**SOCIAL DETERMINANTS OF HEALTH AND**

**CHRONIC OBSTRUCTIVE PULMONARY DISEASE READMISSIONS:**

**SYSTEM CHARACTERISTICS, COMMUNITY FACTORS, AND PRIMARY CARE.**

by

Darren W. Brownlee

A dissertation is submitted to Johns Hopkins University in conformity with the requirements for

the degree of Doctor of Public Health

Baltimore, Maryland
April 2022

**ABSTRACT**

**Introduction:** Social determinants of health (SDH) are the conditions in which people are born, grow, live, work, and age. Located within the paradigm of SDH are the domains of economic stability, neighborhood and physical environment, education, food, community and social context, and health care systems. All variables that influence the health outcomes of mortality, morbidity, life expectancy, health care expenditures, health status, and functional limitations. Chronic obstructive pulmonary disease (COPD) is a prevalent chronic condition impacting the nation, and the world. Social determinants of health have not been studied widely in relation to chronic obstructive pulmonary disease, hence, this dissertation examines the nexus of SDH and COPD with the hope of advancing health equity.

**Methods:** Derived through three approaches (manuscripts), a literature review provided an extensive search of interventions and best practices to address SDH, and two retrospective analyses explored readmission associations with county health rankings (CHR) and primary care provider (PCP) establishment to understand potential relationships.

**Results:** Manuscript One exemplifies interventions and best practices to address SDH and suggests progression in advancing data-driven approaches to assess outcomes across patient populations, communities, and organizations. Manuscript Two outlines community level demographics associated with COPD readmission, demonstrating how increased proactive provision of primary and specialty services, outside of organizational walls, impact readmissions. It concludes that the CHR subfactors of the physical environment and clinical care, the community characteristics of county median age and region, and a hospital's location does influence readmission scores. Lastly, while not statistically significant, Manuscript Three displayed results in the hypothesized direction of an association between

COPD 30-day readmission and having a primary care provider. Results from studies may guide

policymakers to understand that focusing on often neglected services and influences of SDH can lead to

creating an overall healthier population.

**Conclusion:** Challenges cannot be easily addressed independently, rather, an ecosystem collaborative

approach is necessary to define objectives and key results, further garnering relationships, and

influences of systems, communities, and primary care, aligning policies and resources to optimally

advance health.

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**ACKNOWLEDGEMENTS**

**To God be the Glory**! As it was God who provided me the much-needed "S.P.A.C.E." (Silence, Patience, Acceptance, Courage, and Exhale (Breathe)) to take my mind, body, and soul through the most difficult thing which I have done my entire life. I rejoice, I praise, I am unworthy of his grace, and simply thank him for the life in which he has allowed me to have. Period.

To my Mom, Dad, Tia, Titus, Grandma (and Poppa R.I.P.), and the many generations of Brownlee out there, I write this teary-eyed even at the thought of you all, THANK YOU for being my strength, my peace, and know that this feat stems from my greatest motivation – my family. To my extended family (Greg Anderson, Kelli Brown, Iana Clarence, Cortenous Herbert, Joey Hooks, Alexis Jackson, Dr. Kadesha Nicholas, Salim Koroma, Theresa McFaul, Matt Medley, Anthony Nelson, Ricardo Percy, Kabo Shiman, Ryan Scott, Nathan Smith, and Luke Spencer) and all those who have mentally, physically, and emotionally checked on me throughout this entire journey of ups, downs, and life as we know it, words cannot express my love.

To the biggest influencers I have had as it relates to being a doctoral student for the Bloomberg School of Public Health, Dr. Darrell Gaskin and Dr. Aaron Spaulding, who of many things in which they have taught me, have encouraged me through any doubts, imposter syndromes, and for continuing to show me that I, too, earned a seat in the world of academia, thank you. "*It's the learning by doing which will make the subsequent steps more beneficial and beautiful.*" Additionally, to my Thesis Advisory Committee, Dr. Mark Bittle, Ms. Natalie Burke, Dr. Conan Dickson, Dr. Lilly Engineer, Dr. Panagis Galiatsatos, Dr. Sherita Hill Golden, and Dr. Roland Thorpe, who I have known varying from six to ten years, I have learned much from you, and am fortunate to have you embedded at the end.

To my Mayo Family, beginning with my bosses/mentors, Ajani Dunn, and Scott Seinola, thank you for allowing the balance, and even at times, the prioritization of my doctoral studies over my work. During some of health care's more critical times, you ensured that I kept my eye on the prize – my degree. Thank you. To others in the Mayo family, more so, my greatest colleagues and friends (Abena Anyane-Yeboah, Heather Barlow, Greg Beliles, Shalmali Borkar, Tara Brigham, Mechelle Caesar, Hana Hamadi, Chris Hasse, Alexis Jackson, Amy Kidane, Dr. Beth Ladlie, Dr. Margaret Johnson, Dr. Shaheen Kurani, Dr. Augustine Lee, Lebora Nickas, Matt Medley, Ashley Pratt, Mar Sayo, Caroline (Sarratt) Russell, Nathan Smith, Nancy O'Keefe, Dr. Neal Patel, Dr. Yemi Sokumbi, and Ben Ziemer) as well as, the

# TABLE OF CONTENTS

**CHAPTER ONE: INTRODUCTION**

Chronic obstructive pulmonary disease (COPD) is an umbrella term used to describe progressive lung diseases including emphysema, chronic bronchitis, and refractory (non-reversible) asthma. Furthermore, experts from around the world leading the Global Initiative for Chronic Obstructive Lung Disease (GOLD) define COPD as a common, preventable, and treatable disease, characterized by persistent airflow limitation that is usually progressive and associated with a chronic inflammatory response in the airways and the lung to noxious particles or gases (T. Goto et al., 2017). The disease affects roughly 10% of individuals worldwide, is the third leading cause of death in the United States and is prevalent among 15 million Americans (Shah et al., 2016). Furthermore, COPD implications result in annual direct costs equating to $50 billion (A. Agusti et al., 2010).

COPD patients often require frequent hospital admissions, as well as visits to the emergency department for exacerbations of their lung disease (Hunter et al., 2016). These visits to an emergency department often count toward an unplanned 30-day readmission rate, often affiliated with poor care provision, premature discharge, suboptimal medication reconciliation, lack of disease knowledge, and a disconnect between physicians and the patient (Auerbach et al., 2016).

Despite being potentially preventable, roughly one in five individuals are readmitted within 30 days (Garvey & Kaplan, 2018). Even more significant to this study, roughly 10 – 20 percent of COPD patients are readmitted within 30 days of discharge (Simmering, Polgreen, Comellas, Cavanaugh, & Polgreen, 2016). With COPD being a commonly readmitted disease group, it is poorly understood as to which interventions for this specific patient population are most substantial, and, if there is any connection to system characteristics, community factors, or primary care.

*Disease Spectrum & COPD Patients*

Patients with COPD can have acute worsening in their respiratory status marked by a decline in their dyspnea, cough, and/or sputum, leading to other disease related comorbidities such as bronchitis, pneumonia, or pulmonary embolism. Despite preventable measures (such as avoidance or early cessation of smoking) and treatable solutions (such as oxygen therapy and pulmonary rehabilitation), there are various factors and risks which may lead to the development of COPD. Tobacco smokers (cigarette smokers) have had a higher prevalence of respiratory systems and lung function abnormalities, along with a greater COPD mortality rate than non-smokers (Vestbo et al., 2013) leaving tobacco smoking commonly accepted as the greatest risk factor. Individuals with asthma, long-term exposure to tobacco smoke, exposure to dust, chemical, or fuels, and a genetic history also pose the risk of the disease (**FIGURE 1**). Occupational and indoor air pollution, and economic and social conditions of the environment, often referred to as social determinants of health (SDH) are additional major contributors to COPD (A. S. Gershon, T. E. Dolmage, A. Stephenson, & B. Jackson, 2012).
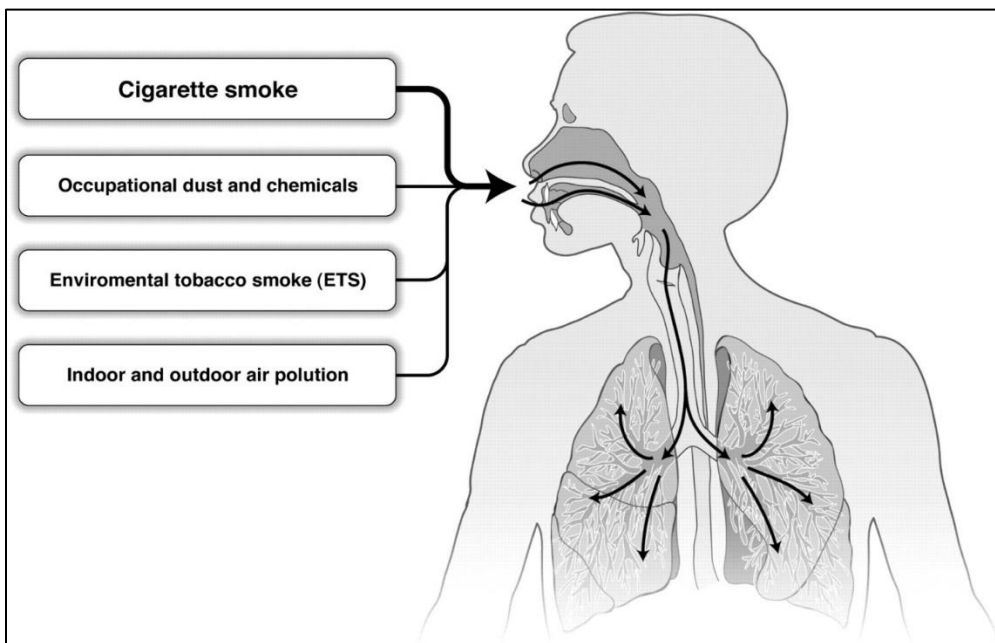


**FIGURE 2: GLOBAL STRATEGY FOR THE DIAGNOSIS, MANAGEMENT, AND PREVENTION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE; GOLD EXECUTIVE SUMMARY (Vestbo et al., 2013)**

Under the premise of COPD readmissions having major ramifications historically and to date, the study aims of this dissertation were within three constructs as follows:

**Manuscript One:** *A Literature Review on Social Determinants of Health*

    **Null Hypothesis:** N/A

    **Alternative Hypothesis:** N/A

The literature review included various methods and designs (including but not limited to case-control, prospective observational, randomized, retrospective studies), numerous peer-reviewed publications (i.e., original research articles, reviews, and reports), and grey and white papers. All studies were conducted in the United States within the past 20 years. Papers that were in languages other than English were based in countries outside of the United States, and did not report findings based on COPD readmission, readmission reduction programs, and/or SDH were excluded from the review.

**Manuscript Two:** *County Health Rankings and the Association to Chronic Obstructive Pulmonary Disease Readmissions*

    **Null Hypothesis**: County Health Rankings have no association with COPD readmissions.

    **Alternative Hypothesis**: County Health Rankings are associated with fewer COPD readmissions.

A retrospective, population-based, county-level analysis of hospitals, identified by County Health Rankings (CHR) and COPD readmissions. The study explored whether county health rankings impact COPD readmission, focusing on addressing health disparities and equitable access.

**Manuscript Three:** *The Relationship Between Having a Primary Care Provider and Chronic Obstructive Pulmonary Disease Readmissions*

**Null Hypothesis**: Primary care provision has no association with COPD readmissions.

**Alternative Hypothesis**: Primary care provision is associated with fewer COPD readmissions.

The retrospective, population-based analysis of COPD patients from a hospital and enterprise-wide emphasis. The study identified if there was an association between COPD 30-day readmission and having a primary care provider.

This dissertation, if successful, will help shift additional attention towards SDH, system characteristics, community factors, and primary care, enhancing focus and attention to population health efforts, ultimately advancing health equity.

**CHAPTER TWO: MANUSCRIPT ONE**

*Health Is More Than Health Care:*

*A Literature Review on Social Determinants of Health*

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**ABSTRACT**

**Introduction:** Social determinants of health (SDH) are the conditions in which people are born, grow, live, work, and age (WHO, 2021). These conditions influenced by socioeconomic factors, the physical environment, and health behaviors are associated with 80 – 90 percent of health outcomes (Carlyn M. Hood, Keith P. Gennuso, Geoffrey R. Swain, & Bridget B. Catlin, 2016). Some initiatives seek to shape policies and practices in non-health sectors in ways that promote health and health equity, other federal and state initiatives are focused on addressing social needs. Efforts to understand factors underlying health inequalities not only highlight the importance of SDH, but also the need to further understand how determinants affect an individual's health outcome. This paper looks at national quality strategies and various ways to address the non-clinical factors that influence health outcomes under the premise that addressing SDH is important for improving health and reducing longstanding disparities in health and health care.

**Methods:** An applied computerized search of literature utilizing a conceptual framework to PubMed, followed by deep analyses and thorough assessment of the findings.

**Results:** The majority of this literature review centered on the SDH domain of the health care system (health coverage, provider availability, provider linguistic and cultural competency, and quality of care). Several studies displayed evidence of the neighborhood and physical environment, with local interventions prioritizing the need for initiatives addressing the domain of community and social context. In this particular search, the literature provided few food and education interventions, with limited findings primarily due to this study being a hospital and health system review.

**Conclusion:** It has been widely accepted to craft and implement initiatives that account for SDH inside

and outside of a health system or hospital's space, promoting holistic care, while also understanding

how to address a patient's physical and social conditions. Despite health system and hospital

contributions, addressing non-clinical factors impacting health, deep-rooted, and seemingly intractable

challenges, create a massive undertaking for any organization to make a significant difference. Even

more challenging, interventions have often targeted reactionary approaches to SDH, rather than

proactive methods to address the root cause. While hospitals cannot do this work alone, playing a more

active role, investing within an infrastructure of relevant stakeholders who are most connected to the

community served, will require a data-driven approach to assess outcomes across patient populations

and organizational silos. Future research would help further gain a grasp on SDH, ultimately developing

better ways to approach health outcomes. Despite challenges to address SDH, new directives must

continue to adhere, leaving our work, optimistically, in front of us.

## INTRODUCTION

While hospital readmissions are influenced by health care quality, access, and coordination of care, recognition addressing health outcomes impacted by a patient's conditions outside of the hospital walls has raised growing concern. Defined by the World Health Organization (WHO), social determinants of health (SDH) are the non-clinical factors that influence health outcomes. They are the conditions in which people are born, grow, live, work, and age (WHO, 2021). These include physical and social conditions such as access to health care, community and social context, economic stability, education, food, and the neighborhood environment.

As health systems and hospitals increasingly become aware of how social determinants influence and impact a patient's health outcome, strategies to address are becoming more urgent as addressing SDH yields better financial outcomes and has been proven to advance health equity.

This literature review evaluates SDH to further identify where health system and hospital efforts have been directed, measurement approaches, and future impacts to better focus on various needs of the patient population and the community served.

## METHODS

A computerized search review was conducted through means of an iterative process of available literature on SDH using PubMed. Controlled vocabulary, keywords, synonyms, and other connected relationships were searched within the database using the terms "chronic obstructive pulmonary disease", "COPD", "population health", "public health", "readmission(s)", "social determinants of health", and "SDH". Peer-reviewed articles were included in this review, of which, inclusion criteria were

studies within a 20-year timeframe, published in English, limiting the articles to only those that took

place in the United States. Significant findings were mined from the included peer-reviewed articles and

reliable web pages. Methods used followed that of a qualitative literature review, utilizing a search

request, title abstract review, full-text review, and final inclusion into the paper.

**RESULTS**

While there was a variation of papers, articles, and reports studied, 45 peer-reviewed articles

met the inclusion criteria (**FIGURE 1**). Those studies detailed hospital and health system approaches to

addressing SDH, implementing new value-based strategies to advance quality, and improve patient care.

Studies were assessed by system redesigns, managing risk and payment models, outcomes, and

operational solutions toward advancing health equity.

> *Title Abstract Review*
> 140 total search outputs from 2002 to 2022
>
> *Full Text Review*
> 70 articles selected for  full text or review
>
> *Inclusion*
> **45 articles selected for this literature review**
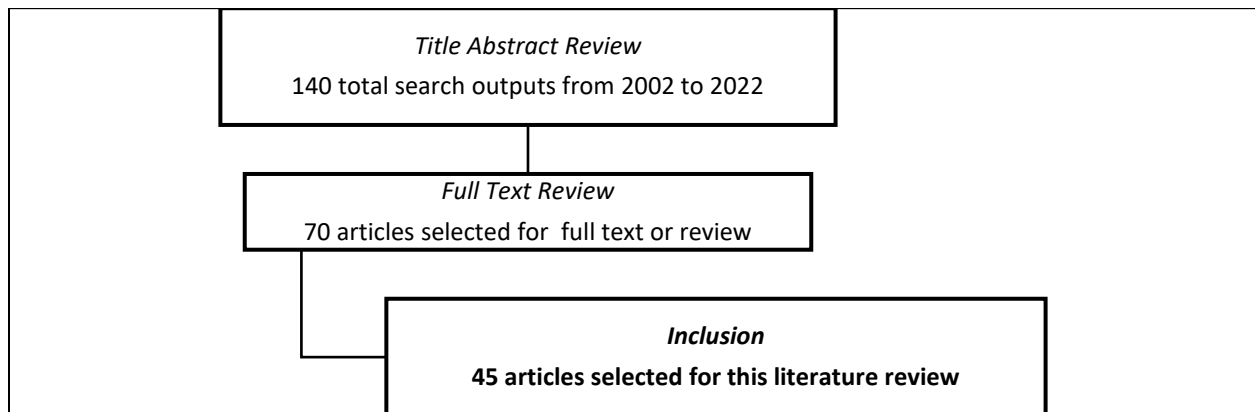
**FIGURE 1: DIAGRAM OF ARTICLE SELECTION PROCESS WITH EXPLANATION OF SEARCH STRATEGY FROM 2002 TO 2022. 45 ARTICLES WERE INCLUDED IN THE LITERATURE REVIEW.**

Managing the nonmedical factors and the integration of social care is becoming more aligned

with achieving better quality and high-value care (Bibbins-Domingo, 2019). As such, SDH is now in the

consciousness of many health care institutions, and increased interest in addressing social needs within

the context of health care delivery is being displayed in a way like it has never been seen before (S.

Butler, 2019; S. M. Butler, 2017; Davidson & McGinn, 2019).

*Setting*

Categorized by SDH domain or relationship, the setting of the majority of the included studies

landed within the category of health care system (19). Six studies correlated to the SDH category of

neighborhood environment, five within the community and social context, four each within and

economic stability and education, three within food, and the remaining studies ebbing and flowing

between multiple determinants or the umbrella of SDH in totality. All of the included papers looked into

activities within health care systems, hospitals, and/or a community basis within the United States.

*Social Determinants of Health*

Social determinants of health (SDH) are the conditions in which people are born, grow, live,

work, and age (WHO, 2021). The studies evaluated SDH, with a general belief that clinical or health care

contributes to only 10 – 20 percent of a population's health outcomes (Carlyn M. Hood et al., 2016), and

that socioeconomic factors, the physical environment, and health behaviors are associated with the

remaining 80 – 90 percent of health outcomes (**FIGURE 2**).
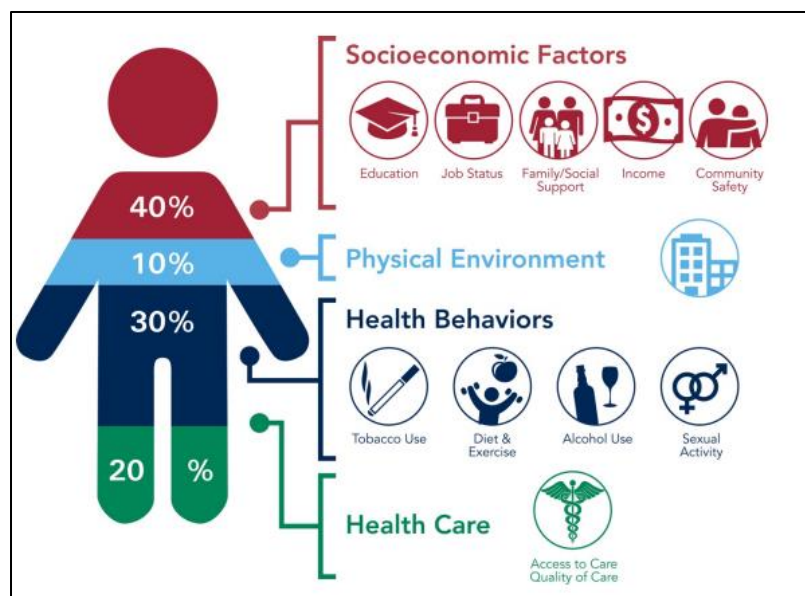
**FIGURE 2: THE IMPACT OF SOCIAL DETERMINANTS OF HEALTH (ICSI, 2014)**

These non-clinical factors, popularized as SDH, have mainly been defined as conditions affecting an individual's health outside of the hospital walls. The six determinant domains of economic stability, neighborhood and physical environment, education, food, community, and social context, and health care systems, are all variables that influence the health outcomes of mortality, morbidity, life expectancy, health care expenditures, health status and functional limitations (**TABLE 1**).

**TABLE 1: SOCIAL DETERMINANTS OF HEALTH**

| Economic Stability | | | | | |
|---|---|---|---|---|---|
| Debt | Employment | Expenses | Income | Medical Bills | Support |
| **Neighborhood and Physical Environment** | | | | | |
| Housing | Parks/Playgrounds | Safety | Transportation | Walkability | Zip Code/Geography |
| **Education** | | | | | |
| Early Childhood Education | Higher Education | Language | Literacy | Vocational Training | |
| **Food** | | | | | |
| Access to Healthy Options | Hunger | | | | |
| **Community and Social Context** | | | | | |
| Community Engagement | Discrimination | Social Integration | Support Systems | Stress | |
| **Health Care System** | | | | | |
| Health Coverage | Provider Availability | Provider Linguistic and Cultural Competency | Quality of Care | | |
| **Health Outcomes:** | | | | | |
| Mortality, Morbidity, Life Expectancy, Health Care Expenditures, Health Status, Functional Limitations | | | | | |

As SDH impact more than that of provisional clinical care (*"health is more than health care"*),

addressing SDH is important to improving an individual's health regardless of age, sex, race, or ethnicity.

Additionally, in addressing SDH, it is the general belief that longstanding disparities of care are reduced,

and health equity is advanced. Moreover, research estimates that eliminating health inequities would

reduce direct medical care expenditures by about $230 billion and reduce indirect costs associated with

illness and premature death by more than $1 trillion (LaVeist, Gaskin, & Richard, 2011).

### Health System and Hospital Efforts

With a vast and growing number of initiatives inside and outside the walls of health

organizations, strategies to assess and improve SDH varied widely. Categorized by SDH domain, are

some efforts listed below.

#### Health Care System

Nineteen studies surrounded health care systems' targeted approaches to address barriers

when trying to access quality care, such as inadequate insurance coverage, or the absence of providers

with appropriate linguistic and cultural competencies. One study addressing quality of care specifically

used multidisciplinary approaches within chronic obstructive pulmonary disease (COPD) care pathways

to address the increased morbidity, mortality, and the rising total cost of care for COPD (Young, Villgran,

Ledgerwood, Schmetzer, & Cheema, 2021). The paper found improvements in care, decreased

readmissions, and total cost of care reductions by investing in multidisciplinary teams of specialists.

Other studies described increases in telehealth implementation and access to computers and the

internet. One particular study (Granger et al., 2017) outlined potential barriers to the implementation of

telemedicine, and an investigation of provider linguistic and cultural competency with patients

demonstrating a lower level of educational achievement. Another study explained factors between

access-to-care and provider availability. The authors found that pulmonary care specialist availability

was a key factor in readmission reduction and hospital utilization (Keating, Lee, & Holland, 2011). Lastly,

one concentrated study (Buhr et al., 2020) demonstrated associations between readmission reductions

and the implementation of the Hospital Readmissions Reduction Program (HRRP). Similarly, health

coverage, specifically commercial insurance trended with readmission reductions.

*Neighborhood and Physical Environment*

Six studies surrounded the determinant of the neighborhood and physical environment,

specifying how an individual's place of residence, and access to transportation as well as, the safety and

walkability of communities, will influence decisions that contribute to wellness. While this determinant

impacts all individuals regardless of demographic, disproportionately, more black and indigenous people

of color (BIPOC) experience housing instability, with Black and Hispanic Americans (40% and 20%) having

the majority of housing insecurities (NAEH, 2020). One study (Holt, Zhang, Presley-Cantrell, & Croft,

2011) aimed to look at sociodemographic disparities, specifically in COPD outcomes, with little to no

success in characterizing geographic variations in COPD hospitalization across the United States. Another

study outlined intersectionalities of housing instability and food insecurity, and how it is associated with

poor access to ambulatory care and high rates of acute care. The literature addressed how competing

life demands may lead to delays in seeking care and predispose to acute care (Kushel, Gupta, Gee, &

Haas, 2006).

Some health care systems addressed the common nonmedical need of transportation by way of

collaboration with transportation companies, relying on transportation systems, and even, designing

new programs to meet a patients' transportation needs, varied by geographic characteristics (Fraze,

Lewis, Rodriguez, & Fisher, 2016). Other studies displayed the correlation between the presence of a

health care facility and the impact on safety. Findings generated lower levels of risky behavior rates, as

well as lower health care expenditures (Youngblade, Curry, Novak, Vogel, & Shenkman, 2006).

*Community and Social Context*

Five studies identified the determinant of community and social context, outlining the

contribution of discrimination, dysfunctional support systems, poor social integration, and a lack of

community engagement to stress and other damaging health effects. Discrimination was a reoccurring

variable, with numerous social characteristics and covariates of gender, race, ethnicity, geographic

location, and socioeconomic status. One study detailed health systems' targeted approaches to promote

health equity, under the premise of racial and ethnic disparities across different patient groups

(Rambachan, Abe-Jones, Fernandez, & Shahram, 2021), concluding that further evidence of

understudied outcomes within patient populations remains critical to achieve health equity. Similarly,

other studies showed the importance of understanding how a lack of family or social support, along with

factors of poverty, can lead to detrimental effects (HFHS, 2021). These findings suggest that the impact

on an individuals' health status is strong and cumulative, therefore increased attention to stress

prevention is needed across the lifespan.

*Economic Stability*

Widely accepted that socioeconomic status is one of the most powerful determinants of health,

four studies of economic stability, took various angles in addressing the associations between

employment and unemployment including that of income, expenses, and debt as it affects a patient's

ability to access and maintain health care services. One study even concluded that socioeconomic

disparities have worsened over the past six decades (Gaffney, Himmelstein, Christiani, & Woolhandler,

2021). Another study outlined health care services and costs before diagnosis, concluding that more

timely diagnosis and subsequent treatment can avoid costly health care utilization (Akazawa et al.,

2008). A systematic review on socioeconomic status supported further necessity to determine risks in

socioeconomically disadvantaged individuals, with the need of implementing strategies to reduce

disease and economic burden (Andrea S. Gershon, Thomas E. Dolmage, Anne Stephenson, & Beth

Jackson, 2012).


*Education*

     Healthy People 2030 deems language and literacy as key issues in the educational domain of

SDH (ODPHP, 2021). However, it is estimated that only one-third to one-half of the United States

population has the capacity to obtain, process, and understand the basic health information and

services needed to make informed health decisions (Paasche-Orlow, Parker, Gazmararian, Nielsen-

Bohlman, & Rudd, 2005). Through four reviews, studies demonstrated that access to good schools can

improve literacy rates, provide early childhood education, vocational training options, and more

opportunities for higher education. Furthermore, research indicates that limited language skills and low

literacy skills are associated with other determinants and worse health outcomes (Hernandez, 2011).

These findings display the necessity to simplify health services and improve health education to improve

health and address health disparities. Additionally, education, specifically, early childhood and higher

education, is incredibly important when it comes to health. A report from the National Institute for Early

Education Research showed the significance of educational attainment and its positive correlation with

health outcomes (Barnett, 2013). More so, there is growing evidence suggesting the vocational training

and links to health equity as programs provide unprecedented opportunity to improve employment,

incomes, and educational levels of historically disadvantaged populations, but also health and health

equity in their area of residence (Tsui, 2010).

*Food*

Impacting eleven percent of United States households, the determinant of food insecurity has one of the most extensive impacts on the overall health of individuals. Moreover, research shows that people who are food insecure are disproportionally affected by diet-sensitive chronic diseases, which are linked to many adverse effects on overall health (FeedingAmerica, 2022). Additionally, communities that have limited access to healthy food options, often lead to individuals having to deal with hunger and food insecurity, which creates and/or complicates further health issues. Countless studies assessed a communities connection to fresh, healthy food, local food producers, and the allocation of increasing amounts of resources to sustainable agriculture (Franck, Grandi, & Eisenberg, 2013). With a lack of supermarkets, a reliance on corner stores (also known as mom-and-pop shops/stores or bodegas), and access to healthy food remaining a challenge, especially in low-income communities of color, the variety of four studies demonstrated strategies for both growers and consumers, aimed to increase food security through nutritional education and food for a healthful diet.

In summary, improvement strategies primarily targeted proactive approaches to patient populations and communities attempting to address one, some, or several social determinants of health. The included published research, often displaying a hospital's or health system's initiative, seeks to shape ways that advance health and health equity. Though health care is essential to health, it being a relatively weak determinant adds greater difficulty to addressing conditions beyond hospital and health system walls, however, left unaddressed will create larger long-term consequences. Further studies that examine SDH and preexisting or emerging initiatives to address them would help fulfill any gaps in the existing literature.

*Measurement Approaches*

The studies examined in this review used a variety of measurement approaches to assess SDH, examining the impact of interventions taken by hospitals and health care systems. The following explores comprehensive measurements used, potential barriers with often-used measures, and the direction of future research.

With such a wide gambit of factors and initiatives, there was no standard approach to measuring SDH. However, hospital and health system internal measures were often shaped by policies and practices to promote health and health equity, while external measures often looked to address social needs. Hospital and health system internal measures are often aligned with efforts under the Affordable Care Act (ACA) to curtail costs, promote quality, and participate in value-based care programs. Several studies focused on measuring improvement under Medicare's Hospital Readmission Reduction Program (HRRP) (M. Chen & Grabowski, 2019; Press et al., 2019; Ryan et al., 2017). Other studies measured health care coverage and ways of advancing access (Baker, Zou, & Su, 2013; Dalal, Liu, & Riedel, 2011; Han et al., 2016; Keating et al., 2011; Singh, Zhang, Kuo, & Sharma, 2016). Health care utilization, (Abernathy et al., 2016; Davis, Bender, Smith, & Broad, 2015; Jiang, Xiao, Segal, Mobley, & Park, 2018) and provider availability (Gavish, Levy, Dekel, Karp, & Maimon, 2015; Njoku et al., 2020; G. Sharma, Y.-F. Kuo, J. L. Freeman, D. D. Zhang, & J. S. Goodwin, 2010) was another frequent measure.

Measures to address SDH external to the hospital and health system frequently looked at socioeconomic distinctions (Gershon et al., 2019; Jinjuvadia et al., 2017; Manickam, Mu, Kshirsagar, & Bang, 2017; Perera, Armstrong, Sherrill, & Skrepnek, 2012). Discrimination toward different populations was another frequent measure (Goto, Faridi, Gibo, Camargo, & Hasegawa, 2017; Nastars, Rojas,

Ottenbacher, & Graham, 2019; Rambachan et al., 2021) as well as, measures surrounding geographical distribution (Blanco et al., 2018; Croft JB, 2018; Holt et al., 2011).

Comprehensive approaches are often aimed at advancing health equity, expanding coverage, and improving health outcomes. Shifting toward holistic care models, the majority of the studies measured strategies to bridge health care to the community. Often looking to take a more proactive approach, as opposed to reactive methods, assessing opportunities to deliver better care, adjust delivery models, and shift towards payments tied to value, quality, and/or outcomes were demonstrated in a variety of ways.

With the majority of health outcomes contributing to conditions outside the walls of a hospital or health care system, the American Hospital Association (AHA) created three distinct, yet connected, strategies to address health equity. These systemic, community, and individual factors, further categorized as systemic causes, social determinants of health, and social needs, are the societal factors that influence health (**FIGURE 3**). Systemic causes have been defined as the fundamental causes of the social inequities that lead to poor health. As noted above, SDH is the underlying social and economic conditions that influence people's ability to be healthy. Lastly, social needs are described as an individual's non-medical, social, or economic circumstances that hinder the ability to stay healthy and/or recover from illness.
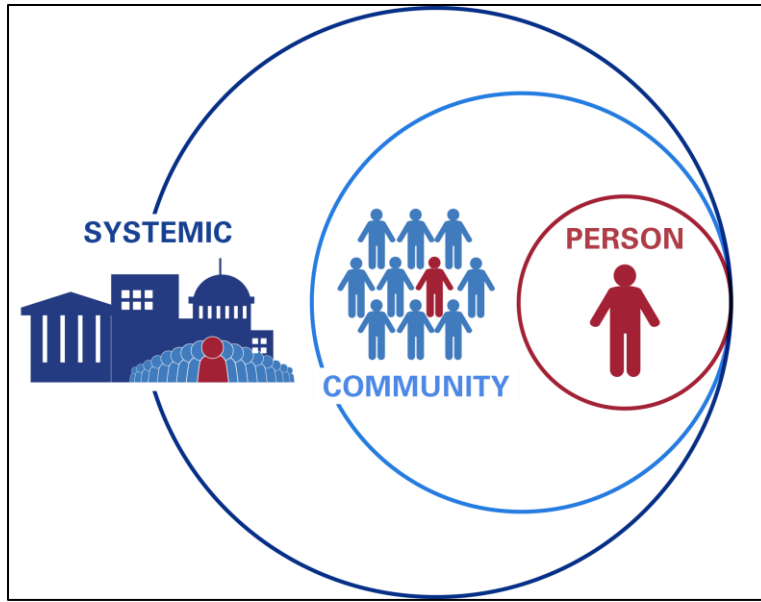
**FIGURE 3: SOCIETAL FACTORS THAT INFLUENCE HEALTH (AHA, 2020)**

The measurements that hospitals and health systems are now employing are moving from individual health to population health. This tactic takes a more holistic approach, shifting away from merely treating only the sick, to helping patients and communities achieve overarching wellness. Hospitals and health systems that are committed to advancing health equity, where all individuals can achieve their highest health potential, must strategically move toward care integration, whole-person delivery models, and societal factors influencing patients and communities.

Recognizing SDH, and hard-wiring organizations to collect demographic, qualitative, and quantitative SDH data continues to be a potential barrier in measurement efforts. Essential to crafting and implementing SDH measures and initiatives, collection, analysis, and interpretation of data on health outcomes and determinants, remain difficult and even at times, unreliable. Further, there remain gaps and inconsistencies in data on SDH that limit the ability to aggregate data across settings or to use data to inform policy and operations, guide quality improvement, or evaluate interventions (Spencer, 2016). Optimistically, not-for-profits requirements mandating the conduction of community health

needs assessments (CHNA), the adaption of broader screening tools, and greater emphasis on data collection will make the identification of health disparities and allocation of resources that can be used to address priority needs, more easily maintained.

*Future Impacts*

With health care moving from volume to value and from treating sickness to promoting health and wellness, tracking social needs with aggregated data will be necessary to personalize care. More so, further understanding of social needs will likely lead to further investments in value-based payment models, innovative strategies for in-home and community-based services, and policies to strengthen health equity.

One value-based model gaining more traction is that of Z codes. Hospitals can capture data on the socials needs of patient populations using Z Codes, which are the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes included in categories Z55 – Z65 (**TABLE 2**) identifying nonmedical factors that may influence one's health status. Despite this tracking system being available since 2016, provision has been limited due to a lack of clarity on who can document a patient's social needs, the absence of operational processes for documenting and coding social needs, and the need for additional education with Z codes (AHA, 2020).

**TABLE 2: ICD-10-CM Z CODE CATEGORIES**

| ICD-10-CM Code Category | Problems/Risk Factors Included in Category |
|---|---|
| Z55 - Problems related to education and literacy | Illiteracy, schooling unavailable, underachievement in a school, less than a high school diploma, no general equivalence degree (GED), educational maladjustment, and discord with teachers and classmates. |
| Z56 - Problems related to employment and unemployment | Unemployment, change of job, threat of job loss, stressful work schedule, discord with boss and workmates, uncongenial work environment, sexual harassment on the job, and military deployment status. |
| Z57 - Occupational exposure to risk factors | Occupational exposure to noise, radiation, dust, environmental tobacco smoke, toxic agents in agriculture, toxic agents in others industries, extreme temperature, and vibration. |
| Z58 - Problems related to physical environment | Inadequate drinking-water supply, and lack of safe drinking water. |
| Z59 - Problems related to housing and economic circumstances | Sheltered homelessness, unsheltered homelessness, residing in street, inadequate housing, housing instability, discord with neighbors, lodgers and landlord, problems related to living in residential institutions, inadequate food, lack of adequate food, food insecurity, extreme poverty, low income, and insufficient social insurance and welfare support. |
| Z60 - Problems related to social environment | Adjustment to life-cycle transitions, living alone, acculturation difficulty, social exclusion and rejection, target of adverse discrimination and persecution. |
| Z61 - Problems related to negative life events in childhood | Loss of an emotionally close relationship, such as of a parent, a sibling, a very special friend or a loved pet, by death or permanent departure or rejection. |
| Z62 - Problems related to upbringing | Inadequate parental supervision and control, parental overprotection, upbringing away from parents, child in welfare custody, institutional upbringing, hostility towards and scapegoating of child, inappropriate excessive parental pressure, personal history of abuse in childhood, personal history of neglect in childhood, personal history of unspecified abuse in childhood, parent-child conflict, and sibling rivalry. |
| Z63 - Other problems related to primary support group, including family circumstance | Absence of family member, disappearance and death of family member, disruption of family by separation and divorce, dependent relative needing care at home, stressful life events affecting family and household, stress on family due to return of family member from military deployment, and alcoholism and drug addiction in family. |
| Z64 - Problems related to certain psychosocial circumstances | Unwanted pregnancy, multiparity, and discord with counselors. |
| Z65 - Problems related to other psychosocial circumstances | Conviction in civil in criminal proceedings without imprisonment, imprisonment and other incarceration, release from prison, other legal circumstances, victim of crime and terrorism, and exposure to disaster, ware and other hostilities. |

Further population health models and increased organizational and community partnerships will also be required to address medical and non-medical needs. Research continues to provide evidence that enhancing preventive care leads to earlier detection, better education, and enhanced care plan adherence. Team-based care transitions models where nurses, social workers, and financial service advisors provide care transition services and community resources for the patient populations in which they serve will also better address connectivity to resources and enhance access.

Frameworks for integrating SDH into health and health care systems are emerging. Advancing forward are systemic initiatives such as collaborating with local partners to employ policy, system, environmental changes, and community-driven and individual data for use in primary care (DeVoe et al., 2016). Alternative payment models influenced by policies and programs associated with health outcomes will continue to evolve to jointly reward hospitals and health care systems that dare and/or aim to address SDH.

Further advocacy and systemic decision making at the local and federal level such as health in all policies legislation should command organizational leaders and the community to better collaborate and address SDH.

**CONCLUSION**

Given the various social determinants of health (SDH), one organization or sector alone cannot create and sustain healthy communities by themselves. However, anchor institutions, or place-based economic organizations dedicated to health within the community such as hospitals and health care systems, remain forerunners to make lasting investments to improve community health and advance health equity. Cross-system approaches actively partnering with organizations and leaders from different sectors to change culture, and policies, and to build new equitable systems remain critical. With several health delivery and Medicaid reform models linking health care and social needs measures to affiliated reimbursements and payments (McConnell et al., 2017), organizations must remain accountable to metrics under fee-for-service and value-based payment to remain successful, viable, and even alive.

**CHAPTER THREE: MANUSCRIPT TWO**

*Exploring Public Health and Health Care:*

*County Health Rankings and the Association to Chronic Obstructive Pulmonary Disease Readmissions*

by

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A dissertation submitted to Johns Hopkins University in conformity with the requirements for

the degree of Doctor of Public Health

Baltimore, Maryland
April 2022

**ABSTRACT**

**Background:** Addressing readmissions remain a priority within the United States health care system. The primary focus of this study was to see if County Health Rankings (CHR) or certain hospital characteristics provide any indication of the readmission rate. This study explores the relationship between county health rankings and hospital 30-day readmission rates for chronic obstructive pulmonary disease (COPD) patients.

**Objective:** There is limited information concerning whether county health rankings affect readmissions. This study aims to understand to what extent the health of a county influences COPD 30-day readmissions.

**Design, Setting, and Patients:** A retrospective, population-based, county-level analysis of 1,469 hospitals identified by way of the American Hospital Association (AHA), associated county rankings, and 30-day readmissions from 2014 – 2018. AHA data was matched to CHR data collected from various governmental and public sources and compiled into domain-specific health rankings for each count. Retrospective data of COPD patients were identified from the Centers for Medicare & Medicaid Services (CMS) Hospital Readmissions Reduction Program (HRRP).

**Main Outcome Measures:** The main outcome variable was risk-adjusted 30-day readmission associated with COPD patients.

**Results:** Community-level demographics are more associated with COPD readmissions than hospital characteristic variables. In comparison to the best reference group, CHR subfactors of medium (IRR: 0.978, 95% CI 0.963, 0.993) and worst (IRR: 0.954, 95% CI 0.935, 0.973) physical environment, worst

clinical care (IRR: 1.055, 95% CI 1.008, 1.103) and community characteristics associated with locations in

the Midwest Region (IRR: 1.318, 95% CI 1.108, 1.566) and South Region (IRR: 1.240, 95% 1.053, 1.459)

have more readmissions. Additionally, the hospital's characteristic of being within a rural hospital

location also increased the readmission rate (IRR: 1.210, 95% CI 1.136, 1.288).

**Conclusions:** Reducing readmissions have become a requirement for hospitals, emphasized by public

reporting and financial penalties. While the increased provision of primary and specialty services

remains a top priority to expand institutional access and health care resources, additional understanding

and identification of community characteristics and social determinants provide better insight into the

impact on readmissions. A call to action for health care providers and health care institutions to become

more proactive to the needs of the community, as opposed to reactive to the characteristics of the

hospital is warranted.

## INTRODUCTION

The County Health Rankings (CHR) model provides details, characteristics, and data for nearly every county in the United States on four modifiable health groups. Those four main categories and associated weights are social and economic (socioeconomic) factors (40%), physical environment (10%), health behaviors (30%), and health care (20%). This CHR model displays greater importance in influencing the health determinants of the community, wielding important but less significance on health care's influence. The determinants, commonly referred to as social determinants of health (SDH) have commonly demonstrated the ability to significantly impact health outcomes, response to treatment, and access (Bierman & Dunn, 2006).

Moreover, while there are factors contributing to hospital readmissions including health care quality, access to care, and coordination of care between hospital and ambulatory settings, studies show there are also greater factors linked to socioeconomic resources (e.g., social support, stable housing, transportation, and food) (Prieto-Centurion, Gussin, Rolle, & Krishnan, 2013).

Although numerous studies have examined the role of clinical care on chronic obstructive pulmonary disease (COPD) readmissions, few have researched the impact of CHR on the patient outcomes of readmissions. As such, this study aims to empirically identify the strength of associations between community health factors and COPD readmissions.

## CONCEPTUAL FRAMEWORK

To better understand the impact of CHR on readmission outcomes, several SDH were used when identifying hospital locations. Developed by the University of Wisconsin Population Health Institute in

collaboration with the Robert Wood Johnson Foundation (RWJF), the CHR conceptual framework

underlies modifiable determinants of health, grouping them into four main categories with associated

weights. Social and economic (socioeconomic) factors (40%) including indicators of community safety,

education, employment, family and social support, and income, physical environment (10%) including

air and water quality and housing and transit, health behaviors (30%) including alcohol and drug use,

diet and exercise, sexual activity and tobacco use, and clinical/health care (20%) including access to and

quality of care, encompasses the holistic view of a populations health, evenly influencing the health

outcomes of length of life (50%) and quality of life (50%). Policies and programs, impact health factors,

which lead to the health outcomes, measured by way of premature death and quality of life (low birth

weight, poor mental or physical health) (**FIGURE 1**).
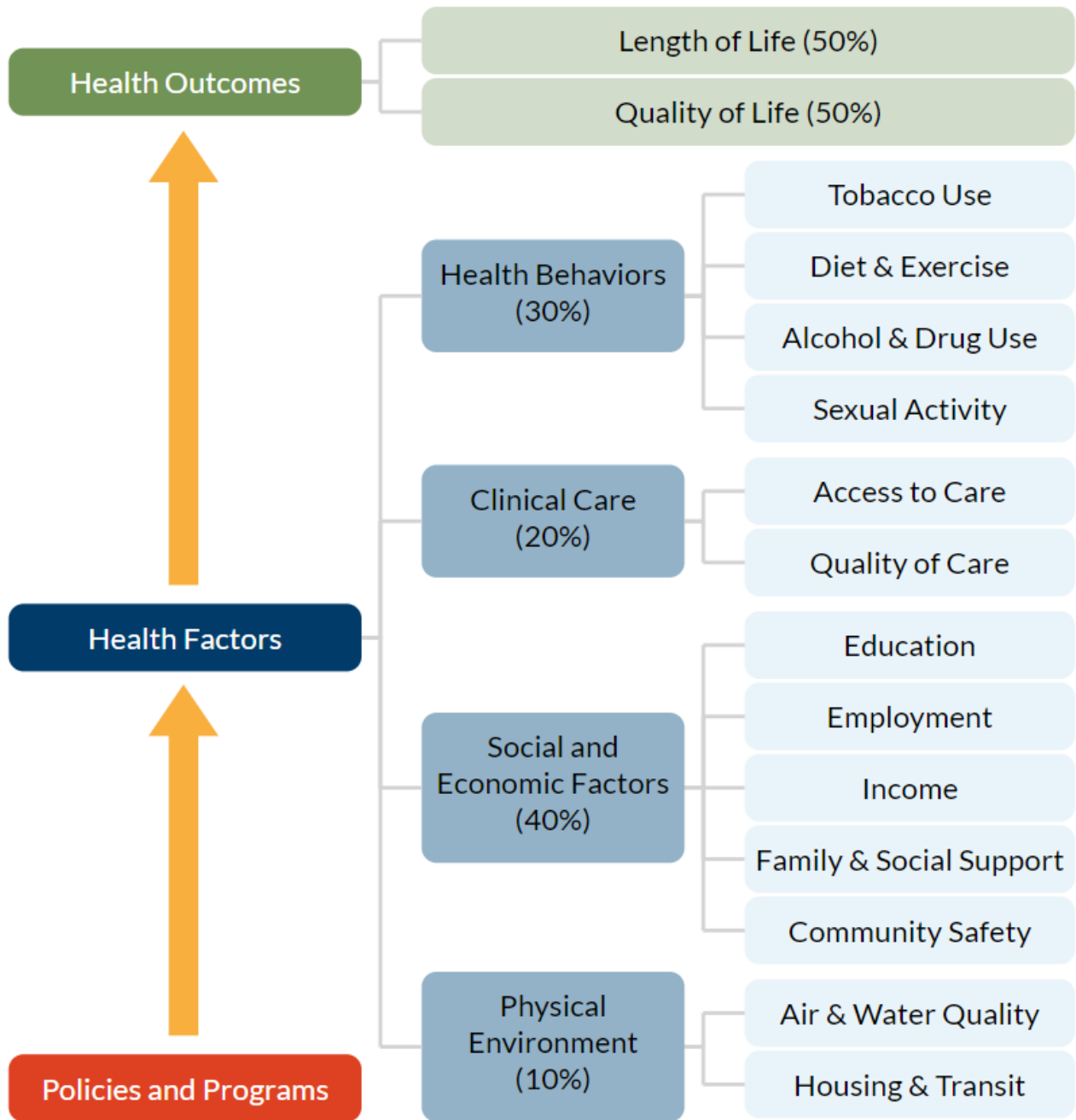
**FIGURE 1: COUNTY HEALTH RANKINGS (CHR) CONCEPTUAL FRAMEWORK (UNIVERSITY OF WISCONSIN POPULATION HEALTH INSTITUTE)**

With this conceptual framework in mind, examined data from the American Hospital Association (AHA), the Area Health Resource Files (AHRF), and the Centers for Medicare & Medicaid Services (CMS) was explored to identify the impact CHR had on hospital outcomes. Following best practices and literature reviews (Shah, Press, Huisingh-Scheetz, & White, 2016), reported readmissions through hospital-specific reports (HSRs), specifically, the CMS Hospital Readmission Reduction Program (HRRP) containing risk-adjusted hospital inpatient readmissions was stratified from the time frame of 2014 – 2018. Hospital characteristics were aligned with HRRP readmission years and eight years of AHA annual survey data to account for any lag in data collection with AHRF to augment county characteristics data. Furthermore, the sample was limited to non-specialty acute care facilities within the 50 states and Washington, District of Columbia (D.C.) that reported throughout all eight years to generate a strongly balanced sample.

The American Hospital Association (AHA) and numerous quality studies helped identify hospital characteristics. Hospital location (urban vs. rural) was based upon metropolitan vs. nonmetropolitan designation as found in the Rural-Urban Continuum Codes developed by the United States Department of Agriculture (USDA). These variables were included as hospitals in rural counties may be able to provide highly efficient care compared to, hospitals located in urban counties, potentially exposed to more demands of powerful constituents (Younis, 2003). System status (hospital being not part of a system vs. part of a system), portrayed as a predictor of resource availability and market power (Cuellar & Gertler, 2005), and Medicare and Medicaid percentage directed predictors of hospital financial stability (Bazzoli, Chen, Zhao, & Lindrooth, 2008) were included. Teaching status (non-teaching vs. teaching), is presented as an indicator of hospital safety and readmission rates (A. S. Chen, Revere, Ratanatawan, Beck, & Allo, 2019). The size of a hospital was identified as it may influence the 30-day readmission rate and is a predictor of hospital quality of care and available resources (Foster D, 2013;

Sosunov et al., 2016). With the number of beds across all hospitals drastically ranging, traditionally

defined size categories of hospital beds from small (fewer than 100 beds), medium (100 – 399 beds),

and large (400 beds or more) were used. Ownership status recognized as a predictor of quality

performance (H. Hamadi, Apatu, & Spaulding, 2018), was categorized by not-for-profit, for-profit, and

government own classifications.

## METHODS

This study aimed to explore any relationship between CHR and hospital readmission rates for

COPD patients. Between the observation period of 2014 – 2018, this study utilized data from the

American Hospital Association (AHA), the Area Health Resource File (AHRF), the Centers for Medicine &

Medicaid Services (CMS) Hospital Readmission Reduction Program (HRRP), and the CHR database to

assess.

The CHR database contained a three-year rolling average of risk-adjusted hospital inpatient

readmissions, in which, 1,469 hospitals were utilized in this study. The sample of hospitals was limited to

only hospitals that reported HRRP scores for all five years (2014 – 2018), having data merged using both

hospital provider numbers (unique identifiers) and county Federal Information Processing Standards

(FIPS). The average was risk-adjusted by a patient's medical history, comorbidities, age, and sex, with

rates being standardized and validated by CMS for use (Alvar Agusti et al., 2010). In due course, hospital

and community characteristics had to be aligned and averaged across the same three-year rolling period

to be considered for any data collection lag (T. Goto et al., 2017).

This study was reviewed by the institutional review board (IRB) at the Johns Hopkins School of Public Health as well as, the Mayo Clinic. The review boards determined the research to be exempt from informed consent as the study was by applicable Health Insurance Portability and Accountability Act (HIPPA) regulations, with additional accordance of the study being a secondary analysis of existing de-identified data examining associations of COPD 30-day readmissions with health system characteristics.

### Study Population (Participants)

The American Hospital Association, the AHRF, and the CMS data were utilized to examine the relationship between CHR and readmissions. Specifically, the CMS HRRP data, containing risk-adjusted hospital inpatient readmissions for 1,469 hospitals during a fiscal year. Providing more depth, CMS HRRP data on readmissions uses three-year rolling scores between the time frame of July 1$^{st}$ and December 1$^{st}$. All acute-care facilities that were open and operating between that time frame (2014 – 2018) were included in this study. Of the 50 states, analysis was limited to counties with at least one acute-care hospital.

### Setting

The CHR database is a national dataset, providing a snapshot of a majority of counties in each of the 50 states ranking the determinants of health behavior, clinical care, social and economic factors, and physical environment, commonly known as the SDH. The AHRF collects county-level health information and demographic, health status, and socioeconomic measures. Consisting of over 6,400 hospitals in the United States, the AHA annual survey contains comprehensive information on hospital characteristics. The CMS HRRP is a pay-for-performance program, penalizing inpatient prospective payment system (IPPS) hospitals up to 3% of Medicare reimbursement for readmission rates greater than the average performance of all hospitals for selected conditions and procedures. COPD is one of six conditions under

the 30-day risk-standardized unplanned readmission measures through the HRRP. While not observed in this study, the other five conditions are Acute Myocardial Infarction (AMI), Heart Failure (HF), Pneumonia, Coronary Artery Bypass Graft (CABG) Surgery, and Elective Primary Total Hip Arthroplasty and/or Total Knee Arthroplasty (THA/TKA).

*Outcome Variables*

The risk-adjusted 30-day readmissions associated with COPD were the primary dependent variable for this study.

*Key Independent Variables*

Primary independent variables were the weighted county health factor rankings three-year rolling average between 2014 and 2018. The population health outcomes, health factors, associated measures, weight, source, and years of data were measured and calculated (**FIGURE 2**). Those competed measures equating to that of the physical environment (10%), clinical care (20%), health behaviors (30%), and social and economic values (40%) (Hood et al., 2016) were included with created tertiles of best, middle, and worst, identified for each CHR domain. Prior and utilized studies validated methodologies calculating county rankings and affiliated tertiles throughout the entire United States (Niazi et al., 2021; Park, Roubal, Jovaag, Gennuso, & Catlin, 2015; Remington, Catlin, & Gennuso, 2015).

| | Measure | Weight | Source | Years of Data |
|---|---|---|---|---|
| **HEALTH OUTCOMES** | | | | |
| Length of Life | Premature death | 50% | National Center for Health Statistics - Mortality Files | 2017-2019 |
| Quality of Life | Poor or fair health | 10% | Behavioral Risk Factor Surveillance System | 2018 |
| | Poor physical health days | 10% | Behavioral Risk Factor Surveillance System | 2018 |
| | Poor mental health days | 10% | Behavioral Risk Factor Surveillance System | 2018 |
| | Low birthweight | 20% | National Center for Health Statistics - Natality files | 2013-2019 |
| **HEALTH FACTORS** | | | | |
| **HEALTH BEHAVIORS** | | | | |
| Tobacco Use | Adult smoking | 10% | Behavioral Risk Factor Surveillance System | 2018 |
| Diet and Exercise | Adult obesity | 5% | United States Diabetes Surveillance System | 2017 |
| | Food environment index | 2% | USDA Food Environment Atlas, Map the Meal Gap from Feeding America | 2015 & 2018 |
| | Physical inactivity | 2% | United States Diabetes Surveillance System | 2017 |
| | Access to exercise opportunities | 1% | Business Analyst, Delorme map data, ESRI, & US Census Tigerline Files | 2010 & 2019 |
| Alcohol and Drug Use | Excessive drinking | 2.50% | Behavioral Risk Factor Surveillance System | 2018 |
| | Alcohol-impaired driving deaths | 2.50% | Fatality Analysis Reporting System | 2015-2019 |
| Sexual Activity | Sexually transmitted infections | 2.50% | National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention | 2018 |
| | Teen births | 2.50% | National Center for Health Statistics - Natality files | 2013-2019 |
| **CLINICAL CARE** | | | | |
| Access to Care | Uninsured | 5% | Small Area Health Insurance Estimates | 2018 |
| | Primary care physicians | 3% | Area Health Resource File/American Medical Association | 2018 |
| | Dentists | 1% | Area Health Resource File/National Provider Identification file | 2019 |
| | Mental health providers | 1% | CMS, National Provider Identification | 2020 |
| Quality of Care | Preventable hospital stays | 5% | Mapping Medicare Disparities Tool | 2018 |
| | Mammography screening | 2.50% | Mapping Medicare Disparities Tool | 2018 |
| | Flu vaccinations | 2.50% | Mapping Medicare Disparities Tool | 2018 |
| **SOCIAL & ECONOMIC FACTORS** | | | | |
| Education | High school completion | 5% | American Community Survey, 5-year estimates | 2015-2019 |
| | Some college | 5% | American Community Survey, 5-year estimates | 2015-2019 |
| Employment | Unemployment | 10% | Bureau of Labor Statistics | 2019 |
| Income | Children in poverty | 7.50% | Small Area Income and Poverty Estimates | 2019 |
| | Income inequality | 2.50% | American Community Survey, 5-year estimates | 2015-2019 |
| Family and Social Support | Children in single-parent households | 2.50% | American Community Survey, 5-year estimates | 2015-2019 |
| | Social associations | 2.50% | County Business Patterns | 2018 |
| Community Safety | Violent crime | 2.50% | Uniform Crime Reporting - FBI | 2014&2016 |
| | Injury deaths | 2.50% | National Center for Health Statistics - Mortality Files | 2015-2019 |
| **PHYSICAL ENVIRONMENT** | | | | |
| Air and Water Quality | Air pollution - particulate matter | 2.50% | Environmental Public Health Tracking Network | 2016 |
| | Drinking water violations | 2.50% | Safe Drinking Water Information System | 2019 |
| Housing and Transit | Severe housing problems | 2% | Comprehensive Housing Affordability Strategy (CHAS) data | 2013-2017 |
| | Driving alone to work | 2% | American Community Survey, 5-year estimates | 2015-2019 |
| | Long commute - driving alone | 1% | American Community Survey, 5-year estimates | 2015-2019 |

**FIGURE 2: 2021 RANKED MEASURES & DATA SOURCES (UNIVERSITY OF WISCONSIN POPULATION HEALTH INSTITUTE, 2021)**

*Control Variables*

Several country and hospital-level factors, within the three-year rolling average among the country and hospital characteristics, were used to control for the difference. An approach deemed a best practice through health services literature (Bazzoli et al., 2008). Literature guided considerations of accounting for county median age, use of the Herfindahl Hershman Index region (Midwest, South, West, and Northeast), and primary care health professional shortage areas (Hanadi Hamadi et al., 2019; Wong, Zhan, & Mutter, 2005). Additional considerations of hospital location (urban/rural), hospital size (small being <100, medium as 100 – 399, or large being 400+), ownership status (for-profit/not-for-profit), teaching status (Non-Teaching/Teaching), Medicare percentage, Medicaid percentage, community hospital designation (no/yes), hospital percentage of total primary care providers, and affiliation to a larger health system (no/yes), were explored.

To control for community-related confounding factors, recognizing that age is a strong predictor of respiratory-related chronic conditions (Lakomkin, Graffeo, & Hadjipanayis, 2020), the average median age of county residents was incorporated, concluded by the Herfindahl-Hirschman Index (HHI) as a continuous variable to assess a county's hospital market competition (Hanadi Hamadi et al., 2019; Wong et al., 2005).

*Sources of Data (Data Collection)*

United States data from the AHA, the AHRF, the CMS HRRP, and the CHR were cleaned and merged from 2011 to 2018. The sample was limited to only include hospitals that reported HRRP scores between the years 2014 – 2018. Data were merged using unique identifiers (hospital provider numbers) and Federal Information Processing Standards (FIPS). The final sample included a total of 1,469 hospitals.

*Statistical Analysis*

A secondary data analysis examining the relationship between a county's health and a hospital's readmission rate for COPD was conducted. Both descriptive and panel analyses were conducted on the final sample. The descriptive statistics reported frequencies and percentages for categorical variables, means, and standard deviation for numeric variables. For the panel analysis, a multilevel Poisson regression, accounting for random effects in county population size as an exposure to examine COPD readmission rates as a count variable. A panel analysis using a logistic regression analysis was conducted with random effects for the COPD penalty. The Hausman test helped determine where the fixed effects (FE) or random effects (RE) model was appropriate, resulting in failing to reject the random-effects model (Wooldridge JM. Econometric analysis of cross-section and panel data. MIT press; 2010). All data were cleaned and scrubbed with the analysis conducted in Stata 17MP. The statistical significance was determined at a p-value of <0.05, with the incident rate ratio, and 95% confidence intervals being reported.

**RESULTS**

The results of the study help guide the conclusion that the CHR subfactors of the physical environment and clinical care, the community characteristics of county median age and region, and a hospital's location influence readmission scores.

The average COPD readmission rate over the five-year study period of 2014 – 2018 was 20.12% with a standard deviation (SD) of 1.36 (**TABLE 1**).

As far as community characteristics, the majority of counties (53.32%) fell into the category of best clinical care, though also relating to the majority of worst behaviors (56.69%). More than half of the counties were associated with the best social economic status (59.95%). Compared to the best physical environment, the majority of hospitals (44.39%) were located in medium environments.

As far as hospital characteristics, less than 10% (8.22%) of the hospitals were located in rural counties. More than three-quarters (78.53%) were categorized as being part of a system, 69.06% had a teaching status, and 76.47% were not-for-profits. About 62% (61.76%) of hospitals in the sample were medium-sized hospitals, with 27.04% being large.

More than half of the hospital inpatient days were Medicare (51.02%), while far fewer Medicaid days (20.52%). Across the entire sample, the county median age averaged to be about 38 years, with a population per 100,000 of 10.10 and an HHI of 0.60, suggesting a low level of competition across the reported health care markets.

The regression model (**TABLE 2**) analyzed readmissions across community and hospital characteristics, also taking CHR subfactors into consideration. Medium and worst physical environments were associated with 30-day readmissions with an associated increase rate within the medium environment of 0.978 (95% CI: 0.963, 0.993) and an associated increase rate within the worst environment of 0.954 (95% CI: 0.935, 0.973). The subfactor of worst clinical care also increases the readmission rate by 1.055 (95% CI: 1.008, 1.103).

Additionally, compared to urban hospitals, the characteristic of rurality provided an increased

incident rate ratio (IRR) of 1.210 (95% CI: 1.136, 1.288), while a hospital with a higher Medicaid

percentage had a slight increase in readmissions (IRR: 1.001, 95% CI: 1.000,1.002).


Of the community characteristics, the higher a county's median age, the greater an association

of increased readmissions (IRR: 1.012, 95% CI: 1.000, 1.023). Lastly, compared to the Northeast Region

reference group, the Midwest (IRR: 1.318, 95% CI: 1.108, 1.566) and South Region (IRR: 1.240, 95% CI:

1.053, 1.459) were associated with increased readmissions rates.

| TABLE 1: DESCRIPTION OF HOSPITAL AND COUNTY CHARACTERISTICS FOR 1,469 UNITED STATES ACUTE-CARE HOSPITALS (2014 - 2018) | | | | | | |
|---|---|---|---|---|---|---|
| | **All** | **2014** | **2015** | **2016** | **2017** | **2018** |
| **Hospital COPD Readmission Score (%) (SD)** | **20.12 (1.36)** | 20.72 (1.38) | 20.24 (1.39) | 20.00 (1.43) | 19.81 (1.31) | 19.81 (1.31) |
| | | | | | | |
| **COUNTY HEALTH RANKINGS SUBFACTORS** | **All** | **2014** | **2015** | **2016** | **2017** | **2018** |
| **Clinical Care** | | | | | | |
| Best | 53.32% | 50.92% | 51.06% | 52.96% | 55.14% | 56.50% |
| Medium | 23.73% | 22.67% | 24.57% | 23.76% | 23.28% | 24.37% |
| Worst | 22.95% | 26.41% | 24.37% | 23.28% | 21.58% | 19.13% |
| **Health Behaviors** | | | | | | |
| Best | 12.73% | 11.03% | 13.61% | 13.14% | 13.68% | 12.19% |
| Medium | 30.58% | 33.36% | 30.29% | 32.27% | 25.94% | 31.04% |
| Worst | 56.69% | 55.62% | 56.09% | 54.59% | 60.38% | 56.77% |
| **Social Economic** | | | | | | |
| Best | 59.95% | 58.75% | 60.45% | 58.95% | 60.79% | 60.79% |
| Medium | 19.82% | 18.92% | 18.31% | 20.29% | 21.58% | 20.01% |
| Worst | 20.23% | 22.33% | 21.24% | 20.76% | 17.63% | 19.20% |
| **Physical Environment** | | | | | | |
| Best | 35.66% | 49.83% | 51.87% | 30.84% | 20.63% | 25.12% |
| Medium | 44.39% | 42.55% | 38.80% | 52.42% | 43.64% | 44.52% |
| Worst | 19.96% | 7.62% | 9.33% | 16.75% | 35.74% | 30.36% |
| **COMMUNITY CHARACTERISTICS** | **All** | **2014** | **2015** | **2016** | **2017** | **2018** |
| County Median Age (%) (SD) | 37.86 (4.03) | 37.65 (4.02) | 37.74 (4.03) | 37.81 (4.03) | 37.97 (4.03) | 38.12 (4.02) |
| Herfindahl-Hirschman Index (0 to 1) (SD) | 0.60 (0.37) | 0.60 (0.37) | 0.60 (0.37) | 0.60 (0.37) | 0.60 (0.37) | 0.60 (0.37) |
| Population per 100,000 (SD) | 10.10 (17.27) | 10.02 (17.17) | 10.04 (17.23) | 10.07 (17.26) | 10.15 (17.34) | 10.21 (17.37) |
| **HOSPITAL CHARACTERISTICS** | **All** | **2014** | **2015** | **2016** | **2017** | **2018** |
| **Hospital Location** | | | | | | |
| Urban | 91.78% | 90.88% | 90.88% | 90.88% | 93.12% | 93.12% |
| Rural | 8.22% | 9.12% | 9.12% | 9.12% | 6.88% | 6.88% |
| **Hospital Part of a System** | | | | | | |
| Not Part of a system | 21.47% | 25.19% | 22.40% | 21.03% | 20.08% | 18.65% |
| Part of a system | 78.53% | 74.81% | 77.60% | 78.97% | 79.92% | 81.35% |
| **Teaching Status** | | | | | | |
| Non-Teaching | 30.94% | 33.36% | 32.68% | 31.25% | 30.16% | 27.23% |
| Teaching | 69.06% | 66.64% | 67.32% | 68.75% | 69.84% | 72.77% |
| **Hospital Size** | | | | | | |
| Small | 11.20% | 11.50% | 11.10% | 10.89% | 11.16% | 11.37% |
| Medium | 61.76% | 62.63% | 62.29% | 61.67% | 61.20% | 60.99% |
| Large | 27.04% | 25.87% | 26.62% | 27.43% | 27.64% | 27.64% |
| **Ownership** | | | | | | |
| Government | 11.07% | 11.64% | 11.37% | 10.96% | 10.76% | 10.62% |
| Not-For-Profit | 76.47% | 76.58% | 76.45% | 76.38% | 76.45% | 76.51% |
| For-Profit | 12.46% | 11.78% | 12.19% | 12.66% | 12.80% | 12.87% |
| **Community Hospital Designation** | | | | | | |
| No | 0.49% | 0.82% | 0.82% | 0.82% | 0.00% | 0.00% |
| Yes | 99.51% | 99.18% | 99.18% | 99.18% | 100.00% | 100.00% |
| **Primary Care Health Professional Shortage Areas** | | | | | | |
| No Shortage | 7.23% | 11.10% | 6.81% | 6.47% | 5.92% | 5.85% |
| Partial Shortage | 9.33% | 42.48% | 1.43% | 1.43% | 0.82% | 0.48% |
| Full Shortage | 83.44% | 46.43% | 91.76% | 92.10% | 93.26% | 93.67% |
| **Hospital Medicare Percentage (%) (SD)** | 51.02 (12.06) | 50.68 (12.49) | 50.96 (12.29) | 50.97 (12.03) | 51.10 (11.87) | 51.40 (11.62) |
| **Hospital Medicaid Percentage (%) (SD)** | 20.52 (11.52) | 19.75 (11.68) | 20.15 (11.62) | 20.41 (11.48) | 21.03 (11.47) | 21.27 (11.37) |
| **Hospital Percentage of total Primary Care Providers (%) (SD)** | 24.60 (11.40) | 25.84 (12.11) | 25.60 (11.66) | 24.97 (11.16) | 23.88 (11.12) | 22.71 (10.95) |

| TABLE 2: RANDOM EFECTS PANEL POISSON REGRESSION ANALYSIS OF COPD 30-DAY READMISSION, COMMUNITY AND HOSPITAL CHARACTERISTICS FOR 1,469 UNITED STATES ACUTE CARE HOSPITALS (2014 - 2018) | | |
|---|---|---|
| **Variables** | **Hospital COPD Readmission Score** | |
| | **IRR** | **95% CI** |
| **COUNTY HEALTH RANKINGS SUBFACTORS** | | |
| **Health Behaviors** | | |
| Medium | 1.01 | [0.975,1.047] |
| Worst | 1.027 | [0.983,1.073] |
| **Social Economic** | | |
| Medium | 1.003 | [0.976,1.030] |
| Worst | 0.999 | [0.961,1.039] |
| **Physical Environment** | | |
| Medium | **0.978**$^{**}$ | **[0.963,0.993]** |
| Worst | **0.954**$^{***}$ | **[0.935,0.973]** |
| **Clinical Care** | | |
| Medium | 1.029 | [0.998,1.062] |
| Worst | **1.055**$^{*}$ | **[1.008,1.103]** |
| **COMMUNITY CHARACTERISTICS** | | |
| County Median Age | **1.012**$^{*}$ | **[1.000,1.023]** |
| Herfindahl-Hirschman Index | 1.005 | [0.979,1.030] |
| **Region (reference: Northeast Region)** | | |
| Midwest Region | **1.318**$^{**}$ | **[1.108,1.566]** |
| South Region | **1.240**$^{**}$ | **[1.053,1.459]** |
| West Region | 0.922 | [0.761,1.118] |
| **HOSPITAL CHARACTERISTICS** | | |
| **Hospital Location** | | |
| Rural | **1.210**$^{***}$ | **[1.136,1.288]** |
| **Hospital Part of a System** | | |
| Part of a system | 0.994 | [0.976,1.013] |
| **Teaching Status** | | |
| Teaching | 0.993 | [0.976,1.011] |
| **Hospital Size** | | |
| Medium | 0.997 | [0.970,1.024] |
| Large | 0.995 | [0.964,1.027] |
| Hospital Medicaid Percentage | 1.001 | [1.000,1.002] |
| Hospital Medicare Percentage | 1.000 | [0.999,1.001] |
| **Ownership** | | |
| Not-For-Profit | 0.981 | [0.955,1.007] |
| For-Profit | 0.999 | [0.967,1.032] |
| Hospital Percentage of total Primary Care Providers | - | - |
| **Community Hospital Designation** | | |
| Community Hospital | 1.011 | [0.932,1.096] |
| N | 7345 | |
| AIC | 39852.539 | |
| BIC | 40025.083 | |
| Exponentiated coefficients; 95% confidence intervals in brackets | | |
| $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$ | | |

**DISCUSSION**

The purpose of this study was to analytically evaluate the association between County Health Rankings (CHR) and chronic obstructive pulmonary disease (COPD) readmissions. The study demonstrated associations with the strongest effect seen among various CHR subfactors and community characteristics, however, did not find strong evidence that readmissions were significantly correlated to the majority of observed hospital characteristics. By and large, the results displayed agreement that the County Health Rankings (CHR) subfactors of the physical environment and clinical care, influenced readmissions.

Community characteristics  consisting of county median age and region influenced readmissions. One could believe the variable of age is self-explanatory as a chronic obstructive pulmonary disease (COPD) is a geriatric disease, therefore the older an individual, the more likely one is to have some type of chronic condition, including that of COPD. As it relates to regionality, the Midwest and South regions were associated with increased readmissions rates. Limited and/or lesser forms of reliable transportation (compared to the Northeast Region reference group) may be a factor in this spike. One study detailed the geographical increases in readmissions is not an accident of geography, but rather a reflection of the impact of policy, funding, and health care resources as well as, access to these resources within these communities (Ladin, Rodrigue, & Hanto, 2009), something to further explore.

Lastly, the hospital characteristic of rurality was found to be statistically highly significant. Some common themes found within rural areas were the smaller number of hospitals and limited access to preventive health within their residencies. A lack of hospitals and limited access to preventative health may lead to more exacerbated chronic diseases, which ultimately can lead to more readmissions. Unlike

most rural hospitals, hospitals that are part of a system, are academic medical centers, or are larger

often having more shared resources are, are likely to have lower readmissions.

*Managerial and Policy Implications*

Research, often shows particularly strong and consistent associations between health and SDH

across environments, geography, and a variety of health outcomes *(C. M. Hood, K. P. Gennuso, G. R.*

*Swain, & B. B. Catlin, 2016).* Surprisingly, some factors in this study were counterintuitive, suggesting the

determinant of the physical environment was contradictory to that of readmissions.  This reverse finding

being not consistent with the literature, suggests that there might be something confounding that is not

being controlled for. Given such, further study is needed to clarify this finding and understand which

SDH are most significant to COPD readmissions.

Despite the modest finding of neighborhood disadvantage, clinical care has proven to be the

biggest consideration for preventive readmission efforts. That is, the higher the age and worse patient

safety and quality of clinical care administered ultimately drove the outcome of readmission.

Under these premises, a better understanding of the community factors that have an impact on

post-discharge outcomes is essential to promote the development of effective, safe, and patient-

centered health care environments.

*Limitations*

This reverse finding being not consistent with the literature, suggests that there might be something confounding that is not being controlled for. This outcome serves as a limitation, providing a reason to further explore other variables. Inferences and limitations based on this data are weakened by the ecological fallacy. While not within this study, the lack of further demographic data serves as a limitation as well. Whether by way of better collection of more detailed and specific data including race, ethnicity, and language (REaL data), or sexual orientation and gender identification (SOGI data), if better captured, opportunities within the community would better align with the individualized care and outcomes provided within hospitals. Furthermore, enhanced data, prioritization of metrics, strategically ordering by importance, financial value, size of impacted population, the severity of disparity, ease of implementation, and community need would emerge (Woods, 2021).

In addition, the results of the study are generally applicable to patients 65 and older. With the data set containing close to 1,500 hospitals, restricting to facilities that had data from each dataset used. As a result, generalizability may be reduced. Lastly, in using aggregate data, one can only assume that each patient is affiliated with the county on file, however, except for rural hospitals, not every patient of a hospital is likely to be from the hospital's county affiliation. Association is not causation nor community affiliation. On the other end, similarly with tertiary care hospitals, destination medical centers, and other world-renowned hospitals within the nation, a considerable international and/or unaffiliated county patient population is likely to be within the data. Lastly, this study is limited by the lack of being able to establish how long or little individuals in the community have been exposed (length of exposure) to county-level factors.

Future research should focus on individual-level data, in a prospective evaluation that links to social determinants of health better tied to COPD or diseased specific readmissions.

**CONCLUSIONS**

Interventions and strategies toward the reduction of readmissions that meet the needs of the community seem wise, if not imperative and public reporting, significant to payments, reimbursements, and penalties to an organization will continue to garner accountability. Although community health rankings will vary from state to state, the framework, empirical data, and multifaced interventions to influence readmission rates and quality of care are an investment much needed.

**CHAPTER FOUR: MANUSCRIPT THREE**

*The Relationship Between Having a Primary Care Provider and*

*Chronic Obstructive Pulmonary Disease Readmissions*

by

Darren W. Brownlee

A dissertation submitted to Johns Hopkins University in conformity with the requirements for

the degree of Doctor of Public Health

Baltimore, Maryland
April 2022

**ABSTRACT**

**Background:** The Mayo Clinic of Florida (MCF) has established numerous goals toward the reduction of Chronic Obstructive Pulmonary Disease (COPD) all-cause 30-day readmission. Given various barriers to widespread goal implementation, the Hospital Readmission Reduction Program (HRRP) performance periods of FY2017 – FY2021 resulted in COPD procedure/condition penalties under the Centers for Medicare & Medicaid Services (CMS) pay-for-performance program. Now under new leadership, increased resources, and a post-COVID era consisting of revamping pre-COVID initiatives, readmission reduction strategies have reemerged as a MCF priority.

**Objective:** This study will analyze COPD from a hospital and enterprise-wide focus. Identifying if there is an association between COPD 30-day readmission and having a primary care provider.

**Design, Setting, and Patients:** A retrospective population-based country-level analysis of 1,432 patients identified by way of being obtained from the electronic health records system from the organizational health enterprise. Discharge reports of patients admitted between January 1st, 2018, through December 31st, 2020, were first retrieved from the three campus sites of the institution. Chronic obstructive pulmonary disease patients were identified using the ICD-10 codes.

**Main Outcome Measures:** The main outcome variable was risk-adjusted 30-day readmission associated with COPD patients.

**Results:** Overall the study did not identify clear associations between the presence of a primary care physician (PCP) and COPD readmissions.

45

**Conclusions:** Reducing readmissions have become a requirement for hospitals, emphasized by public

reporting and financial penalties. The presence of a PCP alone does not reduce COPD readmission

however, this study does not control for the quality of services received or the number of PCP services

offered to this patient population. Future studies should measure the association of receipt of PCP

services that also display indicators of the quality of care for COPD patients and the likelihood of a COPD

readmission. While the increased provision of primary and specialty services remains a top priority to

expand institutional access and health care resources, additional understanding and further

identification of the COPD disease spectrum, PCP, and a health care system's role in the coordination of

treating this patient population will provide better insight of the impact on readmissions. A call to action

for health care providers and health care institutions to become more proactive to the needs of the

community, as opposed to reactive to the characteristics of the hospital is warranted.

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by increasing breathlessness, affecting roughly 10% of individuals worldwide, and is prevalent among fifteen million Americans (Shah et al., 2016). Moreover, COPD is the third leading cause of death in the United States, with implications resulting in annual direct costs equating to $50 billion (A. Agusti et al., 2010). COPD patients often require frequent hospital admissions as well as visits to the emergency department for exacerbations of their lung disease (Hunter et al., 2016). These visits to an emergency department count toward an unplanned 30-day readmission rate.

Composed of hospital-specific reports (HSRs) received from the Medicare & Medicaid Services (CMS), the Hospital Readmission Reduction Program (HRRP) is a pay-for-performance program, penalizing inpatient prospective payment system (IPPS) hospitals up to 3% of Medicare reimbursement for readmission rates greater than the average performance of all hospitals for selected conditions and procedures. Chronic obstructive pulmonary disease (COPD) is one of six selected conditions and procedures. Within this report, CMS assesses hospital performance relative to the performance of other hospitals within similar peer groups. This assessment leads to the provision of an excess readmission rate (ERR), which is based on predicted to expected readmissions measures with 25 or more eligible discharges and an ERR above the peer group median ERR enters the payment adjustment factor (PAF) formula ranging from 0.9700 (3% reduction) to 1.0 (full payment). By the Fiscal Year 2020 HRRP, the discharge performance period between July 1, 2015, and June 30, 2018, Mayo Clinic Arizona and Mayo Clinic Rochester did not have an excess readmission penalty for the condition of COPD, Mayo Clinic Florida did.

Between the period 2015 – 2020, the Mayo Clinic of Florida (MCF) treated many patients with a primary diagnosis of COPD, identified by way of the International Classification of Diseases, 9th and 10th Revision, Clinical Modification (ICD-9 and ICD-10 CM) codes. Despite providing exceptional care, in the calendar year of 2016, MCF had an 18.58% COPD readmission rate (21 out of 113 patients), a 14.78% COPD readmission rate in 2017 (17 out of 115 patients), a 17.65% COPD readmission rate in 2018 (24 out of 136 patients) and a 10.81% COPD readmission rate in 2019 (16 out of 148 patients). To date, there have been various MCF projects and initiatives focused on readmission reductions. As COPD continues to be among the top five readmission groups at MCF, addressing COPD readmissions remains a major and primary focus of the institution.

Historically, MCF has dedicated resources, stakeholder expertise, and data analytics, to look at patient safety and quality measures with the hopes of identifying interventions to address COPD readmissions. During that period in 2019, new hospital, departmental and divisional leadership displayed revamped focuses on readmissions engaging several MCF areas (i.e., Center for Innovation, Kern Center for the Science of Health Care Delivery, Management, Engineering, and, Consulting, Quality Academy, etc.) conducting in-depth deep-dive sessions to identify key interventions. These efforts led to preventable hospital admission forums, analyzing patient flow from preadmission, throughout the processes and workflows up to post-discharge follow-up, ensuring the process flow was smooth and efficient, barring any issues.

Interdisciplinary teams of Mayo administrators, allied health, and physicians explored different initiatives looking at ways to reduce preventable admissions among high-risk patients. During this period, interventions that integrated across the continuum of care, prioritized value over volume, and delivered health care outside of the hospital were explored. Discussions surrounding potential failure

points from the initial point of preadmission and registration to the post-discharge follow-up aspect of a

patient's flow during a hospitalization were identified and documented **(FIGURE 1)**.
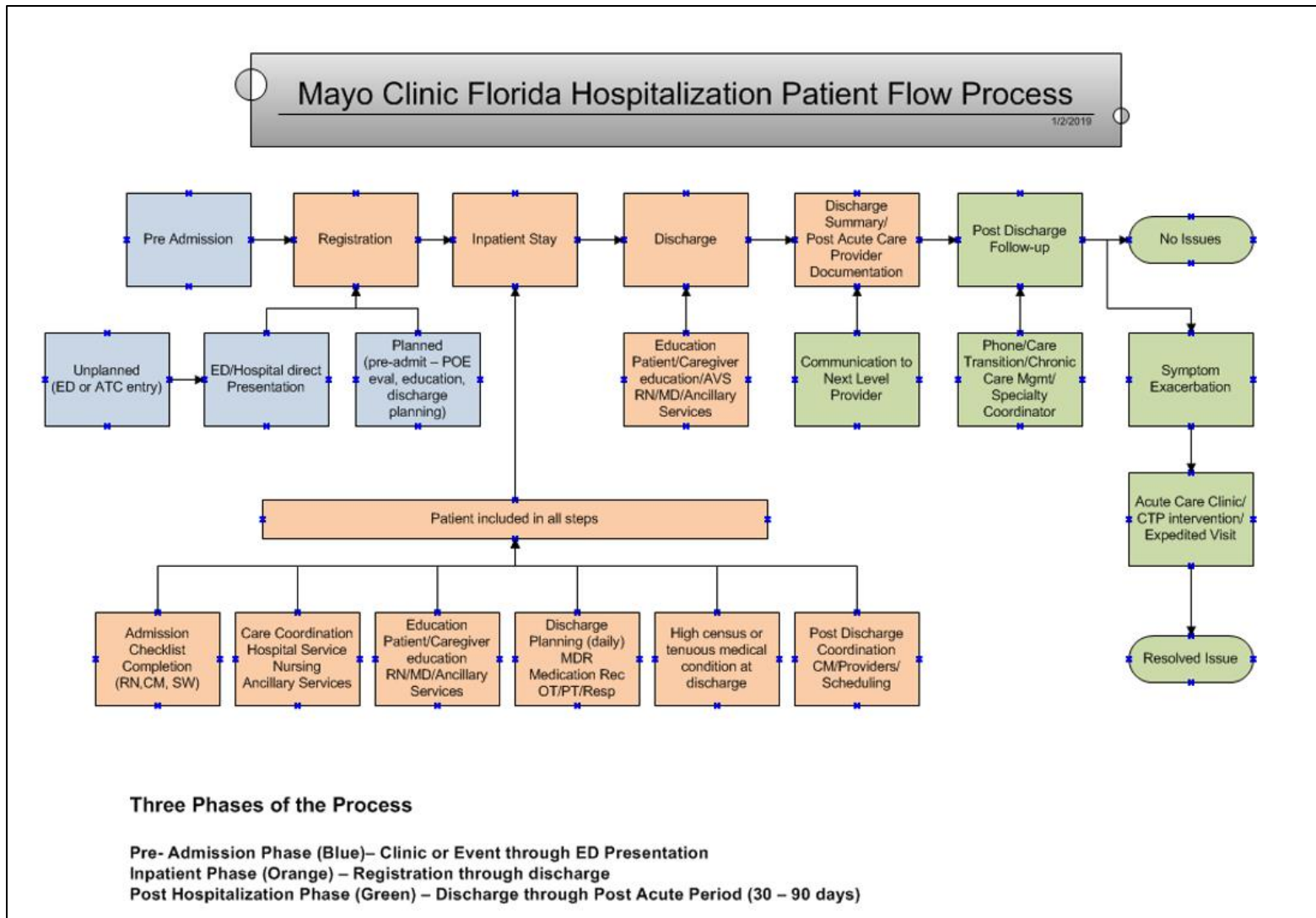
**FIGURE 1: MAYO CLINIC FLORIDA HOSPITALIZATION PATIENT FLOW PROCESS (01/02/2019)**

As the impacts of Coronavirus Disease 2019 (COVID-19) had once ceased many of these efforts, MCF is now at a point to revamp, continue and/or create plans for the reduction of readmissions.

**CONCEPTUAL FRAMEWORK**

Studies have continually highlighted the importance of care transition programs among different subpopulations (Balaban et al., 2017), have outlined differences between women and men hospitalized for chronic obstructive pulmonary disease (COPD) presentation (Bade et al., 2019), have identified that prompt diagnosis in primary care may reduce risk of admission/readmission (Hunter et al., 2016), and, controversially, that factors influencing COPD readmissions are complex and poorly understood (Bashir, Schneider, Naglak, Churilla, & Adelsberger, 2016). Additionally, studies have also examined techniques surrounding post-care discharge, enhanced education models, medication adherence literacy, and other interventions all aimed to reduce 30-day readmissions (Garvey & Kaplan, 2018).

Though readmissions stem from various causes, readmissions are often presumed to be due to poor coordination and quality of care, including timely post-discharge follow-up with a physician. Evidence is lacking as to whether specific interventions, such as early follow-up, can prevent 30-day readmissions, and it is even less clear whether all diagnoses will respond similarly to any specific interventions (Fidahussein, Croghan, Cha, & Klocke, 2014).

With such inconclusive and inconsistent literature regarding the impact of having a primary care physician (PCP) or PCP appointment after a hospital discharge, in addition to complex factors influencing COPD readmissions, this dissertation will help examine PCP and COPD readmission associations.

**METHODS**

This study aimed to explore any relationship between having a primary care provider (PCP) and hospital readmission rates for chronic obstructive pulmonary disease (COPD) patients. The data for this study was obtained from the electronic health records system from the health enterprise. Discharge reports of patients admitted between January 1st, 2018, through December 31st, 2020, were first retrieved from the three campus sites of the institution. COPD patients were identified using the ICD-10 codes from **TABLE 1**.

**TABLE 1**: **INTERNATIONAL CLASSIFICATION OF DISEASES, 10th REVISION, CLINICAL MODIFICATION (ICD-10 CM) CODES**

| ICD-10 CM Codes for COPD | |
|---|---|
| **ICD-10 CM Codes** | **Description** |
| J41.0 | Simple chronic bronchitis |
| J41.1 | Mucopurulent chronic bronchitis. |
| J41.8 | Mixed simple and mucopurulent chronic bronchitis |
| J42 | Unspecified chronic bronchitis |
| J43.0 | Unilateral pulmonary emphysema (MacLeod's syndrome) |
| J43.1 | Panlobular emphysema |
| J43.2 | Centrilobular emphysema |
| J43.8 | Other emphysema |
| J43.9 | Emphysema, unspecified |
| J44.0 | Chronic obstructive pulmonary diseases with acute lower respiratory infection |
| J44.1 | Chronic obstructive pulmonary diseases with (acute) exacerbation |
| J44.9 | Chronic obstructive pulmonary disease, unspecified |

| Principal discharge diagnosis codes included in cohort if combined with a secondary diagnosis of J44.0 or J44.1 | |
|---|---|
| **ICD-10 CM Codes** | **Description** |
| J96.00 | Acute respiratory failure, unspecified whether with hypoxia or hypercapnia |
| J96.01 | Acute respiratory failure with hypoxia |
| J96.02 | Acute respiratory failure with hypercapnia |
| J96.20 | Acute and chronic respiratory failure, unspecified whether with hypoxia or hypercapnia |
| J96.21 | Acute and chronic respiratory failure with hypoxia |
| J96.22 | Acute and chronic respiratory failure with hypercapnia |
| J96.90 | Respiratory failure, unspecified, unspecified whether with hypoxia or hypercapnia |
| J96.91 | Respiratory failure, unspecified with hypoxia |
| J96.92 | Respiratory failure, unspecified with hypercapnia |
| R06.03 | Acute respiratory distress |
| R09.2 | Respiratory arrest |

This study was reviewed by the institutional review board (IRB) at the Johns Hopkins School of

Public Health as well as the Mayo Clinic. The review boards determined the research to be exempt from

informed consent as the study was by applicable Health Insurance Portability and Accountability Act

(HIPPA) regulations, with additional accordance of the study being a secondary analysis of existing de-

identified data examining associations of COPD 30-day readmissions with health system characteristics.

*Study Population (Participants)*

Nine Mayo Clinic hospitals participate in the Medicare & Medicaid Services (CMS) Hospital

Readmission Reduction Program (HRRP) (i.e., Mayo Clinic Arizona (MCA), Mayo Clinic Florida (MCF),

Mayo Clinic Rochester (MCR), Albert Lea & Austin, Eau Claire, Fairmont, La Crosse, Mankato, and Red

Wing). While these nine Mayo Clinic sites fall under the scope of the Mayo enterprise, for this particular

dissertation, the sample consists of patients who received care from the hospital sites of Mayo Clinic

Arizona, Mayo Clinic Florida, and Mayo Clinic Rochester.

*Setting*

A retrospective population-based analysis of 1,432 patients was identified by way of obtaining

an electronic health records system from the organizational health enterprise. Discharge reports of

patients admitted between January 1st, 2018, through December 31st, 2020, were first retrieved from

three campus sites of the institution (Mayo Clinic Arizona, Mayo Clinic Florida, Mayo Clinic Rochester).

Chronic obstructive pulmonary disease (COPD) patients were identified using the ICD-10 codes. Specific

patient populations were then identified as having 30-day readmission or no 30-day readmission, and

then classified as having a primary care physician (PCP) within the Mayo Clinic (PCP at Mayo), outside of

the Mayo Clinic (PCP Elsewhere), or not having a PCP at all (No PCP).

### Sources of Data (Data Collection)

For this study, data were obtained from the Centers for Medicine and Medicaid Services (CMS) Hospital Readmission Reduction Program (HRRP) and from an electronic health records system from the health enterprise. Discharge reports of patients admitted between January $1^{st,}$, 2018 – December $31^{st}$, 2020, were retrieved from three campuses of the institution. Chronic obstructive pulmonary disease (COPD) patients were identified using the International Classification of Diseases $10^{th}$ (ICD-10 CM) codes. Only the first patient hospitalization associated with COPD was collected, and patients that were under the age of 18 were excluded. The final sample included a total of 1,432 patients (**FIGURE 2**).
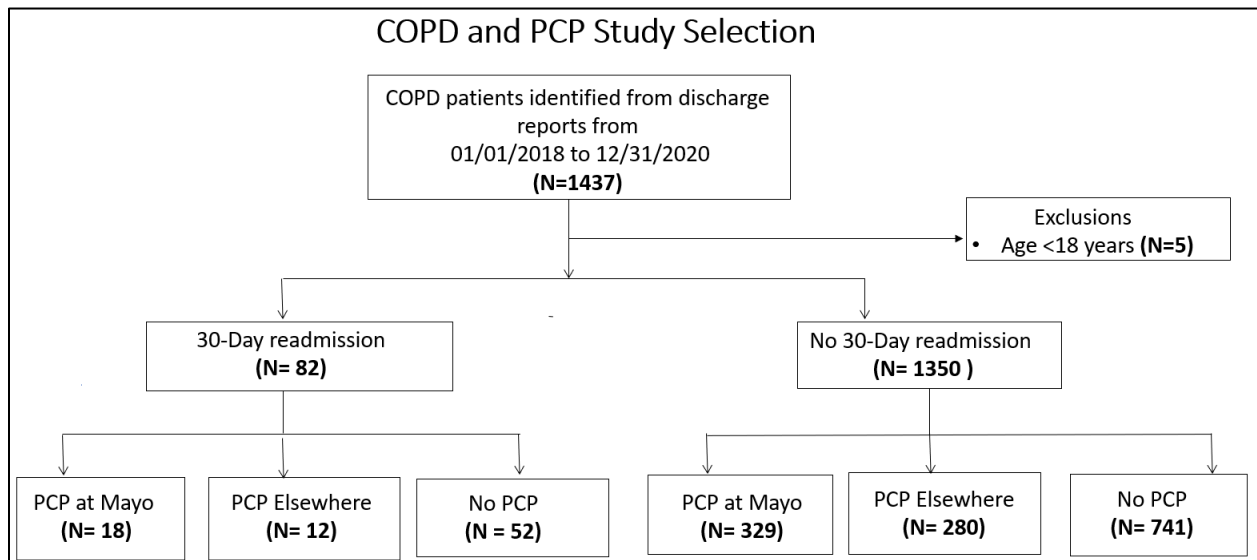


**FIGURE 2: CONSORT DIAGRAM**

### Outcome Variable (Control Variable)

This is an indicator of whether a COPD patient had a readmit to the hospital within 30-days of discharge.

### Independent Variables

The primary independent variable in the study was the identification of having a primary care physician (PCP). Patients were first identified as having a PCP or not. If the patient did have a PCP, they were further categorized as having a PCP within the institution or if the PCP was external to the institution of study.

Patient demographics include age, sex, history of smoking, and comorbidity score (Elixhauser). Age was operationalized as a continuous variable. The history of smoking was identified using the ICD-10 codes S72.0, F17.200, and F17.299. The Elixhauser score was calculated using the comorbidities retrieved from the discharge reports. Lastly, receipt of oxygen therapy was also identified from the discharge reports.

### Statistical Analysis

A bivariate analysis to examine associations between 30-day chronic obstructive pulmonary disease (COPD) readmission and having a primary care physician (PCP). Pearson Chi-squared tests were used to compare those who had readmission versus those who did not and a Kruskal-Wallis test for continuous variables. Logistic regression models were used to obtain the adjusted odds of having 30-day readmission for the presence of a PCP, gender, age, comorbidity score, use of oxygen therapy, and history of smoking. Additionally, logistic regression models were used to determine the association between 30-day readmission and affiliation of the PCP as well as adjusted for other independent factors. All data were cleaned and scrubbed with the analysis conducted in R (R Foundation for Statistical Computing). The statistical significance was determined at a p-value of <0.05, with the odds ratio, and 95% confidence intervals being reported.

**RESULTS**

      This study concluded that COPD 30-day readmission and having a primary care provider are not statistically significant, but the association is in the hypothesized direction. Out of the 1,432 COPD patients, 56% (793) had no PCP, 24% 347 had a Mayo PCP, and 20% (292) had a PCP elsewhere. The total number of COPD readmissions over the three-year study period of 2018 – 2020 was 82 (5.70%). Of the 82 COPD readmissions of this period, 52 (63.40%) identified as having no PCP, 18 (22.00%) a Mayo PCP, and the remaining 12 (14.60%). Patient demographics were almost evenly split 51.70% female, 48.30% male, with no significance in readmissions among gender. Age ranged from 22 to 98 years with a mean of 70.83 years and a standard deviation (SD) of 11.56. The mass majority of the studied cohort smoked (84.70%), and comorbidities were quite prevalent, identified in over half of all the variables observed. Comorbidity ranged from 1.000 – 16.000 with a mean of 5.94 and a SD of 2.52 (**TABLE 2**).

| TABLE 2: FACTORS ASSOCIATED WITH HAVING A READMISSION IN 30 DAYS | | | | |
|---|---|---|---|---|
| | No 30 day readmission (N=1350) | 30 day readmission (N=82) | Total (N=1432) | p value |
| **Primary Care Physician** | | | | 0.270 (1) |
| No PCP | 741 (93.44%) | 52 (6.56%) | 793 (55.40%) | |
| Mayo PCP | 329 (94.81%) | 18 (5.19%) | 347 (24.20%) | |
| Elsewhere PCP | 280 (95.89%) | 12 (4.11%) | 292 (20.40%) | |
| **Sex** | | | | 0.409 (1) |
| Female | 694 (93.78%) | 46 (6.22%) | 740 (51.70%) | |
| Male | 656 (94.80%) | 36 (5.20%) | 692 (48.30%) | |
| **Age** | | | | 0.006 (2) |
| Mean (SD) | 71.039 (11.594) | 67.451 (10.417) | 70.833 (11.557) | |
| Range | 22.000 - 98.000 | 45.000 - 87.000 | 22.000 - 98.000 | |
| **Smoking** | | | | 0.003 (1) |
| No | 1153 (95.05%) | 60 (4.95%) | 1213 (84.70%) | |
| Yes | 197 (89.95%) | 22 (10.05%) | 219 (15.30%) | |
| **Asthma** | | | | < 0.001 (1) |
| No | 1203 (95.10%) | 62 (4.90%) | 1265 (88.30%) | |
| Yes | 147 (88.02%) | 20 (11.98%) | 167 (11.70%) | |
| **Chronic Bronchitis** | | | | < 0.001 (1) |
| No | 1321 (94.76%) | 73 (5.24%) | 1394 (97.30%) | |
| Yes | 29 (76.32%) | 9 (23.68%) | 38 (2.70%) | |
| **Emphysema** | | | | < 0.001 (1) |
| No | 906 (95.87%) | 39 (4.13%) | 945 (66.00%) | |
| Yes | 444 (91.17%) | 43 (8.83%) | 487 (34.00%) | |
| **Comorbidity Score** | | | | < 0.001 (2) |
| Mean (SD) | 5.793 (2.420) | 8.268 (2.885) | 5.935 (2.515) | |
| Range | 1.000 - 14.000 | 3.000 - 16.000 | 1.000 - 16.000 | |
| **Oxygen Therapy** | | | | 0.969 (1) |
| No | 376 (94.24%) | 23 (5.76%) | 399 (27.90%) | |
| Yes | 974 (94.29%) | 59 (5.71%) | 1033 (72.10%) | |

The regression models in **TABLE 3** and **TABLE 4** analyzed readmissions across identified/unidentified primary care physicians (PCP) and No PCP, Mayo PCP, Elsewhere PCP. The logistic regression results suggest that there is no association between the presence of a PCP and the likelihood of 30-day readmissions, however, the associations are in the right direction. The adjusted odds of having a PCP present are .81 (CI), a Mayo PCP is 0.85 (CI) and a PCP elsewhere is 0.76 (CI). Age and comorbidity scores were associated with 30-day readmissions with an associated increase rate in age of 0.97 (95% CI: 0.95, 0.99) and an associated increase rate within the comorbidity score of 1.44 (95% CI: 1.32, 1.57).

| TABLE 3: LOGISTIC REGRESSION MODEL FOR 30-DAY READMISSION ADJUSTED FOR PCP (PRESENT OR NOT) | | |
|---|---|---|
| | **OR (95% CI)** | **p value** |
| **Primary Care Physician Y/N (PCP Present)** | 0.81 (0.49, 1.30) | 0.385 |
| **Age** | **0.97 (0.95, 0.99)** | **0.002** |
| **Sex (Male)** | 0.83 (0.52, 1.33) | 0.439 |
| **Smoking (Yes)** | 1.44 (0.81, 2.49) | 0.205 |
| **Oxygen Therapy (No)** | REF | REF |
| **Oxygen Therapy (Yes)** | 0.82 (0.49, 1.41) | 0.452 |
| **Comorbidity Score** | **1.44 (1.32, 1.57)** | **<0.001** |

| TABLE 4: LOGISTIC REGRESSION MODEL FOR 30-DAY READMISSION ADJUSTED FOR NO PCP VS MAYO PCP VS ELSEWHERE PCP | | |
|---|---|---|
| | **OR (95% CI)** | **p value** |
| **Primary Care Physician (No PCP)** | REF | REF |
| **Primary Care Physician (Mayo PCP)** | 0.85 (0.46, 1.48) | 0.569 |
| **Primary Care Physician (Elsewhere PCP)** | 0.76 (0.37, 1.43) | 0.412 |
| **Age** | **0.97 (0.95, 0.99)** | **0.002** |
| **Sex (Male)** | 0.83 (0.52, 1.33) | 0.437 |
| **Smoking (Yes)** | 1.44 (0.81, 2.48) | 0.205 |
| **Oxygen Therapy (Yes)** | 0.82 (0.49, 1.41) | 0.454 |
| **Comorbidity Score** | **1.44 (1.32, 1.57)** | **<0.001** |

A Pearson's Chi-squared and Linear Model ANOVA test was conducted for **Table 5** providing insight on factors associated with having no primary care physician, a PCP at Mayo, or a PCP elsewhere. The bivariate analysis demonstrates the differences among groups. There were not any differences in sex, smoking (in relation to the variable), or chronic bronchitis. However, age, asthma, emphysema, and oxygen therapy, did prove to be statistically different.

Factors of mean age (71.496) with a standard deviation (SD) of 12.19, and comorbidity score (6.201) with a standard deviation (SD) of (2.54) were the highest among those with no PCP. Factors associated with asthma (53 patients, 15.30% of the population) having a Mayo PCP had the highest readmission rate. Lastly, associated with emphysema (123 patients, 42.10% of the population) and oxygen therapy (232 patients, 79.50% of the population) having a PCP elsewhere had the highest readmission rate.

| TABLE 5: FACTORS ASSOCIATED WITH HAVING 'NO PRIMARY CARE PHYSICIAN' VS 'PCP AT MAYO CLINIC' VS 'PCP ELSEWHERE' | | | | | |
|---|---|---|---|---|---|
| | No PCP (N=793) | Mayo PCP (N=347) | Elsewhere PCP (N=292) | Total (N=1432) | p value |
| **Sex** | | | | | 0.640 (1) |
| Female | 406 (51.20%) | 176 (50.70%) | 158 (54.10%) | 740 (51.70%) | |
| Male | 387 (48.80%) | 171 (49.30%) | 134 (45.90%) | 692 (48.30%) | |
| **Age** | | | | | 0.011 (2) |
| Mean (SD) | 71.496 (12.19) | 70.758 (10.65) | 69.123 (10.65) | 70.833 (11.56) | |
| Range | 22.000 - 98.000 | 40.000 - 97.000 | 33.000 - 95.000 | 22.000 - 98.000 | |
| **Smoking** | | | | | 0.761 (1) |
| No | 673 (84.90%) | 290 (83.60%) | 250 (85.60%) | 1213 (84.70%) | |
| Yes | 120 (15.10%) | 57 (16.40%) | 42 (14.40%) | 219 (15.30%) | |
| **Asthma** | | | | | 0.020 (1) |
| No | 703 (88.70%) | 294 (84.70%) | 268 (91.80%) | 1265 (88.30%) | |
| Yes | 90 (11.30%) | 53 (15.30%) | 24 (8.20%) | 167 (11.70%) | |
| **Chronic Bronchitis** | | | | | 0.533 (1) |
| No | 770 (97.10%) | 337 (97.10%) | 287 (98.30%) | 1394 (97.30%) | |
| Yes | 23 (2.90%) | 10 (2.90%) | 5 (1.70%) | 38 (2.70%) | |
| **Emphysema** | | | | | 0.002 (1) |
| No | 548 (69.10%) | 228 (65.70%) | 169 (57.90%) | 945 (66.00%) | |
| Yes | 245 (30.90%) | 119 (34.30%) | 123 (42.10%) | 487 (34.00%) | |
| **Comorbidity Score** | | | | | < 0.001 (2) |
| Mean (SD) | 6.201 (2.54) | 5.795 (2.46) | 5.380 (2.41) | 5.935 (2.52) | |
| Range | 1.000 - 16.000 | 1.000 - 14.000 | 1.000 - 14.000 | 1.000 - 16.000 | |
| **Oxygen Therapy** | | | | | 0.004 (1) |
| No | 243 (30.60%) | 96 (27.70%) | 60 (20.50%) | 399 (27.90%) | |
| Yes | 550 (69.40%) | 251 (72.30%) | 232 (79.50%) | 1033 (72.10%) | |

**DISCUSSION**

Despite the great implication of this study, there was no strong evidence of any association between having a primary care physician (PCP) and 30-day COPD readmission. However, these findings should be considered carefully, as the sample and patient population is rather specific and relatively small.

In comparison with other findings from studies looking at similar associations, some studies, too, were unfavorable in confirming the linkage. Excluding short-term follow-up, the study did deem other interventions such as pulmonary rehabilitation, patient/caregiver education, smoking cessation advice, and inhaler usage are likely the best approaches to reducing readmission risk within the COPD patient population  (Budde, Agarwal, Mazumdar, & Braman, 2019). Another paper found that patients with COPD who had an early follow-up with their PCP or pulmonologist post-hospitalization had lower odds of hospital readmission compared with patients with no follow-up (Gulshan Sharma et al., 2010).

One angle that was not extensively observed in this study was the variable of socioeconomic status. One study highlighted COPD Medicaid beneficiaries being more likely to be readmitted, as these beneficiaries have greater barriers to primary care, including that of a PCP  (Jacobs et al., 2018).

*Managerial and Policy Implications*

Despite the association being in the hypothesized direction, these findings suggest that COPD 30-day readmission and having a primary care provider (PCP) are not statistically significant. Nonetheless, given the importance to improve the post-discharge care of COPD patients, increased coordination and efforts may be required to reduce readmissions. Readmission avoidance continues to aim to enhance patient safety and quality as well as, to avoid costly penalties. Dating back to Title III of

the 2010 United States Patient Protection and Affordable Care Act (Affordable Care Act), the health care

reform emphasized reducing readmissions to improve the quality and integration of care as well as

reducing costs for CMS beneficiaries (Jencks, Williams, & Coleman, 2009). Consequently, reducing COPD

readmissions will remain a priority throughout the health care system.

While evidence from this study does not have statistical significance, other clinical factors such

as smoking, asthma, chronic bronchitis, emphysema, and comorbidity score to were associated with

readmissions. To address, specific to this patient population, some studies suggest that follow-up visits

after discharge reduce the risk of readmission and ED visits (G. Sharma, Y. F. Kuo, J. L. Freeman, D. D.

Zhang, & J. S. Goodwin, 2010; Sin, Bell, Svenson, & Man, 2002). Similarly, multiple studies have

identified current and impending shortages of PCPs, and the associated impact on health outcomes

(Gemelas, 2021; Zhang, Lin, Pforsich, & Lin, 2020). External to this study, these results continue to

display the demand for PCPs parallel to that of an aging population with the increasing need for chronic

condition care management.

Moreover, as readmissions are often catalyzed by poor care provided, premature discharge,

suboptimal medication reconciliation, lack of disease knowledge, and as previously described, due to a

disconnect between outpatient physicians and the patient, many other stakeholders are influencing the

COPD patient population. Despite numerous tactics and interventions varying across different

organizations, the multidisciplinary approaches of administration, allied health (i.e., nursing, respiratory

therapists, etc.), pharmacy, physicians, and more recently utilized remote technologies and

telemedicine, will all play a significant role in readmission avoidances.

*Limitations*

Further studies are needed to clarify this finding, exploring additional variables, and identifying additional measures potentially significant to the relationship between having a primary care provider (PCP) and chronic obstructive pulmonary disease (COPD) readmissions. Moreover, institutional policies, processes, and patient populations may not be generalizable to other institutions.  Additionally, as COPD often overlaps with other chronic conditions and diseases, ensuring accurate coding of COPD as the primary diagnosis, is a limiting factor, as there is much room for inaccuracies. Further clinical knowledge and input could deem beneficial as this study did not measure the level of severity. Also, this analysis does not control for community factors (i.e., social determinants of health), which explained above, influences associations and outcomes. This data set only consists of patients readmitted to Mayo. As such, the study is limited based on internal data and the sample size seen and readmitted within Mayo. Despite limitations, this study is addressing a necessary gap in the literature by evaluating associations between PCP and COPD readmissions.

**CONCLUSIONS**

Readmission avoidance strategies, and when needed, readmission reduction plans are often a hospital's priority. Whether it's by pure virtue of avoiding the Centers for Medicare & Medicaid Services (CMS) reimbursement penalty, improving inpatient and outpatient throughput, hospital efficiency, or advancing patient safety and quality, linking payment to the quality of care of a hospital often serves as a significant driver towards prioritizing opportunities around readmissions.

Despite the general belief that a patient's linkage to a primary care physician reduces readmissions, literature, along with this study, has often produced inconclusive and inconsistent results

regarding the association (Grafft et al., 2010; Weinberger, Oddone, & Henderson, 1996). Future studies

would benefit from more longitudinal data, possibly helping better articulate relationships which may

transform over time due to changes in PCP access.

This dissertation displayed evidence of how social determinants of health (SDH) is the shared responsibility of organizations, communities, and individuals. A common theme that emerged from the three manuscripts was the great significance of understanding the non-clinical factors that influence health outcomes, requiring a shift from reactionary interventions to proactive solutions to address root causes. Whether it be the disease spectrum of chronic obstructive pulmonary disease (COPD) patients, patient's behaviors, provider availability, or even health care system and hospital access, the most critical characteristic, is influencing the coordinated care which occurs outside of organizational walls.

The three manuscripts, flowing from systemic characteristics to community factors, concluding with primary care, provided interventional examples, and routinely used practices with the hope of displaying a proof of concept that SDH impacts more than that provisional clinical care, hence, health (80 – 90 percent of health outcomes) is more than health care (10 – 20 percent of a population's health outcomes). Should we want to impact COPD readmissions or any other patient populations, it will require devoting resources to the health of a population, well-being, and equity.

**DISCUSSION OF SIGNIFICANT FINDINGS**

*Manuscript One:*

Manuscript One reviewed the published research on SDH with the hope of gaining national quality strategies, best practices, and various ways to address the non-clinical factors that influence health outcomes. The majority of the literature centered on the SDH domain of the health care system however, the review included the remaining determinants of community and social context, economic stability, education and food, and neighborhood environment. The review challenged readers to look at

health care more holistically and proactively, reaching beyond the traditional realm of health and health

care to create a healthier community, environment, and ultimately, ecosystem.

*Manuscript Two:*

Manuscript Two demonstrated connections between county health rankings (CHR) and COPD

readmissions. The study illustrated the relationship between CHR and hospital 30-day readmission rates

for COPD populations. Analyzing American Hospital Association (AHA), associated county rankings, and

30-day readmissions within a particular period, the findings of the study found community-level

demographics to be more associated with COPD readmissions than hospital characteristic variables.

*Manuscript Three:*

Manuscript Three explored the associations between COPD readmissions and having an

established/identified primary care provider. The paper analyzed COPD readmission data obtained

through the Centers for Medicine and Medicaid Services (CMS) Hospital Readmission Reduction

Program (HRRP) and from the electronic health records system at the Mayo Clinic. The study concluded

that COPD 30-day readmission and having a primary care provider were not statistically significant,

however, the association was in the hypothesized direction of reducing readmissions.

## COMMON THEMES AND STRENGTHS OF FINDINGS

Several common themes emerged from the dissertation:

***Advancing health equity is everybody's work.*** Across the range of fields including but not limited to

social policy, community development, public health, and the government, everyone must "lean in" to

address the multitude of pressing issues in advancing health equity. This work will require collaboration

and innovation aimed to solve persistent challenges in improving health and reducing longstanding

disparities.

*Systemic Themes*: Anchor institutions, hospitals, legislatures, and/or policymakers can support and

affect policy, system, and environmental (PSE) cultural changes to achieve widespread impact on

societal issues. Organizational influence and incentivizing investments into the community serve as

strategies that could be used parallel to these studies. It is the responsibility of anchor institutions, to

recognize their influence and impact in eliminating health disparities, not just because it's the right thing

to do, but studies have proven cost savings as well (LaVeist et al., 2011).

*Community Themes:* While the increased provision of primary and specialty services remains a top

priority to expand institutional access and health care resources, additional understanding and

identification of community characteristics and social determinants provide better insight into the

impact on readmissions. A mutually inclusive solution of safe, accessible, quality care organizations AND

communities is achievable, however, this central point for all will require a call to action becoming more

proactive to the needs of the community, as opposed to reactive to the characteristics of the hospital.

*Individual Social Themes:* Making health a shared value will require a mindset and behavioral changes,

having or providing a sense of community, civic engagement, and social justice.

In line with these themes, some core quality metrics better aligned with data and patient volumes by geography, adjusted by the social determinant of health indexes need to be further utilized. Some examples, expanded analytics, and technology include but are not limited to:

*Area Deprivation Index (ADI)*: Allowing for rankings of neighborhoods by a socioeconomic disadvantage in a region of interest. This includes factors for the theoretical domains of income, education, employment, and housing quality, which can be used to inform health delivery and policy.

*Social Vulnerability Index (SVI):* This ranks each tract on 15 social factors including poverty, lack of vehicle access, and crowded housing, and groups them into related themes.

*Distressed Communities Index (DCI):* Examining economic well-being at the zip code level to provide a detailed view of the divided landscape of American prosperity. The tool attempts to understand the spatial distribution of US economic well-being.

Several strengths emerged from the dissertation as well:

*Data:* Widely complete and available data from the Centers for Medicare & Medicaid Services (CMS), county-level public health data, and granular patient-level data across the organizational enterprise provide a unique opportunity to examine associations.

*Wide Approach to Understanding Community Health*: In considering all domains of SDH, a much broader range of strategies to advance health equity is being considered, measured, and hopefully addressed.

*A National and Longitudinal Study*: The depth and reach of this study help better articulate relationships over time. While the research does include a robust set of data allowing for generalizability, many variables can be measured to control for all issues which may affect any correlations.

All themes and strengths of findings require additional attention to SDH, community factors, and primary care. Enhancing consideration of population health efforts will ultimately advance health equity.

## CONCLUDING REMARKS

I have been afforded the privilege and experience to learn and lead at some of the best teaching hospitals in the world, equipping me with operational expertise, differentiated skills, and an aspirational/strategic vision of the transformation that is both possible and necessary in health care. More importantly,  spanning across operations, education/research, and community advocacy I aim to provide health equity and enhance the access to care that continues to affect our communities, organizations our families.

By addressing SDH, health care systems and hospitals enhance access and strengthen the integration of health services; communities become healthier and foster cross-sector collaboration, and the individuals we are most connected to, have a better quality of life and well-being. Advancing populational health ultimately advances health equity.

Following a Robert Wood Johnson Foundation (RWJF) framework once taught to me, it is now my privilege and expectation to advance health forward, with hopes of making health a shared value, fostering cross-sector collaboration to improve well-being, creating healthier more equitable communities, and strengthening the integration of health services in systems with the outcome of improving population health, well-being, and equity for all. Further enhancing my investment in social justice, equity, diversity, and inclusion, the piece showcases the intertwining of SDH embedded within the efforts of health systems, the community, and the individual – operations, education/research, and community – essentially my life.

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| Citation | SDH Domain | Methods/Design | Results | Conclusions |
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| Abernathy, K., Zhang, J., Mauldin, P., Moran, W., Abernathy, M., Brownfield, E., & Davis, K. (2016). Acute Care Utilization in Patients With Concurrent Mental Health and Complex Chronic Medical Conditions. Journal of Primary Care & Community Health, 7(4), 226-233. doi:10.1177/2150131916656155 | HC | A retrospective cohort analysis was performed on 10 408 patients. Adult patients >18 years of age were included in the study if they were seen at least twice in University Internal Medicine primary care clinic at the Medical University of South Carolina from October 10, 2010 through September 30, 2013. The main outcome measure was a count of acute care use (hospital or ED). A linear regression model was used to fit a predictive model for ED and hospital utilization, and agglomerative hierarchical clustering was used to identify patients with similar comorbidities. | Covariates associated with increased risk of ED and hospital utilization include non-white race (rate ratio [RR] = 1.35, P < .0001), resident physician (RR = 1.30, P < .0001), and public insurance (RR = 1.56, P < .0001). Patients within the multiple chronic conditions (MCC), chronic obstructive pulmonary disease (COPD)/asthma, or renal disease clusters had 1.80 (P < .0001), 1.50 (P < .0001), and 2.57 (P < .0001) times, respectively, the amount of predicted utilization compared with healthy patients, whereas patients with a mental health diagnosis had 1.41 (P < .0001) times the predicted utilization. There was a significant association with increased utilization in patients with coexisting mental health disorder and chronic disease within the COPD/asthma (RR = 1.20, P = .0038), renal disease (RR = 1.27, P < .0001), and MCC (RR = 1.34, P < .0001) clusters. | Patients with co-occurring chronic medical conditions and mental health disorders have higher rates of acute care utilization compared with patients with chronic medical conditions alone. Improving access to mental health care at the primary care clinic may have a positive impact on utilization. |
| Akazawa, M., Halpern, R., Riedel, A. A., Stanford, R. H., Dalal, A., & Blanchette, C. M. (2008). Economic burden prior to COPD diagnosis: a matched case-control study in the United States. Respir Med, 102(12), 1744-1752. doi:10.1016/j.rmed.2008.07.009 | Edu | A retrospective case-control study was conducted using medical and pharmacy claims data from a large managed care health plan representing a base population of over 30 million covered lives in the U.S. COPD patients with at least 12 months of continuous enrollment and aged 40 years or older were identified (n=28,968) and matched to up to three random controls (n=81,322) by age, gender, region of plans and index date. Multivariate regression models were used to estimate average incremental service use and cost between COPD patients and controls. Moreover, trends in utilization and costs for the COPD patients were examined over 36 months before diagnosis. | COPD patients used 1.5-1.6 times more inpatient/emergency department (IP/ED) services and office visits compared to control patients. The average incremental annual costs for IP/ED services, office visits, and medical and pharmacy services were estimated at $550, $238, $1438 and $401, respectively, after adjusting for age, gender, region and comorbid conditions. The 36-month trend analysis showed that COPD patients' healthcare utilization and costs increased gradually over time, often with a marked increase in the month before COPD diagnosis. | COPD patients in the U.S. consumed substantial healthcare services and costs prior to diagnosis. More timely diagnosis and subsequent treatment may avoid costly healthcare utilization and unnecessary mortality and morbidity post-diagnosis. |
| Baker, C. L., Zou, K. H., & Su, J. (2013). Risk assessment of readmissions following an initial COPD-related hospitalization. Int J Chron Obstruct Pulmon Dis, 8, 551-559. doi:10.2147/copd.S51507 | HC | This retrospective cohort study used anonymized claims data from the Truven Health MarketScan Commercial Claims and Encounters database. The patients included were aged 40-65 years, had an index hospitalization with a primary diagnosis of COPD between July 1, 2008 and June 30, 2010 (continuously enrolled 12 months before and after), and were alive at hospital discharge. Patients with cystic fibrosis or tuberculosis or who were transferred to another inpatient facility after hospital discharge were excluded. All readmissions regardless of diagnosis, and separately a subset of all readmissions that had COPD as a primary or secondary diagnosis (COPD-related), were examined. Univariate descriptive statistics and multivariable regression methods were used. | Of the 18,568 patients with index COPD hospitalizations, 6,095 (32.83%) met the eligibility criteria. Of those, 503 (8.25%) were readmitted within the first 30 days post-index hospitalization and 2,527 (41.46%) within the first year (COPD-related 340 [5.58%] and 1,681 [27.58%], respectively). The median time to the first readmission post initial discharge was 4.0 months, with a mean of 5.0 ± 3.4 months. Multivariable regression analyses showed that comorbid conditions and health care utilization in the pre-index period were significant predictors for readmission both 30 and 90 days following index hospitalization. | A relatively high readmission rate was observed for patients aged 40-65 years. The results suggest that attention to patient comorbidities and pre-index/index health care service utilization may help identify hospitalized COPD patients at higher risk for readmission. |

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| Barnett, S. W. (2013). Getting the Facts Right on Pre-K inand the President's Pre-K Proposal Retrieved from New Brunswick, NJ | Edu | Regression discontinuity and other methods. | The results of the two methods have been consistent | The report reviews the research related to four key issues regarding the pre-K proposal. 1. Does high-quality pre-K have lasting benefits? 2. What is the evidence for the $7 to $1 return on investment in pre-K? 3. Do non-disadvantaged children benefit from pre-K, and is a targeted or a universal approach to pre-K more effective? 4. Are large-scale public programs, including Head Start, effective? |
| Bibbins-Domingo, K. (2019). Integrating Social Care Into the Delivery of Health Care. JAMA, 322(18), 1763-1764. doi:10.1001/jama.2019.15603 | SDH | The report describes 5 overarching goals, each supported by recommendations, necessary to achieve integration of social care into health care. | The recommendations of this consensus committee report reflect the importance of social factors in determining the health of individuals and the need to recognize the broader environment in which health systems operate. Now is an opportune time for health system leaders, policy makers, and those who work in the health care and social care sectors to proceed in a collaborative fashion to address social needs within the context of health care delivery and improve the health of the people and populations they serve. | The recommendations of this consensus committee report reflect the importance of social factors in determining the health of individuals and the need to recognize the broader environment in which health systems operate. Now is an opportune time for health system leaders, policy makers, and those who work in the health care and social care sectors to proceed in a collaborative fashion to address social needs within the context of health care delivery and improve the health |
| Blanco, I., Diego, I., Bueno, P., Fernández, E., Casas-Maldonado, F., Esquinas, C., . . . Miravitlles, M. (2018). Geographical Distribution of COPD Prevalence in the Americas. Copd, 15(4), 317-325. doi:10.1080/15412555.2018.1481936 | N&PE | Surveys estimating chronic obstructive pulmonary disease (COPD) prevalence are unevenly distributed in the Americas, which make it difficult to estimate accurately its geographical distribution. The geographic information system inverse distance weighted (IDW) interpolation technique has proved to be an effective tool in spatial distribution estimation of epidemiological variables, even when real data are few or widely spread. | Most of the remaining American regions showed intermediate values of COPD prevalence | It may be a valuable help to draw attention about the worrying prevalence of this preventable and treatable disease. |
| Buhr, R. G., Jackson, N. J., Kominski, G. F., Dubinett, S. M., Mangione, C. M., & Ong, M. K. (2020). Readmission Rates for Chronic Obstructive Pulmonary Disease Under the Hospital Readmissions Reduction Program: an Interrupted Time Series Analysis. Journal of General Internal Medicine, 35(12), 3581-3590. | HC | A retrospective cohort, evaluating readmissions across implementation periods for HRRP penalties ("pre-HRRP" January 2010-April 2011, "implementation" May 2011-September 2012, "partial penalty" October 2012-September 2014, and "full penalty" October 2014-December 2016). Calculated differences-in-differences (DID) for 30-day COPD versus HRRP Phase 1 and non-HRRP readmissions. | COPD discharges for 1.2 million Medicare enrollees were compared with 22 million non-HRRP and 3.4 million HRRP Phase 1 discharges. COPD readmissions decreased from 19 to 17% over the study. This reduction was significantly greater than non-HRRP conditions (DID - 0.41%), but not HRRP Phase 1 (DID + 0.02%). A parallel trend was observed in the privately insured, with significant reduction compared with non-HRRP (DID - 0.83%), but not HRRP Phase 1 conditions (DID - 0.45%). Non-significant reductions occurred in Medicaid (DID - 0.52% vs. non-HRRP | In Medicare, HRRP implementation was associated with reductions in COPD readmissions compared with non-HRRP controls but not versus other HRRP conditions. Parallel findings were observed in commercial insurance, but not in Medicaid. Condition-specific penalties may not reduce readmissions further than existing HRRP trends. |
| Chen, A. S., Revere, L., Ratanatawan, A., Beck, C. L., & Allo, J. A. (2019). A Comparative Analysis of Academic and Nonacademic Hospitals on Outcome Measures and Patient Satisfaction. Am J Med Qual, 34(4), 367-375. | HC | This study examines whether the Hospital Readmissions Reduction Program (HRRP), which penalizes hospitals with excess readmissions for certain conditions, has reduced hospital readmissions and led to unintended consequences. | Did not find any evidence of cost-shifting, delayed readmission, or selection on discharge disposition or patient income. However, the HRRP reduced the likelihood of Hispanic patients with target conditions being admitted by 2% to 4%. | Observe several notable trends when examining the 30-day all cause readmissions by condition from 2008 to 2014. |

| Reference | Type | Methods | Findings | Conclusions |
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| Croft JB, W. A., Liu Y, et al. (2018). Urban-Rural County and State Differences in Chronic Obstructive Pulmonary Disease — United States, 2015. Morbidity and Mortality Weekly Report (MMWR), 67(7), 205–211. Retrieved from https://www.cdc.gov/mmwr/volumes/67/wr/mm6707a1.htm?s_cid=mm6707a1_ | N&PE | A multilevel regression and poststratification approach was used to estimate model-predicted COPD prevalence for U.S. counties in 2015. | Overall 5.9% of U.S. residents lived in rural counties in 2015. State-specific percentages of rural residents ranged from zero percent in Connecticut, Delaware, District of Columbia, New Jersey, and Rhode Island to 34.7% in Montana. | Additional efforts are needed to prevent risk factors and overcome barriers to early diagnosis, and the appropriate treatment and management of COPD. Improving access to such health care might improve quality of life and reduce hospital readmissions among COPD patients and reduce COPD mortality. |
| Dalal, A. A., Liu, F., & Riedel, A. A. (2011). Cost trends among commercially insured and Medicare Advantage-insured patients with chronic obstructive pulmonary disease: 2006 through 2009. Int J Chron Obstruct Pulmon Dis, 6, 533-542. doi:10.2147/copd.S24591 | HC | Patient-level and visit-level health care costs in the calendar years 2006, 2007, 2008, and 2009 were assessed for patients with evidence of COPD. Generalized linear models adjusting for sex, age category, and geographic region were used to investigate cost trends over time for patients with Medicare or commercial insurance. | Medical costs, which ranged from an annual mean of US$2382 (Medicare 2007) to US$3339 (commercial 2009) per patient, comprised the majority of total costs in all years for patients with either type of insurance. COPD-related costs were less for Medicare than commercial cohorts. In the multivariate analysis, total costs increased by approximately 6% per year for commercial insurance patients (cost ratio 1.06; 95% confidence interval [CI] 1.04-1.07; P < 0.001) and 5% per year for Medicare patients (cost ratio 1.05; 95% CI 1.03-1.07; P < 0.001). Costs for outpatient and emergency department visits increased significantly over time in both populations. Standard admission costs increased significantly for Medicare patients (cost ratio 1.03; 95% CI 1.00-1.05; P = 0.03), but not | COPD imposed a substantial economic burden on patients and the health care system, with costs increasing significantly in both the Medicare and commercial populations. |
| Davis, C., Bender, M., Smith, T., & Broad, J. (2015). Feasibility and Acute Care Utilization Outcomes of a Post-Acute Transitional Telemonitoring Program for Underserved Chronic Disease Patients. Telemedicine and e-Health, 21(9), 705-713. doi:10.1089/tmj.2014.0181 | HC | Patients were enrolled into the program between October 2010 and August 2012. Primary outcomes included rates of emergency department (ED) visits and all-cause re-admission at 30, 90, and 180 days postdischarge. Program and functional status at enrollment and discharge and satisfaction with telemonitoring at discharge were measured. Telemonitoring included daily symptomatology recording and was removed at 90 days. A control cohort was identified through electronic health records and propensity-matched via 15 variables to achieve a sample size with | Program patients showed 50% reduction in 30-day re-admission and 13-19% reduction in 180-day re-admission compared with control patients. There was no significant difference in ED utilization. Patients were satisfied with telemonitoring services, and functional status improved by program end. | This feasibility study suggests telemonitoring in the context of a transitional care model following an acute event may reduce all-cause 30-day re-admissions by up to 50% and has the potential to reduce long-term acute care utilization and thus care costs. More rigorous and long-term investigation is warranted. |
| DeVoe, J. E., Bazemore, A. W., Cottrell, E. K., Likumahuwa-Ackman, S., Grandmont, J., Spach, N., & Gold, R. (2016). Perspectives in Primary Care: A Conceptual Framework and Path for Integrating Social Determinants of Health Into Primary Care Practice. Ann Fam Med, 14(2), 104-108. doi:10.1370/afm.1903 | SDH | Patients were enrolled into the program between October 2010 and August 2012. Primary outcomes included rates of emergency department (ED) visits and all-cause re-admission at 30, 90, and 180 days postdischarge. Program and functional status at enrollment and discharge and satisfaction with telemonitoring at discharge were measured. Telemonitoring included daily symptomatology recording and was removed at 90 days. A control cohort was identified through electronic health records and propensity-matched via 15 variables to achieve a sample size with | Program patients showed 50% reduction in 30-day re-admission and 13–19% reduction in 180-day re-admission compared with control patients. There was no significant difference in ED utilization. Patients were satisfied with telemonitoring services, and functional status improved by program end. | This feasibility study suggests telemonitoring in the context of a transitional care model following an acute event may reduce all-cause 30-day re-admissions by up to 50% and has the potential to reduce long-term acute care utilization and thus care costs. More rigorous and long-term investigation is warranted. |
| FeedingAmerica. (2022). Hunger in America. Retrieved from https://www.feedingamerica.org/hunger-in-america/impact-of-hunger | Food | The Hunger in America 2014 data files are the sole property of Feeding America but can be provided to researchers in SAS format by request. Two types of datasets are available for use: 1. The public-use datasets include agency, program and client level data in three separate files that are not linked to one another. 2. The restricted-use datasets s include agency, program and client level data in three separate files. | According to the USDA, more than 38 million people, including 12 million children, in the United States are food insecure. The pandemic has increased food insecurity among families with children and communities of color, who already faced hunger at much higher rates before the pandemic. Every community in the country is home to families who face hunger. But rural communities are especially hard hit by hunger. Many households that experience food insecurity do not qualify for federal nutrition programs and visit their local food banks and other food programs for extra support. Hunger in African American, Latino, and Native American communities is higher because of systemic racial injustice. To achieve a hunger-free | By 2025, Feeding America, in collaboration with our network and partners, will ensure access to enough nutritious food for people struggling with hunger and make meaningful progress toward ending hunger. |

| Citation | Category | Methods | Results | Conclusions |
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| Franck, C., Grandi, S. M., & Eisenberg, M. J. (2013). Agricultural Subsidies and the American Obesity Epidemic. American Journal of Preventive Medicine, 45(3), 327-333. doi:https://doi.org/10.1016/j.amepre.2013.04.010 | Food | Policy reforms will be important determinants of the future of obesity in America, primarily through indemnity program revisions, and the allocation of increasing amounts of resources to sustainable agriculture. Public health intervention will be required at the policy level to promote healthy behavioral changes in consumers. The 2013 Farm Bill will be the key mechanism to induce such policy change in the near future. | Government-issued agricultural subsidies are worsening obesity trends in America. Current agricultural policy remains largely uninformed by public health discourse. | Although subsidies provide a necessary safety net to farmers operating in a volatile trade, existing price support programs continue to create strong economic incentives to overproduce a select number of crops at the expense of agricultural diversity and American health. The business of food is the most ubiquitous and powerful industry in the world, dominated by influential stakeholders and interest groups. Public health officials have had little say in shaping the American food system. Thus, the current nutritional environment remains uninformed by healthy eating |
| Fraze, T., Lewis, V. A., Rodriguez, H. P., & Fisher, E. S. (2016). Housing, Transportation, And Food: How ACOs Seek To Improve Population Health By Addressing Nonmedical Needs Of Patients. Health Affairs, 35(11), 2109-2115. doi:10.1377/hlthaff.2016.0727 | N&PE | Qualitative research with leaders and managers of ACOs to understand clinical transformation activities. Included two sets of data in our analyses. The first set consisted of the results from fifty-eight semistructured telephone interviews with leaders at thirty-two ACOs. The second set was information from in-depth site visits at three of those ACOs. To identify potential ACOs for the study, used two sources: the National Survey of Accountable Care Organizations, which surveys newly formed ACOs, and a database of ACOs maintained by our research team. Chose ACOs to ensure diversity in terms of geographical region, composition, safety-net status, leadership type, clinical transformation | Sixteen of the thirty-two ACOs we studied addressed patients' nonmedical needs. Based on analyses, developed a typology that divided the approaches used to integrate patients' nonmedical needs with medical care into four categories ( Exhibit 1 ). Distinguished between two types of integration: organizational integration (for example, related to the integration of governance across distinct medical and nonmedical services) and service delivery integration. ACOs that addressed patients' nonmedical needs displayed varying levels of partnership and integration with other types of organizations (for example, public health, community, social service, and government organizations). Defined service delivery integration as the use of programs or processes designed to meet patients' nonmedical needs with some degree of integration across | Population health management through integrated medical and nonmedical services has garnered significant attention in the past few years, yet there is little understanding of how best to implement integrated services to improve population health. Reform initiatives, especially ACOs, hold the potential for expanding the base of responsibility by moving from a reactive approach to a proactive one. Our study offers early insights into how some ACOs assumed responsibility for addressing patients' nonmedical needs. |
| Gaffney, A. W., Himmelstein, D. U., Christiani, D. C., & Woolhandler, S. (2021). Socioeconomic Inequality in Respiratory Health in the US From 1959 to 2018. JAMA Intern Med, 181(7), 968-976. doi:10.1001/jamainternmed.2021.2441 | C&SC | This repeated cross-sectional analysis of the nationally representative National Health and Nutrition Examination Surveys (NHANES) and predecessor surveys, conducted from 1959 to 2018. included 160 495 participants aged 6 to 74 years. Trends in socioeconomic disparities in prevalence of current/former smoking among adults aged 25 to 74 years; 3 respiratory symptoms (dyspnea on exertion, cough, and wheezing) among adults aged 40 to 74 years; asthma stratified by age (6-11, 12-17, and 18-74 years); chronic obstructive pulmonary disease ([COPD] adults aged 40-74 years); and 3 measures of pulmonary function (forced expiratory volume in 1 second [FEV1], forced vital capacity [FVC], and FEV1/FVC<0.70) among adults aged 24 to 74 years. | Our sample included 160 495 individuals surveyed between 1959 and 2018: 27 948 children aged 6 to 11 years; 26 956 children aged 12 to 17 years; and 105 591 adults aged 18 to 74 years. Income- and education-based disparities in smoking prevalence widened from 1971 to 2018. Socioeconomic disparities in respiratory symptoms persisted or worsened from 1959 to 2018. For instance, from 1971 to 1975, 44.5% of those in the lowest income quintile reported dyspnea on exertion vs 26.4% of those in the highest quintile, whereas from 2017 to 2018 the corresponding proportions were 48.3% and 27.9%. Disparities in cough and wheezing rose over time. Asthma prevalence rose for all children after 1980, but more sharply among poorer children. Income-based disparities in diagnosed COPD also widened over time, from 4.5 percentage points (age- and sex-adjusted) in 1971 to 11.3 percentage points from 2013 to 2018. Socioeconomic disparities in FEV1 and FVC also increased. For instance, from 1971 to 1975, the age- and height-adjusted FEV1 of men in the lowest income quintile was 203.6 mL lower than men in the highest quintile, a difference that widened to 248.5 mL from 2007 to 2012 (95% | Socioeconomic disparities in pulmonary health persisted and potentially worsened over the past 6 decades, suggesting that the benefits of improved air quality and smoking reductions have not been equally distributed. Socioeconomic position may function as an independent determinant of pulmonary health. |
| Gavish, R., Levy, A., Dekel, O. K., Karp, E., & Maimon, N. (2015). The Association Between Hospital Readmission and Pulmonologist Follow-up Visits in Patients With COPD. Chest, 148(2), 375-381. doi:https://doi.org/10.1378/chest.14-1453 | HC | Our population-based retrospective cohort study analyzed the data of all patients with COPD who were treated at a lung institute in an Israeli hospital and were hospitalized between January 1, 2004, and December 31, 2010. Multivariate logistic regression was used to characterize the patient who did not attend the follow-up visit and to examine the effect of lack of visit on rehospitalization within 90 days of discharge. Cox proportional hazards analysis was used to model the effect of lacking visit on additional | Of the 195 patients enrolled in the study, 44.1% had follow-up visits with pulmonologists within 30 days of discharge. Not attending the follow-up visit was associated with distant residence, a higher number of hospitalizations in the previous year, a lack of a recommendation in the discharge letter for a follow-up visit, and a lower frequency of follow-up visits with pulmonologists in the previous year. Moreover, not attending the follow-up visit was associated with a significant increased risk of rehospitalization within 90 days of discharge (OR, 2.91; 95% CI, 1.06-8.01). | Early follow-up visits with pulmonologists seem to reduce the exacerbation-related rehospitalization rates of patients with COPD. We recommend that patients have early postdischarge follow-up visits with pulmonologists. |
| Gershon, A. S., Dolmage, T. E., Stephenson, A., & Jackson, B. (2012). Chronic Obstructive Pulmonary Disease and SocioEconomic Status: a Systematic Review. COPD: Journal of Chronic Obstructive Pulmonary Disease, 9(3), 216- | ES | Electronic databases to October 2011 were searched for studies of adults who had or were at risk for COPD that quantified an association between a measure of socioeconomic status and at least one COPD health outcome. Two authors independently reviewed studies, assessed study quality, and for eligible studies, extracted | Regardless of the population, socioeconomic status measure or COPD outcome examined, with few exceptions, consistent significant inverse associations between socioeconomic status and COPD outcomes were found. Most studies found that individuals of the lowest socioeconomic strata were at least twice as likely to have poor outcomes as those of the highest (range from no difference to 10-fold difference). | Social and economic disadvantage appears to have a significant consistent impact on COPD mortality and morbidity. These findings point to the need for public health strategies and research to address socioeconomic status disparity in individuals with COPD. |

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| Gershon, A. S., Thiruchelvam, D., Aaron, S., Stanbrook, M., Vozoris, N., Tan, W. C., . . . To, T. (2019). Socioeconomic status (SES) and 30-day hospital readmissions for chronic obstructive pulmonary (COPD) disease: A population-based cohort study. PLOS ONE, 14(5), e0216741. | C&SC | A population-based cohort study was conducted using health administrative data from Ontario, Canada. All hospitalizations for COPD between 2004 and 2014 were considered. The primary exposures were socioeconomic status as measured by residential instability (an ecologic variable), and comorbidities such as cardiovascular disease and cancer. Other domains of socioeconomic status were considered as secondary exposures. Logistic regression with generalized estimating equations was used to examine the effect of exposures, adjusting for other patient factors, on 30- | There were 126,013 patients contributing to 252,756 index COPD hospitalizations from 168 Ontario hospitals. Of these hospitalizations, 19.4% resulted in a readmission and 2.8% resulted in death within 30 days. After adjusting for other factors, readmissions or death were modestly more likely among people with the highest residential instability compared to the lowest (OR 1.05, 95% CI 1.01-1.09). Comorbidities such as cardiovascular disease and cancer, as well as other aspects of low socioeconomic status also increased readmission or death risk. | Socioeconomic status, measured in various ways, and many comorbidities predict 30-day readmission or death in patients hospitalized for COPD. Strategies that address these factors may help reduce readmissions and death. |
| Goto, T., Faridi, M. K., Gibo, K., Camargo, C. A., & Hasegawa, K. (2017). Sex and racial/ethnic differences in the reason for 30-day readmission after COPD hospitalization. Respiratory Medicine, 131, 6-10. doi:https://doi.org/10.1016/j.rmed.2017.07.056 | C&SC | We conducted a retrospective cohort study using 2006-2012 data from the State Inpatient Database of eight geographically-diverse US states (Arkansas, California, Florida, Iowa, Nebraska, New York, Utah, and Washington). After identifying all hospitalizations for COPD made by patients aged ≥40 years, we investigated the primary diagnostic code for all-cause readmissions within 30 days after the original COPD hospitalization, among the overall group and by sex and race/ethnicity strata. | Between 2006 and 2012, there was a total of 845,465 COPD hospitalizations at risk for 30-day readmissions in the eight states. COPD was the leading diagnostic for 30-day readmission after COPD hospitalization, both overall (28%) and across all sex and race/ethnicity strata. The proportion of respiratory diseases (COPD, pneumonia, respiratory failure, and asthma) as the readmission diagnosis was higher in non-Hispanic black (55%), compared to non-Hispanic white (52%) and Hispanics (51%) (p < 0.001). The proportion of asthma as the readmission diagnosis differed significantly by sex (6% in men and 9% in women; p < 0.001). Similarly, the proportion of asthma also differed significantly by race/ethnicity (5% in non-Hispanic white, 16% in non-Hispanic black, 15% | In this analysis of all-payer population-based data, we found sex and racial/ethnic differences in the reason for 30-day readmission in patients hospitalized for COPD. |
| Granger, C. L., Wijayarathna, R., Suh, E.-S., Arbane, G., Denehy, L., Murphy, P., & Hart, N. (2017). Uptake of telehealth implementation for COPD patients in a high-poverty, inner-city environment: A survey. Chronic Respiratory Disease, 15(1), 81-84. doi:10.1177/1479972317707653 | HC | Prospectively assessed 98 patients admitted with an acute exacerbation of COPD (mean age: 70.5 ± 9.3 years; force expired volume in the first second: 0.75 ± 0.39 L; 59% male) recording educational level attained and home computer and internet access. | Hospital readmission surveillance occurred up to 2.7 (2.6–2.8) years following the index hospital admission. Only 16% of patients had a computer and only 14% had internet access; this group were younger and more educated than those without a computer. There was no difference in hospital readmissions over 2 years between those with and without access to a computer or internet. Only 12% of the whole cohort were educated to a school leaving age of 16 years and this group were more likely to be still working. School leaving age was directly associated with | Data highlights the current challenges to the widespread implementation of telehealth in COPD patients as there is limited availability of computer and internet access with such patients demonstrating a lower level of education achievement. |
| Han, M. K., Martinez, C. H., Au, D. H., Bourbeau, J., Boyd, C. M., Branson, R., . . . Dransfield, M. T. (2016). Meeting the challenge of COPD care delivery in the USA: a multiprovider perspective. Lancet Respir Med, 4(6), 473-526. doi:10.1016/s2213-2600(16)00094-1 | HC | Summarise expert opinion from key stakeholders—patients, caregivers, and medical professionals, as well as representatives from health systems, insurance companies, and industry—to understand barriers to care delivery and propose potential solutions. | Cost-effectiveness analyses have produced highly variable and sometimes conflicting results. | There are no easy solutions, but engaging patients and innovative thinkers in the development of solutions is crucial. Financial incentives might be important in raising engagement of providers and health systems. Lowering co-pays for maintenance drugs could result in improved adherence and, ultimately, decreased overall health-care spending. Given the substantial geographical diversity, health systems will need to find their own solutions to improve care coordination and integration, until better data for interventions that are |
| Hernandez, D. J. (2011). Double Jeopardy Overview: How Third-Grade Reading Skills and Poverty Influence High School Graduation. Retrieved from Baltimore, Maryland: | Edu | This report updates a 2011 research brief with new data on graduation rates for students living in concentrated poverty. | For children who were poor, lived in neighborhoods of concentrated poverty and not reading proficiently, the proportion jumped to 35 percent. About 31 percent of poor African-American students and 33 percent of poor Hispanic students who did not hit the third-grade proficiency mark failed to graduate. These rates are greater than those for White students with poor reading skills. But the racial and ethnic graduation gaps disappear when students master reading by the end of | Limited language skills and low literacy skills are associated with other determinants and worse health outcomes |

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| HFHS, H. F. H. S. (2021). Social Factors May Affect Hospital Readmissions. Health Affairs. | C&SC | Using in-house data to determine each patient's age, sex, race, marital status, street address, and diagnosis, the researchers mapped patients' addresses to census data to determine their neighborhood socioeconomic factors, including percentage of families with incomes below the federal poverty level, median household income, and percentage of the population aged 25 and older without a | Greater likelihood that patients living in high poverty neighborhoods would be readmitted. | A lack of family or social support, along with factors of poverty, can lead to detrimental effects. |
| Holt, J. B., Zhang, X., Presley-Cantrell, L., & Croft, J. B. (2011). Geographic disparities in chronic obstructive pulmonary disease (COPD) hospitalization among Medicare beneficiaries in the United States. Int J Chron Obstruct Pulmon Dis, 6, 321-328. doi:10.2147/copd.S19945 | N&PE | Almost 3.8 million COPD hospitalization records were extracted from Medicare claims for 1995-2006, and the total population of eligible Medicare beneficiaries was extracted from the Medicare enrollment records to calculate COPD hospitalization rates by Health Service Area (HSA), (n = 949). Spatial cluster analysis and Bayesian hierarchical spatial modeling were used to characterize the geography of COPD hospitalizations. | The overall COPD hospitalization rate was 11.30 per 1,000 beneficiaries for the aggregated period 1995-2006. HSA-level COPD hospitalization rates had a median of 11.7 and a range of 3.0 (Cache, UT) to 76.3 (Pike, KY). Excessive hospitalization risk was concentrated in Appalachia, the southern Great Lakes, the Mississippi Delta, the Deep South, and west Texas. In the Bayesian spatial mixture model, 73% of variability of COPD hospitalization relative risk was attributed to unidentified regional social and physical environments shared by HSAs rather than to unique local | We discovered distinct geographic patterns in COPD hospitalization rates and risks attributed to both regionally-shared environmental risk factors and HSA-unique environmental contexts. The correlates of these geographic patterns remain to be determined. Geographic comparisons of COPD hospitalization risk provide insights for better public health practice, policies, and programs for COPD prevention. |
| Hood, C. M., Gennuso, K. P., Swain, G. R., & Catlin, B. B. (2016). County Health Rankings: Relationships Between Determinant Factors and Health Outcomes. Am J Prev Med, 50(2), 129-135. doi:10.1016/j.amepre.2015.08.024 | SDH | Data for the current study were from the 2015 CHR. Thirty-five measures for 45 states were compiled into four health factors composite scores and one health outcomes composite score. The relative contributions of health factors to health outcomes were estimated using hierarchical linear regression modeling in March 2015. County population size; rural/urban status; and gender, race, and age distributions were included as control variables. | Overall, the relative contributions of socioeconomic factors, health behaviors, clinical care, and the physical environment to the health outcomes composite score were 47%, 34%, 16%, and 3%, respectively. Although the CHR model performed better in some states than others, these results provide broad empirical support for the CHR model and weightings. | This paper further provides a framework by which to prioritize health-related investments, and a call to action for healthcare providers and the schools that educate them. Realizing the greatest improvements in population health will require addressing the social and economic determinants of health. |
| Jiang, X., Xiao, H., Segal, R., Mobley, W. C., & Park, H. (2018). Trends in Readmission Rates, Hospital Charges, and Mortality for Patients With Chronic Obstructive Pulmonary Disease (COPD) in Florida From 2009 to 2014. Clinical Therapeutics, 40(4), 613-626.e611. doi:https://doi.org/10.1016/j.clinthera.2018.03.006 | HC | A retrospective analysis of adult patients (≥18 years of age) with COPD was conducted by using the Healthcare Cost and Utilization Project Florida State Inpatient Database, 2009 to 2014. Weighted least squares regression was used to assess trends in the COPD readmission rate on a yearly basis, as well as other outcomes of interest. A multivariable logistic regression was used to identify patient characteristics that were associated with 30-day COPD readmissions. | Overall, 268,084 adults were identified as having COPD. Between 2009 and 2014, more than half of patients aged 65-84 years, most were white, 55% were female, and 73% had Medicare. The unadjusted rate for COPD-related 30-day readmissions did not change (8.04% to 7.85%; P = 0.434). However, the mean total charge for 30-day COPD-related readmissions was significantly higher in 2014 ($40,611) compared with that in 2009 ($36,714) (P = 0.011). The overall unadjusted in-hospital mortality of COPD-related hospitalizations significantly decreased from 1.83% in 2009 to 1.34% in 2014 (P < 0.001). In a multivariable logistic regression model, patients with COPD were 2% less likely to be readmitted to the hospital for each additional year (odds ratio [OR], 0.98 [95% confidence interval (CI), 0.97-0.99]). Factors associated with significantly higher odds of COPD-related readmission were: older age (45 ≤ age ≤ 64 years; OR, 1.91 [95% CI, 1.70-2.14]), being male (OR, 1.14 [95% CI, 1.10-1.17]), and being a | Although the adjusted odds of COPD readmissions slightly decreased, as did the length of stay and all-cause in-patient mortality, the financial burden increased substantially. Future strategies to further reduce readmissions of patients with COPD and curb financial burden in Florida are needed. |
| Jinjuvadia, C., Jinjuvadia, R., Mandapakala, C., Durairajan, N., Liangpunsakul, S., & Soubani, A. O. (2017). Trends in Outcomes, Financial Burden, and Mortality for Acute Exacerbation of Chronic Obstructive Pulmonary Disease (COPD) in the United States from 2002 to 2010. COPD: Journal of Chronic Obstructive Pulmonary | HC | All data were weighted using discharge level values, based on the relative proportion of the total U.S. hospital patient population accounted for by that record, to produce 100% national estimates. | Overall, the rate for COPD hospitalizations in the United States has not changed significantly from 2002 to 2010 (3.31% to 3.43%, slope 0.020, p = 0.608). Similarly, the rates of primary diagnosis of COPD also did not change significantly over the past few years (1.68% to 1.59%, slope −0.01, p = 0.665) | Although the rate of hospitalization for secondary diagnosis increased from 1.63% to 1.84%, there was no significant increase in hospitalization rate per 10,000 adult US populations |

| Citation | Type | Column 3 | Column 4 | Column 5 |
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| Keating, A., Lee, A., & Holland, A. E. (2011). What prevents people with chronic obstructive pulmonary disease from attending pulmonary rehabilitation? A systematic review. Chronic Respiratory Disease, 8(2), 89-99. doi:10.1177/1479972310393756 | HC | Seven electronic databases were searched for qualitative or quantitative studies that documented factors associated with uptake and completion of pulmonary rehabilitation in people with COPD. | The only demographic features that consistently predicted non-completion were being a current smoker (pooled odds ratio 0.17, 95% confidence interval 0.10 to 0.32) and depression. | In conclusion poor access to transport and lack of perceived benefit affect uptake of pulmonary rehabilitation. Current smokers and patients who are depressed are at increased risk of non-completion. Enhancing attendance in pulmonary rehabilitation will require more attention to transportation, support for those at risk of non-completion and greater involvement of patients in informed decisions about |
| Kushel, M. B., Gupta, R., Gee, L., & Haas, J. S. (2006). Housing instability and food insecurity as barriers to health care among low-income americans. Journal of General Internal Medicine, 21(1), 71-77. doi:10.1111/j.1525-1497.2005.00278.x | Food | Self-reported measures of past-year access: (1) not having a usual source of care, (2) postponing needed medical care, or (3) postponing medication; and past-year utilization: (1) not having an ambulatory care visit, (2) having emergency department (ED) visits, or (3) inpatient hospitalization. | 23.6% of subjects had housing instability and 42.7% had food insecurity. In multivariate logistic regression models, housing instability was independently associated with not having a usual source of care (adjusted odds ratio [AOR] 1.31, 95% confidence interval [CI] 1.08 to 1.59), postponing needed medical care (AOR 1.84, 95% CI 1.46 to 2.31) and postponing medications (AOR 2.16, 95% CI 1.70 to 2.74), increased ED use (AOR: 1.43, 95% CI 1.20 to 1.70), and hospitalizations (AOR 1.30, 95% CI 1.01 to 1.67). Food insecurity was independently associated with postponing needed medical care (AOR 1.74, 95% CI 1.38 to 2.21) and postponing medications (AOR 2.15, 95% CI 1.62 to 2.85), increased ED | Housing instability and food insecurity are associated with poor access to ambulatory care and high rates of acute care. These competing life demands may lead to delays in seeking care and predispose to acute care. |
| Manickam, R. N., Mu, Y., Kshirsagar, A. V., & Bang, H. (2017). Area-Level Poverty and Excess Hospital Readmission Ratios. The American Journal of Medicine, 130(4), e153-e155. doi:https://doi.org/10.1016/j.amjmed.2016.08.047 | ES | The excess readmission ratio is the standardized rate ratio, the observed rate divided by model-based expected rate. Data for acute myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disease, and total hip and knee arthroplasty in 2011-2014.5 For socioeconomic status, we used "percentage below federal-poverty-level",6 linked to Hospital Service Areas. | Data were available for >2100 hospitals (Table). The mean/median of all excess readmission ratios were ~1, as expected for proper standardization. The variability was largest for hip-knee, compared with other conditions (SD 0.14 vs ~0.07). The distribution of poverty was skewed to the right (mean/median 17.1/16.8, range 3%-56%). Correlations between the excess readmission ratios and poverty were relatively small in magnitude, but all positive; highest for heart failure (0.13, P <.0001) and lowest for hip-knee (0.01, P = .6), primarily due to higher variability for hip-knee.7 Excess readmission ratio distributions largely overlapped for 5 poverty subgroups (Appendix, available online). | Current CMS models might focus on the appropriate variables, models, and metrics in determining readmissions across the areas of varying poverty, or weak associations may be destined based on the methodologies used in the CMS models and our study. |
| McConnell, K. J., Renfro, S., Chan, B. K., Meath, T. H., Mendelson, A., Cohen, D., . . . Lindrooth, R. C. (2017). Early Performance in Medicaid Accountable Care Organizations: A Comparison of Oregon and Colorado. JAMA Intern Med, 177(4), 538-545. doi:10.1001/jamainternmed.2016.9098 | ES | Oregon initiated its Medicaid transformation in 2012, supported by a $1.9 billion investment from the federal government, moving most Medicaid enrollees into 16 Coordinated Care Organizations, which managed care within a global budget. Colorado initiated its Medicaid Accountable Care Collaborative in 2011, creating 7 Regional Care Collaborative Organizations that received funding to coordinate care with providers and connect Medicaid enrollees with community services. Data spanning July 1, 2010, through December 31, 2014 (18 months before intervention and 24 months after intervention, treating 2012 as a transition year) were analyzed for 452 371 Oregon and 330 511 Colorado Medicaid enrollees, assessing changes in outcomes using difference-in-differences analyses of regional focus, primary care homes, and care coordination. Oregon's Coordinated Care Organization model was more comprehensive in its reform goals and in the imposition of downside financial risk. Performance on | In a total of 782 882 Medicaid enrollees, 45.0% were male, with mean (SD) age 16.74 (14.41) years. Standardized expenditures for selected services declined in both states during the 2010-2014 period, but these decreases were not significantly different between the 2 states. Oregon's model was associated with reductions in emergency department visits (−6.28 per 1000 beneficiary-months; 95% CI, −10.51 to −2.05) and primary care visits (−15.09 visits per 1000 beneficiary-months; 95% CI, −26.57 to −3.61), improvements in acute preventable hospital admissions (−1.01 admissions per 1000 beneficiary-months; 95% CI, −1.61 to −0.42), 3 of 4 measures of access (well-child visits, ages 3-6 years, 2.69%; 95% CI, 1.20% to 4.19%; adolescent well-care visits, 6.77%; 95% CI, 5.22% to 8.32%; and adult access to preventive ambulatory care, 1.26%; 95% CI, 0.28% to 2.25%), and 1 of 4 measures of appropriateness of care (avoidance of head imaging for uncomplicated headache, 2.59%; 95% CI, 1.35% to 3.83%). | Two years into implementation, Oregon's and Colorado's Medicaid ACO models exhibited similar performance on standardized expenditures for selected services. Oregon's model, marked by a large federal investment and movement to global budgets, was associated with improvements in some measures of utilization, access, and quality, but Colorado's model paralleled Oregon's on several other metrics. |
| NAEH. (2020). Homelessness and Racial Disparities. Retrieved from https://endhomelessness.org/homelessness-in-america/what-causes-homelessness/inequality/ | N&PE | Any effort to end homelessness in the United States must address the range of issues that have resulted from racial inequity. This includes assuring affordable, stable housing for all. Systems, programs, and individuals that serve people experiencing homelessness should monitor their outcomes in order to eliminate disparities in the way that they provide | African Americans, who represent 13 percent of the general population but account for 39 percent of people experiencing homelessness and more than 50 percent of homeless families with children. This imbalance has not improved over time. | Black and Hispanic Americans (40% and 20%) having the majority of housing-insecurities |

| Citation | Type | Methods | Results | Conclusions |
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| Nastars, D. R., Rojas, J. D., Ottenbacher, K. J., & Graham, J. E. (2019). Race/Ethnicity and 30-Day Readmission Rates in Medicare Beneficiaries With COPD. Respiratory Care, 64(8), 931-936. doi:10.4187/respcare.06475 | HC | 100% Medicare in-patient (Part A) files to identify patients hospitalized with COPD (MS-DRG codes 190, 191, 192) who were discharged between January 1, 2013, and September 13, 2014. The outcome measure was an unplanned readmission within 30 d of hospital discharge. Used generalized linear mixed models to test the independent effects of race/ethnicity on 30-d readmission. | The sample included 298,706 Medicare beneficiaries hospitalized for COPD: 87% white, 8% African-American, and 5% Hispanic. Mean age was 77.7 ± 7.7 y. Overall, 17.3% of subjects experienced an unplanned readmission. Whites (17.4%) and African-Americans (17.7%) had significantly higher unadjusted rates than Hispanics, and Hispanics demonstrated the lowest readmission rate (16.3%). The minority groups generally displayed higher-risk clinical profiles. After controlling for those differences, the multivariable model suggested a benefit for both minority groups in terms of readmission risk. The adjusted readmission rates for whites, African-Americans, and Hispanics were 16.6%, 15.9%, and 14.6%, | Racial/ethnic disparities in observed readmission rates may be largely explained by the more severe clinical profiles of minority populations. Controlling for known clinical risk factors effectively mediates the relationship between race/ethnicity and readmission. |
| Njoku, C. M., Alqahtani, J. S., Wimmer, B. C., Peterson, G. M., Kinsman, L., Hurst, J. R., & Bereznicki, B. J. (2020). Risk factors and associated outcomes of hospital readmission in COPD: A systematic review. Respiratory Medicine, 173, 105988. doi:https://doi.org/10.1016/j.rmed.2020.105988 | HC | The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were followed. Five databases were searched for relevant studies. | Fifty-seven studies from 30 countries met the inclusion criteria. The prevalence of COPD-related readmission varied from 2.6 to 82.2% at 30 days, 11.8-44.8% at 31-90 days, 17.9-63.0% at 6 months, and 25.0-87.0% at 12 months post-discharge. There were differences in the reported factors associated with readmissions, which may reflect variations in the local context, such as the availability of community-based services to care for exacerbations of COPD. Hospitalisation in the previous year prior to index admission was the key predictor of COPD-related readmission. Comorbidities (in particular asthma), living in a deprived area and living in or discharge to a nursing home were also associated with readmission. Relative to those without readmissions, readmitted patients had higher in-hospital mortality rates, shorter long-term survival, poorer quality of life, longer hospital stay, increased recurrence of subsequent readmissions, | Hospitalisation in the previous year was the principal risk factor for COPD-related readmissions. Variation in the prevalence and the reported factors associated with COPD-related readmission indicate that risk factors cannot be generalised, and interventions should be tailored to the local healthcare environment. |
| Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The prevalence of limited health literacy. Journal of General Internal Medicine, 20(2), 175-184. doi:10.1111/j.1525-1497.2005.40245.x | Edu | Searched the literature for the period 1963 through January 2004 and identified 2,132 references related to a set of specified search terms. Of the 134 articles and published abstracts retrieved, 85 met inclusion criteria, which were 1) conducted in the United States with > or =25 adults, 2) addressed a hypothesis related to health care, 3) identified a measurement instrument, and 4) presented primary data. The authors extracted data to compare studies by population, methods, and results. | The 85 studies reviewed include data on 31,129 subjects, and report a prevalence of low health literacy between 0% and 68%. Pooled analyses of these data reveal that the weighted prevalence of low health literacy was 26% (95% confidence interval [CI], 22% to 29%) and of marginal health literacy was 20% (95% CI, 16% to 23%). Most studies used either the Rapid Estimate of Adult Literacy in Medicine (REALM) or versions of the Test of Functional Health Literacy in Adults (TOFHLA). The prevalence of low health literacy was not associated with gender (P=.38) or measurement instrument (P=.23) but was associated with level of | A pooled analysis of published reports on health literacy cannot provide a nationally representative prevalence estimate. This systematic review exhibits that limited health literacy, as depicted in the medical literature, is prevalent and is consistently associated with education, ethnicity, and age. It is essential to simplify health services and improve health education. Such changes have the potential to improve the health of Americans and address the health disparities that exist today. |
| Perera, P. N., Armstrong, E. P., Sherrill, D. L., & Skrepnek, G. H. (2012). Acute Exacerbations of COPD in the United States: Inpatient Burden and Predictors of Costs and Mortality. COPD: Journal of Chronic Obstructive Pulmonary Disease, 9(2), 131-141. doi:10.3109/15412555.2011.650239 | ES | This study was a retrospective, attributable, inpatient burden of illness investigation of a nationally-representative sample of hospital discharges for AECOPD in the United States. | Overall, 1,254,703 hospitalizations were reported for AECOPD in 2006. Aggregate, mean, and median costs for 2006, and costs inflation adjusted to 2010 US$ are reported in Table 1. The average LoS was 5.9(±6.1) days (median: 4 days), and in-hospital mortality was 4.3% (N = 53,748). | The findings of the current study indicate that the national inpatient burden of AECOPD is substantial. Furthermore, a number of co-morbidities were associated with increased inpatient costs and mortality, suggesting the relevance of co-morbidities in COPD. The presence of co-existing diseases can be used to identify patients prone to increased resource utilization and poor outcomes. More targeted management of these co-morbidities in COPD may help to reduce some of the disease burden in COPD. Future research should be conducted to explore the outcomes of comprehensive COPD management programs that concurrently |
| Press, V. G., Au, D. H., Bourbeau, J., Dransfield, M. T., Gershon, A. S., Krishnan, J. A., . . . Feemster, L. C. (2019). Reducing Chronic Obstructive Pulmonary Disease Hospital Readmissions. An Official American Thoracic Society Workshop Report. Ann Am Thorac Soc, 16(2), 161-170. doi:10.1513/AnnalsATS.201811- | HC | Assembled a diverse group of stakeholders, including patients, clinicians, researchers, payers, and program leaders, to present and discuss approaches to reducing readmissions. We drew on existing programs, implementation methodologies, and published evidence across COPD and other disease-related readmission reduction programs to develop a workshop program (see Table E1 in the online supplement) | Despite the dearth of published evidence to reduce readmissions beyond available COPD guidelines, many hospitals across the United States began to develop and implement programs, based on little evidence, due to the financial penalty. | This workshop provided an opportunity for experts to review and analyze the literature, hear from key stakeholders, including the patient, clinician, and payer perspectives, and review existing readmission reduction programs to summarize the state of practice and identify key barriers and facilitators for success. |

| Citation | Category | Methods | Results | Conclusions |
|---|---|---|---|---|
| Rambachan, A., Abe-Jones, Y., Fernandez, A., & Shahram, Y. (2021). Racial Disparities in 7-Day Readmissions from an Adult Hospital Medicine Service. Journal of Racial and Ethnic Health Disparities. doi:10.1007/s40615-021-01088-3 | C&SC | This is a retrospective study. We performed multivariable logistic regression between patient race/ethnicity and 7-day readmission. Mediation analysis was performed for limited English proficiency (LEP) status. Subgroup analyses were performed for patients with initial admissions for congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), and cancer. | There were 18,808 patients in our dataset who were discharged between July 2016 and June 2019. A total of 1,297 (6.9%) patients were readmitted within 7 days. Following multivariable regression, patients who identified as Black (OR 1.35, 95% CI 1.15-1.58, p <0.001) and patients who identified as Asian (OR 1.26, 95% CI 1.06-1.50, p = 0.008) had higher odds of readmission compared to white patients. Multivariable regression at the subgroup level for CHF, COPD, and cancer readmissions did not demonstrate significant differences between the racial and ethnic | Black patients and Asian patients experienced higher rates of 7-day readmission than patients who identified as white, confirmed on adjusted analysis. |
| Ryan, A. M., Krinsky, S., Adler-Milstein, J., Damberg, C. L., Maurer, K. A., & Hollingsworth, J. M. (2017). Association Between Hospitals' Engagement in Value-Based Reforms and Readmission Reduction in the Hospital Readmission Reduction Program. JAMA Internal Medicine, 177(6), 862-868. | HC | Longitudinal study of 2837 US hospitals between 2008 and 2015. | Found that participation in 1 or more Medicare value-based reforms—including the Meaningful Use of Electronic Health Records program, the Accountable Care Organization programs, and the Bundled Payment for Care Initiative—was associated with greater reductions in 30-day risk-standardized readmission rates under the Hospital Readmission Reduction Program. | Lend support for Medicare's multipronged strategy to improve hospital value. |
| Sharma, G., Kuo, Y.-F., Freeman, J. L., Zhang, D. D., & Goodwin, J. S. (2010). Outpatient Follow-up Visit and 30-Day Emergency Department Visit and Readmission in Patients Hospitalized for Chronic Obstructive Pulmonary Disease. Archives of Internal Medicine, 170(18), 1664-1670. doi:10.1001/archinternmed.2010.345 | HC | We conducted a retrospective cohort study of fee-for-service Medicare beneficiaries with an identifiable PCP who were hospitalized for COPD between 1996 and 2006. Three or more visits to a PCP in the year prior to the hospitalization established a PCP for a patient. We performed a Cox proportional hazard regression with time-dependent covariates to determine the risk of 30-day ER visit and readmission in patients with or without a follow-up visit to their PCP or pulmonologist. | Of the 62 746 patients admitted for COPD, 66.9% had a follow-up visit with their PCP or pulmonologist within 30 days of discharge. Factors associated with lower likelihood of outpatient follow-up visit were longer length of hospital stay, prior hospitalization for COPD, older age, black race, lower socioeconomic status, and emergency admission. Those receiving care at nonteaching, for-profit, and smaller-sized hospitals were more likely to have a follow-up visit. In a multivariate, time-dependent analysis, patients who had a follow-up visit had a significantly reduced risk of an ER visit (hazard ratio [HR], 0.86; 95% confidence interval [CI], | Continuity with patient's PCP or pulmonologist after an acute hospitalization may lower rates of ER visits and readmission in patients with COPD. |
| Singh, G., Zhang, W., Kuo, Y.-F., & Sharma, G. (2016). Association of Psychological Disorders With 30-Day Readmission Rates in Patients With COPD. Chest, 149(4), 905-915. doi:https://doi.org/10.1378/chest.15-0449 | HC | We analyzed data from 5% fee-for-service Medicare beneficiaries diagnosed with COPD (International Classification of Diseases, Ninth Revision code, 491.xx, 492.xx, 493.xx, and 496.xx) between 2001 and 2011 who were hospitalized with a primary discharge diagnosis of COPD or a primary discharge diagnosis of respiratory failure (518.xx and 799.1) with secondary diagnosis of COPD. We hypothesized that such psychological disorders as depression, anxiety, psychosis, alcohol abuse, and drug abuse are independently associated with an increased risk of | Between 2001 and 2011, 135,498 hospitalizations occurred for COPD in 80,088 fee-for-service Medicare beneficiaries. Of these, 30,218 (22.30%) patients had one or more psychological disorders. In multivariate analyses, odds of 30-day readmission were higher in patients with COPD who had depression (OR, 1.34; 95% CI, 1.29-1.39), anxiety (OR, 1.43; 95% CI, 1.37-1.50), psychosis (OR, 1.18; 95% CI, 1.10-1.27), alcohol abuse (OR, 1.30; 95% CI, 1.15-1.47), and drug abuse (OR, 1.29; 95% CI, 1.11-1.50) compared with those who did not have these disorders. These psychological disorders increased amount of variation in 30-day readmission attributed to patient characteristics by 37%. | Psychological disorders like depression, anxiety, psychosis, alcohol abuse, and drug abuse are independently associated with higher all-cause 30-day readmission rates for Medicare beneficiaries with COPD. |
| Tsui, E. K. (2010). Sectoral job training as an intervention to improve health equity. American journal of public health, 100 Suppl 1(Suppl 1), S88-S94. doi:10.2105/AJPH.2009.181826 | SDH | Lliterature on the social determinants of health strongly suggests the value of examining social policy interventions for potential links to health equity. | Sectoral training programs, whether part of urban development initiatives or federal educational and training efforts, appear to comprise a workforce development approach with increasing popularity and reach. However, the success of these programs depends on a complex array of factors, which have been summarized here. Likewise, an important set of outcomes depends on these programs' success. Implemented well and with attention to the recommendations given here, sectoral training programs provide an unprecedented opportunity to potentially improve not only the employment, incomes, and educational levels of historically disadvantaged populations, but also their health and the health equity of the areas in which they live. | There is growing evidence suggesting the vocational training and links to health equity as programs provide unprecedented opportunity to improve employment, incomes, and educational levels of historically disadvantaged populations, but also health and health equity of their area of residence |

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| Young, M., Villgran, V., Ledgerwood, C., Schmetzer, A., & Cheema, T. (2021). Developing a Multidisciplinary Approach to the COPD Care Pathway. Critical Care Nursing Quarterly, 44(1), 121-127. doi:10.1097/cnq.0000000000000345 | HC | Utilization of a multidisciplinary team approach and care pathway to improve patient outcomes, reduce exacerbations, hospital admissions, and total cost of care, and improve patient satisfaction. | A worldwide initiative is underway in developing a care model that is multifactorial through continuous monitoring of patients to manage and control symptoms, achieve medication adherence, and provide socioeconomic resources. | COPD is financially and socioeconomically manageable. |
| Youngblade, L. M., Curry, L. A., Novak, M., Vogel, B., & Shenkman, E. A. (2006). The impact of community risks and resources on adolescent risky behavior and health care expenditures. Journal of Adolescent Health, 38(5), 486-494. doi:https://doi.org/10.1016/j.jadohealth.2005.07.016 | N&PE | Claims and encounter data were used to classify adolescents enrolled in Florida's Healthy Kids Program into two groups: those who engaged in risky behavior (ARB) and those who did not (NRB). Hierarchical linear modeling techniques were used to predict the odds of risky behavior, the odds of health care use, and health care expenditures based on individual and community characteristics. | ARB consumed significantly more health care services than NRB, and their higher use and charges were attributable not only to individual level factors (i.e., age, gender, presence of special health care need, metropolitan residence status), but also to community level factors (i.e., social capital, risky behavior rates, violence, and ethnic/racial composition) as well. In particular, community investment in social capital predicted lower levels of risky behavior as well as lower health care expenditures. | This information is important in terms of policy efforts at providing health care for this vulnerable group of individuals, as well in developing prevention and intervention programs that can be delivered through the health care system and via links to community supports. |

# Darren W. Brownlee, MHA

A proven leader in the management of both people and resources with special strengths in operations, analytics, health equity and enhancing access. Excellent communicator, with an exceptional ability to guide providers and staff to quickly adapt to rapidly changing environments by articulating a vision, strategy and creating a participatory atmosphere and inspiring employee engagement. Excels in fostering collaboration, mentoring, and forming successful internal and external partnerships.

## Education

**Doctor of Public Health, Johns Hopkins University, Baltimore, MD**                    *Expected 03/2022*
Health Policy & Management, Bloomberg School of Public Health

**Master of Health Administration, Hofstra University, Hempstead, NY**                    **05/2012**
School of Health Sciences & Human Services

**Bachelor of Arts, Hofstra University, Hempstead, NY**                    **05/2009**
Psychology, College of Liberal Arts & Sciences

**West Virginia University, Morgantown, WV**                    **6/2005 – 01/2008**
*Studied Exercise Physiology*

## Professional Experience

**Mayo Clinic, Jacksonville, FL**                    **10/2018 – Present**
*Senior Division Chair, Education, Mayo Clinic Florida*                    05/2021
*Secretary, Operations Coordinating Group (OCG), Mayo Clinic Florida*
*Instructor, Health Care Administration, Mayo Clinic College of Medicine*

- Provides administrative leadership and oversight of the Education shield in Florida, developing and supporting policies, programs, and initiatives in alignment with Mayo Clinic's Enterprise and the Mayo Clinic College of Medicine and Science strategic directives.
- Accountable for strategic planning, staff assessment and mentoring, fiscal management, and monitoring of operational and programmatic outcomes of the five Schools of Education (Continuous Professional Development, Graduate Medical Education, Graduate School of Biomedical Sciences, School of Health Sciences and School of Medicine) and the Experiential Learning Center (Procedural Skills Laboratory and Simulation Laboratory).
- Committee leader of Operations Coordinating Group (OCG) conducting annual reviews of all departments, divisions, centers, and independent multidisciplinary programs, facilitating shared knowledge of progress, priorities, and expectations. Committee provides critical assessments of financial performance, clinical operations, education activities, and research efforts, as well as initiatives for demand generation, outreach, patient experience and equity, diversity, and inclusion. Results in recommendations to Chief Executive Officer and Chief Administrative Officer on funding and physician FTE allocation.

*Operations Administrator*                    10/2018
- Managed clinical, operational, financial, and regulatory activity for the MCF Divisions of Pulmonary, Allergy, and Sleep Medicine, Respiratory Services, and previously the Department of Dermatology and Cosmetic Center, overseeing a total book of business of over **~170M** in gross revenue.
- Organized a multidisciplinary team in the development of a short and long-term plan to modernize and enlarge the bronchoscopy procedure suite. Ultimately, **$1M** in capital funding was secured to transform MCF's Interventional Pulmonology capabilities through facility redesign and integration of state-of-the-art Medical Robotic equipment.
- As a member of the enterprise-wide search committee, helped to lead an extensive national search for Mayo Clinic's first Chief Digital Officer. A core focus was ensuring a diverse pool of candidates was cultivated and analyzed.
- Led multidisciplinary teams in optimizing (1) the compliance of Dermatology's Medical Residency Program through the Accreditation Council for Graduate Medical Education (ACGME), (2) growth of the Pulmonary Critical Care Medicine Fellowship, re-accreditation of the Pulmonary Hypertension Clinical Program – standing as the first Florida accredited Pulmonary Hypertension Center of Comprehensive Care (PHCC), and (3) accreditation of the Cystic Fibrosis Foundation (CFF) Center Adult Program – standing as Mayo Clinic Florida's first CF Center.
- **1** of **17** enterprise-wide task force members who created actionable, feasible, and data-informed measures and strategies to increase access to Mayo's clinical research programs to underrepresented minorities. The resulting recommendation increased major grants from National Cancer Institute (NCI) and clinical and translational science awards, as well as enhanced Mayo's reputation as a global leader in patient care, and as a comprehensive cancer center designation.

- increased major grants from National Cancer Institute (NCI) and clinical and translational science awards, as well as enhanced Mayo's reputation as a global leader in patient care, and as a comprehensive cancer center designation.

**Johns Hopkins Medicine, Baltimore, MD**                                                  **07/2012 – 10/2018**
*Assistant Administrator – Department of Medicine (DOM)*                                     08/2016
- Administratively managed the Department of Medicine's Division of Allergy and Clinical Immunology, comprised of approximately **25** faculty, **10** post-doc fellows, and **30** staff. In collaboration with the Division Director, direct the day-to-day administrative, personnel and financial operations of the division.
- Oversight of clinical practice, faculty and staff human resources management, overall financial performance, grant and contract administration oversight, and strategic visioning/business development of the Division and ensures compliance with government, hospital, university and school policies and procedures.
- Founded and co-chaired a DOM committee raising awareness of health inequities, facilitating the delivery of cultural/linguistic/spiritual competent, patient-centered care, and creating a diverse and inclusive workforce.
- Reviewed financial and clinical productivity reports monthly and takes appropriate follow up action (i.e., direct Senior Financial Analyst in conducting variance analysis, recommend make-up clinic sessions)
- Led system-wide committee responsible in raising **1.7M** in contributions to improve the lives of families across central Maryland; committed to helping families facing poverty obtain access to housing, healthy, affordable food and healthcare, and a quality education.

*Assistant Administrator of Ambulatory & Access Operations – Department of Medicine (DOM)*       09/2015
- Provided leadership and direction to the DOM ambulatory practices regarding efficient care delivery models, staffing analyses, performance improvement, clinical and administrative systems enhancements, regulatory requirements, revenue cycle management, patient satisfaction and provider engagement for **15** specialties.
- Partnered with the Associate Vice Chair of Ambulatory Care to review and update the departmental Outpatient Clinic Standards within **12** Divisions.
- Directly supervised and actively engaged data analyst, **7** Ambulatory Services Managers, a Patient Access Manager and **40** Central Scheduling Staff including all aspects of recruitment, orientation, talent management, performance evaluation and discipline, and other key human resources functions.
- Worked collaboratively with physician, nursing, and care management leadership to provide effective, efficient, and patient-centered care in the Department's outpatient care settings.

*Clinical Operations Project Manager – Department of Surgery (DOS)*                            11/2013
- Managed **5** Discharge Coordinators responsible for post discharge appointments throughout **10** inpatient units; Scheduling appointments for various specialties with the goal of decreasing readmissions, shortening length of stay and increasing patient satisfaction. Initiated bedside appointment scheduling within this role.
- Assisted with the creation of a compensation model around physician productivity comparing **90+** surgeon salaries to the median standards of the Association of American Medical Colleges to address supplement requests for the FY16 budget.
- Supported the Department of Surgical Oncology with the creation of tables, progress reports and data for their T32 Grant, funding **8** Fellows and **2** post graduate students.
- Created a comprehensive model monitoring the clinical activities for new and return consults within **30** ambulatory departments with a volume of **30,000+** visits to assist the Departments FY16 budget planning process which lead to an uptick in provider productivity.
- Regularly produce and connect to primary sources of data (Microsoft Access, Tableau, EPIC & Business Objects) to generate information on provider RVU's, volumes, OR cases, referrals, and other metrics to provide recommendations on process improvement initiatives.
- Developed clinical practice protocols for **7+** Divisions to monitor staff compliance, decreasing the average lag to schedule appointments by **80%** within the Division of Endocrine Surgery.

***Project Coordinator (Postgraduate Administrative Resident)*** <span style="float:right">07/2012</span>

*Business Development & Financial Analysis*
- Created a system-wide furniture recovery initiative generating **$10,000** in revenue, avoiding **$50,000** in expenses, and donating **$75,000** worth of material to non-profit organizations.
- Completed a FY13 budget analysis and projection for a Surgery clinic with **13,000+** visits peryear.
- Generated a broad study displaying activities of **110** discharges across the Department ofMedicine.

*Clinical Operations & Management*
- Supervised business practices and procedures to support day-to-day operations of a Sustainability Network team, a General Services program promoting environmental sustainability throughout Johns Hopkins Institutions.
- Oversaw implementation of EPIC electronic medical records for a clinic with **14** physicians.
- Directed a Lean Six Sigma Project at a full-service **328** bed acute care community hospital, managing the turnaround time of **7,000+** specimens, eliminating waste and increasing productivity by **10%.**

*Project Management*
- Developed a comprehensive report utilizing institutional data for a financial analysis identifying **$200,000** in cost improvement measures.
- Devised an Institutional Property Policy for Corporate Security generating a source of income for the Department of General Services.
- Assisted in a Joint Commission project identifying and monitoring performance standards for **50** contracts.
- Administered an Endoscopy throughput optimization lean project, overseeing room utilization, overtime expenses and patient satisfaction of **50** cases.

## Committees & Professional Affiliations

| | |
|---|---|
| • **National Association of Health Services Executives** – Parliamentarian, NAHSE National | **10/2021 – Present** |
| • **Enterprise Experiential Learning Council,** – Committee Member | **05/2021 - Present** |
| • **Simulation Technology and Equipment Committee, Mayo Clinic** – Committee Member | **05/2021 - Present** |
| • **Mayo Clinic Jacksonville Administrative Committee, Florida –** Committee Member | **05/2021 - Present** |
| • **American College of Healthcare Executives, North Florida** – Local Program Council Director | **04/2021 – Present** |
| • **Mayo Community Engagement Committee (CEC) –** Committee Member | **12/2020 – Present** |
| • **Mayo Clinic Equity, Inclusion & Diversity Committee –** Committee Member | **11/2020 – Present** |
| • **Mayo Employee Resource Group (MERG) –** Executive Sponsor | **08/2020 – Present** |
| • **Mayo Clinic Education Committee, Florida –** Secretary | **01/2020 – Present** |
| • **Hofstra University, School of Health Professions & Human Services –** Dean's Advisory Board | **09/2019 – Present** |
| • **National Association of Health Services Executives** – Member/Past Chapter President | **07/2012 – Present** |
| • **American College of Healthcare Executives** – Member | **03/2010 – Present** |
| • **Alpha Phi Alpha Fraternity, Inc.** – Life Member | **11/2006 – Present** |
| • **United Way of Northeast Florida** – Atlantic Circle Member | **12/2018 – 10/2021** |
| • **Robert Wood Johnson Foundation, Culture of Health Leaders Program** – Leader | **09/2017 – 01/2021** |
| • **United Way of Northeast Florida –** Stein Fellow | **10/2019 – 12/2020** |
| • **American Lung Association, LUNG FORCE** – Cabinet Member | **04/2019 – 03/2020** |
| • **National Association of Health Services Executives** – Parliamentarian, NAHSE National | **10/2017 – 10/2019** |
| • **American Heart Association Young Hearts** – Board Member | **09/2017 – 10/2018** |
| • **Johns Hopkins Bayview Health Equity Committee** – Chair | **08/2017 – 10/2018** |
| • **Johns Hopkins Department of Medicine Civic Engagement Committee** – Co-Chair | **01/ 2016 – 10/2018** |
| • **Johns Hopkins United Way Committee** – Committee Member | **05/2016 – 10/2018** |
| • **Johns Hopkins Medicine Task Force –** Trust Building Committee Member | **11/2015** |
| • **Johns Hopkins Hospital Martin Luther King, Jr. Committee** – Committee Member | **07/2015 – 10/2018** |
| • **Emerging Leaders United** – Committee Member | **12/2012 – 10/2018** |
| • **Big Brothers Big Sisters of the Greater Chesapeake** – BIG Brother | **10/2012 – 10/2018** |

## Awards & Honors

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| • **Northwest High School – Athletics Hall of Fame** | **10/2017** |
| • **Hofstra University – Young Alumni of the Year 2017** | **09/2017** |
| • **The National Association of Health Services Executives – Promise Award** | **10/2016** |
| • **The Maryland General Assembly, Senator Shirley Nathan-Pulliam – Official Citation** | **11/2015** |
| • **United Way of Central Maryland - Philanthropic 5** | **05/2014** |
| • **The Daily Record – 20 in Their Twenties** | **04/2014** |
| • **93.9 WKYS – DMV's Top 30 Under 30 2014** | **02/2014** |
| • **The Silvercrest Center for Nursing and Rehabilitation – Humanitarian Award** | **05/2012** |
| • **Hofstra University – Athletic Scholarship** | **01/2008** |
| • **West Virginia University – Athletic Scholarship** | **06/2005** |

Curriculum Vitae and Bibliography

Darren W. Brownlee, MHA

## Personal Information

| | |
|---|---|
| Work Address: | 4500 San Pablo Road<br>Jacksonville, FL 32224 |
| Email Address: | Brownlee.Darren@mayo.edu |

## Present Academic Rank and Position

**Instructor in Health Care Administration** - Mayo Clinic College of Medicine and Science                                    07/01/2020 - Present

**Senior Division Chair, Education** - Mayo Clinic in Florida, Mayo Clinic College of Medicine and Science: Alix School of Medicine, School of Graduate Medical Education, School of Health Sciences, Graduate School of Biomedical Sciences, School of Continuous Professional Development, Immersive & Experiential Learning                                    05/12/2021 - Present

## Education

West Virginia University, Morgantown, West Virginia –
Exercise Physiology, School of Medicine                                    2008

Hofstra University, Hempstead, New York –
BA, Psychology                                    2009

Hofstra University, Hempstead, New York –
Master, Health Administration                                    2012

Johns Hopkins, Baltimore, Maryland –
DrPH, Health Policy and Management                                    *Expected March 2022*

## Honors and Awards

**Athletic Scholarship** – West Virginia University                                    06/2005

**Athletic Scholarship** – Hofstra University                                    01/2008

**Humanitarian Award** – The Silvercrest Center for Nursing and Rehabilitation                                    05/2012

**DMV'S Top 30 Under 30 2014** - 93.9 WKYS                                    02/2014

**20 in Their Twenties** – The Daily Record                                    04/2014

**Philanthropic 5** – United Way of Central Maryland                                    05/2014

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| **Official Citation** – The Maryland General Assembly, Senator Shirley Nathan-Pulliam | 11/2015 |
| **Promise Award** – The National Association of Health Services Executives | 10/2016 |
| **Young Alumni of the Year 2017** – Hofstra University | 09/2017 |
| **Athletics Hall of Fame** – Northwest High School | 10/2017 |

## Previous Professional Positions and Major Appointments

**Administrative Intern** –
Silvercrest Center for Nursing and Rehabilitation, Queens, New York         2011 - 2012


**Project Coordinator** –
Johns Hopkins Medicine, Baltimore, Maryland                                 2012 - 2013
General Services, Medical Affairs, Department of Surgery, Department of Medicine,
Sibley Memorial Hospital, Johns Hopkins Hospital

**Clinical Operations Project Manager** –
Johns Hopkins Medicine, Baltimore, Maryland                                 2013 - 2015

**Assistant Administrator of Ambulatory & Acces Operations** –
Johns Hopkins Medicine, Baltimore, Maryland                                 2015 - 2016
Department of Medicine (DOM)

**Assistant Administrator** –
Johns Hopkins Medicine, Baltimore, Maryland                                 2016 - 2018
Department of Medicine (DOM)

**Operations Administrator** –
Mayo Clinic, Jacksonville, Florida                                          2018 - 2021
Dermatology, Pulmonary, Allergy, Sleep Medicine, and Respiratory Services



## Professional Memberships and Societies

## Professional Memberships and Services

Alpha Phi Alpha Fraternity, Inc.
    Life Member                                          11/2006 - Present
American College of Healthcare Executives
    Member                                               03/2010 - Present
American College of Healthcare Executives, North Florida Chapter
    Local Program Council Director                        04/2021 - Present
American Heart Association Young Hearts
    Board Member                                         09/2017 - 10/2018
American Lung Association

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| Cabinet Member | 04/2019 – 05/2021 |

Big Brothers Big Sisters of the Greater Chesapeake
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| BIG Brother | 10/2012 - 10/2018 |

Emerging Leaders United
| | |
|---|---|
| Committee Member | 12/2012 - 10/2018 |

Hofstra University, School of Health Professions and Human Services
| | |
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| Dean's Advisory Board | 09/2019 - Present |

Johns Hopkins Bayview Health Equity Committee
| | |
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| Chair | 08/2017 - 10/2018 |

Johns Hopkins Department of Medicine Civic Engagement Committee
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| Co-Chair | 01/2016 - 10/2018 |

Johns Hopkins Hospital Martin Luther King, Jr. Committee
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| Committee Member | 07/2015 - 10/2018 |

Johns Hopkins United Way Committee
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| Committee Member | 05/2016 - 10/2018 |

Johns Hopkins Medicine Task Force
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| Trust Building Committee Member | 06/2015 - 11/2015 |

Mayo Clinic Education Committee, Florida
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| Secretary | 01/2020 - Present |

Mayo Clinic Jacksonville Administrative Committee, Florida
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| Committee Member | 05/2021 - Present |

Mayo Clinic, Office of Equity, Inclusion and Diversity
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| Committee Member | 11/2020 - Present |

Mayo Community Engagement Committee
| | |
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| Committee Member | 12/2020 - Present |

Mayo Employee Resource Group – ALMA MERG
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| Executive Committee of the Board | 08/2020 - Present |

National Association of Health Services Executives
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| Member/President | 07/2012 - 01/2017 |

National Association of Health Services Executives
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|---|---|
| Parliamentarian | 10/2017 - Present |
| Parliamentarian, NAHSE National | 10/2021 - Present |

Robert Wood Johnson Foundation, Culture of Health Leaders Program
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| Leader | 09/2017 - Present |

United Way of Northeast Florida
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|---|---|
| Executive Committee | 12/2018 - Present |
| Stein Fellow | 10/2019 - 12/2020 |

# Education Interests and Accomplishments

## Mentorship

Nicholas, Kadesha (Mentee)
**Description:** 03/2008
**Current Status:** Practice Manager
Mount Sinai Medical Center Miami Beach, Florida
**Outcome:**

Khan, Jamal (Mentee)
**Description:** 03/2012
**Current Status:** Director of Operations, Human Resources
Mayo Clinic Rochester
**Outcome:**

Clarence, Iana (Mentee)
**Description:** 06/2014
**Current Status:** Program Manager, DC Network for Expectant and Parenting Teens
DC Primary Care Association
**Outcome:**

Scott, Ryan 08/2016
**Description:**
**Current Status:** Public Health Student
University of Miami
**Outcome:**

Choudhry, Christopher (Mentee) 11/2016
**Description:**
**Current Status:** Director of Operations, Emergency Medicine
Columbia University Irving Medical Center
**Outcome:**

McFarland, Daniel 07/2018
**Description:**
**Current Status:** Assistant Administrator
Johns Hopkins Hospital
**Outcome:**

Eady-Ceasar, Mechelle 11/2018
**Description:**
**Current Status:** Program Manager of Executive Health
Mayo Clinic Florida
**Outcome:**

Jackson, Alexis 02/2019
**Description:**
**Current Status:** Operations Administrator, Hematology/Oncology, Radiation Oncology
Mayo Clinic Florida
**Outcome:**

Kidane, Amy                                                                                    11/2020
**Description:**
**Current Status:** Operations Manager, Radiology and Interventional Radiology
May Clinic Florida
**Outcome:**

Plowden, Quen                                                                                  06/2021
**Description:**
**Current Status:** Education Administrative Coordinator
Mayo Clinic Florida
**Outcome:**

Schofield, Ashely                                                                              07/2021
**Description:**
**Current Status:** Experience Improvement Advisor
Mayo Clinic Florida
**Outcome:**


## Academic Career Development

American College of Healthcare Executives (ACHE)
Congress on Healthcare Leadership                                                               03/2012
Chicago, Illinois

National Association of Health Services Executives (NAHSE)
Educational Conference                                                                         10/2012
Houston, Texas

American College of Healthcare Executives (ACHE)
Congress on Healthcare Leadership                                                               03/2013
Chicago, Illinois

National Association of Health Services Executives (NAHSE)
Educational Conference                                                                         10/2013
Miami, Florida

American College of Healthcare Executives (ACHE)
Congress on Healthcare Leadership                                                               03/2014
Chicago, Illinois

National Association of Health Services Executives (NAHSE)
Educational Conference                                                                         10/2014
Detroit, Michigan

American College of Healthcare Executives (ACHE)
Congress on Healthcare Leadership                                                               03/2015
Chicago, Illinois

National Association of Health Services Executives (NAHSE)
Educational Conference                                                                         10/2015
New Orleans, Louisiana

| | |
|---|---|
| American College of Healthcare Executives (ACHE)<br>Congress on Healthcare Leadership<br>Chicago, Illinois | 03/2016 |
| National Association of Health Services Executives (NAHSE)<br>Educational Conference<br>Las Vegas, Nevada | 10/2016 |
| National Association of Health Services Executives (NAHSE)<br>Educational Conference<br>San Antonio, Texas | 10/2017 |
| Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)<br>Fall Convening<br>Nashville, Tennessee | 10/2017 |
| 2017 National Forum on Quality Improvement in Health Care<br>Educational Conference<br>Orlando, Florida | 12/2017 |
| Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)<br>Winter Convening<br>Seattle, Washington | 01/2018 |
| American College of Healthcare Executives (ACHE)<br>Congress on Healthcare Leadership<br>Chicago, Illinois | 03/2018 |
| Policy Link Equity Summit<br>Educational Conference<br>Chicago, Illinois | 04/2018 |
| Reimagining Health Equity: Learning for Action<br>Educational Conference<br>Chicago, Illinois | 04/2018 |
| National Association of Health Services Executives (NAHSE)<br>Educational Conference<br>Orlando, Florida | 10/2018 |
| Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)<br>Fall Convening<br>New Orleans, Louisiana | 10/2018 |
| Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)<br>Fall Convening<br>Detroit, Michigan | 10/2018 |
| Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)<br>Winter Convening<br>Indianapolis, Indiana | 01/2019 |
| American College of Healthcare Executives (ACHE)<br>Congress on Healthcare Leadership<br>Chicago, Illinois | 03/2019 |

Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)     04/2019
Spring Convening
Raleigh, North Carolina

National Association of Health Services Executives (NAHSE)                          10/2019
Educational Conference
Washington, DC, United States of America

Robert Wood Johnson Foundation Culture of Health Leaders Convening (RWJF CoHL)     10/2019
Fall Convening
Albuquerque, New Mexico

## Institutional/Departmental Administrative Responsibilities, Committee Memberships and Other Activities

### Mayo Clinic

Mayo Clinic Education Committee
    Member                                                                 12/2019 - 12/2020

## Presentations Extramural

### Unclassified

Administrative Residency & Fellowship Presentation                                 05/2013
The Choice is Yours: Pathways to Residencies and Fellowships
New Orleans, Louisiana

Hosted/MC' d Dancing with the Hopkins Stars                                        03/2015
Dancing with the Hopkins Stars with a cast of eight couples representing The
Johns Hopkins Hospital and Health System, the Johns Hopkins University School of
Medicine, the Johns Hopkins University School of Public Health, Johns Hopkins
Bayview Medical Center, and Johns Hopkins Community Physicians. Each couple
chose a United Way program or nonprofit organization of choice to fundraise for
leading up to the event. As of the night of the event, more than $53,000 had been
pledged for the causes
Baltimore, Maryland

Morgan State Keynote Speaker                                                       05/2016
The Choice is Yours: Creating Your Legacy, Building Your Brand
Baltimore, Maryland

Shaping the Future: Diversity and Leadership with Mayo Clinic in Florida           05/2017
Administrative leaders share experiences about leadership and diversity at Mayo
Clinic in Florida
Jacksonville, Florida

Men's Forum                                                                        10/2018
A powerful interactive event, to include some of the most influential men &
executives from around the nation
Orlando, Florida

The Journey Toward a Culture of Health Equity                                          10/2018
Discussion with Johns Hopkins School of Public Health Academia
Baltimore, Maryland

The Implementation & Evolution of a Data Driven MCF COPD Program                        04/2019
Discussion with Johns Hopkins School of Public Health Academia
Jacksonville, Florida

My Path to Success                                                                     11/2019
UNF Presentation
Jacksonville, Florida

NAHSE Governance, Bylaws & Sustainability UPDATES                                       09/2021
NAHSE Updates
Jacksonville, Florida

RISE for Equity: Reflect, Inspire, Strengthen & Empower                                 11/2021
Prioritizing and addressing diversity, equity and inclusion in workforce
development and organizational culture are essential to providing optimal patient
care, achieving health equity, and attracting and engaging the workforce of the
future.

FAMU: School of Allied Health Sciences - 2022 S. Tanner Stafford Lecture Series        01/2022
The Division of Health Care Management Presents the 2022 S. Tanner Stafford
Lecture

MOS Mentoring Program Presents A Fireside Chat with Darren Brownlee, Sr                 03/2022
Division Chair – Education
Mentoring - investing time, know-how, and effort in enhancing another person's
growth, knowledge, and skills, in a way that prepares the individual for greater
productivity or achievement.

## Clinical Practice, Interests, and Accomplishments

Service Delivery in Health Care, Systems Engineering and Workflow Design in Health Care, Health
Equity/Health Disparities, Community Health, Population Health, Creating a Culture of Health,
Building and Leading Teams in Health Care, Management, Operations, Analytics, Internal and
External partnerships, Advocacy

## Research Grants Awarded

## Active Grants

## Foundation

Project Leader   Culture of Health Leaders Cohort Two - 2017. Funded by          09/2017 - 08/2020
                 Robert Wood Johnson Foundation. (74782)