (inpatient hospital, office, urgent care facility, etc.)
Claim_SvcTypeLoc_Code	Service type location code
Claim_Svc_Code	Service code
Claim_ICD1_Code	The primary ICD diagnosis code
Claim_ICD2_Code	The secondary ICD diagnosis code
Claim_ICD3_Code	The tertiary ICD diagnosis code
Claim_ICD4_Code	The fourth ICD diagnosis code
Claim_ICDProc1_Code	The primary ICD procedure code
Claim_ICDProc2_Code	The secondary ICD procedure code
Claim_ICDProc3_Code	The tertiary ICD procedure code
Claim_CPT_Code	The primary CPT procedure code
Claim_HCPCS_Code	The first Health Care Common Procedure Coding System code
Claim_DRG_Code	The first DRG code
Claim_Adjustment_Code	Indicator used to determine whether a claim is an adjustment
Claim_AdjustmentType_Code	The type of adjustment (reversal, replacement, negative, and positive)
Claim_ProviderSpecialty_Code	The treating provider's specialty
Claim_ProviderType_Code	Type of provider (MD, RN, etc.)
Paid_Year	The year the claim was paid
Claim_Charged_Amt	The amount charged for the provided service
Claim_Excluded_Amt	The amount excluded from charges
Claim_Discount_Amt	The amount discounted from charges
Claim_Allowed_Amt	The amount approved before deductibles are processed
Claim_Deductible_Amt	The deductible amount
Claim_Copay_Amt	The co-pay amount
Claim_Coinsur_Amt	The coinsurance amount
Claim_COB_Amt	The coordination of benefit amount
Claim_COB_Ind	The coordination of benefit indicator
Claim_Withheld_Amt	The withhold amount for the service provided
Claim_FFSEquivalent_Amt	The fee for service equivalent amount
Claim_Paid_Amt	The amount paid by the insurance carrier for the service

Table VI

Pharmacy Claim File Field Description

Field Name	Description
ID	The identifier that uniquely represents the member
Line_ID	The claim line number
Service_Year	The year the medicine was dispensed
Paid_Year	The year the claim was paid
Pharm_Adjustment_Code	The adjustment indicator
Pharm_AdjustmentType_Code	The type of adjustment (reversal, replacement, negative, and positive)
Pharm_NDC_Code	The National Drug Code
Pharm_Refill_Code	Identifies claim as a new prescription or a refill of an existing prescription
Pharm_Generic_Code	Identifies claim as generic (yes, no)
Pharm_TherapeuticClass_Code	The therapeutic class code
Pharm_RefillSequence	Current refill number
Pharm_DaysSupply_Qty	The number of days for which medication was dispensed
Pharm_Dispensed_Qty	The number of units dispensed
Pharm_Paid_Amt	The amount paid by the insurance carrier for the service
Pharm_Ingredient_Cost	The ingredient cost of the drug prescribed
Pharm_Dispense_Fee	The dispensing fee charged for the drug

b. Study Sample*Base Population Sample*

Individuals eligible for the study had at least one month of insurance eligibility between January 1, 2009, and December 31, 2011. Individuals younger than 18 years were excluded from the study because the study focused only on the adult population. Individuals 65 years and older were also excluded from the study because Medicare claims experience was not available for this population.

Chronic Disease Population Subsample

A subset of individuals with the following diagnosed chronic diseases was identified within the base population: diabetes, hypertension, and coronary artery disease (CAD). The claims-based identification algorithms for each chronic disease are presented in Table VII.

Table VII

Chronic Disease Identification Algorithms

Chronic Disease	Identification Algorithms	Claim Definition	Diagnosis Codes	Medication Group Descriptions
Diabetes	<p>At least one hospital inpatient claim in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least one ER claim in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least two nonhospital inpatient/non-ER claims in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least one pharmacy claim in the identification period with a qualifying NDC code</p>	<p><u>Hospital Inpatient Claim</u></p> <p>Claim_SvcTypeLoc_Code = 1 (inpatient) and (Claim_Placeofsvc_Code = 6 (Indian health service provider-based facility), 8 (tribal 638 provider-based facility), 21 (inpatient hospital), 25 (birthing center), or 26 (military treatment facility))</p> <p>OR</p> <p><u>ER Claim</u></p> <p>Claim_PlaceOfSvc_Code = 23 (emergency)</p> <p>OR</p> <p>Claim_CPT_Code = 99281, 99282, 99283, 99284, or 99285</p> <p>OR</p> <p>Claim_Revenue_Code = 450 or 451, 452, 456, 459, or 981</p> <p><u>Pharmacy Claim</u></p> <p>Any Claim that comes from a pharmacy benefits manager</p>	<p><u>ICD-9</u></p> <ul style="list-style-type: none"> · 250.xx · 357.2x · 362.0x · 366.41 	<ul style="list-style-type: none"> · Anti-hyperglycemic, incretin mimetic (glp-1 recep.agonist) · Anti-hyperglycemic, alpha-glucosidase inhib (n-s) · Anti-hyperglycemic, amylin analog-type · Anti-hyperglycemic, biguanide type · Anti-hyperglycemic, dpp-4 inhibitors · Anti-hyperglycemic, insulin-release stimulant type · Anti-hyperglycemic, insulin-response enhancer (n-s) · Anti-hyperglycemic, biguanide type(nonsulfonylurea) · Anti-hyperglycemic, insulin-rel stim. & biguanide cmb · Anti-hyperglycemic, insulin-resp.enhancer & biguanide · Anti-hyperglycemic, insulin-response & release comb · Anti-hyperglycemic, insul-resp.enhancer & biguanide cmb · Insulins
Hypertension	<p>At least one hospital inpatient claim in the identification period with a qualifying ICD-9 diagnosis code within any of the first five diagnostic positions</p> <p>OR</p> <p>At least one ER claim</p>	<p><u>Hospital Inpatient Claim</u></p> <p>Claim_SvcTypeLoc_Code = 1 (inpatient) and (Claim_Placeofsvc_Code = 6 (Indian health service provider-based facility), 8 (tribal 638 provider-based facility), 21 (inpatient hospital), 25 (birthing center), or 26 (military treatment</p>	<p><u>ICD-9</u></p> <ul style="list-style-type: none"> · 401.x · 402.x · 403.x · 405.x 	<ul style="list-style-type: none"> · Ace inhibitor/calcium channel blocker combination · Ace inhibitor/thiazide and thiazide-like diuretic · Alpha/beta-adrenergic blocking agents · Angiotensin receptor antag./thiazide diuretic comb · Angiotensin receptor

	<p>in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least two nonhospital inpatient/non-ER claims in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least one pharmacy claim in the identification period with a qualifying NDC code</p>	<p>facility)</p> <p>OR</p> <p><u>ER Claim</u></p> <p>Claim_PlaceOfSvc_Code = 23 (emergency)</p> <p>OR</p> <p>Claim_CPT_Code = 99281, 99282, 99283, 99284, or 99285</p> <p>OR</p> <p>Claim_Revenue_Code = 450, 451, 452, 456, 459, or 981</p> <p><u>Pharmacy Claim</u></p> <p>Any Claim that comes from a pharmacy benefits manager</p>		<p>antgnst & calc.channel blockr</p> <ul style="list-style-type: none"> · Antihyperlip-hmg-coa&calcium channel blocker cb · Antihypertensives, ace inhibitors · Antihypertensives, angiotensin receptor antagonist · Antihypertensives, ganglionic blockers · Antihypertensives, miscellaneous · Antihypertensives, sympatholytic · Antihypertensives, vasodilators · Antihypertensives, ace inhibitor/dietary supp.comb · Beta-adrenergic blocking agents · Beta-adrenergic blocking agents thiazide & related · Calcium channel blocking agents · Hypotensives, ace inhibitors · Hypotensives, angiotensin receptor antagonist · Hypotensives, miscellaneous · Hypotensives, sympatholytic · Hypotensives, vasodilators · Loop diuretics · Potassium sparing diuretics · Potassium sparing diuretics in combination · Renin inhibitor, direct & angiotensin recept antag · Thiazide and related diuretics · Vasodilators, combination
CAD	At least one hospital inpatient claim in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions	<p><u>Hospital Inpatient Claim</u></p> <p>Claim_SvcTypeLoc_Code = 1 (inpatient) and (Claim_Placeofsvc_Code = 6 (Indian health service provider-based facility), 8 (tribal 638 provider-based</p>	<p><u>ICD-9</u></p> <ul style="list-style-type: none"> · 36.xx · 410.xx · 411.xx · 412.xx · 413.xx · 414.xx 	Not applicable

	<p>OR</p> <p>At least one ER claim in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p> <p>OR</p> <p>At least two nonhospital inpatient/non-ER claims in the identification period with a qualifying ICD-9 diagnosis code within any of the first four diagnostic positions</p>	<p>facility), 21 (inpatient hospital), 25 (birthing center), or 26 (military treatment facility))</p> <p>OR</p> <p><u>ER Claim</u></p> <p>Claim_PlaceOfSvc_Code = 23 (emergency)</p> <p>OR</p> <p>Claim_CPT_Code = 99281, 99282, 99283, 99284, or 99285</p> <p>OR</p> <p>Claim_Revenue_Code = 450, 451, 452, 456, 459, or 981</p>	<p>· V4581</p> <p>· V4582</p>	
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c. Data Collection and Preparation

The health care administrative claims data accessed for this study were maintained within Structured Query Language (SQL) relational databases located on a secure data server within Alere Health's secure data network. The data were accessed on the secure data server through layers of password protection on an encrypted laptop computer. To maintain the highest level of confidentiality, only the principle investigator (PI) had authorized access to the study data. At no point during the study did the PI copy, share, or remove any data from Alere's secure data network. All data extraction, preparation, and analysis were completed within a secure storage area network using SAS 9.1.3 (SAS Institute Inc, Cary, NC).

Data extraction began with a query run against the membership file table to isolate all individuals who meet the study criteria. After the membership data were extracted, all personally identifiable information (PII) within the file was removed in accordance with Health Insurance Portability and

Accountability Act (HIPAA) standards. The original unique eligibility identifier contained in the membership extract was based on a combination of PII elements including date of birth and social security number. A new unique identifier field which did not contain PII was created to replace the original identifier and was carried through the developing study data set. Once the original identifier was used to match the individuals within the eligibility extract to their corresponding medical and pharmacy claims data, the original identifier containing PII was stripped from the study data set and replaced with the new identifier.

Two additional data extraction queries were run against the medical and pharmacy claims tables to extract all medical and pharmacy claims incurred during the study period. Each data set was matched back to the membership extract to isolate only the claims for the individuals who met the study inclusion criteria. Once all the medical and pharmacy claims were isolated, the medical and pharmacy claims were stripped of all PII. The medical and pharmacy files were also stripped of their original eligibility identifier and replaced with the new identifier.

Each medical claim was also classified into one of five service categories. The algorithms for categorizing claims into service categories are found in Table VIII.

Table VIII

Medical Claim Service Category Algorithms

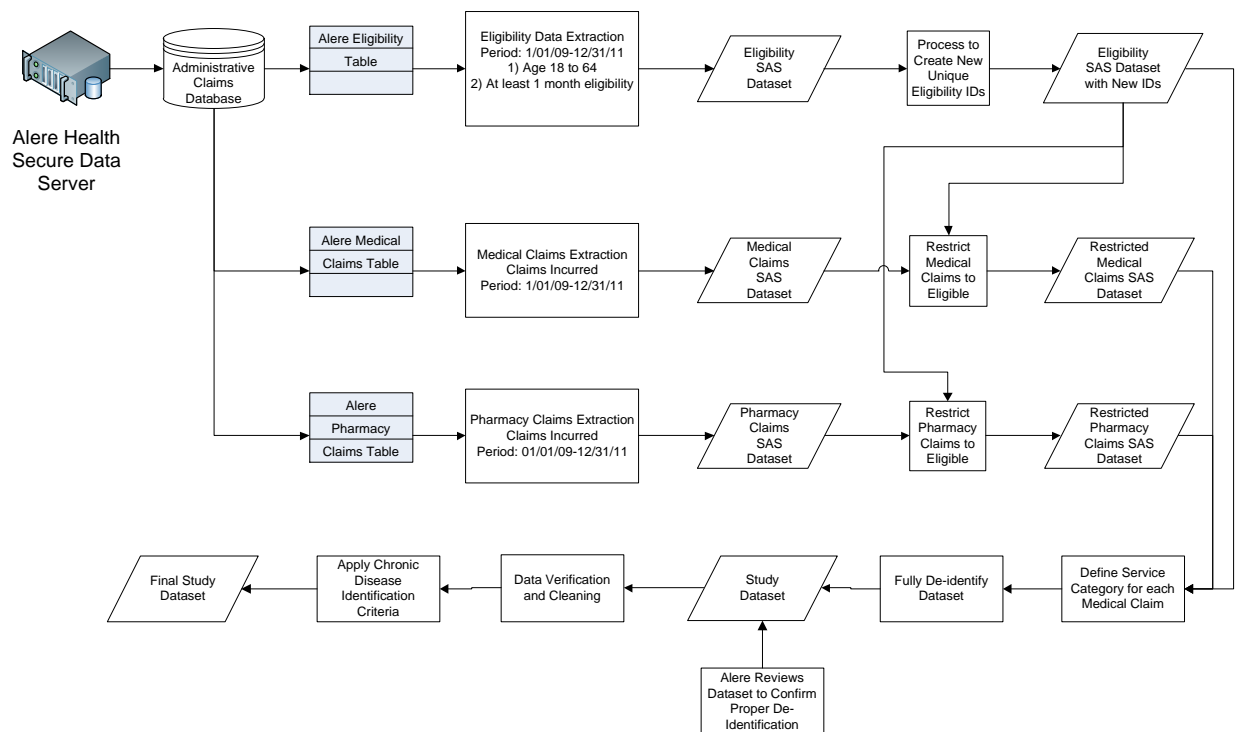
Service Category	Algorithm
Inpatient	Claim_SvcTypeLoc_Code = 1 (inpatient) and (Claim_Placeofsvc_Code = 6 (Indian health service provider–based facility) or 8 (tribal 638 provider-based facility), or 21 (inpatient hospital) or 25 (birthing center) or 26 (military treatment facility))
ER	Claim_Revenue_Code = (450 or 451 or 452 or 456 or 459 or 981) OR Claim_CPT_Code = (99281 or 99282 or 99283 or 99284 or 99285) OR Claim_Placeofsvc_Code = 23 (emergency)
Professional	Claim_Placeofsvc_Code = 11 (office)
Outpatient	Claim_Placeofsvc_Code = 22 (outpatient hospital)
Remainder	Observation Room Stays [Meets inpatient service category logic and Claim_CPT_Code = (99217 or 99218 or 99219 or 99220) OR Claim_Revenue_Code = 0762] AND All remaining claims

For inpatient admissions, claim lines were grouped together according to admission and discharge dates by member. If there was no overlap or the days were not consecutive, then they were deemed not part of the same event. Same-day admissions were counted as admissions unless they were observation room stays. Claim lines for ER, professional, outpatient, or remainder events were grouped by service date and member to define a single event. If an ER, professional, or outpatient claim occurred on or within an inpatient event, those claims were reclassified as an inpatient service category.

Once all service categories were defined for all claims, the data sets were stripped of all remaining PII. Alere reviewed each data set to confirm that the data have been aggregated and de-

identified in accordance with HIPAA de-identification standards. After approval of the data sets by Alere, a data verification and data cleaning stage began. A series of basic analyses were performed to identify missing values, out of range values, outliers, and other unusual patterns in the data that would potentially affect the analysis. Once the study data set was cleaned, the chronic disease algorithms were applied to the data. This step finalized the data set for the analysis stage of the study. The full data collection and preparation process is described in Figure 2.

Figure 2. Data Collection and Preparation Flow Diagram



3. Analysis Plan

a. Demographic and Claims Analysis

The demographic analysis included a count of unique members, the total and average number of insurance member months, and the count and percentage of members by insurance relationship type (i.e., qualifier, dependent) stratified by age (based on subjects most recent month of eligibility within the period) and gender for the full sample and subgroups. The claims analysis included the medical and pharmacy claim count and average per member per year (PMPY) by service category (hospital, ER, outpatient, professional, remainder, and pharmacy) for the full sample and subgroups.

b. Chronic Disease Prevalence Analysis

The chronic disease prevalence analysis included the prevalence of individuals diagnosed with diabetes, hypertension, and CAD stratified by age and gender based on the definitions described in Table VII. The analysis also included the prevalence of individuals with comorbidities for all chronic disease combinations.

c. Utilization and Cost of Care Analysis

The utilization analysis included event counts and per thousand members per year (PTMPY) event rates of all cause inpatient admissions, all cause ER visits, professional visits, outpatient visits, remainder events, and pharmacy claims stratified by age and gender for all sample subgroups. The average length of stay (LOS) was also included in the all cause inpatient admission analysis. The utilization analysis was completed for the overall sample and for the subset of members with a diagnosed chronic disease. The cost of care analysis examined overall paid costs and per member per month (PMPM) by age and gender for the overall sample subgroups. The cost of care analysis was completed for the overall sample and for the subset of members with a diagnosed chronic disease. The cost of care was also stratified by the various places of service categories.

C. Phase 2

1. Study Methodology

Phase 2 of the study used a focus group data collection methodology. Focus groups are a qualitative data collection methodology designed to extract descriptive data from a group of selected individuals on a specific topic or set of topics (Wilkinson, 2004b). Focus groups are used primarily to understand the meanings and interpretations of a select group of people to gain an understanding of a specific issue from the perspective of the participants within the group (Liamputtong, 2009). A distinguishing advantage of focus groups as compared with individual interviews is the leveraging of communication and interactions between the group participants as research data (Kitzinger, 1994, 1995). Other advantages of a focus group methodology include the following: it controls the quality of data collection due to participants' ability to question, refute, or validate one another's comments; it permits the researcher to request immediate clarification of ambiguous data; and it enables efficient and timely data collection as compared with individual interviews (Jamieson & Williams, 2003).

Traditionally, focus groups are facilitated in person due to the value of nonverbal communication and the richness, spontaneity, and creativity of in person interactions (Litosseliti, 2003). However, the use of telephonic focus groups has emerged as a viable methodology especially in the area of public health research (Cooper, Jorgensen, & Merritt, 2003). Two strategic advantages of telephonic focus groups are the ability to facilitate discussions between individuals geographically dispersed across the world and the ability to bring together individuals who are busy and would have difficulty getting together in person (Krueger & Casey, 2002). For this study, a telephonic focus group approach was used given the geographic separation of the focus group participants which did not make a in person focus group feasible.

Figure 3 is an illustrative overview of all the major steps followed to conduct the focus group study and to analyze the study data. The proceeding sections provide a more detailed description of each step identified in Figure 3.

2. Data Sources, Data Collection, and Data Management

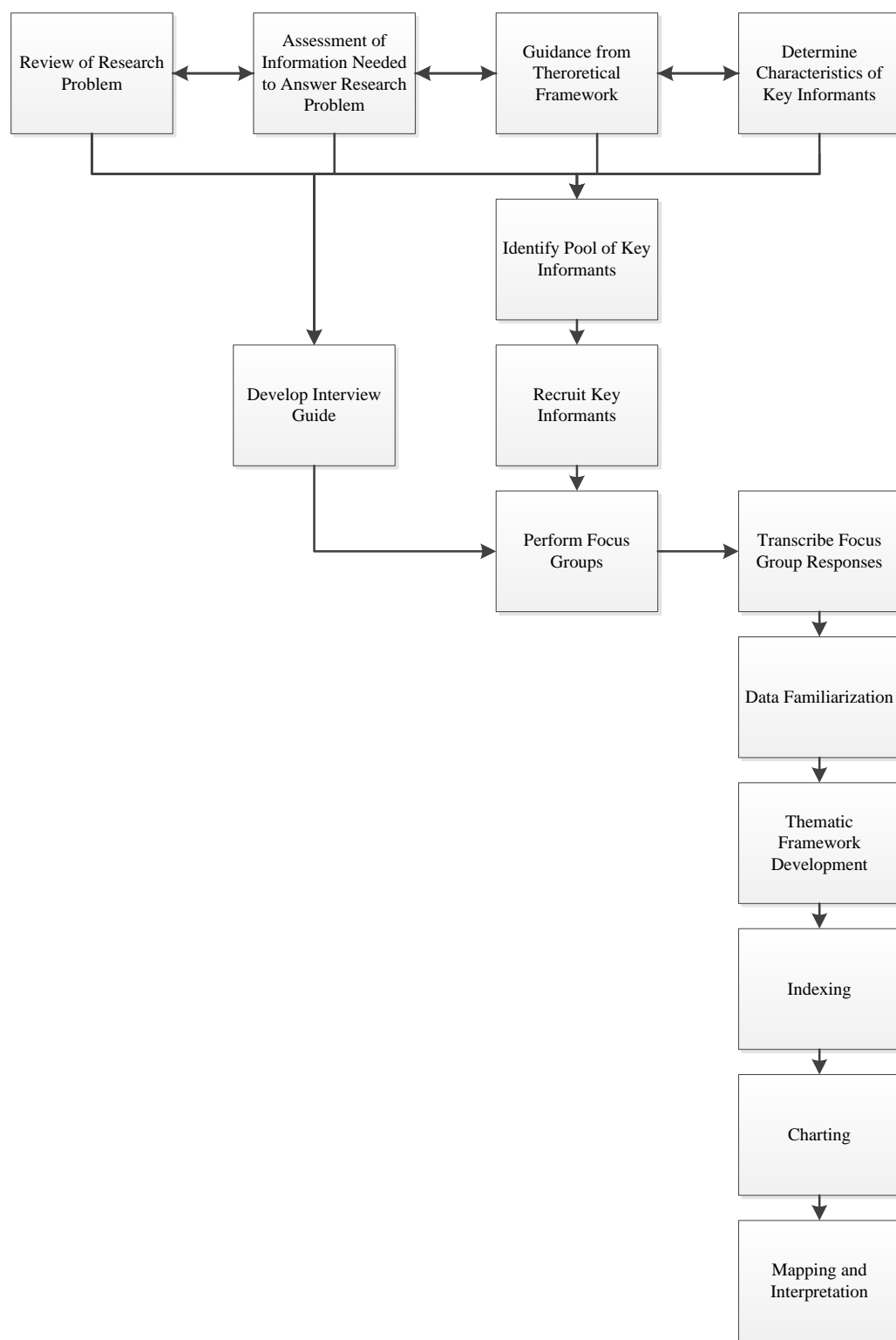
a. Data Source and Description

The data source for the study was the responses and dialogue from a set of questions posed to key informants organized into a set of focus groups. Key informants are individuals with particular knowledge about a topic and can provide particular insight into the experience or knowledge of a group (Gilchrist & Williams 1999).

b. Study Sample

The process for selecting key informants for each focus group followed a process outlined by Tongco (2007), which included a review of the research problem, an assessment of the information needed to answer the research problem, and a review of the required characteristics of the key informant groups. Through this process, several different categories of key informants were identified. Categories of informants included state health officials, state epidemiologists, state CDEs, state informatics or information technology directors, local (city/county) health department directors and epidemiologists, health care administrative claims data owners and providers, and subject matter experts knowledgeable in APCD initiatives across the country. With such a broad number of categories identified, a second pass was required to identify the categories with the highest relevancy to the study questions and to narrow the overall scope of the study to account for limitations in resources and time. As a result, two categories of key informants emerged and were pursued for the study: state CDEs (focus group A) and subject matter experts knowledgeable in APCD initiatives (focus group B).

Figure 3. Focus Group Study Process and Analysis Overview



CDEs were selected because of their proximity to the issue, experience, perspective on value of the data, influence on chronic disease epidemiology practice, and likelihood of having experience or exposure to health care administrative claims data. Subject matter experts knowledgeable in APCD initiatives were selected as the second key informant group due to their perspective on issues with access to health care administrative claims data, experience with public health's role in APCDs, understanding of the policy and political-level influences, and overall experience understanding the challenges of APCD initiatives across the country.

Key informants within each focus group category were then selected using a purposive sampling approach. Purposive sampling is the nonrandom deliberate selection of individuals based on the goals of the project and the potential contributions of the participant (Miles & Huberman, 1994; Tongco, 2007). With the goal of achieving representativeness and comparability, the purposive sampling technique used in this study was homogenous sample selection. Homogeneous sampling is when target participants have similar attributes or experiences (Lodico, Spaulding, & Voegle, 2010).

The next step in the sample selection process was compiling a broad list of individuals within each key informant group. A list of CDEs and their contact information was identified using the Council of State and Territorial Epidemiologists website (<http://www.cste.org>). A list of subject matter experts knowledgeable in APCD initiatives and their contact information was identified using a combination of literature reviews, Internet searches, and informal discussions with key contacts.

Focus Group Recruitment

A review of the literature suggests a focus group should consist of approximately four to twelve participants (Brown, 1999). It has also been suggested that good practice is to over recruit by 20% to 50% due to participant unavailability (Morgan, 1997; Wilkinson, 2004a). Considering this guidance and the uncertainty in terms of the recruitment response rate, a decision was made to recruit a broad group of

informants within each focus group category to maximize the chances of having a meaningful number of participants in each group.

Targeted key informants were recruited using a standard e-mail, which provided an overview of the study, a formal request to participate in the study, and a detailed study information sheet. Individuals who responded with interest in participating in the study received a follow-up e-mail with a Doodle[®] poll listing potential dates and times for the focus group. The poll allowed participants to select dates and times of availability, which helped identify the most mutually agreeable date and time across all potential focus group participants. Once an optimal date and time was identified, an e-mail was sent out to the participants with the conference call in details and a web-conferencing link for viewing presentation slides during the focus group session.

c. Data Collection and Preparation

Development of the Interview Guide

Data collection for this study was facilitated using an interview guide. Interview guides are used to direct a group discussion, to encourage conversation about the research topic, and to ensure that all the needed information is sought (Kingry, Tiedje, & Friedman, 1990). Interview guides are also used to help organize the discussion as it moves from general questions and conversation to a more specific well-focused discussion (Connaway, Wilcox-Johnson, & Searing, 1997; Morgan & Keueger, 1998).

For this study, the interview guide was developed using open-ended questions because it encourages interviewees to respond with an extensive and developmental answer and helps to reveal attitudes or acquire facts (Grummit, 1980). A question development for the interview guide followed an iterative process of creating and revising various questions which connected back to the primary research questions. When developing and reviewing questions for inclusion, questions that were more likely to solicit viewpoints of health care administrative claims data within the framework of Roger's (2003) five main attributes (relative advantage, complexity, compatibility, trialability, and observability)

that influence the adoption of an innovation were prioritized. This assured that the conversation focused on factors that were most likely to explain the barriers and enabling factors influencing the adoption of health care administrative claims data for supporting chronic disease epidemiology. In addition, insights from the literature review and the example of GIS technology diffusion within public health were used to help frame the questions in the interview guide. The total number of questions was dictated by the estimated time available for the focus group discussion. For this study, no pretesting of the questions was completed. The final interview guide questions for each focus group can be found in Appendix B.

Focus Group Facilitation

Both focus groups (A and B) were moderated by the study PI. The roles of the moderator are to create a supportive environment that promotes sharing of viewpoints and encourages interactions among focus group members, to interpose probing question and comments to foster deeper discussion without dominating the discussion, and to insure all topics and questions are covered while adapting to the dynamics of the discussion (Basch, 1987).

At the beginning of each focus group session, the moderator read aloud an oral informed consent script to all focus group participants. Participants were given the opportunity to ask questions about the study, and then verbal consent was requested from all participants. Verbal consent was documented via recorded audio and a verbal consent document.

Participants were also given the option to have their identity and affiliated organization remain confidential when sharing the findings. If the participant elected to have their identity to remain confidential, information gathered through the interview was not reported in any way that can be attributed to the participant or participant's affiliated organization. Information obtained during this study, including the participant's identity, recordings, or transcripts, was not released to anyone outside the investigators conducting the study. The participant's connection to the information disclosed during the interview is kept in a secure location.

After study consent was completed, the moderator provided an overview of the focus group session and discussed expectations of how the session would be facilitated. The beginning of the focus group session included a short PowerPoint presentation on the topic and the purpose of the study. This presentation was used to provide the context for the focus group members and prime them for the question and answer session that followed.

Both focus group sessions were facilitated using the Sonexis ConferenceManager web-conferencing software. Focus group interviews were approximately ninety minutes in length. The recording function of the web-conferencing software was used to capture the dialogue from the group. A Windows Media Audio (WMA) was produced at the end of the recorded conference call.

d. Analysis Plan

Analytic Methodology

For this study, Ritchie and Spencer's (1994) "Framework Analysis" was used to analyze the focus group data. Framework analysis was developed in the 1980s as a pragmatic method for applied policy research. Framework analysis originates within a broad family of analytic methods often called thematic analysis or qualitative content analysis. It is a matrix-based approach for systematically reducing qualitative data and is composed of several distinct but interconnected steps, which allow for theme-based and/or case-based analysis through the development of charts that can be read across cases (individuals, groups, or organizations) or themes (Gale, Heath, Cameron, Rashid, & Redwood, 2013; Ward, Furber, Tierney, & Swallow, 2013). The framework analysis approach provides systematic and discernible stages to the analytic process so others can clearly understand the stages by which the results have been deduced from the data (Lacy & Luff, 2009).

Framework analysis was specifically designed for research with specific questions, a limited time frame, a predefined study sample, and a priori issues that need to be addressed (Srivastava & Thomson, 2009). A practical benefit of framework analysis is that it allows for questions or issues

identified in advance to be considered in the analysis while also allowing for enough flexibility to identify and characterize issues that emerge from the data (Dixon-Woods, 2011). Framework analysis is primarily based on the observation and accounts of participants and is dynamic in that it allows for change or amendment throughout the process, systematic in the methodical approach to data analysis, comprehensive, and transparent (Srivastava & Thomson, 2009).

A primary aim of this study was to use the experience and viewpoints of key informants to generate meaningful recommendations in regard to public health policy related to the use of health care administrative claims data for understanding chronic disease. As previously indicated, framework analysis is a particularly well-suited approach for deducing policy relevant information from the qualitative data produced from interviews with groups with specific a priori research questions. Framework analysis is also a commonly used methodology to analyze semistructured interview transcripts similar to what was used in this study (Ward et al., 2013).

Analytic Procedures

The procedure for analyzing the focus group transcripts was adapted from the process originally developed by Ritchie and Spencer (1994) and further described by Gale et al. (2013). In general, the framework method as described by Gale et al. has seven major stages: transcription, familiarization, coding, developing a working analytic or “conceptual” framework, applying the analytical framework, charting, and interpretation. Beginning with transcription, the two WMA files produced from the conference recording were transcribed verbatim and formatted into Microsoft Word files for analysis. Each focus group participant’s name was also tagged to their instance of dialogue in the transcript to help assist the analysis process.

The next step, familiarization, is the process in which the analyst becomes familiar with the interview data by listening to the interview audio, by reading transcripts, and by reviewing notes made during interviews. The goal of this step is for the analyst to begin taking notes of key concepts and

themes that emerge from the data (Gale et al., 2013). In this analysis, the familiarization stage began with first activating the line numbering option within the focus group interview transcript files to easily reference places throughout the transcript. The PI then read hard copies of both focus group transcripts multiple times to refamiliarize himself with the dialogue and the responses to study questions. Ideas and thoughts that emerged during this process were added to the margins of the transcript.

The third step in the framework method, coding, is the process of applying labels to transcript passages describing important points. Codes could include and are not limited to behaviors, events, structures, beliefs, philosophies, emotions, methods, or predefined concepts. Coding is intended to help classify the data for systematic comparison across the data set (Gale et al., 2013). In this analysis, each transcript was read line by line, and codes were added to the margins throughout the transcript.

The next step, developing a working analytic or “conceptual” framework, is the process in which the analyst identifies the codes that best fit the overall transcript. In this analysis, a tree diagram was created to help categorize and list out all the relevant codes (Gale et al., 2013). Several iterations of the tree diagram were created until a final framework was identified. Although the a priori issues used to drive the research design (e.g., the interview guide) heavily guided the analytic framework, there were additional themes and issues that emerged from the data which were included in the framework.

The fifth step, applying the analytic framework, is the process of applying the analytic framework to the transcript data. In this analysis, the transcript was read line by line and the text was highlighted and tagged with the relevant codes from the analytic framework where appropriate. Each code had a unique number so that text passages could easily be identified.

The next step, charting, is the process of organizing and reducing the data into a manageable format. The charting step takes the data in the previous step and arranges it into charts (matrix) of the themes (Gale et al., 2013). For this analysis, Microsoft Excel spreadsheets were created for each coding category. The spreadsheet included a row for each subcode and columns identifying each focus group

participant. Relevant phrases and references to quotes in the transcript were then entered into each cell of the spreadsheet.

The final step, interpretation, is the process of reviewing the matrix and making connections within and between participants and categories (Gale et al., 2013). For this thesis, data from both focus groups (A and B) were pooled together and analyzed across respondents in both focus groups. The results of the analysis are presented by category and theme.

IV. RESULTS

This chapter provides the results of the data analyses from both study phases, including a description of the study samples, a description of the study data, and findings from the study analyses.

A. Phase 1

1. Description of the Study Sample

A total of 52,834 unique individuals met the study inclusion criteria over the three-year study period. A full description of the frequency and distribution of all variables for the sample in the study data set can be found in Tables IX-XI (see Appendix C). The age of the sample ranged from 18 to 64 years, with a mean age of 42.0 years. Overall, the sample was slightly more male (52.0%) than female (48.0%). Table XII (see Appendix D) describes the age-group and gender distribution of the sample during the entire study period, for each calendar year, and for the cohort of individuals present in every calendar year during the study period.

The insurance relationship type was evenly split between qualifiers (the primary policy holder) (50.5%) and dependents (49.5%). Table XIII (see Appendix D) displays the distribution of insurance relationship type by age-group and gender. Over the three-year study period, the sample had an average of 26.7 months (8.9 months per year) of insurance eligibility. Table XIV (see Appendix D) includes a detailed description of the total and average insurance member months by age-group and gender for the sample over the study period.

2. Description of the Claims Data

A total of 2,344,265 medical and pharmacy claims were extracted for the sample over the three-year study period. These claims were categorized into six mutually exclusive service type categories (hospital, ER, outpatient, professional, remainder, and pharmacy). Table XV includes a summary of the total claims, percentage of claims, and average number of claims per year within each service type category.

Table XV

Claims Summary by Service Category

Service Type Category	Total Number of Claims (2009–2011)	Percentage of Total Claims	Average Number of Claims PMPY (2009–2011)
Pharmacy	1,098,748	47.1	6.93
Professional	732,632	31.3	4.62
Outpatient	232,512	9.9	1.47
Remainder	203,663	8.7	1.28
Hospital	45,137	1.8	0.28
ER	31,572	1.3	0.20
Total	2,344,265	100.0	14.79

Pharmacy claims were the largest percentage of all claims (47.1%), and ER was the smallest percentage of all claims (1.3%). Table XVI (see Appendix D) contains the overall claim counts and the average number of claims PMPY by service type category for all sample subgroups.

3. Utilization Findings by Service Type Category

Focusing on the most recent year (2011) of claims data, the estimated inpatient admission rate for the study sample was 62 PTMPY. In comparison, an analysis by the Health Care Cost Institute (HCCI) of more than 33 million individuals aged 0 to 64 years with private employer-sponsored health insurance estimated the 2011 national inpatient admission rate to be 61 PTMPY (2012e). Even with demographic differences between the study sample and the HCCI benchmark data (there was insufficient demographic detail in the benchmark data to adjust rates), the comparison does suggest that the inpatient admission rates of the sample are comparable with national trends.

The average LOS of an inpatient admission for the sample in 2009 and 2010 was 3.4 days and 3.2 days, respectively. The average inpatient LOS within HCCI's benchmark data for 2009 and 2010 was 4.3 days each year (HCCI, 2012d). Although the sample LOS estimates are lower than the

benchmark, this is likely a function of the benchmark including skilled nursing facilities admissions (which typically have longer LOS) and demographic differences between the sample data and the benchmark. Table XVII (see Appendix D) provides a detailed description of inpatient admissions and average LOS by age and gender for the sample.

In the most recent year (2011) of claims data, the ER rate was 151 PTMPY. HCCI's national ER rate in 2011 was 175 PTMPY (HCCI, 2012e). Although the sample's ER rate is slightly lower than the benchmark, these findings suggest that the sample is generally similar to the national benchmark rate. Table XVIII (see Appendix D) includes a detailed description of the ER visits by age and gender for the sample.

The rate of outpatient visits for the sample in 2010 was 1,298 PTMPY. In comparison, an analysis by the IMS Institute of Health Care Informatics of more than 10 million individuals aged 0 to 64 years with private employer-sponsored health insurance estimated the 2010 national outpatient visit rate to be 1,032 PTMPY (IMS Institute for Healthcare Informatics, 2012). Although there are demographic differences between the sample and the IMS benchmark, the sample rates are generally similar to the national benchmark. Table XIX (see Appendix D) includes a description of outpatient visits by age and gender for the sample.

In 2010, the rate of professional visits for the sample was 6,029 PTMPY. The IMS Institute of Health Care Informatics benchmark for professional visits in 2010 was 6,161 PTMPY (IMS Institute for Healthcare Informatics, 2012). The sample rate is comparable with the IMS benchmark even with demographic differences. Table XX (see Appendix D) includes a display of professional visits by age and gender for the sample.

In the most recent year (2011) of claims data, the rate of remainder events was 1,289 PTMPY. Unfortunately, there is no benchmark data for remainder events for comparison as defined in this study. Table XXI (see Appendix D) displays the remainder visits by age and gender for the sample.

In 2011, the pharmacy utilization rate for the sample was 9,299 PTMPY. HCCI's estimated pharmacy utilization rate in 2011 was 9,246 PTMPY (HCCI, 2012c). Table XXII (see Appendix D) includes the total pharmacy claims and event rate PTMPY by age and gender for the sample.

Table XXIII provides a summary comparison of sample utilization rates for each service type category compared with national benchmark rates.

Table XXIII

Utilization Summary by Service Type Category

Service Type	Year	Sample	HCCI Benchmark	IMS Benchmark
Inpatient (PTMPY)	2011	62	61	54
Inpatient LOS (mean days)	2009	3.4	4.3	4.2
ER (PTMPY)	2011	151	175	161
Outpatient (PTMPY)	2010	1,298	1,032	1,297
Professional (PTMPY)	2010	6,029	6,161	7,076
Remainder (PTMPY)	2011	1,289	NA	NA
Pharmacy (PTMPY)	2011	9,299	9,246	15,870

4. Health Care Cost Findings by Service Type Category

In 2010, the paid health care cost for the sample was \$317 PMPM. In comparison, the IMS Institute of Health Care Informatics benchmark of estimated paid (reported allowed costs were adjusted to paid costs by using an 80% adjustment factor), the health care cost in 2010 among individuals 20 to 64 year olds was \$321 PMPM (IMS Institute for Healthcare Informatics 2012). Table XXIV (see Appendix D) displays the total and PMPM costs by age and gender for the sample.

The paid inpatient health care cost in 2010 was \$77 PMPM. The IMS Institute of Health Care Informatics benchmark of estimated paid inpatient health care costs was \$67 PMPM (IMS Institute for

Healthcare Informatics, 2012). Table XXV (see Appendix D) describes the total and the PMPM inpatient health care costs by age and gender for the sample.

The ER paid cost in 2010 was \$6 PMPM. The IMS Institute of Health Care Informatics benchmark of estimated paid ER costs was \$15 PMPM (IMS Institute for Healthcare Informatics, 2012). Table XXVI (see Appendix D) includes the total and the PMPM ER visit costs by age and gender for the sample.

In 2010, the outpatient paid cost was \$93 PMPM. In comparison, the IMS Institute of Health Care Informatics benchmark of estimated paid outpatient costs was \$70 PMPM (IMS Institute for Healthcare Informatics, 2012). Table XXVII (see Appendix D) includes the total and PMPM outpatient visit costs by age and gender for the sample.

The paid professional visit cost in 2010 was \$56 PMPM. The IMS Institute of Health Care Informatics benchmark of estimated paid professional costs was \$77 PMPM (IMS Institute for Healthcare Informatics, 2012). Table XXVIII (see Appendix D) includes the total and PMPM professional visit costs by age and gender for the sample.

In 2010, the paid remainder event cost was \$22 PMPM. Unfortunately, there is no benchmark data for remainder event costs as defined in this study. Table XXIX (see Appendix D) includes the total and the PMPM remainder event costs by age and gender for the sample.

The paid pharmacy cost for the sample in 2010 was \$64 PMPM compared with IMS Institute of Health Care Informatics benchmark of \$70 PMPM (IMS Institute for Healthcare Informatics, 2012). Table XXX (see Appendix D) includes the total and PMPM pharmacy claims costs by age and gender for the sample.

Table XXXI provides a summary comparison of sample costs for each service type category compared with benchmark costs.

Table XXXI

Health Care Cost Summary by Service Type Category

Service Type	Year	PMPM Paid Cost Sample (\$)	PMPM Paid Cost IMS Benchmark (\$)
Overall	2010	317	321
Inpatient	2010	77	67
ER	2010	6	15
Outpatient	2010	93	70
Professional	2010	56	77
Remainder	2010	22	NA
Pharmacy	2010	64	70

5. Chronic Disease Prevalence Findings

In 2011, the estimated prevalence of diagnosed diabetes in the sample was 7.7%. In comparison, a 2013 study (American Diabetes Association, 2013) estimated the 2011 diagnosed diabetes prevalence rate for U.S. adults 18 to 64 years of age to be 6.7%. When the study sample was age adjusted to the U.S. population reported in the 2013 analysis, the 2011 age-adjusted prevalence rate of the sample was 7.1%. Table XXXII (see Appendix D) provides a detailed description of the diagnosed diabetes prevalence rate by age and gender for the sample.

In 2010, the estimated prevalence of diagnosed hypertension in the sample was 23.1%. In comparison, the estimated diagnosed hypertension prevalence rate for adults aged 20 to 64 years old between 2009 and 2010 was 26.9% (Yoon, Burt, Louis, & Carroll, 2012). When the study sample was age adjusted to the U.S. population reported by Yoon et al. (2012), the age-adjusted prevalence rate for the sample was 18.8%. However, when the study's three-year cohort is examined, the age-adjusted prevalence of hypertension is 24.5% (crude prevalence rate of 32.4%), which is much closer to the prevalence rate reported by Yoon and colleagues. This suggests that multiple years of claims data may be needed to provide accurate estimates of hypertension prevalence and is consistent with findings

published by others on the topic (Tu et al., 2007). Table XXXIII (see Appendix D) describes the diagnosed hypertension prevalence rate by age and gender for the sample.

The 2010 estimated diagnosed CAD prevalence rate in the sample was 1.7%. In comparison, the estimated diagnosed heart disease prevalence rate for adults aged 18 to 64 years in 2010 was 3.3% (CDC, 2011b). The prevalence of CAD in the sample is lower relative to the benchmark after age adjustment (prevalence did not change after age adjustment). However, the CAD prevalence for the three-year cohort was 3.3%, which is similar to the comparative benchmark reported above. As previously noted with hypertension, the findings suggest that multiple years of claims data are needed to accurately estimate CAD prevalence in a population and is consistent with recommendations from other published research (Lix & Shaw, 2006). Table XXXIV (see Appendix D) describes the diagnosed CAD prevalence rate by age and gender for the sample.

In 2010, the estimated prevalence of individuals diagnosed with diabetes and hypertension in the sample was 3.9%. Among the three-year cohort, the prevalence of diabetes and hypertension was 8.4%. The percentage of diabetics with hypertension in 2010 was 51% and 78% for the three-year cohort. In comparison, the percentage of adult diabetics 20 years or older with hypertension has been estimated at 67% (CDC, 2011a). Table XXXV (see Appendix D) describes the diagnosed diabetes and hypertension prevalence rate by age and gender for the sample.

The estimated prevalence of individuals diagnosed with both diabetes and CAD in the sample was 0.6% in 2010. Among the three-year cohort, the prevalence increased to 1.1%. The percentage of individuals with CAD that have diabetes is 35% in 2010 and 33% for the three-year cohort. Table XXXVI (see Appendix D) describes the diagnosed diabetes and CAD prevalence rate by age and gender for the sample.

In 2010, the estimated prevalence of individuals diagnosed with both hypertension and CAD in the sample was 1.2 percent in 2010. Among the three-year cohort, the prevalence increased to 3.0

percent. The percentage of individuals with CAD that have hypertension is 71% in 2010 and 91% for the three-year cohort. Table XXXVII (see Appendix D) describes the diagnosed hypertension and CAD prevalence rate by age and gender for the sample.

In 2010, the estimated prevalence of individuals diagnosed with diabetes, hypertension, and CAD in the sample was 0.5% in 2010. Among the three-year cohort, the prevalence increased to 1.1%. Table XXXVIII (see Appendix D) describes the diagnosed diabetes, hypertension, and CAD prevalence rate by age and gender for the sample. Table XXXIX provides a summary comparison of prevalence by chronic disease for a single year and for the 2009-2011 cohort.

Table XXXIX

Prevalence Summary by Chronic Disease

Chronic Disease	Prevalence (Year)	Prevalence Cohort (2009-2011)
Diabetes	7.7% (2011)	10.8%
Hypertension	23.1% (2010)	32.4%
CAD	1.7% (2010)	3.3%
Diabetes and hypertension	3.9% (2010)	8.4%
Diabetes and CAD	0.6% (2010)	1.1%
Hypertension and CAD	1.2% (2010)	3.0%
Diabetes, Hypertension, and CAD	0.5% (2010)	1.1%

6. Chronic Disease Utilization Findings

Among the cohort of individuals diagnosed with diabetes in the sample between 2009 and 2011, the inpatient admission rate was 218 PTMPY. This was approximately 2.3 times higher than the overall sample admission rate of 93 PTMPY. In addition, the average LOS for diabetics was 4.5 days compared with 3.6 days in the overall sample. In general, diabetics had higher utilization rates than the overall sample across all utilization categories. These utilization findings are consistent with previously

published research (Laditka, Mastanduno, & Laditka, 2001; Peele, Lave, & Songer, 2002). A detailed description of health care utilization among diabetics in the sample can be found in Tables XL-XLV (see Appendix D).

For the 2009-2011 cohort, the inpatient admission rate for individuals diagnosed with hypertension was approximately 1.9 times higher than the overall sample (179 PTMPY vs. 93 PTMPY). The average LOS for individuals with hypertension was 4.2 days compared with 3.6 days in the overall sample. ER visits were approximately 1.4 times higher than the overall sample (200 PTMPY vs. 142 PTMPY). A 2010 study by Milliman, Inc. found that inpatient admission rates of working age adults with hypertension were approximately 2.8 times higher, and ER visits were 1.75 times higher than adults without hypertension (Milliman, 2010). Although the Milliman findings are likely higher due to the difference in the comparison group, it corroborates with the findings that individuals with hypertension have higher health care utilization than the overall population. A detailed description of health care utilization among individuals with hypertension in the sample can be found in Tables XLVI-LI (see Appendix D).

Among the study cohort, the inpatient admission rate for individuals diagnosed with CAD was approximately 5.9 times higher than the overall sample (549 PTMPY vs. 93 PTMPY). The average LOS for individuals with CAD was 4.2 days compared with 3.6 days in the overall sample. ER visits were approximately 2.3 times higher than the overall sample (326 PTMPY vs. 142 PTMPY). Individuals with hypertension had higher utilization rates than the overall sample across all utilization categories. A detailed description of health care utilization among individuals with CAD in the sample can be found in Tables LII-LVII (see Appendix D).

When focusing on individuals among the cohort with comorbid diabetes and hypertension, the inpatient admission rate was approximately 1.8 times higher than the overall sample (166 PTMPY vs. 93 PTMPY). The average LOS for individuals with diabetes and hypertension was 4.5 days compared with

3.6 days in the overall sample. ER visits were approximately 1.5 times higher than the overall sample (214 PTMPY vs. 142 PTMPY). Individuals with comorbid diabetes and hypertension had higher utilization rates than the overall sample across all utilization categories.

Among the cohort with comorbid diabetes and CAD, the inpatient admission rate was approximately 4.6 times higher than the overall sample (426 PTMPY vs. 93 PTMPY). The average LOS for individuals with diabetes and hypertension was 5.1 days compared with 3.6 days in the overall sample. ER visits were approximately 2.6 times higher than the overall sample (363 PTMPY vs. 142 PTMPY). Particularly interesting was the difference in pharmacy utilization among those with diabetes and CAD compared with the overall sample. Individuals with comorbid diabetes and CAD had approximately 4.75 times higher pharmacy utilization as compared with the overall sample (46,033 PTMPY vs. 9,676 PTMPY). Overall, individuals with comorbid diabetes and CAD had higher utilization rates than the overall sample across all utilization categories.

Similar patterns of utilization were found among the cohort with comorbid hypertension and CAD as compared with the group with CAD only. In addition, as expected, the cohort with all three chronic diseases (diabetes, hypertension, and CAD) had the highest overall utilization as compared with all condition groups examined. A full summary of utilization by chronic disease cohort can be found in Table LVIII.

Table LVIII

Utilization Summary by Chronic Disease

	Inpatient PTMPY (LOS)	ER PTMPY	Outpatient PTMPY	Professional PTMPY	Remainder PTMPY	Pharmacy PTMPY
Overall sample	93 (3.6)	142	1,291	6,079	1,316	9,676
Diabetes	218 (4.5)	194	2,344	9,037	2,660	27,277
Hypertension	179 (4.2)	200	2,125	8,759	2,136	21,303
CAD	549 (4.2)	326	4,137	11,463	3,563	30,713
Diabetes and hypertension	166 (4.5)	214	2,583	9,539	2,872	33,303
Diabetes and CAD	426 (5.1)	363	5,954	12,660	4,988	46,033
Hypertension and CAD	374 (4.1)	337	4,417	11,722	3,786	34,568
Diabetes, hypertension, and CAD	433 (5.1)	368	6,090	12,880	5,041	46,801

7. Chronic Disease Cost Findings

Among the cohort of individuals diagnosed with diabetes in the sample between 2009 and 2011, the overall health care cost was \$695 PMPM (\$8,340 PMPY) compared with \$316 PMPM (\$3,792 PMPY) for the overall sample on average. The health care costs of diabetic are approximately 2.2 times higher compared with the overall sample. These findings are consistent with a 2012 study estimating that individuals diagnosed with diabetes on average have expenditures approximately 2.3 times higher than expenditures in the absence of diabetes (American Diabetes Association, 2013). Tables LIX-LXV (see Appendix D) describe the total and PMPM costs across all cost categories by age and gender for the sample diagnosed with diabetes.

For the 2009-2011 cohort, the overall health care costs for individuals with hypertension were \$577 PMPM (\$6,924 PMPY) compared with \$316 PMPM (\$3,792 PMPY) for the overall sample on

average. Individuals with hypertension had health care costs approximately 1.8 times higher than the health care costs of the overall population. A 2010 study by Milliman, Inc. found that the overall health care costs of working age adults with hypertension were approximately 2.8 times higher than adults without hypertension (Milliman, 2010). Although the Milliman findings are likely somewhat higher due to the difference in the comparison groups, the findings generally corroborate the existence of a cost differential found in the analysis. Tables LXVI-LXXII (see Appendix D) describe the total and PMPM costs across all cost categories by age and gender for the sample diagnosed with hypertension.

The average annual health care cost for individuals with CAD in the sample was \$1,328 PMPM (\$15,936 PMPY). A 2010 joint study by the University of Michigan and Blue Cross Blue Shield of Michigan found the average annual cost of insured members with CAD in 2008 to be \$16,882 PMPY (Ehrlich, Kofke-Egger, & Udow-Phillips, 2010). This finding suggests that health care cost estimates for individuals with CAD found in this analysis are consistent with previously published literature. Tables LXXIII-LXXIX (see Appendix D) describe the total and PMPM costs across all cost categories by age and gender for the sample diagnosed with CAD.

The overall health care costs for the cohort with comorbid diabetes and hypertension were approximately 2.5 times than the overall sample (\$577 PMPM vs. \$318 PMPM). In addition, individuals with both diabetes and hypertension cost \$87 PMPM more than the cohort with just diabetes. The cohort with comorbid diabetes and CAD had approximately fifteen times higher costs than the overall sample (\$4,747 PMPM vs. \$318 PMPM) and costs \$3,419 PMPM more than the cohort with just CAD alone. The cohort with comorbid hypertension and CAD had approximately 4.5 times higher costs than the overall sample (\$1,410 PMPM vs. \$318 PMPM) and costs \$82 PMPM more than the group with CAD alone. The cohort with comorbid diabetes, hypertension, and CAD had approximately 5.75 times higher costs than the overall sample (\$1,816 PMPM vs. \$318 PMPM). This cohort only had the second highest cost. The cohort with diabetes and CAD was \$2,931 higher than the cohort with

comorbid diabetes, hypertension, and CAD. A full summary of health care costs by chronic disease cohort can be found in Table LXXX.

Table LXXX

Health Care Cost Summary by Chronic Disease

	Inpatient PMPM (\$)	ER PMPM (\$)	Outpatient PMPM (\$)	Professional PMPM (\$)	Remainder PMPM (\$)	Pharmacy PMPM (\$)	Total PMPM (\$)
Overall sample	76	6	91	55	22	66	316
Diabetes	195	8	175	90	52	175	695
Hypertension	156	9	158	87	39	128	577
CAD	530	15	351	126	88	218	1,328
Diabetes and hypertension	225	9	195	97	57	199	782
Diabetes and CAD	1,717	69	1,488	739	439	295	4,747
Hypertension and CAD	577	15	372	128	95	223	1,410
Diabetes, hypertension, and CAD	710	16	506	135	148	301	1,816

B. Phase 2

1. Sample

Focus Group A: State Chronic Disease Epidemiologists

Focus group recruitment e-mails were sent to a total of 25 state CDEs across the United States. A total of eight individuals responded back to the recruitment e-mail. Five of the respondents agreed to participate in the focus group, and of these, three attended the focus group session. Focus group session A lasted approximately 90 minutes. A list of focus group participants and their titles can be found in Table LXXXI.

Table LXXXI

Focus Group A: State Chronic Disease Epidemiologists

Participant	Name	Title
P1	Sarah Lyon-Callo, MA, MS	Lifecourse Epidemiology and Genomics Division Director at Michigan Department of Community Health
P2	Michael Friedrichs, MPH	Epidemiologist, Bureau of Health Promotion, Utah Department of Health
P3	Confidential	Chronic Disease Epidemiologist, State Health Department

Focus Group B: Subject Matter Experts Knowledgeable in APCDs

Focus group recruitment e-mails were sent to a total of 10 subject matter experts across the country. A total of four individuals responded back to the recruitment e-mail. All four respondents agreed to participate in the focus group and attended the focus group session. Focus group session B lasted approximately ninety minutes. A list of focus group participants and their titles can be found in Table LXXXII.

Table LXXXII

Focus Group B: Subject Matter Experts Knowledgeable In APCDs

Participant	Name	Title
P4	Denise Love, MBA	Executive Director, National Association of Health Data Organizations (NAHDO), and cochair of the APCD Council
P5	Patrick Miller, MPH	Research Associate Professor, University of New Hampshire founder, and cochair of the APCD Council
P6	Barry Nangle, PhD	Director of the Center for Health Data in the Utah Department of Health
P7	Sarah Jenson	Program Director at Wisconsin Health Information Organization (WHIO)

2. Analytic Framework and Framework Matrix Chart

Following the procedures outlined in the analysis plan, an analytic framework was created for the analysis and can be found in Appendix E. Subsequently, the analytic framework was used to develop the charting matrix used to interpret the interview data. The final charting matrix for the analysis can be found in Appendix F.

3. Focus Group Findings

a. Value of Claims Data

1.1 Public Health

The consensus across focus group participants was public health does recognize that administrative claims data have value. This finding is corroborated by the literature presented in chapter II regarding public health's use of health care administrative claims data for various epidemiological

purposes. Both health care administrative claims data and clinical data were both acknowledged as recognized gaps in current public health practice. However, there was an acknowledgment that although public health sees value in these data, there is likely a gap in public health practitioner's understanding of the exact value health care administrative claims data can provide. Public health has interest in working with claims especially in the context of outside forces pushing programs to look at all sources of data that are available. Some respondents suggested that claims data should be used to help understand how limited population health dollars are being spent.

In regard to the value of claims data in the context of APCDs, there was general agreement that public health has significant interest in data across multiple payers and APCDs are viewed with greater value than a single payer source alone. However, APCDs were not perceived as a game changer for public health but population-level clinical data would be. It was suggested that APCDs would be useful in serving as a foundation or building block for public health while waiting for HIE to arrive:

P1: "Health information exchange in terms of public health access to it for chronic disease purposes is a long way off I think. The claims data not only will it fill at least part of a need right now but it's also sort of a training ground for understanding some of the things that will be coming up with that information flow . . . the more that you can be working claims data the more that you can understand some of those challenges you'll face with HIE."

1.2 Chronic Disease Epidemiology

Within the area of chronic disease epidemiology, participants agreed that there is an interest and belief that administrative claims data can support an improved understanding of the chronic disease burden, variation in disease treatment costs and quality, and efficiency at the provider level. Respondents cited examples of analyses of the chronic disease burden and health care costs using claims data that were very well received. Epidemiologists in particular did feel that claims data can begin to help answer some important fundamental surveillance questions such as hypertension control and to identify chronic disease hotspots. However, they cautioned that claims data can only go so far and will need to be supplemented with clinical data from HIE to truly be transformative for public health.

1.3 Health Care System

Interest in using claims data to understand the health care system was not identified as a primary area of interest for public health among respondents. Provider efficiency, quality of care, and understanding Medicaid expenditures were some cited peripheral interests. One respondent in particular indicated that understanding the health care system is primarily focused on improving public health service integration and assessing the health care system is not currently a key or encouraged role for the public health department:

P1: “I have to speak about that carefully in this state because you can get pushed back from other folks who use these claims data in terms of like what’s public health’s role in understanding the functioning of the healthcare system. You have to talk about it as a very high level activity and you have to talk about it in terms of integration with public health services. You have to be very careful not to make it sound like I’m assessing the quality of the healthcare system.”

1.4 Case Studies and Demonstration Projects

There was a universal agreement that case studies and demonstration projects showcasing the value of claims and APCDs would be useful for public health. Two themes emerged in regard to how case studies and demonstration projects could provide the most value. The first theme was the value in supporting the argument for gaining access to the claims data. It was suggested that although public health recognizes the value of claims data, they do not really understand exactly what is in it. Examples that showcase what can be done with the data and what other states and individuals have done with the data would provide concrete examples to support the argument for access. The second theme was the value of case studies and demonstration projects in providing trust and reassurance that public health knows how to work with and manipulate claims data to define opportunities with the data.

b. Experience with Claims Data

2.1 Access

Public health has varying degrees of access to specific claims data sets or APCD data. In general, most state epidemiologists have or have had access to Medicaid claims data. Access is typically

provided through the state's Medicaid data warehouse. However, one state received access through a partnering university who already cleaned and organized the claims data. Unfortunately, Medicaid data are no longer available to this health department via the university pathway. The inconsistency of access to Medicaid across states is consistent with previous research (Council of State and Territorial Epidemiologists, 2010; Lichter, 2004; Optum, 2012).

Beyond Medicaid data, public health's access to claims data from other payers has been limited. No relationships and meaningful access to commercial payer's claims data or Medicare were cited. With respect to APCDs, most states today do not currently have a state based or voluntary APCD. Among the states with APCDs, public health lacks momentum to leverage APCDs, has competing interests, or has temporarily lost interest in the data due to disastrous early attempts to access the data from the state or APCD vendors.

P2: "I'll just tell you straight away the APCD here, for me, has been a huge disappointment. More disappointing than I could've even possibly imagined ahead of time. We can talk about it being in its infancy but we've had it for four years now and we still can't get meaningful data and answer simple questions."

2.1 Use

Several examples of how public health are using health care administrative claims data include measuring the burden of asthma in the Medicaid population; understanding services provided to the aged, blind, and disabled population; supporting maternal child health services; linking to public health registries; public health planning; identifying the incidence and prevalence of specific chronic diseases; investigating health care costs among those with chronic disease; examining quality of care; exploring health care costs by geography for improving deployment of limited public health funds; and measuring the effect of diabetes disease management in public health clinics. Many of the cited examples by focus group participants are consistent with examples previously identified in the literature review section.

c. Challenges to Using Claims Data

3.1 Access

The lack of access to claims and APCD data was identified as a major barrier across respondents, and there was not much optimism that this would be solved soon. Among the claims that are more likely to be available to public health (Medicaid), there was an acknowledgment that the data available are typically several years old and not updated frequently. This was seen as a barrier to doing timely analysis reflective of the current state of the population.

P2: “To me the biggest barrier still is not having access to the data . . . if we have the data we would learn and we would be able to use it.”

In general, health plans were indicted as a major obstacle for public health receiving access to claims data across payers. The misalignment of missions among health plans and public health was seen as a challenge for gaining access to claims data and working collaboratively on population health goals. The risk of sharing data from a business and regulatory perspective (e.g., HIPAA) was also cited as a barrier to insurers exchanging data with public health. The lack of understanding by health plans on what public health would do with the data has also led to resistance among insurers. Public health’s inexperience in understanding claims data was seen as limiting public health effectiveness to dialog with health plans regarding access.

Recent APCD initiatives have changed the game some for health plans. Legislation in many states has forced payers to share their data. Among voluntary APCD efforts, agreements that do not publicly report the source of the data and do not require claims allowed and paid amounts have been successful in convincing health plans to share their data.

3.2 Resources

The lack of resources was identified as one of the biggest barriers for public health in being able to leverage claims data. Although capacity is being built up within health departments in the area of chronic disease, an emerging area of focus and capacity to analyze claims data is still limited. In

relation to other priorities, an analysis of claims data was considered lower priority. A certain level of infrastructure is needed to effectively analyze secondary data sources such as claims data. It was suggested that public health could increase their capacity by working across agencies and partnering with academia.

In the context of APCDs, similar themes emerged in regard to resources being a significant barrier to the development, sustainment, and use of APCDs. It was suggested that a paradox has emerged in regard to the influence of funding on APCD development:

P4: “On one hand, yes, it is an inhibitor because there is just no money or perception of money. On the other hand it has also stimulated states to do something. They can’t do anything else, so they really need the data more than ever. So they sense more acutely the need because it’s their interventions and cuts . . . states that [have] had that discussion [say] now’s the time to build the big system so we know where to cut and how to cut more strategically. I think it has been a double-edged sword. It has stopped some states but it has motivated others.”

3.3 Experience and Expertise

Inexperience working with claims and APCD data was cited as an issue for public health. Specifically, inexperience with understanding the idiosyncrasy of claims data and how to properly manipulate the data were mentioned as barriers. In addition, public health’s inexperience with understanding the policy and programmatic influences on the data across payers was also seen as a limitation:

P1: “There are things about your particular data set or particular policies and how they impact the data set that may only be knowable because you have relationships with the Medicaid program . . . I would imagine those kinds of issues would be on steroids when you get to things like looking at Blue Cross, Blue Shield data or other payers.”

There was however a differing viewpoint to whether or not public health has the requisite expertise to use claims data. The general opinion was that public health does have the expertise to analyze the data. However, access and time would be needed to learn and become proficient at it. Some respondents cited examples where public health was analyzing the data today as support of this position.

In regard to what level of public health departments have on the skills and capacity to use administrative claims data, consensus was that the state and only the largest city and county health departments had the capacity to do it. The likelihood of a local, county, or city health department to access and analyze claims data on their own is primarily a function of how these health departments would be resourced and supported by the state health department. Respondents suggested that the local health departments might provide better insights and interpretation of the results from the data because of their local-level perspective and experience. In addition, they could provide a better idea of what they need to help describe the health of their populations.

3.4 Training of the Public Health Workforce

The training of the public health workforce in claims data was another recognized barrier. Efforts have been made to hire epidemiologists with strong analytic skills to support the increasingly data-centric demands on the health departments. However, this strategy has been inadequate on several different levels. First, there is insufficient technical training of students within the schools of public health on big data analytics. Second, the turnover of trained individuals in these skilled positions is a challenge. Third, there is limited training available on the software that APCD vendors use to analyze APCD data. Fourth, public health is not doing a good job of defining the use case for claims data. This is critical for helping to determine what training and what type of staff are needed to leverage the claims data.

3.5 Vendors

Among states with an APCD, several are using a third-party vendor to develop, maintain, and analyze APCD data within the state. Overall, vendors and more specifically their software were perceived as a barrier. Vendor's software was seen as a black box, too fixed, inflexible, and not aligned with the needs of epidemiologists:

P2: "The vendors come in like hawks and say, "okay we're going to do this stuff, and you have to build this platform with our software, and you have to analyze the data with our

software.” What their software does isn’t necessarily meaningful for us. There’s all this stuff about episodes of care. I can’t answer a basic question like how many claims did you have last year that involved asthma from ICD-9 codes or from reimbursement codes because they say, the algorithms in the software are proprietary and we can’t tell you what their algorithm for identifying someone with asthma is because it’s copyrighted, blah, blah, blah. We can tell you there may be this many episodes of care related to asthma but we don’t really know what that means.”

There was however one state that cited the relationship with the vendor was good and the vendor was providing valuable analytic support.

3.6 Data Quality and Completeness

There was recognition that claims data can be messy and imperfect, and this was the identified barrier for some epidemiologists and academics. The common criticism is that claims data are not perfect and missing pockets of the population. It is therefore not adequate. This limitation is consistent with what was identified in the literature review as a barrier. Respondents reacted strongly to this point, indicating that although the data are not perfect, it has its strengths, and even with its imperfections, it is a powerful data source:

P4: “Don’t let the perfect be the enemy of the good, move forward and get these systems evoked . . . When I hear an epidemiologist say it’s got gaps, it’s this or that; show me a perfect data system and why are you not part of the solution? Why are you just taking pot shots at it? And this is where public health and public health authorities should be stepping up to the plate, because they have the authority to link these databases and fill those gaps. We need public health and epidemiology to step up and not just sit back and take pot shots and say they are going to build their own surveillance system or they are going to have Biosense or whatever they come up with tomorrow. They are going to come up with another one to spend a billion dollars . . .”

One respondent indicated that this criticism is the same criticism public health had of the hospital discharge systems 25 years ago. However, once public health started using these systems, many of the concerns and issues were resolved.

Another data quality challenge is several states have been mired in the production and infrastructure supporting APCDs. This is really slowing down the ability of states to leverage the data and get value out of it.

3.7 Standard Methods

Respondents agreed that guidance on standard analytic methods and measures for analyzing administrative claims data is a gap. The group declared that no champion has emerged at the federal level to help fill this gap. Specifically, CDC has not shown interest in helping states develop these data from a surveillance perspective. One respondent thought that CMS could provide a little leadership in this area in terms of using public health resources or using epidemiology within public health. The group mentioned the Agency for Healthcare Research and Quality (AHRQ) as a possible leader and partner to develop standards methods and measures. In terms of current guidance, the respondents did indicate that they looked to common metrics in use by various health plans as a starting point for a standard and to help explain what analysis they have done. Some respondents felt that in time, more open source tools and measures will become available, making internal analytics more cost-effective for states.

3.8 Limits of Claims Data

One of the prevailing opinions regarding claims data is that it is necessary but not sufficient to be transformative for epidemiology and public health. Claims data are seen as a valuable piece of data for understanding the chronic disease burden but are insufficient because it lacks the laboratory and clinical data. Also, aggregate claims data (such as what is found in APCDs) are geographically too broad to really identify chronic care hotspots to make real public health use of the data.

d. APCD Data

Advocacy and Public Health Leadership

A vast majority of states do not have a state based or voluntary APCD. The consensus among respondents was that public health is advocating for APCDs to be developed but has not been a visible lead pushing to get it done. It was suggested that some of this is a function of who within the state is interested in moving an APCD forward and the model of oversight being recommended or selected.

APCDs have been advocated for and/or managed by the state insurance department, the governor's office, the state Medicaid office, the health department, or some type of hybrid or delegated model.

Public health's advocacy for APCD may be tempered by the interest and anticipation for HIE due to the promise of providing very impactful data for public health practice. This may be contributing to lack of urgency to pursue claims and APCD data because claims do not offer the clinical information HIE will. The group was quick to caution that public health should temper its optimism on how quickly HIE will be available.

Respondents provided recommendations on approaches public health could take to support the development of APCDs in their state. It was suggested that public health should contact payers directly to get data and to perform analysis that demonstrates the value. Others suggested to focus on Medicaid data to build the support for getting commercial data. Medicaid is considered a good starting point because public health typically already has access to Medicaid claims and through their relationships with Medicaid could potential leverage Medicaid funding for the efforts.

Politics and Legislation

Because of public health typically having limited political clout, public health is rarely seen as leading APCD development efforts. Consequently, it was suggested that public health should be focused on finding the right political champion or consider a multistakeholder approach to get the APCD discussion prioritized. Another approach mentioned was the use of "public health authority" to mandate these data to be collected for public health purposes. Respondents did however recognize that this approach comes with its own challenges. However, in general, legislation has been an effective tool for getting payers to share claims data for APCDs.

Federal Leadership

There is very limited federal support and leadership for APCD initiatives. It is not that federal agencies do not see the value in APCDs, they are siloed and focused on their own priorities. They are

opting for states to figure APCDs on their own. It was suggested that federal support for APCDs is a kin to the federal support historically for hospital discharge data systems:

P4: “To be honest it is consistent with hospital data systems that received no federal support of any kind and still continue not to, but yet once a critical mass of states had comparable data were eager to take advantage of that data and use it and rightfully so. But it is I think the same trajectory where states are figuring this out, on their own, then getting criticism from federal CDC and others. Well its claims data and it varies across states and it’s hard to get. Not realizing that that is because the states are funding it in different ways and governing it in different ways, and that is just the way it is and so it’s this circular argument.”

Although federal agencies have encouraged states to take advantage of Medicaid funding for APCD development, no direct funding has been provided to states. CMS has recently helped to remove some of the barriers for gaining access to Medicare data. Although an important step forward, respondents felt much more could be done to promote the adoption and support APCDs in states. For example, agencies such as the CDC could help provide guidance on analyzing claims data and really developing it from a surveillance perspective.

V. DISCUSSION

A. Study Overview

Chronic disease has emerged as a major problem for both the public health and the health care system. The primary focus of the health care system has been on treatment of chronic disease. With increased rates of obesity and chronic disease, it has been suggested that the health care system needs to become more prevention oriented. This presents an opportunity for public health to play a meaningful role in helping to shape the health care system toward a prevention focus. With a mutual goal of reducing the effect of chronic disease, the sharing and collaborative use of data could help public health and medicine make meaningful progress toward this goal.

Public health does not have robust data on the burden of chronic disease in the population. Therefore, it has been suggested that public health should increase its efforts to access and use both emerging and existing data sources to help form a more integrative relationship with medicine and to support chronic disease epidemiology. One such existing data source is health care administrative claims data. Evidence suggests that health care administrative claims data can be valuable for population-level chronic disease research, surveillance, and epidemiology.

Although there is important value contained within health care administrative claims data, public health has not widely adopted this data source for supporting chronic disease epidemiology. Some potential barriers to the adoption of health care administrative claims data have been identified in the literature; however, there is a paucity of research exploring the barriers and enabling factors influencing public health's adoption of this data source for chronic disease epidemiology. The aim of this study was to demonstrate the analytic utility of health care administrative claims data to support chronic disease epidemiology, to explore public health's attitudes regarding the value of health care administrative claims data, to understand public health's experience accessing and using claims data, and to understand the factors influencing access and use of claims data.

B. Overview of Study Findings

1. Phase 1

Overall, the findings from the first phase of the study suggest that meaningful information about chronic disease morbidity and its effect (utilization and costs) on the health care system can be gleaned from health care administrative claims data when appropriate analytic techniques are applied to the data. A large sample of health care administrative claims data from a commercially insured population were shown to have sufficient demographic detail, and overall health care utilization and health care costs seem to be reasonably representative of the overall profile of the commercially insured population in the United States. Taking advantage of the diagnostic coding within the claims data, reasonable estimates of diabetes, hypertension, and CAD prevalence were produced when compared with national benchmarks.

In general, the health care utilization rate among the cohort of individuals with a chronic disease or multiple chronic diseases was significantly higher than the rate for the overall sample. For example, the rate of hospital inpatient admissions was approximately two to six times higher among those with a chronic disease as compared with the overall sample. A similar pattern emerged for health care costs among individuals with at least one chronic disease. Individuals with a chronic disease had total health care costs approximately two to six times higher (those with diabetes and CAD were fifteen times higher) as compared with the overall sample. These findings are consistent with others' analyses of the relationship between chronic disease and health care utilization and health care costs (Steiner & Friedman, 2013).

2. Phase 2

In general, public health does recognize the value of health care administrative claims data for supporting overall public health activities and chronic disease epidemiology. However, there was an acknowledgment that a gap likely exists in public health practitioners' understanding of the value in

detail, and a limit exists in how much value can be gleaned from this data source. There was overwhelming agreement that case studies and demonstration projects that showcase the value of claims and APCDs would be useful in justifying access to the data and for providing reassurance that public health knows how to work and define opportunities with the data.

Access to claims data and APCDs emerged as a major challenge for public health. Resources, capacity, experience, and training were all cited as major limitations to public health using claims data. Specifically, when discussing APCDs, third-party vendors and their software, were identified as a barrier to epidemiologists being able to get the needed information out of the data. Data quality, data completeness, and lack of standard methods to analyze claims data were also identified as limitations.

In regard to APCDs, public health has been an advocate for their development but has not been a visible lead in pushing to get them implemented. This has been a function of who within states are interested in moving an APCD forward and the model of oversight being recommended or selected. It was suggested that advocacy for APCD may be tempered by the interest and anticipation for HIE due to the promise of providing very impactful data for public health practice. Public health's limited political clout was also identified as a reason why public health has not really been seen as leading APCD development efforts.

Lastly, there has been limited federal support for APCD initiatives. It was suggested that the lack of federal support is a barrier and the government could do more from a leadership, funding, and methodological perspective to support the use of claims data and development of APCDs.

C. Study Limitations

The intention of this study was not to conduct a true epidemiological analysis but rather to demonstrate what public health can leverage from health care administrative claims data to support chronic disease epidemiology. The claims data used in this study are a convenience sample of commercially insured individuals who were eligible for various health management services. This

sample was not intended to be a representative cross section of the entire U.S. population. However, the various epidemiological techniques performed in this study can be applied to administrative claims databases that contain health care interactions across all health care settings, payers, and populations.

This analysis was also sensitive to the overall validity of administrative claims data. Major gaps in the data would have a large effect on the accuracy of the study findings. For example, missing claims data would potentially lead to the underreporting of condition prevalence rates. A data completeness and quality check was performed to assess any potential effect on the study findings. No major data issues were identified.

Another validity consideration for this study was the diagnostic accuracy of the algorithms based on administrative claims to identify individuals with chronic disease. Because the purpose of administrative data is to facilitate financial reimbursement and not public health surveillance, particular attention needs to be paid to the sensitivity, specificity, and predictive value of administrative claims-based identification algorithms. However, without an ability to perform a concurrent validation study of the identification algorithms based on claims, an extensive literature review of claims-based identification validation studies was completed instead. The claims-based algorithms selected for this study were based on a combination of recommended best practices and findings from a literature review of validation studies for diabetes based on claims (Blanchard et al., 1996; Keating et al., 2003; Lix et al., 2006; Maskarinec, 1997; O'Connor, Rush, Pronk, & Cherney, 1998; Rector et al., 2004; Southern et al., 2010; Wilchesky, Tamblyn, & Huang, 2004; Young, Roos, & Hammerstrand, 1991), CAD (Lix et al., 2006; Mahonen et al., 1997; O'Connor et al., 1998; Rawson & Malcolm, 1995; Shah, Hux, & Zinman, 2000), and hypertension (Borzecki, Wong, Hickey, Ash, & Berlowitz, 2004; Lix et al. 2006; Muhajarine, Mustard, Roos, Young, & Gelskey, 1997; Quam et al., 1993; Quan et al., 2009; Tu et al., 2007; Wilchesky et al., 2004). Pharmacy data were also included as a data source to improve the breadth of condition identification.

When conducting focus group interviews, it is possible that interviewees could intentionally or unintentionally provide misleading responses to questions. This risk is minimized in a focus group setting due to participants' ability to question, contest, or validate one another's comments (Jamieson & Williams, 2003). Focus group interviews are susceptible to facilitator bias and can potentially be dominated by select individuals. Facilitator bias is minimized by staying as objective as possible and by allowing the participants to drive the dialogue. The moderator also asks specific individuals their opinion in situations when the conversation is being dominated.

Additional focus group studies of epidemiologists, state health department officials, and information technology/informatics directors may be warranted to provide an even richer context of the barriers and enabling factors and to help corroborate the study findings.

Telephonic focus groups specifically have been criticized for the lack of nonverbal communication. However, a recent study by Frazier et al. (2010) compared the findings from face-to-face and telephonic focus groups and found that the content analysis results from telephonic focus groups were similar to those generated in face-to-face focus groups.

Another potential limitation of the study is both the unitizing and the interpretative reliability of the content analysis and coding categories. Only the PI completed the framework analysis. Intercoder reliability was not assessed in this study.

D. Conclusions and Leadership Implications

The findings from this study suggest that if public health has the appropriate access, capacity, and experience to analyze health care administrative claims data, this data source can be a valuable tool for supporting chronic disease epidemiology. However, in order for public health to fully adopt health care administrative claims data as a standard and commonly used data set for chronic disease epidemiology, progress needs to be made in removing some key barriers that are preventing this data source from diffusing into public health practice.

Access to health care administrative claims data is clearly a major barrier for public health. For example, access to Medicaid claims data, which should be easily accessible to the public health authority, was confirmed to be a challenge for some epidemiologists. This finding is consistent with a survey of chronic disease epidemiologists (CDEs), which indicated that only 35.3 percent of epidemiologists surveyed had unfettered access to state Medicaid data (Council of State and Territorial Epidemiologists, 2010). Furthermore, in regard to APCDs that are intended to provide an unprecedented view of health care and health care costs across all settings, it is clear that epidemiologists in states with APCDs are having trouble accessing the data. With similar challenges of access to claims data from individual payers, public health will need to make significant inroads in improving access to health care administrative claims data or the likelihood of adoption will remain low. From the perspective of Rogers' attributes of innovations that determine the rate of innovation adoption, a lack of access to health care administrative claims data decreases the opportunity of trialability and less opportunity to assess the relative advantage of the innovation. If there are fewer opportunities to try out and experiment with health care administrative claims data, it is less likely the innovation will diffuse into practice.

Capacity was also cited as a major barrier to health care administrative claims data diffusion for supporting chronic disease epidemiology. Capacity limitations could be overcome by making the use of health care administrative claims data a priority. Public health has a history of being creative in maximizing its effectiveness with limited resources. It should be no different here. For example, focus group participants identified creative ways chronic disease grant funds could be used to focus resources on the analysis of health care administrative claims data.

The prioritization of the use of health care administrative claims data is likely impeded by the lack of knowledge and understanding of the value of these data to support chronic disease epidemiology. Consequently, case studies and demonstration projects that showcase the value that can be extracted

from health care administrative claims data are vitally important to creating the awareness and interest in the data. From the perspective of Rogers' attributes of innovations, case studies and demonstration projects provide evidence of the relative advantage and compatibility of the data source and increase the observability of the innovation, which would all help increase the likelihood of innovation diffusion.

The validity and the accuracy of health care administrative claims data were also identified in both the literature and among focus group members as a major limitation. Although all data systems have strengths and weaknesses, it is surprising that health care administrative claims data receive so much criticism for the potential lack of validity and accuracy by epidemiologists. Interestingly, epidemiologists do not need to stray far to find an example of a commonly used and accepted administrative data source for epidemiology with a similar limitation as health care administrative claims data. As discussed in Chapter II, hospital discharge data are a valuable and pervasive administrative data source used by public health with similar strengths and weaknesses to health care administrative claims data (Love et al., 2008). Therefore, if hospital discharge data have become an accepted and commonly used data source for public health despite its recognized limitations, there is no reason to believe that health care administrative claims data, which are a similar type of data source and include information on health care interactions beyond the inpatient and ER settings, could not gain a similar level of acceptance and use.

Experience, expertise, and lack of training were all identified as barriers to the use of health care administrative claims data for supporting chronic disease epidemiology. Unfortunately, using Rogers' attributes of innovations framework as a guide, this is likely having a negative influence on the adoption of health care administrative claims data from a complexity perspective. Excessive complexity in using health care administrative claims data will decrease the likelihood this innovation will diffuse.

Gaps in experience and expertise can be overcome over time with a real commitment to accessing, using and learning the data source. In addition, commitments need to be made in training

staff and attracting individuals with the requisite skills to work with and analyze health care administrative claims data. On the basis of comments from focus group participants, there is likely a gap in the training and analytic skills of public health students using large databases and other “big data” sources. This suggests that the curriculum and training within the schools of public health should be examined to insure it is meeting the future needs of public health practice. Also, public health needs to make a focused effort to attract individuals with specialized talent and skills to support these analytic needs now and in the future.

Leadership support was also identified as a barrier inhibiting the diffusion of health care administrative claims data for supporting chronic disease epidemiology. In particular, the lack of leadership support from the federal government was specifically emphasized by focus group participants. Drawing upon the history of GIS diffusion within public health, federal support from an advocacy, training, and resource perspective were identified as key factors in driving successful adoption of GIS in public health practice. The federal government has a tremendous opportunity to help support the diffusion of health care administrative claims data for supporting chronic disease epidemiology. One area in particular where federal agencies such as CDC and AHRQ have been lacking is guidance on standard methods to analyze health care administrative claims data. This is an area where the federal government can make a real difference. For example, AHRQ’s Healthcare Cost and Utilization Project (HCUP) is a federal, state, and industry partnership that provides access to state health care databases and related software tools. AHRQ provides tremendous technical leadership through this project, and it only makes sense that HCUP’s focus could expand into health care administrative claims data and APCDs providing needed support.

Lastly, another reason health care administrative claims data may not be diffusing into public health practice is it does not offer the clinical detail needed to be transformative for public health. Public health may rather wait on the sidelines for HIE to arrive. Although there is little doubt that HIE

has the potential to provide tremendous value for public health, it is possible that public health will have many challenges when it does arrive. It is likely that many of the same issues identified in regard to access and use of health care administrative claims data will also apply to HIE. Therefore, this study should serve as an early warning sign of the potential challenges to come. It suggests that committing to the successful adoption of health care administrative claims data for supporting chronic disease may help public health be more prepared when HIE arrives. Even if public health does not choose to adopt health care administrative claims data, it will need to be prepared to overcome the identified barriers in this study to maximize the value that can be obtained from HIE.

APPENDICES

APPENDIX A

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Exemption Granted

November 28, 2012

Vincent Haufle, MPH
Public Health
395 Graceland Avenue, Unit 401
Des Plaines, IL 60016
Phone: (847) 529-7818

RE: Research Protocol # 2012-0817

“The Public Health Value of Healthcare Administrative Claims Data for Chronic Disease Prevention”

Sponsors: None

Dear Mr. Haufle:

Your Claim of Exemption was reviewed on November 21, 2012 and it was determined that your research meets the criteria for exemption. You may now begin your research.

<u>Exemption Period:</u>	November 21, 2012 – November 21, 2015
Performance Site(s):	UIC
Subject Population:	Adult (18+ years) subjects only
Number of Subjects:	52,898 (Study A = 52,878, Study B = 20)

The specific exemption categories under 45 CFR 46.101(b) are:

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation; and

(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities

Phone: 312-996-1711

<http://www.uic.edu/depts/ovcr/oprs/>

Fax: 312-413-2929

APPENDIX A (continued)

2012-0817

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November 28, 2012

for the ethical conduct of the research under state law and UIC policy. Please be aware of the following UIC policies and responsibilities for investigators:

1. Amendments You are responsible for reporting any amendments to your research protocol that may affect the determination of the exemption and may result in your research no longer being eligible for the exemption that has been granted.
2. Record Keeping You are responsible for maintaining a copy all research related records in a secure location in the event future verification is necessary, at a minimum these documents include: the research protocol, the claim of exemption application, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to subjects, or any other pertinent documents.
3. Final Report When you have completed work on your research protocol, you should submit a final report to the Office for Protection of Research Subjects (OPRS).
4. Information for Human Subjects UIC Policy requires investigators to provide information about the research protocol to subjects and to obtain their permission prior to their participating in the research. The information about the research protocol should be presented to subjects in writing or orally from a written script. When appropriate, the following information must be provided to all research subjects participating in exempt studies:
 - a. The researchers affiliation; UIC, JBVMAC or other institutions,
 - b. The purpose of the research,
 - c. The extent of the subject's involvement and an explanation of the procedures to be followed,
 - d. Whether the information being collected will be used for any purposes other than the proposed research,
 - e. A description of the procedures to protect the privacy of subjects and the confidentiality of the research information and data,
 - f. Description of any reasonable foreseeable risks,
 - g. Description of anticipated benefit,
 - h. A statement that participation is voluntary and subjects can refuse to participate or can stop at any time,
 - i. A statement that the researcher is available to answer any questions that the subject may have and which includes the name and phone number of the investigator(s).
 - j. A statement that the UIC IRB/OPRS or JBVMAC Patient Advocate Office is available if there are questions about subject's rights, which includes the appropriate phone numbers.

Please be sure to:

→ Use your research protocol number (2012-0817) on any documents or correspondence with the IRB concerning your research protocol.

APPENDIX A (continued)

2012-0817

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November 28, 2012

We wish you the best as you conduct your research. If you have any questions or need further help, please contact the OPRS office at (312) 996-1711 or me at (312) 355-2908. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Charles W. Hoehne, CIP
Assistant Director, IRB # 2
Office for the Protection of Research Subjects

cc: Paul Brandt-Rauf, Public Health, M/C 923
Michael Cailas, Public Health, M/C 922

APPENDIX B

Focus Group A: State Chronic Disease Epidemiologists

- 1) In your opinion, what is public health's current view regarding the overall value of healthcare administrative claims data as a data source to support public health activities?
- 2) Then specifically, what is public health's view regarding its value as a source of information to better understand: (1) the burden of chronic disease in the population (2) the functioning (e.g. costs and utilization) of the healthcare system?
- 3) Is there broad consensus regarding the value or is there a need for more case studies and demonstration projects which showcase the value?
- 4) Is aggregate population-level healthcare administrative claims data a potential “game changer” for public health or is public health waiting for other data sources such as HIE where the value is perceived to be high?
- 5) Describe your experiences in accessing and using administrative claims data? States with APCDs – What has been your experience?
- 6) Why do you believe public health has not been more aggressive in requesting and more successful in gaining access to healthcare administrative claims data (beyond hospital discharge/ER data) across payers (e.g. Commercial, Medicare, Medicaid)?
 - a) What do you believe are the major barriers?
 - b) Are there any relevant enabling factors which increase the likelihood public health is successful in gaining broader access to healthcare administrative claims data?
- 7) In your opinion, do state public health agencies have the technical skills and resources to use, analyze, report on and disseminate this data if available?
- 8) If not, what technical skills/training or resources would be needed?
 - a) Are third party analytic organizations needed?
- 9) What about county/city/local health department's technical ability and capacity to use this data?

Focus Group B - All Payer Claims Database Subject Matter Experts

- 1) Based on your experience, what has been public health's engagement (level and type) in supporting and advocating for All Payer Claims Database (APCD) initiatives within states and nationally?
- 2) In your opinion, do you believe there is broad consensus across the public health community regarding the value of APCDs or is there a need for more case studies and demonstration projects which showcase the value of APCDs?
- 3) Based on your knowledge, can you provide examples of how public health is currently using APCDs across the country? Also, any specific examples in the area of chronic disease?

APPENDIX B (continued)

- 4) In states without an existing APCD model and where public health has a strong interest in accessing population-level administrative claims data across payers...
 - a) Based on your experience/opinion, where and how best should public health focus its efforts to gain access to this data?
 - b) Is advocating and supporting state-based or voluntary APCD models the only viable option available or is it both feasible and realistic to believe that public health could pursue and aggregate this data on their own?
 - c) Based on other states experience, what are the major barriers public health and other stakeholders can anticipate in trying to get an APCD off the ground or in pursuing this data themselves?
- 5) In states with an existing an APCD model and data is available...
 - a) Has public health had a lot of success gaining access to the data (I know in some states the public health department is the authority over the APCD per legislative authority)?
 - b) What has been the experience in states with voluntary efforts?
 - c) Are there any relevant barriers for public health, other agencies or organizations in gaining access?
- 6) In regards to the data itself, are the any major issues or limitations that decrease the usefulness and value of the data?
- 7) In your opinion, do state public health agencies have the technical skills and resources to use, analyze, report on and disseminate this data or are third party analytic organizations needed

APPENDIX C

TABLE IX

SUMMARY OF MEMBERSHIP FILE

Variable	N	Mean	Median	SD	Min	Max
Elig_Age_Yr1	42,440	42.7	45.0	13.2	18	64
Elig_Age_Yr2	43,292	42.7	45.0	13.5	18	64
Elig_Age_Yr3	44,751	42.3	45.0	13.8	18	64
MM_Yr1	52,834	8.6	12.0	5.0	0	12
MM_Yr2	52,834	8.8	12.0	4.9	0	12
MM_Yr3	52,834	9.3	12.0	4.6	0	12
MM_Total	52,834	26.7	36.0	11.9	1	36
	N	%				
Elig_Relationship_Code						
Dependent	26,171	49.5				
Qualifier	26,663	50.5				
Elig_RecordType_Code						
Child	8,253	15.6				
Domestic Partner	13	0.0				
Disabled Dependent	25	0.1				
Other	19	0.0				
Qualifier	26,663	50.5				
Spouse	16,541	31.3				
Student	1,320	2.5				
Elig_Gender_Code						
Female	25,517	48.3				
Male	27,317	51.7				

APPENDIX C (continued)

TABLE X

SUMMARY OF MEDICAL CLAIM FILE

Variable	N	Mean	Median	SD	Min	Max
Length of Stay (LOS)	163,403	6.5	3.0	15.4	0	226
Claim_Charged_Amt	2,494,714	263.4	50.0	2494.0	-607,796	909,830
Claim_Excluded_Amt	2,494,714	1.4	0.0	176.0	101,240	100,900
Claim_Discount_Amt	2,867,717	10.9	0.0	716.1	-380,758	380,245
Claim_Allowed_Amt	2,494,714	191.9	39.2	1509.0	-380,245	380,758
Claim_Deductible_Amt	2,867,717	3.8	0.0	22.0	-500	2,274
Claim_Copay_Amt	2,867,717	1.5	0.0	8.6	-1,090	350
Claim_Coinsur_Amt	2,867,717	1.6	0.0	15.9	-1,246	2,500
Claim_COB_Amt	2,494,714	3.3	0.0	212.8	-30,934	100,000
Claim_Withheld_Amt	2,494,714	0.0	0.0	0.0	0	4
Claim_FFSEquivalent_Amt	2,494,714	9.1	0.0	587.2	-379,995	380,508
Claim_Paid_Amt	2,867,717	123.1	24.6	1308.4	-394,246	396,226
	N	%				
Claim_Type						
ER	48,433	1.7				
Hospital	163,403	5.7				
Outpatient	673,620	23.5				
Professional	1,420,842	49.6				
Remainder	561,419	19.6				
Service_Year						
2009	921,714	32.1				
2010	960,415	33.5				
2011	985,588	34.4				
Admit_Year						
2008	3	0.0				
2009	39,761	24.3				
2010	48,993	30.0				
2011	74,646	45.7				
Discharge_Year						
2009	38,758	23.7				
2010	48,727	29.8				
2011	75,918	46.5				
Claim_PlaceOfSvc_Code						
Unknown	103	0.0				
School	1	0.0				
Office	1,423,004	49.6				

APPENDIX C (continued)

Home	20,768	0.7				
Mobile Unit	2	0.0				
Urgent Care Facility	5,947	0.2				
Inpatient Hospital	169,866	5.9				
Outpatient Hospital	692,714	24.2				
Emergency	51,418	1.8				
Ambulatory	12,671	0.4				
Skilled Nursing Facility	162	0.0				
Nursing Facility	492	0.0				
Custodial Care Facility	3	0.0				
Hospice	1,581	0.1				
Ambulance-land	5,758	0.2				
Independent Clinic	51	0.0				
Inpatient Psychiatric Facility	12	0.0				
Psychiatric Facility-Partial	2	0.0				
Intermediate Care Facility/Mentally Retarded	7	0.0				
Residential Substance Abuse Treatment Facility	1	0.0				
Comprehensive Inpatient Rehabilitation Facility	69	0.0				
Comprehensive Outpatient Rehabilitation Facility	3,641	0.1				
End-Stage Renal Disease	3,270	0.1				
State or Local Public Health Clinic	38	0.0				
Rural Health Clinic	210	0.0				
Independent Laboratory	301,747	10.5				
Other Place of Service	173,287	6.0				
Claim_SvcTypeLoc_Code						
Facility Utilization - Hospital	875,251	30.5				
ER Utilization	57,365	2.0				
Physician/Provider Visits	1,423,303	49.6				
Facility Utilization - Hospice	1,581	0.1				
Facility Utilization - Other	335,934	11.7				
Other	173,288	6.0				
Unknown	995	0.0				
Claim_Svc_Code						
Other	1,656,532	57.8				
Inpatient	170,607	6.0				
Outpatient	1,040,578	36.3				

APPENDIX C (continued)

Claim_Adjustment_Code						
No	2,714,559	94.66				
Yes	153,158	5.34				
Claim_AdjustmentType_Code						
Negative	46,618	30.44				
Positive	106,540	69.56				
Claim_ProviderSpecialty_Code						
Adolescent Medicine-Internal Medicine	46	0.00				
Allergy	792	0.03				
Allergy And Immunology	15,830	0.55				
Anatomic And Clinical Pathology	1,243	0.04				
Anatomic Pathology	641	0.02				
Anesthesiology	21,689	0.76				
Cardiac Electrophysiology	129	0.00				
Cardiovascular Diseases	28,399	0.99				
Child Neurology	66	0.00				
Clinical & Lab Dermatological Immunology	4	0.00				
Clinical Molecular Genetics	14	0.00				
Clinical Neurophysiology	6	0.00				
Clinical Pathology	1,113	0.04				
Colon And Rectal Surgery	2,318	0.08				
Critical Care Medicine-Internal Medicine	270	0.01				
Cytopathology	26	0.00				
Dermatology	24,723	0.86				
Dermatopathology	535	0.02				
Emergency Medicine	19,910	0.69				
Endocrinology, Diabetes & Metabolism	9,977	0.35				
Family Practice	166,136	5.79				
Gastroenterology	13,266	0.46				
General Practice	2,653	0.09				
General Preventive Medicine	179	0.01				
General Surgery	10,115	0.35				
Geriatric Medicine-Internal Medicine	246	0.01				
Gynecological Oncology	809	0.03				
Gynecology	1,861	0.06				

APPENDIX C (continued)

Hand Surgery	850	0.03				
Hematology-Internal Medicine	9,920	0.35				
Hematology/Oncology	9,462	0.33				
Hospitalist	71	0.00				
Immunology	1	0.00				
Infectious Diseases	1,837	0.06				
Infectious Diseases	97,263	3.39				
Interventional Cardiology	33	0.00				
Maternal & Fetal Medicine	1,616	0.06				
Medical Genetics	52	0.00				
Medical Oncology	3,502	0.12				
Neonatal-Perinatal Medicine	153	0.01				
Nephrology	2,822	0.10				
Neurological Surgery	2,920	0.10				
Neurology	9,217	0.32				
Neuroradiology	7	0.00				
Nuclear Medicine	584	0.02				
Nuclear Radiology	5	0.00				
Nutrition	42	0.00				
Obstetrics	18	0.00				
Obstetrics And Gynecology	44,856	1.56				
Occupational Medicine	74	0.00				
Ophthalmology	16,191	0.56				
Orthopedic Surgery	38,755	1.35				
Orthopedic Surgery Of The Spine	20	0.00				
Osteopathic Manipulative Medicine	6	0.00				
Other Specialty	1,001,065	34.91				
Otolaryngology	17,078	0.60				
Otology	1,057	0.04				
Pain Management	5,304	0.18				
Pediatric Allergy	155	0.01				
Pediatric Cardiology	219	0.01				
Pediatric Critical Care Medicine	3	0.00				
Pediatric Emergency Medicine-Pediatrics	5	0.00				
Pediatric Endocrinology	17	0.00				
Pediatric Gastroenterology	25	0.00				
Pediatric Hematology-Oncology	48	0.00				

APPENDIX C (continued)

Pediatric Infectious Diseases	2	0.00				
Pediatric Nephrology	3	0.00				
Pediatric Ophthalmology	12	0.00				
Pediatric Otolaryngology	8	0.00				
Pediatric Pulmonology	27	0.00				
Pediatric Radiology	3	0.00				
Pediatric Surgery-Surgery	10	0.00				
Pediatric Urology	15	0.00				
Pediatrics	7,613	0.27				
Physical Medicine And Rehabilitation	8,508	0.30				
Plastic Surgery	2,762	0.10				
Proctology	249	0.01				
Psychiatry	6,081	0.21				
Public Health And General Preventive Medecine	70	0.00				
Pulmonary Diseases	6,882	0.24				
Radiation Oncology	2,152	0.08				
Radiology	78,593	2.74				
Reproductive Endocrinology	1,546	0.05				
Rheumatology	7,689	0.27				
Sleep Medicine	83	0.00				
Sports Medicine (Physical Medicine & Rehabilitati	44	0.00				
Sports Medicine-Family Practice	2	0.00				
Sports Medicine-Internal Medicine	474	0.02				
Sports Medicine-Pediatrics	2	0.00				
Surgery Critical Care-Surgery	20	0.00				
Thoracic Surgery	869	0.03				
Undersea Medicine & Hyperbaric Medicine	38	0.00				
Unspecified	845,854	29.50				
Urology	15,737	0.55				
Vascular & Interventional Radiology	8	0.00				
Vascular Surgery	1,197	0.04				
Ambulatory Surgery Center	2,084	0.07				
Chiropractic Medicine	223,570	7.80				
DME Medical Supply Co	24,652	0.86				
Nurse Practitioner	3,542	0.12				

APPENDIX C (continued)

Pathology	30,280	1.06				
Podiatrist	7,502	0.26				
Urgent Care Medicine	881	0.03				
Oral & Maxillofacial Surgery	358	0.01				
Claim_ProviderType_Code						
Alcohol & Drug	1	0.00				
Ambulance	3,233	0.11				
Ambulatory Surgical Facility (Facility Fee Only)	8,966	0.31				
Transportation, broker	2	0.00				
Clinic	8,407	0.29				
Chiropractor	219,596	7.66				
DME	4,322	0.15				
Dentist	186	0.01				
Podiatrist	6,402	0.22				
Hearing Aid Dealer	12	0.00				
Home Health	3,944	0.14				
Hospital Outpatient	27	0.00				
Hospital-Outpatient	318,759	11.12				
Hospice	411	0.01				
Independent Lab	240,173	8.38				
Physician	599,446	20.90				
Medical Equipment Vendor	21,690	0.76				
Medical Supply Provider	4	0.00				
Nurse Anesthetist, Anesthesiologist Assistants	2,943	0.10				
Naturopath	5	0.00				
Nursing Facility SNF/ICF	4,355	0.15				
Midwives, direct entry	178	0.01				
Nurse Practitioner	9,036	0.32				
Optometrist	2,555	0.09				
Other	491,540	17.14				
Optician, dispensing	4	0.00				
Osteopaths (DO)/ Osteopath Groups (Clinic)	164	0.01				
Occupational Therapist	1,442	0.05				
Physician Assistant	4,706	0.16				
Pharmacy	512	0.02				
Psychiatric Hospital	23	0.00				
Physical Therapist	28,632	1.00				
X-ray Service, Portable	2	0.00				

APPENDIX C (continued)

Psychologist	6	0.00				
Private Duty Nurse	271	0.01				
Audiologist	382	0.01				
Unknown	9	0.00				
Urgent Care Center	881	0.03				
Unknown	884,349	30.84				
Vision	2	0.00				
Paid_Year						
2009	836,212	29.16				
2010	948,840	33.09				
2011	994,740	34.69				
2012	87,925	3.07				
Claim_COB_Ind						
No	1,112,270	38.79				
Unknown	1,699,146	59.25				
Yes	56,301	1.96				
Claim_ICD1_Code	7,862					
Claim_ICD2_Code	6,825					
Claim_ICD3_Code	5,581					
Claim_ICD4_Code	3,083					
Claim_ICDProc1_Code	1,662					
Claim_ICDProc2_Code	749					
Claim_ICDProc3_Code	156					
Claim_CPT_Code	5,772					
Claim_HCPCS_Code	1,668					
Claim_DRG_Code	411					

APPENDIX C (continued)

TABLE XI

SUMMARY OF PHARMACY CLAIM FILE

Variable	N	Mean	Median	SD	Min	Max
Pharm_DaysSupply_Qty	1,329,198	34.87	30.00	28.68	-900	910
Pharm_Dispensed_Qty	1,329,198	55.73	30.00	219.70	-100,510	100,510
Pharm_Paid_Amt	1,329,198	66.68	16.86	366.61	-176,388	176,388
Pharm_Ingredient_Cost	1,329,198	48.79	5.27	343.58	-178,550	178,550
Pharm_Dispense_Fee	1,329,198	1.22	0.00	2.51	-9	9
	N	%				
Service_Year						
2009	412,818	31.06				
2010	440,946	33.17				
2011	475,434	35.77				
Paid_Year						
2009	404,709	30.45				
2010	439,999	33.10				
2011	475,392	35.77				
2012	9,098	0.68				
Pharm_Adjustment_Code						
No	1,250,807	94.10				
Yes	78,391	5.90				
Phaarm_AdjustmentType_Code						
Negative	78,349	99.95				
Positive	42	0.05				
Pharm_Refill_Code						
No	746,089	56.13				
Yes	583,109	43.87				
Pharm_Generic_Code						
No	278,934	20.99				
Unknown	429,151	32.29				
Yes	621,113	46.73				
Pharm_RefillSequence						
0	675,329	50.81				
1	259,948	19.56				
2	175,185	13.18				
3	83,848	6.31				
4	45,236	3.40				
5	36,157	2.72				
6	20,016	1.51				

APPENDIX C (continued)

7	9,863	0.74				
8	7,883	0.59				
9	6,104	0.46				
10	4,766	0.36				
11	3,153	0.24				
12	993	0.07				
13	264	0.02				
14	136	0.01				
15	76	0.01				
16	41	0.00				
17	28	0.00				
18	24	0.00				
19	29	0.00				
20	28	0.00				
21	13	0.00				
22	12	0.00				
23	14	0.00				
24	11	0.00				
25	8	0.00				
26	5	0.00				
27	2	0.00				
28	2	0.00				
29	1	0.00				
30	1	0.00				
33	1	0.00				
89	1	0.00				
90	2	0.00				
91	3	0.00				
92	3	0.00				
93	2	0.00				
94	2	0.00				
95	2	0.00				
96	2	0.00				
97	2	0.00				
98	2	0.00				
Pharm_NDC_Code	14,256					
Pharm_TherapeuticClass_Code	246					

APPENDIX D

TABLE XII

AGE AND GENDER DISTRIBUTION STUDY MEMBERSHIP

Year(s)	Age Group	Male (N)	Male (%)	Female (N)	Female (%)	Total (N)	Total (%)
2009	18-24	3,293	15.1%	3,167	15.3%	6,460	15.2%
2009	25-34	2,483	11.4%	2,535	12.3%	5,018	11.8%
2009	35-44	4,367	20.1%	4,653	22.5%	9,020	21.3%
2009	45-54	6,558	30.1%	6,358	30.8%	12,916	30.4%
2009	55-64	5,072	23.3%	3,954	19.1%	9,026	21.3%
Total		21,773		20,667		42,440	
2010	18-24	3,594	16.1%	3,455	16.5%	7,049	16.3%
2010	25-34	2,649	11.9%	2,567	12.2%	5,216	12.0%
2010	35-44	4,177	18.7%	4,401	21.0%	8,578	19.8%
2010	45-54	6,475	29.0%	6,347	30.2%	12,822	29.6%
2010	55-64	5,413	24.3%	4,214	20.1%	9,627	22.2%
Total		22,308		20,984		43,292	
2011	18-24	4,135	17.8%	3,892	18.1%	8,027	17.9%
2011	25-34	2,986	12.9%	2,713	12.6%	5,699	12.7%
2011	35-44	4,033	17.4%	4,183	19.4%	8,216	18.4%
2011	45-54	6,365	27.4%	6,332	29.4%	12,697	28.4%
2011	55-64	5,670	24.5%	4,442	20.6%	10,112	22.6%
Total		23,189		21,562		44,751	
2009-2011	18-24	5,172	18.9%	4,868	19.1%	10,040	19.0%
2009-2011	25-34	3,520	12.9%	3,294	12.9%	6,814	12.9%
2009-2011	35-44	4,724	17.3%	4,890	19.2%	9,614	18.2%
2009-2011	45-54	7,126	26.1%	7,110	27.9%	14,236	26.9%
2009-2011	55-64	6,775	24.8%	5,355	21.0%	12,130	23.0%
Total		27,317		25,517		52,834	
2009-2011 (Cohort)	18-24	1,847	10.4%	1,876	11.2%	3,723	10.8%
2009-2011 (Cohort)	25-34	1,893	10.6%	1,762	10.5%	3,655	10.6%
2009-2011 (Cohort)	35-44	3,253	18.3%	3,423	20.4%	6,676	19.3%
2009-2011 (Cohort)	45-54	5,577	31.3%	5,618	33.4%	11,195	32.4%
2009-2011 (Cohort)	55-64	5,220	29.3%	4,117	24.5%	9,337	27.0%
Total		17,790		16,796		34,586	

APPENDIX D (continued)

TABLE XIII

RELATIONSHIP TYPE DISTRIBUTION BY AGE AND GENDER

Year(s)	Age Group	Male Qualifier (N)	Male Qualifier (%)	Female Qualifier (N)	Female Qualifier (%)	Total Qualifier (N)	Total Qualifier (%)	Male Dependent (N)	Male Dependent (%)	Female Dependent (N)	Female Dependent (%)	Total Dependent (N)	Total Dependent (%)
2009	18-24	549	3.5%	224	3.2%	773	3.4%	2,744	45.6%	2,943	21.5%	5,687	28.8%
2009	25-34	2,167	13.8%	1,108	15.9%	3,275	14.4%	316	5.3%	1,427	10.4%	1,743	8.8%
2009	35-44	3,620	23.0%	1,769	25.4%	5,389	23.7%	747	12.4%	2,884	21.0%	3,631	18.4%
2009	45-54	5,296	33.6%	2,375	34.2%	7,671	33.8%	1,262	21.0%	3,983	29.0%	5,245	26.6%
2009	55-64	4,126	26.2%	1,475	21.2%	5,601	24.7%	946	15.7%	2,479	18.1%	3,425	17.4%
Total		15,758		6,951		22,709		6,015		13,716		19,731	
2010	18-24	545	3.4%	216	3.1%	761	3.3%	3,049	47.6%	3,239	23.0%	6,288	30.7%
2010	25-34	2,265	14.2%	1,060	15.3%	3,325	14.6%	384	6.0%	1,507	10.7%	1,891	9.2%
2010	35-44	3,488	21.9%	1,651	23.8%	5,139	22.5%	689	10.8%	2,750	19.6%	3,439	16.8%
2010	45-54	5,245	33.0%	2,406	34.7%	7,651	33.5%	1,230	19.2%	3,941	28.0%	5,171	25.3%
2010	55-64	4,363	27.4%	1,595	23.0%	5,958	26.1%	1,050	16.4%	2,619	18.6%	3,669	17.9%
Total		15,906		6,928		22,834		6,402		14,056		20,458	
2011	18-24	526	2.3%	179	0.8%	705	3.0%	3,609	15.6%	3,713	17.2%	7,322	34.0%
2011	25-34	2,358	10.2%	1,011	4.7%	3,369	14.5%	628	2.7%	1,702	7.9%	2,330	10.8%
2011	35-44	3,382	14.6%	1,560	7.2%	4,942	21.3%	651	2.8%	2,623	12.2%	3,274	15.2%
2011	45-54	5,182	22.3%	2,406	11.2%	7,588	32.7%	1,183	5.1%	3,926	18.2%	5,109	23.7%
2011	55-64	4,566	19.7%	1,694	7.9%	6,260	27.0%	1,104	4.8%	2,748	12.7%	3,852	17.9%
Total		16,014		6,850		22,864		7,175		14,712		21,887	
2009-2011	18-24	711	2.6%	272	1.1%	983	3.6%	4,461	16.3%	4,596	18.0%	9,057	35.5%
2009-2011	25-34	2,799	10.2%	1,295	5.1%	4,094	15.0%	721	2.6%	1,999	7.8%	2,720	10.7%
2009-2011	35-44	3,924	14.4%	1,828	7.2%	5,752	21.1%	800	2.9%	3,062	12.0%	3,862	15.1%
2009-2011	45-54	5,748	21.0%	2,656	10.4%	8,404	30.8%	1,378	5.0%	4,454	17.5%	5,832	22.9%
2009-2011	55-64	5,448	19.9%	1,982	7.8%	7,430	27.2%	1,327	4.9%	3,373	13.2%	4,700	18.4%
Total		18,630		8,033		26,663		8,687		17,484		26,171	
2009-2011 (Cohort)	18-24	162	0.9%	44	0.3%	206	1.2%	1,685	9.5%	1,832	10.9%	3,517	20.9%
2009-2011 (Cohort)	25-34	1,566	8.8%	725	4.3%	2,291	12.9%	327	1.8%	1,037	6.2%	1,364	8.1%
2009-2011 (Cohort)	35-44	2,734	15.4%	1,323	7.9%	4,057	22.8%	519	2.9%	2,100	12.5%	2,619	15.6%
2009-2011 (Cohort)	45-54	4,573	25.7%	2,140	12.7%	6,713	37.7%	1,004	5.6%	3,478	20.7%	4,482	26.7%
2009-2011 (Cohort)	55-64	4,253	23.9%	1,592	9.5%	5,845	32.9%	967	5.4%	2,525	15.0%	3,492	20.8%
Total		13,288		5,824		19,112		4,502		10,972		15,474	

APPENDIX D (continued)

TABLE XIV

MEMBER MONTH DISTRIBUTION BY AGE AND GENDER

Year(s)	Age Group	Male Member Months	Female Member Months	Total Member Months	Male Average Member Months	Female Average Member Months	Total Average Member Months
2009	18-24	29,432	29,143	58,575	8.9	9.2	9.1
2009	25-34	26,010	26,474	52,484	10.5	10.4	10.5
2009	35-44	47,679	50,842	98,521	10.9	10.9	10.9
2009	45-54	73,748	71,324	145,072	11.2	11.2	11.2
2009	55-64	56,641	43,852	100,493	11.2	10.1	11.1
Total		233,510	221,635	455,145	10.7	10.7	10.7
2010	18-24	30,786	30,678	61,464	8.6	8.9	8.7
2010	25-34	27,535	26,512	54,047	10.4	10.3	10.4
2010	35-44	46,443	48,895	95,338	11.1	11.1	11.1
2010	45-54	73,738	72,694	146,432	11.4	11.5	11.4
2010	55-64	60,568	47,138	107,706	11.2	11.2	11.2
Total		239,070	225,917	464,987	10.7	10.8	10.7
2011	18-24	42,490	39,886	82,376	10.3	10.2	10.3
2011	25-34	31,356	28,627	59,983	10.5	10.6	10.5
2011	35-44	44,607	46,617	91,224	11.1	11.1	11.1
2011	45-54	72,790	72,703	145,493	11.4	11.5	11.5
2011	55-64	63,667	49,843	113,510	11.2	11.2	11.2
Total		254,910	237,676	492,586	11.0	11.0	11.0
2009-2011	18-24	95,910	94,578	190,488	18.5	19.4	19.0
2009-2011	25-34	82,943	77,697	160,640	23.6	23.6	23.6
2009-2011	35-44	130,312	136,781	267,093	27.6	28.0	27.8
2009-2011	45-54	215,610	216,375	431,985	30.3	30.4	30.3
2009-2011	55-64	202,715	159,797	362,512	29.9	29.8	29.9
Total		727,490	685,228	1,412,718	26.6	26.9	26.7
2009-2011 (Cohort)	18-24	59,401	60,824	120,225	32.2	32.4	32.3
2009-2011 (Cohort)	25-34	63,848	59,514	123,362	33.7	33.8	33.8
2009-2011 (Cohort)	35-44	113,388	119,371	232,759	34.9	34.9	34.9
2009-2011 (Cohort)	45-54	196,770	198,165	394,935	35.3	35.3	35.3
2009-2011 (Cohort)	55-64	182,886	143,819	326,705	35.0	34.9	35.0
Total		616,293	581,693	1,197,986	34.6	34.6	34.6

APPENDIX D (continued)

TABLE XVI

TOTAL CLAIMS BY SERVICE TYPE

Service Type	Total Claims (2009)	Total Claims (2010)	Total Claims (2011)	Total Claims (2009-2011)	Total Claims (2009-2011) Cohort	PMPY Claims (2009)	PMPY Claims (2010)	PMPY Claims (2011)	PMPY Claims (2009-2011)	PMPY Claims (2009-2011) Cohort
Hospital	14,836	14,542	15,759	45,137	36,873	0.35	0.34	0.35	0.28	0.36
ER	9,814	9,951	11,808	31,572	25,932	0.23	0.23	0.26	0.20	0.25
Outpatient	76,559	78,314	77,639	232,512	202,003	1.80	1.81	1.73	1.47	1.95
Professional	240,910	247,816	243,906	732,632	641,315	5.68	5.72	5.45	4.62	6.18
Remainder	61,670	67,615	74,378	203,663	178,598	1.45	1.56	1.66	1.28	1.72
Pharmacy	352,750	364,290	381,708	1,098,748	965,953	8.31	8.41	8.53	6.93	9.31
Total	756,539	782,528	805,198	2,344,265	2,050,674	17.83	18.08	17.99	14.79	19.76

APPENDIX D (continued)

TABLE XVII

INPATIENT ADMISSIONS AND AVERAGE LENGTH OF STAY BY AGE AND GENDER

Year(s)	Age Group	Male Admits	Male Admit Rate PTMPY	Male Average LOS (Days)	Female Admits	Female Admit Rate PTMPY	Female Average LOS (Days)	Total Admits	Total Admit Rate PTMPY	Average LOS (Days)
2009	18-24	83	34	3.6	140	58	3.8	223	46	3.7
2009	25-34	93	43	2.1	462	209	2.4	555	127	2.4
2009	35-44	196	49	3.2	507	120	3.1	703	86	3.1
2009	45-54	474	77	3.5	539	91	3.0	1,013	84	3.2
2009	55-64	713	151	3.6	635	174	4.5	1,348	161	4.0
	Total	1,559	80	3.4	2,283	124	3.3	3,842	101	3.4
2010	18-24	66	26	3.2	101	40	2.4	167	33	2.7
2010	25-34	52	23	6.0	351	159	2.4	403	89	2.9
2010	35-44	174	45	3.4	353	87	2.6	527	66	2.8
2010	45-54	359	58	3.5	457	75	3.2	816	67	3.3
2010	55-64	604	120	3.3	465	118	4.0	1,069	119	3.6
	Total	1,255	63	3.5	1,727	92	3.1	2,982	77	3.2
2011	18-24	95	27	4.8	146	44	4.2	241	35	4.4
2011	25-34	68	26	3.5	353	148	2.4	421	84	2.6
2011	35-44	127	34	3.4	305	79	2.5	432	57	2.8
2011	45-54	241	40	2.7	336	55	3.7	577	48	3.3
2011	55-64	506	95	4.1	360	87	4.3	866	92	4.2
	Total	1,037	49	3.7	1,500	76	3.3	2,537	62	3.5
2009-2011	18-24	245	31	4.2	369	47	3.3	614	39	3.7
2009-2011	25-34	230	33	4.2	1,149	177	2.6	1,379	103	2.9
2009-2011	35-44	501	46	3.2	1,233	108	3.2	1,734	78	3.2
2009-2011	45-54	1,235	69	3.2	1,571	87	3.7	2,806	78	3.5
2009-2011	55-64	2,394	142	3.7	2,118	159	5.6	4,512	149	4.6
	Total	4,605	76	3.6	6,440	113	4.0	11,045	94	3.8
2009-2011 (Cohort)	18-24	158	32	4.0	238	47	3.6	396	40	3.8
2009-2011 (Cohort)	25-34	175	33	4.9	899	181	2.6	1,074	104	3.0
2009-2011 (Cohort)	35-44	435	46	3.0	1,096	110	3.2	1,531	79	3.1
2009-2011 (Cohort)	45-54	1,072	65	2.9	1,384	84	3.8	2,456	75	3.4
2009-2011 (Cohort)	55-64	2,062	135	3.6	1,801	150	4.5	3,863	142	4.0
	Total	3,902	76	3.4	5,418	112	3.7	9,320	93	3.6

APPENDIX D (continued)

TABLE XVIII

EMERGENCY ROOM VISITS BY AGE AND GENDER

Year(s)	Age Group	Male ER	Male ER Rate PTMPY	Female ER	Female ER Rate PTMPY	Total ER	Total ER Rate PTMPY
2009	18-24	365	149	487	201	852	175
2009	25-34	333	154	551	250	884	202
2009	35-44	530	133	748	177	1,278	156
2009	45-54	702	114	829	139	1,531	127
2009	55-64	526	111	523	143	1,049	125
	Total	2,456	126	3,138	170	5,594	147
2010	18-24	335	131	451	176	786	153
2010	25-34	337	147	488	221	825	183
2010	35-44	507	131	747	183	1,254	158
2010	45-54	668	109	800	132	1,468	120
2010	55-64	618	122	650	165	1,268	141
	Total	2,465	124	3,136	167	5,601	145
2011	18-24	562	159	721	217	1,283	187
2011	25-34	350	134	547	229	897	179
2011	35-44	511	137	724	186	1,235	162
2011	45-54	737	122	831	137	1,568	129
2011	55-64	594	112	613	148	1,207	128
	Total	2,754	130	3,436	173	6,190	151
2009-2011	18-24	1,186	148	1,590	202	2,776	175
2009-2011	25-34	996	144	1,520	235	2,516	188
2009-2011	35-44	1,511	139	2,114	185	3,625	163
2009-2011	45-54	2,074	115	2,467	137	4,541	126
2009-2011	55-64	1,908	113	2,019	152	3,927	130
	Total	7,675	127	9,710	170	17,385	148
2009-2011 (Cohort)	18-24	730	147	923	182	1,653	165
2009-2011 (Cohort)	25-34	772	145	1,121	226	1,893	184
2009-2011 (Cohort)	35-44	1,294	137	1,777	179	3,071	158
2009-2011 (Cohort)	45-54	1,876	114	2,189	133	4,065	124
2009-2011 (Cohort)	55-64	1,696	111	1,776	148	3,472	128
	Total	6,368	124	7,786	161	14,154	142

APPENDIX D (continued)

TABLE XIX

OUTPATIENT VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient	Male Outpatient Rate PTMPY	Female Outpatient	Female Outpatient Rate PTMPY	Total Outpatient	Total Outpatient Rate PTMPY
2009	18-24	1,235	504	1,599	658	2,834	581
2009	25-34	1,160	535	2,931	1,329	4,091	935
2009	35-44	2,820	710	5,561	1,313	8,381	1,021
2009	45-54	6,271	1,020	9,787	1,647	16,058	1,328
2009	55-64	8,580	1,818	8,342	2,283	16,922	2,021
	Total	20,066	1,031	28,220	1,528	48,286	1,273
2010	18-24	1,034	403	1,544	604	2,578	503
2010	25-34	1,205	525	2,990	1,353	4,195	931
2010	35-44	2,919	754	5,875	1,442	8,794	1,107
2010	45-54	6,545	1,065	9,851	1,626	16,396	1,344
2010	55-64	8,934	1,770	9,402	2,393	18,336	2,043
	Total	20,637	1,036	29,662	1,576	50,299	1,298
2011	18-24	1,650	466	2,367	712	4,017	585
2011	25-34	1,410	540	2,901	1,216	4,311	862
2011	35-44	2,610	702	5,137	1,322	7,747	1,019
2011	45-54	5,812	958	9,849	1,626	15,661	1,292
2011	55-64	8,587	1,618	9,772	2,353	18,359	1,941
	Total	20,069	945	30,026	1,516	50,095	1,220
2009-2011	18-24	3,719	465	5,148	653	8,867	559
2009-2011	25-34	3,587	519	8,321	1,285	11,908	890
2009-2011	35-44	7,644	704	15,166	1,331	22,810	1,025
2009-2011	45-54	17,594	979	28,888	1,602	46,482	1,291
2009-2011	55-64	28,228	1,671	30,385	2,282	58,613	1,940
	Total	60,772	1,002	87,908	1,539	148,680	1,263
2009-2011 (Cohort)	18-24	2,514	508	3,279	647	5,793	578
2009-2011 (Cohort)	25-34	2,904	546	6,484	1,307	9,388	913
2009-2011 (Cohort)	35-44	6,604	699	13,321	1,339	19,925	1,027
2009-2011 (Cohort)	45-54	15,716	958	26,390	1,598	42,106	1,279
2009-2011 (Cohort)	55-64	24,431	1,603	27,250	2,274	51,681	1,898
	Total	52,169	1,016	76,724	1,583	128,893	1,291

APPENDIX D (continued)

TABLE XX

PROFESSIONAL VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Professional	Male Professional Rate PTMPY	Female Professional	Female Professional Rate PTMPY	Total Professional	Total Professional Rate PTMPY
2009	18-24	5,594	2,281	9,189	3,784	14,783	3,029
2009	25-34	8,097	3,736	14,861	6,736	22,958	5,249
2009	35-44	17,539	4,414	28,021	6,614	45,560	5,549
2009	45-54	33,058	5,379	44,500	7,487	77,558	6,415
2009	55-64	33,508	7,099	32,245	8,824	65,753	7,852
	Total	97,796	5,026	128,816	6,974	226,612	5,975
2010	18-24	5,721	2,230	9,108	3,563	14,829	2,895
2010	25-34	8,161	3,557	14,642	6,627	22,803	5,063
2010	35-44	17,432	4,504	27,718	6,803	45,150	5,683
2010	45-54	32,976	5,366	46,095	7,609	79,071	6,480
2010	55-64	36,313	7,194	35,433	9,020	71,746	7,994
	Total	100,603	5,050	132,996	7,064	233,599	6,029
2011	18-24	8,145	2,300	12,714	3,825	20,859	3,039
2011	25-34	8,222	3,147	14,008	5,872	22,230	4,447
2011	35-44	15,459	4,159	25,098	6,461	40,557	5,335
2011	45-54	31,030	5,116	44,287	7,310	75,317	6,212
2011	55-64	37,683	7,103	36,055	8,680	73,738	7,795
	Total	100,539	4,733	132,162	6,673	232,701	5,669
2009-2011	18-24	18,298	2,289	29,352	3,724	47,650	3,002
2009-2011	25-34	22,725	3,288	40,133	6,198	62,858	4,696
2009-2011	35-44	46,822	4,312	75,398	6,615	122,220	5,491
2009-2011	45-54	92,092	5,125	132,324	7,339	224,416	6,234
2009-2011	55-64	119,001	7,044	116,767	8,769	235,768	7,804
	Total	298,938	4,931	393,974	6,899	692,912	5,886
2009-2011 (Cohort)	18-24	11,612	2,346	19,158	3,780	30,770	3,071
2009-2011 (Cohort)	25-34	18,251	3,430	31,855	6,423	50,106	4,874
2009-2011 (Cohort)	35-44	41,630	4,406	66,570	6,692	108,200	5,578
2009-2011 (Cohort)	45-54	85,311	5,203	121,724	7,371	207,035	6,291
2009-2011 (Cohort)	55-64	105,825	6,944	104,947	8,757	210,772	7,742
	Total	262,629	5,114	344,254	7,102	606,883	6,079

APPENDIX D (continued)

TABLE XXI

REMAINDER EVENTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder	Male Remainder Rate PTMPY	Female Remainder	Female Remainder Rate PTMPY	Total Remainder	Total Remainder Rate PTMPY
2009	18-24	728	297	1,929	794	2,657	544
2009	25-34	1,057	488	3,428	1,554	4,485	1,025
2009	35-44	2,784	701	6,534	1,542	9,318	1,135
2009	45-54	6,212	1,011	9,025	1,518	15,237	1,260
2009	55-64	8,327	1,764	7,657	2,095	15,984	1,909
	Total	19,108	982	28,573	1,547	47,681	1,257
2010	18-24	762	297	1,844	721	2,606	509
2010	25-34	981	428	3,452	1,562	4,433	984
2010	35-44	2,891	747	6,288	1,543	9,179	1,155
2010	45-54	6,365	1,036	9,372	1,547	15,737	1,290
2010	55-64	9,186	1,820	8,293	2,111	17,479	1,947
	Total	20,185	1,013	29,249	1,554	49,434	1,276
2011	18-24	1,195	337	2,829	851	4,024	586
2011	25-34	1,057	405	3,678	1,542	4,735	947
2011	35-44	2,674	719	5,597	1,441	8,271	1,088
2011	45-54	6,391	1,054	9,529	1,573	15,920	1,313
2011	55-64	10,632	2,004	9,338	2,248	19,970	2,111
	Total	21,949	1,033	30,971	1,564	52,920	1,289
2009-2011	18-24	2,518	315	5,202	660	7,720	486
2009-2011	25-34	2,907	421	9,751	1,506	12,658	946
2009-2011	35-44	7,479	689	17,446	1,531	24,925	1,120
2009-2011	45-54	17,804	991	27,387	1,519	45,191	1,255
2009-2011	55-64	30,534	1,808	28,007	2,103	58,541	1,938
	Total	61,242	1,010	87,793	1,537	149,035	1,266
2009-2011 (Cohort)	18-24	1,680	339	4,083	806	5,763	575
2009-2011 (Cohort)	25-34	2,141	402	7,710	1,555	9,851	958
2009-2011 (Cohort)	35-44	6,661	705	15,536	1,562	22,197	1,144
2009-2011 (Cohort)	45-54	16,350	997	25,257	1,529	41,607	1,264
2009-2011 (Cohort)	55-64	27,130	1,780	24,827	2,072	51,957	1,908
	Total	53,962	1,051	77,413	1,597	131,375	1,316

APPENDIX D (continued)

TABLE XXII

PHARMACY UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy	Male Pharmacy Rate PTMPY	Female Pharmacy	Female Pharmacy Rate PTMPY	Total Pharmacy	Total Pharmacy Rate PTMPY
2009	18-24	5,812	2,370	11,562	4,761	17,374	3,559
2009	25-34	8,444	3,896	17,865	8,098	26,309	6,015
2009	35-44	24,147	6,077	37,763	8,913	61,910	7,541
2009	45-54	56,010	9,114	71,796	12,079	127,806	10,572
2009	55-64	61,866	13,107	57,485	15,731	119,351	14,252
	Total	156,279	8,031	196,471	10,638	352,750	9,300
2010	18-24	5,554	2,165	11,748	4,595	17,302	3,378
2010	25-34	8,702	3,792	17,297	7,829	25,999	5,773
2010	35-44	24,724	6,388	36,900	9,056	61,624	7,756
2010	45-54	56,119	9,133	69,781	11,519	125,900	10,317
2010	55-64	68,888	13,648	64,577	16,439	133,465	14,870
	Total	163,987	8,231	200,303	10,639	364,290	9,401
2011	18-24	8,262	2,333	16,301	4,904	24,563	3,578
2011	25-34	9,762	3,736	17,752	7,441	27,514	5,504
2011	35-44	23,997	6,456	36,159	9,308	60,156	7,913
2011	45-54	56,550	9,323	69,303	11,439	125,853	10,380
2011	55-64	74,423	14,027	69,199	16,660	143,622	15,183
	Total	172,994	8,144	208,714	10,538	381,708	9,299
2009-2011	18-24	18,639	2,332	37,314	4,734	55,953	3,525
2009-2011	25-34	24,659	3,568	48,726	7,526	73,385	5,482
2009-2011	35-44	66,639	6,137	102,918	9,029	169,557	7,618
2009-2011	45-54	157,316	8,756	198,301	10,998	355,617	9,879
2009-2011	55-64	226,007	13,379	213,506	16,033	439,513	14,549
	Total	493,260	8,136	600,765	10,521	1,094,025	9,293
2009-2011 (Cohort)	18-24	12,442	2,513	25,127	4,957	37,569	3,750
2009-2011 (Cohort)	25-34	19,513	3,667	38,830	7,829	58,343	5,675
2009-2011 (Cohort)	35-44	59,535	6,301	91,519	9,200	151,054	7,788
2009-2011 (Cohort)	45-54	145,014	8,844	181,480	10,990	326,494	9,920
2009-2011 (Cohort)	55-64	202,025	13,256	190,468	15,892	392,493	14,416
	Total	438,529	8,539	527,424	10,880	965,953	9,676

APPENDIX D (continued)

TABLE XXIV

OVERALL COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Total Costs	Male Total Costs PMPM	Female Total Costs	Female Total Costs PMPM	Total Costs	Total Costs PMPM
2009	18-24	\$3,346,285	\$114	\$3,971,739	\$136	\$7,318,024	\$125
2009	25-34	\$3,412,200	\$131	\$8,744,430	\$330	\$12,156,630	\$232
2009	35-44	\$8,563,517	\$180	\$15,456,728	\$304	\$24,020,245	\$244
2009	45-54	\$21,700,987	\$294	\$23,340,332	\$327	\$45,041,319	\$310
2009	55-64	\$27,313,325	\$482	\$21,473,050	\$490	\$48,786,375	\$485
	Total	\$64,336,313	\$276	\$72,986,279	\$329	\$137,322,593	\$302
2010	18-24	\$2,869,218	\$93	\$4,068,165	\$133	\$6,937,383	\$113
2010	25-34	\$3,355,537	\$122	\$8,595,111	\$324	\$11,950,647	\$221
2010	35-44	\$9,865,077	\$212	\$15,200,129	\$311	\$25,065,205	\$263
2010	45-54	\$20,908,801	\$284	\$26,391,842	\$363	\$47,300,643	\$323
2010	55-64	\$31,139,611	\$514	\$25,175,422	\$534	\$56,315,033	\$523
	Total	\$68,138,244	\$285	\$79,430,668	\$352	\$147,568,912	\$317
2011	18-24	\$5,388,417	\$127	\$5,730,787	\$144	\$11,119,204	\$135
2011	25-34	\$4,142,825	\$132	\$9,056,980	\$316	\$13,199,805	\$220
2011	35-44	\$8,521,461	\$191	\$15,220,230	\$326	\$23,741,691	\$260
2011	45-54	\$20,204,718	\$278	\$26,729,910	\$368	\$46,934,628	\$323
2011	55-64	\$34,376,011	\$540	\$27,382,869	\$549	\$61,758,880	\$544
	Total	\$72,633,432	\$285	\$84,120,775	\$354	\$156,754,207	\$318
2009-2011	18-24	\$11,031,825	\$115	\$12,799,601	\$135	\$23,831,426	\$125
2009-2011	25-34	\$10,377,393	\$125	\$24,743,162	\$318	\$35,120,555	\$219
2009-2011	35-44	\$24,520,279	\$188	\$42,121,358	\$308	\$66,641,637	\$250
2009-2011	45-54	\$58,837,424	\$273	\$75,872,186	\$351	\$134,709,610	\$312
2009-2011	55-64	\$100,341,068	\$495	\$81,001,414	\$507	\$181,342,483	\$500
	Total	\$205,107,990	\$282	\$236,537,722	\$345	\$441,645,712	\$313
2009-2011 (Cohort)	18-24	\$7,019,581	\$118	\$8,227,321	\$135	\$15,246,902	\$127
2009-2011 (Cohort)	25-34	\$8,642,701	\$135	\$19,646,309	\$330	\$28,289,010	\$229
2009-2011 (Cohort)	35-44	\$21,462,056	\$189	\$36,882,670	\$309	\$58,344,726	\$251
2009-2011 (Cohort)	45-54	\$51,330,944	\$261	\$68,475,891	\$346	\$119,806,835	\$303
2009-2011 (Cohort)	55-64	\$87,041,608	\$476	\$70,973,339	\$493	\$158,014,947	\$484
	Total	\$175,496,890	\$285	\$204,205,531	\$351	\$379,702,421	\$317

APPENDIX D (continued)

TABLE XXV

INPATIENT ADMISSION COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Inpatient Costs	Male Inpatient Costs PMPM	Female Inpatient Costs	Female Inpatient Costs PMPM	Total Inpatient Costs	Total Inpatient Costs PMPM
2009	18-24	\$1,033,573	\$35	\$758,089	\$26	\$1,791,662	\$31
2009	25-34	\$856,765	\$33	\$2,990,345	\$113	\$3,847,110	\$73
2009	35-44	\$1,711,444	\$36	\$3,976,737	\$78	\$5,688,181	\$58
2009	45-54	\$6,654,678	\$90	\$3,950,342	\$55	\$10,605,021	\$73
2009	55-64	\$8,444,292	\$149	\$5,035,326	\$115	\$13,479,618	\$134
	Total	\$18,700,752	\$80	\$16,710,841	\$75	\$35,411,593	\$78
2010	18-24	\$751,760	\$24	\$915,789	\$30	\$1,667,549	\$27
2010	25-34	\$380,679	\$14	\$2,429,327	\$92	\$2,810,006	\$52
2010	35-44	\$2,500,831	\$54	\$3,245,128	\$66	\$5,745,959	\$60
2010	45-54	\$4,607,495	\$62	\$5,841,296	\$80	\$10,448,792	\$71
2010	55-64	\$8,786,354	\$145	\$6,133,375	\$130	\$14,919,729	\$139
	Total	\$17,027,119	\$71	\$18,564,915	\$82	\$35,592,034	\$77
2011	18-24	\$1,779,327	\$42	\$1,103,547	\$28	\$2,882,873	\$35
2011	25-34	\$802,066	\$26	\$2,969,570	\$104	\$3,771,636	\$63
2011	35-44	\$1,898,728	\$43	\$4,215,637	\$90	\$6,114,365	\$67
2011	45-54	\$4,488,960	\$62	\$5,853,889	\$81	\$10,342,849	\$71
2011	55-64	\$11,348,473	\$178	\$6,686,980	\$134	\$18,035,453	\$159
	Total	\$20,317,553	\$80	\$20,829,623	\$88	\$41,147,176	\$84
2009-2011	18-24	\$3,473,991	\$36	\$2,477,500	\$26	\$5,951,491	\$31
2009-2011	25-34	\$1,993,493	\$24	\$7,998,190	\$103	\$9,991,682	\$62
2009-2011	35-44	\$5,337,521	\$41	\$10,470,106	\$77	\$15,807,627	\$59
2009-2011	45-54	\$14,769,106	\$68	\$16,136,161	\$75	\$30,905,267	\$72
2009-2011	55-64	\$30,471,314	\$150	\$19,023,422	\$119	\$49,494,736	\$137
	Total	\$56,045,424	\$77	\$56,105,379	\$82	\$112,150,803	\$79
2009-2011 (Cohort)	18-24	\$2,164,237	\$36	\$1,417,312	\$23	\$3,581,549	\$30
2009-2011 (Cohort)	25-34	\$1,752,013	\$27	\$6,146,763	\$103	\$7,898,776	\$64
2009-2011 (Cohort)	35-44	\$4,552,127	\$40	\$8,711,399	\$73	\$13,263,526	\$57
2009-2011 (Cohort)	45-54	\$11,237,846	\$57	\$14,171,563	\$72	\$25,409,409	\$64
2009-2011 (Cohort)	55-64	\$25,749,215	\$141	\$15,495,553	\$108	\$41,244,768	\$126
	Total	\$45,455,438	\$74	\$45,942,589	\$79	\$91,398,027	\$76

APPENDIX D (continued)

TABLE XXVI

EMERGENCY ROOM VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male ER Costs	Male ER Costs PMPM	Female ER Costs	Female ER Costs PMPM	Total ER Costs	Total ER Costs PMPM
2009	18-24	\$139,975	\$5	\$206,028	\$7	\$346,003	\$6
2009	25-34	\$138,251	\$5	\$245,451	\$9	\$383,702	\$7
2009	35-44	\$267,009	\$6	\$399,175	\$8	\$666,184	\$7
2009	45-54	\$406,899	\$6	\$418,407	\$6	\$825,306	\$6
2009	55-64	\$261,601	\$5	\$247,976	\$6	\$509,578	\$5
	Total	\$1,213,735	\$5	\$1,517,037	\$7	\$2,730,772	\$6
2010	18-24	\$136,693	\$4	\$210,902	\$7	\$347,595	\$6
2010	25-34	\$167,682	\$6	\$251,956	\$10	\$419,638	\$8
2010	35-44	\$288,349	\$6	\$390,898	\$8	\$679,248	\$7
2010	45-54	\$312,739	\$4	\$356,662	\$5	\$669,401	\$5
2010	55-64	\$296,465	\$5	\$299,889	\$6	\$596,355	\$6
	Total	\$1,201,930	\$5	\$1,510,308	\$7	\$2,712,237	\$6
2011	18-24	\$258,565	\$6	\$328,082	\$8	\$586,647	\$7
2011	25-34	\$169,408	\$5	\$285,679	\$10	\$455,087	\$8
2011	35-44	\$295,031	\$7	\$415,334	\$9	\$710,365	\$8
2011	45-54	\$370,901	\$5	\$433,177	\$6	\$804,079	\$6
2011	55-64	\$327,297	\$5	\$318,186	\$6	\$645,483	\$6
	Total	\$1,421,203	\$6	\$1,780,458	\$7	\$3,201,660	\$6
2009-2011	18-24	\$502,114	\$5	\$715,286	\$8	\$1,217,401	\$6
2009-2011	25-34	\$457,130	\$6	\$751,277	\$10	\$1,208,407	\$8
2009-2011	35-44	\$833,261	\$6	\$1,133,577	\$8	\$1,966,838	\$7
2009-2011	45-54	\$1,072,208	\$5	\$1,246,489	\$6	\$2,318,697	\$5
2009-2011	55-64	\$972,154	\$5	\$961,173	\$6	\$1,933,328	\$5
	Total	\$3,836,867	\$5	\$4,807,803	\$7	\$8,644,670	\$6
2009-2011 (Cohort)	18-24	\$320,434	\$5	\$428,183	\$7	\$748,617	\$6
2009-2011 (Cohort)	25-34	\$370,585	\$6	\$546,088	\$9	\$916,674	\$7
2009-2011 (Cohort)	35-44	\$717,313	\$6	\$976,022	\$8	\$1,693,335	\$7
2009-2011 (Cohort)	45-54	\$990,492	\$5	\$1,086,118	\$5	\$2,076,610	\$5
2009-2011 (Cohort)	55-64	\$875,581	\$5	\$859,491	\$6	\$1,735,072	\$5
	Total	\$3,274,406	\$5	\$3,895,902	\$7	\$7,170,307	\$6

APPENDIX D (continued)

TABLE XXVII

OUTPATIENT VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient Costs	Male Outpatient Costs PMPM	Female Outpatient Costs	Female Outpatient Costs PMPM	Total Outpatient Costs	Total Outpatient Costs PMPM
2009	18-24	\$875,994	\$30	\$1,102,902	\$38	\$1,978,896	\$34
2009	25-34	\$893,307	\$34	\$2,211,594	\$84	\$3,104,901	\$59
2009	35-44	\$2,486,265	\$52	\$4,195,028	\$83	\$6,681,293	\$68
2009	45-54	\$5,260,421	\$71	\$7,396,286	\$104	\$12,656,707	\$87
2009	55-64	\$7,289,795	\$129	\$6,112,033	\$139	\$13,401,828	\$133
	Total	\$16,805,782	\$72	\$21,017,843	\$95	\$37,823,625	\$83
2010	18-24	\$736,463	\$24	\$1,047,878	\$34	\$1,784,341	\$29
2010	25-34	\$1,230,698	\$45	\$2,343,483	\$88	\$3,574,181	\$66
2010	35-44	\$2,909,953	\$63	\$4,861,323	\$99	\$7,771,275	\$82
2010	45-54	\$6,242,422	\$85	\$7,720,927	\$106	\$13,963,349	\$95
2010	55-64	\$9,022,191	\$149	\$7,290,130	\$155	\$16,312,321	\$151
	Total	\$20,141,727	\$84	\$23,263,740	\$103	\$43,405,467	\$93
2011	18-24	\$1,391,886	\$33	\$1,638,972	\$41	\$3,030,858	\$37
2011	25-34	\$1,492,256	\$48	\$2,493,053	\$87	\$3,985,309	\$66
2011	35-44	\$2,219,500	\$50	\$4,348,611	\$93	\$6,568,111	\$72
2011	45-54	\$6,050,575	\$83	\$8,239,829	\$113	\$14,290,404	\$98
2011	55-64	\$8,225,362	\$129	\$7,433,246	\$149	\$15,658,609	\$138
	Total	\$19,379,579	\$76	\$24,153,712	\$102	\$43,533,290	\$88
2009-2011	18-24	\$2,818,858	\$29	\$3,530,525	\$37	\$6,349,384	\$33
2009-2011	25-34	\$3,467,316	\$42	\$6,709,803	\$86	\$10,177,119	\$63
2009-2011	35-44	\$6,940,216	\$53	\$12,294,344	\$90	\$19,234,560	\$72
2009-2011	45-54	\$16,398,779	\$76	\$23,115,263	\$107	\$39,514,042	\$91
2009-2011	55-64	\$26,701,918	\$132	\$22,785,360	\$143	\$49,487,277	\$137
	Total	\$56,327,087	\$77	\$68,435,295	\$100	\$124,762,382	\$88
2009-2011 (Cohort)	18-24	\$1,783,819	\$30	\$2,338,048	\$38	\$4,121,867	\$34
2009-2011 (Cohort)	25-34	\$2,958,241	\$46	\$5,528,305	\$93	\$8,486,546	\$69
2009-2011 (Cohort)	35-44	\$6,080,382	\$54	\$10,983,992	\$92	\$17,064,373	\$73
2009-2011 (Cohort)	45-54	\$14,727,214	\$75	\$20,860,399	\$105	\$35,587,613	\$90
2009-2011 (Cohort)	55-64	\$23,507,183	\$129	\$20,514,794	\$143	\$44,021,977	\$135
	Total	\$49,056,839	\$80	\$60,225,538	\$104	\$109,282,376	\$91

APPENDIX D (continued)

TABLE XXVIII

PROFESSIONAL VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Professional Costs	Male Professional Costs PMPM	Female Professional Costs	Female Professional Costs PMPM	Total Professional Costs	Total Professional Costs PMPM
2009	18-24	\$469,162	\$16	\$860,757	\$30	\$1,329,920	\$23
2009	25-34	\$772,979	\$30	\$1,432,733	\$54	\$2,205,712	\$42
2009	35-44	\$1,800,244	\$38	\$3,004,042	\$59	\$4,804,286	\$49
2009	45-54	\$3,800,117	\$52	\$4,832,904	\$68	\$8,633,021	\$60
2009	55-64	\$4,380,643	\$77	\$4,101,280	\$94	\$8,481,923	\$84
	Total	\$11,223,146	\$48	\$14,231,715	\$64	\$25,454,861	\$56
2010	18-24	\$512,961	\$17	\$849,384	\$28	\$1,362,345	\$22
2010	25-34	\$719,661	\$26	\$1,443,400	\$54	\$2,163,061	\$40
2010	35-44	\$1,829,737	\$39	\$3,027,217	\$62	\$4,856,954	\$51
2010	45-54	\$3,613,129	\$49	\$5,166,487	\$71	\$8,779,616	\$60
2010	55-64	\$4,705,563	\$78	\$4,382,751	\$93	\$9,088,314	\$84
	Total	\$11,381,050	\$48	\$14,869,240	\$66	\$26,250,290	\$56
2011	18-24	\$749,696	\$18	\$1,108,980	\$28	\$1,858,676	\$23
2011	25-34	\$711,165	\$23	\$1,357,821	\$47	\$2,068,986	\$34
2011	35-44	\$1,461,365	\$33	\$2,505,618	\$54	\$3,966,984	\$43
2011	45-54	\$3,125,321	\$43	\$4,798,382	\$66	\$7,923,703	\$54
2011	55-64	\$4,637,972	\$73	\$4,720,685	\$95	\$9,358,658	\$82
	Total	\$10,685,520	\$42	\$14,491,487	\$61	\$25,177,007	\$51
2009-2011	18-24	\$1,636,707	\$17	\$2,657,954	\$28	\$4,294,661	\$23
2009-2011	25-34	\$1,996,099	\$24	\$3,907,638	\$50	\$5,903,737	\$37
2009-2011	35-44	\$4,758,178	\$37	\$7,673,381	\$56	\$12,431,559	\$47
2009-2011	45-54	\$9,872,309	\$46	\$14,753,465	\$68	\$24,625,774	\$57
2009-2011	55-64	\$15,026,423	\$74	\$14,600,004	\$91	\$29,626,428	\$82
	Total	\$33,289,716	\$46	\$43,592,442	\$64	\$76,882,158	\$54
2009-2011 (Cohort)	18-24	\$1,028,563	\$17	\$1,765,360	\$29	\$2,793,923	\$23
2009-2011 (Cohort)	25-34	\$1,586,818	\$25	\$3,055,187	\$51	\$4,642,005	\$38
2009-2011 (Cohort)	35-44	\$4,215,562	\$37	\$6,739,398	\$56	\$10,954,960	\$47
2009-2011 (Cohort)	45-54	\$9,052,347	\$46	\$13,382,681	\$68	\$22,435,028	\$57
2009-2011 (Cohort)	55-64	\$12,588,092	\$69	\$12,891,503	\$90	\$25,479,595	\$78
	Total	\$28,471,382	\$46	\$37,834,129	\$65	\$66,305,511	\$55

APPENDIX D (continued)

TABLE XXIX

REMAINDER EVENT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder Costs	Male Remainder Costs PMPM	Female Remainder Costs	Female Remainder Costs PMPM	Total Remainder Costs	Total Remainder Costs PMPM
2009	18-24	\$209,495	\$7	\$276,368	\$9	\$485,864	\$8
2009	25-34	\$233,048	\$9	\$842,228	\$32	\$1,075,276	\$20
2009	35-44	\$538,956	\$11	\$1,252,458	\$25	\$1,791,414	\$18
2009	45-54	\$1,136,605	\$15	\$1,290,559	\$18	\$2,427,164	\$17
2009	55-64	\$1,323,108	\$23	\$1,088,491	\$25	\$2,411,599	\$24
	Total	\$3,441,212	\$15	\$4,750,104	\$21	\$8,191,316	\$18
2010	18-24	\$209,971	\$7	\$234,624	\$8	\$444,595	\$7
2010	25-34	\$265,022	\$10	\$1,133,019	\$43	\$1,398,041	\$26
2010	35-44	\$589,081	\$13	\$1,247,718	\$26	\$1,836,799	\$19
2010	45-54	\$1,267,700	\$17	\$1,658,282	\$23	\$2,925,982	\$20
2010	55-64	\$1,969,155	\$33	\$1,444,704	\$31	\$3,413,859	\$32
	Total	\$4,300,929	\$18	\$5,718,347	\$25	\$10,019,276	\$22
2011	18-24	\$515,068	\$12	\$447,727	\$11	\$962,795	\$12
2011	25-34	\$316,245	\$10	\$857,101	\$30	\$1,173,346	\$20
2011	35-44	\$826,136	\$19	\$1,343,059	\$29	\$2,169,195	\$24
2011	45-54	\$1,433,735	\$20	\$1,805,368	\$25	\$3,239,103	\$22
2011	55-64	\$2,781,866	\$44	\$2,044,403	\$41	\$4,826,269	\$43
	Total	\$5,873,050	\$23	\$6,497,659	\$27	\$12,370,708	\$25
2009-2011	18-24	\$888,290	\$9	\$877,318	\$9	\$1,765,608	\$9
2009-2011	25-34	\$798,632	\$10	\$2,538,120	\$33	\$3,336,752	\$21
2009-2011	35-44	\$1,801,891	\$14	\$3,837,229	\$28	\$5,639,120	\$21
2009-2011	45-54	\$3,653,819	\$17	\$4,651,230	\$21	\$8,305,049	\$19
2009-2011	55-64	\$6,472,558	\$32	\$5,062,213	\$32	\$11,534,771	\$32
	Total	\$13,615,191	\$19	\$16,966,110	\$25	\$30,581,300	\$22
2009-2011 (Cohort)	18-24	\$526,321	\$9	\$563,132	\$9	\$1,089,453	\$9
2009-2011 (Cohort)	25-34	\$613,568	\$10	\$2,087,542	\$35	\$2,701,110	\$22
2009-2011 (Cohort)	35-44	\$1,596,871	\$14	\$3,439,089	\$29	\$5,035,960	\$22
2009-2011 (Cohort)	45-54	\$3,302,994	\$17	\$4,270,531	\$22	\$7,573,525	\$19
2009-2011 (Cohort)	55-64	\$5,762,031	\$32	\$4,528,943	\$31	\$10,290,974	\$31
	Total	\$11,801,785	\$19	\$14,889,237	\$26	\$26,691,022	\$22

APPENDIX D (continued)

TABLE XXX

PHARMACY COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy Costs	Male Pharmacy Costs PMPM	Female Pharmacy Costs	Female Pharmacy Costs PMPM	Total Pharmacy Costs	Total Pharmacy Costs PMPM
2009	18-24	\$618,085	\$21	\$767,594	\$26	\$1,385,679	\$24
2009	25-34	\$517,850	\$20	\$1,022,079	\$39	\$1,539,929	\$29
2009	35-44	\$1,759,599	\$37	\$2,629,287	\$52	\$4,388,886	\$45
2009	45-54	\$4,442,267	\$60	\$5,451,834	\$76	\$9,894,101	\$68
2009	55-64	\$5,613,886	\$99	\$4,887,944	\$111	\$10,501,830	\$105
	Total	\$12,951,687	\$55	\$14,758,739	\$67	\$27,710,426	\$61
2010	18-24	\$521,370	\$17	\$809,588	\$26	\$1,330,958	\$22
2010	25-34	\$591,795	\$21	\$993,925	\$37	\$1,585,720	\$29
2010	35-44	\$1,747,126	\$38	\$2,427,844	\$50	\$4,174,970	\$44
2010	45-54	\$4,865,315	\$66	\$5,648,188	\$78	\$10,513,504	\$72
2010	55-64	\$6,359,883	\$105	\$5,624,573	\$119	\$11,984,456	\$111
	Total	\$14,085,489	\$59	\$15,504,118	\$69	\$29,589,607	\$64
2011	18-24	\$693,876	\$16	\$1,103,478	\$28	\$1,797,354	\$22
2011	25-34	\$651,685	\$21	\$1,093,756	\$38	\$1,745,440	\$29
2011	35-44	\$1,820,700	\$41	\$2,391,971	\$51	\$4,212,672	\$46
2011	45-54	\$4,735,227	\$65	\$5,599,264	\$77	\$10,334,490	\$71
2011	55-64	\$7,055,040	\$111	\$6,179,368	\$124	\$13,234,408	\$117
	Total	\$14,956,528	\$59	\$16,367,837	\$69	\$31,324,365	\$64
2009-2011	18-24	\$1,711,865	\$18	\$2,541,017	\$27	\$4,252,882	\$22
2009-2011	25-34	\$1,664,724	\$20	\$2,838,135	\$37	\$4,502,859	\$28
2009-2011	35-44	\$4,849,212	\$37	\$6,712,722	\$49	\$11,561,933	\$43
2009-2011	45-54	\$13,071,203	\$61	\$15,969,577	\$74	\$29,040,780	\$67
2009-2011	55-64	\$20,696,701	\$102	\$18,569,242	\$116	\$39,265,943	\$108
	Total	\$41,993,704	\$58	\$46,630,693	\$68	\$88,624,397	\$63
2009-2011 (Cohort)	18-24	\$1,196,208	\$20	\$1,715,286	\$28	\$2,911,494	\$24
2009-2011 (Cohort)	25-34	\$1,361,476	\$21	\$2,282,424	\$38	\$3,643,900	\$30
2009-2011 (Cohort)	35-44	\$4,299,801	\$38	\$6,032,771	\$51	\$10,332,572	\$44
2009-2011 (Cohort)	45-54	\$12,020,050	\$61	\$14,704,599	\$74	\$26,724,649	\$68
2009-2011 (Cohort)	55-64	\$18,559,506	\$101	\$16,683,055	\$116	\$35,242,562	\$108
	Total	\$37,437,041	\$61	\$41,418,136	\$71	\$78,855,177	\$66

APPENDIX D (continued)

TABLE XXXII

DIABETES PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Diabetes (N)	Male Diabetes Prevalence (%)	Population Female (N)	Female Diabetes (N)	Female Diabetes Prevalence (%)	Population Total (N)	Total Diabetes (N)	Total Diabetes Prevalence (%)
2009	18-24	3,293	23	0.7%	3,167	24	0.8%	6,460	47	0.7%
2009	25-34	2,483	43	1.7%	2,535	76	3.0%	5,018	119	2.4%
2009	35-44	4,367	206	4.7%	4,653	225	4.8%	9,020	431	4.8%
2009	45-54	6,558	650	9.9%	6,358	467	7.3%	12,916	1,117	8.6%
2009	55-64	5,072	861	17.0%	3,954	536	13.6%	9,026	1,397	15.5%
	Total	21,773	1,783	8.2%	20,667	1,328	6.4%	42,440	3,111	7.3%
2010	18-24	3,594	26	0.7%	3,455	26	0.8%	7,049	52	0.7%
2010	25-34	2,649	44	1.7%	2,567	78	3.0%	5,216	122	2.3%
2010	35-44	4,177	198	4.7%	4,401	205	4.7%	8,578	403	4.7%
2010	45-54	6,475	671	10.4%	6,347	533	8.4%	12,822	1,204	9.4%
2010	55-64	5,413	916	16.9%	4,214	595	14.1%	9,627	1,511	15.7%
	Total	22,308	1,855	8.3%	20,984	1,437	6.8%	43,292	3,292	7.6%
2011	18-24	4,135	43	1.0%	3,892	51	1.3%	8,027	94	1.2%
2011	25-34	2,986	46	1.5%	2,713	83	3.1%	5,699	129	2.3%
2011	35-44	4,033	192	4.8%	4,183	198	4.7%	8,216	390	4.7%
2011	45-54	6,365	642	10.1%	6,332	527	8.3%	12,697	1,169	9.2%
2011	55-64	5,670	1004	17.7%	4,442	651	14.7%	10,112	1,655	16.4%
	Total	23,189	1,927	8.3%	21,562	1,510	7.0%	44,751	3,437	7.7%
2009-2011	18-24	5,172	51	1.0%	4,868	71	1.5%	10,040	122	1.2%
2009-2011	25-34	3,520	64	1.8%	3,294	136	4.1%	6,814	200	2.9%
2009-2011	35-44	4,724	252	5.3%	4,890	306	6.3%	9,614	558	5.8%
2009-2011	45-54	7,126	842	11.8%	7,110	699	9.8%	14,236	1,541	10.8%
2009-2011	55-64	6,775	1363	20.1%	5,355	902	16.8%	12,130	2,265	18.7%
	Total	27,317	2,572	9.4%	25,517	2,114	8.3%	52,834	4,686	8.9%
2009-2011 (Cohort)	18-24	1,847	26	1.4%	1,876	36	1.9%	3,723	62	1.7%
2009-2011 (Cohort)	25-34	1,893	42	2.2%	1,762	94	5.3%	3,655	136	3.7%
2009-2011 (Cohort)	35-44	3,253	192	5.9%	3,423	242	7.1%	6,676	434	6.5%
2009-2011 (Cohort)	45-54	5,577	686	12.3%	5,618	596	10.6%	11,195	1,282	11.5%
2009-2011 (Cohort)	55-64	5,220	1085	20.8%	4,117	728	17.7%	9,337	1,813	19.4%
	Total	17,790	2,031	11.4%	16,796	1,696	10.1%	34,586	3,727	10.8%

APPENDIX D (continued)

TABLE XXXIII

HYPERTENSION PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Hyper (N)	Male Hyper Prevalence (%)	Population Female (N)	Female Hyper (N)	Female Hyper Prevalence (%)	Population Total (N)	Total Hyper (N)	Total Hyper Prevalence (%)
2009	18-24	3,293	33	1.0%	3,167	57	1.8%	6,460	90	1.4%
2009	25-34	2,483	184	7.4%	2,535	186	7.3%	5,018	370	7.4%
2009	35-44	4,367	752	17.2%	4,653	669	14.4%	9,020	1,421	15.8%
2009	45-54	6,558	1,913	29.2%	6,358	1,659	26.1%	12,916	3,572	27.7%
2009	55-64	5,072	2,392	47.2%	3,954	1,683	42.6%	9,026	4,075	45.1%
	Total	21,773	5,274	24.2%	20,667	4,254	20.6%	42,440	9,528	22.5%
2010	18-24	3,594	44	1.2%	3,455	53	1.5%	7,049	97	1.4%
2010	25-34	2,649	181	6.8%	2,567	183	7.1%	5,216	364	7.0%
2010	35-44	4,177	759	18.2%	4,401	662	15.0%	8,578	1,421	16.6%
2010	45-54	6,475	1,963	30.3%	6,347	1,729	27.2%	12,822	3,692	28.8%
2010	55-64	5,413	2,579	47.6%	4,214	1,848	43.9%	9,627	4,427	46.0%
	Total	22,308	5,526	24.8%	20,984	4,475	21.3%	43,292	10,001	23.1%
2011	18-24	4,135	89	2.2%	3,892	113	2.9%	8,027	202	2.5%
2011	25-34	2,986	198	6.6%	2,713	205	7.6%	5,699	403	7.1%
2011	35-44	4,033	685	17.0%	4,183	614	14.7%	8,216	1,299	15.8%
2011	45-54	6,365	1,950	30.6%	6,332	1,789	28.3%	12,697	3,739	29.4%
2011	55-64	5,670	2,822	49.8%	4,442	1,903	42.8%	10,112	4,725	46.7%
	Total	23,189	5,744	24.8%	21,562	4,624	21.4%	44,751	10,368	23.2%
2009-2011	18-24	5,172	119	2.3%	4,868	178	3.7%	10,040	297	3.0%
2009-2011	25-34	3,520	289	8.2%	3,294	343	10.4%	6,814	632	9.3%
2009-2011	35-44	4,724	985	20.9%	4,890	917	18.8%	9,614	1,902	19.8%
2009-2011	45-54	7,126	2,506	35.2%	7,110	2,354	33.1%	14,236	4,860	34.1%
2009-2011	55-64	6,775	3,697	54.6%	5,355	2,669	49.8%	12,130	6,366	52.5%
	Total	27,317	7,596	27.8%	25,517	6,461	25.3%	52,834	14,057	26.6%
2009-2011 (Cohort)	18-24	1,847	55	3.0%	1,876	91	4.9%	3,723	146	3.9%
2009-2011 (Cohort)	25-34	1,893	201	10.6%	1,762	236	13.4%	3,655	437	12.0%
2009-2011 (Cohort)	35-44	3,253	776	23.9%	3,423	727	21.2%	6,676	1,503	22.5%
2009-2011 (Cohort)	45-54	5,577	2,083	37.3%	5,618	1,983	35.3%	11,195	4,066	36.3%
2009-2011 (Cohort)	55-64	5,220	2,968	56.9%	4,117	2,100	51.0%	9,337	5,068	54.3%
	Total	17,790	6,083	34.2%	16,796	5,137	30.6%	34,586	11,220	32.4%

APPENDIX D (continued)

TABLE XXXIV

CORONARY ARTERY DISEASE PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male CAD (N)	Male CAD Prevalence (%)	Population Female (N)	Female CAD (N)	Female CAD Prevalence (%)	Population Total (N)	Total CAD (N)	Total CAD Prevalence (%)
2009	18-24	3,293	0	0.0%	3,167	3	0.1%	6,460	3	0.0%
2009	25-34	2,483	3	0.1%	2,535	0	0.0%	5,018	3	0.1%
2009	35-44	4,367	18	0.4%	4,653	14	0.3%	9,020	32	0.4%
2009	45-54	6,558	163	2.5%	6,358	55	0.9%	12,916	218	1.7%
2009	55-64	5,072	358	7.1%	3,954	95	2.4%	9,026	453	5.0%
	Total	21,773	542	2.5%	20,667	167	0.8%	42,440	709	1.7%
2010	18-24	3,594	0	0.0%	3,455	0	0.0%	7,049	0	0.0%
2010	25-34	2,649	4	0.2%	2,567	6	0.2%	5,216	10	0.2%
2010	35-44	4,177	18	0.4%	4,401	16	0.4%	8,578	34	0.4%
2010	45-54	6,475	152	2.3%	6,347	64	1.0%	12,822	216	1.7%
2010	55-64	5,413	377	7.0%	4,214	101	2.4%	9,627	478	5.0%
	Total	22,308	551	2.5%	20,984	187	0.9%	43,292	738	1.7%
2011	18-24	4,135	1	0.0%	3,892	0	0.0%	8,027	1	0.0%
2011	25-34	2,986	7	0.2%	2,713	1	0.0%	5,699	8	0.1%
2011	35-44	4,033	34	0.8%	4,183	10	0.2%	8,216	44	0.5%
2011	45-54	6,365	135	2.1%	6,332	52	0.8%	12,697	187	1.5%
2011	55-64	5,670	365	6.4%	4,442	105	2.4%	10,112	470	4.6%
	Total	23,189	542	2.3%	21,562	168	0.8%	44,751	710	1.6%
2009-2011	18-24	5,172	1	0.0%	4,868	1	0.0%	10,040	2	0.0%
2009-2011	25-34	3,520	11	0.3%	3,294	9	0.3%	6,814	20	0.3%
2009-2011	35-44	4,724	52	1.1%	4,890	27	0.6%	9,614	79	0.8%
2009-2011	45-54	7,126	248	3.5%	7,110	113	1.6%	14,236	361	2.5%
2009-2011	55-64	6,775	690	10.2%	5,355	223	4.2%	12,130	913	7.5%
	Total	27,317	1,002	3.7%	25,517	373	1.5%	52,834	1,375	2.6%
2009-2011 (Cohort)	18-24	1,847	1	0.1%	1,876	0	0.0%	3,723	1	0.0%
2009-2011 (Cohort)	25-34	1,893	8	0.4%	1,762	8	0.5%	3,655	16	0.4%
2009-2011 (Cohort)	35-44	3,253	40	1.2%	3,423	22	0.6%	6,676	62	0.9%
2009-2011 (Cohort)	45-54	5,577	205	3.7%	5,618	102	1.8%	11,195	307	2.7%
2009-2011 (Cohort)	55-64	5,220	577	11.1%	4,117	189	4.6%	9,337	766	8.2%
	Total	17,790	831	4.7%	16,796	321	1.9%	34,586	1,152	3.3%

APPENDIX D (continued)

TABLE XXXV

DIABETES AND HYPERTENSION PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Diabetes & Hypertension (N)	Male Diabetes & Hypertension Prevalence (%)	Population Female (N)	Female Diabetes & Hypertension (N)	Female Diabetes & Hypertension Prevalence (%)	Population Total (N)	Total Diabetes & Hypertension (N)	Total Diabetes & Hypertension Prevalence (%)
2009	18-24	3,293	2	0.1%	3,167	0	0.0%	6,460	2	0.0%
2009	25-34	2,483	17	0.7%	2,535	12	0.5%	5,018	29	0.6%
2009	35-44	4,367	88	2.0%	4,653	73	1.6%	9,020	161	1.8%
2009	45-54	6,558	312	4.8%	6,358	206	3.2%	12,916	518	4.0%
2009	55-64	5,072	515	10.2%	3,954	312	7.9%	9,026	827	9.2%
	Total	21,773	934	4.3%	20,667	603	2.9%	42,440	1,537	3.6%
2010	18-24	3,594	0	0.0%	3,455	2	0.1%	7,049	2	0.0%
2010	25-34	2,649	11	0.4%	2,567	16	0.6%	5,216	27	0.5%
2010	35-44	4,177	86	2.1%	4,401	78	1.8%	8,578	164	1.9%
2010	45-54	6,475	352	5.4%	6,347	242	3.8%	12,822	594	4.6%
2010	55-64	5,413	544	10.0%	4,214	374	8.9%	9,627	918	9.5%
	Total	22,308	993	4.5%	20,984	712	3.4%	43,292	1,705	3.9%
2011	18-24	4,135	2	0.0%	3,892	3	0.1%	8,027	5	0.1%
2011	25-34	2,986	9	0.3%	2,713	13	0.5%	5,699	22	0.4%
2011	35-44	4,033	73	1.8%	4,183	64	1.5%	8,216	137	1.7%
2011	45-54	6,365	317	5.0%	6,332	254	4.0%	12,697	571	4.5%
2011	55-64	5,670	624	11.0%	4,442	380	8.6%	10,112	1,004	9.9%
	Total	23,189	1,025	4.4%	21,562	714	3.3%	44,751	1,739	3.9%
2009-2011	18-24	5,172	11	0.2%	4,868	19	0.4%	10,040	30	0.3%
2009-2011	25-34	3,520	41	1.2%	3,294	55	1.7%	6,814	96	1.4%
2009-2011	35-44	4,724	173	3.7%	4,890	168	3.4%	9,614	341	3.5%
2009-2011	45-54	7,126	651	9.1%	7,110	518	7.3%	14,236	1,169	8.2%
2009-2011	55-64	6,775	1180	17.4%	5,355	774	14.5%	12,130	1,954	16.1%
	Total	27,317	2,056	7.5%	25,517	1,534	6.0%	52,834	3,590	6.8%
2009-2011 (Cohort)	18-24	1,847	4	0.2%	1,876	9	0.5%	3,723	13	0.3%
2009-2011 (Cohort)	25-34	1,893	32	1.7%	1,762	43	2.4%	3,655	75	2.1%
2009-2011 (Cohort)	35-44	3,253	132	4.1%	3,423	139	4.1%	6,676	271	4.1%
2009-2011 (Cohort)	45-54	5,577	530	9.5%	5,618	442	7.9%	11,195	972	8.7%
2009-2011 (Cohort)	55-64	5,220	954	18.3%	4,117	636	15.4%	9,337	1,590	17.0%
	Total	17,790	1,652	9.3%	16,796	1,269	7.6%	34,586	2,921	8.4%

APPENDIX D (continued)
TABLE XXXVI

DIABETES AND CORONARY ARTERY DISEASE PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Diabetes & CAD (N)	Male Diabetes & CAD Prevalence (%)	Population Female (N)	Female Diabetes & CAD (N)	Female Diabetes & CAD Prevalence (%)	Population Total (N)	Total Diabetes & CAD (N)	Total Diabetes & CAD Prevalence (%)
2009	18-24	3,293	0	0.0%	3,167	0	0.0%	6,460	0	0.0%
2009	25-34	2,483	1	0.0%	2,535	0	0.0%	5,018	1	0.0%
2009	35-44	4,367	4	0.1%	4,653	1	0.0%	9,020	5	0.1%
2009	45-54	6,558	36	0.5%	6,358	17	0.3%	12,916	53	0.4%
2009	55-64	5,072	115	2.3%	3,954	31	0.8%	9,026	146	1.6%
	Total	21,773	156	0.7%	20,667	49	0.2%	42,440	205	0.5%
2010	18-24	3,594	0	0.0%	3,455	0	0.0%	7,049	0	0.0%
2010	25-34	2,649	0	0.0%	2,567	1	0.0%	5,216	1	0.0%
2010	35-44	4,177	3	0.1%	4,401	5	0.1%	8,578	8	0.1%
2010	45-54	6,475	43	0.7%	6,347	24	0.4%	12,822	67	0.5%
2010	55-64	5,413	125	2.3%	4,214	38	0.9%	9,627	163	1.7%
	Total	22,308	171	0.8%	20,984	68	0.3%	43,292	239	0.6%
2011	18-24	4,135	0	0.0%	3,892	0	0.0%	8,027	0	0.0%
2011	25-34	2,986	3	0.1%	2,713	0	0.0%	5,699	3	0.1%
2011	35-44	4,033	4	0.1%	4,183	3	0.1%	8,216	7	0.1%
2011	45-54	6,365	32	0.5%	6,332	15	0.2%	12,697	47	0.4%
2011	55-64	5,670	111	2.0%	4,442	39	0.9%	10,112	150	1.5%
	Total	23,189	150	0.6%	21,562	57	0.3%	44,751	207	0.5%
2009-2011	18-24	5,172	0	0.0%	4,868	0	0.0%	10,040	0	0.0%
2009-2011	25-34	3,520	4	0.1%	3,294	1	0.0%	6,814	5	0.1%
2009-2011	35-44	4,724	6	0.1%	4,890	6	0.1%	9,614	12	0.1%
2009-2011	45-54	7,126	74	1.0%	7,110	40	0.6%	14,236	114	0.8%
2009-2011	55-64	6,775	238	3.5%	5,355	87	1.6%	12,130	325	2.7%
	Total	27,317	322	1.2%	25,517	134	0.5%	52,834	456	0.9%
2009-2011 (Cohort)	18-24	1,847	0	0.0%	1,876	0	0.0%	3,723	0	0.0%
2009-2011 (Cohort)	25-34	1,893	3	0.2%	1,762	1	0.1%	3,655	4	0.1%
2009-2011 (Cohort)	35-44	3,253	5	0.2%	3,423	4	0.1%	6,676	9	0.1%
2009-2011 (Cohort)	45-54	5,577	62	1.1%	5,618	37	0.7%	11,195	99	0.9%
2009-2011 (Cohort)	55-64	5,220	198	3.8%	4,117	75	1.8%	9,337	273	2.9%
	Total	17,790	268	1.5%	16,796	117	0.7%	34,586	385	1.1%

APPENDIX D (continued)

TABLE XXXVII

HYPERTENSION AND CORONARY ARTERY DISEASE PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Hypertension & CAD (N)	Male Hypertension & CAD Prevalence (%)	Population Female (N)	Female Hypertension & CAD (N)	Female Hypertension & CAD Prevalence (%)	Population Total (N)	Total Hypertension & CAD (N)	Total Hypertension & CAD Prevalence (%)
2009	18-24	3,293	0	0.0%	3,167	0	0.0%	6,460	0	0.0%
2009	25-34	2,483	1	0.0%	2,535	0	0.0%	5,018	1	0.0%
2009	35-44	4,367	12	0.3%	4,653	6	0.1%	9,020	18	0.2%
2009	45-54	6,558	102	1.6%	6,358	30	0.5%	12,916	132	1.0%
2009	55-64	5,072	243	4.8%	3,954	60	1.5%	9,026	303	3.4%
	Total	21,773	358	1.6%	20,667	96	0.5%	42,440	454	1.1%
2010	18-24	3,594	0	0.0%	3,455	0	0.0%	7,049	0	0.0%
2010	25-34	2,649	0	0.0%	2,567	3	0.1%	5,216	3	0.1%
2010	35-44	4,177	13	0.3%	4,401	9	0.2%	8,578	22	0.3%
2010	45-54	6,475	108	1.7%	6,347	35	0.6%	12,822	143	1.1%
2010	55-64	5,413	264	4.9%	4,214	79	1.9%	9,627	343	3.6%
	Total	22,308	385	1.7%	20,984	126	0.6%	43,292	511	1.2%
2011	18-24	4,135	0	0.0%	3,892	0	0.0%	8,027	0	0.0%
2011	25-34	2,986	4	0.1%	2,713	0	0.0%	5,699	4	0.1%
2011	35-44	4,033	23	0.6%	4,183	7	0.2%	8,216	30	0.4%
2011	45-54	6,365	93	1.5%	6,332	32	0.5%	12,697	125	1.0%
2011	55-64	5,670	255	4.5%	4,442	72	1.6%	10,112	327	3.2%
	Total	23,189	375	1.6%	21,562	111	0.5%	44,751	486	1.1%
2009-2011	18-24	5,172	0	0.0%	4,868	0	0.0%	10,040	0	0.0%
2009-2011	25-34	3,520	10	0.3%	3,294	4	0.1%	6,814	14	0.2%
2009-2011	35-44	4,724	41	0.9%	4,890	18	0.4%	9,614	59	0.6%
2009-2011	45-54	7,126	222	3.1%	7,110	96	1.4%	14,236	318	2.2%
2009-2011	55-64	6,775	633	9.3%	5,355	192	3.6%	12,130	825	6.8%
	Total	27,317	906	3.3%	25,517	310	1.2%	52,834	1,216	2.3%
2009-2011 (Cohort)	18-24	1,847	0	0.0%	1,876	0	0.0%	3,723	0	0.0%
2009-2011 (Cohort)	25-34	1,893	8	0.4%	1,762	4	0.2%	3,655	12	0.3%
2009-2011 (Cohort)	35-44	3,253	32	1.0%	3,423	13	0.4%	6,676	45	0.7%
2009-2011 (Cohort)	45-54	5,577	187	3.4%	5,618	86	1.5%	11,195	273	2.4%
2009-2011 (Cohort)	55-64	5,220	535	10.2%	4,117	166	4.0%	9,337	701	7.5%
	Total	17,790	762	4.3%	16,796	269	1.6%	34,586	1,031	3.0%

APPENDIX D (continued)

TABLE XXXVIII

DIABETES, HYPERTENSION AND CORONARY ARTERY DISEASE PREVALENCE BY AGE AND GENDER

Year(s)	Age Group	Population Male (N)	Male Diabetes, Hypertension & CAD (N)	Male Diabetes, Hypertension & CAD Prevalence (%)	Population Female (N)	Female Diabetes, Hypertension & CAD (N)	Female Diabetes, Hypertension & CAD Prevalence (%)	Population Total (N)	Total Diabetes, Hypertension & CAD (N)	Total Diabetes, Hypertension & CAD Prevalence (%)
2009	18-24	3,293	0	0.0%	3,167	0	0.0%	6,460	0	0.0%
2009	25-34	2,483	0	0.0%	2,535	0	0.0%	5,018	0	0.0%
2009	35-44	4,367	3	0.1%	4,653	1	0.0%	9,020	4	0.0%
2009	45-54	6,558	27	0.4%	6,358	13	0.2%	12,916	40	0.3%
2009	55-64	5,072	92	1.8%	3,954	23	0.6%	9,026	115	1.3%
	Total	21,773	122	0.6%	20,667	37	0.2%	42,440	159	0.4%
2010	18-24	3,594	0	0.0%	3,455	0	0.0%	7,049	0	0.0%
2010	25-34	2,649	0	0.0%	2,567	1	0.0%	5,216	1	0.0%
2010	35-44	4,177	3	0.1%	4,401	5	0.1%	8,578	8	0.1%
2010	45-54	6,475	35	0.5%	6,347	17	0.3%	12,822	52	0.4%
2010	55-64	5,413	105	1.9%	4,214	35	0.8%	9,627	140	1.5%
	Total	22,308	143	0.6%	20,984	58	0.3%	43,292	201	0.5%
2011	18-24	4,135	0	0.0%	3,892	0	0.0%	8,027	0	0.0%
2011	25-34	2,986	3	0.1%	2,713	0	0.0%	5,699	3	0.1%
2011	35-44	4,033	4	0.1%	4,183	3	0.1%	8,216	7	0.1%
2011	45-54	6,365	24	0.4%	6,332	9	0.1%	12,697	33	0.3%
2011	55-64	5,670	85	1.5%	4,442	31	0.7%	10,112	116	1.1%
	Total	23,189	116	0.5%	21,562	43	0.2%	44,751	159	0.4%
2009-2011	18-24	5,172	0	0.0%	4,868	0	0.0%	10,040	0	0.0%
2009-2011	25-34	3,520	4	0.1%	3,294	1	0.0%	6,814	5	0.1%
2009-2011	35-44	4,724	6	0.1%	4,890	6	0.1%	9,614	12	0.1%
2009-2011	45-54	7,126	73	1.0%	7,110	39	0.5%	14,236	112	0.8%
2009-2011	55-64	6,775	229	3.4%	5,355	81	1.5%	12,130	310	2.6%
	Total	27,317	312	1.1%	25,517	127	0.5%	52,834	439	0.8%
2009-2011 (Cohort)	18-24	1,847	0	0.0%	1,876	0	0.0%	3,723	0	0.0%
2009-2011 (Cohort)	25-34	1,893	3	0.2%	1,762	1	0.1%	3,655	4	0.1%
2009-2011 (Cohort)	35-44	3,253	5	0.2%	3,423	4	0.1%	6,676	9	0.1%
2009-2011 (Cohort)	45-54	5,577	61	1.1%	5,618	36	0.6%	11,195	97	0.9%
2009-2011 (Cohort)	55-64	5,220	193	3.7%	4,117	72	1.7%	9,337	265	2.8%
	Total	17,790	262	1.5%	16,796	113	0.7%	34,586	375	1.1%

APPENDIX D (continued)

TABLE XL

DIABETES INPATIENT ADMISSIONS AND LENGTH OF STAY BY AGE AND GENDER

Year(s)	Age Group	Male Admits	Male Admit Rate PTMPY	Male Average LOS (Days)	Female Admits	Female Admit Rate PTMPY	Female Average LOS (Days)	Total Admits	Total Admit Rate PTMPY	Average LOS (Days)
2009	18-24	8	400	2.5	8	376	2.1	16	388	2.3
2009	25-34	31	769	4.7	29	424	1.5	60	552	1.8
2009	35-44	41	212	3.3	106	491	4.6	147	359	4.2
2009	45-54	110	177	3.8	72	161	4.3	182	170	4.0
2009	55-64	256	313	4.0	162	322	5.5	418	317	4.5
	Total	446	264	3.9	377	300	4.6	823	279	4.2
2010	18-24	4	192	5.8	4	183	0.0	8	187	5.3
2010	25-34	0	0	2.5	11	148	4.8	11	96	2.5
2010	35-44	25	131	3.9	36	182	4.5	61	157	4.1
2010	45-54	104	160	2.6	62	119	4.2	166	142	3.6
2010	55-64	178	204	5.1	114	201	3.4	292	203	4.1
	Total	311	175	4.1	227	164	3.8	538	170	3.9
2011	18-24	4	105	5.8	4	86	0.5	8	94	3.1
2011	25-34	10	238	3.1	19	252	9.4	29	247	5.2
2011	35-44	20	110	2.8	36	188	8.6	56	150	4.8
2011	45-54	62	99	4.8	77	150	2.7	139	122	3.9
2011	55-64	158	166	6.2	121	194	5.3	279	177	5.6
	Total	254	138	5.1	257	177	4.9	511	155	5.0
2009-2011	18-24	21	220	2.4	20	21	3.4	41	175	2.9
2009-2011	25-34	29	199	16.8	77	2	3.2	106	234	6.9
2009-2011	35-44	111	178	4.5	196	251	3.8	307	218	4.1
2009-2011	45-54	360	164	3.4	346	185	4.0	706	173	3.7
2009-2011	55-64	855	244	4.1	742	319	8.6	1,597	274	6.2
	Total	1,376	210	4.2	1,381	255	6.4	2,757	230	5.3
2009-2011 (Cohort)	18-24	19	268	2.7	14	140	3.9	33	193	3.2
2009-2011 (Cohort)	25-34	24	200	19.8	52	200	4.3	76	200	9.2
2009-2011 (Cohort)	35-44	105	189	4.3	177	253	3.6	282	225	3.9
2009-2011 (Cohort)	45-54	309	153	3.3	294	169	4.3	603	160	3.8
2009-2011 (Cohort)	55-64	730	230	4.0	646	305	5.7	1,376	260	4.8
	Total	1,187	200	4.1	1,183	241	4.9	2,370	218	4.5

APPENDIX D (continued)

TABLE XLI

DIABETES EMERGENCY ROOM VISITS BY AGE AND GENDER

Year(s)	Age Group	Male ER	Male ER Rate PTMPY	Female ER	Female ER Rate PTMPY	Total ER	Total ER Rate PTMPY
2009	18-24	6	300	7	329	13	315
2009	25-34	11	273	29	424	40	368
2009	35-44	53	274	74	343	127	310
2009	45-54	102	164	103	230	205	192
2009	55-64	147	180	112	223	259	196
	Total	319	189	325	259	644	218
2010	18-24	7	336	2	91	9	211
2010	25-34	20	491	30	405	50	435
2010	35-44	45	236	107	540	152	391
2010	45-54	101	155	98	188	199	170
2010	55-64	155	178	147	259	302	210
	Total	328	185	384	278	712	226
2011	18-24	3	78	14	301	17	201
2011	25-34	9	214	26	345	35	298
2011	35-44	44	243	74	386	118	316
2011	45-54	103	164	107	208	210	184
2011	55-64	135	142	145	232	280	178
	Total	294	160	366	252	660	200
2009-2011	18-24	14	147	25	179	39	166
2009-2011	25-34	58	397	96	313	154	340
2009-2011	35-44	158	253	290	371	448	319
2009-2011	45-54	336	153	360	193	696	171
2009-2011	55-64	539	154	547	235	1,086	187
	Total	1,105	168	1,318	243	2,423	202
2009-2011 (Cohort)	18-24	12	169	14	140	26	152
2009-2011 (Cohort)	25-34	51	426	73	280	124	326
2009-2011 (Cohort)	35-44	138	248	258	369	396	316
2009-2011 (Cohort)	45-54	288	142	325	187	613	163
2009-2011 (Cohort)	55-64	471	149	471	222	942	178
	Total	960	162	1,141	232	2,101	194

APPENDIX D (continued)

TABLE XLII

DIABETES OUTPATIENT VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient	Male Outpatient Rate PTMPY	Female Outpatient	Female Outpatient Rate PTMPY	Total Outpatient	Total Outpatient Rate PTMPY
2009	18-24	20	1,000	37	1,741	57	1,382
2009	25-34	49	1,215	172	2,514	221	2,032
2009	35-44	278	1,435	682	3,159	960	2,343
2009	45-54	1,316	2,118	1,129	2,523	2,445	2,288
2009	55-64	2,476	3,031	1,818	3,614	4,294	3,253
	Total	4,139	2,446	3,838	3,056	7,977	2,706
2010	18-24	23	1,104	33	1,506	56	1,310
2010	25-34	61	1,497	173	2,335	234	2,038
2010	35-44	359	1,882	628	3,172	987	2,539
2010	45-54	1,537	2,362	1,244	2,392	2,781	2,375
2010	55-64	2,554	2,932	2,345	4,132	4,899	3,405
	Total	4,534	2,556	4,423	3,201	8,957	2,838
2011	18-24	39	1,020	65	1,398	104	1,227
2011	25-34	65	1,545	167	2,214	232	1,974
2011	35-44	249	1,373	553	2,885	802	2,150
2011	45-54	1,111	1,774	1,249	2,433	2,360	2,071
2011	55-64	2,209	2,318	2,066	3,310	4,275	2,710
	Total	3,673	1,995	4,100	2,825	7,773	2,361
2009-2011	18-24	86	901	142	1,018	228	971
2009-2011	25-34	243	1,665	638	2,078	881	1,945
2009-2011	35-44	888	1,421	1,910	2,444	2,798	1,990
2009-2011	45-54	3,918	1,780	4,295	2,300	8,213	2,018
2009-2011	55-64	8,788	2,512	7,760	3,341	16,548	2,843
	Total	13,923	2,121	14,745	2,721	28,668	2,392
2009-2011 (Cohort)	18-24	75	1,058	89	889	164	959
2009-2011 (Cohort)	25-34	210	1,754	482	1,852	692	1,821
2009-2011 (Cohort)	35-44	806	1,450	1,700	2,431	2,506	1,997
2009-2011 (Cohort)	45-54	3,217	1,592	3,960	2,275	7,177	1,908
2009-2011 (Cohort)	55-64	7,777	2,455	7,125	3,364	14,902	2,819
	Total	12,085	2,036	13,356	2,716	25,441	2,344

APPENDIX D (continued)

TABLE XLIII

DIABETES PROFESSIONAL VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Professional	Male Professional Rate PTMPY	Female Professional	Female Professional Rate PTMPY	Total Professional	Total Professional Rate PTMPY
2009	18-24	137	6,850	204	9,600	341	8,267
2009	25-34	315	7,810	877	12,819	1,192	10,961
2009	35-44	1,456	7,515	2,437	11,287	3,893	9,503
2009	45-54	5,398	8,689	4,642	10,375	10,040	9,395
2009	55-64	8,058	9,865	6,233	12,390	14,291	10,827
	Total	15,364	9,079	14,393	11,459	29,757	10,093
2010	18-24	161	7,728	126	5,749	287	6,713
2010	25-34	378	9,276	677	9,138	1,055	9,187
2010	35-44	1,490	7,811	2,154	10,879	3,644	9,374
2010	45-54	5,541	8,514	5,342	10,270	10,883	9,294
2010	55-64	9,045	10,385	6,915	12,183	15,960	11,094
	Total	16,615	9,365	15,214	11,011	31,829	10,086
2011	18-24	167	4,366	277	5,957	444	5,239
2011	25-34	232	5,513	825	10,939	1,057	8,996
2011	35-44	1,165	6,425	1,950	10,174	3,115	8,351
2011	45-54	4,975	7,945	5,092	9,919	10,067	8,835
2011	55-64	9,588	10,060	6,981	11,185	16,569	10,505
	Total	16,127	8,760	15,125	10,423	31,252	9,493
2009-2011	18-24	540	5,659	790	5,663	1,330	5,662
2009-2011	25-34	1,079	7,395	2,773	9,033	3,852	8,505
2009-2011	35-44	4,109	6,575	7,643	9,781	11,752	8,356
2009-2011	45-54	16,455	7,474	18,323	9,810	34,778	8,547
2009-2011	55-64	32,626	9,327	25,644	11,039	58,270	10,010
	Total	54,809	8,348	55,173	10,182	109,982	9,177
2009-2011 (Cohort)	18-24	439	6,190	545	5,445	984	5,754
2009-2011 (Cohort)	25-34	837	6,990	2,319	8,911	3,156	8,305
2009-2011 (Cohort)	35-44	3,642	6,553	6,835	9,776	10,477	8,349
2009-2011 (Cohort)	45-54	15,287	7,563	16,683	9,583	31,970	8,498
2009-2011 (Cohort)	55-64	29,160	9,204	22,339	10,548	51,499	9,742
	Total	49,365	8,316	48,721	9,907	98,086	9,037

APPENDIX D (continued)

TABLE XLIV

DIABETES REMAINDER EVENTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder	Male Remainder Rate PTMPY	Female Remainder	Female Remainder Rate PTMPY	Total Remainder	Total Remainder Rate PTMPY
2009	18-24	30	1,500	62	2,918	92	2,230
2009	25-34	82	2,033	202	2,952	284	2,611
2009	35-44	441	2,276	924	4,279	1,365	3,332
2009	45-54	1,389	2,236	1,268	2,834	2,657	2,486
2009	55-64	2,700	3,305	1,837	3,651	4,537	3,437
	Total	4,642	2,743	4,293	3,418	8,935	3,031
2010	18-24	55	2,640	50	2,281	105	2,456
2010	25-34	101	2,479	218	2,943	319	2,778
2010	35-44	585	3,067	870	4,394	1,455	3,743
2010	45-54	1,447	2,223	1,347	2,590	2,794	2,386
2010	55-64	2,637	3,028	1,870	3,295	4,507	3,133
	Total	4,825	2,720	4,355	3,152	9,180	2,909
2011	18-24	62	1,621	89	1,914	151	1,782
2011	25-34	101	2,400	209	2,771	310	2,638
2011	35-44	361	1,991	571	2,979	932	2,499
2011	45-54	1,372	2,191	1,472	2,868	2,844	2,496
2011	55-64	3,432	3,601	2,179	3,491	5,611	3,557
	Total	5,328	2,894	4,520	3,115	9,848	2,991
2009-2011	18-24	146	1,530	243	1,742	389	1,656
2009-2011	25-34	355	2,433	691	2,251	1,046	2,309
2009-2011	35-44	1,307	2,091	2,567	3,285	3,874	2,755
2009-2011	45-54	4,401	1,999	4,611	2,469	9,012	2,215
2009-2011	55-64	10,487	2,998	7,324	3,153	17,811	3,060
	Total	16,696	2,543	15,436	2,849	32,132	2,681
2009-2011 (Cohort)	18-24	112	1,579	158	1,579	270	1,579
2009-2011 (Cohort)	25-34	295	2,463	583	2,240	878	2,311
2009-2011 (Cohort)	35-44	1,208	2,174	2,332	3,335	3,540	2,821
2009-2011 (Cohort)	45-54	4,000	1,979	4,196	2,410	8,196	2,179
2009-2011 (Cohort)	55-64	9,372	2,958	6,616	3,124	15,988	3,025
	Total	14,987	2,525	13,885	2,823	28,872	2,660

APPENDIX D (continued)

TABLE XLV

DIABETES PHARMACY UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy	Male Pharmacy Rate PTMPY	Female Pharmacy	Female Pharmacy Rate PTMPY	Total Pharmacy	Total Pharmacy Rate PTMPY
2009	18-24	261	13,050	402	18,918	663	16,073
2009	25-34	629	15,595	1,340	19,586	1,969	18,106
2009	35-44	5,100	26,323	5,771	26,728	10,871	26,536
2009	45-54	17,576	28,291	14,386	32,153	31,962	29,908
2009	55-64	24,851	30,424	17,853	35,487	42,704	32,354
	Total	48,417	28,612	39,752	31,648	88,169	29,906
2010	18-24	281	13,488	329	15,011	610	14,269
2010	25-34	719	17,644	1,386	18,709	2,105	18,331
2010	35-44	5,152	27,009	5,184	26,182	10,336	26,588
2010	45-54	18,336	28,173	16,826	32,347	35,162	30,027
2010	55-64	27,535	31,613	21,141	37,247	48,676	33,836
	Total	52,023	29,322	44,866	32,470	96,889	30,701
2011	18-24	427	11,163	657	14,129	1,084	12,791
2011	25-34	800	19,010	1,737	23,032	2,537	21,591
2011	35-44	4,913	27,094	5,380	28,070	10,293	27,595
2011	45-54	18,835	30,080	17,365	33,828	36,200	31,768
2011	55-64	31,033	32,561	24,660	39,509	55,693	35,310
	Total	56,008	30,424	49,799	34,318	105,807	32,141
2009-2011	18-24	999	10,470	1,568	11,240	2,567	10,927
2009-2011	25-34	2,283	15,646	5,229	17,033	7,512	16,586
2009-2011	35-44	14,489	23,185	16,951	21,693	31,440	22,356
2009-2011	45-54	53,409	24,260	53,579	28,686	106,988	26,292
2009-2011	55-64	99,084	28,327	78,601	33,836	177,685	30,525
	Total	170,264	25,932	155,928	28,776	326,192	27,218
2009-2011 (Cohort)	18-24	772	10,886	1,041	10,401	1,813	10,602
2009-2011 (Cohort)	25-34	1,978	16,518	4,388	16,861	6,366	16,753
2009-2011 (Cohort)	35-44	13,108	23,586	15,093	21,587	28,201	22,472
2009-2011 (Cohort)	45-54	49,271	24,378	49,896	28,662	99,167	26,360
2009-2011 (Cohort)	55-64	88,974	28,082	71,539	33,781	160,513	30,365
	Total	154,103	25,961	141,957	28,864	296,060	27,277

APPENDIX D (continued)

TABLE XLVI

HYPERTENSION INPATIENT ADMISSIONS AND LENGTH OF STAY BY AGE AND GENDER

Year(s)	Age Group	Male Admits	Male Admit Rate PTMPY	Male Average LOS (Days)	Female Admits	Female Admit Rate PTMPY	Female Average LOS (Days)	Total Admits	Total Admit Rate PTMPY	Average LOS (Days)
2009	18-24	2	70	5.5	4	83	2.8	6	78	3.7
2009	25-34	20	119	2.3	30	177	3.5	50	148	3.0
2009	35-44	64	92	3.4	110	177	2.8	174	132	3.0
2009	45-54	279	152	3.5	212	134	2.8	491	144	3.2
2009	55-64	498	219	3.6	376	238	4.6	874	227	4.0
	Total	863	173	3.5	732	183	3.7	1,595	177	3.6
2010	18-24	2	51	4.5	5	110	5.4	7	83	5.1
2010	25-34	16	93	14.4	25	147	3.5	41	120	7.8
2010	35-44	68	93	3.9	64	100	3.9	132	96	3.9
2010	45-54	223	117	4.1	176	104	4.6	399	111	4.3
2010	55-64	402	164	3.5	289	165	4.5	691	164	3.9
	Total	711	134	4.0	559	130	4.4	1,270	132	4.2
2011	18-24	2	26	3.5	5	47	1.0	7	38	1.7
2011	25-34	10	54	2.1	29	151	4.2	39	104	3.7
2011	35-44	54	83	4.6	68	115	3.2	122	98	3.8
2011	45-54	143	75	2.6	156	90	4.7	299	82	3.7
2011	55-64	334	125	4.1	203	112	5.1	537	120	4.5
	Total	543	99	3.7	461	104	4.6	1,004	101	4.1
2009-2011	18-24	22	105	5.0	55	161	8.8	77	140	7.7
2009-2011	25-34	75	111	8.1	213	266	4.3	288	195	5.3
2009-2011	35-44	283	114	3.6	455	196	4.6	738	154	4.2
2009-2011	45-54	964	145	3.2	1,004	161	4.5	1,968	153	3.9
2009-2011	55-64	2,005	211	3.8	1,701	251	6.0	3,706	228	4.8
	Total	3,349	172	3.7	3,428	208	5.3	6,777	188	4.5
2009-2011 (Cohort)	18-24	14	95	3.3	35	140	10.5	49	123	8.4
2009-2011 (Cohort)	25-34	68	119	8.6	165	248	4.4	233	188	5.6
2009-2011 (Cohort)	35-44	247	110	3.2	418	199	4.6	665	153	4.1
2009-2011 (Cohort)	45-54	848	138	3.1	868	149	4.7	1,716	144	3.9
2009-2011 (Cohort)	55-64	1,752	202	3.6	1,450	237	4.8	3,202	217	4.1
	Total	2,929	165	3.6	2,936	196	4.8	5,865	179	4.2

APPENDIX D (continued)

TABLE XLVII

HYPERTENSION EMERGENCY ROOM VISITS BY AGE AND GENDER

Year(s)	Age Group	Male ER	Male ER Rate PTMPY	Female ER	Female ER Rate PTMPY	Total ER	Total ER Rate PTMPY
2009	18-24	6	211	18	374	24	314
2009	25-34	45	267	52	307	97	287
2009	35-44	137	197	154	248	291	221
2009	45-54	260	142	265	168	525	154
2009	55-64	300	132	274	173	574	149
	Total	748	150	763	191	1,511	168
2010	18-24	5	128	9	199	14	166
2010	25-34	59	344	52	305	111	325
2010	35-44	157	215	194	303	351	256
2010	45-54	241	126	268	159	509	142
2010	55-64	360	146	325	186	685	163
	Total	822	155	848	198	1,670	174
2011	18-24	19	245	9	85	28	153
2011	25-34	39	212	45	235	84	223
2011	35-44	139	213	190	321	329	264
2011	45-54	287	151	283	163	570	157
2011	55-64	346	129	304	168	650	145
	Total	830	151	831	187	1,661	167
2009-2011	18-24	66	316	134	392	200	363
2009-2011	25-34	214	318	372	464	586	397
2009-2011	35-44	599	242	844	363	1,443	301
2009-2011	45-54	1,200	181	1,294	207	2,494	194
2009-2011	55-64	1,395	147	1,359	201	2,754	169
	Total	3,474	178	4,003	243	7,477	208
2009-2011 (Cohort)	18-24	36	244	89	357	125	315
2009-2011 (Cohort)	25-34	181	317	298	447	479	387
2009-2011 (Cohort)	35-44	513	229	716	340	1,229	283
2009-2011 (Cohort)	45-54	1,077	176	1,161	200	2,238	187
2009-2011 (Cohort)	55-64	1,250	144	1,204	197	2,454	166
	Total	3,057	172	3,468	232	6,525	200

APPENDIX D (continued)

TABLE XLVIII

HYPERTENSION OUTPATIENT VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient	Male Outpatient Rate PTMPY	Female Outpatient	Female Outpatient Rate PTMPY	Total Outpatient	Total Outpatient Rate PTMPY
2009	18-24	21	739	48	998	69	902
2009	25-34	167	992	215	1,268	382	1,130
2009	35-44	746	1,072	926	1,493	1,672	1,270
2009	45-54	2,452	1,338	2,446	1,548	4,898	1,435
2009	55-64	5,038	2,220	3,572	2,261	8,610	2,237
	Total	8,424	1,687	7,207	1,803	15,631	1,738
2010	18-24	10	255	20	441	30	355
2010	25-34	161	938	239	1,404	400	1,170
2010	35-44	930	1,274	1,124	1,757	2,054	1,499
2010	45-54	2,994	1,567	2,876	1,706	5,870	1,632
2010	55-64	5,357	2,180	4,005	2,292	9,362	2,226
	Total	9,452	1,780	8,264	1,927	17,716	1,846
2011	18-24	41	528	73	692	114	622
2011	25-34	193	1,048	362	1,887	555	1,476
2011	35-44	706	1,081	899	1,519	1,605	1,289
2011	45-54	2,363	1,243	2,839	1,630	5,202	1,428
2011	55-64	5,249	1,960	4,487	2,475	9,736	2,168
	Total	8,552	1,557	8,660	1,949	17,212	1,732
2009-2011	18-24	494	2,366	640	1,873	1,134	2,060
2009-2011	25-34	911	1,354	2,232	2,783	3,143	2,131
2009-2011	35-44	3,378	1,366	5,391	2,317	8,769	1,827
2009-2011	45-54	10,416	1,572	14,014	2,241	24,430	1,897
2009-2011	55-64	21,609	2,275	19,290	2,848	40,899	2,513
	Total	36,808	1,889	41,567	2,520	78,375	2,178
2009-2011 (Cohort)	18-24	411	2,785	420	1,685	831	2,094
2009-2011 (Cohort)	25-34	803	1,407	1,819	2,729	2,622	2,119
2009-2011 (Cohort)	35-44	2,949	1,314	4,741	2,254	7,690	1,769
2009-2011 (Cohort)	45-54	9,209	1,502	12,841	2,207	22,050	1,845
2009-2011 (Cohort)	55-64	18,996	2,192	17,311	2,835	36,307	2,458
	Total	32,368	1,823	37,132	2,484	69,500	2,125

APPENDIX D (continued)

TABLE XLIX

HYPERTENSION PROFESSIONAL VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Professional	Male Professional Rate PTMPY	Female Professional	Female Professional Rate PTMPY	Total Professional	Total Professional Rate PTMPY
2009	18-24	100	3,519	121	2,516	221	2,889
2009	25-34	760	4,515	785	4,629	1,545	4,572
2009	35-44	3,757	5,397	4,000	6,448	7,757	5,892
2009	45-54	11,641	6,352	11,148	7,056	22,789	6,678
2009	55-64	16,885	7,442	13,224	8,372	30,109	7,824
	Total	33,143	6,636	29,278	7,324	62,421	6,942
2010	18-24	69	1,762	148	3,265	217	2,568
2010	25-34	894	5,210	923	5,421	1,817	5,315
2010	35-44	4,035	5,526	4,013	6,273	8,048	5,875
2010	45-54	12,216	6,394	11,652	6,912	23,868	6,637
2010	55-64	18,367	7,474	15,014	8,593	33,381	7,939
	Total	35,581	6,702	31,750	7,404	67,331	7,015
2011	18-24	205	2,639	193	1,829	398	2,173
2011	25-34	801	4,351	895	4,666	1,696	4,512
2011	35-44	3,199	4,898	3,564	6,021	6,763	5,432
2011	45-54	10,959	5,766	10,687	6,137	21,646	5,943
2011	55-64	19,488	7,279	14,224	7,846	33,712	7,508
	Total	34,652	6,308	29,563	6,653	64,215	6,463
2009-2011	18-24	1,074	5,143	2,231	6,528	3,305	6,003
2009-2011	25-34	4,378	6,506	7,758	9,674	12,136	8,229
2009-2011	35-44	15,785	6,382	23,474	10,088	39,259	8,178
2009-2011	45-54	48,382	7,302	60,605	9,692	108,987	8,463
2009-2011	55-64	82,299	8,663	71,622	10,575	153,921	9,459
	Total	151,918	7,798	165,690	10,044	317,608	8,828
2009-2011 (Cohort)	18-24	689	4,669	1,575	6,319	2,264	5,705
2009-2011 (Cohort)	25-34	3,725	6,528	6,577	9,866	10,302	8,327
2009-2011 (Cohort)	35-44	14,189	6,322	20,955	9,962	35,144	8,083
2009-2011 (Cohort)	45-54	44,974	7,334	55,922	9,610	100,896	8,442
2009-2011 (Cohort)	55-64	73,714	8,507	64,136	10,502	137,850	9,332
	Total	137,291	7,731	149,165	9,981	286,456	8,759

APPENDIX D (continued)

TABLE L

HYPERTENSION REMAINDER EVENTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder	Male Remainder Rate PTMPY	Female Remainder	Female Remainder Rate PTMPY	Total Remainder	Total Remainder Rate PTMPY
2009	18-24	41	1,443	23	478	64	837
2009	25-34	162	962	154	908	316	935
2009	35-44	774	1,112	1,236	1,992	2,010	1,527
2009	45-54	2,635	1,438	2,477	1,568	5,112	1,498
2009	55-64	4,965	2,188	3,565	2,257	8,530	2,216
	Total	8,577	1,717	7,455	1,865	16,032	1,783
2010	18-24	13	332	44	971	57	675
2010	25-34	181	1,055	194	1,140	375	1,097
2010	35-44	939	1,286	1,306	2,041	2,245	1,639
2010	45-54	2,664	1,394	2,681	1,590	5,345	1,486
2010	55-64	5,572	2,267	3,967	2,270	9,539	2,269
	Total	9,369	1,765	8,192	1,910	17,561	1,830
2011	18-24	38	489	29	275	67	366
2011	25-34	108	587	177	923	285	758
2011	35-44	706	1,081	895	1,512	1,601	1,286
2011	45-54	2,547	1,340	2,841	1,631	5,388	1,479
2011	55-64	6,143	2,294	4,097	2,260	10,240	2,280
	Total	9,542	1,737	8,039	1,809	17,581	1,769
2009-2011	18-24	329	1,575	561	1,642	890	1,616
2009-2011	25-34	697	1,036	1,648	2,055	2,345	1,590
2009-2011	35-44	3,262	1,319	5,883	2,528	9,145	1,905
2009-2011	45-54	10,461	1,579	12,918	2,066	23,379	1,815
2009-2011	55-64	23,488	2,472	18,370	2,712	41,858	2,572
	Total	38,237	1,963	39,380	2,387	77,617	2,157
2009-2011 (Cohort)	18-24	250	1,694	409	1,641	659	1,661
2009-2011 (Cohort)	25-34	614	1,076	1,396	2,094	2,010	1,625
2009-2011 (Cohort)	35-44	2,942	1,311	5,411	2,572	8,353	1,921
2009-2011 (Cohort)	45-54	9,556	1,558	11,888	2,043	21,444	1,794
2009-2011 (Cohort)	55-64	21,021	2,426	16,356	2,678	37,377	2,530
	Total	34,383	1,936	35,460	2,373	69,843	2,136

APPENDIX D (continued)

TABLE LI

HYPERTENSION PHARMACY UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy	Male Pharmacy Rate PTMPY	Female Pharmacy	Female Pharmacy Rate PTMPY	Total Pharmacy	Total Pharmacy Rate PTMPY
2009	18-24	129	4,540	199	4,139	328	4,288
2009	25-34	1,681	9,986	1,545	9,111	3,226	9,547
2009	35-44	8,729	12,539	8,670	13,976	17,399	13,216
2009	45-54	27,889	15,217	24,660	15,608	52,549	15,398
2009	55-64	38,512	16,974	29,859	18,903	68,371	17,766
	Total	76,940	15,405	64,933	16,243	141,873	15,777
2010	18-24	88	2,247	214	4,721	302	3,574
2010	25-34	1,857	10,823	1,657	9,733	3,514	10,280
2010	35-44	9,592	13,137	9,055	14,154	18,647	13,612
2010	45-54	29,835	15,615	27,613	16,380	57,448	15,974
2010	55-64	43,556	17,723	36,068	20,642	79,624	18,936
	Total	84,928	15,996	74,607	17,397	159,535	16,622
2011	18-24	296	3,811	371	3,517	667	3,641
2011	25-34	1,788	9,713	1,735	9,044	3,523	9,372
2011	35-44	9,057	13,866	8,591	14,514	17,648	14,174
2011	45-54	30,492	16,043	28,540	16,389	59,032	16,208
2011	55-64	48,891	18,261	38,514	21,245	87,405	19,466
	Total	90,524	16,480	77,751	17,498	168,275	16,935
2009-2011	18-24	2,018	9,663	4,184	12,243	6,202	11,264
2009-2011	25-34	9,580	14,237	14,492	18,072	24,072	16,322
2009-2011	35-44	42,098	17,020	49,906	21,448	92,004	19,166
2009-2011	45-54	123,848	18,692	141,520	22,633	265,368	20,605
2009-2011	55-64	207,026	21,792	179,250	26,465	386,276	23,737
	Total	384,570	19,741	389,352	23,602	773,922	21,511
2009-2011 (Cohort)	18-24	1,233	8,355	2,893	11,607	4,126	10,397
2009-2011 (Cohort)	25-34	8,042	14,094	11,804	17,706	19,846	16,040
2009-2011 (Cohort)	35-44	38,014	16,938	45,076	21,429	83,090	19,111
2009-2011 (Cohort)	45-54	113,848	18,565	129,960	22,334	243,808	20,400
2009-2011 (Cohort)	55-64	185,907	21,456	159,950	26,191	345,857	23,413
	Total	347,044	19,541	349,683	23,397	696,727	21,303

APPENDIX D (continued)

TABLE LII

CORONARY ARTERY DISEASE INPATIENT UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Admits	Male Admit Rate PTMPY	Male Average LOS (Days)	Female Admits	Female Admit Rate PTMPY	Female Average LOS (Days)	Total Admits	Total Admit Rate PTMPY	Average LOS (Days)
2009	18-24	0	0	0.0	1	429	1.0	1	429	1.0
2009	25-34	3	1,286	2.7	0	0	0.0	3	1,286	2.7
2009	35-44	11	641	5.8	11	786	2.9	22	706	4.4
2009	45-54	81	511	2.4	47	887	2.4	128	605	2.4
2009	55-64	254	748	4.5	105	1,160	7.7	359	835	5.4
	Total	349	675	4.0	164	1,026	5.8	513	758	4.6
2010	18-24	0	0	0.0	0	0	0.0	0	0	0.0
2010	25-34	1	250	2.0	4	667	3.5	5	500	3.2
2010	35-44	14	862	2.4	8	505	5.3	22	686	3.4
2010	45-54	70	474	3.3	31	485	1.7	101	477	2.8
2010	55-64	166	457	3.3	89	911	5.3	255	554	3.9
	Total	251	473	3.2	132	720	4.3	383	536	3.6
2011	18-24	3	3,000	1.0	0	0	0.0	3	3,000	1.0
2011	25-34	7	1,292	2.1	0	0	0.0	7	1,091	2.1
2011	35-44	15	450	2.0	8	800	7.0	23	531	3.7
2011	45-54	56	422	2.9	28	554	4.2	84	458	3.3
2011	55-64	148	422	4.3	59	592	5.1	207	460	4.5
	Total	227	434	3.7	95	589	5.0	324	473	4.1
2009-2011	18-24	3	1,000	0.3	0	0	0.0	3	655	0.3
2009-2011	25-34	9	374	2.1	6	255	3.8	15	315	2.8
2009-2011	35-44	64	482	3.5	38	518	3.5	102	494	3.5
2009-2011	45-54	316	479	3.3	173	553	3.5	489	503	3.4
2009-2011	55-64	903	500	3.8	619	1,050	9.4	1,522	635	6.1
	Total	1,295	493	3.7	836	835	7.8	2,131	588	5.3
2009-2011 (Cohort)	18-24	3	1,000	0.3	0	0	0.0	3	1,000	0.3
2009-2011 (Cohort)	25-34	5	219	1.0	5	224	4.2	10	221	2.6
2009-2011 (Cohort)	35-44	57	489	2.2	30	461	2.7	87	479	2.4
2009-2011 (Cohort)	45-54	258	428	3.3	153	517	3.5	411	457	3.4
2009-2011 (Cohort)	55-64	764	457	3.5	564	1,030	6.0	1,328	598	4.5
	Total	1,087	450	3.3	752	808	5.3	1,839	549	4.2

APPENDIX D (continued)

TABLE LIII

CORONARY ARTERY DISEASE EMERGENCY ROOM UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male ER	Male ER Rate PTMPY	Female ER	Female ER Rate PTMPY	Total ER	Total ER Rate PTMPY
2009	18-24	0	0	12	5,143	12	5,143
2009	25-34	2	857	0	0	2	857
2009	35-44	13	757	7	500	20	642
2009	45-54	60	379	40	755	100	473
2009	55-64	91	268	50	552	141	328
	Total	166	321	109	682	275	406
2010	18-24	0	0	0	0	0	0
2010	25-34	4	1,000	7	1,167	11	1,100
2010	35-44	10	615	17	1,074	27	842
2010	45-54	49	332	33	516	82	387
2010	55-64	93	256	67	686	160	347
	Total	156	294	124	676	280	392
2011	18-24	0	0	0	0	0	0
2011	25-34	6	1,108	1	1,000	7	1,091
2011	35-44	31	930	17	1,700	48	1,108
2011	45-54	80	603	28	554	108	589
2011	55-64	119	339	34	341	153	340
	Total	236	451	80	496	316	462
2009-2011	18-24	1	333	21	13,263	22	4,800
2009-2011	25-34	15	623	20	851	35	736
2009-2011	35-44	81	609	52	708	133	645
2009-2011	45-54	246	373	152	486	398	409
2009-2011	55-64	424	235	255	432	679	283
	Total	767	292	500	500	1,267	349
2009-2011 (Cohort)	18-24	1	333	0	0	1	333
2009-2011 (Cohort)	25-34	12	526	19	851	31	686
2009-2011 (Cohort)	35-44	63	540	39	599	102	561
2009-2011 (Cohort)	45-54	209	347	145	490	354	394
2009-2011 (Cohort)	55-64	375	224	229	418	604	272
	Total	660	273	432	464	1,092	326

APPENDIX D (continued)

TABLE LIV

CORONARY ARTERY DISEASE OUTPATIENT UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient	Male Outpatient Rate PTMPY	Female Outpatient	Female Outpatient Rate PTMPY	Total Outpatient	Total Outpatient Rate PTMPY
2009	18-24	0	0	11	4,714	11	4,714
2009	25-34	3	1,286	0	0	3	1,286
2009	35-44	44	2,563	65	4,643	109	3,497
2009	45-54	607	3,832	332	6,264	939	4,441
2009	55-64	2,115	6,231	953	10,530	3,068	7,136
	Total	2,769	5,352	1,361	8,515	4,130	6,099
2010	18-24	0	0	0	0	0	0
2010	25-34	7	1,750	15	2,500	22	2,200
2010	35-44	53	3,262	126	7,958	179	5,579
2010	45-54	842	5,699	214	3,348	1,056	4,989
2010	55-64	1,838	5,063	500	5,119	2,338	5,075
	Total	2,740	5,160	855	4,662	3,595	5,032
2011	18-24	0	0	0	0	0	0
2011	25-34	23	4,246	1	1,000	24	3,740
2011	35-44	124	3,720	53	5,300	177	4,085
2011	45-54	670	5,050	242	4,784	912	4,977
2011	55-64	1,743	4,968	739	7,421	2,482	5,510
	Total	2,560	4,892	1,035	6,422	3,595	5,253
2009-2011	18-24	2	667	13	8,211	15	3,273
2009-2011	25-34	38	1,578	58	2,468	96	2,018
2009-2011	35-44	341	2,566	292	3,977	633	3,068
2009-2011	45-54	2,552	3,870	1,219	3,900	3,771	3,880
2009-2011	55-64	7,722	4,274	3,822	6,482	11,544	4,817
	Total	10,655	4,057	5,404	5,400	16,059	4,428
2009-2011 (Cohort)	18-24	2	667	0	0	2	667
2009-2011 (Cohort)	25-34	31	1,358	53	2,373	84	1,860
2009-2011 (Cohort)	35-44	288	2,469	214	3,288	502	2,762
2009-2011 (Cohort)	45-54	1,968	3,267	1,151	3,886	3,119	3,471
2009-2011 (Cohort)	55-64	6,538	3,910	3,605	6,584	10,143	4,570
	Total	8,827	3,652	5,023	5,395	13,850	4,137

APPENDIX D (continued)

TABLE LV

CORONARY ARTERY DISEASE PROFESSIONAL VISITS BY AGE AND GENDER

Year(s)	Age Group	Male Professional	Male Professional Rate PTMPY	Female Professional	Female Professional Rate PTMPY	Total Professional	Total Professional Rate PTMPY
2009	18-24	0	0	23	9,857	23	9,857
2009	25-34	21	9,000	0	0	21	9,000
2009	35-44	188	10,951	234	16,714	422	13,540
2009	45-54	1,903	12,013	973	18,358	2,876	13,603
2009	55-64	4,411	12,996	1,517	16,762	5,928	13,789
	Total	6,523	12,609	2,747	17,187	9,270	13,689
2010	18-24	0	0	0	0	0	0
2010	25-34	17	4,250	92	15,333	109	10,900
2010	35-44	156	9,600	222	14,021	378	11,782
2010	45-54	1,782	12,061	1,063	16,631	2,845	13,441
2010	55-64	4,812	13,256	1,503	15,389	6,315	13,708
	Total	6,767	12,744	2,880	15,702	9,647	13,503
2011	18-24	3	3,000	0	0	3	3,000
2011	25-34	65	12,000	5	5,000	70	10,909
2011	35-44	317	9,510	156	15,600	473	10,915
2011	45-54	1,462	11,020	588	11,624	2,050	11,187
2011	55-64	4,002	11,407	1,356	13,617	5,358	11,896
	Total	5,849	11,178	2,105	13,061	7,954	11,622
2009-2011	18-24	11	3,667	20	12,632	31	6,764
2009-2011	25-34	143	5,938	329	14,000	472	9,919
2009-2011	35-44	1,192	8,968	868	11,823	2,060	9,984
2009-2011	45-54	6,374	9,666	4,396	14,063	10,770	11,080
2009-2011	55-64	20,511	11,353	8,049	13,650	28,560	11,918
	Total	28,231	10,750	13,662	13,652	41,893	11,551
2009-2011 (Cohort)	18-24	11	3,667	0	0	11	3,667
2009-2011 (Cohort)	25-34	111	4,861	315	14,104	426	9,432
2009-2011 (Cohort)	35-44	1,048	8,983	678	10,417	1,726	9,497
2009-2011 (Cohort)	45-54	5,850	9,712	4,252	14,357	10,102	11,243
2009-2011 (Cohort)	55-64	18,593	11,120	7,518	13,732	26,111	11,764
	Total	25,613	10,598	12,763	13,708	38,376	11,463

APPENDIX D (continued)

TABLE LVI

CORONARY ARTERY DISEASE REMAINDER UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Remainder	Male Remainder Rate PTMPY	Female Remainder	Female Remainder Rate PTMPY	Total Remainder	Total Remainder Rate PTMPY
2009	18-24	0	0	4	1,714	4	1,714
2009	25-34	5	2,143	0	0	5	2,143
2009	35-44	54	3,146	35	2,500	89	2,856
2009	45-54	514	3,245	172	3,245	686	3,245
2009	55-64	1,588	4,679	564	6,232	2,152	5,006
	Total	2,161	4,177	775	4,849	2,936	4,336
2010	18-24	0	0	0	0	0	0
2010	25-34	3	750	13	2,167	16	1,600
2010	35-44	19	1,169	358	22,611	377	11,751
2010	45-54	466	3,154	188	2,941	654	3,090
2010	55-64	1,758	4,843	534	5,468	2,292	4,975
	Total	2,246	4,230	1,093	5,959	3,339	4,674
2011	18-24	1	1,000	0	0	1	1,000
2011	25-34	1	185	1	1,000	2	312
2011	35-44	82	2,460	31	3,100	113	2,608
2011	45-54	296	2,231	217	4,290	513	2,799
2011	55-64	1,356	3,865	485	4,870	1,841	4,087
	Total	1,736	3,318	734	4,554	2,470	3,609
2009-2011	18-24	2	667	7	4,421	9	1,964
2009-2011	25-34	9	374	37	1,574	46	967
2009-2011	35-44	222	1,670	781	10,638	1,003	4,861
2009-2011	45-54	1,583	2,401	1,006	3,218	2,589	2,664
2009-2011	55-64	6,875	3,805	2,795	4,740	9,670	4,035
	Total	8,691	3,309	4,626	4,623	13,317	3,672
2009-2011 (Cohort)	18-24	2	667	0	0	2	667
2009-2011 (Cohort)	25-34	8	350	36	1,612	44	974
2009-2011 (Cohort)	35-44	187	1,603	758	11,647	945	5,199
2009-2011 (Cohort)	45-54	1,381	2,293	974	3,289	2,355	2,621
2009-2011 (Cohort)	55-64	6,081	3,637	2,502	4,570	8,583	3,867
	Total	7,659	3,169	4,270	4,586	11,929	3,563

APPENDIX D (continued)

TABLE LVII

CORONARY ARTERY DISEASE PHARMACY UTILIZATION BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy	Male Pharmacy Rate PTMPY	Female Pharmacy	Female Pharmacy Rate PTMPY	Total Pharmacy	Total Pharmacy Rate PTMPY
2009	18-24	0	0	22	9,429	22	9,429
2009	25-34	555	237,857	0	0	555	237,857
2009	35-44	650	37,864	324	23,143	974	31,251
2009	45-54	4,751	29,991	2,048	38,642	6,799	32,159
2009	55-64	10,857	31,987	3,535	39,061	14,392	33,476
	Total	16,813	32,499	5,929	37,095	22,742	33,584
2010	18-24	0	0	0	0	0	0
2010	25-34	57	14,250	137	22,833	194	19,400
2010	35-44	473	29,108	650	41,053	1,123	35,003
2010	45-54	4,726	31,986	2,429	38,003	7,155	33,803
2010	55-64	12,009	33,083	4,145	42,440	16,154	35,067
	Total	17,265	32,514	7,361	40,133	24,626	34,470
2011	18-24	4	4,000	0	0	4	4,000
2011	25-34	89	16,431	14	14,000	103	16,052
2011	35-44	1,101	33,030	418	41,800	1,519	35,054
2011	45-54	4,682	35,291	2,098	41,476	6,780	36,999
2011	55-64	11,569	32,976	4,521	45,399	16,090	35,722
	Total	17,445	33,340	7,051	43,750	24,496	35,791
2009-2011	18-24	5	1,667	12	7,579	17	3,709
2009-2011	25-34	299	12,415	565	24,043	864	18,158
2009-2011	35-44	3,513	26,430	1,792	24,409	5,305	25,711
2009-2011	45-54	18,861	28,603	11,830	37,846	30,691	31,575
2009-2011	55-64	51,968	28,765	22,634	38,384	74,602	31,132
	Total	74,646	28,425	36,833	36,805	111,479	30,737
2009-2011 (Cohort)	18-24	5	1,667	0	0	5	1,667
2009-2011 (Cohort)	25-34	274	12,000	461	20,642	735	16,273
2009-2011 (Cohort)	35-44	3,007	25,774	1,532	23,539	4,539	24,974
2009-2011 (Cohort)	45-54	17,152	28,476	11,283	38,097	28,435	31,647
2009-2011 (Cohort)	55-64	47,797	28,587	21,314	38,930	69,111	31,138
	Total	68,235	28,233	34,590	37,150	102,825	30,713

APPENDIX D (continued)

TABLE LIX

DIABETES TOTAL COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Total Costs	Male Total Costs PMPM	Female Total Costs	Female Total Costs PMPM	Total Costs	Total Costs PMPM
2009	18-24	\$98,006	\$408	\$103,971	\$408	\$201,977	\$408
2009	25-34	\$219,539	\$454	\$466,486	\$568	\$686,025	\$526
2009	35-44	\$1,149,915	\$495	\$2,477,782	\$956	\$3,627,697	\$738
2009	45-54	\$4,313,670	\$579	\$3,415,597	\$636	\$7,729,267	\$603
2009	55-64	\$9,159,346	\$934	\$4,116,754	\$682	\$13,276,100	\$838
	Total	\$14,940,477	\$736	\$10,580,589	\$702	\$25,521,065	\$721
2010	18-24	\$188,723	\$755	\$79,928	\$304	\$268,651	\$524
2010	25-34	\$215,787	\$441	\$329,786	\$371	\$545,573	\$396
2010	35-44	\$1,865,689	\$815	\$1,680,877	\$707	\$3,546,565	\$760
2010	45-54	\$5,424,437	\$695	\$4,128,705	\$661	\$9,553,142	\$680
2010	55-64	\$9,382,985	\$898	\$5,654,475	\$830	\$15,037,460	\$871
	Total	\$17,077,620	\$802	\$11,873,771	\$716	\$28,951,391	\$764
2011	18-24	\$209,434	\$456	\$180,727	\$324	\$390,162	\$384
2011	25-34	\$604,959	\$1,198	\$484,909	\$536	\$1,089,869	\$773
2011	35-44	\$1,140,066	\$524	\$2,327,412	\$1,012	\$3,467,478	\$775
2011	45-54	\$5,974,609	\$795	\$4,783,126	\$776	\$10,757,735	\$787
2011	55-64	\$10,597,671	\$927	\$7,765,606	\$1,037	\$18,363,277	\$970
	Total	\$18,526,740	\$839	\$15,541,780	\$893	\$34,068,520	\$862
2009-2011	18-24	\$503,297	\$440	\$428,386	\$256	\$931,683	\$331
2009-2011	25-34	\$1,411,682	\$806	\$1,665,166	\$452	\$3,076,848	\$566
2009-2011	35-44	\$4,289,459	\$572	\$6,388,519	\$681	\$10,677,979	\$633
2009-2011	45-54	\$15,742,153	\$596	\$14,853,631	\$663	\$30,595,784	\$627
2009-2011	55-64	\$33,968,149	\$809	\$23,212,803	\$833	\$57,180,952	\$819
	Total	\$55,914,740	\$710	\$46,548,505	\$716	\$102,463,245	\$712
2009-2011 (Cohort)	18-24	\$449,963	\$529	\$293,754	\$245	\$743,717	\$362
2009-2011 (Cohort)	25-34	\$1,291,692	\$899	\$1,381,851	\$442	\$2,673,544	\$586
2009-2011 (Cohort)	35-44	\$4,005,080	\$601	\$5,713,815	\$681	\$9,718,895	\$645
2009-2011 (Cohort)	45-54	\$13,846,700	\$571	\$13,412,733	\$642	\$27,259,433	\$604
2009-2011 (Cohort)	55-64	\$29,445,596	\$774	\$20,706,424	\$815	\$50,152,020	\$791
	Total	\$49,039,032	\$688	\$41,508,577	\$703	\$90,547,609	\$695

APPENDIX D (continued)

TABLE LX

DIABETES INPATIENT ADMISSION COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Inpatient Costs	Male Inpatient Costs PMPM	Female Inpatient Costs	Female Inpatient Costs PMPM	Total Inpatient Costs	Total Inpatient Costs PMPM
2009	18-24	\$15,603	\$65	\$40,856	\$160	\$56,459	\$114
2009	25-34	\$59,062	\$122	\$132,317	\$161	\$191,379	\$147
2009	35-44	\$257,082	\$111	\$893,905	\$345	\$1,150,987	\$234
2009	45-54	\$1,147,046	\$154	\$524,428	\$98	\$1,671,474	\$130
2009	55-64	\$3,293,608	\$336	\$1,589,450	\$263	\$4,883,058	\$308
	Total	\$4,772,401	\$235	\$3,180,956	\$211	\$7,953,357	\$225
2010	18-24	\$77,194	\$309	\$29,181	\$111	\$106,375	\$207
2010	25-34	\$0	\$0	\$67,872	\$76	\$67,872	\$49
2010	35-44	\$796,597	\$348	\$408,988	\$172	\$1,205,585	\$258
2010	45-54	\$1,560,756	\$200	\$1,041,102	\$167	\$2,601,858	\$185
2010	55-64	\$2,226,041	\$213	\$1,336,149	\$196	\$3,562,190	\$206
	Total	\$4,660,588	\$219	\$2,883,291	\$174	\$7,543,879	\$199
2011	18-24	\$45,348	\$99	\$28,529	\$51	\$73,877	\$73
2011	25-34	\$264,032	\$523	\$144,877	\$160	\$408,910	\$290
2011	35-44	\$420,590	\$193	\$805,963	\$350	\$1,226,553	\$274
2011	45-54	\$1,630,679	\$217	\$1,370,539	\$222	\$3,001,217	\$219
2011	55-64	\$3,785,210	\$331	\$2,591,994	\$346	\$6,377,203	\$337
	Total	\$6,145,858	\$278	\$4,941,902	\$284	\$11,087,760	\$281
2009-2011	18-24	\$138,145	\$121	\$110,936	\$66	\$249,081	\$88
2009-2011	25-34	\$519,002	\$296	\$554,044	\$150	\$1,073,046	\$197
2009-2011	35-44	\$1,431,968	\$191	\$1,841,763	\$196	\$3,273,731	\$194
2009-2011	45-54	\$4,185,634	\$158	\$3,674,181	\$164	\$7,859,815	\$161
2009-2011	55-64	\$10,540,366	\$251	\$6,787,736	\$243	\$17,328,101	\$248
	Total	\$16,815,115	\$213	\$12,968,660	\$199	\$29,783,775	\$207
2009-2011 (Cohort)	18-24	\$137,703	\$162	\$93,846	\$78	\$231,550	\$113
2009-2011 (Cohort)	25-34	\$495,643	\$345	\$464,102	\$149	\$959,745	\$210
2009-2011 (Cohort)	35-44	\$1,329,884	\$199	\$1,583,836	\$189	\$2,913,720	\$193
2009-2011 (Cohort)	45-54	\$3,449,825	\$142	\$3,250,240	\$156	\$6,700,065	\$148
2009-2011 (Cohort)	55-64	\$8,648,750	\$227	\$5,885,351	\$232	\$14,534,101	\$229
	Total	\$14,061,805	\$197	\$11,277,374	\$191	\$25,339,180	\$195

APPENDIX D (continued)

TABLE LXI

DIABETES EMERGENCY ROOM VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male ER Costs	Male ER Costs PMPM	Female ER Costs	Female ER Costs PMPM	Total ER Costs	Total ER Costs PMPM
2009	18-24	\$2,758	\$11	\$2,538	\$10	\$5,295	\$11
2009	25-34	\$7,122	\$15	\$12,489	\$15	\$19,611	\$15
2009	35-44	\$26,530	\$11	\$32,430	\$13	\$58,960	\$12
2009	45-54	\$56,699	\$8	\$60,508	\$11	\$117,207	\$9
2009	55-64	\$76,396	\$8	\$59,303	\$10	\$135,699	\$9
	Total	\$169,504	\$8	\$167,268	\$11	\$336,772	\$10
2010	18-24	\$3,748	\$15	\$885	\$3	\$4,633	\$9
2010	25-34	\$11,164	\$23	\$14,713	\$17	\$25,877	\$19
2010	35-44	\$24,178	\$11	\$58,419	\$25	\$82,597	\$18
2010	45-54	\$48,034	\$6	\$45,327	\$7	\$93,361	\$7
2010	55-64	\$77,110	\$7	\$67,900	\$10	\$145,010	\$8
	Total	\$164,234	\$8	\$187,245	\$11	\$351,479	\$9
2011	18-24	\$2,598	\$6	\$6,851	\$12	\$9,449	\$9
2011	25-34	\$4,372	\$9	\$13,230	\$15	\$17,602	\$12
2011	35-44	\$20,140	\$9	\$50,950	\$22	\$71,090	\$16
2011	45-54	\$40,337	\$5	\$54,613	\$9	\$94,950	\$7
2011	55-64	\$68,118	\$6	\$75,858	\$10	\$143,976	\$8
	Total	\$135,565	\$6	\$201,501	\$12	\$337,067	\$9
2009-2011	18-24	\$7,848	\$7	\$10,737	\$6	\$18,585	\$7
2009-2011	25-34	\$40,263	\$23	\$48,552	\$13	\$88,815	\$16
2009-2011	35-44	\$82,622	\$11	\$163,101	\$17	\$245,723	\$15
2009-2011	45-54	\$155,094	\$6	\$180,985	\$8	\$336,079	\$7
2009-2011	55-64	\$272,886	\$7	\$278,313	\$10	\$551,199	\$8
	Total	\$558,713	\$7	\$681,687	\$10	\$1,240,401	\$9
2009-2011 (Cohort)	18-24	\$7,299	\$9	\$5,380	\$4	\$12,678	\$6
2009-2011 (Cohort)	25-34	\$36,792	\$26	\$39,811	\$13	\$76,603	\$17
2009-2011 (Cohort)	35-44	\$69,402	\$10	\$147,874	\$18	\$217,276	\$14
2009-2011 (Cohort)	45-54	\$127,009	\$5	\$161,609	\$8	\$288,618	\$6
2009-2011 (Cohort)	55-64	\$240,116	\$6	\$260,180	\$10	\$500,297	\$8
	Total	\$480,617	\$7	\$614,854	\$10	\$1,095,471	\$8

APPENDIX D (continued)

TABLE LXII

DIABETES OUTPATIENT VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient Costs	Male Outpatient Costs PMPM	Female Outpatient Costs	Female Outpatient Costs PMPM	Total Outpatient Costs	Total Outpatient Costs PMPM
2009	18-24	\$14,213	\$59	\$8,603	\$34	\$22,816	\$46
2009	25-34	\$48,195	\$100	\$121,275	\$148	\$169,471	\$130
2009	35-44	\$196,187	\$84	\$558,390	\$216	\$754,577	\$153
2009	45-54	\$966,072	\$130	\$1,091,506	\$203	\$2,057,578	\$160
2009	55-64	\$2,046,435	\$209	\$1,222,969	\$203	\$3,269,404	\$206
	Total	\$3,271,102	\$161	\$3,002,743	\$199	\$6,273,845	\$177
2010	18-24	\$21,967	\$88	\$6,252	\$24	\$28,219	\$55
2010	25-34	\$101,262	\$207	\$85,979	\$97	\$187,241	\$136
2010	35-44	\$399,284	\$174	\$399,964	\$168	\$799,247	\$171
2010	45-54	\$1,258,014	\$161	\$1,069,059	\$171	\$2,327,073	\$166
2010	55-64	\$2,952,785	\$283	\$1,520,010	\$223	\$4,472,796	\$259
	Total	\$4,733,312	\$222	\$3,081,264	\$186	\$7,814,576	\$206
2011	18-24	\$70,287	\$153	\$52,929	\$95	\$123,216	\$121
2011	25-34	\$122,103	\$242	\$81,917	\$91	\$204,019	\$145
2011	35-44	\$215,309	\$99	\$527,236	\$229	\$742,546	\$166
2011	45-54	\$1,923,354	\$256	\$1,163,976	\$189	\$3,087,330	\$226
2011	55-64	\$1,959,648	\$171	\$1,624,925	\$217	\$3,584,573	\$189
	Total	\$4,290,702	\$194	\$3,450,983	\$198	\$7,741,685	\$196
2009-2011	18-24	\$111,342	\$97	\$95,145	\$57	\$206,487	\$73
2009-2011	25-34	\$319,616	\$183	\$401,858	\$109	\$721,474	\$133
2009-2011	35-44	\$846,961	\$113	\$1,598,304	\$170	\$2,445,265	\$145
2009-2011	45-54	\$4,183,450	\$158	\$4,000,400	\$178	\$8,183,850	\$168
2009-2011	55-64	\$8,264,104	\$197	\$5,438,886	\$195	\$13,702,990	\$196
	Total	\$13,725,472	\$174	\$11,534,593	\$177	\$25,260,065	\$176
2009-2011 (Cohort)	18-24	\$102,491	\$120	\$56,413	\$47	\$158,903	\$77
2009-2011 (Cohort)	25-34	\$293,962	\$205	\$320,556	\$103	\$614,518	\$135
2009-2011 (Cohort)	35-44	\$803,298	\$120	\$1,446,286	\$172	\$2,249,585	\$149
2009-2011 (Cohort)	45-54	\$3,653,977	\$151	\$3,563,239	\$171	\$7,217,216	\$160
2009-2011 (Cohort)	55-64	\$7,634,512	\$201	\$4,972,607	\$196	\$12,607,120	\$199
	Total	\$12,488,241	\$175	\$10,359,101	\$176	\$22,847,341	\$175

APPENDIX D (continued)

TABLE LXIII

DIABETES PROFESSIONAL VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Professional Costs	Male Professional Costs PMPM	Female Professional Costs	Female Professional Costs PMPM	Total Professional Costs	Total Professional Costs PMPM
2009	18-24	\$13,354	\$56	\$16,201	\$64	\$29,554	\$60
2009	25-34	\$26,257	\$54	\$83,097	\$101	\$109,353	\$84
2009	35-44	\$206,782	\$89	\$280,628	\$108	\$487,410	\$99
2009	45-54	\$610,995	\$82	\$480,297	\$89	\$1,091,293	\$85
2009	55-64	\$1,312,385	\$134	\$845,955	\$140	\$2,158,340	\$136
	Total	\$2,169,773	\$107	\$1,706,178	\$113	\$3,875,951	\$110
2010	18-24	\$23,785	\$95	\$11,468	\$44	\$35,253	\$69
2010	25-34	\$32,125	\$66	\$66,563	\$75	\$98,689	\$72
2010	35-44	\$191,559	\$84	\$212,789	\$90	\$404,348	\$87
2010	45-54	\$668,767	\$86	\$621,212	\$100	\$1,289,979	\$92
2010	55-64	\$1,202,482	\$115	\$910,502	\$134	\$2,112,984	\$122
	Total	\$2,118,718	\$100	\$1,822,535	\$110	\$3,941,253	\$104
2011	18-24	\$19,759	\$43	\$29,257	\$52	\$49,016	\$48
2011	25-34	\$23,018	\$46	\$95,458	\$105	\$118,477	\$84
2011	35-44	\$98,954	\$45	\$241,292	\$105	\$340,247	\$76
2011	45-54	\$577,699	\$77	\$554,676	\$90	\$1,132,375	\$83
2011	55-64	\$1,124,323	\$98	\$991,701	\$132	\$2,116,024	\$112
	Total	\$1,843,754	\$83	\$1,912,385	\$110	\$3,756,138	\$95
2009-2011	18-24	\$61,271	\$54	\$74,227	\$44	\$135,498	\$48
2009-2011	25-34	\$94,910	\$54	\$284,615	\$77	\$379,525	\$70
2009-2011	35-44	\$494,548	\$66	\$822,947	\$88	\$1,317,495	\$78
2009-2011	45-54	\$2,020,986	\$77	\$2,075,183	\$93	\$4,096,169	\$84
2009-2011	55-64	\$4,441,862	\$106	\$3,421,594	\$123	\$7,863,456	\$113
	Total	\$7,113,576	\$90	\$6,678,567	\$103	\$13,792,142	\$96
2009-2011 (Cohort)	18-24	\$53,003	\$62	\$50,431	\$42	\$103,434	\$50
2009-2011 (Cohort)	25-34	\$80,333	\$56	\$244,592	\$78	\$324,925	\$71
2009-2011 (Cohort)	35-44	\$454,905	\$68	\$729,909	\$87	\$1,184,813	\$79
2009-2011 (Cohort)	45-54	\$1,882,611	\$78	\$1,808,667	\$87	\$3,691,278	\$82
2009-2011 (Cohort)	55-64	\$3,504,249	\$92	\$2,940,099	\$116	\$6,444,348	\$102
	Total	\$5,975,101	\$84	\$5,773,697	\$98	\$11,748,798	\$90

APPENDIX D (continued)

TABLE LXIV

DIABETES REMAINDER COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder Costs	Male Remainder Costs PMPM	Female Remainder Costs	Female Remainder Costs PMPM	Total Remainder Costs	Total Remainder Costs PMPM
2009	18-24	\$8,391	\$35	\$4,192	\$16	\$12,583	\$25
2009	25-34	\$25,991	\$54	\$58,305	\$71	\$84,295	\$65
2009	35-44	\$82,578	\$36	\$281,776	\$109	\$364,354	\$74
2009	45-54	\$199,235	\$27	\$185,054	\$34	\$384,289	\$30
2009	55-64	\$446,536	\$46	\$275,078	\$46	\$721,614	\$46
	Total	\$762,730	\$38	\$804,405	\$53	\$1,567,135	\$44
2010	18-24	\$20,429	\$82	\$5,272	\$20	\$25,700	\$50
2010	25-34	\$23,376	\$48	\$29,850	\$34	\$53,227	\$39
2010	35-44	\$97,811	\$43	\$299,924	\$126	\$397,734	\$85
2010	45-54	\$339,269	\$43	\$201,085	\$32	\$540,354	\$38
2010	55-64	\$641,606	\$61	\$319,072	\$47	\$960,678	\$56
	Total	\$1,122,491	\$53	\$855,203	\$52	\$1,977,694	\$52
2011	18-24	\$11,824	\$26	\$17,283	\$31	\$29,107	\$29
2011	25-34	\$143,095	\$283	\$43,635	\$48	\$186,730	\$132
2011	35-44	\$85,267	\$39	\$386,667	\$168	\$471,933	\$105
2011	45-54	\$298,306	\$40	\$261,561	\$42	\$559,866	\$41
2011	55-64	\$1,056,662	\$92	\$502,175	\$67	\$1,558,837	\$82
	Total	\$1,595,154	\$72	\$1,211,319	\$70	\$2,806,473	\$71
2009-2011	18-24	\$40,927	\$36	\$28,202	\$17	\$69,129	\$25
2009-2011	25-34	\$292,793	\$167	\$118,975	\$32	\$411,768	\$76
2009-2011	35-44	\$450,711	\$60	\$1,000,774	\$107	\$1,451,485	\$86
2009-2011	45-54	\$935,723	\$35	\$753,201	\$34	\$1,688,924	\$35
2009-2011	55-64	\$2,453,668	\$58	\$1,390,457	\$50	\$3,844,126	\$55
	Total	\$4,173,822	\$53	\$3,291,609	\$51	\$7,465,432	\$52
2009-2011 (Cohort)	18-24	\$32,896	\$39	\$15,141	\$13	\$48,037	\$23
2009-2011 (Cohort)	25-34	\$265,028	\$184	\$88,269	\$28	\$353,297	\$77
2009-2011 (Cohort)	35-44	\$434,763	\$65	\$949,897	\$113	\$1,384,660	\$92
2009-2011 (Cohort)	45-54	\$860,943	\$35	\$682,480	\$33	\$1,543,423	\$34
2009-2011 (Cohort)	55-64	\$2,189,148	\$58	\$1,256,869	\$49	\$3,446,017	\$54
	Total	\$3,782,778	\$53	\$2,992,655	\$51	\$6,775,433	\$52

APPENDIX D (continued)

TABLE LXV

DIABETES PHARMACY COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy Costs	Male Pharmacy Costs PMPM	Female Pharmacy Costs	Female Pharmacy Costs PMPM	Total Pharmacy Costs	Total Pharmacy Costs PMPM
2009	18-24	\$43,689	\$182	\$31,582	\$124	\$75,271	\$152
2009	25-34	\$52,913	\$109	\$59,003	\$72	\$111,916	\$86
2009	35-44	\$380,756	\$164	\$430,652	\$166	\$811,408	\$165
2009	45-54	\$1,333,622	\$179	\$1,073,804	\$200	\$2,407,426	\$188
2009	55-64	\$1,983,986	\$202	\$123,999	\$21	\$2,107,985	\$133
	Total	\$3,794,966	\$187	\$1,719,040	\$114	\$5,514,006	\$156
2010	18-24	\$41,601	\$166	\$26,870	\$102	\$68,471	\$133
2010	25-34	\$47,859	\$98	\$64,809	\$73	\$112,668	\$82
2010	35-44	\$356,261	\$156	\$300,793	\$127	\$657,054	\$141
2010	45-54	\$1,549,597	\$198	\$1,150,920	\$184	\$2,700,516	\$192
2010	55-64	\$2,282,959	\$218	\$1,500,841	\$220	\$3,783,801	\$219
	Total	\$4,278,276	\$201	\$3,044,233	\$184	\$7,322,509	\$193
2011	18-24	\$59,618	\$130	\$45,879	\$82	\$105,497	\$104
2011	25-34	\$48,339	\$96	\$105,792	\$117	\$154,131	\$109
2011	35-44	\$299,806	\$138	\$315,304	\$137	\$615,109	\$137
2011	45-54	\$1,504,235	\$200	\$1,377,762	\$224	\$2,881,996	\$211
2011	55-64	\$2,603,710	\$228	\$1,978,953	\$264	\$4,582,663	\$242
	Total	\$4,515,707	\$204	\$3,823,690	\$220	\$8,339,397	\$211
2009-2011	18-24	\$143,765	\$126	\$109,138	\$65	\$252,903	\$90
2009-2011	25-34	\$145,098	\$83	\$257,122	\$70	\$402,220	\$74
2009-2011	35-44	\$982,650	\$131	\$961,631	\$103	\$1,944,281	\$115
2009-2011	45-54	\$4,261,266	\$161	\$4,169,682	\$186	\$8,430,948	\$173
2009-2011	55-64	\$7,995,264	\$190	\$5,895,816	\$212	\$13,891,079	\$199
	Total	\$13,528,042	\$172	\$11,393,389	\$175	\$24,921,430	\$173
2009-2011 (Cohort)	18-24	\$116,572	\$137	\$72,543	\$60	\$189,115	\$92
2009-2011 (Cohort)	25-34	\$119,934	\$83	\$224,522	\$72	\$344,457	\$76
2009-2011 (Cohort)	35-44	\$912,828	\$137	\$856,013	\$102	\$1,768,842	\$117
2009-2011 (Cohort)	45-54	\$3,872,335	\$160	\$3,946,500	\$189	\$7,818,835	\$173
2009-2011 (Cohort)	55-64	\$7,228,821	\$190	\$5,391,317	\$212	\$12,620,138	\$199
	Total	\$12,250,490	\$172	\$10,490,896	\$178	\$22,741,386	\$175

APPENDIX D (continued)

TABLE LXVI

HYPERTENSION TOTAL COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Total Costs	Male Total Costs PMPM	Female Total Costs	Female Total Costs PMPM	Total Costs	Total Costs PMPM
2009	18-24	\$252,847	\$741	\$206,075	\$357	\$458,923	\$500
2009	25-34	\$664,778	\$329	\$1,004,201	\$493	\$1,668,979	\$412
2009	35-44	\$3,148,049	\$377	\$4,602,592	\$618	\$7,750,641	\$491
2009	45-54	\$11,187,050	\$509	\$10,199,912	\$538	\$21,386,962	\$522
2009	55-64	\$15,690,490	\$576	\$10,652,256	\$562	\$26,342,746	\$570
	Total	\$30,943,215	\$516	\$26,665,036	\$556	\$57,608,250	\$534
2010	18-24	\$96,106	\$204	\$205,145	\$377	\$301,251	\$297
2010	25-34	\$907,837	\$441	\$1,291,402	\$632	\$2,199,238	\$536
2010	35-44	\$3,948,672	\$451	\$4,846,193	\$631	\$8,794,865	\$535
2010	45-54	\$11,966,665	\$522	\$12,205,895	\$603	\$24,172,561	\$560
2010	55-64	\$20,935,967	\$710	\$15,123,695	\$721	\$36,059,662	\$715
	Total	\$37,855,246	\$594	\$33,672,330	\$654	\$71,527,576	\$621
2011	18-24	\$102,619	\$110	\$384,385	\$304	\$487,004	\$222
2011	25-34	\$1,020,119	\$462	\$1,198,832	\$521	\$2,218,951	\$492
2011	35-44	\$3,169,061	\$404	\$4,815,432	\$678	\$7,984,493	\$534
2011	45-54	\$11,458,356	\$502	\$12,609,738	\$603	\$24,068,094	\$551
2011	55-64	\$25,217,639	\$785	\$17,260,105	\$793	\$42,477,744	\$788
	Total	\$40,967,794	\$622	\$36,268,491	\$680	\$77,236,285	\$648
2009-2011	18-24	\$879,781	\$351	\$1,486,710	\$363	\$2,366,491	\$358
2009-2011	25-34	\$3,047,225	\$377	\$6,076,732	\$631	\$9,123,957	\$516
2009-2011	35-44	\$11,248,891	\$379	\$16,322,012	\$585	\$27,570,902	\$479
2009-2011	45-54	\$39,125,603	\$492	\$43,269,382	\$577	\$82,394,985	\$533
2009-2011	55-64	\$79,869,099	\$701	\$56,638,646	\$697	\$136,507,745	\$699
	Total	\$134,170,598	\$574	\$123,793,482	\$625	\$257,964,080	\$598
2009-2011 (Cohort)	18-24	\$481,401	\$272	\$925,903	\$310	\$1,407,304	\$296
2009-2011 (Cohort)	25-34	\$2,744,903	\$401	\$4,947,683	\$618	\$7,692,586	\$518
2009-2011 (Cohort)	35-44	\$9,846,772	\$366	\$14,623,599	\$579	\$24,470,370	\$469
2009-2011 (Cohort)	45-54	\$34,305,420	\$466	\$38,903,752	\$557	\$73,209,172	\$510
2009-2011 (Cohort)	55-64	\$69,872,055	\$672	\$49,237,871	\$672	\$119,109,926	\$672
	Total	\$117,250,551	\$550	\$108,638,808	\$606	\$225,889,359	\$576

APPENDIX D (continued)

TABLE LXVII

HYPERTENSION INPATIENT ADMISSION COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Inpatient Costs	Male Inpatient Costs PMPM	Female Inpatient Costs	Female Inpatient Costs PMPM	Total Inpatient Costs	Total Inpatient Costs PMPM
2009	18-24	\$105,943	\$311	\$25,871	\$45	\$131,814	\$144
2009	25-34	\$210,052	\$104	\$300,196	\$148	\$510,248	\$126
2009	35-44	\$830,069	\$99	\$1,049,515	\$141	\$1,879,584	\$119
2009	45-54	\$3,521,181	\$160	\$2,020,871	\$107	\$5,542,053	\$135
2009	55-64	\$4,220,614	\$155	\$2,375,977	\$125	\$6,596,591	\$143
	Total	\$8,887,859	\$148	\$5,772,430	\$120	\$14,660,289	\$136
2010	18-24	\$4,678	\$10	\$84,451	\$155	\$89,129	\$88
2010	25-34	\$222,081	\$108	\$424,704	\$208	\$646,785	\$158
2010	35-44	\$1,285,371	\$147	\$1,004,677	\$131	\$2,290,047	\$139
2010	45-54	\$2,831,927	\$124	\$3,283,442	\$162	\$6,115,370	\$142
2010	55-64	\$6,328,915	\$215	\$4,017,841	\$192	\$10,346,756	\$205
	Total	\$10,672,972	\$168	\$8,815,115	\$171	\$19,488,087	\$169
2011	18-24	\$6,733	\$7	\$83,617	\$66	\$90,350	\$41
2011	25-34	\$348,130	\$158	\$389,281	\$169	\$737,411	\$163
2011	35-44	\$946,097	\$121	\$1,553,695	\$219	\$2,499,792	\$167
2011	45-54	\$2,669,998	\$117	\$3,406,934	\$163	\$6,076,932	\$139
2011	55-64	\$8,770,336	\$273	\$4,754,100	\$219	\$13,524,435	\$251
	Total	\$12,741,294	\$193	\$10,187,626	\$191	\$22,928,920	\$192
2009-2011	18-24	\$339,856	\$136	\$455,082	\$111	\$794,938	\$120
2009-2011	25-34	\$873,977	\$108	\$1,814,922	\$189	\$2,688,899	\$152
2009-2011	35-44	\$2,961,875	\$100	\$4,235,746	\$152	\$7,197,620	\$125
2009-2011	45-54	\$11,407,857	\$143	\$10,520,911	\$140	\$21,928,768	\$142
2009-2011	55-64	\$25,806,687	\$226	\$15,318,507	\$188	\$41,125,194	\$211
	Total	\$41,390,252	\$177	\$32,345,167	\$163	\$73,735,419	\$171
2009-2011 (Cohort)	18-24	\$173,840	\$98	\$188,483	\$63	\$362,323	\$76
2009-2011 (Cohort)	25-34	\$817,415	\$119	\$1,359,520	\$170	\$2,176,935	\$147
2009-2011 (Cohort)	35-44	\$2,545,090	\$95	\$3,676,403	\$146	\$6,221,494	\$119
2009-2011 (Cohort)	45-54	\$9,042,300	\$123	\$9,235,334	\$132	\$18,277,634	\$127
2009-2011 (Cohort)	55-64	\$21,913,878	\$211	\$12,265,681	\$167	\$34,179,559	\$193
	Total	\$34,492,522	\$162	\$26,725,422	\$149	\$61,217,943	\$156

APPENDIX D (continued)

TABLE LXVIII

HYPERTENSION EMERGENCY ROOM VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male ER Costs	Male ER Costs PMPM	Female ER Costs	Female ER Costs PMPM	Total ER Costs	Total ER Costs PMPM
2009	18-24	\$7,113	\$21	\$11,028	\$19	\$18,141	\$20
2009	25-34	\$21,075	\$10	\$28,461	\$14	\$49,535	\$12
2009	35-44	\$82,683	\$10	\$99,403	\$13	\$182,085	\$12
2009	45-54	\$185,976	\$8	\$185,726	\$10	\$371,702	\$9
2009	55-64	\$141,623	\$5	\$119,426	\$6	\$261,049	\$6
	Total	\$438,469	\$7	\$444,044	\$9	\$882,513	\$8
2010	18-24	\$5,417	\$12	\$6,366	\$12	\$11,783	\$12
2010	25-34	\$54,423	\$26	\$29,512	\$14	\$83,935	\$20
2010	35-44	\$82,695	\$9	\$114,564	\$15	\$197,259	\$12
2010	45-54	\$152,034	\$7	\$152,525	\$8	\$304,560	\$7
2010	55-64	\$194,248	\$7	\$167,733	\$8	\$361,981	\$7
	Total	\$488,817	\$8	\$470,700	\$9	\$959,518	\$8
2011	18-24	\$4,885	\$5	\$4,936	\$4	\$9,821	\$4
2011	25-34	\$35,128	\$16	\$35,025	\$15	\$70,153	\$16
2011	35-44	\$102,785	\$13	\$115,594	\$16	\$218,380	\$15
2011	45-54	\$147,400	\$6	\$185,761	\$9	\$333,161	\$8
2011	55-64	\$204,301	\$6	\$189,420	\$9	\$393,720	\$7
	Total	\$494,499	\$8	\$530,736	\$10	\$1,025,235	\$9
2009-2011	18-24	\$38,191	\$15	\$51,189	\$12	\$89,381	\$14
2009-2011	25-34	\$126,494	\$16	\$163,620	\$17	\$290,114	\$16
2009-2011	35-44	\$335,066	\$11	\$419,173	\$15	\$754,239	\$13
2009-2011	45-54	\$630,542	\$8	\$674,663	\$9	\$1,305,205	\$8
2009-2011	55-64	\$720,479	\$6	\$673,494	\$8	\$1,393,973	\$7
	Total	\$1,850,772	\$8	\$1,982,139	\$10	\$3,832,911	\$9
2009-2011 (Cohort)	18-24	\$21,722	\$12	\$30,644	\$10	\$52,366	\$11
2009-2011 (Cohort)	25-34	\$115,164	\$17	\$133,207	\$17	\$248,371	\$17
2009-2011 (Cohort)	35-44	\$286,585	\$11	\$366,358	\$15	\$652,943	\$13
2009-2011 (Cohort)	45-54	\$579,340	\$8	\$611,807	\$9	\$1,191,147	\$8
2009-2011 (Cohort)	55-64	\$658,117	\$6	\$610,895	\$8	\$1,269,012	\$7
	Total	\$1,660,928	\$8	\$1,752,911	\$10	\$3,413,839	\$9

APPENDIX D (continued)

TABLE LXIX

HYPERTENSION OUTPATIENT VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient Costs	Male Outpatient Costs PMPM	Female Outpatient Costs	Female Outpatient Costs PMPM	Total Outpatient Costs	Total Outpatient Costs PMPM
2009	18-24	\$70,319	\$206	\$58,219	\$101	\$128,538	\$140
2009	25-34	\$135,872	\$67	\$297,508	\$146	\$433,380	\$107
2009	35-44	\$740,267	\$89	\$1,199,294	\$161	\$1,939,560	\$123
2009	45-54	\$2,356,981	\$107	\$2,806,167	\$148	\$5,163,147	\$126
2009	55-64	\$4,354,142	\$160	\$2,867,473	\$151	\$7,221,615	\$156
	Total	\$7,657,579	\$128	\$7,228,660	\$151	\$14,886,240	\$138
2010	18-24	\$22,491	\$48	\$39,075	\$72	\$61,566	\$61
2010	25-34	\$255,232	\$124	\$377,713	\$185	\$632,946	\$154
2010	35-44	\$987,603	\$113	\$1,538,814	\$200	\$2,526,416	\$154
2010	45-54	\$3,443,569	\$150	\$3,183,810	\$157	\$6,627,379	\$154
2010	55-64	\$5,834,771	\$198	\$4,033,355	\$192	\$9,868,126	\$196
	Total	\$10,543,666	\$165	\$9,172,767	\$178	\$19,716,433	\$171
2011	18-24	\$12,935	\$14	\$159,462	\$126	\$172,397	\$78
2011	25-34	\$218,168	\$99	\$356,574	\$155	\$574,742	\$127
2011	35-44	\$735,421	\$94	\$1,268,182	\$179	\$2,003,603	\$134
2011	45-54	\$3,338,374	\$146	\$3,537,949	\$169	\$6,876,323	\$157
2011	55-64	\$5,746,325	\$179	\$4,345,060	\$200	\$10,091,385	\$187
	Total	\$10,051,223	\$152	\$9,667,226	\$181	\$19,718,449	\$165
2009-2011	18-24	\$156,307	\$62	\$443,200	\$108	\$599,508	\$91
2009-2011	25-34	\$843,907	\$105	\$2,011,857	\$209	\$2,855,764	\$161
2009-2011	35-44	\$3,014,579	\$102	\$4,686,041	\$168	\$7,700,620	\$134
2009-2011	45-54	\$10,058,706	\$127	\$12,337,030	\$164	\$22,395,735	\$145
2009-2011	55-64	\$20,828,404	\$183	\$14,742,081	\$181	\$35,570,485	\$182
	Total	\$34,901,903	\$149	\$34,220,208	\$173	\$69,122,111	\$160
2009-2011 (Cohort)	18-24	\$63,267	\$36	\$323,762	\$108	\$387,028	\$81
2009-2011 (Cohort)	25-34	\$758,214	\$111	\$1,706,563	\$213	\$2,464,777	\$166
2009-2011 (Cohort)	35-44	\$2,569,021	\$95	\$4,237,766	\$168	\$6,806,786	\$130
2009-2011 (Cohort)	45-54	\$9,062,556	\$123	\$11,086,720	\$159	\$20,149,276	\$140
2009-2011 (Cohort)	55-64	\$18,716,071	\$180	\$13,345,217	\$182	\$32,061,288	\$181
	Total	\$31,169,129	\$146	\$30,700,028	\$171	\$61,869,156	\$158

APPENDIX D (continued)

TABLE LXX

HYPERTENSION PROFESSIONAL VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Professional Costs	Male Professional Costs PMPM	Female Professional Costs	Female Professional Costs PMPM	Total Professional Costs	Total Professional Costs PMPM
2009	18-24	\$14,858	\$44	\$32,513	\$56	\$47,371	\$52
2009	25-34	\$109,465	\$54	\$156,539	\$77	\$266,004	\$66
2009	35-44	\$490,146	\$59	\$827,747	\$111	\$1,317,893	\$83
2009	45-54	\$1,694,348	\$77	\$1,822,211	\$96	\$3,516,559	\$86
2009	55-64	\$2,052,959	\$75	\$1,608,020	\$85	\$3,660,979	\$79
	Total	\$4,361,777	\$73	\$4,447,030	\$93	\$8,808,806	\$82
2010	18-24	\$11,782	\$25	\$27,199	\$50	\$38,981	\$38
2010	25-34	\$96,431	\$47	\$170,263	\$83	\$266,693	\$65
2010	35-44	\$546,117	\$62	\$857,720	\$112	\$1,403,837	\$85
2010	45-54	\$1,696,788	\$74	\$1,925,981	\$95	\$3,622,768	\$84
2010	55-64	\$2,617,595	\$89	\$2,221,117	\$106	\$4,838,712	\$96
	Total	\$4,968,713	\$78	\$5,202,279	\$101	\$10,170,991	\$88
2011	18-24	\$15,718	\$17	\$32,010	\$25	\$47,727	\$22
2011	25-34	\$90,899	\$41	\$149,451	\$65	\$240,350	\$53
2011	35-44	\$391,488	\$50	\$552,895	\$78	\$944,382	\$63
2011	45-54	\$1,472,013	\$65	\$1,776,785	\$85	\$3,248,798	\$74
2011	55-64	\$2,999,312	\$93	\$2,562,887	\$118	\$5,562,200	\$103
	Total	\$4,969,430	\$75	\$5,074,028	\$95	\$10,043,457	\$84
2009-2011	18-24	\$89,714	\$36	\$188,947	\$46	\$278,661	\$42
2009-2011	25-34	\$395,776	\$49	\$813,149	\$85	\$1,208,925	\$68
2009-2011	35-44	\$1,735,074	\$58	\$2,656,408	\$95	\$4,391,482	\$76
2009-2011	45-54	\$5,605,949	\$71	\$7,479,589	\$100	\$13,085,537	\$85
2009-2011	55-64	\$10,802,355	\$95	\$9,236,590	\$114	\$20,038,945	\$103
	Total	\$18,628,868	\$80	\$20,374,683	\$103	\$39,003,551	\$90
2009-2011 (Cohort)	18-24	\$56,674	\$32	\$129,230	\$43	\$185,904	\$39
2009-2011 (Cohort)	25-34	\$323,493	\$47	\$693,608	\$87	\$1,017,101	\$69
2009-2011 (Cohort)	35-44	\$1,563,054	\$58	\$2,329,874	\$92	\$3,892,927	\$75
2009-2011 (Cohort)	45-54	\$5,107,818	\$69	\$6,704,803	\$96	\$11,812,621	\$82
2009-2011 (Cohort)	55-64	\$9,056,887	\$87	\$8,047,743	\$110	\$17,104,630	\$96
	Total	\$16,107,926	\$76	\$17,905,258	\$100	\$34,013,183	\$87

APPENDIX D (continued)

TABLE LXXI

HYPERTENSION REMAINDER COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder Costs	Male Remainder Costs PMPM	Female Remainder Costs	Female Remainder Costs PMPM	Total Remainder Costs	Total Remainder Costs PMPM
2009	18-24	\$21,145	\$62	\$12,646	\$22	\$33,791	\$37
2009	25-34	\$37,522	\$19	\$79,991	\$39	\$117,513	\$29
2009	35-44	\$216,321	\$26	\$454,402	\$61	\$670,722	\$42
2009	45-54	\$646,255	\$29	\$594,871	\$31	\$1,241,126	\$30
2009	55-64	\$757,513	\$28	\$449,884	\$24	\$1,207,398	\$26
	Total	\$1,678,756	\$28	\$1,591,794	\$33	\$3,270,550	\$30
2010	18-24	\$19,637	\$42	\$10,279	\$19	\$29,916	\$30
2010	25-34	\$127,393	\$62	\$157,873	\$77	\$285,266	\$70
2010	35-44	\$242,686	\$28	\$478,855	\$62	\$721,541	\$44
2010	45-54	\$681,644	\$30	\$820,317	\$41	\$1,501,962	\$35
2010	55-64	\$1,242,135	\$42	\$835,384	\$40	\$2,077,519	\$41
	Total	\$2,313,495	\$36	\$2,302,709	\$45	\$4,616,204	\$40
2011	18-24	\$5,980	\$6	\$21,160	\$17	\$27,140	\$12
2011	25-34	\$164,351	\$74	\$70,669	\$31	\$235,020	\$52
2011	35-44	\$208,123	\$27	\$564,567	\$79	\$772,689	\$52
2011	45-54	\$704,152	\$31	\$708,066	\$34	\$1,412,218	\$32
2011	55-64	\$2,036,656	\$63	\$1,242,417	\$57	\$3,279,073	\$61
	Total	\$3,119,262	\$47	\$2,606,879	\$49	\$5,726,140	\$48
2009-2011	18-24	\$108,748	\$43	\$88,570	\$22	\$197,318	\$30
2009-2011	25-34	\$355,012	\$44	\$585,430	\$61	\$940,442	\$53
2009-2011	35-44	\$759,730	\$26	\$1,637,884	\$59	\$2,397,614	\$42
2009-2011	45-54	\$2,386,617	\$30	\$2,583,375	\$34	\$4,969,991	\$32
2009-2011	55-64	\$5,082,189	\$45	\$3,326,740	\$41	\$8,408,929	\$43
	Total	\$8,692,296	\$37	\$8,221,998	\$42	\$16,914,294	\$39
2009-2011 (Cohort)	18-24	\$52,004	\$29	\$56,628	\$19	\$108,633	\$23
2009-2011 (Cohort)	25-34	\$341,421	\$50	\$480,381	\$60	\$821,802	\$55
2009-2011 (Cohort)	35-44	\$652,114	\$24	\$1,534,544	\$61	\$2,186,658	\$42
2009-2011 (Cohort)	45-54	\$2,150,166	\$29	\$2,383,247	\$34	\$4,533,413	\$32
2009-2011 (Cohort)	55-64	\$4,574,618	\$44	\$2,985,757	\$41	\$7,560,375	\$43
	Total	\$7,770,323	\$36	\$7,440,558	\$41	\$15,210,881	\$39

APPENDIX D (continued)

TABLE LXXII

HYPERTENSION PHARMACY COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy Costs	Male Pharmacy Costs PMPM	Female Pharmacy Costs	Female Pharmacy Costs PMPM	Total Pharmacy Costs	Total Pharmacy Costs PMPM
2009	18-24	\$33,470	\$98	\$65,798	\$114	\$99,268	\$108
2009	25-34	\$150,792	\$75	\$141,506	\$70	\$292,298	\$72
2009	35-44	\$788,564	\$94	\$972,232	\$131	\$1,760,796	\$111
2009	45-54	\$2,782,309	\$127	\$2,770,066	\$146	\$5,552,375	\$136
2009	55-64	\$4,163,639	\$153	\$3,231,476	\$170	\$7,395,115	\$160
	Total	\$7,918,774	\$132	\$7,181,078	\$150	\$15,099,852	\$140
2010	18-24	\$32,101	\$68	\$37,775	\$69	\$69,876	\$69
2010	25-34	\$152,276	\$74	\$131,337	\$64	\$283,613	\$69
2010	35-44	\$804,200	\$92	\$851,564	\$111	\$1,655,765	\$101
2010	45-54	\$3,160,702	\$138	\$2,839,819	\$140	\$6,000,522	\$139
2010	55-64	\$4,718,304	\$160	\$3,848,264	\$184	\$8,566,568	\$170
	Total	\$8,867,583	\$139	\$7,708,760	\$150	\$16,576,343	\$144
2011	18-24	\$56,369	\$60	\$83,200	\$66	\$139,570	\$63
2011	25-34	\$163,443	\$74	\$197,833	\$86	\$361,276	\$80
2011	35-44	\$785,146	\$100	\$760,500	\$107	\$1,545,646	\$103
2011	45-54	\$3,126,419	\$137	\$2,994,242	\$143	\$6,120,661	\$140
2011	55-64	\$5,460,709	\$170	\$4,166,221	\$192	\$9,626,931	\$179
	Total	\$9,592,087	\$146	\$8,201,996	\$154	\$17,794,083	\$149
2009-2011	18-24	\$146,963	\$59	\$259,722	\$63	\$406,685	\$62
2009-2011	25-34	\$452,059	\$56	\$687,754	\$71	\$1,139,813	\$64
2009-2011	35-44	\$2,442,566	\$82	\$2,686,761	\$96	\$5,129,327	\$89
2009-2011	45-54	\$9,035,934	\$114	\$9,673,816	\$129	\$18,709,749	\$121
2009-2011	55-64	\$16,628,984	\$146	\$13,341,235	\$164	\$29,970,220	\$153
	Total	\$28,706,506	\$123	\$26,649,288	\$135	\$55,355,794	\$128
2009-2011 (Cohort)	18-24	\$113,893	\$64	\$197,157	\$66	\$311,050	\$65
2009-2011 (Cohort)	25-34	\$389,196	\$57	\$574,403	\$72	\$963,600	\$65
2009-2011 (Cohort)	35-44	\$2,230,908	\$83	\$2,478,653	\$98	\$4,709,562	\$90
2009-2011 (Cohort)	45-54	\$8,363,241	\$114	\$8,881,841	\$127	\$17,245,082	\$120
2009-2011 (Cohort)	55-64	\$14,952,484	\$144	\$11,982,578	\$164	\$26,935,062	\$152
	Total	\$26,049,723	\$122	\$24,114,632	\$134	\$50,164,355	\$128

APPENDIX D (continued)

TABLE LXXIII

CORONARY ARTERY DISEASE TOTAL COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Total Costs	Male Total Costs PMPM	Female Total Costs	Female Total Costs PMPM	Total Costs	Total Costs PMPM
2009	18-24	\$0	\$0	\$13,866	\$495	\$13,866	\$495
2009	25-34	\$32,299	\$1,154	\$0	\$0	\$32,299	\$1,154
2009	35-44	\$230,054	\$1,117	\$186,867	\$1,112	\$416,921	\$1,115
2009	45-54	\$2,489,605	\$1,310	\$1,167,362	\$1,835	\$3,656,967	\$1,441
2009	55-64	\$5,529,312	\$1,358	\$1,876,175	\$1,728	\$7,405,486	\$1,435
	Total	\$8,281,269	\$1,334	\$3,244,270	\$1,691	\$11,525,539	\$1,418
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$25,049	\$522	\$61,584	\$855	\$86,633	\$722
2010	35-44	\$351,978	\$1,805	\$524,982	\$2,763	\$876,960	\$2,278
2010	45-54	\$2,479,713	\$1,399	\$1,005,176	\$1,311	\$3,484,889	\$1,372
2010	55-64	\$6,627,420	\$1,521	\$2,636,391	\$2,249	\$9,263,811	\$1,676
	Total	\$9,484,160	\$1,488	\$4,228,134	\$1,921	\$13,712,294	\$1,599
2011	18-24	\$1,656	\$138	\$0	\$0	\$1,656	\$138
2011	25-34	\$57,543	\$885	\$4,017	\$335	\$61,560	\$799
2011	35-44	\$662,078	\$1,655	\$91,188	\$760	\$753,266	\$1,449
2011	45-54	\$3,394,210	\$2,132	\$954,664	\$1,573	\$4,348,874	\$1,978
2011	55-64	\$7,889,601	\$1,874	\$2,569,108	\$2,150	\$10,458,709	\$1,935
	Total	\$12,005,088	\$1,912	\$3,618,978	\$1,871	\$15,624,067	\$1,902
2009-2011	18-24	\$9,564	\$266	\$10,360	\$545	\$19,924	\$362
2009-2011	25-34	\$151,281	\$523	\$167,341	\$593	\$318,622	\$558
2009-2011	35-44	\$1,632,529	\$1,024	\$1,592,638	\$1,808	\$3,225,167	\$1,303
2009-2011	45-54	\$10,175,845	\$1,286	\$5,098,468	\$1,359	\$15,274,313	\$1,310
2009-2011	55-64	\$30,381,582	\$1,401	\$12,270,681	\$1,734	\$42,652,263	\$1,483
	Total	\$42,350,802	\$1,344	\$19,139,487	\$1,594	\$61,490,289	\$1,413
2009-2011 (Cohort)	18-24	\$9,564	\$266	\$0	\$0	\$9,564	\$266
2009-2011 (Cohort)	25-34	\$91,492	\$334	\$149,251	\$557	\$240,744	\$444
2009-2011 (Cohort)	35-44	\$1,435,287	\$1,025	\$1,232,653	\$1,578	\$2,667,939	\$1,223
2009-2011 (Cohort)	45-54	\$8,572,705	\$1,186	\$4,839,871	\$1,362	\$13,412,576	\$1,244
2009-2011 (Cohort)	55-64	\$25,796,099	\$1,286	\$11,230,465	\$1,709	\$37,026,565	\$1,390
	Total	\$35,905,147	\$1,238	\$17,452,240	\$1,562	\$53,357,388	\$1,328

APPENDIX D (continued)

TABLE LXXIV

CORONARY ARTERY DISEASE INPATIENT ADMISSION COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Inpatient Costs	Male Inpatient Costs PMPM	Female Inpatient Costs	Female Inpatient Costs PMPM	Total Inpatient Costs	Total Inpatient Costs PMPM
2009	18-24	\$0	\$0	\$4,879	\$174	\$4,879	\$174
2009	25-34	\$20,642	\$737	\$0	\$0	\$20,642	\$737
2009	35-44	\$98,749	\$479	\$94,728	\$564	\$193,477	\$517
2009	45-54	\$1,138,118	\$599	\$468,232	\$736	\$1,606,349	\$633
2009	55-64	\$2,372,557	\$583	\$654,655	\$603	\$3,027,212	\$587
	Total	\$3,630,065	\$585	\$1,222,495	\$637	\$4,852,560	\$597
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$5,473	\$114	\$18,994	\$264	\$24,467	\$204
2010	35-44	\$233,932	\$1,200	\$78,550	\$413	\$312,482	\$812
2010	45-54	\$1,172,426	\$661	\$345,260	\$450	\$1,517,686	\$598
2010	55-64	\$2,936,344	\$674	\$1,331,496	\$1,136	\$4,267,840	\$772
	Total	\$4,348,176	\$682	\$1,774,300	\$806	\$6,122,475	\$714
2011	18-24	\$1,426	\$119	\$0	\$0	\$1,426	\$119
2011	25-34	\$17,929	\$276	\$0	\$0	\$17,929	\$233
2011	35-44	\$328,738	\$822	\$32,500	\$271	\$361,238	\$695
2011	45-54	\$1,237,884	\$778	\$429,720	\$708	\$1,667,603	\$758
2011	55-64	\$3,911,769	\$929	\$1,365,376	\$1,143	\$5,277,145	\$976
	Total	\$5,497,746	\$876	\$1,827,596	\$945	\$7,325,341	\$892
2009-2011	18-24	\$4,885	\$136	\$0	\$0	\$4,885	\$89
2009-2011	25-34	\$58,421	\$202	\$41,234	\$146	\$99,655	\$175
2009-2011	35-44	\$724,080	\$454	\$456,685	\$518	\$1,180,765	\$477
2009-2011	45-54	\$3,860,475	\$488	\$1,852,506	\$494	\$5,712,981	\$490
2009-2011	55-64	\$13,034,544	\$601	\$5,247,928	\$742	\$18,282,473	\$636
	Total	\$17,682,404	\$561	\$7,598,354	\$633	\$25,280,758	\$581
2009-2011 (Cohort)	18-24	\$4,885	\$136	\$0	\$0	\$4,885	\$136
2009-2011 (Cohort)	25-34	\$22,017	\$80	\$35,573	\$133	\$57,590	\$106
2009-2011 (Cohort)	35-44	\$659,202	\$471	\$203,513	\$261	\$862,715	\$396
2009-2011 (Cohort)	45-54	\$3,110,742	\$430	\$1,732,539	\$487	\$4,843,280	\$449
2009-2011 (Cohort)	55-64	\$10,884,825	\$543	\$4,625,807	\$704	\$15,510,632	\$582
	Total	\$14,681,670	\$506	\$6,597,432	\$590	\$21,279,102	\$530

APPENDIX D (continued)

TABLE LXXV

CORONARY ARTERY DISEASE EMERGENCY ROOM VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male ER Costs	Male ER Costs PMPM	Female ER Costs	Female ER Costs PMPM	Total ER Costs	Total ER Costs PMPM
2009	18-24	\$0	\$0	\$1,150	\$41	\$1,150	\$41
2009	25-34	\$172	\$6	\$0	\$0	\$172	\$6
2009	35-44	\$5,105	\$25	\$2,827	\$17	\$7,933	\$21
2009	45-54	\$41,962	\$22	\$20,419	\$32	\$62,381	\$25
2009	55-64	\$39,106	\$10	\$25,552	\$24	\$64,658	\$13
	Total	\$86,345	\$14	\$49,948	\$26	\$136,293	\$17
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$1,185	\$25	\$7,396	\$103	\$8,581	\$72
2010	35-44	\$7,532	\$39	\$10,951	\$58	\$18,484	\$48
2010	45-54	\$23,219	\$13	\$14,777	\$19	\$37,996	\$15
2010	55-64	\$34,290	\$8	\$34,276	\$29	\$68,566	\$12
	Total	\$66,226	\$10	\$67,401	\$31	\$133,627	\$16
2011	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2011	25-34	\$1,961	\$30	\$1,158	\$97	\$3,119	\$41
2011	35-44	\$19,907	\$50	\$4,027	\$34	\$23,935	\$46
2011	45-54	\$32,846	\$21	\$12,718	\$21	\$45,564	\$21
2011	55-64	\$57,801	\$14	\$23,158	\$19	\$80,959	\$15
	Total	\$112,515	\$18	\$41,061	\$21	\$153,577	\$19
2009-2011	18-24	\$0	\$0	\$3,591	\$189	\$3,591	\$65
2009-2011	25-34	\$6,760	\$23	\$14,765	\$52	\$21,525	\$38
2009-2011	35-44	\$55,898	\$35	\$26,546	\$30	\$82,445	\$33
2009-2011	45-54	\$136,822	\$17	\$73,031	\$19	\$209,853	\$18
2009-2011	55-64	\$218,622	\$10	\$135,629	\$19	\$354,251	\$12
	Total	\$418,102	\$13	\$253,562	\$21	\$671,665	\$15
2009-2011 (Cohort)	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2009-2011 (Cohort)	25-34	\$4,822	\$18	\$13,660	\$51	\$18,482	\$34
2009-2011 (Cohort)	35-44	\$44,195	\$32	\$22,346	\$29	\$66,541	\$31
2009-2011 (Cohort)	45-54	\$123,897	\$17	\$70,182	\$20	\$194,078	\$18
2009-2011 (Cohort)	55-64	\$189,254	\$9	\$117,474	\$18	\$306,728	\$12
	Total	\$362,167	\$12	\$223,662	\$20	\$585,829	\$15

APPENDIX D (continued)

TABLE LXXVI

CORONARY ARTERY DISEASE OUTPATIENT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Outpatient Costs	Male Outpatient Costs PMPM	Female Outpatient Costs	Female Outpatient Costs PMPM	Total Outpatient Costs	Total Outpatient Costs PMPM
2009	18-24	\$0	\$0	\$4,673	\$167	\$4,673	\$167
2009	25-34	\$829	\$30	\$0	\$0	\$829	\$30
2009	35-44	\$43,772	\$212	\$40,073	\$239	\$83,845	\$224
2009	45-54	\$537,719	\$283	\$308,310	\$485	\$846,030	\$333
2009	55-64	\$1,390,814	\$341	\$592,095	\$545	\$1,982,909	\$384
	Total	\$1,973,135	\$318	\$945,150	\$493	\$2,918,285	\$359
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$6,359	\$132	\$14,748	\$205	\$21,107	\$176
2010	35-44	\$50,768	\$260	\$144,321	\$760	\$195,089	\$507
2010	45-54	\$564,648	\$318	\$335,393	\$437	\$900,040	\$354
2010	55-64	\$1,546,421	\$355	\$488,698	\$417	\$2,035,119	\$368
	Total	\$2,168,196	\$340	\$983,160	\$447	\$3,151,356	\$368
2011	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2011	25-34	\$30,862	\$475	\$1,534	\$128	\$32,397	\$421
2011	35-44	\$190,702	\$477	\$19,823	\$165	\$210,525	\$405
2011	45-54	\$1,480,914	\$930	\$243,966	\$402	\$1,724,880	\$784
2011	55-64	\$1,606,128	\$382	\$491,341	\$411	\$2,097,469	\$388
	Total	\$3,308,606	\$527	\$756,664	\$391	\$4,065,271	\$495
2009-2011	18-24	\$2,116	\$59	\$2,868	\$151	\$4,984	\$91
2009-2011	25-34	\$58,839	\$204	\$43,484	\$154	\$102,323	\$179
2009-2011	35-44	\$418,767	\$263	\$318,030	\$361	\$736,797	\$298
2009-2011	45-54	\$3,416,668	\$432	\$1,505,191	\$401	\$4,921,859	\$422
2009-2011	55-64	\$7,312,118	\$337	\$3,007,761	\$425	\$10,319,879	\$359
	Total	\$11,208,509	\$356	\$4,877,333	\$406	\$16,085,842	\$370
2009-2011 (Cohort)	18-24	\$2,116	\$59	\$0	\$0	\$2,116	\$59
2009-2011 (Cohort)	25-34	\$42,198	\$154	\$39,151	\$146	\$81,349	\$150
2009-2011 (Cohort)	35-44	\$362,598	\$259	\$272,338	\$349	\$634,936	\$291
2009-2011 (Cohort)	45-54	\$2,851,486	\$395	\$1,435,323	\$404	\$4,286,809	\$398
2009-2011 (Cohort)	55-64	\$6,276,058	\$313	\$2,833,917	\$431	\$9,109,975	\$342
	Total	\$9,534,456	\$329	\$4,580,730	\$410	\$14,115,185	\$351

APPENDIX D (continued)

TABLE LXXVII

CORONARY ARTERY DISEASE PROFESSIONAL VISIT COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Professional Costs	Male Professional Costs PMPM	Female Professional Costs	Female Professional Costs PMPM	Total Professional Costs	Total Professional Costs PMPM
2009	18-24	\$0	\$0	\$1,694	\$61	\$1,694	\$61
2009	25-34	\$1,930	\$69	\$0	\$0	\$1,930	\$69
2009	35-44	\$23,227	\$113	\$13,852	\$82	\$37,079	\$99
2009	45-54	\$277,703	\$146	\$161,350	\$254	\$439,053	\$173
2009	55-64	\$497,762	\$122	\$170,194	\$157	\$667,956	\$129
	Total	\$800,621	\$129	\$347,090	\$181	\$1,147,712	\$141
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$1,660	\$35	\$10,100	\$140	\$11,760	\$98
2010	35-44	\$19,582	\$100	\$48,792	\$257	\$68,374	\$178
2010	45-54	\$208,256	\$117	\$129,596	\$169	\$337,852	\$133
2010	55-64	\$648,438	\$149	\$179,506	\$153	\$827,945	\$150
	Total	\$877,937	\$138	\$367,994	\$167	\$1,245,931	\$145
2011	18-24	\$177	\$15	\$0	\$0	\$177	\$15
2011	25-34	\$3,861	\$59	\$731	\$61	\$4,592	\$60
2011	35-44	\$28,453	\$71	\$6,937	\$58	\$35,390	\$68
2011	45-54	\$145,923	\$92	\$65,411	\$108	\$211,333	\$96
2011	55-64	\$505,082	\$120	\$147,388	\$123	\$652,470	\$121
	Total	\$683,496	\$109	\$220,466	\$114	\$903,962	\$110
2009-2011	18-24	\$2,503	\$70	\$3,642	\$192	\$6,144	\$112
2009-2011	25-34	\$12,294	\$43	\$30,184	\$107	\$42,478	\$74
2009-2011	35-44	\$140,619	\$88	\$99,547	\$113	\$240,166	\$97
2009-2011	45-54	\$810,840	\$102	\$602,378	\$161	\$1,413,218	\$121
2009-2011	55-64	\$3,286,208	\$152	\$1,056,247	\$149	\$4,342,455	\$151
	Total	\$4,252,464	\$135	\$1,791,997	\$149	\$6,044,460	\$139
2009-2011 (Cohort)	18-24	\$2,503	\$70	\$0	\$0	\$2,503	\$70
2009-2011 (Cohort)	25-34	\$9,602	\$35	\$28,479	\$106	\$38,081	\$70
2009-2011 (Cohort)	35-44	\$120,429	\$86	\$70,678	\$90	\$191,107	\$88
2009-2011 (Cohort)	45-54	\$733,988	\$102	\$583,871	\$164	\$1,317,859	\$122
2009-2011 (Cohort)	55-64	\$2,541,828	\$127	\$983,911	\$150	\$3,525,740	\$132
	Total	\$3,408,350	\$118	\$1,666,939	\$149	\$5,075,289	\$126

APPENDIX D (continued)

TABLE LXXVIII

CORONARY ARTERY DISEASE REMAINDER COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Remainder Costs	Male Remainder Costs PMPM	Female Remainder Costs	Female Remainder Costs PMPM	Total Remainder Costs	Total Remainder Costs PMPM
2009	18-24	\$0	\$0	\$479	\$17	\$479	\$17
2009	25-34	\$5,477	\$196	\$0	\$0	\$5,477	\$196
2009	35-44	\$31,905	\$155	\$17,804	\$106	\$49,709	\$133
2009	45-54	\$153,261	\$81	\$68,604	\$108	\$221,865	\$87
2009	55-64	\$276,415	\$68	\$95,048	\$88	\$371,463	\$72
	Total	\$467,057	\$75	\$181,936	\$95	\$648,993	\$80
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$4,976	\$104	\$4,358	\$61	\$9,334	\$78
2010	35-44	\$21,039	\$108	\$203,889	\$1,073	\$224,929	\$584
2010	45-54	\$160,893	\$91	\$49,343	\$64	\$210,235	\$83
2010	55-64	\$339,308	\$78	\$126,427	\$108	\$465,735	\$84
	Total	\$526,216	\$83	\$384,017	\$174	\$910,233	\$106
2011	18-24	\$38	\$3	\$0	\$0	\$38	\$3
2011	25-34	\$546	\$8	\$499	\$42	\$1,045	\$14
2011	35-44	\$37,588	\$94	\$7,052	\$59	\$44,640	\$86
2011	45-54	\$114,177	\$72	\$53,668	\$88	\$167,845	\$76
2011	55-64	\$456,887	\$109	\$218,633	\$183	\$675,520	\$125
	Total	\$609,236	\$97	\$279,852	\$145	\$889,087	\$108
2009-2011	18-24	\$45	\$1	\$203	\$11	\$248	\$5
2009-2011	25-34	\$5,415	\$19	\$13,590	\$48	\$19,006	\$33
2009-2011	35-44	\$128,286	\$80	\$565,556	\$642	\$693,842	\$280
2009-2011	45-54	\$504,851	\$64	\$276,043	\$74	\$780,894	\$67
2009-2011	55-64	\$1,672,501	\$77	\$800,689	\$113	\$2,473,190	\$86
	Total	\$2,311,099	\$73	\$1,656,081	\$138	\$3,967,180	\$91
2009-2011 (Cohort)	18-24	\$45	\$1	\$0	\$0	\$45	\$1
2009-2011 (Cohort)	25-34	\$3,880	\$14	\$11,637	\$43	\$15,516	\$29
2009-2011 (Cohort)	35-44	\$101,650	\$73	\$547,288	\$701	\$648,938	\$298
2009-2011 (Cohort)	45-54	\$441,784	\$61	\$269,119	\$76	\$710,903	\$66
2009-2011 (Cohort)	55-64	\$1,445,992	\$72	\$717,471	\$109	\$2,163,463	\$81
	Total	\$1,993,351	\$69	\$1,545,514	\$138	\$3,538,866	\$88

APPENDIX D (continued)

TABLE LXXIX

CORONARY ARTERY DISEASE PHARMACY COSTS BY AGE AND GENDER

Year(s)	Age Group	Male Pharmacy Costs	Male Pharmacy Costs PMPM	Female Pharmacy Costs	Female Pharmacy Costs PMPM	Total Pharmacy Costs	Total Pharmacy Costs PMPM
2009	18-24	\$0	\$0	\$990	\$35	\$990	\$35
2009	25-34	\$3,250	\$116	\$0	\$0	\$3,250	\$116
2009	35-44	\$27,296	\$133	\$17,582	\$105	\$44,878	\$120
2009	45-54	\$340,843	\$179	\$140,447	\$221	\$481,290	\$190
2009	55-64	\$952,658	\$234	\$338,631	\$312	\$1,291,289	\$250
	Total	\$1,324,047	\$213	\$497,651	\$259	\$1,821,697	\$224
2010	18-24	\$0	\$0	\$0	\$0	\$0	\$0
2010	25-34	\$5,396	\$112	\$5,988	\$83	\$11,384	\$95
2010	35-44	\$19,124	\$98	\$38,478	\$203	\$57,603	\$150
2010	45-54	\$350,271	\$198	\$130,809	\$171	\$481,080	\$189
2010	55-64	\$1,122,618	\$258	\$475,987	\$406	\$1,598,605	\$289
	Total	\$1,497,410	\$235	\$651,261	\$296	\$2,148,671	\$251
2011	18-24	\$15	\$1	\$0	\$0	\$15	\$1
2011	25-34	\$2,383	\$37	\$96	\$8	\$2,479	\$32
2011	35-44	\$56,689	\$142	\$20,849	\$174	\$77,538	\$149
2011	45-54	\$382,468	\$240	\$149,182	\$246	\$531,650	\$242
2011	55-64	\$1,351,934	\$321	\$323,212	\$270	\$1,675,146	\$310
	Total	\$1,793,490	\$286	\$493,339	\$255	\$2,286,829	\$278
2009-2011	18-24	\$15	\$0	\$56	\$3	\$71	\$1
2009-2011	25-34	\$9,552	\$33	\$24,085	\$85	\$33,636	\$59
2009-2011	35-44	\$164,878	\$103	\$126,274	\$143	\$291,152	\$118
2009-2011	45-54	\$1,446,190	\$183	\$789,318	\$210	\$2,235,508	\$192
2009-2011	55-64	\$4,857,589	\$224	\$2,022,427	\$286	\$6,880,016	\$239
	Total	\$6,478,224	\$206	\$2,962,160	\$247	\$9,440,384	\$217
2009-2011 (Cohort)	18-24	\$15	\$0	\$0	\$0	\$15	\$0
2009-2011 (Cohort)	25-34	\$8,974	\$33	\$20,751	\$77	\$29,725	\$55
2009-2011 (Cohort)	35-44	\$147,213	\$105	\$116,489	\$149	\$263,702	\$121
2009-2011 (Cohort)	45-54	\$1,310,809	\$181	\$748,838	\$211	\$2,059,646	\$191
2009-2011 (Cohort)	55-64	\$4,458,142	\$222	\$1,951,885	\$297	\$6,410,027	\$241
	Total	\$5,925,153	\$204	\$2,837,963	\$254	\$8,763,116	\$218

APPENDIX E

Analytic Framework**1. Value of Claims Data**

- 1.1. Public Health
- 1.2. Chronic Disease Epidemiology
- 1.3. Healthcare System
- 1.4. Case Studies and Demonstration Projects

2. Experience with Claims Data

- 2.1. Access
- 2.2. Use

3. Challenges to Using Claims Data

- 3.1. Access
- 3.2. Resources
- 3.3. Experience and Expertise
- 3.4. Training of the Public Health Workforce
- 3.5. Vendors
- 3.6. Data Quality and Completeness
- 3.7. Standard Methodologies
- 3.8. Limits of Claims Data

4. APCD Data

- 4.1. Advocacy and Public Health Leadership
- 4.2. Politics and Legislation
- 4.3. Federal Leadership

APPENDIX F

Value of Claims Data		P1	P2	P3	P4	P5	P6	P7
1.1	Public Health	Some outside forces push programs to look at all data available so that creates interest in using claims data [120] Claims would have even more value if it was across multiple payers because you get something back [124] Experience with claims data one of the building blocks that need to be in place so when HIE arrives public health is ready to take part from a data perspective [132]	Claims and clinical data one piece really missing, and we recognize we need it [5] APCDs are not a game changer, it's just another Band-Aid [115]	Public health program people see the value even though they don't know exactly what value they can get out of it [20] Very valuable data source [22] at least the state has the APCD data and to me it would be excellent to get access to data and use the data for now, and then we have our larger scale implementation of the HIE then that can extend what we have already in the claims data and then you can put those two systems together [601]	Once an APCD has been legislatively established, public health is eager to figure out what they can get out of it [648]	There is a business case on how you are spending limited population health dollars [1212] The folks at the federal level see the value of the data and the effort that states are putting into it [735]	People could see there is something in this data [701]	Public health is encouraged and interested in working with APCD data [1116] Agree this data should be used by public health to understand how limited population health dollars are being spent [1218]
1.2	Chronic Disease Epidemiology	Huge interest in getting into claims data and doing things with it [13]		Chronic disease analysis well received by public health program leads [28] Having all the claims data we may be able to better understand the disease burden in the population, we can roughly know the population with diabetes [87]			Utah was able to show right away the amount of money that is spent on chronic disease. [701]	Interest in using the data to look at disease prevalence, variation in disease treatment costs and quality and efficiency at the provider level [821]
1.3	Healthcare System	Sensitivities within the state when you talk about using claims data to assess the functioning of the healthcare system. You have to talk about it term of integration with public health services, it cannot sound like assessing quality of the system [52]				With the expenditures of the Medicaid alone should be looking at this data [1212]		Interest in provider specific (group level or more broadly) variation in efficiency and quality using HEDIS process measures [809]

APPENDIX F (continued)

1.4	Case Studies and Demonstration Projects	Case studies and demonstration projects would be useful [180] Case studies and demonstration projects are the first step toward building a trust level or comfort with we know how to do this and there are other folks who know how to do it [196]		There would be value because people know there is value in it but don't know exactly what's in it. Examples to show what can be done with the data or another state or people have done it will help support the argument to gain access to the data [166]		Demonstration projects and case studies would absolutely be helpful [678] More work can be done by public health to define the opportunities with the data [908]		Definitely could use more case studies, projects, illustrations on showcasing the value [694]
Experience with Claims Data		P1	P2	P3	P4	P5	P6	P7
2.1	Access	Have access to Medicaid claims [45] The Medicaid program opened up the claims data warehouse to the epi program [288]	Access to APCDs has been a huge disappointment. Four years and no meaningful data [214] Many chronic disease programs lost faith in APCDs and moved on because it's not really going to be there for them [246]	Have experience accessing Medicaid data [24] Years ago epidemiologists got access to formatted Medicaid data through a university that had been doing their own research on it [250] Have not seen the data. Trying to get access but have so many competing interests that it is being put on the back burner [149]		Public health is not fully utilizing or maximizing the opportunity to use APCDs [659]	Public health is not the primary user of the data. Health care reform is the focus. In time it will become more general use. It's a timing thing, quality measure needs to be solidified before much attention can be paid to public health needs [1107] Public health temporarily lost interest. The first attempts by chronic disease epidemiologists to go at the data themselves was a disaster [705]	Health department has access to APCD [638] Public health has access. Interest and support but not a lot of momentum in leveraging APCDs [642]

APPENDIX F (continued)

2.2	Use	<p>Identified the ABD population and examined things of interest to help health promotion [47]</p> <p>With asthma and disability grant funds able to work with the data, learned a lot, especially with disabled population on how we were classifying hospitalizations for example [65]</p> <p>Focus of analyses was on what can we say about the burden of chronic disease in this population, what can we say about preventive services that might have been provided, what gaps exist and how might public health help fill the gaps (integration with public health services) [68]</p> <p>Put a lot of asthma grant money to build own capacity to analyze Medicaid data [288]</p> <p>Incredible use of the claims with newborn screening program...linking directly to claims to directly to improve quality of programs that the state health department offers outside Medicaid [305]</p> <p>Medicaid data used to examine asthma [57]</p>	<p>Used to identify which conditions are the leading cost drivers [72]</p> <p>Have access to Medicaid data warehouse (easier because Medicaid falls in the health department) and have used it sort of effectively [313]</p>	<p>Have done analysis on their own of disease burden specifically asthma prevalence in Medicaid population. Data was already cleaned up by the university [27,258]</p>	<p>One state used claims data for population health both for planning purposes as well as finding areas for investment opportunities with limited public health dollars based on where the problems are [614]</p> <p>Claims data also used to link to registry data [617]</p> <p>Using claims to identify specific disease categories/disease states. Incidence/prevalence and cost by geography for deployment of scarce public health dollars [759]</p> <p>Benchmarking between Medicaid and commercial populations [767]</p> <p>Have run HEDIS for quality of care purposes [771]</p> <p>Employers benchmarking their own employer groups against others helping to evolve health and wellness programming [779]</p>	<p>Use has been limited. Some public health people are trying to do diabetes disease management in clinics so the data is being use for measurement [826]</p>	<p>Public health users are looking at disease prevalence and costs associated with chronic disease by region, by geography [805]</p>
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APPENDIX F (continued)

Challenges to Using Claims Data		P1	P2	P3	P4	P5	P6	P7
3.1	Access	When the technologies emerged to allow exchange of claims data, HIPPA introduced confusion. Inappropriate exchange would have consequences so a lot easier for plans not to take the risk [428] Ownership over the population and the data, we don't need you in our data [432]	The biggest barrier is not having access to the data [539] We have had a health plan partnership for many years which we learned quite a bit. However, the health plan system is difficult in the United States. First priority is to make money not population based public health [489] We have had success with health plans around specific activities (diabetic eye exams, mammograms) but it hard to get them to unite. Their nature is not to work together. Don't have the same mission [494] Medicaid data is not current (2-3yrs old) so it's a limitation [313]	Lost ability to access Medicaid claims data [29]	Getting public health access will be a challenge for a while [1224]			
3.2	Resources	Difficulty with resource support and time due to other priorities (chronic disease) [15] Program are interested to use the data but ultimately back away in terms of resource commitment [120] You need to maintain a certain infrastructure to be able to do analyses of secondary data sources like claims [400]	Capacity may be an issue with understanding vendor software analyzing APCD data [229]	Resources to work on the data is seen as a challenge [32] Still building up epidemiology capacity in the area of chronic disease. [451,461]	Money is a big barrier [1065] Scares people away [1070] Paradox with funding. One hand having not money or the perception of money stops progress. On the other hand, it has stimulated states because they need this data to make better decisions about where to cut and where to cut more strategically [1084]	Money is a big barrier [1067]	Health department is challenged from a resource perspective in leveraging APCD [634] APCDs takes a lot of resources [1030]	Resources a major barrier [1119]

APPENDIX F (continued)

Challenges to Using Claims Data		P1	P2	P3	P4	P5	P6	P7
3.3	Experience and Expertise	<p>Due to the lack of experience with claims data, if it was used and happens to show a program in a bad light, is it due to our own lack of quality control or lack of knowing how to work with data [184]</p> <p>Not a lot of experience shared across states on how to manipulate claims data [190]</p> <p>Try to vet with the actuary staff but the time they can spend with us can vary [193]</p> <p>Expertise is a barrier on a couple levels...one is at the policy level. Need specific expertise about the policies which impact the data. Medicaid is one program where you need state level expertise, private payers like BCBS would be a whole other level [199]</p> <p>You need to work with the data to learn things like de-duplication or understanding continuity of care. You need the detail [295]</p> <p>Limited skills in terms of analysis [511]</p>	<p>We have the capability of figuring this out. It just takes some time. We have the capacity to do it. If we had the data, we would learn how to use it [533]</p>	<p>Lack of experience/expertise to analyze the data is a challenge [35]</p>	<p>State health departments have the skill to use, analyze and report this data [1246]</p> <p>Public health has analytic capacity and are partnering with other agencies and academic institutions. [1250]</p> <p>I hope to see APCD analysis with open source tools instead of relying on vendors [1262]</p>	<p>They are doing it today. They have the expertise [1248]</p>	<p>They couldn't make sense of the big data [705]</p>	<p>Understanding is a major barrier [1119]</p> <p>They have the skill to do it [1268]</p> <p>Challenge is maintaining a level of understanding of the APCD, the data, limitations, methodologies [1270]</p>
3.4	Training of the Public Health Workforce	<p>Feels like that we train people up and then they go work for Blue Cross Blue shield [480]</p> <p>Trying to hire epidemiologists with certain expertise [515]</p> <p>Big data analytics not really covered in the Schools of Public Health [519]</p>	<p>Training may be an issue with understanding vendor software analyzing APCD data [229]</p>	<p>Trying to hire epidemiologist with strong analytic skills. The health department has a deficiency in strong analytic skills. Lacks the people who can see the value in the data and dig in [471]</p> <p>No strong academic public health support. The schools of public health are not long established programs. Not pushing things forward [459]</p>				<p>Challenged with turnover and keeping someone at the health department knowledgeable and trained [639, 1269]</p> <p>Training on methodologies is a major barrier [1119, 1269]</p> <p>Public health not defining the use case needed to determine what training and what staff is needed to leverage the data [1125]</p>

APPENDIX F (continued)

Challenges to Using Claims Data		P1	P2	P3	P4	P5	P6	P7
3.5	Vendors		Vendor's software is not aligned with the needs of epidemiologists to analyze the data. Cannot answer basic questions about the data. Proprietary algorithms [218] The black boxes that vendors have for analyzing data are not helpful because we don't know the methods underneath [233] Their goal is isn't' really public health [524]	Private software is too fixed, not flexible. Not a lot of faith in it [267]			Vendor is a barrier. Slowing things down. But relying on a vendor so the state does not have to invest in building the code to analyze the data [1288]	Good relationship with vendor [1271] Can provide valuable analytic support [1280]

APPENDIX F (continued)

3.6	Data Quality and Completeness			<p>Claims data in original format is messy and may increase difficulty using it [265]</p>	<p>Early metrics are geared at state level or geography, blunt measures because the data quality of the clinical and physical level data is a challenge in the early years and will continue to be [195]</p> <p>If they can get their act together and investments are made in data quality there is huge application in the area of chronic disease treatment, but just can't get there. Systems are established and running on a dime [802]</p> <p>25 yrs ago public health had the same criticisms of hospital discharge systems. But once people started using it many of those issues were resolved [1170]</p> <p>When epidemiologists says the data has gaps, show me a perfect data system and why are you not part of the system [1175]</p> <p>Don't let the perfect be the enemy of the good, move forward and get these systems evoked [1175]</p>	<p>Lots of states are mired in the data production and the actions that take place afterword [775]</p>	<p>Administrative data is administrative data. Contributors have a fair amount of skin in the game [812]</p> <p>A challenge is some university folks and epidemiologist and comment that it is not perfect so it's not adequate [817]</p> <p>There are gaps in the data, missing pockets of commercial business and Medicare [1142]</p> <p>This is a limitation for the epidemiologists and research minded which is a barrier itself [1147]</p> <p>The data is not perfect but it has its strengths and is directional. It may not be perfect but it's what we have and even with its imperfections it is powerful [1194]</p>
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APPENDIX F (continued)

Challenges to Using Claims Data		P1	P2	P3	P4	P5	P6	P7
3.7	Standard Methodologies	Continuity of enrollment a challenge [359]	Agreed upon methodology for analyzing claims data would be helpful [233] Documented standard methods would allow for us to replicate consistently across health plans and other payers [404] People pop in and out of Medicaid so defining who is in Medicaid is difficult [322]	Confirming eligibility is an issue and validation of diagnoses [333]			Maybe public health could help define the requirements of what should be in the data and what should be there from an analysis perspective [898]	
3.8	Limits of Claims Data	You almost can answer but you need the clinical data too [85] With aggregate claims data, zip code is still too high, need to be more geographically granular to identify chronic care hotspots to make real public health use of the data [135]	We are trying to get at the % of the population has control hypertension [76]	We don't know what patients have controlled diabetes unless we see them in the hospital (likely uncontrolled if hospitalized) [93] Claims data alone very valuable but lacks the lab/clinical information [98]				

APPENDIX F (continued)

APCD Data		P1	P2	P3	P4	P5	P6	P7
4.1	Advocacy for Claims Data	<p>Worried and frustrated about the optimism among people in the state on how quickly it will be here. [126]</p> <p>Its worth pursuing claims data because it is here now if you could get the buy in. [587]</p> <p>Accessing HIE for chronic disease is a long ways off [589]</p> <p>Claims can fill some of the need now and its sort of a training ground for understanding the things that will be coming when the information flow. The more you work with claims the more you will understand the challenges you will face with HIE [595]</p>	<p>Competing interests in the APCDs. Public health becomes a lesser interest because there are lots of researchers and people interested in the data and it gets in the way of basic core fundamental public health [238]</p> <p>HIE will be viable but is a ways off [501]</p> <p>Its minimal, but there are things we can learn. It's a baby step [598]</p>	<p>Not much of a force going out to request the data [451,461]</p> <p>Get access to APCDs and use the data now. Then when we have a large scale implementation of HIE that can extend what we already have in the claims data and we can put the two systems together. That would be something [603]</p>	<p>Agreement with We've seen one state. You've seen one state [611]</p> <p>Public health one of the cited uses [625] Public health not the lead in terms of advocacy, more out of governor's office or Medicaid office [627]</p> <p>Public health should be pushing hard to get this data and what is working is some states is to start with Medicaid [853]</p> <p>In states where not APCDs efforts have started, public health should advocate for this data as a core public health dataset [940]</p>	<p>We've seen one state. You've seen one state [610] APCDs have been advocated for and/or managed by the state insurance department, the governor's office, the state Medicaid office, the health department, or some type of hybrid or delegated model [618]</p> <p>I don't think I have ever not see Public Health at the table [656]</p> <p>Public health has built a strong case to get APCDs created [840]</p> <p>Some states did demonstration projects with carriers directly [842] In some states if you go after the top 3-4 carriers you would have a big chunk of the population [845]</p> <p>Starting with Medicaid is easier because states have direct access to that data. Also, they can leverage funds from Medicaid to start building APCDS [864]</p> <p>In Delaware, a cancer consortium was trying to get data on voluntary basis but got some small funding and are starting to build it out with a population focus [886]</p> <p>Suggestion was the development of a voluntary 501c3 model or a 501c3 hybrid where the state authorizes the development of the APCD but the 501c3 manages it.</p>	<p>Public health was not a advocate for APCD in Utah, it was driven by the people interested in health care reform and transparency [662]</p>	<p>Public health department as interested in APCD [636]</p> <p>Public health can only be a collaborator with the other users of the data. [1030]</p> <p>Not a lot of success in leveraging the data due to the concentrated dedicated approach with public health to define the use case [1125]</p> <p>Public health needs to be part of the solution [1206]</p>

APPENDIX F (continued)

APCD Data		P1	P2	P3	P4	P5	P6	P7
4.2	Politics and Legislation				Both the carrot and stick approach have been used. Legislation and then value prop (Wisconsin) [1313]	There will be political barriers and political navigation. Public health needs to find the right person to take up the cause or the right person with the right clout to get the discussion on the table [1045] Public health does not have a lot of clout [1060] The multi-stakeholder approach may be more successful [1048] Legislation pushed payers to share data [1308]		
4.3	Leadership	CDC does not get it. Not much interest from CDC to help provide guidance on analyzing claims data and really developing it from a surveillance perspective (likely due to each state's Medicaid program is different) [346] No champion for the use of claims data [358] CMS could also provide some leadership in terms of using public health resources or epidemiology on this data [383] AHRQ could be beneficial in helping to develop the resource base for public health to look at these data more routinely [396]	CDC could show more leadership on standard methodologies [234,537] AHRQ could help too [399]	CDC should take a lead on getting definitions and some sort of standard methodology to analyze this data [337]	At the federal level (CDC), the APCD initiatives are basically invisible [689] The lack of federal leadership with APCDs is consistent with how the Fed treated hospital data systems. No support to states however when states hit critical mass with comparable data they were eager to take advantage of the data [724] We are on the same trajectory with states figuring it out then getting criticism from the CDC and others [728] Public health and epidemiology to step up to link databases and fill in the gaps (because they have the authority). Instead of building their own expensive surveillance system, leverage this one [1181] Data improves, the CDC should be helping support [1184]	It's hard for the fed to focus on supporting APCDs due to their silos or own priorities [739] CMS did work to get APCDs easier access to Medicare data [745]		

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