A DATA ANALYSIS OF THE PREDICTIVE RISKS FOR READMISSION OF PATIENTS WITH DEPRESSION POST-MYOCARDIAL INFARCTION

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Title

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF NURSING PRACTICE

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ABSTRACT

Depression is prevalent in patients with cardiovascular disease (CVD). Past studies have found that one in five patients experience depression post-myocardial infarction (MI) (Osler et al., 2016; Thombs et al., 2006). Patients with depression post-MI are at increased risk for adverse outcomes, mortality, and readmission to the hospital (Hess et al., 2016; Szpakowski, Bennell, Qui, Kirdyak, & Wijeysundera, 2016). This study utilized retrospective data obtained from electronic medical records (EMRs) to examine the relationship between readmission rates and depression post-MI. The sample consisted of 593 patients with depression post-MI, and 98 patients, or 16.5%, were readmitted within 12 months post-MI. Demographic data including age, gender, and race were also analyzed in the study. The ICD-9 and ICD-10 codes requested consisted of MI and depression codes to ensure inclusion of all types of MI and depression diagnoses. The data sample consisted of men and women ages 40-70 years old who had a diagnosis of depression, had experienced an MI, and had visited their primary care provider within 12 months post-MI. The data were gathered from a date range of January 1st, 2012 to December 31st, 2016 to include a five-year representation of data. Using a Chi-Square Test of Independence and a Fischer's Exact Test, the findings of the data analysis concluded that there was no significant relationship (Region 1 P-value=0.6921; Region 2 P-value=0.4613) between depression screening and readmission in post-myocardial infarction patients for both regions examined within the organization. However, treatment data was not obtainable for the data sets, therefore, an analysis of the relationship between depression treatment and readmissions post-MI was not possible. Despite these findings, current guidelines and past evidence continue to recommend depression screening in post-MI patients to ensure patients receive appropriate treatment and care. Overall, recommendations of this study are for future studies to examine

depression screening, include analysis of treatment in post-MI patients, and for practitioners to screen post-MI patients for depression per the guidelines.

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DEDICATION

This dissertation is dedicated to my family for their unwavering support throughout my graduate school endeavors.

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CHAPTER ONE: INTRODUCTION

The connection between the body and mind continues to be a growing topic in research and clinical practice. Depression is the leading cause of disability world-wide, and cardiovascular disease (CVD) continues to be the deadliest disease world-wide and in the United States (Friederich, 2017; Mozzafarian et al., 2015; National Center for Health Statistics, 2017). The economic burden of depression is estimated at $210.5 billion, and the most significant portion of this burden relates to comorbidities with depression (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Depression is most common in the first 12 months following a myocardial infarction (MI), and occurs in 45% of patients with a peak occurrence at 3 months post-MI (Haws, Ramjeet, & Gray, 2011). However, depression often goes unrecognized in patients with cardiovascular disease (CVD), thus creating an area of concern.

In chapter one, the background and significance of depression in post-MI patients will be discussed. Current screening recommendations, prevalence of depression post-MI, and readmission in this cohort will be outlined to further demonstrate the importance of screening and treating depressed post-MI patients. Once the background has been examined, the significance of the project in relation to nursing and the healthcare organization is discussed. The purpose of this project, identifying predictive risks for readmission in depressed post-MI patients, will be examined along with the project objectives.

Background and Significance

The prevalence of depression in patients with CVD is significant, and subsequently the American Heart Association (AHA) has developed recommendations that routine screening for depression in patients with CVD be performed (Lichtman et al., 2008). The American Academy of Family Physicians (AAFP) went one step further and recommended depression screening in

patients specifically post-MI. Their recommendations are to screen for depression in patients who have had a myocardial infarction at regular intervals throughout the post-MI period (Green et al., 2009). Despite these recommendations, screening for depression post-MI is often missed.

A study examining prevalence of depression post-MI found that almost 19% of post-MI patients had depression 3 months post-MI, and only 3.3% of these patients were screened for depression in the first 3 months post-MI (Larsen, 2013). This compares to the prevalence of depression in the general population of 6.7% (Center for Behavioral Health Statistics and Quality, 2016). Ziegelstein et al. (2005) examined the ability of healthcare workers to identify depression in post-MI patients without use of a formal screen, and found that without a formal screen there was up to a 75% false-negative rate in recognizing depressive symptoms. The authors recommend that formal screening be incorporated into routine post-MI care (Ziegelstein et al., 2005). A similar study by Huffman et al. (2006) estimated that <15% of depressed CVD patients are diagnosed and treated for their depression. Therefore, the high prevalence of depression and under-recognition of depressive symptoms in cardiac patients is concerning.

Readmission to the hospital is a significant burden in healthcare. A study by Pederson, Warkentin, Majumdar, and McAlister (2016) found that patients who suffered from depression after discharge from the hospital had a 73% increased risk for readmission, and two-fold risk for death in 30 days compared to patients without depression. A study examining readmission specifically in patients post-MI, found that 61.7% of 3,609 patients were re-hospitalized within one year post-discharge (Southern et al., 2014). Beginning in 2012, the Centers for Medicare & Medicaid Services (CMS) were required by the Affordable Care Act to reduce reimbursement to healthcare organizations with excessive hospital readmissions for certain diagnoses, including MI's, and measures early readmission within 30 days post-discharge (Centers for Medicare &

Medicaid Services, 2016). The literature suggests that depression screening and treatment will lead to less readmissions post-MI, decreased emergency room visits, and overall cost savings for patients and healthcare organizations (Celano et al., 2016; Huffman et al., 2014).

Unfortunately, readmission for post-MI patients is high, as studies have found a 20% readmission rate in post-MI patients within 30-days post-discharge (Dharmarajan et al., 2013; Southern et al., 2014). Patients with a psychiatric comorbidity, such as depression, have an even higher rate of readmission post-MI. A study by Ahmedani et al. (2015) found that there was a 6% increase in the rate of readmission in depressed post-MI patients compared to post-MI patients without depression. Costs for readmission post-MI are substantially high. As part of the Healthcare Cost & Utilization Project (HCUP), the Agency for Research and Healthcare Quality (AHQR) examined trends of United States hospital readmissions in 2013, and found that there were over 71,000 readmissions for MI patients totaling over $1 billion in aggregate hospital costs (Fingar & Washington, 2015).

Statement of the Problem

In a meeting with the Family Medicine Director of Clinic Operations in Region 1 of the midwestern healthcare organization (MHO), the director expressed interest for improved mental healthcare in primary care. The director expressed interest in a project examining depression screening in cardiac patients with a focus on readmissions. The readmission rates in depressed post-MI patients were largely unknown for the MHO, therefore, a data analysis examining predictive risks for readmission in depressed post-MI patients was necessary.

Significance for Nursing and the MHO

The research conducted in this project has potential implications for improved depression healthcare for patients post-MI. Depression is a modifiable risk factor in CVD, thus by

identifying and treating depressive symptoms patients will less likely have a cardiac-related readmission (Reese et al., 2011). Depression screening will increase the amount of identified depression in post-MI patients, and allow for patients to be treated appropriately. With improved depression care, the literature suggests patients will have decreased mortality, less adverse outcomes, and a reduced risk for readmission to the hospital (Banankhah, Friedmann, & Thomas, 2015; Myers, Gerber, Benyamini, Goldbourt, & Drory, 2012; Pederson et al., 2016). Thus, depression screening and treatment in post-MI patients can potentially result in healthcare cost-savings for patients and healthcare organizations.

Project Description

Project Purpose

The purpose of this project was to identify predictive risks of readmission in post-MI patients within the MHO. The project intended to focus on examination of depression screening in relation to readmission of post-MI patients. Also, the project intended to examine readmission rates in patients who were screened and treated for depression post-MI. Other data examined included demographics, such as age, gender, race, and region to make comparisons to past research and identify any correlations. The analysis examined what type of provider was screening for depression, and the specialty of the provider performing the screening. By identifying potential risks for readmission in post-MI patients with depression, recommendations could be made for improved mental health care based on guidelines and past evidence.

Project Objectives

The following objectives were developed for the project:

1. Determine the percentage of readmission in patients within 12 months post-MI who have depression.
2. Determine the percentage of readmission in patients within 12 months post-MI who have depression and were screened for depression.
3. Determine the percentage of readmission in patients within 12 months post-MI who have depression, were screened for depression, and treated for depression.
4. Identify correlations or differences that can be made for depressed post-MI patients and demographic variables.
5. Determine what type of provider screened, diagnosed, and/or treated for depression in the sample.

These objectives will be discussed with the results in Chapter Four and further evaluated in Chapter Five. The use of a Logic Model will be utilized in the development, and in the evaluation of the objectives. The Logic Model will be further discussed along with a review of the literature, and the theoretical framework for the project within the next chapter.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Introduction

There is a substantial amount of literature regarding depression and CVD. Relevant and current studies were reviewed, and were obtained through multiple searches of the following databases: Academic Search Premier, CINAHL Complete, EBSCO MegaFILE, PsychINFO, COCHRANE databases of systematic reviews, and PubMed. Key words and search terms included but were not limited to: depression, depression screening, primary care, cardiovascular disease, coronary heart disease, myocardial infarction, acute myocardial infarction, heart attack, and readmission. Reviewing the literature focused on the following areas: depression in post-MI patients, recommendations for screening post-MI patients, screening tools, barriers to depression screening of post-MI patients, and hospital readmission in post-MI patients with depression.

Examining the literature regarding depression in post-MI patients helped in identifying the prevalence of depression, identifying outcomes for patients, and determining how depression is currently managed for this cohort. A review of past literature's recommendations for depression screening in post-MI patients clarified when to screen patients, and determined what were recommended screening tools. Next, identifying the barriers to screening post-MI patients helped to determine areas potentially needing improvements in mental healthcare. Lastly, review of the literature regarding readmission in patients post-MI provided an understanding of what may increase risks for readmission. Once risks for readmission have been identified, then recommendations may be made to decrease the risk for readmission in post-MI patients with depression.

Depression in Post-MI Patients

Patients who have experienced an MI are commonly found to have depression. Studies have found that one in every five patients hospitalized with an MI had symptoms for major depression (Osler et al., 2016; Thombs et al., 2006). Depression post-MI may also be a significant prognostic factor with studies indicating a worse prognosis for mortality remaining consistent over the past 25 years (Meijer et al., 2011). The AHA recently conducted a systematic review of literature examining depression as a risk factor for poor prognosis in patients post-MI. The committee recommended that depression be recognized as an established risk factor for poor prognosis after an MI due to an increase in risk for all-cause and cardiac mortality post-MI (Lichtman et al., 2014).

Prevalence and Mortality

Historically, depression in post-MI patients has been prevalent. As stated earlier, a systematic review by Thombs et al. (2006) examined the prevalence of depression in over 14,000 patients, and found that major depression occurred in 1 out of 5 post-MI patients. In a recent cohort study by Osler et al. (2016), depression was also found to occur in 20% of the 97,793 patients examined within 2 years post-MI. This prevalence rate is similar to previous study results that also show major depression is present in 20% of post-MI patients (Thombs et al., 2006). A more recent study examined 25,000 patients after a diagnosis of MI, and found that 15% of those patients were diagnosed with depression (May et al., 2017). For reference, the depression prevalence rate of the general population is 6.7% (Center for Behavioral Health Statistics and Quality, 2016).

Several studies have found an association between post-MI patients who have depression and adverse outcomes. A meta-analysis examining 25 years of past research concluded that post-

MI depression has a 2.25 times increased risk of all-cause mortality, and a 2.71 times increased risk of cardiac mortality (Meijer et al., 2011). A study by Osler et al. (2016) had similar results and found that depression in post-MI patients is associated with an increased risk of mortality in both patients who were previously diagnosed with depression and patients who developed new onset depression. A more recent study emphasized that having a previous diagnosis of depression will increase all-cause mortality, and concluded that history of depression is an adverse prognostic factor for post-MI patients (Sundboll et al., 2017). In fact, depression has been found to double the risk of death after an MI and/or diagnosis of CVD (May et al., 2017). Lastly, an important finding in the literature is that untreated depression had twice as high of a mortality rate compared to treated depression one year post-MI (Smolderen et al., 2017). This last point emphasizes the importance of depression treatment in post-MI patients.

Management of Depression Post-MI

Multiple studies have examined depression treatment after an MI. Treatment options for depression include non-pharmacologic methods and pharmacologic methods. The majority of the studies in the literature evaluated cardiac outcomes with use of cognitive behavior therapy and/or use of antidepressants, typically with use of a selective serotonin reuptake inhibitor (SSRI). In a review by Maverides and Nemeroff (2013), SSRI's were found to be the safest medication in patients with CVD, and recommend sertraline as first-line therapy for this patient population. SSRI's may also decrease risk for an arrhythmia and/or MI (Coupland et al., 2016). The AHA recommends sertraline or citalopram as first-line pharmacologic therapy for depression in cardiac patients, and that cognitive behavioral therapy and physical activity are effective in reducing depressive symptoms (Lichtman et al., 2008).

The Enhancing Recovery in Coronary Heart Disease (ENRICHD) trial implemented cognitive behavior therapy and SSRI treatment in 2,481 post-MI patients with depression. The authors found that the treatment had no impact on survival, however, it did improve patients' depression and social isolation (Berkman et al., 2003). A post-hoc analysis of the ENRICHD study found a significant decrease in risk for a recurrent MI and/or death in patients who were on a SSRI (Taylor et al., 2005). Another secondary data analysis using the ENRICHD trial data examined the effects of adequate treatment for depression post-MI. The analysis concluded that treating depression effectively decreased mortality (Banankhah et al., 2015).

In the Sertraline Antidepressant Heart Attack Randomized Trial (SADHART), the authors examined the impact of sertraline treatment in post-MI patients with depression. Results of the study found that sertraline is a safe medication for use in patients with depression post-MI, and that treatment with sertraline is effective (Glassman et al., 2002). The authors concluded that aggressive treatment of depression is indicated post-MI to decrease mortality and increase medication adherence in patients (Glassman et al., 2002).

In looking at the effects of other anti-depressants, a randomized controlled trial implemented treatment strategies in depressed post- MI patients examining the effects of mirtazapine, citalopram, and psychiatric care. In this study, the authors found that antidepressant treatment did not improve cardiovascular outcomes, but treating depression increased survival (Zuidersma, Conradi. Van Melle, Ormel, & de Jonge, 2013). The authors surmise that post-MI patients who receive antidepressant treatment are more motivated to care for themselves, and adhere to new medication and healthy lifestyle recommendations (Zuidersma et al., 2013).

Recommendations for Screening

Depression screening in patients with CVD is supported by multiple organizations. Advisories or guidelines have been developed recommending depression screening by the following entities: AHA, AAFP, and the National Institute for Health and Care Excellence (NICE). The United States Preventative Services Task Force (USPSTF) recently published a recommendation statement that depression screening be performed in the general adult population, stating that treatment of depression will improve patient outcomes (Siu & USPSTF, 2016). Overall, each organization has similar recommendations for depression screening.

The AHA developed their recommendations for screening of depression in response to the increased prevalence of depression in CVD patients. The advisory board determined that routine screening for depression should be performed in all settings, i.e. primary care, inpatient, cardiac rehabilitation, etc. If a patient does screen positive, they must be appropriately evaluated in the effort to avoid missing a diagnosis for depression (Lichtman et al., 2008). The AHA recommends using a two-step screening process with use of the Patient Health Questionnaire-2 (PHQ-2). First, using the PHQ-2, and if the screen is positive move onto the PHQ-9 consisting of 9 questions for a more thorough evaluation (Elderon, Smolderen, Na, & Whooley, 2011).

The AAFP developed guidelines for detecting depression post-MI that specifically aimed for use by the primary care provider. These guidelines were initially developed in 2009, and were more recently reaffirmed in 2014 (National Guideline Clearinghouse, 2014). The AAFP panel developed their guidelines in response to an evidence report issued by the Agency for Healthcare Research and Quality (AHQR). Their screening recommendation is that all patients with an MI be screened for depression with a standardized screening tool at regular intervals post-MI starting during their hospitalization (Green et al., 2009).

European guidelines similarly recommend screening CVD patients for depression, and offering treatment if indicated (Perk et al., 2012). The NICE in the United Kingdom, supports depression screening in patients with CVD followed by appropriate consult for treatment (NICE, 2010). The NICE guideline highlights the importance for all patients with depression who screen positive to be treated appropriately, and if providers are unsure how to treat that patient they are to refer that patient to a mental health specialist (NICE, 2010). The guideline does not specifically recommend certain screening intervals or screening tools, but does discuss in-depth treatment options for various cases (NICE, 2010).

Screening Tools for Depression

Multiple screening tools have been developed for depression, however, there is no single screening tool that has been decided upon as a standard for screening. Many screening tools have been validated for use in detecting depression. There is no standard depression screening tool for cardiac patients that has been identified, however, most researchers have been found to use either the PHQ-2, PHQ-9, or Beck's Depression Inventory (BDI).

Patient Health Questionnaire Depression Scale

The PHQ screening tools are commonly used in multiple healthcare settings with ease of use for the provider and patient. The original PHQ is a three page questionnaire that is self-reported by the patient, and assesses for eight other psychiatric diagnoses including: major depression, panic disorder, anxiety disorders, and bulimia nervosa (Kroenke, Spitzer, & Williams, 2003). The PHQ-9 was derived from the PHQ to help in diagnosis for major depression (Kroenke, Spitzer, & Williams, 2001). The PHQ tools include a two question and/or a nine question format. The PHQ-2 and PHQ-9 are recommended by the USPSTF, AHA, and the AAFP as depression screening tools (Lichtman, 2008; Mauerer, 2012; Siu & USPSTF, 2016)

The PHQ-2 questions the patient regarding frequency of a depressed mood and anhedonia over the previous two weeks giving a score of 0 for "not at all" up to a score of 3 for "nearly every day". If a patient screens positive, the PHQ-9 should be conducted. The 2-question format allows for a brief, but validated, screening to be given. The PHQ-2 is a condensed screening tool, and cannot be used for diagnosis of depression, however, it may be used to rule out depression (Mauerer, 2012). The PHQ-2 alone has been proven a valid depression screening tool with sensitivity of 86% and specificity of 78% for major depression (Arroll et al., 2010). The short form screening tool has specifically been proven a valid tool in CVD patients, and if providers are not comfortable using the PHQ-2, then the PHQ-9 is recommended for screening and diagnosis in CVD patients (McManus, Pipkin & Whooley, 2005).

The PHQ-9 is composed of a 9-item tool that is multifunctional, and may be used for screening, assisting in making a diagnosis, and/or monitoring of depression symptoms (Mauerer, 2012). The PHQ-9 is derived from the depression criteria of the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, (DSM-IV) allowing it to be a screening and diagnostic tool if a patient meets the criteria for depression. The PHQ-9 also determines severity of depression as no depression, mild depression, moderate depression, moderately severe depression, or severe depending on score from 0-27 (Zimmerman, 2012). More specifically a score of 0-4 is interpreted as no depression, 5-9 as mild depression, 10-14 moderate depression, 15-19 as moderately severe, and lastly a score of <19 as severe depression (Kroenke et al., 2001). To make a diagnosis for major depression, a patient must have at least 5 out of the 9 depressive symptoms criteria for "more than half the days" in the last two weeks and includes either depressed mood or anhedonia as one of the symptoms (Kroenke et al., 2003). A meta-analysis of the PHQ-9 found that it is a suitable tool for screening and diagnosis of depression, with a

diagnostic sensitivity of 92% and specificity of 80% (Gilbody, Richards, Brealey, & Hewitt, 2007). However, it is recommended to follow-up positive screens with an interview and assessment prior to making a diagnosis. The PHQ-9 is also found to work well across different cultures, and is easily translated to other languages (Gilbody et al., 2007).

Beck's Depression Inventory

The Beck Depression Inventory (BDI) was initially a 21-item tool assessing different symptoms and their severity with a score from 0-3 (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The newest version of this tool, the BDI-II, was created after the DSM-IV was released, and added four more items from the DSM-IV criteria, including: agitation, worthlessness, concentration, and loss of energy (Ceccarini, Manzoni, & Castelnuovo, 2014). The BDI uses standardized cut-offs to classify a patient's score and their severity of depressive symptoms. Use of the BDI-II has been found to be an effective screening tool, but not effective in making a diagnosis for depression (Ceccarini et al., 2014; Subica et al., 2014). A recent study confirms that the BDI-II as a screening tool is adequate and valid for use in the cardiac patient population (Moullec, Plourde, Lavoie, Suarthana, & Bacon, 2015).

Barriers to Depression Screening Post-MI Patients

Multiple barriers to depression screening of post-MI patients have been found. Often screening is not performed due to time constraints in clinical and hospital settings (Smolderen et al., 2011). Another common barrier is the lack of mental health resources and referrals available once depression has been identified (Davidson, 2012; Smolderen et al., 2011). The opposition by professionals against the recommendations for screening is another barrier with claims that there is a lack of evidence available to support the recommendations (Thombs et al., 2008). Lastly, a

lack of knowledge on depression screening and the treatment that follows has been identified as a barrier (Haws et al., 2011).

Time constraints in performing depression screening is a barrier in both inpatient and outpatient settings. A study examining a quality improvement depression screening protocol developed by the Mid America Heart and Vascular Institute (MAHVI) found that the time it took to screen patients by providers or nurses was a barrier to performing the screen (Smolderen et al., 2011). Recommendations by the AHA, USPSTF, and the NICE are to make use of short depression screening tools to decrease time spent screening, while maintaining effectiveness (Lichtman et al., 2008; NICE, 2009; Siu & USPSTF, 2016).

The shortage of mental health specialists, and the availability for referral has created a barrier for some providers to screen their patients for depression. In the study examining the MAHVI depression screening protocol, providers reported that the short supply of mental health professionals to refer patients to was a barrier for them to screen their CVD patients (Smolderen et al., 2011). Again, another examination of barriers in management of depression in patients with CVD revealed that primary care providers and cardiologists believe there are inadequate mental health specialty referrals available (Davidson, 2012).

Despite recommendations for routine screening for depression in CVD patients, opponents of the recommendations believe the statements were made too early (Hasnain, Vieweg, Lesnefsky, & Pandurangi, 2011). Opponents argue that there is a lack of evidence for routine screening, that routine screening will result in high-false positive screens, and screening may induce a negative social stigma (Thombs et al., 2013; Whooley, 2009). Past clinical trials have found that depression screening may improve depressive symptoms, but not necessarily affect mortality and morbidity relating to cardiac outcomes (Thombs et al., 2008). An important

argument made by opponents to avoid misdiagnosis in a false-positive screen is to ensure a clinical interview is conducted prior to diagnosing depression, and that screening be performed in a primary care setting with collaborative care resources available (Thombs et al., 2008; Whooley, 2009).

There is a lack of knowledge by providers that depression screening is recommended post-MI. A national survey conducted by Haws et al. (2011), examined primary care provider's attitudes and beliefs concerning depression post-MI, finding that providers underestimated the prevalence of depression post-MI by 20%. The authors determined that providers failed to understand how common depression is in this cohort, and that there was little understanding in making a depression diagnosis with help from a screening tool. Providers in the survey preferred to use their own experience and clinical knowledge for diagnosis, and results from the survey found that 33% of providers do not routinely screen for depression post-MI (Haws et al., 2011).

Depression Post-MI and Readmission

Depression is prevalent in nearly one-third of hospitalized patients, and continues to affect half of these patients for at least one month post-discharge (Pederson et al., 2016). Depression has been found to not only increase risk for adverse outcomes and increased mortality, but also increases risk for readmission in post-MI patients (Hess et al., 2016; Szpakowski, Bennell, Qui, Kirdyak, & Wijeysundera, 2016). Risk for readmission has been thought to be influenced by how depression often impacts a patient's functional status, i.e. ability to comply with medication regimen, continue follow-up for medical care, and self-care (Hess et al., 2016).

Hess et al. (2016) conducted a study examining readmission within 30 days after discharge in post-MI patients. The authors examined multiple factors associated with 30-day

readmission, including: demographics, comorbidities, presentation features, procedure features, in-patient events, medication use, etc. Results of the study found a 10% 30-day readmission rate after discharge post-MI, and that the most strongly associated factors increasing risk for readmission were patients who had depression and lower quality of life (Hess et al., 2016).

Health behaviors and other comorbidities, such as diabetes mellitus, obesity, hypertension, hyperlipidemia, etc., in patients with depression post-MI have also been linked to the risk for readmission (Myers et al., 2012). Patients with depression post-MI are less likely to adhere to newly recommended secondary prevention measures putting them at increased risk for readmission (Myers et al., 2012). Secondary prevention methods that the AHA guidelines recommend for post-MI patients include the followings: medication therapy, discontinuation of tobacco use, encouragement of physical activity, attendance to a cardiac rehabilitation program, healthy diet, and management of other comorbidities (O'Gara et al., 2013).

A study examining medication adherence post-MI found that depressed patients are directly associated with non-adherence to their medication regimen, and recommend methods to improve adherence (Gehi, Haas, Pipkin, & Whooley, 2005). Depressed patients are also unlikely to follow physical activity recommendations post-MI (Whooley et al., 2008). Therefore, strategies, such as depression screening, in conjunction with other secondary prevention measures, may be beneficial in reducing readmission risk (Hess et al., 2016).

Theoretical Framework and Logic Model

The theoretical framework for this project is based on two nursing theories. Betty Neuman's Systems Model theory was found to be applicable to the project based on its concepts of holistic nursing care and prevention. The second nursing theory, Hildegard Peplau's Nurse-Patient Relationship Theory, emphasizes the importance of the nurse-patient relationship in

nursing care, specifically psychiatric care. A logic model has been developed to help guide the process of the project by incorporating the planning, implementation, and evaluation phases of the project.

Neuman's Systems Model

Neuman's Systems Model has a holistic view of the patient who is represented by an open system that interacts with stressors to achieve a goal of total wellness. Nursing care in this theory focuses on the nursing intervention of prevention care. She believes environmental stressors interrupt the balance of the system that could potentially be prevented with early intervention. Neuman believed that health and wellness is a dynamic continuum, and the system works to achieve stability or wellness on this continuum. Neuman's conceptual model provides visual guidance in application of the four domains of nursing: the human being, environment, health, and nursing (Neuman, 1995).

Neuman developed a conceptual model (Figure 1) called the client-client model consisting of five different variables that co-exist within the system: physiological, psychological, sociocultural, developmental and spiritual. The core of the model, or basic structure, consists of factors common to all humans, such as: normal temperature, genetic structure, response pattern, organ strength/weakness, ego structure, and knowns or commonalities (Neuman, 1995). The system's defenses to maintain stability are described in the theory as: the lines of resistance, the normal line of defense, and the flexible line of defense. Defense mechanisms help the person to adapt and respond to stressors from the external and internal environments (Neuman, 1995).

The use of primary, secondary, and tertiary prevention as a nursing intervention is a key concept of nursing care in Neuman's model. Primary prevention by acting before a stressor

occurs strengthens the flexible line of defense, and protects a client's normal line of defense. Secondary prevention is required to treat symptoms from a stressor, and maintain client wellness. Lastly, tertiary prevention allows for adaptation to a stressor, prevention of a reoccurrence, and/or maintenance of a state of wellness (Neuman, 1995).

Applications of Neuman's Systems Model

Application of Neuman's Systems Model to this project primarily focuses on her concepts of holistic nursing care through collaboration between the nurse and client, and the use of prevention as a primary nursing intervention. Post-MI patients physiologically must heal to return to a state of wellness, but may also need psychological healing to attain total wellness. The model has helped to guide what stressors could be examined in this project that may affect the outcomes of depressed post-MI patients, i.e. age, sex, race, screening for depression, diagnosis of depression, treatment of depression, etc. In identifying what potential stressors are affecting readmission rates of depressed post-MI patients, potential recommendations may be made for primary, secondary or tertiary prevention measures in this cohort. Nursing care has the potential to improve depressed post-MI patient outcomes through prevention, early identification and treatment, and helping patients to cope and adapt to achieve their individual state of wellness.

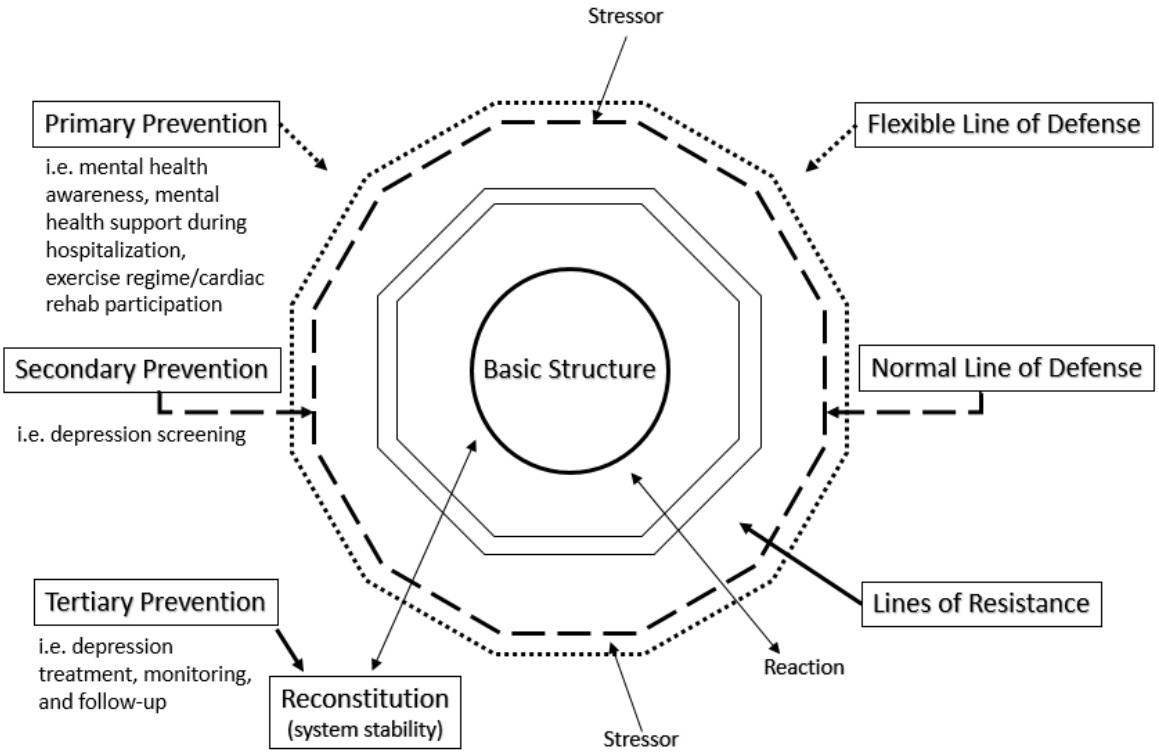

Figure 1. Neuman's Systems Model.
Adapted from Betty Neuman (1995)

Peplau's Theory of Interpersonal Relations

Hildegard Peplau's Theory of Interpersonal Relations emphasizes the nurse-patient relationship as being central to all nursing care. The theory may be applied to any nursing situation (Peplau, 1992). The nurse brings forth their professional experience and knowledge to the relationship with a focus on the needs of the patient (Peplau, 1992).

The four main factors of the nurse-patient relationship are the nurse, the patient, professional expertise, and patient need. Peplau's theory recognizes that there are phases that the relationship will work through starting with the orientation phase. The orientation phase begins as the relationship develops, and the nurse and patient begin to understand each other. During this phase, trust will begin to be made between the two individuals. The second phase is the

working phase in which the patient begins to take part in their care with the nurse guiding them when needed. The nurse empowers the patient as the patient becomes more independent in their own care. Lastly, the resolution phase occurs as the patient continues to move into a more independent role in managing their care as they move away from the nurse. A mutual ending of the nurse-patient relationship is the complete end to this final phase as the patient gains independence (Peplau, 1992).

Application of Peplau's Theory of Interpersonal Relations

Peplau's Theory of Interpersonal Relations applies to the project, because a collaborative, trusting relationship between the patient and nurse, or provider, is important in mental health care. Depression screening is dependent on the patient being honest in their answers, and in their willingness to receive mental health care. A patient who is depressed is more likely to share their feelings and concerns to a provider who they trust and have a relationship with. Primary care providers are more likely to build a relationship with their patient over time, and patients may respond more honestly in screenings when they have a health need. Therefore, The Theory of Interpersonal Relations can be incorporated when caring for post-MI patients to ensure that patients' mental health needs are recognized and addressed.

Logic Model

The logic model was used to identify main concepts of the project including: inputs, activities, outputs, and outcomes. In the planning phase of the model, the inputs and the activities were identified to help recognize what resources would be needed, and what steps needed to be taken to conduct the project. Implementation of the project included the data collection process, data analysis, and dissemination of findings. The next phase of the model determined the outputs

expected from the data collected and analyzed. In the final phase of the model, the predicted outcomes were identified, and helped to develop the objectives of the project.

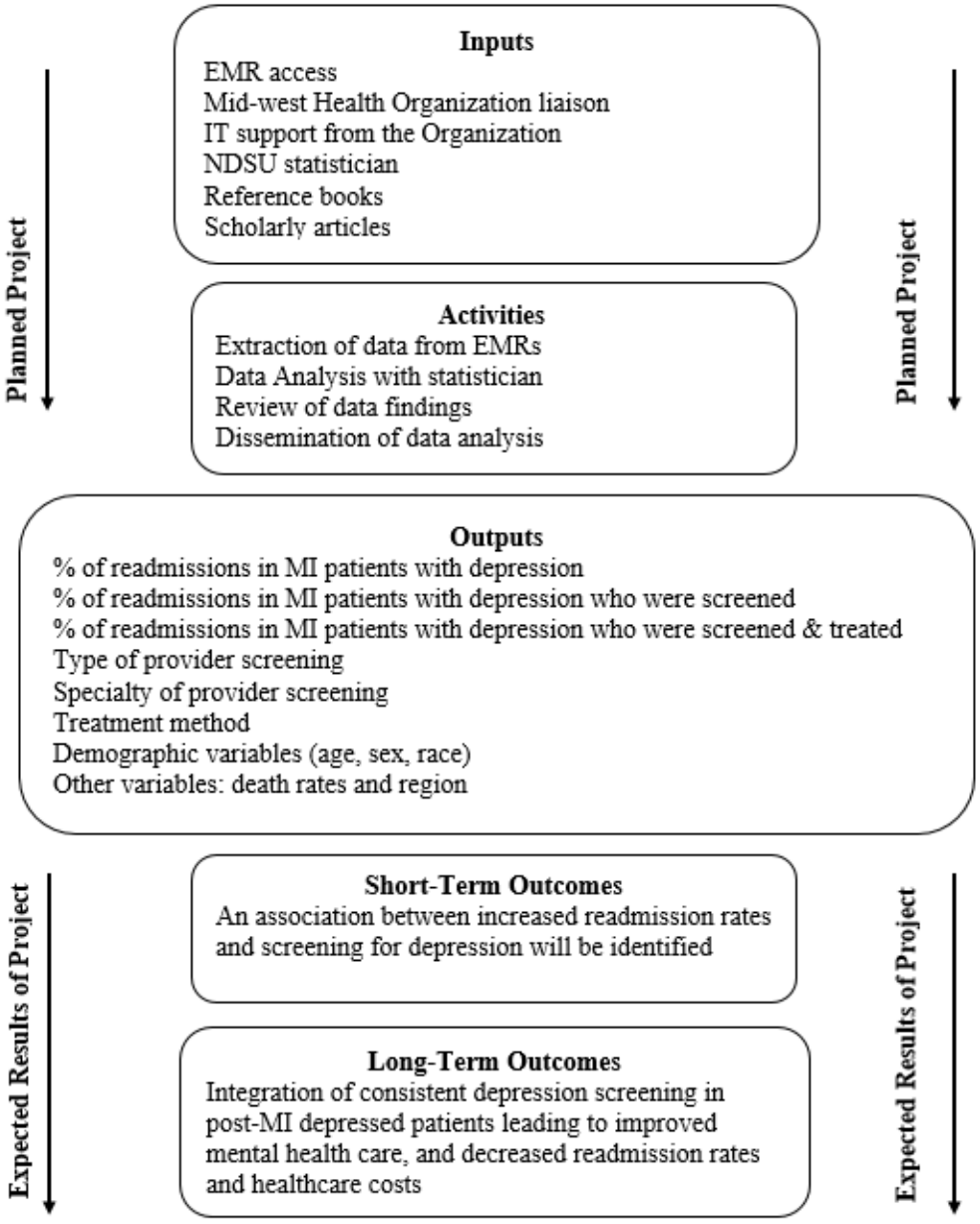

Figure 2. Logic Model.

Conclusion

Chapter two focused on a review of the literature, and presented the theoretical framework of the project. The literature review examined depression in post-MI patients, prevalence and mortality, management of depression post-MI, depression screening recommendations, screening tools, barriers to depression screening in post-MI patients, and lastly, depression post-MI and readmission's. Neuman's Systems Model and Peplau's Theory of Interpersonal Relations were summarized and a discussion was made in relation to the project. The information attained in chapter two facilitated the development of the project design, implementation of the data analysis, and evaluation of the data analysis which will be discussed and reviewed in the next chapter.

CHAPTER 3: PROJECT DESIGN

The study was a quantitative retrospective data analysis performed by examination of data from electronic medical records (EMRs). The purpose of the study was to identify rates of depression screening post-MI, and determine how it relates to readmission rates within the MHO. The study also aimed to determine if other factors contributed to readmission rates post-MI. The data were obtained with assistance from an information technology (IT) specialist who retrieved the necessary data from the EMRs within the MHO.

To gain access to the data from the EMRs the project proposal was presented to a committee of individuals from Region 1 of the MHO who are part of the research, quality improvement, and/or student experience departments within the organization. At this meeting, the members agreed that the proposed project would be of value to the organization, and granted permission for the project to proceed at the MHO. The committee also assigned a liaison at that time to help facilitate the project within the MHO.

Next, obtaining IRB approval from both the MHO IRB and North Dakota State University (NDSU) IRB was completed after submitting the required paperwork and research proposal. After permission was obtained from the MHO IRB and NDSU IRB, a request for the data reports was submitted to the MHO research department. A list of ICD-9 and ICD-10 codes, and a table of variables were also submitted with the data request form.

The ICD-9 and ICD-10 codes requested consisted of MI and depression codes to ensure inclusion of all types of MI and depression diagnoses (See Appendix C & Appendix D for ICD codes included). A list of variables was also requested to be retrieved from EMRs that met inclusion requirements for the study, including: medical record number (MRN), date of birth, gender, race, region, if they were deceased, deceased date, admission date with MI diagnosis,

readmission's post MI diagnosis with subsequent MI, depression diagnosis within 12 months post-MI, PHQ-9 depression screening conducted within 12 months post-MI, the screening provider, and specialty of screening provider. Once the reports were obtained, they were shared with an NDSU statistician who assisted in analyzing the data in the reports.

Sample

The data sample consisted of men and women ages 40-70 years old who had a diagnosis of depression, had experienced an MI, and had visited their primary care provider within 12 months post-MI. Exclusion criteria included ICD coded diagnoses of other mental health disorders (bipolar disorder, schizophrenia, post-traumatic stress disorder, anxiety, etc.) and coronary artery bypass graft patients. The data were gathered from a date range of January 1st, 2012 to December 31st, 2016 to include a five-year representation of data. The data were obtained from two different midwestern regions of the healthcare organization to compare differences and similarities between the regions.

EMR Data

ICD codes were used to retrieve the data from the EMR, and then compiled into two separate reports based on region. To include sample data from years 2012-2016 both ICD-9 and ICD-10 codes were required to retrieve the requested data. ICD-10 codes replaced ICD-9 codes in 2015. Other data variables, such as, demographics, PHQ-9 score, provider performing the PHQ-9, and specialty of provider performing the PHQ-9 were retrieved by the IT specialist after identifying which patients met sample criteria in the reports. The PHQ-9 screening data were retrieved instead of a current procedural terminology (CPT) code for depression screening to obtain more data meeting sample criteria. According to the IT specialist, providers at the MHO were more likely to input the PHQ-9 depression screening tool than input the CPT depression

screening code. Data regarding treatment method, and if a patient was being treated for their depression were not obtainable by the IT specialist. For this information to be obtained individual charts and clinical notes would have had to have been examined to determine if a patient was on antidepressant treatment, receiving therapy, consulted to see psychology, etc.

CHAPTER 4: RESULTS

The data reports received from the MHO included 1,181 patients who had been diagnosed with depression within 12 months of their initial MI during the time frame of January 1st, 2012 to December 31st, 2016. Of the 1,181 patients from both regions, 593 met all inclusion sample criteria of the study. Therefore, the sample size of the study was 593. Of these patients, 348 were of Region 1's data set, and 245 were of Region 2's data set.

The first objective of the study was, "Identify the percentage of readmission in patients within 12 months post-MI who have depression". Of the 593 patients with depression post-MI 16.52% were readmitted within 12 months post-MI (See Table 1). In examination of the two different regions' readmission rates within 12 months post-MI, Region 1 had 61 readmissions (17.53%), and Region 2 had 37 readmissions (15.10%) (See Table 2 and Table 3).

Table 1

Total Patients Readmitted within 12 Months Post-MI

N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
98	Age	98	59	8	40	70
	Days To Readmission	98	88	101	0	340
	Days To Deceased	27	392	310	12	1105

Table 2

Regional Total Readmissions within 12 Months Post-MI

Region	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
1	61	Age	61	59	8	42	70
		Days To Readmit	61	116	111	5	340
		Days To Deceased	17	389	284	37	1105
2	37	Age	37	58	9	40	70
		Days To Readmit	37	41	59	0	236
		Days To Deceased	10	398	366	12	1018

Table 3

Readmission within 12 Months Post-MI by Region

	Region 1		Region 2	
Readmit Category	Frequency	Percent	Frequency	Percent
Not readmitted	271	77.87	197	80.41
Readmitted within 12-months	61	17.53	37	15.10
Readmitted after 12-months	16	4.60	11	4.49

To further examine readmissions overall and regionally, the distribution of days to readmission was identified. As seen in Figure 3, the overall distribution of days to readmission within 12 months was skewed right with greater than 60% of overall readmissions less than 50 days post-discharge. In examining the two regions' distributions of days to readmission within 12 months, Region 2 had a higher proportion of readmissions within 0-50 days post-discharge than Region 1. Region 1's distribution of days was skewed right, however, it had more readmissions than Region 2 past 50 days post-discharge (See Figure 4).

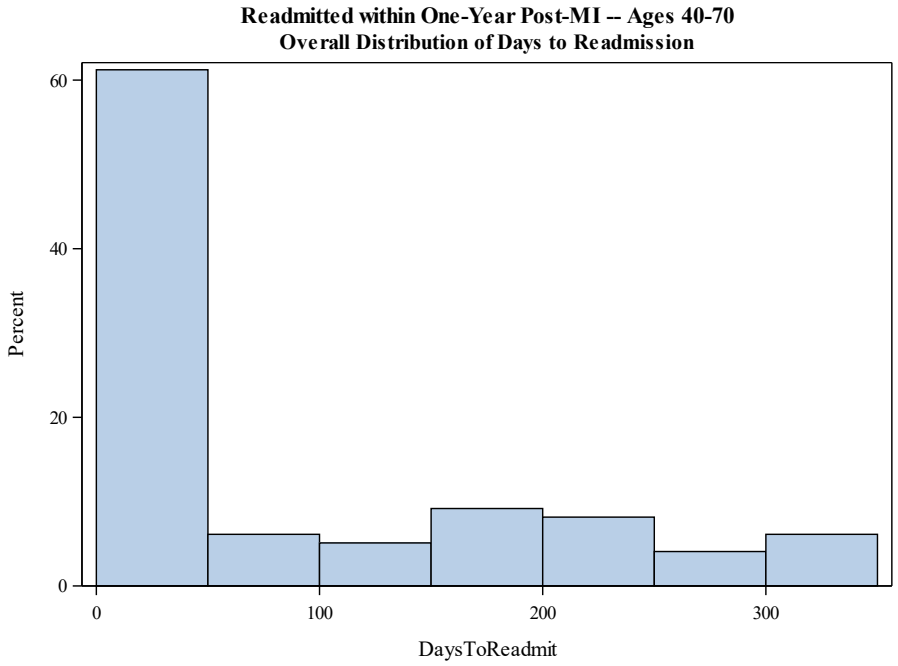

Figure 3. Overall Distribution of Days to Readmission.

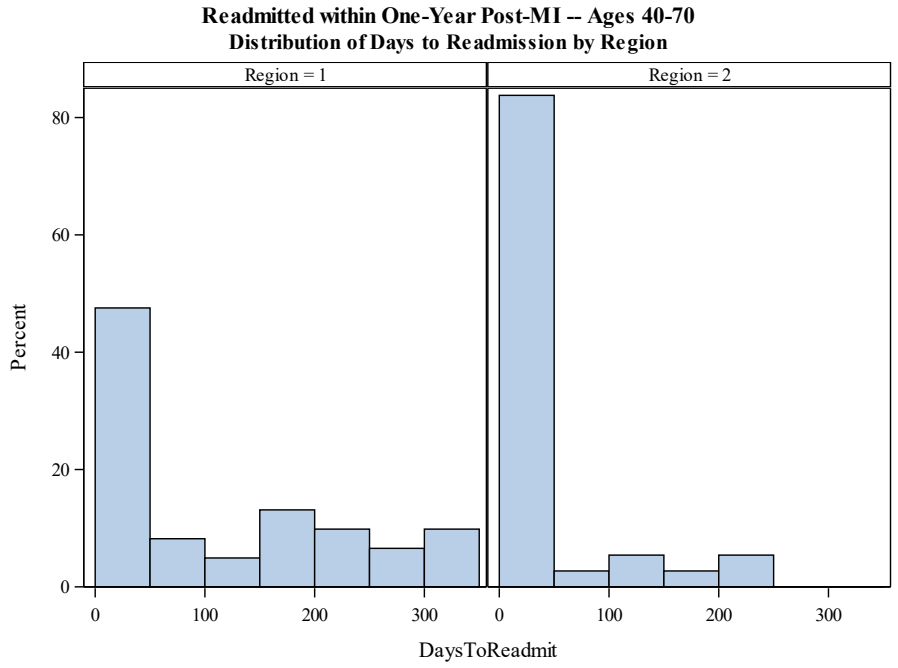

Figure 4. Distribution of Days to Readmission by Region.

A timeline of 0-30 days and 31+ days post discharge was also developed (See Table 4). Readmissions within 30 days post-discharge are of importance to organizations as this effects reimbursement from CMS. Region 1 had 22 of 98 (22.45%) readmissions within 12 months be readmitted within 30 days post-discharge. Region 2 had a higher percentage of readmissions within 30 days; 27 of the 98 (27.55%) patients readmitted within 12 months in Region 2 were readmitted within 30 days post-discharge.

Table 4

Region 1 Distribution of Days to Readmission

	Region 1		Region 2	
Readmit Category	Frequency	Percent	Frequency	Percent
0 - 30 Days	22	36.07	27	72.67
31+ Days	39	63.93	10	27.03

The second objective of the study was to, "Determine the percentage of readmission in patients within 12 months post-MI who have depression and were screened for depression". For Region 1, 44.26% of the patients in the sample were not screened for depression within 12 months post-MI and were readmitted within 1 year compared to 55.74% who were screened, and subsequently readmitted within 12 months (See Table 5). In further breaking down the timeline to examine 0-30 days and 31+ days post-discharge, of the patients in Region 1 who were screened within 12 months post-MI 38.24% were readmitted within 30 days post-discharge. Lastly, of the patients who were not screened for depression with 12 months post-MI, 33.33% were subsequently readmitted within 30 days post-discharge (See Table 6). Using the Chi-Square Test of Independence, the P-value of 0.6921 suggests that there is not a relationship between depression screening and readmission within 12 months post-MI for Region 1 (See Table 7).

Table 5

Region 1 Readmissions Relating to Screened or Not Screened within 1 year Post-MI

Category	Frequency	Percent
Not screened within 1 year post-MI	27	44.26
Screened within 1 year post-MI	34	55.74

Table 6

Region 1 Readmissions Relating to Screening within 30 days

Screening	Readmit Category		
Frequency Expected Row Percentage	0 - 30 Days	31+ Days	Total
Not screened within 1 year post-MI	9 9.7377 33.33	18 17.262 66.67	27
Screened within 1 year post-MI	13 12.262 38.24	21 21.738 61.76	34
Total	22	39	61

Table 7

Region 1 Chi-Square Test of Independence for Screening and Readmission

Statistic	DF	Value	Prob
Chi-Square	1	0.1568	0.6921
Likelihood Ratio Chi-Square	1	0.1573	0.6917
Continuity Adj. Chi-Square	1	0.0163	0.8985
Mantel-Haenszel Chi-Square	1	0.1543	0.6945
Phi Coefficient		-0.0507	
Contingency Coefficient		0.0506	
Cramer's V		-0.0507	

For the Chi-Square Test of Independence an $\alpha=0.05$ was utilized.

In Region 2, 43.24% of the patients were screened for depression within 12 months, and subsequently were readmitted to the hospital. The analysis found that 56.76% of the sample who were not screened for depression within 12 months were readmitted (See Table 8). In examining the readmission timeline of 0-30 days post-discharge, 81.25% of the sample of patients who were screened in Region 2 were readmitted within 30 days post-MI. Lastly, 66.67% of the sample who were not screened for depression within 12 months were readmitted within 30 days. (See Table 9).

In performing data analysis of Region 2's data, the Chi Square Test of Independence resulted in a P-value of 0.3224, however since the contingency table included expected counts less than 5, the Fisher's Exact Test was indicated for a valid test (See Table 10 and Table 11). The Fisher's Exact Test resulted in a P-value of 0.4613 compared to the α-value of 0.05 suggesting that there is not a relationship between depression screening and readmission within 12 months post-MI for Region 2 (See Table 11).

Table 8

Region 2 Readmissions Relating to Screened or Not Screened within 1 year Post-MI

Screening	Frequency	%	Cumulative Frequency	Cumulative %
Not screened within 1 year post-MI	21	56.76	21	56.76
Screened within 1 year post-MI	16	43.24	37	100.00

Table 9

Region 2 Readmissions Relating to Screening within 30 days

Screening	Readmit Category		
Frequency Expected Row Percentage	0 - 30 Days	31+ Days	Total
Not screened within 1 year post-MI	14 15.324 66.67	7 5.6757 33.33	21
Screened within 1 year post-MI	13 11.676 81.25	3 4.3243 18.75	16
Total	27	10	37

Table 10

Region 2 Chi-Square Test of Independence for Screening and Readmission

Statistic	DF	Value	Prob
Chi-Square	1	0.9792	0.3224
Likelihood Ratio Chi-Square	1	1.0050	0.3161
Continuity Adj. Chi-Square	1	0.3794	0.5379
Mantel-Haenszel Chi-Square	1	0.9528	0.3290
Phi Coefficient		-0.1627	
Contingency Coefficient		0.1606	
Cramer's V		-0.1627	

For the Chi-Square Test of Independence α=0.05 was utilized.

Table 11

Region 2 Fisher's Exact Test

Fisher's Exact Test	
Cell (1,1) Frequency (F)	14
Left-sided Pr <= F	0.2716
Right-sided Pr >= F	0.9154
Table Probability (P)	0.1869
Two-sided Pr <= P	0.4613

The third objective of the study was, “Determine the percentage of readmission in patients within 12 months post-MI who have depression, were screened for depression, and treated for depression”. To complete this objective, treatment data would have been necessary to obtain. The IT specialist of the MHO was unable to retrieve treatment data as this would have required individual examination of charts and clinic notes. Therefore, this objective was unable to be completed, but will be further discussed in the next Chapter.

The fourth objective of the study was, “Identify correlations or differences that can be made for depressed post-MI patients and demographic variables”. Demographics between the two regions of the sample had similarities and differences. The age range of the sample was kept to 40-70-year-old patients with the age representing the patient’s age as of the first MI admission date. The overall distribution of age among the entire sample had a skewed-left distribution with a mean age of 58 years old (See Figure 5). The two regions had similar mean ages with Region 1 having a mean age of 59 years old and Region 2 having a mean age of 58 years old. However, Region 2 had a much higher proportion of their population at age 56 years old compared to Region 1 (See Figure 6).

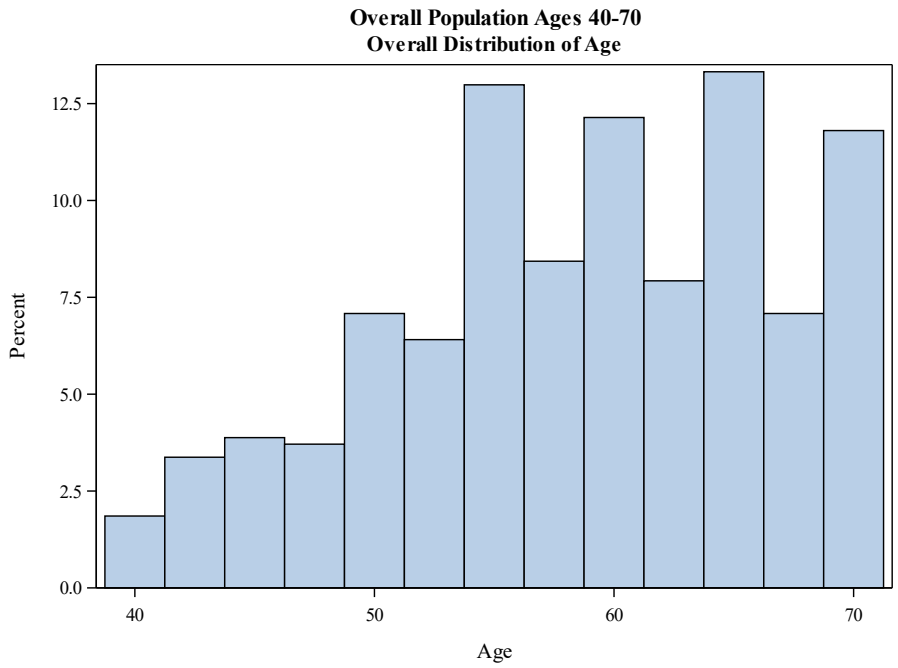

Figure 5. Overall Distribution of Age.

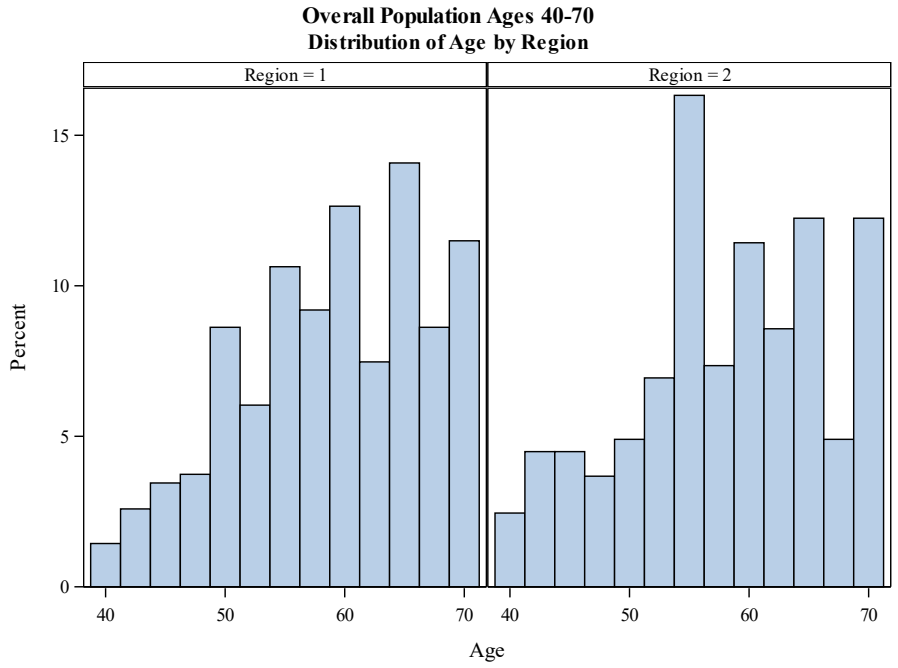

Figure 6. Distribution of Age by Region.

In examining the gender of the regions, both regions had higher frequencies of males than females. Region 1 sample consisted of 175 males (50.29%) and 173 females (49.71%). Region 2 sample consisted of 130 males (53.06%) and 115 females (46.94%) (See Table 12).

While examining the race of the sample, Caucasian/White had the highest frequency for both regions. Region 1 consisted of 92.24% Caucasian/White patients, 4.31% American Indian/Alaskan Native patients, 0.57% African American/Black patients, 0.57% Asian patients, and 2.30% that declined to identify race in their chart. Region 2 consisted of 89.80% Caucasian/White patients, 6.12% American Indian/Alaskan Native patients, 1.22% African American/Black patients, 1.63% Asian patients, 0.41% Hispanic/Latino patients, and 0.82% that declined to identify race in their chart (See Table 13).

Table 12

Gender by Region

	Region 1		Region 2	
Gender	Frequency	Percent	Frequency	Percent
Female	173	49.71	115	46.94
Male	175	50.29	130	53.06

Table 13

Race by Region

	Region 1		Region 2	
Race	Frequency	Percent	Frequency	Percent
African American/Black	2	0.57	3	1.22
American Indian or Alaskan Native	15	4.31	15	6.12
Asian	2	0.57	4	1.63
Caucasian/White	321	92.24	220	89.80
Hispanic/Latino	n.a.	n.a.	1	0.41
Declined	8	2.30	2	0.82

Objective five of the study was, “Determine what type of provider screened, diagnosed, and/or treated for depression in the sample”. The type of provider performing the PHQ-9 screen was provided when able to for individual patients, however, many patients screened had an unknown healthcare professional listed as the screener. For region 1, 271 of the 348 patients had an unknown provider listed. For region 2, 201 of the 245 patients had an unknown provider listed (See Table 14). The data provided by the MHO also did not include the type of provider diagnosing depression or the type of provider treating depression as this would have required individual examination of charts and clinic notes.

Table 14

Provider Type Performing Depression Screen- Region 1 and Region 2

	Region 1		Region 2	
Specialty	Frequency	Percent	Frequency	Percent
Clinical Nurse Specialist	6	1.72	n.a.	n.a.
Medical Doctor	54	15.52	34	13.88
Nurse Practitioner	6	1.72	5	2.04
Physician's Assistant	9	2.59	5	2.04
Social Worker	2	0.57	n.a.	n.a.
Unknown	271	77.87	201	82.04

Conclusion

Chapter Four provided an overview of the results of the data collection and data analysis in relation to the objectives developed for the study. Chapter Five provides identification and interpretation of the results and outputs for the objectives of the study. The next chapter also discusses limitations, recommendations for future research, and implications for advanced nursing practice.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

In this retrospective data analysis, there were no statistically significant relationships found between depression screening in post-MI patients and readmission within 12 months. Despite these findings, numerous guidelines continue to recommend screening, and studies continue to find that systematic depression screening post-MI is associated with improved health outcomes. Many of the findings in this analysis are consistent with findings of past studies, and will be further discussed in this chapter.

Interpretation of Results

Objective One

The first objective of the study, "Identify the percentage of readmission in patients within 12 months post-MI who have depression", was completed with data outputs that were difficult to compare to past research findings. As stated in the results section, the overall readmission rate within 12 months post-MI for patients with depression was 16.52%. In looking at 30-day readmission rates of the 98 patients readmitted within 12 months post-MI, Region 1 had a 22.45% readmission rate and Region 2 had a 27.55% readmission rate. In performing the literature review, few studies examined readmission rates with a similar cohort to make comparisons of this study's findings. However, a study conducted by Hess et al. (2016), examined post-MI patients and 30-day readmission rates, and found that 10.8% of the 12,312 patients examined were readmitted in 30-days with one of the highest risks for readmission being depression. Another study examined 30-day readmissions for acute MI's and found a 21.7% readmission rate for patients with psychiatric comorbidities (Ahmedani et al., 2015).

This study demonstrated that the overall readmission rate within 12 months post-MI is similar to these past research findings, however, in looking at the individual regions' 30-day

readmission rates the researchers found they had slightly higher rates for readmission compared to other 30-day readmission studies. This may be because the patients in study are at higher risk for readmission by having a psychiatric comorbidity of depression as suggested by past studies. Therefore, it is difficult to determine consistency of readmission rate data findings for this analysis to past research without having more comparison studies examining the population of depressed post-MI patients.

Objective Two

The second objective of the study, "Determine the percentage of readmission in patients within 12 months post-MI who have depression and were screened for depression" was met. In comparing the two regions, it was interesting to find that Region 1 had higher readmission rates in patients who were screened for depression compared to patients who were not screened (55.74% vs. 44.26%), and Region 2 had lower readmission rates in patients who were screened compared to patients who were not screened (43.24% vs. 56.76%). The differences in screening and readmission for the regions is unknown. Both regions utilize the PHQ-2 and PHQ-9 screening tools, and both utilize cardiac rehabilitation programs. However, it is unknown if the regions have different follow-up or treatment protocols for positive screens, or if the cardiac rehabilitation programs are conducted differently. The study did not examine any components of cardiac rehabilitation, or even if a patient attended a program.

In performing the statistical analysis of the data for patients screened and readmitted within 30 days post-discharge, both regions showed no statistically significant relationship between the categories. As suggested by past evidence, the data of this study were expected to reflect a relationship for lower readmission rates in patients who were screened and treated for depression. However, there are no studies that have been found that specifically examined

readmission rates and depression screening post-MI to make exact comparisons. Multiple past studies have suggested that routine depression screening post-MI may be effective in decreasing readmissions, however, further studies are needed to assess implications of depression screening (Bertelsen et al., 2017; Hess et al., 2016; Pederson et al., 2016). Although screening for depression post-MI is recommended in many studies and reputable guidelines, the most important aspect is following up on a positive screen and treating patients if appropriate. An important missing factor of the data in this study included if the patients were screened, and then treated for their depression. As discussed in the next section, treatment is key to improved depression symptoms and post-MI health outcomes.

Objective Three

The third objective, "Determine the percentage of readmission in patients within 12 months post-MI who have depression, were screened for depression, and treated for depression", was unable to be completed. As stated in the results section, treatment data for depression of the sample was unable to be retrieved by IT of the MHO for this study. Unfortunately, the resources and time needed to perform that type of analysis was not available. In the development of the objectives for the study it was thought that treatment data would be attainable, however, to examine treatment data for the sample thorough investigation of individual patient charts and clinical notes would have been necessary. That process would require a team of qualified investigators as well as significant economic and human resources.

As current guidelines recommend, depression screening should routinely be performed in post-MI patients to identify patients who may be depressed, and then provide adequate treatment for their symptoms (Green et al., 2009; Lichtman et al., 2008). Post-MI patients with depression who receive treatment are found to have better health outcomes, improved medication adherence,

and decreased mortality (Glassman et al., 2002; Siu & USPSTF, 2016; Zuidersma et al., 2013). An important consideration in treating post-MI patients with depression includes monitoring effectiveness of treatment. A recent study examined treatment resistant depression in post-MI patients and found that 13.4% of the sample had treatment resistant depression requiring patients to trial multiple medication options before achieving improvement in depressive symptoms. The authors concluded that effective treatment and monitoring of depression shows reduced mortality and improved cardiac outcomes in post-MI patients (Banankhah et al., 2015). Currently there is a gap in the literature regarding depression screening and treatment in post-MI patients, and the implications on readmissions to the hospital. A statistical analysis examining the relationship among screening for depression, treating depression, and readmission rates post-MI would have been interesting to learn. Unfortunately, treatment data were not able to be examined for this study, therefore future research and studies would be of value to provide evidence of the impact treating depression in post-MI patients has on readmission rates.

Objective Four

The fourth objective "Identify correlations or differences that can be made for depressed post-MI patients and demographic variables" was met. Many consistent findings were found that were similar to past research. Age, gender, and race were examined for this study, but many other demographic considerations such as socioeconomic status, education level, or marital status. would be interesting for future studies focusing on demographic variables of the cohort.

As discussed earlier, the sample age range of 40-70 years old was chosen to include patients of similar expected health and to exclude younger, generally healthy patients, and older, generally more frail patients. Many studies examining depression post-MI utilized similar sample age ranges, or sample ages of greater than or equal to 18 years old. The mean age of patients for

Region 1 and Region 2 for this study were 59 and 58 years old, respectively. These findings are consistent with past research findings with a majority of studies examining depression post-MI finding mean sample ages of 56-65 years old (Edmondson et al., 2014; Hess et al., 2017; Southern, 2014). This author concludes that patients within this age range are at higher risk for readmission post-MI, and thus, practitioners should be screening these patients for depression to reduce risk of readmission.

An unexpected finding of the data was that samples for both regions consisted of more males than females. Previous studies that included examination of gender found that females are more likely to experience depression post-MI and experience adverse outcomes (Hess et al., 2017; Smolderen et al., 2017). In fact, studies have even found that females were more likely to be readmitted post-MI compared to males (Dreyer et al., 2015; Parashar et al., 2009). Depression in the general adult population is also more prevalent in females by 3.7% (National Institute of Mental Health [NIMH], 2016). Determining why the male gender had a higher frequency in the data of this study is difficult to explain. Females have longer life expectancies than males, and possibly if the age range had been expanded to include older patients in the sample it would reflect a higher frequency of females readmitted with depression post-MI (National Center for Health Statistics, 2017).

In examining the racial differences of the study sample, Caucasian/White patients were the highest frequency followed by American Indian/Alaskan Native patients as the second highest frequency in both regions. This demographic finding was expected, as this coincides with the state population data for both regions. The states in which the regions belong have by far a higher population of Caucasian/White persons compared to any other race, which is followed by the second highest population of American Indian/Alaskan Natives (Unites States Census

Bureau, 2016). However, another study examining racial and sex differences in post-MI patients with unplanned readmissions found that the highest risk patients for readmission were African American females, followed by White females, African Americans males, and lastly White males (Hess et al., 2017). A limitation of this study is that the researchers only compared White versus African American race groups and excluded any other races. For the regions included in this author's study, the population of African Americans was low compared to other regions in the United States. Despite previous evidence, finding African Americans as the highest frequency race was not an expected finding in this study sample. However, further research and studies examining age, gender, and racial disparities among depressed post-MI patients in the two regions examined and in other regions of the U.S. would be interesting to identify further correlations and risks for readmission.

Objective Five

Objective five "Determine what type of provider screened, diagnosed, and/or treated for depression in the sample" was partially met as the data findings were largely inconsistent. The data that were retrieved from IT was pulled from input boxes in the chart that record which provider is charting. For both regions an unknown category performed the majority of depression screening followed by the category of medical doctor (See Table 18 and Table 19). The unknown category is predicted to be made up of nursing staff who often perform and input the depression screen into charts as part of the rooming process in the clinic setting. Unfortunately, IT was also unable to pull data identifying who made the diagnosis or treatment for patients in the sample. Further investigation via actual physical review of individual charts and clinical notes would be required to obtain all the data to meet this objective. Also, improvements of the EMR, or in the

data retrieval process, could be made to more easily identify who made up the unknown category in the flowsheets.

Additional Discussion: Deceased Rates

Much of past literature has examined the impact that depression has on mortality rates post-MI. Although examining mortality and/or deceased rates were not objectives of the study, the deceased rates were gathered along with the other data. Of the 593 patients who made up the sample for this analysis, 117 (19.7%) were deceased at the time of the analysis. In comparing the two regions, Region 1 had 10.63% of the 348 patients in the sample were deceased within 12 months post-MI, and Region 2 had 8.98% of the 245 patients in the sample were deceased within 12 months post-MI. In Figure 7, a side by side comparison is given for the regions with both showing a higher percentage of deaths were under 60 days post-MI. Further research should be conducted on the data found to examine mortality and death rates for this cohort. A recent finding of researchers examining depression and the risk of death following coronary artery diagnosis, concluded that depression following a cardiovascular event was the strongest predictor of death (May et al., 2017). In another recent study, reserachers found that long-term mortality risks are elevated in depressed post-MI patients, but more so in patients who have untreated depression (Smolderen et al., 2017). Therefore, identification, treatment, and follow-up for depressed post-MI patients is of utmost importance to decrease risk of mortality.

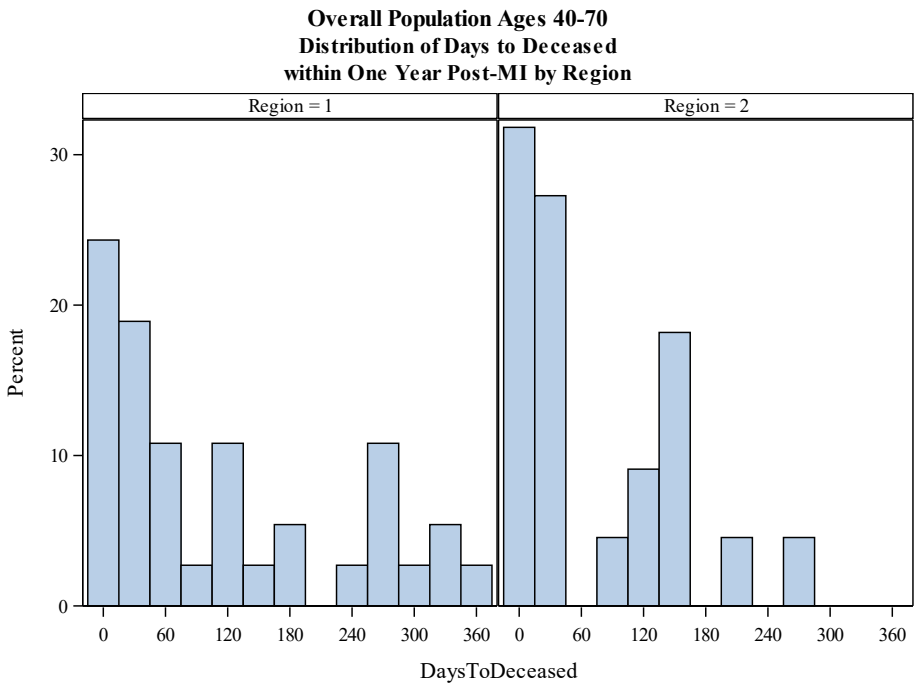

Figure 7. Distribution of Days to Deceased in 12 Months by Region.

Limitations

Research limitations included the inability to obtain all data, potential missing data, potential inapplicability of findings to other regions, and unknown past depression history of patients. As discussed prior, one limitation of the study was the inability to obtain all requested data. The data that was collected from the MHO had been either entered into flowsheets, associated with an ICD code, and/or associated with the MRN (admission date, deceased date, etc.). Unfortunately, all treatment related data were unable to be obtained as this would have required individual investigation of patient charts and provider clinical notes. Although the treatment component of the study would have been valuable, going back through individual charts to obtain this information was not feasible.

A second limitation of the data output includes the inability to determine if a PHQ-9 screening was performed based solely on flowsheet data. A conclusion cannot be made that a

provider did not perform a depression screening by examining flowsheet data alone. A provider may have charted the screening results within their clinical notes, or they may have not recorded it at all despite having asked the appropriate questions from the PHQ-2 or PHQ-9. With PHQ-9 screening data pulled only from flowsheets there is the potential that data may have been missed. Another consideration for missing PHQ data, is that the EMR the MHO utilizes has a file button that must be pushed to submit the results; if not pushed, the result will not be recorded. In conclusion, appropriate charting and recording of PHQ results is needed to provide accurate and consistent assessment data within the organization.

A third limitation of the study is that the data were obtained from a mid-western region in the U.S., and the data analysis may not be applicable to other regions. The Midwest has a higher proportion of Caucasian/white population with a low population of African Americans, Hispanic/Latinos, or Asians compared to other regions (United States Census Bureau, 2016). African Americans, Hispanic/Latinos, and Caucasians have the highest risk for cardiovascular disease compared to other races (Centers for Disease Control & Prevention, 2013). American Indians/Alaskan Natives and Caucasians have the highest prevalence of adult depression in the U.S. (NIMH, 2016). Therefore, data findings examining race in depressed post-MI patients in other regions may have different results. More studies and investigations are needed to make any recommendations.

Lastly, a fourth limitation is that past depression history of the individual patients in the sample was unknown, and was not taken into consideration for the purpose of this study. The study did not assess if a patient had a history beyond one year prior to admission. This is important to acknowledge as patients with a past history of depression (recurrent or chronic) should be continually assessed for depressive symptoms, for worsening symptoms, and/or have

continual treatment follow-up. Patients with a history of depression are at risk for recurrent depression especially with a major life event, such as a MI. As this author has discussed, depression post-MI increases risk for adverse outcomes. In fact, a study by Sundboll et al. (2017), found that a history of depression post-MI was associated with increased all-cause mortality.

Recommendations

The first recommendation that can be made for these regions of the MHO is the development of a protocol or quality measure to ensure post-MI patients are screened for depression and results documented at follow-up visits. Although this data analysis did not find a relationship between depression screening and readmissions to the hospital, past evidence and current guidelines emphasize the importance of identifying depression post-MI. Once a depression screen is positive, a clinical interview by the provider is needed to accurately diagnosis depression to avoid any false-positive screenings. Once a depression diagnosis is established, ensuring patients receive appropriate treatment for depression post-MI has been shown to decrease risks for mortality and adverse outcomes in numerous studies (Glassman et al., 2002; Siu & USPSTF, 2016; Zuidersma et al., 2013).

A second recommendation for the regions of the MHO is to ensure the PHQ-2 or the PHQ-9 screening results are recorded in the chart appropriately to maintain consistency within the organization. The data analysis used for this study was unable to investigate individual charts or clinical notes; however, potential depression screening information may be found in other locations other than the flowsheet. Also, providers and other staff may be missing the file submit button and mistakenly not recording PHQ results. Therefore, accurate use of the flowsheet and

use of another mechanism would allow for consistent charting, and assessment of past screening results within the MHO.

A final recommendation can be made for the development and implementation of further studies and practice improvement projects relating to depression in post-MI patients. The author of this study found a gap in the literature regarding examination of readmission rates in depressed post-MI patients. Addressing risks for readmission are of importance to any organization with our current and future healthcare state providing financial incentives emphasizing quality of care and health outcomes.

Future analysis of depression screening, depression treatment and effect on readmissions post-MI would be valuable in providing insight to the relationship between these variables, and provide evidence for improved depression healthcare. It should be noted that a study examining depression treatment post-MI and its relationship to readmissions would require a cross-sectional and a longitudinal methodology to collect data and investigate individual treatment options provided to patients. Lastly, a future study would benefit from a team approach with improved IT support to retrieve data and provide access to charts, and assistance from other researchers in examining individual patient charts and clinical notes to ensure all screening and treatment data is collected.

Implications for Advanced Nursing Practice

Ongoing efforts must continue to be made to improve depression and mental healthcare for post-MI patients. The AHA and the AAFP recognize the importance of providers to identify depressive symptoms in post-MI patients to ensure appropriate treatment and follow-up is provided. Advanced practice registered nurses (APRNs) must stay current with and utilize evidence-based recommendations to guide patient care and decision making. Currently the

AAFP is in the process of updating their guidelines regarding depression screening and treatment in post-MI patients. In reviewing the Journal of the American Academy of Nurse Practitioners, The Journal for Nurse Practitioners, and The National Organization of Nurse Practitioner Faculties, no relevant data pertaining to depression in cardiac patients was found, and confirms the need for additional studies to be completed and published in nurse practitioner related journals. As more studies and analyses are conducted regarding this topic it will be interesting to learn of any new recommendations that can be made for improved practices.

APRNs are uniquely prepared through their education and training to meet the challenges and complexity of our healthcare system. They have the opportunity to improve cost-savings within their organization. When APRNs are involved on collaborative teams, the holistic approach and strengths they bring have shown to decrease 30-day readmission rates by 50%, improve overall patient outcomes, and effectively reduce costs (David, Britting, & Dalton, 2015; Kutzleb et al., 2015). Integration of APRNs into inpatient or outpatient settings would be of benefit to any organization.

Lastly, findings from this study can be used to increase awareness among APRNs and other providers of the risks for readmission in post-MI patients with depression. The implications of the study are to ensure that depression screening is performed and documented, and that depressed patients receive appropriate treatment and depression care. APRNs have the opportunity to conduct further studies on this topic to further investigate risks for readmission and identify any other implications for practice improvement. APRNs should also implement quality improvement measures regarding depression screening and treatment of post-MI patients within their own clinical practice to improve depression management, health outcomes for post-MI patients, and cost-savings to the patient and organization.

Conclusion

This data analysis is one of few known studies that has examined risk for readmission and readmission rates in post-MI patients with depression. The retrospective review of MI and depression in these regions is the only known review completed by the organization. Overall, a statistically significant relationship between depression screening post-MI patients and readmission to the hospital in either regions was not found in this study. However, a relationship between depression treatment in post-MI patients and readmissions could not be determined due to inability to fully retrieve appropriate data. Numerous past findings have suggested improved health outcomes and health cost-savings for patients who are treated for depression post-MI. Therefore, further research should be conducted to examine the implications treating depression has on post-MI readmission rates. In conclusion, depression must be screened for, identified, and appropriately treated in post-MI patients to reduce risk of mortality, adverse outcomes, readmissions to the hospital, and reduce healthcare costs.

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APPENDIX A: NDSU IRB APPROVAL

Institutional Review Board (IRB) Authorization Agreement

Name of Institution Providing IRB Review (Institution A): Sanford FWA #: FWA00016819

Name of Institution Relying on the Designated IRB (Institution B): North Dakota State University

IRB Registration #, if any: IRB00001365 Federalwide Assurance (FWA) #, if any: FWA00002439

The Officials signing below agree that Sanford may rely on the designated IRB for review and continuing oversight of its human research described below: (*check one*)

☐ This agreement applies to all human research covered by Institution B's FWA.

☒ This agreement is limited to the following specific protocol(s):

Name of Research Project: A Data Analysis of the Predictive Risks for Readmission of Patients with Depression Post-Myocardial Infarction

Name of Principal Investigator: Dean Gross

Sponsor or Funding Agency: n/a

Award Number, if any: n/a

☐ Other (*describe*):

The review performed by the designated IRB will meet the human subject protection requirements of Institution A's OHRP-approved FWA. The IRB at Institution/Organization A will follow written procedures for reporting its findings and actions to appropriate officials at Institution B. Relevant minutes of IRB meetings will be made available to Institution B upon request. Institution B remains responsible for ensuring compliance with the IRB's determinations and with the terms of its OHRP-approved FWA. This document must be kept on file by both parties and provided to OHRP upon request.

Signature of Signatory Official (Institution A): _____ Date: 6/23/17

Printed Name: David Pearce, PhD Institutional Title:

Executive Vice President, Research, Sanford Health
Senior Scientist, Children's Health Research Center
Professor, Department of Pediatrics, Sanford School of Medicine of the University of South Dakota

Signature of Signatory Official (Institution B): Valrey V. Kettner Date: 06/29/17

Printed Name: Valrey V. Kettner, JD Institutional Title: Assoc. VP, Sponsored Programs Administration

APPENDIX B: SANFORD IRB APPROVAL

SANFORD HEALTH

APPROVAL OF SUBMISSION

June 20, 2017

Dear Dean Gross:

The IRB reviewed the following submission:

Type of Review:	Initial Study via Expedited review, Category 5
Title of Study:	Predictive Risks for Readmission for Depressed Post-MI Patients: A Data Analysis of the Predictive Risks for Readmission of Patients with Depression Post-Myocardial Infarction
Investigator:	Dean Gross
IRB ID:	STUDY00000998
New Items This Review:	• Letter of Support -A. Larson.docx, Category: Other; • Protocol_KDobberstein, Category: IRB Protocol
Special Determinations:	Waiver of HIPAA authorization; Waiver/alteration of the consent process

The IRB approved the study in its current form from 6/20/2017 to 6/19/2018 inclusive. Before 6/19/2018 or within 30 days of study closure, whichever is earlier, you are to submit a continuing review with required explanations. You can submit a continuing review by navigating to the active study and clicking Create Modification / CR.

If continuing review approval is not granted on or before 6/19/2018, approval of this study expires after that date.

All documents previously approved by the IRB remain approved until modified or withdrawn. If this study is closed to accrual, a new consent is not approved unless required for re-consent.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103) and all policies relevant to human research, which can be found by navigating to the eIRB library.

For questions please contact the IRB Office: eIRB@sanfordhealth.org.

APPENDIX C: ICD-9 & ICD-10 CODES FOR ACUTE MYOCARDIAL INFARCTION

Table C1

ICD-9 Codes for Acute Myocardial Infarction

ICD-9 Code	Description
410.00	Acute Myocardial Infarction of Anterolateral Wall, episode of care unspecified
410.01	Acute Myocardial infarction of Anterolateral Wall, initial episode of care
410.10	Acute Myocardial Infarction of Other Anterior Wall, episode of care unspecified
410.11	Acute Myocardial Infarction of Other Anterior Wall, initial episode of care
410.20	Acute Myocardial Infarction of Inferolateral Wall, episode of care unspecified
410.21	Acute Myocardial Infarction of Inferolateral Wall, initial episode of care
410.30	Acute Myocardial Infarction of Inferoposterior Wall, episode of care unspecified
410.31	Acute Myocardial Infarction of Inferoposterior Wall, initial episode of care
410.40	Acute Myocardial Infarction of Other Inferior Wall, episode of care unspecified
410.41	Acute Myocardial Infarction of Other Inferior Wall, initial episode of care
410.50	Acute Myocardial Infarction of Other Lateral Wall, episode of care unspecified
410.51	Acute Myocardial Infarction of Other Lateral Wall, initial episode of care
410.60	True Posterior Wall Infarction, episode of care unspecified
410.61	True Posterior Wall Infarction, initial episode of care
410.70	Subendocardial Infarction, episode of care unspecified
410.71	Subendocardial Infarction, initial episode of care
410.80	Acute Myocardial Infarction of Other Specified Sites, episode of care unspecified
410.81	Acute Myocardial Infarction of Other Specified Sites, initial episode of care
410.90	Acute Myocardial Infarction of Unspecified Site, episode of care unspecified
410.91	Acute Myocardial Infarction of Unspecified Site, initial episode of care

Table C2

ICD-10 Codes for Acute Myocardial Infarction

ICD-10 Code	Description
I21.09	ST Elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
I21.11	ST Elevation (STEMI) myocardial infarction involving right coronary artery
I21.19	ST Elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
I21.29	ST Elevation (STEMI) myocardial infarction involving other sites
I21.3	ST Elevation (STEMI) myocardial infarction of unspecified site
I21.4	Non-ST elevation (NSTEMI) myocardial infarction

APPENDIX D: ICD-9 & ICD-10 CODES FOR DEPRESSION

Table D1

ICD-9 Codes for Depression

ICD 9 Code	Description
296.20	Major Depressive Affective Disorder Single Episode Unspecified Degree
296.21	Major Depressive Affective Disorder Single Episode Mild Degree
296.22	Major Depressive Affective Disorder Single Episode Moderate Degree
296.23	Major Depressive Affective Disorder Single Episode Severe Degree W/o Psychotic Behavior
296.24	Major Depressive Affective Disorder Single Episode Severe Degree W/ Psychotic Behavior
296.25	Major Depressive Affective Disorder Single Episode In Partial Or Unspecified Remission
296.26	Major Depressive Affective Disorder Single Episode In Full Remission
296.30	Major Depressive Affective Disorder Recurrent Episode Unspecified Degree
296.32	Major Depressive Affective Disorder Recurrent Episode Mild Degree
296.32	Major Depressive Affective Disorder Recurrent Episode Moderate Degree
296.33	Major Depressive Affective Disorder Single Recurrent Severe Degree W/o Psychotic Behavior
296.34	Major Depressive Affective Disorder Recurrent Episode Severe Degree W/ Psychotic Behavior
296.35	Major Depressive Affective Disorder Recurrent Episode In Partial Or Unspecified Remission
296.36	Major Depressive Affective Disorder Recurrent Episode In Full Remission

Table D2

ICD-10 Codes for Depression

ICD-10 Code	Description
F32	Major depressive disorder, single episode
F32.0	Major depressive disorder, single episode, mild
F32.1	Major depressive disorder, single episode, moderate
F32.2	Major depressive disorder, single episode, severe without psychotic features
F32.3	Major depressive disorder, single episode, severe with psychotic features
F32.4	Major depressive disorder, single episode, in partial remission
F32.5	Major depressive disorder, single episode, in full remission
F32.8	Other depressive episodes
F32.9	Major depressive disorder, single episode, unspecified
F33	Major depressive disorder, recurrent
F33.0	Major depressive disorder, recurrent, mild
F33.1	Major depressive disorder, recurrent, moderate
F33.2	Major depressive disorder, recurrent severe without psychotic features
F33.3	Major depressive disorder, recurrent severe with psychotic symptoms
F33.4	Major depressive disorder, recurrent, in remission
F33.40	Major depressive disorder, recurrent, in remission, unspecified
F33.41	Major depressive disorder, recurrent, in partial remission
F33.42	Major depressive disorder, recurrent, in full remission
F33.8	Other recurrent depressive disorders
F33.9	Major depressive disorder, recurrent, unspecified

APPENDIX E: EXECUTIVE SUMMARY

Depression is the leading cause of disability world-wide, and cardiovascular disease continues to be the deadliest disease world-wide and in the United States. The economic burden of depression is estimated at $210.5 billion, and the most significant portion of this burden relates to comorbidities with depression. Depression is highly prevalent after a myocardial infarction, and occurs in one in every five patients. However, depression often goes unrecognized in patients with cardiovascular disease, thus creating an area of concern.

A data analysis was conducted using past electronic medical record data obtained from two regions of a midwestern healthcare organization. The data were analyzed to assess for risk factors contributing to readmission to the hospital in post-myocardial infarction patients with depression. Depressed patients are at highest risk for readmission within the first year after a myocardial infarction (MI), therefore the study examined if depression screening within 12 months after a myocardial infarction influenced readmission rates.

Background

Depression in post-myocardial infarction patients increases risk for adverse outcomes and mortality. Studies have found that untreated depression post-myocardial infarction increases risk for mortality, readmissions, and further complications. In fact, depression has been found to double the risk of death after a heart attack. Lastly, untreated depression had twice as high of a mortality rate compared to treated depression 1 year post-myocardial infarction. This last point emphasizes the importance of depression screening and treatment in post-MI patients.

The American Heart Association and American Academy of Family Physicians developed guidelines recommending routine depression screening in post-myocardial infarction patients. They emphasize the importance of providing appropriate treatment interventions to

improve health outcomes in patients who have depression. The data analysis was developed based on these guidelines' recommendations, past research evidence, and after meetings with the organization.

Process

The data were collected with collaboration of an IT specialist who used diagnosis codes, called ICD codes, to retrieve data from patient charts. Components of the analysis included: identifying readmission rates in depressed post-myocardial infarction patients, identifying readmission rates in depressed post-myocardial infarction patients who were screened for depression, and identifying readmission rates in depressed post-myocardial infarction patients who were screened and treated for depression. Other data components included age, gender, race, death rates, and type of provider performing depression screening. A statistician performed the statistical analyses of the results, and then evaluation of the results was conducted.

Findings and Conclusion

First, readmission rates were analyzed from the data sets. There was an overall rate of 16.5% of patients who were readmitted within 12 months post-myocardial infarction. A category of readmission within 0-30 days post discharge was developed since readmissions within 30 days post-discharge are of importance to organizations as they effect reimbursement from the Centers for Medicare & Medicaid Services. Region 1 had a 22.4% 30-day readmission rate, and Region 2 had a 27.55% 30-day readmission rate.

Demographic data findings had consistencies and differences when comparing to past study findings. The median ages for Region 1 and Region 2 were 58 and 59 years old, respectively. This is consistent with past study findings of a median age range of 56-65 years old. The study had a higher number of males than females who had depression post-MI. This finding

is inconsistent with past findings that females are more commonly found to have depression post-MI. Lastly, race of the data sample was examined, and found that the highest number of patients were Caucasian followed by the second highest race of American Indians/Alaskan Natives. This finding was expected as Caucasians make up the largest portion of the population in the Midwest, and have the highest incidence of adult depression in the U.S.

In performing statistical analysis of these findings, there were no statistically significant relationships found between depression screening and readmission post-myocardial infarction for either region. Treatment data were unobtainable for this data analysis. A prediction of the study was to find a significant relationship between depression screening, treatment, and decreased readmission rates. However, no conclusions can be made regarding implications that depression treatment has on readmission rates in post-myocardial infarction patients for these regions.

Recommendations for Further Action

The first recommendation that can be made for the regions is development of a protocol or quality measure to ensure post-myocardial infarction patients are screened for depression and appropriately treated at follow-up visits with their primary care provider (Green et al., 2009). Screening patients for depression allows for better identification of depressive symptoms post-myocardial infarction. A second recommendation for the regions is to ensure that the depression screening tool results are recorded in the chart appropriately to maintain consistency of documentation within the organization. Lastly, a final recommendation can be made for the development and implementation of future research and practice improvement projects relating to depression in post-MI patients. Future analysis of depression screening, depression treatment, and effect on readmissions post-MI would be valuable in providing insight to their relationship, and provide evidence for improved depression healthcare.