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Impact of Medicare and Medicaid Beneficiaries with Selected Conditions on Emergency Department Utilization

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Abstract

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MBA, The George Washington University, 1998

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) and Congestive Heart Failure (CHF) are conditions that represent significant and ongoing medical costs, including frequent emergency department (ED) visits, hospitalizations, work absences, and disability. This retrospective cross-sectional study, examined the effects of the frequent ED visits due to COPD and CHF on the beneficiaries of Medicare and Medicaid in Maryland. The goal was to identify the factors that led these patients to visit the ED, the impact of these visits on Medicare utilization and costs across Maryland, and preventative intervention strategies to control this population's costs of care. Secondary data were analyzed from 2010-2012 using the Administrative Claims Data in Chronic Condition Warehouse (CCW). The results for the first research question revealed that an increase in the number of primary care physicians was correlated with a decrease in ED visits; thus, persons living in areas with higher PCPs also had lower ED visits therefore the first null hypothesis was rejected ($\chi^2 = 3.85$, $p=.05$) . The results for the second research question revealed that ED visits had no significant relationship with death in a given year; thus, patients may be diverted to less expensive care sites to minimize cost and ED overcrowding, therefore the second null hypothesis was not rejected ($\chi^2 = 0$, $p=.98$). In both cases, the confounding variables of gender, age, and race had significant effects upon the relationship. Health Professionals and policy makers may use the findings to develop strategies to increase supply of PCPs, adapt patient centered interventions and modify existing chronic disease care strategies to minimize or prevent lifestyle and environmental factors that affect chronic disease outcomes. Such improvements could contribute to positive social change by eliminating or reducing the overcrowding that occurs in emergency departments in Maryland and other states.

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Dedication

For my wife, Rita, and my children, Sam, Max and Joshua. You are each equally my pride and joy. Rita, thank you for your support and selfless sacrifices made in shouldering far more than your fair share of the parenting and household burdens throughout the entire doctorate program.

Acknowledgments

I would like to express my sincere appreciation and gratitude to my Chair, Dr. James Rohrer, for his advice, guidance, and encouragement throughout this journey, the Ph.D. program in the school of Health Science. Dr. Rohrer's intellectual heft is matched by his genuinely good nature, constructive and timely feedback kept me focused. I am truly fortunate to have had the opportunity to work with him during completion of the project.

I would also like to thank my committee members, Dr. Lawrence Fulton and Dr. Naoyo Mori for their guidance, thought provoking suggestions provided to me during the course of my dissertation writing. In a similar way, I would like to recognize my professional colleagues, Dr. Alexandre Laberge, Dr. Sha Maresh, Lirong Zhao, M.S., Dr. Caitlin Cross-Barnet, Dr. Erin Colligan, Dr. Sai Ma and Dr. Nevin Laib for the contributions that each of them made to my intellectual growth and understanding of the subject.

Finally, I would remiss if I didn't acknowledge the enormous sacrifices made by my parents, Mr. John and Margaret Amoh, and my guardians, Walter W. Martin, Max and Sarah Mayes for their words of wisdom, instilling in me discipline, hard work, dedication and commitment in achieving my educational and lifelong goals. I will forever be grateful.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is associated with a significant economic burden including frequent emergency department (ED) visits, hospitalization, work absence, and disability (Rabe et al., 2007). COPD affects more than 24 million adults in the United States (Gold, Phelps, Jacobson, & Neuman, 2010; Mannino, Homa, Akinbami, Ford, & Redd, 2002) surpassing stroke as the third leading cause of death (Center for Disease Control [CDC], 2010). COPD also affects 12% of elderly adults and disabled Medicare beneficiaries and is frequently associated with comorbid conditions and increased disease severity (Dalal, Shah, Lunacsek, & Hanania, 2011). In 2007, the costs of COPD exceeded $42 billion, with $29.5 billion attributed to direct health care expenditures and $8 billion to mortality (National Institutes of Health [NIH], 2012). One may determine the severity of COPD and classify it by utilizing various methods. Incidence and prevalence estimates differ greatly, depending on the methods used for diagnosis and classification. It remains important to understand the true epidemiology of COPD to monitor trends over time and to determine the effectiveness of potential treatments or preventive measures (Rycroft, Heyes, Lanza, & Becker, 2012).

Similarly, Congestive Heart Failure (CHF) also represents the most common cause of ED visits and hospitalization in the Medicare program, and led to nearly 1.4 million hospitalizations and $17 billion in total spending in 2007 alone (Medicare Payment Advisory Commission [MPAC], 2009). Despite pharmacologic and technical advances in the diagnosis and management of CHF, outcomes remain suboptimal: one in

10 patients die in the first 30 days after hospitalization for CHF, and of those who survive, one in four is readmitted (Krumholz et al., 2009). The high clinical and financial burden of this condition, especially among elderly persons, has led to great interest in both improving outcomes and decreasing the cost of care (Krumholz et al., 2009).

This study examined the association between COPD/CHF and the frequent ED visits impact on utilization and costs among Maryland Medicare and Medicaid beneficiaries. The research identified the characteristics that drive CHF/COPD patients to frequent the ED and how they influence utilization and cost across the various counties in Maryland. Intervention strategies were examined to help address preventive measures and how to control cost of care for such population. This study also assessed how the Medicare and Medicaid beneficiaries' access their Primary Care Physicians (PCPs) as well as the epidemiologic triad model (person, time, and place) of those with CHF/COPD among Maryland Medicare and Medicaid beneficiaries.

This study promoted positive social change by supporting research in CHF and COPD to assist healthcare providers in focusing more on preventive measures in reducing CHF and COPD. The study examined how insurance coverage, access to care, cost, location (counties), and other characteristics are related to significant differences in ED use in the state of Maryland Medicare and Medicaid general population. Two specific case types, CHF and COPD, were examined for the analysis, as these types were known as costly to the medical care system (Knowlton et al., 2013).

Chapter 1 previewed this research including what the study was about along with the related literature summaries. Applicable literature reviews were examined under

Chapter 2. The study addressed all the specified criteria per the quantitative checklist including research questions and hypotheses.

Background

While frequent ED use among Medicare and Medicaid beneficiaries in Maryland is not well understood, findings from related research on other populations provide insight that may be relevant to the Medicare and Medicaid population. In this section, articles of frequent ED use are reviewed and relevant information will be synthesized. Ultimately, gaps in the literature on frequent ED use will be discussed, as well as how this research analysis will further the understanding of ED use among Medicare and Medicaid beneficiaries in the state of Maryland. Pines et al. (2011), in a recent literature review and expert consensus, identified several gaps in the public health and medical literature on frequent ED use. The major challenge to coherently synthesizing results from research conducted to date on frequent ED attendance is the lack of a meaningful categorization of frequent users in a given year as well as longitudinally across time (Pines et al., 2011). The authors call for a more meaningful taxonomy to describe ED utilization based not only on frequency but also patterns such as long-term, shot-term, and periodic use, admission to the hospital, number of facilities visited, and stratification by specific conditions (Pines et al., 2011).

Mandelberg, Kuhn, and Kohn (2000) observed that the proportional risk of frequent use in the elderly is not well understood, as researchers studying data based on observations of single ED and population surveys demonstrated low representations of older adults. The authors call for interventions focused on patients with chronic frequent

use, as these patients may have substantial needs that are not being met in primary care (Mandelberg et al., 2000). Gruneir, Silver, and Rochon (2011) found that lack of studies on the effect of proactive health services, such as primary care on reducing ED visits, represents the most obvious gap in the research literature. Fuda and Immekus (2006) found that, in an analysis of claims from all nonfederal, acute-care hospitals in Massachusetts, a bimodal distribution in frequent ED use is defined as five or more visits annually with increased prevalence in patients aged 25-44 and older than 65. They noticed that regression to the mean in frequent users with most returning in frequent or nonuse the subsequent year (Fuda & Immekus, 2006). Cook et al.. (2004) observed similar trend in a statewide analysis of ED claims from 1996-1998 in Utah finding that only 5% of participants were frequent ED users in all 3 years of study. Hunt, Weber, Showstack, Colby, and Callaham (2006) made the case that frequent ED use should be defined according to the size and impact of the group of patients. Their rationale was that persons accounting for a disproportionate share of ED incidents would be an appropriate target for intervention (Hunt et al., 2006). They also emphasized that focusing on a group that represents 25% of ED events would likely have a substantive impact on the total number of ED visits (Hunt et al., 2006).

LaCalle and Rabin's (2010) systematic review concluded that there is no generally accepted standard of what constitutes frequent ED use. The identified variable definitions ranged from two to 14 visits annually and observed that investigators usually weigh the sensitivity of a measure in capturing the population of interest against the specificity of defining a group that can be targeted for intervention (LaCalle & Rabin,

2010). LaCalle and Rabin (2010) advocated for a cut of four or more visits in a calendar year, which is commonly used in most literatures. Locker, Baston, Mason, and Nicholl (2007) further supported a threshold of four or more visits to classify frequent ED use. They projected a theoretical distribution of ED visits to an ED and minor injury unit in England. At four visits, the observed frequency plateaued at around 1000 on a logarithmic scale, deviating significantly from the expected distribution, which continued to decline (Locker et al., 2007). The authors found that 99.99% of chance attenders would be expected to show up in ED less than four times in a calendar year (Locker et al., 2007). Xu, Nelson, and Burke (2009) found that frequent ED users are heavy users of other healthcare services; in addition, they have more outpatient visits and hospitalizations compared to infrequent ED users.

This research contributed to the literature on frequent ED use in the state of Maryland by examining the persistent and frequent ED use among Medicare beneficiaries. This work identified a population of users that are potentially suited to public health intervention. This study addressed an important gap in the current research by exploring the importance of primary care at the community and individuals level in reducing frequent ED use. The goal of this dissertation was to provide health services researchers and policy makers with a better understanding of modifiable factors that affect frequent ED use to guide future studies and inform the development of targeted interventions and policies.

Problem Statement

The 1986 Emergency Medical Treatment and Active Labor Act (EMTALA), requires hospitals to perform examinations and provide stabilization treatment before transferring a person to another provider (Byrne et al.., 2003; Centers for Medicare & Medicaid Services [CMS], 2012). EMTALA offers hospitals no option other than treating anyone who comes through the ED. People using ED services and increasing congestion in emergency rooms (ERs) in Maryland hospitals has developed into a significant burden and represents a concern to Maryland hospitals and lawmakers (Lucas et al., 2009; Maryland Health Care Commission [MHCC], 2002). The joint work group on ED Utilization conducted a study of ED issues (Cheung, Wiler, Lowe, & Ginde, 2012; MHCC, 2002; Tang et al., 2010) and found that, from 1990 to 2001, ED visits rose from 1.5 million annually to 1.9 million – an increase of 27% (Garcia, Bernstein, & Bush, 2010). The group also found that hospitals increasingly use temporary closures of EDs to manage overcrowding (Fwu, Eggers, Kimmel, Kusek, & Kerala, 2013). As a result, ambulance diversions (as measured by hours that hospitals in the state operate on yellow alerts status) have risen fourfold between 1996 and 2001 (Fwu et al., 2013). These findings in utilization are consistent with the national trend (Affleck Parks, Drummond, Rowe, & Ovens, 2013; Burt & McCaig, 2001; McCaig & Nawar, 2006).

According to LaCalle and Robin (2010); Ruger, Richter, Spitznagel, and Lewis (2004); and Locker et al. (2007), frequent ED users are more likely to arrive by ambulance and to be admitted to the hospital. While in the hospital, the frequent users stay for longer periods (Locker et al., 2007). Several authors, including LaCalle and

Robin (2010), Hunt et al. (2006), and Ruger et al. (2004), in a systemic review found that frequent ED users are also a resource-intensive population that relies mainly on services such as physician and hospital care.

Medicare beneficiaries are nearly twice as likely compared to privately insured individuals to identify as frequent ED users (Hunt et al., 2006). ED uses are particularly unhealthy events for older adults, who represent the majority of the Medicare population, as they may start a series of adverse events such as hospitalization, readmission, nursing homes bound, and death (Gruneir et al., 2011). Identifying individual and health system factors associated with frequent ED users in the Medicare and Medicaid population remained policy-relevant and would fill the knowledge gap. It would also inform and assist Maryland policy makers in allocating scarce resources to bring about a positive social change, such as supporting research in CHF and or COPD to assist healthcare providers in focusing more on preventive measures in reducing CHF or COPD.

This researcher examines how insurance coverage, access to care, cost, location (counties) and other characteristics are related to the significant differences in ED use in the state of Maryland among the Medicare and Medicaid general population. Two specific cases types were chosen to adjust for clinical differences among medical care users that might bias findings. COPD and CHF were chosen as the case types for this analysis because they are known to be costly to the medical care system (Knowlton et al., 2013).

Purpose of the Study

This quantitative study explored whether ED use by Medicare and Medicaid beneficiaries in Maryland with CHF and COPD is associated with utilization and cost. Dependent variables include two ambulatory care sensitive condition (ACSC) conditions (e.g., CHF and COPD) and patient outcomes. Quantitative statistical analysis were used to assess ED utilization and cost for patients with CHF/COPD compared to patients who did not access ED during the years under consideration, while controlling for and evaluating effects of covariates known to affect ED visits. Results were examined to ascertain the economic burden on families, states, and the nation.

This study was unique in addressing the overcrowding in Maryland ED and the ways Medicare and Medicaid beneficiaries with CHF and COPD influence the health resource utilization and cost. It focused on patients 65 years and over with CHF/COPD, a condition that need attention in the state of Maryland. The retrospective quantitative design allowed for evaluation of the impact of ED use on acute care hospitals. The epidemiological design study assessed hospitals ED characteristics in the counties in the states and time of CHF/COPD condition onset.

Research Questions and Hypotheses

The primary research objective included drawing from the administrative claims data in chronic condition warehouse (CCW) and Medicaid analytic extract files (MAX), the researcher examined the importance of primary care, measured at the community and individual level, in regard to episodic (1 year) and persistent (2 consecutive years) frequent ED use in the calendar years 2011 and 2012. COPD and CHF were chosen as

the case types for this analysis because they are known to be costly to the medical care system (Knowlton et al., 2013).

RQ1. Is the primary care provider (PCP) supply in the State of Maryland associated with frequent ED use among Maryland Medicare and Medicaid beneficiaries who have either CHF or COPD?

> **$H_0$1**: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have no significant relationship with number of ER visits by beneficiaries, while controlling for age, gender, and race.
>
> **H_a1**: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have a significant relationship with number of ER visits by beneficiaries, while controlling for age, gender, and race.

RQ2. Is frequent ED use associated with end of life for Maryland Medicare and Medicaid beneficiaries with either CHF or COPD who die during the study?

> **$H_0$2**: Increased number of visits to the ER will not have a significant relationship with death among Maryland Medicare and Medicaid beneficiaries with either CHF or COPD while controlling for age, gender, and race.
>
> **H_a2**: Increased number of visits to the ER will have a significant relationship with death among Maryland Medicare and Medicaid

beneficiaries with either CHF or COPD while controlling for age, gender, and race.

Theoretical Foundation

According to Andersen's model of health behavior, utilization of health services is determined by chain of predisposing characteristics, enabling resources, and need (Andersen, 2008). Need, both perceived and evaluated, represents the proximate determinant of health services utilization (Andersen, 2008). However, predisposing factors, such as sociodemographic characteristics and health beliefs, place certain individuals at greater risk for developing an illness (need), and enabling resources such as community resources and access to primary care influence the seeking of medical services to address needs (Andersen, 2008). When need is the primary determinant of health service utilization, rather than predisposing characteristics or enabling resources, access to services is assumed to be equitable (Andersen, 2008). On the contrary, if predisposing characteristics and enabling resource explain more variance in health service utilization, it suggests inequity in utilization (Andersen, 2008) access and quality.

Andersen updated this model in 2008 to reflect the importance of contextual characteristics as well as individual determinants of health service utilization (Andersen, 2008). Contextual characteristics can predispose (as in the demographic composition of a community), enable (as the supply of medical personnel and facilities), or suggest need for health services (as in mortality and morbidity rates; Andersen, 2008). These factors interact with individual characteristics, which predispose, enable, or suggest need for health services, as discussed in the previous paragraph. The contextual and individual

characteristics in turn lead to health behavior such as personal health practices (i.e., nutrition and fitness), processes of medical care (i.e., physician-patient communication, ordering certain tests or prescriptions), and use of personal health services (e.g., physician and ED visits; Andersen, 2008). Ultimately, these factors result in the outcomes of perceived health, evaluated health, and consumer satisfaction (Andersen, 2008).

This study focused on the usage of one type of health services: ED use. The main contextual variables of interest will be measures of insurance coverage, at two levels: (a) the number of beneficiaries with Medicare coverage who frequent the ED and (b) the number of beneficiaries with Medicaid coverage who frequent the ED. Other contextual level variables such as case type, cost, sociodemographic composition and health indices of the community will be used as controls. Individual level variables relating to predisposing characteristics such as race, age, and Medicaid eligibility, and need (e.g., chronic disease diagnoses and Health Care Commission [HCC] scores) were also used as controls to help isolate the effects of primary care factors.

The Epidemiological Triad Model is a common model used in public health illustrates the relationships among an agent, a host, and the environment (Andersen, 2008). This, as used in communicable disease, is basic and foundational to all epidemiology (Andersen, 2008). However, infectious diseases are no longer the leading cause of death in industrialized nations (Andersen, 2008). As a result, a more advanced model of the triangle of epidemiology has been developed (Andersen, 2008). The new model includes all aspects of the communicable disease model and it is useful with the current causes of diseases, conditions, disorders, defects, injury, and death reflecting

current causes of illness and conditions (Andersen, 2008). Behavior, lifestyle factors, environmental causes, ecological elements, physical factors, and chronic diseases have been accounted for (Lilienfeld & Lilienfeld, 1980).

Figure 1 presents an adapted and advanced model of the triangle of epidemiology, better reflecting the behavior, lifestyle, and chronic disease issues found in modern times. The advanced model recognizes that disease states and conditions affecting a population are complex and that causative factors are many (Lilienfeld & Lilienfeld, 1980). It gives recognition to the fact that many factors and elements contribute to disease in populations.

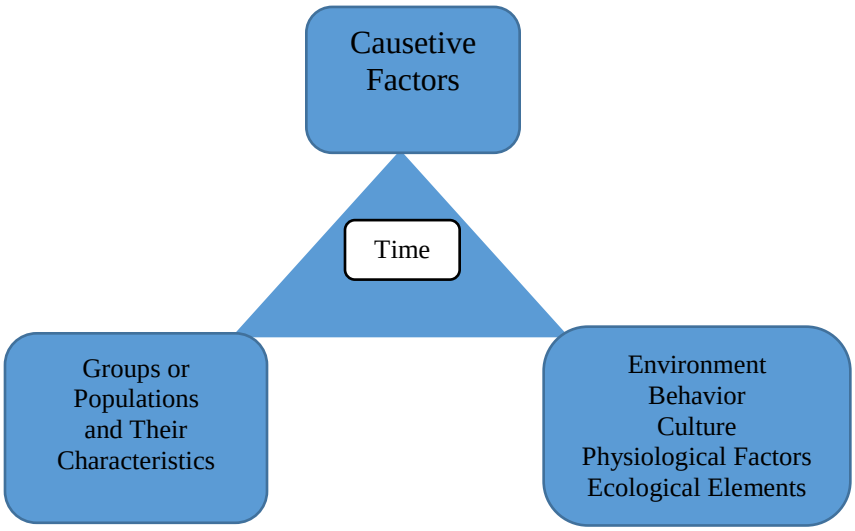

Figure 1. Advanced model of the triangle of epidemiology. Adapted from Foundations of Epidemiology, 2nd ed. p. 14.

Nature of the Study

This study consisted of retrospective analyses of secondary administrative claims from the Medicare program for calendar year 2010-2012 and a corresponding 100% Medicaid administrative claims data for the same years under consideration. A 20%

sample of the CCW, which includes approximately 10 million Medicare beneficiaries in any given recent calendar year, was analyzed for the study with specific emphasis on the state of Maryland (Buccaneer, 2011). CMS (2012), in partnership with Buccaneer Computing and Software Services, launched the CCW in 2005 as a means of linking claims by beneficiary across the continuum of care (Buccaneer, 2011). Using a unique beneficiary identification number, information regarding inpatient, outpatient, skilled nursing facility, home health, hospice, and Part D prescription drug use may be linked to demographic and assessment data for a given beneficiary (Buccaneer, 2011). The CCW only administrates claims for beneficiaries enrolled in fee-for-service (FFS) Medicare; encounter data for beneficiaries in Medicare Advantage (MA) managed care plans are maintained by private health plans (Buccaneer, 2011). The MAX data, on the other hand, is a set of person-level data files on Medicaid eligibility, service utilization, and payments (Buccaneer, 2011). The MAX data are created to support research and policy analysis (Buccaneer, 2011). The MAX data are extracted from the Medicaid Statistical Information System (MSIS; Buccaneer, 2011).

Definitions

Ambulatory care sensitive condition (ACSC): Chronic diseases for which there is wide variation in hospitalization rates and for which had better access to and quality of primary care is believed to reduce unnecessary hospitalization (Oster & Bondmen, 2005).

Continuity of Care (COC): The period that Medicare and Medicaid beneficiaries with CHF/COPD visited their primary care physician consistently in managing their condition within the study period (Bayliss et al., 2015; Wolinsky et al., 2007).

Frequent Emergency Department visit: Four or more ED visits in a calendar year (LaCalle & Rabin, 2010).

Assumptions

The research depended on the administrative data for Medicare and Medicaid in analyzing the impact of utilization and cost on ED visits by beneficiaries with CHF and COPD. For the purposes of this study, it is assumed that all the beneficiaries experiencing CHF/COPD will access ED, though it is likely that some may access other means of heath care, which may or may not be captured in the data used.

It is assumed that an evidence of COC will help manage beneficiaries' condition thereby minimizing the frequent ED visits associated with CHF/COPD patients. In general, beneficiaries who experience chronic illness may be taking prescribed medication (Philipson, Snider, Lakdawalla, Stryckman, & Goldman, 2013). However, this researcher anticipated that this bias might be minimized by controlling for related covariates.

Scope and Delimitations

This study examined the Maryland Medicare and Medicaid beneficiaries (age 65 or over) with CHF and COPD conditions. Beneficiaries with these two chronic conditions were selected for this study because they are among the leading causes of death in the U.S. and their potential impact on ED utilization and cost are alarming (Aziz et al., 2011). The burden of the selected conditions (CHF/COPD) on families, local governments, and the nation merit a special attention and understanding of the characteristics that drives ED visits and cost. Knowing these will assist health professionals and policy makers in

controlling these public health issues through prevention measures. While there is previous evidence of CHF and COPD interventions to minimize the impact of these two conditions, more needs to be done with respect to prevention. In addition, CHF and COPD are among the health conditions flagged by CMS (2012) as high-risk population and having high readmission rate (Aziz et al., 2011; Kociol et al., 2013). Therefore, this study focused on beneficiaries with these two diagnoses.

Other studies have focused on adults (18 years and over) because patients at any age may experience any of the two conditions, this study included only Medicare and Medicaid beneficiaries 65 years and over who reside in the state of Maryland. Only beneficiaries exclusively diagnosed with CHF/COPD access the ED were considered. While there are other subgroups suffering from the selected conditions in Maryland, it was not feasible to include such groups.

The results of this study could potentially apply to other states within U.S. as well as hospitals across the nation that experience overcrowding in their EDs with Medicare and Medicaid beneficiaries afflicted with CHF and COPD. While there may be variations between hospitals, depending on the extent of patient condition and the frequency with which the patients access ED, geographic location of beneficiaries and other relevant covariates were included in the study.

Limitations

CHF/COPD prevention may be encouraged through exercise, diet, and medication or in some cases invasive surgery (Hannan et al., 2008). Nevertheless, a combination of different approaches may be employed for a maximum outcome. An attempt was made to

control confounding variables; however, not all covariates related to frequent ED visits were identified. For instance, the lack of availability of an appropriate rehabilitation environment after ED/hospital might have significantly influenced patients' health outcomes. Therefore, literature from previous studies was assessed to determine other relevant variables likely to affect COC.

Design and or Methodological Weaknesses

This study attempted to produce results that may apply to other states and hospital settings and potentially other chronic condition diagnoses (Hannan et al., 2008). Afflicted patients with one chronic condition are generally lacking physical activities, eating poorly, and or are sicker compared to average patients with one chronic condition (Philipson et al., 2013). Any likely weakness were controlled for during the analyses. Patients with congestive heart failure may have large amounts of fluid retention; therefore, weights might have varied and some weight loss might have associated with improvement in condition.

Biases

The biggest potential bias might have included selection bias; meaning, patients with CHF/COPD, no Medicare, and no Medicaid benefits were not considered for this study. CHF/COPD screening of patients in hospitals within 24 hours is a national standard of the Joint Commission (TJC; Somanchi, Tao, & Mullin, 2011). I overcame this bias by adjusting for CHF/COPD risk, as well as other factors affecting ED use (e.g., age, sex, BMI, and comorbidity score) through linear regression analysis. I understood

the rules surrounding research and designed this study accordingly to provide the data of interest. I believe I was free of bias in evaluating results of the study.

Significance

The significance of the study lay in the possibility of examining the significant differences in ED use across different counties in the state of Maryland, and assessing how insurance coverage, access to care, cost, and other characteristics related to frequent ED use. This research could have significant implication for public health policy. As not much is known about the characteristics of ED users in Maryland, the study could fill the knowledge gap. In addition, it could inform and assist policy makers in allocating scarce resources to bring about a positive social change. This research could assist policy makers in allocating scarce resources to support research in CHF and COPD. This would in effect assist healthcare providers to focus more on preventive measures in reducing CHF and or COPD. Knowledge from this research could potentially assist Medicare and Medicaid beneficiaries in making meaningful healthier lifestyle changes such as diet, nutrition, exercise, moderation in alcohol consumption, and smoking cessation that have the effect of prolonging longevity and minimizing the burden (healthcare cost, financial, loss of home, single parenthood) on families and society. Ultimately, the positive effects could alleviate the financial burden on the local, state, and federal governments. The findings of the study could potentially suggest further reforms to improve primary care and reduce ED utilization. Furthermore, geriatric EDs that mainly cater to the needs of chronically ill elderly patients have recently emerged as a possible alternative to

traditional EDs, and this research could lend support to Medicare pursuing this model of care to cater for the most vulnerable population in our society (Hartocollis, 2012).

Summary

This chapter outlined the problem of frequent ED visits by Maryland Medicare and Medicaid beneficiaries with CHF and COPD, and of the economic burden experienced by families, states, and the nation as well as the need for preventive measures and treatment of preventive strategies for patients who are Medicare and Medicaid beneficiaries. Effective preventive measures of ED service utilization and healthcare cost among this vulnerable population were also examined. Rosenblatt et al. (2000) found that a PCP who is generalist, as opposed to a specialist, appears to be a protective factor along with the patient having high COC with PCPs. Oster and Bindman (2005) found that ambulatory care sensitive conditions (ACSC) are chronic diseases for which there is wide variation in hospitalization rates and for which better access to and quality of primary care is believed to reduce unnecessary hospitalization. Jencks, Williams, and Coleman (2009) found that three ACSCs, heart failure, pneumonia, and COPD, represented the top three causes of 30-day hospitalizations in Medicare fees for service beneficiaries. Kirby, Dennis, Jayasinghe, and Harris (2010) reported that COPD and CHF were two of the conditions most strongly associated with frequent readmission on the ED use. Ruger et al. (2004) argued that gender also appears to influence ED use with women more compared to men. They found that frequent ED users have consistently been found to be insured and have greater odds of being covered by Medicare or Medicaid than infrequent or nonusers (Ruger et al., 2004).

The need for further study in understanding the characteristics of the older population in accessing ED in managing their chronic conditions (CHF/COPD) with respect to Maryland Medicare and Medicaid beneficiaries closed the knowledge gap and helps reduce the economic burden as well. This study design, employed in addressing the research, was restricted to the two chronic conditions of CHF and COPD. These two high-risk conditions have higher health care resource utilization, costs, and high 30-day readmission rates (Aziz et al., 2011; Kociol et al., 2013). The use of physical exercise and diet were both studied as preventive measures. The theoretical foundation of the epidemiological triad was discussed was to describe the problem of CHF/COPD patients' frequent use of ED in Maryland.

Chapter 2 includes a literature review that presents further details on the research described above. In addition, further background research on the theoretical foundation and conceptual framework is presented in more detail in the next chapter. Chapter 3 follows, containing a description of the methods used in this study.

Chapter 2: Literature Review

Introduction

While frequent ED use among Medicare and Medicaid beneficiaries in Maryland is not well understood, findings from related research on other populations provide insight that may be relevant to the Medicare and Medicaid population. Pines et al. (2011), in a recently literature review and expert consensus, identified several gaps in the public health and medical literature on frequent ED use. The major challenge to coherently synthesizing results from research conducted to date on frequent ED attendance is the lack of a meaningful categorization of frequent users in a given year as well as longitudinally across time. The authors call for a more meaningful taxonomy to describe ED utilization based not only on frequency but also on patterns, such as long-term, short-term, and periodic use, admission to the hospital, number of facilities visited, and stratification by specific conditions (Mandelberg et al., 2000). Mandelberg et al. (2000) observed that the proportional risk of frequent use by the elderly is not well understood as studies based on observations of single ED and population survey have low representation of older adults. The authors call for interventions focused on patients with chronic frequent use, as these patients may have substantial needs that are not being met in primary care (Mandelberg et al., 2000). Gruneir et al. (2011) found that lack of studies on the effect of proactive health services such as primary care on reducing ED visits is the most obvious gap in the research literature.

Fuda and Immekus (2006) found that in an analysis of claims from all nonfederal, acute-care hospitals in Massachusetts, a bimodal distribution in frequent ED use is

defined as five or more visits annually with increased prevalence in patients aged 25-44 and older than 65. They noticed that regression to the mean in frequent users with most returning in frequent or nonuse the subsequent year. Cook et al. (2004) observed similar trend in a statewide analysis of ED claims from 1996-1998 in Utah finding that only 5% of participants were frequent ED users in all 3 years of study. Hunt et al. (2006) made the case that frequent ED use should be defined according to the size and impact of the group of patients. Their rationale was that persons accounting for a disproportionate share of ED incidents would be an appropriate target for intervention. They also emphasized that focusing on a group that represents 25% of ED events would likely have a substantive impact on the total number of ED visits (Hunt et al., 2006).

LaCalle and Rabin's (2010) systematic review concluded that there is no generally accepted standard of what constitutes frequent ED use. The identified variable definitions ranged from two to 14 visits annually and observed that investigators usually weigh the sensitivity of a measure in capturing the population of interest against the specificity of defining a group that can be targeted for intervention (LaCalle & Rabin, 2010). LaCalle and Rabin (2010) advocated for a cut of four or more visits in a calendar year, which is commonly used in most literatures. Locker et al. (2007) further supported a threshold of four or more visits to classify frequent ED use. They projected a theoretical distribution of ED visits to an ED and minor injury unit in the England (LaCalle & Rabin, 2010). At four visits, the observed frequency plateaued at around 1,000 on a logarithmic scale, deviating significantly from the expected distribution, which continued the decline (LaCalle & Rabin, 2010). The authors found that 99.99% of chance attenders would be

expected to show up in ED less than four times in a calendar year (LaCalle & Rabin, 2010).

Oster and Bindman (2003) found that ACSC are chronic diseases for which there is wide variation in hospitalization rates and for which better access to and quality of primary care is believed to reduce unnecessary hospitalization. Jencks et al. (2009) found that three ACSCs in particular – heart failure, pneumonia, and COPD were the top three causes of 30-day hospitalizations in Medicare FFS beneficiaries. Kirby et al. (2010) reported that COPD and CHF were two of the conditions most strongly associated with frequent readmission on to the ED.

Chapter Overview

In this section, articles of frequent ED use were reviewed and relevant information was synthesized. Ultimately, gaps in the literature on frequent ED was also discussed, as well as how this research analysis furthered our understanding of ED use among Medicare and Medicaid beneficiaries in the state of Maryland. This research attempted to contribute to the literature on frequent ED use in the state of Maryland by examining the persistent and frequent ED use among Medicare beneficiaries.

This work could help identify a population of users that are potentially suited to public health intervention. This study could also address an important gap in the current research by exploring the importance of primary care at the community and individuals level in reducing frequent ED use. The goal of this dissertation was to provide health services researchers and policy makers with a better understanding of modifiable factors

that affect frequent ED use in order to guide future studies and inform the development of targeted interventions and policies.

To evaluate the problem statement for this study thoroughly, applicable previous research literature was reviewed and summarized under Appendix A. Previous literature identified as relevant to my research topic was used to support the study while attempting to address potential gaps in the literature.

Literature Search Strategy

I used Google Scholar search engine, Center for Medicare and Medicaid Services database, Walden University Database, and PubMed to identify related articles and journals. The key words used in conducting the research include *frequent emergency department use/visits, emergency room visits, emergency department use by Medicare and Medicaid beneficiaries in Maryland,* and *Medicare and Medicaid beneficiaries with CHF and or COPD*. Papers published within 6 years were mainly used for the research. However, earlier articles that were deemed useful were also reviewed.

Theoretical Foundation

Andersen's Model of Health Behavior

According to Andersen's (2008) model of health behavior, utilization of health services is determined by chain of predisposing characteristics, enabling resources, and need. Need, both perceived and evaluated, represents the proximate determinant of health services utilization (Andersen, 2008). However, predisposing factors, such as sociodemographic characteristics and health beliefs, place certain individuals at greater risk for developing an illness (i.e., need) and enabling resources, such as community

resources and access to primary care, influence the seeking of medical services to address needs (Andersen, 2008). When need is the primary determinant of health service utilization, rather than predisposing characteristics or enabling resources, access to services is assumed to be equitable (Andersen, 2008). On the contrary, if predisposing characteristics and enabling resources explain more variance in health service utilization, then it also suggests inequity in utilization of access and quality (Andersen, 2008). Andersen (2008) updated this model to reflect the importance of contextual characteristics as well as individual determinants of health service utilization. Contextual characteristics can predispose (as in the demographic composition of a community), enable (as the supply of medical personnel and facilities), or suggest need for health services (as in mortality and morbidity rates; Anderson, 2008). These factors interact with individual characteristics, which predispose, enable, or suggest need for health services, as discussed in the previous paragraph. The contextual and individual characteristics in turn lead to health behavior such as personal health practices (i.e., nutrition and fitness), processes of medical care (i.e., physician-patient communication, ordering certain tests, or prescriptions), and use of personal health services (e.g., physician and ED visits). Ultimately, these factors result in the outcomes of perceived health, evaluated health, and consumer satisfaction.

Andersen's (2008) Behavioral Model (BM) has been used extensively in studies investigating the use of health services (Babitsch, Gohl, & von Lengerke, 2012). The studies identified for this review showed that the model has been used in several areas of the health care system and in relation to different diseases (Babitsch et al., 2012). The

1995 version of the BM was the version most frequently applied by researchers (Babitsch et al., 2012). However, the studies showed substantial differences in the variables used. The majority of the reviewed studies included age, marital status, gender/sex, education, and ethnicity as predisposing factors and income/financial situation, health insurance, and having a usual source of care/family doctor as enabling factors (Babitsch et al., 2012). As need factors, most of the studies included evaluated health status and self-reported/perceived health as well as variety of diseases (Babitsch et al., 2012). Although associations were found between the main factors examined in the studies and the utilization of health care, there was a lack of consistency in these findings (Babitsch et al., 2012).

This study focused on the usage of one type of health services: ED use. The main contextual variables of interest will be measures of insurance coverage, at two levels: (a) the number of beneficiaries with Medicare coverage who frequent the ED and (b) the number of beneficiaries with Medicaid coverage who frequent the ED. Other contextual level variables such as case type, cost, sociodemographic composition, and health indices of the community were used as controls. Individual level variables relating to predisposing characteristics such as race, age, and Medicaid eligibility, and need, such as chronic disease diagnoses and HCC scores, were also used as controls to help isolate the effects of primary care factors.

The Epidemiological Triad

The epidemiological triad model consists of a common model used in public health, and it illustrates the relationships among an agent, a host, and the environment

(Lilienfeld & Lilienfeld, 1980). This, as used in communicable disease, is basic and foundational to all epidemiology (Lilienfeld & Lilienfeld, 1980). However, infectious diseases are no longer the leading cause of death in industrialized nations (Lilienfeld & Lilienfeld, 1980). As a result, a more advanced model of the triangle of epidemiology has been developed. The new model includes all aspects of the communicable disease model and updated with the current causes of diseases, conditions, disorders, defects, injury, and death reflecting current causes of illness and conditions (Lilienfeld & Lilienfeld, 1980). Behavior, lifestyle factors, environmental causes, ecological elements, physical factors, and chronic diseases have been accounted for (Lilienfeld & Lilienfeld, 1980).

The new advanced model of the triangle of epidemiology reflects the behavior, lifestyle, and chronic disease issues found in modern times better compared to the first version. The advanced model recognizes that disease states and conditions affecting a population are complex and that causative factors are many. It gives recognition to the fact that many factors and elements contribute to disease in populations.

Applications of this Model in Ways Similar to this Study

By the 1960s, extensive studies such as the Framingham Heart Study, the Seven Countries Study, and the British Doctors Study, began to identify the leading causes of chronic diseases (Foody, Mendys, Liu, & Simpson, 2010). The various researches showed the effect of cigarette smoking, poor diet, physical inactivity, and high blood pressure to be leading causes of death (Foody et al., 2010). Almost half a century ago, the various researches helped identified behavioral causes of chronic diseases afflicting humankind (Foody et al., 2010). No researchers established a culprit of death to any

particular chronic disease; instead, causes were shown to have contributed to death (Remington & Brownson, 2010).

During and after the 1960s, researchers continued to study the relationship between risk factors (e.g., poor diet, lack of exercise, high blood pressure) and major chronic diseases (Remington & Brownson, 2010). For example, the diet and heart hypothesis was tested in observational studies such as the Framingham Heart Study, a prospective cohort study of residents of Framingham, Massachusetts (Foody et al., 2010). At the same time, researchers shifted their focus from chronic diseases to the behavioral risk factors preceding the diseases. The authors used the results from decades of epidemiologic studies to explain that about half of all deaths may be attributed to few risk factors (Foody et al., 2010). The research was later updated by Mokdad (as cited in Remington & Brownson, 2010).

In 1974, the Canadian Lalonde Report concluded that the health of a population could be considered in four broad elements: human biology, environment, lifestyle, and healthcare organization (Remington & Brownson, 2010). The model of the multiple determinants of health provides a broad conceptual framework for looking at the factors that affect health in a society (Remington & Brownson, 2010). The multidisciplinary approach of the model, along with other factors, were found to be accounting for differences in health outcomes and the opportunity for prevention (Remington & Brownson, 2010).

Some studies focused on the role of social and economic factors that had high risk for chronic disease. Marmot's research relating to British civil servants vividly portrayed

these concepts (Remington & Brownson, 2010). Marmot and other researchers have since showed demonstrated that health behaviors alone may not fully explain the risk associated with mainly health determinants (Remington & Brownson, 2010). A new field of social epidemiology emerged during this same period and became best known for identifying the social rise in health, in which health outcome effects exist not only at the extremes of high and low levels of education and income but also the ranges in between (Berkman & Kawachi, 2000; McGinnis et al., 2002).

Previous studies have shown the contribution to health outside the environment and behavior health (Woolf, Johnson, Phillips, & Philipsen, 2007). These factors include socioeconomic position, race/ethnicity, social networks and support, work conditions, economic inequality, and social capital (Woolf et al., 2007). These assertions were summarized, stating, "The greatest advances in understanding the factors that shape population health during the past 20 years has been the identification of social and behavioral conditions that influence morbidity, mortality, and functioning" (Remington & Brownson, 2010, p. 1). Though there has been a remarkable improvement in chronic disease epidemiology and management, there is a lag between scientific knowledge of viable chronic disease management and the widespread application to the particular population (Remington & Brownson, 2010).

Rationale for Choice of the Theory

The proposed research focused on epidemiological dimension as opposed to clinical trial. This retrospective cross-sectional study will use administrative data (Medicare and Medicaid) in performing the analyses. The three confounding relating to

the epidemiological triad model include person, time, and place. The investigative analyses of CHF/COPD would be done by controlling for age, sex, race, and socioeconomic factors, in relation to frequent ED use among Medicare and Medicaid beneficiaries. The place variable that was used in the analysis of the study included the State of Maryland, and comparing ED use in relation to CHF and COPD among Medicare and Medicaid beneficiaries; this represented an aspect that has been shown previously as costly (Agarwal et al., 2012). Time was considered in this study as the duration a patient is admitted into a particular hospital and the time beneficiaries are afflicted with CHF/COPD, whether it started in the early or later stage in the patient life and whether the impact of ED use is affected by such timing factors.

Conceptual Framework

The CMS (2012) has been inflicting financial penalties on hospitals with high risk-adjusted, 30-day all-cause unplanned readmission rates after an index hospitalization for an acute exacerbation of chronic obstructive pulmonary disease (AECOPD; DHHS, 2014). This policy is an extension of Medicare's Hospital Readmission Reduction Program (HRRP), which seeks to improve quality and reduce costs by creating financial incentives for hospitals to prevent readmissions and it is a part of a trend toward increased accountability in health care (CMS, 2012). One of the means to improve care quality, eliminate waste, and reduce costs, performance measures is an increased use of public reporting, pay for performance, and accreditation. All this is an effort to result in a benefit for patients (Joint Commission, 2015).

The focus was the topic of 30-day hospital readmissions. Among Medicare beneficiaries discharged from the hospital in 2005, 17.6% were rehospitalized within 30 days, resulting in estimated annual expense of $17 billion (MedPAC, 2007). Approximately 76% of these patients were rehospitalized for cause potentially due to poor quality of care. The report hinted that decreasing avoidable, quality-driven readmissions could possibly save $12 billion annually (MedPAC, 2007; Jencks et al., 2009).

Literature Review Related to Key Variables and Concepts

In an effort to reduce ED visits and prevent avoidable hospitalization and readmission as well as a means for cost savings, the U. S. Patient Protection and Affordable Care Act (ACA) was passed in 2010. Included in this ACA was legislation to support the HRRP, an initiative that ties Medicare reimbursement to hospitals with patient outcomes (CMS, 2012). CMS began reducing payments by 1%, which eventually increased to a full 3% in October 2014, to hospitals with high rates of all-cause readmission for three conditions: acute myocardial infraction, congestive heart failure (CHF), and pneumonia (DHHS, 2012). Until now, more than 2,000 hospitals have been penalized nationwide, resulting in an estimated $280 million in penalties for fiscal year 2013 (Kaiser Health Network, 2012).

Since October 2014, CMS has expanded the conditions to include all-cause unplanned readmissions after an index hospitalization for AECOPD (DHHS, 2014). In the United States, COPD is responsible for more than 1.5 million emergency room visits and 725,000 hospital admissions annually, with resulting healthcare costs approaching

$60 billion (Mannino et al., 2002). Among patients hospitalized for AECOPD, 34 to 40% do not receive recommended therapies, whereas nearly half receive at least one inappropriate or potentially harmful therapy (Lindenauer et al., 2006; Mularski, Asch, Shrank et al., 2006). Approximately 22.6% of patients discharged after AECOPD have an all-cause 30-day readmission, indicating the significant impact to patients, payers, and healthcare systems (Jencks et al., 2009; see Appendix A).

Critique of Method

Critique of CHF Studies

This section of the literature review will consist of an analysis of the various study designs, methods, and limitations relating to the studies associated with my research. Among the studies reviewed, there were differences in the design as well as the methods used in analyzing the research materials. According to O'Neil et al. (2010), the results indicated that race is a key predictor of preventable hospitalizations among the elderly for CHF, hypertension, diabetes, and adult asthma; racial disparities in these hospitalization rates are not explained completely by demographic and socioeconomic factors or underlying prevalence; and the excess costs from such disparities are substantial. These findings suggest that differences may be due to variation in access to primary care, quality of care, and physician practice experienced by elderly African Americans compared with Whites.

It was shown that minorities are less likely to have a regular doctor, source of care, and medical home. They are also less likely to report getting medical care when they need it. Further, it was found that racial disparities in access to care might be at least

partly explained by the type and extent of medical services available within communities with different racial compositions. The present study indirectly supports this finding, in that overall differences were found in ACSC hospitalization rates by geographic areas based on the racial composition of elderly residents. At the same time, it was found that racial differences persist within geographic, that is, residence location does not explain all racial differences suggesting that different racial groups may have different experiences in access to and quality of care even when they have the same geographic access to care.

Biello, Rawlings, Carroll-Scott, Browne, and Ickovics (2010) found that African Americans were hospitalized at a significantly younger ages that Whites for all causes, chronic conditions, acute conditions, and the following conditions – uncontrolled diabetes; bacterial pneumonia; diabetes of the circulatory system such as congestive heart failure and hypertension; COPD; and dehydration. Some of the limitations with respect to this study include that the data did not allow a determination of whether these were first or repeat admissions for ambulatory care-sensitive conditions. Using discharged records with incomplete data on SES and comorbid conditions limits the extent to which underlying causes can be disentangled. Primary sampling units were not available in the public-use files of the NHDS; therefore, generalized linear models could not be performed, and robust SEs had to be performed account for the dependence of individuals within clusters. Finally, because data were collected using discharge records, missing data and measurement error was problematic.

On the contrary, this study had some strengths, utilizing data from a representative national sample of more than 6800 hospital discharges. The focus on

ambulatory care-sensitive conditions, which are frequently used measures, can be easily replicated. Moreover, this can serve as a common metric through which changes over time can be documented. The results of this study highlight the impact that younger age at hospitalization may have on the social an economic well-being of individuals and their families, through loss of wages, poorer quality of life, and risk for a greater number of hospitalizations and severity of illness over the life span.

Another study of coronary heart disease risk trends, conducted by Kramarow, Lubitz, Lentzner, and Gorina (2007), showed an estimated 10-year risk of coronary events of an adult aged 45 to 65 years decreased largely despite an increased prevalence of obesity, and diabetes. Previous discharge statistics showed ischemic heart disease mortality and hospital admission for this population group described during the study period. The result for younger adults was similar to the decrease among older CHF group. The study found a 31% decrease in risk for older people aged 65 to 74 years in the study period. Recent study evidence for the role of decreasing risk factors in reducing coronary occurrence and mortality. The finding is similar to earlier studies of heart risk among patients with diabetes. It also affirms reports of risk to obesity decline due to treatment of risk factors (Ford, 2011).

Joynt, Orav, and Jha (2011) examined the relationship between volume of patients with CHF and clinical processes, outcomes, and costs, and found that patients with CHF discharged from hospitals with a higher volume of such patients received higher-quality care, on average, and had better outcomes, but at modestly higher cost. These relationships were independent of other key hospital characteristics, including teaching

status and hospitals size. The strongest effect of volume on outcomes was seen in the group of hospitals with the lowest volume. The effects of volume on outcomes seemed to diminish beyond 200 to 400 discharges over the study period. The findings suggest that the volume-outcome relationship previously observed for procedure-based conditions also existed for CHF and may extend more broadly to chronic medical conditions. The finding that higher volume was associated with greater inpatient costs is novel and has important implications for the health policy debate.

Limitations to this study include lack of data about the clinicians who cared for these patients and could not assess the effect of clinician volume or specialty on outcomes. Additionally, because administrative data were used rather than clinical data, the authors calculated a nurse-o-patient ratio for each hospital but lacked data on the intensity of the nursing care that each patient received. Furthermore, administrative data also presents difficulties in accounting for variations in the severity of illness across hospitals. Although administrative data are imperfect, they are standardized, validated, and increasingly used, even for public reporting. The focus on Medicare patients, though these patients make up more than 80% of CHF admissions, the applicability of the findings to non-Medicare patients was unclear.

Critiques of COPD Studies

The effects of exacerbations frequency of COPD patient may influence quality of life as well as overall long-term health outcome (Laurin, Moullec, Bacon, & Lavoie, 2012). The frequency of episodes could potentially affect overall health care cost of a state/nation. Most of the COPD studies reviewed did not touch on subgroup analysis or

medication adherence. The researchers observed utilization, cost, and the relationship with COPD beneficiaries with chronic bronchitis who have moderate and severe episodes within a year regarding health care service use and cost compared to other subgroups (Laurin et al., 2012). Patients who experience two or more episodes had higher numbers including rate of COPD episodes, PCP visits, as well as COPD associated cost of care.

The results highlighted that severe conditions have higher utilization and costs incurred for each patient. The amount reported under this study approximately could save $5125 within a year for COPD patients and $11,599 total costs. These results are similar to those reported by previous studies. For example, Yu et al. (2011) observed that health care costs increased in parallel with the severity of exacerbations experienced by COPD patients. Similarly, as seen in the current study, Yu et al. demonstrated that all-cause costs were double for patients with any exacerbation compared with those without any exacerbation. However, although similar trends in data were observed in both the study by Yu et al. (2011) and the current study, the cost and utilization rates reported by Yu et al. were lower compared to those observed in the current study. This may be because Yu et al. reported the data quarterly as opposed to annually, or it may be because Yu et al. focused on the general COPD patient rather than restricting the study to COPD patients with chronic bronchitis. In addition, the difference in data sources and or geographic location of the members observed in both Yu et al.'s study and the current study may include other contributing factors to cost differences.

Interestingly, as with the study by Yu et al. (2011), the research reported in the study derived from data from a claims database. One of the limitations inherent in using

claims data is that clinical measures, such as FEV1, were not available to identify baseline severity of patients or to measure outcomes during follow-up. In addition, as with all claims data analyses, there is the possibility for error due to missing information that was not coded in the database. However, the use of a claims database does provide a range and depth of data not necessarily available from other resources. Importantly, studies examining the cost of COPD exacerbations in other countries including France Canada, and Poland (Pasquale, Sun, Song, Hartnett, & Stemkowski, 2011) reported that cost went up because of severe exacerbations, which is similar to this research. Another limitation was that a multivariate regression was used to account for the selection bias and strengthen the causal inference. This design can only minimize bias affected by covariates; it would not minimize bias caused by unmeasured covariates. Hence, no causal deduced from the study.

Dalal et al. (2010) stated that more than 15% of hospital admission of COPD patients in 2008 were readmitted within 30–60 days and 17.8% of ED patients had frequent ED visit within 30 to 60 days. Other research reported that all-cause readmission rate for COPD patients was 22.6% within 30 days and a COPD-related had 38% within 5 months (Jencks et al., 2009).

Although Dalal et al. did not assess effect of other related conditions on utilization and cost, a number of patients afflicted with comorbidities such as cardiovascular, depression and asthma. Having other comorbidities have the effect of high hospitalization; for instance, asthmatic and COPD patients have significantly higher

respiratory-related costs relating to ER visits compared to COPD alone (Blanchette, Dalal, & Mapel, 2012).

Dalal et al. (2010) observed unadjusted relating to ER visits costs hospital admissions. The research has advantages in that costs of treating chronic disease are rarely examined from hospital point of view as many studies used administrative data with third party payer. The research highlights the cost incurred by hospitals. One of the major strength is the larger sample size pertaining to encounter categories.

A limitation affecting the larger database of inpatient data from 6022 hospitals is that unique patients may be identified from the records from a given hospital. Those who were readmitted to a different hospital, Dalal et al. (2010) could not evaluate the readmission rate. Jencks et al. (2009) found that 24% of Medicare beneficiaries admitted to a large hospital for any reason were readmitted to a different facility within 30 days. With these limitations, rates of rehospitalization and frequent ED visits are more likely to be underestimated.

In relation to the data, since it contained no clinical data, the authors could not assess smoking effect. Although prominent database had all the U. S. regional information, it mainly contained southern region data. The findings could not represent all the regions in the U.S. Lastly, there are possible missing diagnosis codes and procedures in administrative databases.

Yeatts et al. (2013) study conducted to estimate the burden of COPD-related ED visits used a surveillance system that captured 99.5% of ED visits in North Carolina provided an excellent opportunity to characterized COPD-related ED visits among a large

population. Yeatts et al. found that the COPD-related ED visits rate of 13 per 1,000 person-years among adults 45 years and older for 2008 to 2009 was higher than a national average of 8.72 per 1,000 person-years for 1992 to 2000 for adults greater or equal to 25 years of age. Yeatts et al.'s estimate was similar to the 13.16 per 1,000 person-years annual rate for ages 55 to 64 years (Mannino et al., 2002), but lower compared to the study by Rosychuk et al. (2010), which included those greater or equal to 55 years of age (25.6/1,000). Differences between Yeatts et al. rates and previous estimates are likely influenced by the study's age distribution, COPD definition, and temporal increases in disease.

Yeatts et al. (2013) related their findings to multiple ED visits were mixed compared with previous reports in the U.S. and Canadian Eds. They found patients on Medicare or Medicaid or noninsured patients were consistently more likely to have subsequent 30-day, 365-day, and multiple COPD ED visits within 365 days. Although Tsai, Griswold, Clark, and Camargo (2007) similarly found Medicaid was associated with increased COPD ED visits, other public (all Canadian and Medicare) insurance was not. Similar to Watson et al. (2004) that found no sex differences for ED visits.

Another study by DiBonaventura et al. (2012) examined some variables affecting working adults 40 to 64 years suffering from COPD in the U.S. Though earlier research evaluated impact of COPD on patient's outcomes, few researchers have focused only on workforce. Results indicated that workers who have COPD has significantly lower quality of life. The study however, excluded patients under 65 years of age with COPD.

The resource utilization was found to be significantly associated with COPD conditions. After taking into consideration the demographic and health history variables, COPD workers had primary care physician (PCP) visits. COPD workers showed significantly higher ER visits and hospital admissions compared to the control group. It may be possible that lack of PCP visits will explain patient's productivity loss. Perhaps, the absence of proper management of one's condition may result in poor outcomes and may account for higher rates of ER visits and hospital admissions (DiBonaventura et al., 2012).

This study was a cross sectional National Health and Wellness Survey (NHWS) so it was reported as associations rather than relationship. Due to self-reported nature of the survey, a recall bias may have accounted for unintended errors in the observed associations. Most could possibly be ignored to account for COPD diagnosis. Finally, though NHWS is demographic representation of the U.S. population, the randomized sampling framework was possibly different other than demographics, which may influence the size and direction of the relationship observed in the study (DiBonaventura et al., 2012).

Gap Addressed by this Study

Review of all previous literature that used administrative data and surveys were retrospective; others however were randomized controlled studies. While the studies may be of interest in establishing association, they may not fully exemplify the characteristics of Medicare and Medicaid beneficiaries in Maryland with chronic conditions, specifically CHF and COPD, and the impact on ED visits. Limited research was found regarding ED

utilization and cost, and no literature was identified that explored the epidemiological triad characteristics of person, time, place, and the ways some variables impact CHF and COPD preventive measures to curb health care costs among the older population. Several of the reviewed researchers showed a relationship between frequent ED visits and CHF and COPD. This include the vulnerable population (Dalal et al., 2010; Pasquale et al., 2012), patients with multiple chronic conditions (Joynt et al., 2011; Mannino et al., 2002; O'Neil et al., 2010), and workforce (DiBonaventura et al., 2012). While these researchers related CHF and COPD impact on ED visits to utilization and cost, none of the researchers conducted their studies in the State of Maryland, and none considered the epidemiological triad model's association with the two chronic conditions.

Evidence is limited, however, on the effectiveness of intervention for patients with a primary diagnosis of Heart failure. No studies specifically focused on Medicare and Medicaid beneficiaries ED visits; however, studies about utilization and cost impact among HF patients could be found. For example, the study on outpatients with CHF by Rosychuk et al. (2010) had too small of a sample size to draw definitive conclusions. Therefore, a gap exists for the study of CHF and COPD among Medicare and Medicaid beneficiaries who are frequent ED users. Furthermore, no literature was identified that observed epidemiological triad in the context of CHF/COPD. My research however will focus on filling the gap in the previous studies is intended to help fill a gap on studies of association of CHF and COPD patients' utilization and cost impact in relation to frequent ED visits will be evaluated. The epidemiological triad review will be considered in the analysis of covariates.

Additionally, some of the current research appears to be from outside the United States. Several studies (Agarwal et al., 2012; Miller et al., 2006; Tan et al., 2009) took place in Australia and New Zealand; Gershon, Wang, Wilton, Raut, and To (2010) and Al-Hazmi et al.'s (2007) studied occurred in Canada, and Shahab, Jarvis, Britton, and West (2006) and Soriano et al.'s (2003) studies occurred in England. Those that appear to focus on the population in the U.S. included O'Neil et al. (2010) and Biello et al. (2010), which were also involved in examining racial disparities in hospitalization for ACSC. Others that related to my research focused mainly on the U.S. population in general (DiBonaventura et al., 2012; Ford, 2011; Joynt et al., 2011; Kramarow et al., 2007; Krumholz et al., 2009; Laurin et al., 2012; Mannino et al., 2002; Pasquale et al., 2010; Sandoval et al., 2010; Thorpe, Ogden, & Galactionova, 2010; Tsai et al., 2007; Watson et al., 2004; Yeatts et al., 2013; Yu et al., 2011). The other researchers who considered cost impact included Blanchette et al. (2012); Dalal et al. (2010); Jencks et al. (2009); Marton et al. (2006); and Miller et al.'s (2005) studies. None of the studies reviewed were performed in Maryland, which has unique ED characteristics that has impact on utilization and cost among Medicare and Medicaid beneficiaries, and outcomes related to CHF and COPD interventions.

In summary, a number of factors have been identified in the existing literature that are related to the frequent ED visits among CHF and COPD patients associated with utilization and costs of care. CHF and COPD has been demonstrated to be a burden on not only the families of the patients but also on the state government and the nation as a whole. Most studies were conducted outside of the United States and none of them

examined the epidemiological triad model. The research will examine CHF/COPD health concerns of the most vulnerable population in Maryland, utilization and cost impact on ED visits with consideration of person, place and time burden of the two chronic conditions. The retrospective approach, evaluating the utilization and cost impact among the Medicare and Medicaid beneficiaries in Maryland, and help identify whether certain intervention strategies may help mitigate the excessive cost of care of CHF and COPD patients, and the burden on families, and the state of Maryland.

Summary and Conclusions

As described in the above analysis, CHF represents the most common cause of hospitalization in the Medicare program, and led to nearly 1.4 million hospitalizations and $17 billion in total spending in 2007 alone (MPAC, 2009). Despite pharmacologic and technical advances in the diagnosis and management of CHF, outcomes in the suboptimal, that is, one in 10 patients dies in the first 30 days after hospitalization for CHF, and of those who survive, one in four is readmitted (Krumholz et al., 2009). Earlier research showed improved health among the elderly population. Though prevalence of chronic conditions has risen, life expectancy among elderly have also increased and other health conditions have improved (Federal Interagency Forum on Aging-Related Statistics [FIFAS], 2010; Kramarow et al., 2007). As the trend indicates, the risk of CHD, it has contributed to poor health, disability, and death. The consequence of the aging baby-boomers could potentially put a strain on the healthcare system and cost but the overall effect may depend on the rate and extent of CHD (Ford, 2011; Thorpe et al., 2010).

The National health surveys showed an alarming rise of prevalence in obesity for the past three decades, current years the rise has plateaued for women. Recently, the prevalence of diabetes has risen for the entire population and for some age groups. Decrease in physical activity, quality diet and risen caloric intake have been identified as the culprit (Caballero, 2007). This has led to expectation that the negative effects on risk outcome of the population could diminish or reverse the decrease in CHD mortality and stroke in the future. It is interesting to note that several risk factors associated with CHD are interrelated and show varying trend (Kramarow et al., 2007).

Similarly, treatment of exacerbation is burdensome, however, information about cost drivers are hard to come by. COPD is known to be a leading cause of mortality and morbidity around the globe, which affect approximately 210 million people and account for 3 million deaths per year (World Health Organization [WHO], 2009). In the U.S., COPD is the third cause of death and amount to 15.4 million physician visits, 1.5 million ED visits, and 636,000 hospital admissions annually (Mannino et al., 2002; Pasquale et al., 2012). Referencing the national survey data, the overall economic burden of COPD in the U.S. in 2007 yielded $42.6 billion, including $26.7 billion in health care expenditures, while $11.3 billion was hospital care. The impact of COPD is anticipated to rise, as the population becomes older (Dalal et al., 2010).

COPD is deemed a critical public health issue due to higher incidence and COPD associated morbidity and mortality. The COPD condition have a significant health impact and a significant economic burden on the nation. The COPD condition was reported for 5.1% of adults in the U.S. from 2007 to 2009, and the condition was much prevalent

among the elderly and higher for women than men (Pasquale et al., 2012). COPD patients ended up having one to three times exacerbation yearly and treatment usually required ED visits or hospitalization. This posed a significant financial burden on society. Based on target population considered, approximately 25% to 47% of COPD patients experienced hospitalization and about 26% had emergency room visits yearly (Dalal et al., 2010). Several observational research showed that inpatient care amounts to 52% to 70% direct medical costs of COPD (Marton et al., 2006; Miller et al., 2005). Undoubtedly, utilization of ED services and cost increases with disease severity.

Chapter 3: Research Method

Introduction

This retrospective cross sectional study assessed the association between COPD/CHF and the frequent ED visits impact on utilization and costs among Maryland Medicare and Medicaid beneficiaries. The research identified the characteristics that drive CHF/COPD patients to frequent the ED visits and how they influences utilization and cost across the various counties in Maryland. Intervention strategies were examined to help address preventive measures and to control cost of care for such population. This study also reviewed how the Medicare and Medicaid beneficiaries' access their PCPs as well as the epidemiologic triad model (i.e., person, time, and place) of those with CHF/COPD conditions among Maryland Medicare and Medicaid beneficiaries.

This study promoted positive social change by supporting research in CHF and COPD to assist healthcare providers in focusing more on preventive measures in reducing CHF and COPD. The study examined how insurance coverage, access to care, cost, location (counties), and other characteristic s are related to significant differences in ED use in the state of Maryland Medicare and Medicaid general population. This section of the dissertation proposal describes the study variables, confounders, study design, research questions, hypotheses sampling procedure, research construct, sample size, data analyses, and comments on threat to validity.

Research Design and Rationale

A retrospective cross sectional study design for this research used the 2010 through 2012 Medicare Administrative Claims Data in CCW to identify individuals with CHF and COPD, classification of Medicare-Medicaid eligibility (MME) type, and calculation of cost and utilization statistics. Analysis was limited to individuals identified as FFS Medicare and Medicaid due to the unavailability of managed care data in the CCW and MMLEADS. The MMLEADS is a collection of data files of annual person-level and service-level analytic files designed to serve as a tool for improving the care for Medicare and Medicaid enrollees (Buccaneer, 2011). The conditions data file provides information for the 27 CCW conditions developed to enhance research of Medicare-Medicaid enrollees (Buccaneer, 2011). Integrated Medicare and Medicaid data available in the MMLEADS from the CCW allows for research of physical conditions, eligibility, enrollment, cost, and utilization of Medicare-Medicaid beneficiaries (Buccaneer, 2011; ccwdata.org).

This is a retrospective cross-sectional study. The research was also designed as an epidemiological model: person, time, and place. The observational retrospective design allowed for evaluation of the ED utilization and the cost burden on families, states, the nation, as well as the day-to-day operations in an acute care setting. A quantitative method analyses was used to evaluate outcomes of Medicare and Medicaid beneficiaries with CHF/COPD who frequent ED within the 2-year study period. This research assessed ED utilization and the cost burden on families, states, and the nation as a whole. A sizeable portion of the literature reviewed was prospective case-control studies. Though

retrospective design may not have the robust internal validity of a randomized controlled trial (RCT), it does have the advantage of greater external validity. It may also not be generally applicable beyond the study population. The study sought to yield applicable results that could potentially be useful to other chronic conditions other than CHF and COPD. Furthermore, the study design has an advantage that includes predicting acute care hospitals to inform lawmakers on healthcare cost.

Methodology

Population

Target population for this study comprised of Medicare and Medicaid beneficiaries 65 years and older diagnosed with CHF and or COPD who are also a frequent ED user. The study specifically focused on these beneficiaries in the state of Maryland. Medicare and Medicaid beneficiaries who are continuously enrolled in fee-for-service (FFS) Medicare Part A and B from 2010 to 2012 were examined. Preliminary sample of beneficiaries eligible for inclusion for this study in the CCW 100% file is approximately 10 million, and a subsample of those with CHF and or COPD related to the state of Maryland was extracted and analyzed.

Sampling and Sampling Procedures

Using the associated data for the specific conditions (CHF and COPD), related ER visit and utilization de-identified data were extracted from the CCW using SPSS for the required analysis. No informed consent was needed as the collected data has already been cleared (Buccaneer, 2011). The ICD-9-CM's 14,000 plus diagnosis codes and 3,900 procedure codes are aggregated into a smaller number of clinically meaningful categories

that are easier to analyze and interpret (Elixhauser, Steiner, & Palmer, 2012). A high-level categories of relevant chronic conditions were created based on clinical similarity and include as dichotomous 0/1 variables in the analysis. In addition, for the analysis of the beneficiaries with CHF and COPD, an index measure of comorbidities was created.

The CCW files internal to CMS also included hospice claims and minimum data set (MDS) assessment data linked by the unique beneficiary ID. These files were used to flag individuals who receive hospice care or reside in a nursing home at any point during the study's period. HCC scores were also be used to control for patient acuity. HCC scores measured the predicted utilization based on a system developed by CMS for risk adjustment in reimbursement to managed care plans (Pope et al., 2004). HCC scores were tracked internally at CMS and were matched to beneficiaries in the CCW using the unique beneficiary ID.

A 100% sample of the CCW, which includes approximately 10 million current Medicare beneficiaries in any given calendar year, was analyzed for this study. CMS, in partnership with Buccaneer Computing and Software Services, launched the CCW in 2005 as a means of linking claims by beneficiary across the continuum of care. (Buccaneer, 2011). Using a unique beneficiary identification number, information regarding inpatient, outpatient, skilled nursing facility, home health, hospice, and Part D prescription drug use may be linked to demographic and assessment data for a particular beneficiary (Buccaneer, 2011). The CCW only included administrative claims for beneficiaries enrolled in FFS Medicare; however, encounter data for beneficiaries in MA managed care plans are maintained by private health plans (Buccaneer, 2011).

The study sample for the research questions consisted of Medicare beneficiaries continuously enrolled in FFS Medicare Parts A and B from 2010-2012. Exclusion criteria included enrollment in a MA plan, disenrollment from Medicare Part A or B, and death during the study period. To separate ED services related to end-of-life care, beneficiaries were excluded from the initial analysis if they died in the first 6 months of 2013. Based on a preliminary sample creation exercise, the number of beneficiaries eligible for inclusion for this study in the CCW 100% files was approximately 10 million. A subsample of beneficiaries with chronic disease indicators for the ACSC of interest (CHF and COPD) specific to state of Maryland was constructed. Finally, the beneficiaries excluded from the initial analysis for dying between 2011 and mid 2013 were analyzed separately and to compare ED use between those with and without hospice benefits.

Sample Size Calculations

Sample size will be extrapolated using SPSS from the 100% Medicare sample from 2010, 2011, and 2012 data. These sample sizes were precalculated for each state based on the available information. This study focuses on state of Maryland and as such, the sample size was extracted from the 10 million-sample size for the Medicare Medicaid population. Sample size analysis was conducted for each of the dependent variables as specified by Buccaneer (2011) associated with the ED visits, as it relates to CHF and COPD, to give a power of 80% to 95% two-sided confidence interval.

Power Analysis

I used G*Power, which is a free power analysis program, for a variety of statistical tests in computing the sample size and the power calculation. The latest version

3.1 presents extensions and improvements of the version introduced by Faul, Erdfelder, Lang, and Buchner (2007) in the domain of correlation and regression analyses. The specific model used in performing the power calculation is position regression yielding a minimum sample size of 972 for the study, given alpha of 0.05, a statistical power of more than 80%, and an effect size strong enough due to the potential higher anticipated sample size for the Medicare and Medicaid beneficiaries (see Figure 2).

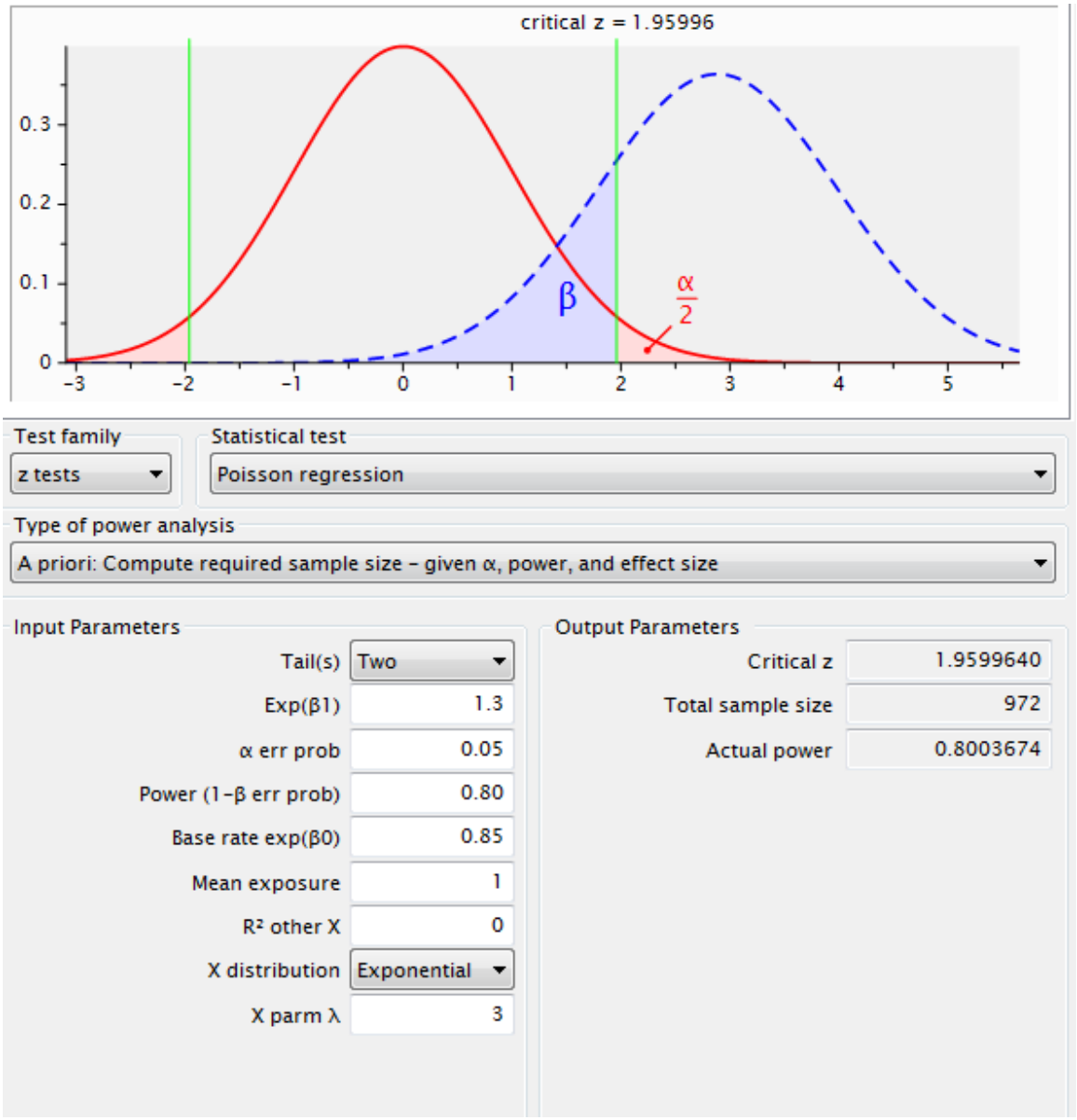

Figure 2. Medicare and Medicaid beneficiaries' analysis.

Due to the serious extreme cases of ED visits compared to others, I found the poisson regression as an appropriate model to conduct this study. The Poisson distribution arises when conducting a number of events across time or over an area (Faul et al., 2007). The counts are usually represented as a rate, such as number of ED visits per year due to CHF/COPD, or the number of ED visits per particular state (Faul et al.,

2007). The specified region could take the form of length of time, an area, a volume, or a period (Faul et al., 2007). It is important to note that during the analysis, logistic regression, and Chi-Square were employed where appropriate.

Operationalization for the Variables

Measures – Independent Variables

The independent variables for the study included supply/availability of PCPs the state of Maryland attending to the Medicare and Medicaid population; COC of the beneficiaries; frequency of the ED visits by the beneficiaries with CHF and COPD; season; service utilization and cost; rate of admission to the hospital, or release from the hospital. These variables were assessed using Poison regression, Chi-Square statistics, logistic regression, and multiple linear regression where appropriate.

At the contextual level, predisposing characteristics were measured using the Dartmouth Atlas of Health Care (2012) and the Area Resource File (ARF). The Dartmouth Atlas Project is an ongoing effort to document geographic variations in medical resources and outcomes in the U.S. using Medicare data (Faul et al., 2007). The institute provides free, downloadable reports of physician supply and other relevant variables at the national, regional, and local level (Faul et al., 2007). Primary Care Service Areas (PCSAs) include 6,542 small areas, defined by Dartmouth (2012), as aggregating ZIP areas to reflect Medicare patient travel to primary care providers. PCSA level variables occurred wherever possible. The Dartmouth Atlas contains measures for the percent of African-Americans and percent of elderly at the PCSA level, which were both explored as contextual level predisposing characteristics.

The ARF, which is maintained by the Health and Resources Services Administration (HRSA), compiles data from several sources, including the US Census and medical professional associations to produce 6000 variables at the state level (Healthcare Cost and Utilization Project [HCUP], 2012). The ARF describes each state as it relates to environmental, economic, public health indicators, and healthcare resource availability. To control for other predisposing characteristics that may influence ED use, the percent of the population with less than a high school education, unemployment rate, and rural/urban status was examined at the state level, consistent with previous research (Probst, Laditka, & Laditka, 2009).

At the individual level, the Beneficiary Summary File of the CCW included sociodemographic and clinical indicators of interest to ED use such as beneficiaries' age at the end of the reference year, gender, race, and chronic disease diagnoses (CHF and COPD). The Research Triangle Institute (RTI) race code indicated racial categories because prior research has demonstrated that it is better able to capture Hispanic ethnicity (Frank, 2015). There was no income information in the CCW; however, the Beneficiary Summary File did contain a variable indicating the number of months in the year that a member was enrolled in Medicaid (Frank, 2015). Any beneficiary with at least 1 month of Medicaid enrollment during 2010 was considered as Medicaid eligible, which was used as a proxy for poverty status.

Measures: Dependent Variables

Congestive heart failure. Medicare and Medicaid beneficiaries with CHF must have at least one inpatient or Part B (institutional or noninstitutional) claims with a heart

failure code in any position during the 2-year reference period. The CCW's chronic condition flags require beneficiaries to satisfy both claims criteria (a minimum number/type of claims that have the proper diagnosis of FFS Part A and B) of coverage during the entire specified time. The CCW's criteria were developed after reviewing validated algorithms from the research literature and criteria used by other federal data sources (ccwdata.org, 2015).

Chronic obstructive pulmonary disease. Medicare and Medicaid beneficiaries with COPD must have at least one inpatient, SNF, or home health claim, or two Part B (institutional or non-institutional) claims with a COPD code in any position during the 1-year reference period. The CCW's chronic condition flags require beneficiaries to satisfy both claims criteria (a minimum number/type of claims that have the proper diagnosis code and occurred within a specified time) and coverage criteria (FFS Part A and Part B coverage during the entire specified time). This variable was also reviewed, validated, from research literature and criteria used by other federal data sources (ccwdata.org, 2015).

Information regarding services delivered in the E.D may appear in three separate files, as follows. Medicare beneficiaries, seen in the emergency room and admitted to the hospital, are represented in the inpatient records; whereas, those seen in the ED, but released, are represented in the outpatient file (Merriman & Caldwell, 2003). Additional ED service was not captured in the inpatient and outpatient files, such as charges for physicians not employed by a hospital and laboratory services, which were documented in the carrier files instead (Merriman & Caldwell, 2003). Inpatient and outpatient ED

claims can be identified by Revenue Center Codes 0450-0459 (Merriman & Caldwell, 2003). ED claims in the Carrier files are designated by Place of Service Code 23 or HCPCS codes 99281-99285, which represent evaluation and management (E&M) codes for ED services (Merriman & Caldwell, 2003). Frequent ED use referred to four or more visits in a calendar year.

Frequent users were further categorized by the persistence of frequent use over the 2-year study period. Consistent with the rationale provided by Mandelberg et al. (2000), beneficiaries with four or more visits in 2 or more consecutive years were considered "persistent" frequent ED users. Beneficiaries with 1 year of frequent ED use were considered "episodic" frequent ED users.

A further differentiation among ED users was made regarding admission to the hospital and reason for the ED visits. Each ED visit was classified by two binary variables for whether or not the visit resulted in a hospital admission and whether or not the visit was for an ACSC. These determinations were based on whether the ED carrier claim has a corresponding inpatient claim and the claim primary diagnostic code, respectively. At the beneficiary level, this information was aggregated into a continuous variable indicating the percentage of visits that result in hospitalization and the percentage of visits that were for ACSC.

Medicare FFS utilization and payment data. The Medicare/Medicaid eligibility status for all members of the study population is available in the Beneficiary/Enrollee File. There is a single row of data for each unique person in the beneficiary fil, even if the person was enrolled in Medicaid in more than one state during the year. The Beneficiary

File includes detailed enrollment information, as well as descriptive information (e.g., demographic and summary use and payment variables).

As mentioned earlier, an adaptation with ICD-9 codes was used for this study. The constructs in CCW to be used for this study relating to Medicare-Medicaid enrollees has all the utilization and payments variables within the Beneficiary File. In this file, many of useful payment and service use information has already been aggregated by month and year for ease of use.

Data Analysis Plan

SPSS was used for the analyses. The administrative claims data that was used for this study had already been cleaned and screened. Therefore, the claims data did not need further scrutiny. Provider submit Medicare claims to Medicare Administrative Contractors (MACs) for payment processing. All valid claims were uploaded to CMS National Claims History (NCH). Then, the NCH files represented the original source data for all CMS claims files and contained all transactional claims data. The CCW downloaded files from the NCH and extracted the final action claims data (i.e., the final reconciled version) to create the SPSS analytic files related to Medicare services cost and utilization (Buccaneer, 2011). Medicare/Medicaid administrative claims data, specific to state of Maryland beneficiaries with either CHF or COPD who frequent ED, was tested against the following research questions and hypotheses:

RQ1. Is the primary care provider (PCP) supply in the State of Maryland associated with frequent ED use among Maryland Medicare and Medicaid beneficiaries who have either CHF or COPD?

$H_0$1: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have no significant relationship with number of ER visits by beneficiaries, while controlling for age, gender, and race.

H_A1: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have a significant relationship with number of ER visits by beneficiaries, while controlling for age, gender, and race.

RQ2. Is frequent ED use associated with end of life for Maryland Medicare and Medicaid beneficiaries with either CHF or COPD who die during the study?

$H_0$2: Increased number of visits to the ER will not have a significant relationship with death among Maryland Medicare and Medicaid beneficiaries with either CHF or COPD while controlling for age, gender, and race.

H_A2: Increased number of visits to the ER will have a significant relationship with death among Maryland Medicare and Medicaid beneficiaries with either CHF or COPD while controlling for age, gender, and race.

Description of Data Analysis Plan

An exploratory data analysis was used to examine the distribution of ED visits as a count outcome and as a categorical outcome. Histograms displayed the frequency of ED counts from zero to the highest count, and bar graphs will display the distribution of

Medicare beneficiaries among the four ED categories of non-, infrequent, and episodic frequent and persistent frequent users. A descriptive correlational design explored comparisons among the four categories of ED users using chi-squared statistics for categorical variables and multiple linear regression for continuous variables. Tables were created to display the relative values of the variables along with p-values to indicate statistical significance. Relevant comparisons among the four ED categories will include:

- Mean age, percent over 65 and under 65
- Percent Medicare/Medicaid eligible
- Mean primary care physician supply/1,000, percent high, medium and low supply
- Percentage of visits resulting in hospitalization
- Percentage of visits for ACSC (CHF and COPD)

The research analysis also included a series of univariate multinomial logistic regression models to test univariate relationships between the categorical outcome of ED use and the independent variables. All independent variables, with a statistically significant association with ED use, were included in a multivariate multinomial model.

Finally, multivariate multinomial logistic regression was used to determine the relative risk ratio of being an infrequent, episodic frequent, and persistent frequent ED user compared to a non-user. The multinomial logistic regression model was an extension of the simple logistic regression model for dichotomous dependent variables that applies to discrete, nominal, and unordered poltytomous dependent variables (Kwak & Clayton-Matthews, 2002). Unlike ordinal logistic regression models, multinomial models do not

assume proportional odds for being in each category higher than the base category and instead estimate separate equations for each category compared to the base category (Weng & Barner, 2005). As in the case of the simple logistic regression, maximum likelihood estimation (MLE) is used as the normality assumption of ordinary least squared (OLS) regression is violated (Weng & Barner, 2005). Wald tests were used to test the significance of regression coefficients (Kwak & Clayton-Matthews, 2002).

One assumption of multinomial logistic regression models is that the error terms are independent across individuals and equations. Another key assumption is that of the Independence of Irrelevant Alternatives (IIA), which posited that the inclusion or exclusion of one category should not affect the relative odds of any other category. To test this assumption, I performed a Hausmann test, which compared the estimated coefficients of the unconstrained model with all dependent categories to the estimated coefficients of various constrained models that exclude one category. If the results did not support IIA, I would have used a probit model that allows for flexibility in this assumption. Results were reported in terms of relative risk ratios for being in each category compared to the index category of no ED use.

Threats to Validity

Threats to External Validity

There are several advantages in using the administrative claims data in CCW, including that the results from this study were applicable to the majority of elderly men and women in America. There were some limitations to working with the CCW. First, it only represented fee-for-service Medicare enrollees, thus one cannot draw conclusions

about beneficiaries in MA plans (Buccaneer, 2011). However, only 20% of Medicare enrollees were in MA plans in 2010, thus CCW still captured the vast majority of the Medicare population (Global Initiative for Chronic Obstructive Pulmonary Disease [GOLD], 2010). Therefore, the conclusions I drew remained generalizable to beneficiaries enrolled in traditional Medicare, and the study still had strong external validity.

Threats to Internal Validity

One major threat to internal validity of my approach to studying frequent ED use includes that using administrative claims data precluded examination of critical aspects of access to care and quality of care, including clinical measures, such as blood pressure, measures of patient functioning, or patient-provider communication. For instance, I could not gauge care coordination among medical providers, which obviously represented an important aspect of managing ACSCs. Without self-reported information from patients and providers, I could not explore certain factors that might be relevant to predicting ED use, such as ease of getting an appointment with a primary care provider and satisfaction with primary care providers.

Threats to Construct or Statistical Conclusion Validity

To avoid threats to statistical conclusion validity, I studied frequent ED use over a longer period, specifically 2 years. This allowed for a more definitive and practical classification of users by persistence of use and concentration of ED use within a given year. Due to the large sample size of the Medicare and Medicaid population, there was no threat to the statistical power resulting larger sample is not identified.

Another threat to validity may occur if statistical analyses are performed outside the framework of the statistical test, for instance, abnormality of error distribution or nonlinear relational linear regression. For the purpose of this study, all appropriate assumptions tied to the frequent ED use in the CCW administrative data were applied to avoid invalidity of statistical conclusion. Correspondingly, using two case studies (CHF and COPD) helped reduce any threat to validity. It is important to note that the CMS administrative claims data in CCW have been thoroughly cleaned and vetted for research purposes (Buccaneer, 2011) to prevent any distortions in the CCW data.

Ethical Procedures

This study went through the approval process of the Walden University Institutional Review Board (IRB) paving the way for data collection and analyses of the study. With respect to using the CCW in accessing the Medicare Administrative data, I already had access in using the data as an employee for research purposes, and I did not anticipate any issues in conducting the research and performing any related analyses. Prior to this, I was cleared and certified for CMS' privacy and HIPAA regulations. I followed all HIPAA regulations governing the use of the Medicare Medicaid Claims data. If any ethical questions arose, I intended to consult with the school IRB and the agency ethics committee as needed.

Summary

In summary, this retrospective study with quantitative analysis of the relationship between Medicare population with chronic CHF and COPD and frequent ED visits. The impact on ED utilization and cost was examined to ascertain the burden on families,

hospitals, and the state of Maryland. I analyzed using linear regression, and two tailed t-tests to examine the distribution of ED visits. A descriptive correlational design was compared among the four categories of ED users using chi-squared statistics for categorical variables. Charts and tables were created to illustrate the relative values of the variables in conjunction with p-values to show statistical significance of this study. Including variables relevant to place, time, and place would render the epidemiological analyses as an effective approach to care and wellbeing of Medicare and Medicaid beneficiaries with diagnosis of heart failure and congestive obstructive pulmonary disease. Data collection, analysis, and results of this study were provided in the following chapter.

Chapter 4: Results

Introduction

The purpose of this study is to examine key characteristics of frequent ED visits and used administrative claims data to assess utilization and cost for Medicare and Medicaid enrollees that were identified as having either CHF or COPD. This was done using ICD 9 Codes – primary and secondary diagnostic code (see Appendix 1). Specifically, administrative claims data for the State of Maryland was used, focusing on beneficiaries with either CHF or COPD who visited ER in the years 2010, 2011 and 2012.

This chapter will first present data cleaning and preprocessing, then summary statistics of the data. Next, data analysis using GEE's will be presented to answer both of the research questions and the results discussed. Finally, a summary will conclude the chapter.

Data Cleaning and Preprocessing

The initial sample size was 33,174. Some subjects changed age, gender and race through the years. It was assumed that the age, gender and race reported in 2010 was the correct age, gender and race for data analysis purposes and all other demographic data was removed from the analysis. There was also significant amounts of missing data regarding if a patient had made an ER claim, visited the ER or payment was made that year. This missing data was assumed to be 0 throughout. Finally some patients had missing age, race or dead status data. These patients were removed from analysis. This left a dataset of 14,118 for analysis. Finally, to ensure continuity of dead status, data from

patients that have died was removed from the following years. 1,335 subjects died during 2010 and their data was removed from subsequent years and an additional 1,085 subjects died in 2011 and their data was removed from 2012. All data cleaning was conducted in R 3.1.2.

Data Analysis

Summary statistics of continuous variables are presented in Table 1. The average age of subjects included in the study was 79.63, and the average number of ER visits for 2010, 2011 and 2012 were 1.52, 1.46 and 1.50 respectively.

Table 1.

Summary Statistics of Age, ER Visits, ER Claims and Payments for the years 2010, 2011 and 2012 for all COPD and CHF patients.

Variable	Statistics	2010	2011	2012
Age	Mean	79.63	-	-
	Minimum	65	-	-
	Maximum	110	-	-
	Standard Deviation	8.84	-	-
ER Visits	Mean	1.52	1.46	1.50
	Minimum	1	1	1
	Maximum	20	11	12
	Standard Deviation	0.43	0.35	0.37
	Total Visits	2332	1797	1551
ER Claims	Mean	0.10	0.08	0.07
	Minimum	0	0	0
	Maximum	20	11	12
	Standard Deviation	0.35	0.00	0.00
Payment Amounts	Mean	193.85	182.42	189.49
	Minimum	0.00	0.00	0.00
	Maximum	2565.33	1264.86	1560.21
	Standard Deviation	6921.74	5862.90	4194.59
	Total Claims ($)	297954.50	224924.00	196319.00

Summary statistics of categorical variables are presented in Table 2. Most subjects were female (70.8%) and white (46.6%). The death rates for 2010, 2011 and 2012 were 9.50%, 7.78% and 12.00% respectively. Many racial categories had only a few subjects in each, so for the purposes of analysis they were combined into White (n = 6573), Black (n = 5240) and Other (n = 2305) which included all other racial categories including unknowns. Many subjects had both COPD and CHF, subjects with both generally formed just over one third of the sample.

Table 2.

Summary Statistics of Gender, Race and Death for 2010, 2011 and 2012 for all COPD and CHF patients.

Variable	Level	2010 Count	Percentage	2011 Count	Percentage	2012 Count	Percentage
Gender	Male	4118	29.2	-	-	-	-
	Female	10000	70.8	-	-	-	-
	Total	14118	100.0	-	-	-	-
Age	Under 70	2871	20.3	-	-	-	-
	71-89	9135	64.7	-	-	-	-
	Over 90	2112	15.0	-	-	-	-
	Total	14118	100.0	-	-	-	-
Race	White	6573	46.6	-	-	-	-
	Black	5240	37.1	-	-	-	-
	Other	2305	16.3	-	-	-	-
	Total	14118	100.0	-	-	-	-
Died	No	12783	90.50	11698	92.22	10294	88.00
	Yes	1335	9.50	1085	7.78	1404	12.00
	Total	14118	100.0	12783	100.0	11698	100.0
	Admitted to Hospital	753	-	717	-	798	-
Disease	COPD	3034	21.5	2578	20.1	2225	19.0
	CHF	6064	42.9	5248	41.0	4521	38.6
	Both	5020	35.6	4957	38.7	4952	42.3
	Total	14118	100.0	12783	100.0	11698	100.0

Research Question 1.

Research Question 1 asked: Is the primary care provider (PCP) supply in the State of Maryland associated with frequent ED use among Maryland Medicare and Medicaid beneficiaries who have either CHF or COPD?

$H_0$1: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have no significant relationship with number of ER visits by beneficiaries, while controlling for age, gender and race.

H_A1: Increased ratios of PCP to State of Maryland Medicare and Medicaid beneficiaries with either CHF or COPD will have a significant relationship with number of ER visits by beneficiaries, while controlling for age, gender and race.

The total number of PCP providers (see Appendix 2) in Maryland was 5,622,987 for 2010, 5,699,640 for 2011 and 5,701,628 for 2012. PCP was converted to number of providers per CHF or COPD patient (33,174 from unreduced dataset), giving 169.49 PCP per CHF or COPD patient for 2010, 171.81 for 2011 and 171.87 for 2012. It should be noted that these definitions did not include nurse practitioners, physician's assistants and online/telehealth professionals which could affect the outcomes of this analysis.

Summary data on the number of ER visits for each independent variable is presented in Table 3. On average, males had more ER visits (7 per 100 individuals) in a given year than females (6 per 100 individuals) and subjects who identify as white also have the highest average of ER visits (7 per 100 individuals) in a given year for any racial category. Under 70's also had the highest average of ER visits out of any age category (10 per 100 individuals), and finally 2010 which had the lowest ratio of PCP to CHF and COPD patients had the highest average number of ER visits (8 per 100 individuals). There were no obvious differences in mean number of ER visits for patients with and without CHF and COPD, although subjects without COPD had the highest mean ER visits (9 per 100 compared to 8 per 100 for all other COPD and CHF categories).

Table 3.

Summary Statistics for ER Visits for each Independent Variable.

Independent Variable	Level	Mean ER Visits per 100	Std Deviation ER Visits per 100
Gender	Male	7	44.7
	Female	6	36.6
Race	White	7	41.1
	Black	6	37.9
	Other	5	35.4
Age	Under 70	10	49.2
	71-89	6	36.8
	Over 90	5	34.1
PCP Ratio	169.49 (2010)	8	43.1
	171.81 (2011)	6	35.8
	171.87 (2012)	6	37.0
CHF	No	8	38.6
	Yes	8	43.9
COPD	No	9	46.3
	Yes	8	40.0

This research questions was answered using a Generalized Estimating Equation with Poisson log-linear distribution and robust variance estimates (Williams 2000) to account for repeated measurements by subject through the years. A model was fitted that included ER visit count as the dependent variable, total number of PCP providers as the independent variable and that included age, race, gender and COPD or CHF status as confounding variables. The model that was developed included separate parameters for COPD status and CHF status. This type of model assumes that the effect of COPD and CHF on number of ER visits is additive when a subject has both. A correlation matrix with an exchangeable structure was used. Type I tests for model effects using Wald Chi-Square tests (Deddens et al. 1998) are presented for the model in Table 4. Based on the significant effect of PCP ratio on number of ER visits, we accept the alternative

hypothesis and also conclude that the confounding variables of gender, age, race and COPD status are significant. To determine the strength of the effect, the model parameters were examined.

Table 4.

Significance of Variables for Research Question 1.

Variable	Wald Chi Square	df	P value
Intercept	5705.59	1	< 0.001
PCP Ratio	6.076	1	0.01
Gender	5.499	1	0.02
Age (categorical)	52.85	2	< 0.001
Race (categorical)	6.802	2	0.03
CHF	1.522	1	0.22
COPD	3.850	1	0.05

The model developed to answer question 1 has the following formula:

$$V_{ij} \sim Poisson\ (Y_{ij})$$

$$Log(Y_{ij}) = \beta_0 + \beta_1 g_i + \beta_2 x_i + \beta_3 z_i + \beta_4 p_j + \beta_5 w_i + \beta_6 b_i + \beta_7 h_i + \beta_8 c_i + \varepsilon_{ij}$$

where V_{ij} is the number of visits for subject i at year j is V_{ij}, g_i is equal to 1 if subject i is male, 0 otherwise, p_j is the ratio of primary care providers for year j, x_i is equal to 1 if the subject is aged 70 or under, 0 otherwise, z_i is equal to 1 if the subject is aged between 71 and 89, 0 otherwise, w_j is equal to 1 if the subject is white, 0 otherwise, and b_j is equal to 1 if the subject is black, 0 otherwise. h_i is equal to 1 is the subject does not have CHF and c_i is equal to 1 if the subject does not have COPD, 0 otherwise for both. ε_{ij} is the error term for subject i in year j. Parameter estimates, standard errors and significance are presented in Table 5.

PCP ratio was found to have a significant relationship with number of ER visits, where an increase of PCP ratio by 1 increases ER visits by 3%. The confounding variables of gender, age race and COPD status were also found to have a significant relationship with number of ER visits. Being male increased the number of ER visits by 9% compared to being female, and not having COPD increases ER visits by 11% compared to having COPD. Being aged below 70 increased ER visits by .76 compared to being aged over 90, and being aged between 71-89 increased ER visits by .10 compared to being aged over 90. Finally, being white increased ER visits by .29 compared to being in the 'other' racial category, and being black increased ER visits by .25 compared to being in the 'other' racial category.

Table 5.

Parameter Estimates.

Parameter	β	Std Error	E^ β	Wald Stat	Df	P value
Intercept (β_0)	-9.487	3.24	0.00	8.589	1	0.003
PCP Ratio (β_4)	0.03	0.01	1.03	4.019	1	0.04
Gender = Male (β_1)	0.09	0.07	1.09	1.899	1	0.17
Gender = Female				Baseline		
Age below 70 (β_2)	0.57	0.11	1.76	24.486	1	< 0.001
Age between 71-89 (β_3)	0.10	0.10	1.10	1.046	1	0.03
Age above 90				Baseline		
Race White (β_5)	0.26	0.10	1.29	6.396	1	0.01
Race Black (β_6)	0.23	0.10	1.25	5.206	1	0.02
Race Other				Baseline		
Does not have CHF (β_7)	-0.006	0.06	0.99	0.010	1	0.92
Has CHF				Baseline		
Does not have COPD (β_8)	0.11	0.05	1.11	3.850	1	0.05
Has COPD				Baseline		

Research Question 2

Research Question 2 asked: Is frequent ED use associated with end of life for Maryland Medicare and Medicaid beneficiaries with either CHF or COPD who die during the study?

$H_0$2: Increased number of visits to the ER will not have a significant relationship with death among Maryland Medicare and Medicaid beneficiaries with either CHF or COPD while controlling for age, gender and race.

H_A2: Increased number of visits to the ER will have a significant relationship with death among Maryland Medicare and Medicaid beneficiaries with either CHF or COPD while controlling for age, gender and race.

Summary statistics of deaths for each categorical variable are presented in Table 6. The large total counts are due to each subject having repeated measurements over 3 years, hence totals are three times larger than those presented in Tables 1 and 2. Males and females had comparable death frequencies (11.1% for each), but subjects who identified as white had a higher frequency of deaths than other racial categories (12.6%). Subjects who were aged under 70 had the lowest frequency of death out of all the age categories (7.0%). Death rates for subjects with and without CHF were similar (10.0% and 9.7% respectively), and death rates for subjects with and without COPD were also similar (10.0% and 9.9% respectively).

The mean number of ER visits for subjects who did not die was 0.07 (standard deviation = 0.39) and the mean number of ER visits for subjects who did die was 0.06 (standard deviation = 0.40).

Table 6.

Summary Statistics for Death for each of the Categorical Independent Variables.

Independent Variable	Level	Died (Count)	Died %	Not Dead (Count)	Not Dead %	Total
Gender	Male	2258	11.1	18126	88.9	20384
	Female	5621	11.1	44745	88.9	50366
Race	White	4186	12.6	26122	87.4	33308
	Black	2763	10.4	23654	89.5	26417
	Other	930	8.4	10095	91.6	11025
Age	Under 70	948	7.0	12549	93.0	13497
	71-89	5229	11.2	41537	88.8	46766
	Over 90	1702	16.2	8785	83.7	10487
CHF	No	913	9.7	8437	90.2	9350
	Yes	3477	10.0	31104	89.9	34581
COPD	No	1869	9.9	16976	90.0	18845
	Yes	2521	10.0	22565	89.9	25086

This time a GEE with a binary logistic distribution and robust variance estimates was estimated to predict death using ER visits and the confounding variables of age, gender, race and COPD and CHF status were included. Similar to the previous model, separate parameters were used for both COPD and CHF status, which assumes the effect of both on death outcome is additive. A correlation matrix with an exchangeable structure was used. Type I tests for the second model are presented in Table 7. Based on these findings we accept that ER visits had no significant relationship with death in a given year, therefore we accept the null hypothesis. The confounding variables of age and race were both found to be significant. To estimate the effect of these variables on death, the model parameters were examined.

Table 7.

Significance of Variables Included in the Model for Research Question 2.

Variable	Wald Chi Square	df	P value
Intercept	16087.04	1	< 0.001
Gender	2.22	1	0.13
Age (categorical)	339.05	2	< 0.001
Race (categorical)	120.19	2	< 0.001
CHF	0.327	1	0.56
COPD	0.646	1	0.42
ER Visits	0.000	1	0.98

This model has the following formula:

$$D_{ij} \sim Bernoulli(Y_{ij})$$

$$Log(Y_{ij}/1- Y_{ij}) = \beta_0 + \beta_1 g_i + \beta_2 x_i + \beta_3 z_i + \beta_{4\,vij} + \beta_5 w_i + \beta_6 b_i + \beta_7 h_i + \beta_8 c_i + \varepsilon_{ij}$$

where D_{ij} is the death outcome of subject i in year j, g_i is equal to 1 if subject i is male, 0 otherwise, v_{ij} is the number of ER visits for subject i in year j, x_i is equal to 1 if the subject is aged 70 or under, 0 otherwise, z_i is equal to 1 if the subject is aged between 71 and 89, 0 otherwise, w_j is equal to 1 if the subject is white, 0 otherwise, and b_j is equal to 1 if the subject is black, 0 otherwise. h_i is equal to 1 is the subject does not have CHF and c_i is equal to 1 if the subject does not have COPD, 0 otherwise for both. ε_{ij} is the error term for subject i in year j. Parameter estimates for this model are presented in Table 8.

The two variables found to be significant were age and race. Being aged 70 and below was found to decrease the odds of death by .65 compared to being aged over 90. Being aged between 71 and 89 was found to decrease the odds of death by .35 compared to being aged over 90. Being white was found to increase the odds of death by .68

compared to being in the ‘other racial category. Finally, being black was found to increase the odds of death by .47 compared to being in the ‘other’ racial category.

Table 8.

Parameter Estimates.

Parameter	B	Std Error	E^β	Wald Stat	df	P value
Intercept (β_0)	-2.09	0.06	0.12	1269.79	1	< 0.001
ER Visits (β_0)	-0.001	0.04	0.99	0.00	1	0.98
Gender = Male (β_0)	0.06	0.03	1.06	3.77	1	0.05
Gender = Female						
Age 70 and below (β_0)	-1.03	0.06	0.35	334.09	1	< 0.001
Age between 71-89 (β_0)	-0.42	0.04	0.65	105.75	1	< 0.001
Age above 90						
Race White (β_0)	0.52	0.05	1.68	119.48	1	< 0.001
Race Black (β_0)	0.39	0.05	1.47	61.66	1	< 0.001
Race Other						
Does not have CHF (β_0)	-0.03	0.04	0.97	0.76	1	0.38
Has CHF						
Does not have COPD (β_0)	-0.03	0.03	0.97	0.645	1	0.42
Has COPD						

Summary

The purpose of this study was to determine what variables contributed to increased ER visits and death among Medicaid and Medicare beneficiaries whom are identified with CHF or COPD in the state of Maryland, using a sample from the MMLEADS in the years 2010, 2011 and 2012. This was done using two GEE type regression equations to determine which variables such as age, gender, PCP availability and race significantly affect either ER visits or death outcome for a given year. Increased PCP was found to significantly decrease the number of ER visits when controlling for other confounding variables. Alternatively, persons living in areas with higher PCP also

had lower ER visits. It is likely that the classification of PCP categories could affect this finding, and future studies may need to use a broader definition of a primary care provider. There was no significant relationship found between the number of ER visits and death outcome in a given year. The broader implications of these results will be discussed in chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Medicare and Medicaid recipients across the country aged 65 and older are a resource intensive population for which CHF and COPD are an ongoing issue (Dalal, Shah, Lunacsek, & Hanania, 2011; MPAC, 2009). In Maryland, ED visits are on the rise, and between 1990 and 2001, ER visits increased from 1.5 million to 1.9 million across the United States (Aziz et al., 2011; Garcia et al., 2010; Kociol et al., 2013; Lucas et al., 2009). Because of these increases, hospital administration decided to use temporary closings as a cost cutting measure, a decision that influenced ambulatory services through increased utilization (Fwu et al., 2013). The designation of resource intensive clientele refers to frequent ED users, as they are more likely to arrive by ambulance and receive a bed within the hospital for services (LaCalle & Rabin, 2010; Locker et al., 2007; Ruger et al. 2004).

Most in American society are unwilling to pay the costs associated with caring for frequent ED users, who are likely to be, according to research, poor, male, socially isolated, chronically, and psychologically ill alcoholics (Mandelberg, Kuhn, & Kohn, 2000). Thus, the impetus is to find a way to lower costs without closing ERs; therefore, this study was both relevant and necessary.

The current quantitative study was a retrospective cross sectional study designed to explore the connection between Maryland Medicare and Medicaid beneficiaries with CHF and COPD and frequent emergency room use and cost. It was conducted both to evaluate the impact of ED usage on patients from the aforementioned demographic, and

to add to the current research on ways to lower costs to Maryland hospitals through preventive services designed to reduce ED utilization (Burt & McCaig 2001).

This chapter will discuss and interpret the findings of the study and point to the potential implications of the study findings on hospital EDs across the United States. In addition, the chapter will conclude with recommendations for further research.

Discussion

The primary research objective was to examine the importance of primary care provider usage for Medicare and Medicaid patients with CHF or COPD, at the community and individual levels, as they relate to episodic, persistent, and frequent ED usage during the calendar years of 2010 and 2012. Secondarily, the research sought to determine if frequent visits to the ED were associated with end of life for the same population in those same years.

Two research questions informed the research in this study:

1. Is the PCP supply in the State of Maryland associated with frequent ED use among Maryland Medicare and Medicaid beneficiaries who have CHF or COPD?
2. Is frequent ED use associated with end of life for Maryland Medicare and Medicaid beneficiaries with either CHF or COPD who die during the study?

I used the study to either confirm or deny the association through the collection and analysis of data, or alternately, that there was a definite connection between the two phenomena studied within each question.

Interpretations of the Findings

Hypothesis 1 and 1a

The presumption (Hypothesis 1) was that either there would be no significant difference in the number of ER visits for any gender, race, or age of Medicare or Medicaid beneficiaries as a result of an increase in PCPs, or alternately, (Hypothesis 1a), that there would be a significant difference due to the increase. Tests of the data collected determined that the year with the lowest number of PCPs included 2010, which coincided with the highest number of emergency room visits by patients with CHF and COPD, thus proving the first supposition to be true.

The measure of the probability that the researcher's assumptions are correct (its *p*-value) was calculated to determine the presence or absence of statistical errors in the data. A *p*-value that is calculated to be less than or equal to 0.05 indicates that the first presumption (Hypothesis 1) was not acceptable, and that the researcher must then accept the alternative assumption (Hypothesis 1a). In this case, the data indicating the rate of the yearly PCP increase, gender, and age, all have *p*-values of less than 0.05, thus the first presumption, that there would be no difference in the rate of ER usage relative to age, and gender, was rejected, proving that there was indeed a relationship between these variables.

The analysis of *p*-value also revealed that gender played a significant part, as rates of ER visits for males were higher compared to those for females, increasing slightly during each year studied. Additionally, patient age was also positively correlated. Perhaps surprisingly, being aged 71 to 89 was negatively related to ER visit frequency, with the

number of visits decreasing, instead of increasing as alternate hypothesis suggested, each year when compared with the number of visits for patients aged 70 years or less. Remarkably, for patients over the age of 90, ER visits also decreased a small percentage annually as compared with those of patients 70 and younger.

Because it showed a higher *p*-value, the variable of race was not statistically significant enough to reject the null hypothesis in research question one. The *p*-values for data relative to race were larger, with a *p*-value of .09, indicating that the researcher could not reject Hypothesis 1. Thus, for age and gender only, the alternate hypothesis (Hypothesis 1a), which stated that there would be a significant difference in ER usage due to the increase in PCP's was affirmed.

Hypothesis 2 and 2a

Another research question posed in this study indicated the extent to which frequent use of the ED was associated with end of life for Medicare and Medicaid beneficiaries with CFH or COPD with regard to age, race, and gender. The presumption was that increased emergency room visits would not influence death rates (Hypothesis 2), while the alternate view (Hypothesis 2a) suggested that it would. Results of the data analysis showed that frequency of ER visits had no significant impact on end of life for Medicare or Medicaid beneficiaries with COPD or CHF concerning gender as the *p*-value was calculated to be 0.89, much higher than the .05 necessary to reject the Hypothesis 2. Race and age however, proved to be significant due to *p*-values that were less than .001, showing that Whites and patients under the age of 70 had higher rates of death than those from other racial and age groups relative to frequency of ER visitation. Interestingly,

patients under the age of 70 were the least likely of all age categories to die, regardless of ER visit frequency.

The current study explored the correlation between ER visits and death among Medicaid and Medicare beneficiaries in Maryland identified to have CHF or COPD. The researcher used comparisons of age, gender, and race to determine rates of death as they related to frequency of ER visitation and death. A review of the literature reveals both confirmation and disconfirmation of the current study's findings, a fact that does not disqualify the results, but helps to extend the knowledge of the field.

The theoretical premise utilized in the study relates to Andersen's (2008) model of health behavior. I addressed this theory using demographic statistics concerning Medicare and Medicaid patients with CHF and COPD as they relate to age, race, and gender, by indirectly speaking to the concept of service equality within the context of perceived need, resource allocation, and predisposing characteristics. Within this context, need has been proven to be the greatest determinant of health services usage (Andersen, 2008). However, when need is surpassed by concerns about resources or predisposition characteristics, equality of services can become questionable.

In direct contrast to the findings in this report, a study by O'Neil et al. (2010) reveals that rates of hospitalization by race for ambulatory care sensitive conditions such as CHF and COPD differed considerably from those alluded to in the current study. According to the authors, African Americans with Medicare in Maryland had significantly higher rates of ACSC hospitalizations for congenital heart failure than any other race, while Whites had significantly higher rates of hospitalization for COPD

compared to other races (O'Neil et al., 2010). The current study's findings differ in that it lists the rates of frequency of emergency room visits as significantly higher for Whites than for any other race, though it did not delineate rates for COPD alone, instead combining it with CHF and presenting the resultant findings as a whole and utilizing data about ER visitations only.

I used variables, such as age, ER visits, ER claims, payment amounts, gender, race, and rates of death and disease, to assess utilization and costs of Medicare and Medicaid beneficiaries identified as having CHF and COPD. The statistics served to demonstrate Andersen's (2008) premise that health coverage usage may determine equality of services. I determined that the variables that contributed to decreased ER visits of CHF/COPD in the years 2010, 2011, and 2012 related to the supply of PCPs available during those years. This study's findings that the year with the lowest ratio of PCPs per CHF and COPD patients had higher ER rates compared to other years, seems to coincide with Andersen' premise that access to services not based on need leads to inequality of service, and thus the over usage of ER services and financial burden on area hospitals (Buccaneer, 2011; ccwdata.org). The implications of the study speak to the impact of access to PCP's and the possibility that preventative care can positively contribute to patient health as it relates to ED usage for Medicare and Medicaid beneficiaries with either COPD or CHF.

Biello et al. (2010) suggested that African Americans were more likely than other races to be hospitalized for chronic diseases at younger ages, a fact that O'Neil et al. (2010) attributed to racial disparities in the type and extent of medical services available

in their communities. The researcher determined that hospitalization at younger ages could negatively affect the quality of life for the patient due to loss of wages, and risk of further hospitalizations and severity of illness. The researcher did not look at hospitalization overall, but focused on ED visitation amongst Medicaid and Medicare beneficiaries only, as reported by the Administrative Claims Data files in CCW. The sample size included 100% of the claims data for the years 2010 to 2012, and a 20 percent, or two million, client sample of the Medicare claims as reported by the CCW during the same period (CCW, 2015).

Because of its focus on ED visitation only, the results differ from the more broadly scoped studies of hospitalization as a whole. While the researcher in the current study also concluded that patients under the age of 70 had the highest rates of ER visitation, (which could coincide with the higher rates of hospitalization for younger African Americans), it also concluded that Whites had the highest average of ER visits when compared to other races. Thus, the previous literature both confirms and disconfirms the study results in this area.

Another area of apparent disagreement between this study and those utilized in the literature review involves the idea that there is a significant difference in how many men make more trips to the ER than women. Tsai et al. (2007) and Watson et al. (2004) found no difference in ER visits by gender, and yet the current study's findings that men made more visits to the emergency room at a rate of .01 higher than women, is contradictory. The results of the current study may extend the previous research due to the difference in sample size utilized. In a study with a small sample size, the difference

between a mean of .06 and a mean of .07 may not be as significant, but the extremely large sample size, (about 2 million prior to subdivision), utilized in this study makes for a substantial difference, making sample size a confounding variable in this study.

Another phenomenon studied references expenses for ED usage per year. The findings, that the Medicaid and Medicare payments for ER usage by CHF and COPD patients was highest in the year with the lowest PCP accessibility, coincides with Aziz et al. (2011) and Kociol et al.'s (2013) studies on the conditions. These researchers determined that CHF and COPD represented conditions with the highest admission and readmission rates, thus the costs to Medicare and Medicaid are significant.

Some factors, not presented as a part of this study, include the rates of hospitalization and rehospitalization and its relation to the death of Maryland Medicare and Medicaid beneficiaries with CHF and or COPD. Although much of the literature reviewed detailed the rates of hospitalization for the aforementioned population, a study of death rates for this particular group is not included. The current study results indicated the rates of death for this population, based on findings using data from a sample size of up to 2 million Medicare and Medicaid beneficiaries, but did not address a possible correlation between the two ideas.

A recommendation for future research applies to the findings in this study that look at the relationship between primary care providers and frequency of ED usage. The inclusion of demographic data relative to PCPs and ER usage, paired with hospitalization, rehospitalization, and death statistics could present a clear picture of the disparities

alluded to by Andersen (2008), the primary theoretical framework of this study, and could extend the previous research considerably.

The current study results align with the methodology of the research in the field, as claimant information for Medicaid and Medicare beneficiaries is accessible. Other studies also observed data related to racial disparities, chronic disease trends, and costs of care on the Medicaid and Medicare population.

Limitations of the Study

The study's design and implementation has inherent limitations. The most prominent limitation is within the design of the study. Because the researcher used an observational retrospective cross-study design with a large sample population, the question of external validity is considered. The researcher was limited in the use of PCPs as alternative care groups such as Physician's Assistants, Nurse Practitioners, and family doctors were not included in this study. In addition, the types of data that the researcher could measure and compare due to reliance on Administrative Claims Data from CCW was an issue. Although the data used in the study produced valuable information about Medicare and Medicaid beneficiaries' primary care physician status in Maryland, it did not differentiate ER usage rates by state, by socioeconomic status, or by hospital, thereby leaving a gap in an important research area that could have been useful to extend the research. Thus, the data, while useful as a whole, does not necessarily provide Maryland hospital administration and lawmakers with the types of generalized information needed to understand and rectify the inequalities present in their care models.

Recommendations

The limitations of the study reveal a possible area of potential for future researchers. To extend the research, there is a need for additional studies designed to isolate the independent variables relative to geography, patient income, and hospital spending as it relates to re-hospitalization and death. Further research is needed to include alternative sources of care such as Physician's Assistants, Nurse Practitioners and family doctors in addition to elucidate the relationships between variables. Low-income patients for example, may be less willing to seek medical treatment regularly due to the costs associated with doctor's appointments and or prescription purchasing, a decision that could negatively influence ED spending as chronic illnesses are worsened and acute care is needed. Geography's impact on ER spending could also be important in that geographic areas in Maryland, like all states, likely contain geographic areas populated based on income and access to services, thus creating an overuse of ED services, which in turn raises costs and affects service quality.

In the future, researchers could use a mixed research methodology for a case study, rather than relying solely on data taken from Administrative Claims Data in CCW. A mixed research model could offer insights into individual patients' reasoning behind using emergency room services rather than taking actions, such as healthy lifestyle or primary care services, that may have prevented their chronic condition from worsening. The combination of in depth case studies relative to Maryland ED usage and quantitative data could be a powerful way to bridge the gap and put a more human face on the data.

A study of the effects of age, race, gender, and cost on the consistency and quality of treatment for chronic health conditions could bring to light many of the concepts and correlational characteristics mentioned in the literature review with reference to the epidemiological triad model of person, time and place (Anderson, 2008). Future research could indicate how variables such as the financial burden, on families, hospitals and the state of Maryland, influence the treatment of CHF and COPD, and spur the development of preventive measures designed to curb health care costs among Medicare and Medicaid beneficiaries, while optimizing health.

Implications

The study findings have the potential for real positive change; however, the limitations of the study may limit its impact. The study problem, combined with the available research indicates that more research is needed to determine the scope of the problem as it relates to geographical and racial disparities, and what, if anything, can be done to eliminate the overcrowding of EDs in Maryland and other states. The findings correlated to PCP supply and lowered ER costs have the possibility of positively impacting hospital spending on ED services, as preventative care creates positive change in the quality of life for ACSC patients. This may be achieved by increasing the supply of nurse practitioners, physician assistance and family doctors. Furthermore, since ED visits are not associated with mortality, programs should try to divert patients to less expensive care sites such as retail medicine, after-hour clinics, and online visits.

The results of the study indirectly support the theoretical framework of the epidemiological triad through the statistical acknowledgement of the relationships

specifically between behavior, ecological and environmental factors, and lifestyle and physical factors and chronic diseases. The implications of the study also positively correlate to Andersen's (2008) Model of Health Behavior as it potentially exposes the predisposing characteristics, enabling resources and need relevant to CHF and COPD patients. The statistical significance of financial impact, race and age correlates within the study have the potential of bringing clarity to the theoretical framework, and suggest that corrections to access to services could result in significant change.

The study results combined with the theoretical framework can guide further research in determining the optimal PCP supply, and costs analysis of ACSC response to preventative medicine, which in turn could help researchers to develop a plan to even the playing field with regard to equality of care. With a projected 127 percent growth in the number of Americans living with chronic illnesses by the year 2020, the vast majority of those individuals will be living under the poverty line (Bodenheimer, Chen, & Bennett, 2009). Insight into racial, socioeconomic, and geographical disparities could yield research that promotes positive social change. However, a limitation of the current study is that its data does not necessarily coincide with other studies in that the findings did not show the racial, socioeconomic or geographical disparities highlighted in much of the literature. Policy makers can utilize the information obtained in this and future studies to understand the impact of age, gender, and race on supply of PCPs on Medicare and Medicaid patients, and their impact on hospital ED spending. Hence, this research has the potential to inform health care delivery system and also improve existing and emerging public health programs through better care, better health and reduced cost to health care.

Conclusion

I used a quantitative, observational, and retrospective cross-study design to answer the following research questions: Is the primary care provider (PCP) supply in a state associated with frequent ED use among Maryland Medicare and Medicaid beneficiaries who have CHF or COPD? Is frequent ED use associated with end of life for Maryland Medicare and Medicaid beneficiaries with either CHF or COPD who die during the study? The prevalence of Medicare and Medicaid beneficiary utilization of emergency room services are in direct correlation with the amount of PCPs that are accessible. Therefore, the answers to these questions could help the state of Maryland to develop new programs and adjust current practices related to the rising costs of emergency room care relative to overuse, and simultaneously improve health outcomes or patients with chronic disorders.

References

Affleck, A., Parks, P., Drummond, A., Rowe, B. H., & Ovens, H. J. (2013). Emergency department overcrowding and access block. *CJEM, 15*(6), 359-370.

Agarwal, E., Ferguson, M., Banks, M., Bauer, J., Capra, S., & Isenring, E. (2012). Nutritional status and dietary intake of acute care patients: results from the Nutrition Care Day Survey 2010. *Clinical Nutrition (Edinburgh, Scotland)*, *31*(1), 41–7. doi:10.1016/j.clnu.2011.08.002

Al-Hazmi, M., Wooldrage, K., Anthonisen, N. R., Becklake, M. R., Bowie, D., Chan-Yeung, M., . . . Siersted, H. C. (2007). Airflow obstruction in young adults in Canada. *Canadian Respiratory Journal*, *14*(4), 221-227. http://dx.doi.org/10.1155/2007/987249

Andersen, R. M. (2008). National health survey and the behavioral model of health services use. *Medical Care, 46*(7), 647-53.

Aziz, E. F., Javed, F., Pratap, B., Musat, D., Nader, A., Pulimi, S., … Kukin, M. L. (2011). Malnutrition as assessed by nutritional risk index is associated with worse outcome in patients admitted with acute decompensated heart failure: An ACAP-HF data analysis. *Heart International*, *6e2*(1), 3-8. doi:10.4081/hi. 2011.e2

Babitsch, B., Gohl, D., & von Lengerke, T. (2012). Re-revisiting Andersen's Behavioral Model of Health Services Use: A systematic review of studies from 1998–2011. *GMS Psycho-Social-Medicine*, *9*.

Bayliss, E. A., Ellis, J. L., Shoup, J. A., Zeng, C., McQuillan, D. B., & Steiner, J. F. (2015). Effect of continuity of care on hospital utilization for seniors with multiple medical conditions in an integrated health care system. *The Annals of Family Medicine*, *13*(2), 123-129.

Berkman, L., & Kawachi, I., (2000). Social cohesion, social capital, and health. *Social Epidemiology*, 174-190.

Biello, K. B., Rawlings, J., Carroll-Scott, A., Browne, R., & Ickovics, J. R. (2010). Racial disparities in age at preventable hospitalization among us adults. *American Journal of Preventive Medicine, 38*(1), 54-60.

Blanchette, C. M., Dalal, A. A., & Mapel, D. (2012). Changes in COPD demographics and costs over 20 years. *Journal of Medical Economics, 15*(6), 1176-1182.

Bodenheimer, T., Chen, E., & Bennett, H. D. (2009). Confronting the growing burden of chronic disease: Can the US health care workforce do the job?. *Health Affairs*, *28*(1), 64-74.

Buccaneer, M. (2011). *Chronic condition data warehouse: User guide*. New York, NY: Routledge.

Burt, C. W., & McCaig, L. F. (2001). Trends in hospital emergency department utilization: United States, 1992-1999. National Center for Health Statistics. *Vital Health Stat, 12,* 150.

Byrne, M., Murphy, A. W., Plunkett, P. K., McGee, H. M., Murray, A., & Bury, G. (2003). Frequent attenders to an emergency department: a study of primary health care use, medical profile, and psychosocial characteristics. *Annals of Emergency Medicine*, *41*(3), 309-318. http://dx.doi.org/10.1067/mem.2003.68

Caballero, B. (2007). The global epidemic of obesity: An overview. *Epidemiologic Review, 29*(1), 1-5.

Centers for Disease Control and Prevention. (2010). *Deaths: Preliminary data for 2008.* Retrieved from http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_02.pdf

Centers for Medicare & Medicaid Services. (2012). *The Emergency Medical Treatment and Active Labor Act (EMTALA).* Retrieved from https://www.cms.gov/Regulations-and-Guidance/Legislation/EMTALA/index.html

Cheung, P. T., Wiler, J. L., Lowe, R. A., & Ginde, A. A. (2012). National study of barriers to timely primary care and emergency department utilization among Medicaid beneficiaries. *Annals of Emergency Medicine, 60*(1), 4-10.

Cook, L. J., Knight, S., Junkins, E. P., Mann, N. C., Dean, J. M., & Olson, L. M. (2004). Repeat patients to the emergency department in a statewide database. *Academic Emergency Medicine*, *11*(3), 256-263. doi:10.1111/j.1553-2712.2004.tb02206.x

Dalal, A. A., Shah, M., D'souza, A. O., & Rane, P. (2010). Costs of inpatient and emergency department care for chronic obstructive pulmonary disease in an elderly Medicare population. *Journal of Medical Economics*, *13*(4), 591-598.

Dalal, A. A., Shah, M., Lunacsek, O., & Hanania, N. A. (2011). Clinical and economic burden of patients diagnosed with COPD with comorbid cardiovascular disease. *Respiratory Medicine, 105*(10), 1516-1522.

The Dartmouth Atlas of Health Care. (2012). *Primary Care Service Area (PCSA).* Retrieved from http://www.dartmouthatlas.org/data/topic/topic.aspx?cat=13

Deddens, J., Petersen, M. R., & Endahl, L. (1998). Prevalence proportion ratios: Estimation and hypothesis testing. *International Journal of Epidemiology, 27*(1), 91-95.

DiBonaventura, M. D., Paulose-Ram, R., Su, J., McDonald, M., Zou, K. H., Wagner, J. S., & Shah, H. (2012). The impact of COPD on quality of life, productivity loss, and resource use among the elderly United States workforce. *COPD: Journal of Chronic Obstructive Pulmonary Disease*, *9*(1), 46-57.

Elixhauser, A., Steiner, C., & Palmer, L. (2012). *Clinical classifications software*. Washington, DC: U.S. Agency for Healthcare Research and Quality.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Federal Interagency Forum on Aging-Related Statistics. (2010). *Older Americans 2010: Key indicators of well-being*. Washington, DC: U.S. Government Printing Office.

Foody, J. M., Mendys, P. M., Liu, L. Z., & Simpson Jr., R. J. (2010). The utility of observational studies in clinical decision making: lessons learned from statin trials. *Postgraduate Medicine, 122*(3), 222-229.

Ford, E. S. (2011). Trends in the risk for coronary heart disease among adults with diagnosed diabetes in the US Findings from the National health and nutrition examination survey, 1999–2008. *Diabetes Care, 34*(6), 1337-1343. http://dx.doi.org/10.2337/dc10-2251

Frank, B. (2015). *Using CMS Data.* Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/Part-B-National-Summary-Data-File/Overview.html

Fuda, K. K., & Immekus, R. (2006). Frequent users of Massachusetts emergency departments: A state analysis. *Annals of Emergency Medicine, 48*(1), 9-16.

Fwu, C. W., Eggers, P. W., Kimmel, P. L., Kusek, J. W., & Kerala, Z. (2013). Emergency department visits, use of imaging, and drugs for urolithiasis have increased in the United States. *Kidney international, 83*(3), 479-486.

Garcia, T. C., Bernstein, A. B., & Bush, M. A. (2010). *Emergency department visitors and visits: who used the emergency room in 2007?*. Washington, DC: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Gershon, A. S., Wang, C., Wilton, A. S., Raut, R., & To, T. (2010). Trends in chronic obstructive pulmonary disease prevalence, incidence, and mortality in Ontario, Canada, 1996 to 2007: A population-based study. *Archives of Internal Medicine, 170*(6), 560-565. doi:10.1001/archinternmed.2010.17

Global Initiative for Chronic Obstructive Pulmonary Disease. (2010). *Global strategy for diagnosis, management, and prevention of chronic obstructive pulmonary disease.* Retrieved from http://www.goldcopd.org/Guidelines/guideline-2010-gold-report.html.

Gold, M., Phelps, D., Jacobson, G., & Neuman, T. (2010). *Medicare Advantage 2010 data spotlight: Plan enrollment patterns and trends*. Washington DC: Henry J. Kaiser Family Foundation. Available at https://kaiserfamilyfoundation.files.wordpress.com/2013/01/8080.pdf.page7

Gruneir, A., Silver, M. J., & Rochon, P. A. (2011). Emergency department use by older adults: A literature review on trends, appropriateness, and consequences of unmet health care needs. *Medical Care Research Review: MCRR, 68*(2) 131-155. doi:10.1177/1077558710379422

Hannan, E. L., Wu, C., Walford, G., Culliford, A. T., Gold, J. P., Smith, C. R., … Jones, R. H. (2008). Drug-eluting stents vs. coronary-artery bypass grafting in multivessel coronary disease. *New England Journal of Medicine, 358*(4), 331-341.

Hartocollis, A. (2012). For the elderly, emergency rooms of their own. *New York Times*, A1. Retrieved from http://www.nytimes.com/2012/04/10/nyregion/geriatric-emergency-units-opening-at-us-hospitals.html?_r=0

Healthcare Cost and Utilization Project. (2012). *Clinical Classifications Software (CCS) for ICD-9-CM.* Rockville, MD: Agency for Healthcare Research and Quality. Retrieved from www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp

Hunt, K. A., Weber, E. J., Showstack, J. A., Colby, D. C., & Callaham, M. L. (2006). Characteristics of frequent users of emergency departments. *Annals of Emergency Medicine, 48*(1), 1-8. http://dx.doi.org/10.1016/j.annemergmed.2005.12.030

Jencks, S. F., Williams, M. V., & Coleman, E. A. (2009). Rehospitalizations among patients in the Medicare fee-for-service program. *New England Journal of Medicine*, *360*(14), 1418-1428. doi:10.1056/NEJMsa0803563

Joynt, K. E., Orav, E. J., & Jha, A. K. (2011). Thirty-day readmission rates for Medicare beneficiaries by race and site of care. *Jama*, *305*(7), 675-681. doi:10.1001/jama.2011.123

Kirby, S. E., Dennis, S. M., Jayasinghe, U. W., & Harris, M. F. (2010). Patient related factors in frequent readmissions: the influence of condition, access to services and patient choice. *BMC Health Services Research, 10*(1), 1. doi:10.1186/1472-6963-10-216

Knowlton, A., Weir, B. W., Hughes, B. S., Southerland, R. J., Schultz, C. W., Sarpatwari, R., … Gaasch, W. (2013). Patient demographic and health factors associated with frequent use of emergency medical services in a midsized city. *Academic Emergency Medicine*, *20*(11), 1101-1111. doi:10.1111/acem.12253

Kociol, R. D., Eapen, Z. J., Reed, S. D., Li, Y., Armstrong, P. W., Starling, R. C., … Hernandez, A. F. (2013). Do countries or hospitals with longer hospital stays for acute heart failure have lower readmission rates? Findings from ASCEND-HF. *Circulation: Heart Failure*, *6*(4), 727-732.

Kramarow, E., Lubitz, J., Lentzner, H., & Gorina, Y. (2007). Trends in the health of older Americans, 1970–2005. *Health Affairs*, *26*(5), 1417-1425. doi:10.1377/hlthaff.26.5.1417

Krumholz, H. M., Merrill, A. R., Schone, E. M., Schreiner, G. C., Chen, J., Bradley, E. H., … Rapp, M. T. (2009). Patterns of hospital performance in acute myocardial infarction and heart failure 30-day mortality and readmission. *Circulation: Cardiovascular Quality and Outcomes*, *2*(5), 407-413. doi:10.1161/CIRCOUTCOMES.109.883256

Kwak, C., & Clayton-Matthews, A. (2004). Multinomial logistic regression. *Nursing Research, 51*(6), 404-410.

LaCalle, E., & Rabin, E. (2010). Frequent users of emergency departments: The myths, the data, and the policy implications. *Annals of Emergency Medicine, 56*(1), 42-48. http://dx.doi.org/10.1016/j.annemergmed.2010.01.032

Laurin, C., Moullec, G., Bacon, S. L., & Lavoie, K. L. (2012). Impact of anxiety and depression on chronic obstructive pulmonary disease exacerbation risk. *American Journal of Respiratory and Critical Care Medicine, 185*(9), 918-923. doi:10.1164/rccm.201105-0939PP

Lilienfeld, A. M., & Lilienfeld, D. E. (1980). *Foundations of epidemiology* (2nd ed.), New York, NY: Oxford University Press.

Lindenauer, P. K., Pekow, P., Gao, S., Crawford, A. S., Gutierrez, B., & Benjamin, E. M. (2006). Quality of care for patients hospitalized for acute exacerbations of chronic obstructive pulmonary disease. *Annals of Internal Medicine, 144*(12), 894-903.

Locker, T. E., Baston, S., Mason, S. M., & Nicholl, J. (2007). Defining frequent use of an urban emergency department. *Emergency Medicine Journal*, *24*(6), 398-401. doi:10.1136/emj.2006.043844

Lucas, R., Farley, H., Twanmoh, J., Urumov, A., Olsen, N., Evans, B., & Kabiri, H. (2009). Emergency department patient flow: the influence of hospital census variables on emergency department length of stay. *Academic Emergency Medicine*, *16*(7), 597-602.

Mandelberg, J. H., Kuhn, R. E., & Kohn, M. A. (2000). Epidemiologic analysis of an urban, public emergency department's frequent users. *Academic Emergency Medicine*, *7*(6), 637-646. doi:10.1111/j.1553-2712.2000.tb02037.x

Mannino, D. M., Homa, D. M., Akinbami, L. J., Ford, E. S., & Redd, S. C. (2002). Chronic obstructive pulmonary disease surveillance---United States, 1971--2000. *Respiratory Care*, *76*(10).

Marton, J. P., Boulanger, L., Friedman, M., Dixon, D., Wilson, J., & Menzin, J. (2006). Assessing the costs of chronic obstructive pulmonary disease: the state Medicaid perspective. *Respiratory Medicine*, *100*(6), 996-1005. http://dx.doi.org/10.1016/j.rmed.2005.10.001

Maryland Health Care Commission. (2002). *Trends in Maryland hospital emergency department utilization: An analysis of issues and recommended strategies to address crowding.* Retrieved from http://www.hscrc.state.md.us/documents/HSCRC_PolicyDocumentsReports/HSCRC-MHCC_Papers/Trends%20in%20MD%20Hospital%20ED%20Utilization%20(2002).pdf

McCaig, L. F., & Nawar, E. W. (2006). *National hospital ambulatory medical care survey: 2004 emergency department summary (No. 372).* Washington, DC: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

McGinnis, K. A., Crothers, K., Griffith, T. A., Rodriguez-Barradas, M. C., Leaf, D. A., Weissman, S., & Justice, A. C. (2005). The impact of cigarette smoking on mortality, quality of life, and comorbid illness among HIV-positive veterans. *Journal of General Internal Medicine*, *20*(12), 1142-1145.

Medicare Payment Advisory Commission. (2009). *A data book: Healthcare spending and the Medicare program.* Washington, DC: Author.

Merriman, K., & Caldwell, D. (2003). *How to identify emergency room services in the Medicare claims data.* Minneapolis: University of Minnesota.

Miller, J. D., Foster, T., Boulanger, L., Chace, M., Russell, M. W., Marton, J. P., & Menzin, J. (2005). Direct costs of COPD in the US: an analysis of Medical Expenditure Panel Survey (MEPS) data. *COPD: Journal of Chronic Obstructive Pulmonary Disease, 2*(3), 311-318. doi:10.1080/15412550500218221

National Institutes of Health. (2012). *2012 NHLBI Mortality Chart Book.* Retrieved from http://www.nhlbi.nih.gov/research/reports/2012-mortality-chart-book

O'Neil, S. S., Lake, T., Merrill, A., Wilson, A., Mann, D. A., & Bartnyska, L. M. (2010). Racial disparities in hospitalizations for ambulatory care–sensitive conditions. *American Journal of Preventive Medicine, 38*(4), 381-388. http://dx.doi.org/10.1016/j.amepre.2009.12.026

Oster, A., & Bondmen, A. B. (2003). Emergency department visits for ambulatory care sensitive conditions: insights into preventable hospitalizations. *Medical Care, 41*(2), 198-207.

Pasquale, M. K., Sun, S. X., Song, F., Hartnett, H. J., & Stemkowski, S. A. (2012). Impact of exacerbations on health care cost and resource utilization in chronic obstructive pulmonary disease patients with chronic bronchitis from a predominantly Medicare population. *International Journal of Chronic Obstruction Pulmonary Disease, 7*(21), 757-764. Retrieved from https://www.dovepress.com/international-journal-of-chronic-obstructive-pulmonary-disease-journal

Philipson, T. J., Snider, J. T., Lakdawalla, D. N., Stryckman, B., & Goldman, D. P. (2013). Impact of oral nutritional supplementation on hospital outcomes. *The American Journal of Managed Care*, *19*(2), 121-128.

Pines, J. M., Asplin, B. R., Kaji, A. H., Lowe, R. A., Magid, D. J., Raven, M., … Yealy, D. M. (2011). Frequent users of emergency department services: gaps in knowledge and a proposed research agenda. *Academic Emergency Medicine*, *18*(6), e64-e69. doi:10.1111/j.1553-2712.2011.01086.x

Pope, G. C., Kautter, J., Ellis, R. P., Ash, A. S., Ayanian, J. Z., Ingber, M. J., . . . Robst, J. (2004). Risk adjustment of Medicare capitation payments using the CMS-HCC model. *Health Care Finance Review*, *25*(4), 119-141.

Probst, J. C., Laditka, J. N., & Laditka, S. B. (2009). Association between community health center and rural health clinic presence and county-level hospitalization rates for ambulatory care sensitive conditions: an analysis across eight US states. *BMC Health Services Research*, *9*(1), 1. doi:10.1186/1472-6963-9-134

Rabe, K. F., Hurd, S., Anzueto, A., Barnes, P. J., Buist, S. A., Calverley, P., . . . Zielinski, J. (2007). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *American Journal of Respiratory and Critical Care Medicine*, *176*(6), 532-555.

Remington, P. L., & Brownson, R. C. (Eds.) (2010). *Chronic disease epidemiology and control.* Washington, DC, USA: American Public Health Association.

Rosenblatt, R. A., Wright, G. E., Baldwin, L. M., Chan, L., Clitherow, P., Chen, F. M., & Hart, L. G. (2000). The effect of the doctor-patient relationship on emergency department use among the elderly. *American Journal of Public Health*, *90*(1), 97-102.

Rosychuk, R. J., Voaklander, D. C., Klassen, T. P., Senthilselvan, A., Marrie, T. J., & Rowe, B. H. (2010). Asthma presentations by children to emergency departments in a Canadian province: A population-based study. *Pediatric Pulmonology*, *45*(10), 985-992.

Ruger, J. P., Richter, C. J., Spitznagel, E. L., & Lewis, L. M. (2004). Analysis of costs, length of stay, and utilization of emergency department services by frequent users: implications for health policy. *Academic Emergency Medicine*, *11*(12), 1311-1317. doi:10.1197/j.aem.2004.07.008

Rycroft, C. E., Heyes, A., Lanza, L., & Becker, K. (2012). Epidemiology of chronic obstructive pulmonary disease: a literature review. *International Journal Chronic Obstruction Pulmonary Disease*, *7*, 457-494. Retrieved from https://www.dovepress.com/international-journal-of-chronic-obstructive-pulmonary-disease-journal

Sandoval, E., Smith, S., Walter, J., Schuman, S. A. H., Olson, M. P., Striefler, R., . . . Hickner, J. (2010). A comparison of frequent and infrequent visitors to an urban emergency department. *The Journal of Emergency Medicine*, *38*(2), 115-121. http://dx.doi.org/10.1016/j.jemermed.2007.09.042

Shahab, L., Jarvis, M. J., Britton, J., & West, R. (2006). Prevalence, diagnosis and relation to tobacco dependence of chronic obstructive pulmonary disease in a nationally representative population sample. *Thorax, 61*(12), 1043-1047. doi:10.1136/thx.2006.064410

Somanchi, M., Tao, X., & Mullin, G. E. (2011). The facilitated early enteral and dietary management effectiveness trial in hospitalized patients with malnutrition. *Journal of Parenteral and Enteral Nutrition, 35*(2), 209-216. doi:10.1177/0148607110392234

Soriano, J. B., Davis, K. J., Coleman, B., Visick, G., Mannino, D., & Pride, N. B. (2003). The proportional Venn diagram of obstructive lung disease: two approximations from the United States and the United Kingdom. *CHEST Journal, 124*(2), 474-481. doi:10.1378/chest.124.2.474

Tang, E. K., Li, W., Janjetovic, Z., Nguyen, M. N., Wang, Z., Slominski, A., & Tuckey, R. C. (2010). Purified mouse CYP27B1 can hydroxylate 20, 23-dihydroxyvitamin D3, producing 1α, 20, 23-trihydroxyvitamin D3, which has altered biological activity. *Drug Metabolism and Disposition, 38*(9), 1553-1559. doi:10.1124/dmd.110.034389

Tan, W. C., Seale, P., Ip, M., SHIM, Y. S., CHIANG, C. H., NG, T. P., . . . Mangunnegoro, H. (2009). Trends in COPD mortality and hospitalizations in countries and regions of Asia-Pacific. *Respirology, 14*(1), 90-97. doi:10.1111/j.1440-1843.2008.01415.x

Thorpe, K. E., Ogden, L. L., & Galactionova, K. (2010). Chronic conditions account for rise in Medicare spending from 1987 to 2006. *Health Affairs*, *29*(4), 718-724. doi:10.1377/hlthaff.2009.0474

Tsai, C. L., Griswold, S. K., Clark, S., & Camargo Jr, C. A. (2007). Factors associated with frequency of emergency department visits for chronic obstructive pulmonary disease exacerbation. *Journal of General Internal Medicine*, *22*(6), 799-804.

Watson, L., Vestbo, J., Postma, D. S., Decramer, M., Rennard, S., Kiri, V. A., & Soriano, J. B. (2004). Gender differences in the management and experience of chronic obstructive pulmonary disease. *Respiratory Medicine*, *98*(12), 1207-1213.

Weng, B., & Barner, K. E. (2005). Nonlinear system identification in impulsive environments. *Signal Processing, IEEE Transactions On*, *53*(7), 2588-2594.

Williams, R. L. (2000) A note on robust variance estimation for cluster-correlated data *Biometrics, 56*(2), 645-646.

Wolinsky, F. D., Miller, T. R., Geweke, J. F., Chrischilles, E. A., An, H., Wallace, R. B., … Rosenthal, G. E. (2007). An interpersonal continuity of care measure for Medicare Part B claims analyses. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *62*(3), S160-S168.

Woolf, S. H., Johnson, R. E., Phillips Jr, R. L., & Philipsen, M. (2007). Giving everyone the health of the educated: An examination of whether social change would save more lives than medical advances. *American Journal of Public Health*, *97* (4), 679-683.

World Health Organization. (2009). *Chronic obstructive pulmonary disease.* Geneva: Author. Retrieved from www.int/mediacentre/fact Sheet/fs315/en/;Fact Sheet no.315

Xu, K. T., Nelson, B. K., & Berk, S. (2009). The changing profile of patients who used emergency department services in the United States: 1996 to 2005. *Annals of Emergency Medicine*, *54*(6), 805-810. http://dx.doi.org/10.1016/j.annemergmed.2009.08.004

Yeatts, K. B., Lippmann, S. J., Waller, A. E., Lich, K. H., Travers, D., Weinberger, M., & Donohue, J. F. (2013). Population-based burden of COPD-related visits in the ED: return ED visits, hospital admissions, and comorbidity risks. *CHEST Journal*, *144*(3), 784-793.

Yu, A. P., Yang, H., Wu, E. Q., Setyawan, J., Mocarski, M., & Blum, S. (2011). Incremental third-party costs associated with COPD exacerbations: A retrospective claims analysis. *Journal of Medical Economics*, *14*(3), 315-323.

Appendix A

Summaries of the Literature: Impact of Medicare and Medicaid Beneficiaries with Selected Conditions on Emergency Department Utilization

Author & Year	**Title**	**Study Design**	**Study Population**	**Independent Variables**	**Dependent variables**	**Results**	**Other**
O'Neil S. O'Neil, Timothy Lake, Angela Merrill, Ander Wilson, David A. Mann, Linda M. Bartnyska (2010)	Racial Disparities in Hospitalizations for Ambulatory Care–Sensitive Conditions	Retrospective study. A Poisson regression model identified race, age, gender, and income as factors associated with differences in ACSC hospitalization rates.	Using 2006 Medicare claims data, eight ACSC hospitalization measures were developed for 569,896 Maryland Medicare beneficiaries.	Race, Age, Gender, and Income.	ACSC, hospitalization rates, in-hospital mortality, cost of care	African Americans with Medicare in Maryland had significantly higher unadjusted rate of ACSC hospitalizations related to CHF, dehydration, diabetes, adult asthma, and hydration than Whites. Although African Americans had a slightly higher rate for UTI, the difference was not significant. Whites had significantly	Race may be a key predictor of preventable emergency department visits and hospitalizations for some ACSCs. Racial disparities in these hospitalizations represent excess costs to Medicare.Because ACSC admission are potentially preventable, improving care for minority may reduce disparities and lower hospital costs.

						higher rates for two conditions (COPD and bacterial pneumonia). Excess costs from disparities in quality ranged from $8 million (heart failure) to $38,000 (Urinary tract infection).	
Katie Brooks Biello, James Rawlings, Amy Carroll-Scott, Rosa Browne, Jeannette R. Ickovics (2010).	Racial Disparities in Age at Preventable Hospitalization Among U.S. Adults	Retrospective study.	Differences in mean age at hospital for ACSCs were evaluated in a nationally representative sample of 6815 hospital discharge using 2005 National Hospital Discharge Survey. Linear regression was used to evaluate differences among nine chronic and three acute conditions.	Race, Gender, socioeconomic status.	Rate of ER visit and hospitalization, Cost of medical care.	After adjustment for sociodemographic characteristics, Blacks were hospitalized ≥5 years earlier than Whites across all conditions combined and for chronic and acute conditions separately. The largest differences were seen for uncontrolled diabetes (adjusted difference= −12.0 years) and bacterial pneumonia (adjusted difference= −7.5 years).	Promoting equity in disease prevention, management, and treatment should be a priority of any healthcare reform efforts.

Ellen Kramarow, James Lubitz, Robert Francis (2012).	Trends in the Coronary heart disease risk profile of middle-aged adults	Retrospective study using data from the National Health and Nutrition Examination Survey from 2 time periods.	1862 (1988-1994) and 1563 (2005-2008) from the NHANES	Gender, Race, and Age group (45-54 and 55-64).	Coronary Heart Disease risk, blood pressure levels, total and high-density lipoprotein serum cholesterol, weight (BMI), diabetes, and smoking status.	The CHD risk profile of middle-aged adults has improved over time. For instance, the mean 10-year risk of heart attack or CHD death among persons 55 to 64 years has declined from 7.1% to 5.2%. Declines are seen among both men and women and among non-Hispanic Blacks and non-Hispanic Whites.	Despite increase in diabetes and obesity, the CHD risk profile of middle-aged adults improved during the period from 1988-1994 to 2005-2008.
Karen E. Joynt, E. John Orav, and Ashish K. (2015).	The Association Between Hospital Volume and Processes, Outcomes, and Costs of Care for Congestive Heart Failure	Retrospective cohort study.	National Medicare claims data with a primary discharge diagnosis of CHF from 4095 hospitals in the United States.	Race, Gender, socioeconomic factors.	Mortality rate, readmission rate, and cost per discharge.	Hospitals in the low income group had lower performance on the process measures (80.2%) than the medium-volume (87.0%) or high-volume (89.1%) hospitals ($P < 0.001$). In the low-volume group, being admitted to a hospital with a higher case	Experience managing CHF is associated with higher quality of care and better outcomes for patients but a higher cost. Understanding this will help improve care and health outcomes for all CHF patients.

						volume was associated with lower mortality, lower readmission, and higher costs. Similar, though smaller, relationships were found between case volume and both mortality and costs in the medium-and high-volume hospital groups.	
Margaret K. Pasquale, Shawn X. Sun, Frank Song, Heather J. Hartnett, Stephen A. Stemkowski (2012)	Impact of Exacerbations on Health care cost and resource utilization in chronic obstructive pulmonary disease patients with chronic bronchitis from a predominantly Medicare population	A retrospective analysis which involves patients who were aged 40-89 years, had been enrolled continuously for 24 months or more, who had at least two separate insurance claims for COPD with chronic bronchitis.	Retrospective analysis was performed on data extracted from a large national health plan with a predominantly Medicare population – involves 8554 patients from 2007-2009.	Age, Gender, Race/Ethnicity, United States geographic region (Midwest,Northeast, South, West), Income level.	DCI Score, Top five comorbidities [n (%)] – Congestive heart failure, Related COPD diagnoses, Diabetes without complication, Peripheral vascular disease, renal disease, Maintenance medication total [n (%)].	Generalized linear regression model was computed using SPSS. P-values < 0.05 was considered to indicate statistically significant differences. GLM with log link and gamma distribution for the term, was used to estimate adjusted health care costs – controlling for demographic and clinical	The results indicated that despite treatment with maintenance medications, COPD patients continue to have exacerbations resulting in higher costs. New medication and disease management intervention is needed to severity and frequency of exacerbations and related cost impact of the disease.

						characteristics. 49.8% of the overall population had exacerbation, 13.9% had a severe exacerbation only, 29.1% had a moderate exacerbation only, and 6.8% had a severe and moderate exacerbation. COPD-related mean annual costs were $4069 for overall population and $6381 for patients two or more exacerbations. All-caused health care costs were $18,976 for the overall population and $23,901 for patients with history of two or more exacerbations. Severity of exacerbation, presence of cardiovascular	

						disease, diabetes, and long-term, oxygen use were associated with higher adjusted costs.	
Anand A. Dalal, Manan Shah, Anna O. D'Souza, Pallavi Rane (2010).	Cost of COPD exacerbations in the emergency department and inpatient setting	A retrospective, cross-sectional study of healthcare costs and utilization using hospital administrative data from the Premier Perspective Database. The study evaluated outcomes of Medicare Population for three categories of utilization: ED visits, simple inpatient admissions, and complex inpatient admissions.	Administrative data from 602 hospitals were used to calculate 2008 costs for COPD-related emergency department visits, simple inpatient admissions and admissions among COPD patients aged > 40 years.	Age, Gender, Payor (Medicare, Medicaid, Commercial self-pay, and other, Geographic region (East, Midwest, South, West).	ED visits, Inpatient mortality rate, length of stay, and readmission rates in 2005-2008, and COPD conditions were calculated.	Statistical analyses were conducted using SPSS (v.9.1.3). The database contained de-identified billing and coding data and patient demographic and hospital characteristics from 602 not for profit hospitals. A total of 71,493 encounters met inclusion criteria. Of these, 28.7% were ED visits, 49.*% were simple inpatient admission s, and 4.8% were complex inpatient admissions. More than half of ED visits and inpatient admissions occurred in	Costs of hospital-based care for COPD are substantial. Admissions involving intubation or intensive care are associate with the highest costs and mortality.

						females (56.4%) and patients who were 65 years of age or older. Mean 2008 costs were $647 for ED visits, $7242 for simple admissions, and $20,757 for complex admissions. Intensive care/intubation admissions incurred the highest costs $44,909. Complex admission accounted for 5.8% of hospital-based COPD care in 2008 but 20.9% of costs.	
Marco daCosta DiBonaventura, Ryne Paulose-Ram, Jun Su, Margaret McDonald, Kelly H Zou, Jan-Samuel Wagner, Hemal Shah (2012).	The burden of chronic obstructive pulmonary disease among employed adults	A cross-sectional study from a self-administered, internet-based questionnaire from a sample population identified through a web-	Data were obtained from 75,000 respondents who completed the 2009 US National Health and Wellness Survey	Age, Gender, Race/ethnicity, education level, household income, health insurance and type of employment (FT/PT, SE), BMI.	Health condition (COPD), Health utility score, ER visits, mental component, physical component summaries.	After adjusting for demographics and patient characteristics, adults with COPD reported significantly lower mean level of the various components than	Employed adults with COPD reported significantly lower quality of life and work productivity, and increased health resource utilization than

		based consumer panel.	(NHWS). The study focused on 40 years or older.			adults without COPD. Overall work impairment (20.5% vs 16.3%), and impairment in daily activities (23.5% vs 17.9%) than adults without COPD. Employed adults with COPD also reported more mean emergency room visits (0.21 vs 0.12) and more mean hospitalizations (0.10 vs 0.06) in the previous months than employed adults without COPD. All of the differences were significantly at two-sided $P < 0.05$. The results depicts the substantial impact and burden of COPD in the United States workforce.	employed adults without COPD.
Karin B. Yeatts, Steven	Population-Based Burden	Population-based	Using SPSS (v.9.2) to run	Age, Gender, insurance type	ED visits, hospital	In 2008 to 2009 in North Carolina,	Population-based burden of COPD-

J. Lippmann, Anna E. Walker, Kristen Hassmiller Lich, Debbie Travers, Morris Weinberger, James F. Donohue (2013).	of COPD-Related Visits in the ED Return ED visits, Hospital Admissions, and Comorbidity Risks.	retrospective cohort design was used to identify all patients 45 years or older who had at least one COPD related Ed visit between 2008 and 2009.	generalized linear models, 97,511 COPD related patients were examined in North Carolina from 110 and 111 eligible hospitals in 2008 and 2009 respectively.	(Medicare, Medicaid, Private, other gov't), Time	discharge rate, hospital admission rate, most common conditions – hypertension, respiratory failure/ shortness of breath, heart disease, tobacco use, diabetes, congestive heart failure.	97,511 COPD-related ED visits were made by adults 45 years or older at an annual rate of 13.8% ED visits/1,000 person. Among Patients with COPD (n-33,977), 7% and 28% had a COPD-related return ED visits within a 30 and 365 day period of their index visit respectively. Fifty-one percent of patients with COPD were admitted to the hospital from the index ED visit. Hospital admission increased with age in the cohort. Patients with congestive heart failure were more likely to have subsequent hospital admission compared with patients without	related care in the ED is significant. Further studies is needed to understand variations in COPD-related ED visits and hospital admissions.

						these conditions.	
Christopher M. Blanchette, Nicholas J. Gross, Pablo Altman (2014).	Rising Costs of COPD and the Potential for Maintenance Therapy to slow the Trend	Longitudinal studies of the costs associated with the management of patients with COP, the costs associated with hospitalizations for acute exacerbation of COPD, and randomized clinical trials evaluating effects of maintenance therapy of COPD.	62 studies from 28 countries for adults who have COPD-related conditions.	Age, Gender, insurance type, 28 Countries	ED visits, Health utilization, COPD-related conditions (smoking, coronary heart disease hypertension, stroke asthma, diabetes, myocardial infraction.	A meta-analysis that included 62 studies from 28 countries reported that prevalence of COPD among smokers was 15.4% compared with 10.7% among nonsmokers. The study found that smoking was responsible for more than 77% of all deaths from COPD in US. The direct healthcare costs for patients with COPD increased by 38% between 1987 – 2007, and continued to increase by 5% annually between 2006 – 2009. The costs associated with hospital admissions for patients with COPD accounted for the largest increase $2,289	The study suggested that treatment of acute exacerbation of COPD remains the major driver of increasing healthcare costs associate with the condition. Appropriate use of maintenance therapy has been shown to reduce the incidence of exacerbations and has the potential to reduce overall costs.

						per admission in 2007. Recent estimate suggest that the aggregate costs associated with treatment was between $3.2 billion and 3.8 billion, and annual healthcare costs were 10-fold greater for patients with COPD associated with acute exacerbation.	
Perera N. Prasdini, Edward P. Amstrong, Duane L. Sherrill, Grant H. Skrepnek (2012)	Acute Exacerbations of COPD in the United States: Inpatient Burden and Predictors of Costs and Mortality	Analysis of the Healthcare cost and utilization project data. This study determined the national inpatient burden of AECOPD and assessed the association of co-morbidities and hospital characteristics with inpatient costs and mortality.	1,254,703 hospitalizations for AECOPD were observed in the United States.	Age, Gender, Insurance, geographic region, Weight (BMI)	ED visits, COPD-related conditions, length of stay, admission period.	From 2006 – 2010, the aggregate cost for hospitalization for acute COPD exacerbation increased from $2.96 billion to $3.47 billion. Overall, 1,254,703 hospitalizations for AECOPD were observed with mean costs of $9545(±12,700) and total costs of $11.9 billion. In-hospital mortality	Future research should determine if better management of these conditions can favorably impact the COPD disease burden.

						was 4.3% (N = 53,748). Discharges averaged 70.6 (±11.9) years of age. The majority were female (52.8%) and of White race (83.6% of reported race). Several co-morbidities were significantly associated with both costs and mortality ($p <$ 0.001. Significantly higher costs ($p <$ 0.001) were associated with large and urban hospitals.	
Yu, A. P., Yang, H., Wu, E. Q., Setyawan, J., Mocarski, M., & Blum, S (2011).	Incremental third-party costs associated with COPD exacerbations: a retrospective claims analysis	Analysis of service claims and costs data from the Thomson Reuters MarketScan database. The method used for defining exacerbations does not	A total of 2644,174 patient-quarters, derived from 228,978 COPD patients in the United States were included in the analysis. The average patient was	Age, Gender, Insurance, Geographic region	ED visits, COPD-related conditions,	In 2004-2008, the total COPD-related cost for patients with a severe exacerbation was $7014 per quarter. Cost associated with COPD patients who had no exacerbations was $658 per	Exacerbations, especially severe ones, result in a significant economic burden for third-party payers. Effective management of COPD and prevention of exacerbations may lead to

		capture mild exacerbations. Additional limitations exist due to the nature of claims data.	followed an average of 2.9 years.			quarter or $2632 annually. The mean total cost was $17,016 per patient-quarter with severe exacerbation, $6628 per patient-quarter with non-severe exacerbation, an average of $8726 per patient-quarters with any exacerbation compared to $4762 per patient-quarter with no exacerbation. After adjusting for patient demographics, the mean incremental total cost was $11,261 per patient-quarter with severe exacerbation, $1509 per patient-quarter for non-severe exacerbation, and $3439 per patient-quarter with any exacerbation	improved patient outcomes and reduction in total healthcare costs for long-term management of COPD.

						compared with patient-quarters with no exacerbation.	
Dalal, A. A., Shah, M., Lunacsek, O., & Hanania, N. A. (2011).	Clinical and economic burden of patients diagnosed with COPD with comorbid cardiovascular disease	A retrospective cohort study of COPD patients CVD ± ≥40 years of age using administrative claims data were conducted. COPD-CVD patients were matched to COPD patients without CVD (COPD-Only cohort) using propensity scores	Each cohort included 4594 patients with COPD-related conditions in the United States. Multivariate analyses were conducted to assess the 1-year risk of COPD exacerbations (hospitalization and or emergency room visits), along with differences in 1-year and 2-year all-cause and COPD-related utilization and costs among COPD-CVD and COPD-Only cohorts.	Age, Gender, Insurance Type (Commercial or Medicare Advantage),	ED visits, COPD-related conditions, simple inpatient admission,	Compared to COPD-Only cohort, the COPD-CVD cohort was almost 2 times more likely to require COPD-related hospitalization (odds ratio [OR], 1.95; $p < 0.001$), 47% more likely to have an ER visit (OR, 1.47; $p < 0.001$) and 62% more likely to require hospitalization and or ER visit (OR, 1.62; $p < 0.001$). Average annual all-cause medical costs per patient were $22,755 for COPD-CVD vs $8036 for COPD-Only ($p < 0.001$), and total costs were $27,032 vs	COPD patients with CVD have significantly higher risk of COPD exacerbations and increased costs than COPD patients without CVD. This suggests a close association between COPD and CVD that needs further exploration.

						$11,506 ($p < 0.001$), respectively; corresponding average COPD-related annual medical costs were $1891 vs $1060 ($p < 0.001$) and total costs were $3295 vs $2379 ($p < 0.001$).	

Summary of the Literature: Impact of Medicare and Medicaid Beneficiaries with Selected Conditions on Emergency Department Utilization

Appendix B

CHF and COPD Codes

CHF Codes used in this study were: 39891, 40201, 40211, 40291, 40401, 40403, 40491, 40493, 4280, 4281, 42820, 42821, 42822, 42823, 42830, 42831, 42832, 42833, 42840, 42841, 42842, 42943, 4289.

COPD Codes used in this study were: 490, 4910, 4911, 4918, 4919, 4920, 4928, 49120, 49121, 49122, 4940, 4941, 496.

Appendix C

Primary Care Physician Codes Used in This Study

Code	Description
01	General Practice
08	Family Practice
11	Medicine
38	Geriatric Medicine