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Association Between Learning Methods and Analgesic Opioid Abuse

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Abstract

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MPH, Walden University, 2016

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Opioids are an extremely addictive class of medication used to treat pain; overprescribing practices and chronic misuse has led to an epidemic that continues to grow. The opioid epidemic not only has the potential to cause injury or even death but also has a large impact on the U.S. economy. Research regarding determinants of abuse are needed to improve safeguards for opioid abuse prevention. The purpose of this quantitative study was to determine if learning capabilities and/or learning medium preference are correlated with analgesic opioid abuse. The social-ecological model was used to evaluate the social levels of influence for abuse in order to limit abuse illness, injury, and economic burdens. The target population for this study was the active patient population of a large healthcare network in New York State that represents both rural and urban population densities. Secondary data from the Bassett Healthcare Network electronic health record was used to examine the association between the presence of analgesic opioid abuse and the results of a learning assessment; additional determinants that were examined included county of residence characteristics, population density, access to patient portals, and patient demographics. The results of this study revealed an association between learning assessments and analgesic opioid abuse. Furthermore, a significant relationship was identified between analgesic opioid abuse diagnosis and preferred learning methods, learning barriers, population density, county of residence, age, insurance status, and access to a patient portal. Identification of factors related to analgesic opioid abuse can be utilized by all levels of government to determine the direction of funding, enhance policy development, and further refine public health intervention works, and thus promote social change.

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Dedication

This dissertation is dedicated to my family who taught me to always chase my passions, my U.S. Air Force brothers and sisters who taught me strength, and God for teaching me there is no mountain too large if you're always looking up.

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I would like to thank Walden University for affording me the opportunity complete my doctoral degree. Additionally, I'd like to extend gratitude to my committee members, Dr. Vasileios Margaritis and Dr. Patrick Dunn, for all their immense support and assistance throughout this process.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study and Literature Review

Introduction

Opioids are an extremely addictive class of medications utilized to treat pain. In recent years analgesic opioid abuse has garnered extensive media coverage as nearly every population in the United States has been negatively impacted in some way or another. According to the National Institute on Drug Abuse (NIDA, 2018), more than 115 people in the United States die from an opioid overdose in the United States every day. Furthermore, the same organization reports that 21 to 29% of those prescribed opioids for chronic pain will misuse them and 8–12% of those patients will develop an opioid use disorder. Additionally, around 80% of individuals who use heroin first misused prescription opioids (NIDA, 2018). Research regarding social risk factors of analgesic opioid abuse is needed in order to improve the prescribing and distribution process of opioids and perhaps improve the management of pain in noncancer patients. With the necessary protocol in place, prescribers can have added safeguards to protect their patients from the dangers of opioid disorders. Protocols may also reduce the economic burden associated with opioid abuse. The Centers for Disease Control and Prevention (CDC, 2018) reported an economic burden of $78.5 billion a year according to 2013 data. The cost is expected to rise as the years pass (CDC, 2018).

In this study, I evaluated the potential correlation between learning preference/capacity and the presence of analgesic opioid abuse. In identifying the additional opioid abuse determinates regarding of learning preference, social change can occur through better policy development and distribution of information in the clinical

(provider office) and nonclinical setting (public health entities) for those receiving opioid prescriptions. If individuals receive information regarding the usage of opioids and the dangers of misuse in a method that is most appropriate for that patient, they may be more likely to use the medication safely (Waszak et al, 2017). This section is comprised of the following subsections: (a) Problem Statement, (b) Purpose of the Study, (c) Research Questions (RQ) and Hypotheses, (d) Theoretical Foundation for the Study, (e) Nature of the Study, (f) Literature Search Strategy, (g) Literature Review Related to Key Variables, (h) Definitions, (i) Assumptions of the Study, (j) Scope and Delimitations, (k) Significance, and (l) Summary and Conclusions.

Problem Statement

Opioid abuse in upstate New York and rural areas throughout the United States is a growing problem. According to the CDC (2017), 15,000 Americans died of a prescription opioid overdose in 2015 in the United States. The same article goes on to mention that between the years of 1999 to 2015, a total of 183,000 individuals died from prescription opioid overdose (CDC, 2017). To further show the impact of the opioid epidemic, a 2012 report revealed that at the time, 2.1 million Americans had a substance abuse disorder related to prescription, or analgesic, opioids (Volkow, 2014). The New York State Department of Health (NYSDOH) reported the rate of opioid-related overdoses increased from 5.4 per 100,000 in 2010 to 10.8 per 100,000 in 2015 (NYSDOH, 2017). Additionally, NYSDOH has reported an increase in opioid analgesic-related deaths; in 2013 there were 952 opioid analgesic-related deaths, which was up more than 30% from 2009 (NYSDOH, 2015).

Regarding risk factors, a NIDA report describes numerous factors contributing to the growing rate of opioid abuse associated with prescription opioids (analgesic opioids). These factors include an increased number of prescriptions written and dispensed and greater social acceptance, in addition to aggressive marketing by pharmaceutical companies (Volkow, 2014). A 2015 annual review of the opioid epidemic echoed this finding by stating that the greatest cause for the rise in opioid abuse is due to added prescription writing caused by the introduction of the *fifth vital sign* (Kolodny et al., 2015). The fifth vital sign was part of a federal push to treat patients' level of pain as a vital sign that must be treated; this coincided with aggressive campaigning by pharmaceutical companies who stated that opioids are not dangerous. The combination of added clinician expectation and pharmaceutical campaigning created a culture of over prescribing (Kolodny et al., 2015).

Volkow (2014) also stated that greater social acceptance has an influential part in the increase of opioid abuse. This study can assist researchers in determining if information assimilation is correlated with social acceptance due to a decreased understanding of risk factors or instructions, therefore, following social influence and increasing likelihood of abuse. In rural areas such as the target population in rural Upstate New York, there is often limited access to care, low health literacy, low overall literacy, high unemployment, and low transportation services. In this context, the misuse of analgesic opioids should be greater; high social acceptance of opioid abuse and a low understanding of addiction mechanisms, or even perhaps the appropriate usage of the drug due to low health literacy, indicates a potential for increased abuse (CDC, October

2017). Protheroe et al. (2016) determined that old age, lower educational level, lower income, perceived poor health, and lack of access to the internet are determinants of limited health literacy leaving people in rural areas at high risk for opioid abuse.

Identifying correlations between analgesic opioid abuse and if the method of health information distribution meets learning needs is the next logical step in research in order to reduce rising opioid abuse rates. If an individual has a learning barrier and does not receive health information in a medium that is conducive to their style of learning, they may not truly understand appropriate medication usage or where to obtain additional information outside of their social units (Sheikh et al, 2018). One may expect an individual who is not receiving medical information in the appropriate method would have a similar understanding to that of an individual with low health literacy putting them at risk for misuse and abuse.

Purpose of the Study

The purpose of this quantitative study was to determine if learning capabilities and/or learning medium preference are correlated with analgesic opioid abuse in the population of patients serviced by the Bassett Healthcare Network. The Bassett Healthcare Network spans 5,600 square miles of New York State across eight counties: Chenango, Delaware, Herkimer, Madison, Montgomery, Oneida, Otsego, and Schoharie. Additionally, I evaluated independent variables such as location (rural vs. urban), age, sex, race, insurance status, patient portal access, and county-level characteristics for correlation with analgesic opioid abuse. In conducting this research, I wanted to contribute to the literature on the study topic. A review of the available literature

regarding analgesic opioid abuse determinates revealed significant gaps in nearly all areas of social determinants of health.

From a perspective of public health, the opioid epidemic is a population-level issue that affects nearly everyone in the United States. Limited research regarding risk factors of opioid abuse has resulted in ineffective preventative policy and protocols that only fuels opioid outbreak and the burden it places on the United States (Thomas et al, 2020). The limited research surrounding opioids directly links to many of the 10 essential public health services; most specifically, it connects to research for new insights and innovative solutions to health problems (CDC, 2017). A more targeted and innovative approach to opioid prescribing through identification of risk factors in patients receiving opioid prescriptions could help providers in their efforts to safeguard patients from the dangers of misuse and abuse of the opioid prescription.

Theoretical Foundations for the Study

The social-ecological model (SEM) is often used to explain the association between individual practices, social factors, the physical environment, and other factors as they relate to a specific health behavior (Thomas et al, 2020). The framework explains the interaction between these levels, which are identified through varied relationships: intrapersonal or individual (personal knowledge and behavior), interpersonal (social networks), organizational (healthcare system, professional associations, and state/local health departments), community (institutional relationships, media), and public policy (local, state, federal laws) (Bronfenbrenner, 1979). For instance, the intrapersonal belief that one is not susceptible to disease, which is based on misinformation, could impact

participation in healthy behavior. In addition, interpersonal relationships may impose cultural beliefs limiting an individual's participation in a healthy behavior.

Tran et al. (2012) used the SEM to explain multilevel predictors for individuals using opioids while also on methadone maintenance treatment protocols. The researchers were able to successfully evaluate varied levels of influence found in the SEM in order to identify influences similar to that of this study (Tran et al., 2012). In another study of social-ecological influences on patterns of substance use among nonmetropolitan high school students, the researchers also used the SEM in order to determine the level of influences which impacted the patterns of substance abuse in a population of high school students. The researchers determined that a great amount of influence resulting in abuse patterns stemmed from specific parental characteristics thus showing the value of utilizing the SEM (Connell et al., 2010).

In this study, I applied the SEM to all of the RQs as the model evaluates the influences that relationships of the surrounding environment can have on the variables. In regard to opioids, SEM was used to explain access to services, external perceptions to opioid usage, and surrounding policies developed to combat the rate of abuse.

Research Questions and Hypotheses

RQ1: Is there an association between a learning assessment being accomplished to determine learning capabilities and analgesic opioid abuse in population of upstate New York.

$H_0$1: There is no association between the presence of a learning assessment and analgesic opioid abuse.

H_a1: The presence of a learning assessment is associated to analgesic opioid abuse.

RQ2: Is there an association between preferred method of learning identified on the learning assessment (reading, listening, demonstration, pictures/video, and unspecified) and analgesic opioid abuse in New York state.

$H_0$2a: There is no association between any specific preferred methods of learning and analgesic opioid abuse.

H_a2a: There is a higher rate of analgesic opioid abuse among specific preferred methods of learning.

RQ3: Are there any learning barriers from the learning assessment (language, visual, hearing, physical, emotional, cognitive, financial, spiritual, cultural, no learning barriers and unspecified barriers) which can be identified as determinates of analgesic opioid abuse?

$H_0$3a: There is no association between no specific learning barriers documented and analgesic opioid abuse.

H_a3a: There is a higher rate of analgesic opioid abuse among specific learning barriers.

RQ4: Is there an association between population density (rural vs. urban) and analgesic opioid abuse?

$H_0$4a: There is no association between urban population density and analgesic opioid abuse.

H_a4a: There is an association between the rate of analgesic opioid abuse in urban

populations.

$H_0$4b: There is no association between rural population density and analgesic opioid abuse.

H_a4b: There is an association between the rate of analgesic opioid abuse in rural populations.

RQ5: Is there an association with between specific limitations in the county of residence (access to transportation, access to care, or SES) and analgesic opioid abuse?

$H_0$5a: There is no association between analgesic opioid and county level limitations.

H_a5a: There is an association between analgesic opioid abuse and county level limitations.

RQ6: Is there an association between analgesic opioid abuse and demographic/SES (age, gender, insurance coverage, and race)?

$H_0$6a: There is no association between analgesic opioid and specific demographic/SES characteristics.

H_a6a: There is an association between analgesic opioid abuse and specific demographic/SES characteristics.

RQ7: Is there an association between opioid abuse and increased access to medical advice through access to a medical patient access portal?

$H_0$7: There is no association between analgesic opioid abuse and access to a medical patient portal.

H_a7: There is an association between analgesic opioid abuse and access to a

medical patient portal.

Nature of the Study

I performed a secondary data analysis for this study using data from the Bassett Healthcare Network electronic health record. The purpose of this study was to determine if there was a correlation between county-level limitations (independent variable), preferred education method (independent variable), population density (independent variable), learning barriers (independent variable), access to a patient access portal (independent variable), and the presence of analgesic opioid abuse (dependent variable). The covariates were age, sex, race, education status, and socioeconomic status. The study population consisted of patient records from the Bassett Healthcare Network, which is in Upstate New York and spans 5,600 square miles through multiple local government counties and population density areas (Bassett Healthcare Network, n.d.).

Literature Search Strategy

Two databases (PubMed and Medline), two libraries (Bassett Healthcare Network and Walden University), the NYSDOH site, the CDC site, and Google Scholar were utilized to search for scholarly journal articles, current policy, and presence data. Keyword search terms utilized include: *opioid abuse, fifth vital sign, literacy, analgesic opioid abuse, rural opioid abuse, determinants of opioid abuse, opioid epidemic, opioid addiction mechanisms, public health approach to opioid, public health approach to addiction epidemic, analgesic opioid diversion, community impact of opioid abuse, literacy and opioid abuse,* and *patient access portal opioid abuse.* Due to opioid abuse being a relatively new health issue there is not an enormous amount of data regarding

determinants of opioid abuse however foundational information for this study was all found within a five-year lookback period.

Literature Review Related to Key Variables and/or Concepts

The topics included in the literature review are (a) the target population, (b) the history of opioids in the United States, (c) mechanisms of opioid addiction, (d) opioid abuse in New York State and in the United States, (e) current policy and interventions, (f) determinants of opioid abuse and addiction, and (g) gaps in the literature.

Target Population

The Bassett Healthcare Network spans 5,600 square miles of New York State which consists of eight counties: Chenango, Delaware, Herkimer, Madison, Montgomery, Oneida, Otsego, and Schoharie.

Chenango County

Chenango County Community Health Assessment notes that the county is a rural community in which 90% of the county's land is dedicated to agriculture or forest. The county is of the lesser populated counties in New York state with 49,868 residents. The county is primarily white non-Hispanic community (94%) with 58.2% of the population falling between the age range of 20-64 years of age. Overall the median family income is below average for the state at $44,427 with 16.8% of the population living below the Federal Poverty Level. This poor economic status is listed as a cause for challenges relating to food, housing, clothing, transportation, and healthcare. The county's community health assessment lists county disparities to include

- lack of public and private transportation

- high percentage of the residents living at or below the poverty threshold
- aging population
- rural living
- government based payer population seeking medical care
- limited access to health care (health, dental, and mental)
- shortage of medical provider staff
- lack of adequate housing
- lack of rehabilitation facilities/care for substance abuse population
- lack of community knowledge for preventative lifestyles (Chenango County Department of Health and UHS Chenango Memorial Hospital, 2016)

Delaware County

Delaware County Community Health Assessment (2013) states that the county is also a primarily rural area which has much of its' residents isolated due to two of the largest reservoir watersheds which support the New York City population. Approximately 55% of the county's population of 47, 980 individuals reside within the watershed. Just outside of the watershed on the western rim is where a majority of the county's industry resides as mostly manufacturing. Otherwise, the county economy is stimulated by a large agricultural presence, tourism, and recreation facilities (ex: skiing, hiking, fishing, etc.).

Of the 47,980 residents, 50.3% are males, and 49.7% are female. Racial diversity is minimal is Delaware County, 95.6% of the population is Non-Hispanic White, 1.9% African America, .3% American Indian/Eskimo, .9% Asian, and 34.% are of Hispanic

Origin. The median income of the county is $43,554. From an educational perspective, the vast majority of residents have only a high school education.

Factors influencing the health status of the county (Delaware County Public Health, 2013):

- Lack of public and private transportation
- Aging population
- Rural/ geographically isolated populations
- Limited access to health care (health, dental, and mental)
- Shortage of medical provider staff
- Lack of rehabilitation facilities/care for substance abuse population
- Lack of community knowledge for preventative lifestyles

Herkimer County

Herkimer County Community Health Assessment (2016) notes that the county population is 63,100 individuals with 95.4% White non-Hispanic, 2.1% African American, .3% American Indian and Alaska Native, .7% Asian, and 2.9% Hispanic. Income in the county mostly comes from industry with Remington Arms in addition to agriculture. The median household income for the area is $45,649 with 15.9% falling below the poverty level (Herkimer County Public Health, 2016).

Madison County

The Madison County Community Health Assessment (2016) has 72,427 residents with a median income of $54,145. Of the population, 12.2% of residents are living in poverty with 17.9% of the poverty population under 18 years of age. The county is

reported to be predominantly rural with a population density of 110 persons per land square mile. Farmland consists of 45% of the land in the county. The median age of the county residents is 40.8 with 16.3% of resident being over 65 years of age. While numerous healthcare facilities exist in the area, the lowered health status is contributed mostly to the lowered socioeconomic status which contributes to numerous health disparities such as a higher rate of chronic disease, cancer, heart disease, chronic lower respiratory disease (CLRD), and stroke (Madison County Public Health, 2016).

Montgomery County

Montgomery County Public Health (2016) describes Montgomery County as having a population of 50,019 residents. The racial disparities include: 90% White, 1.8% African American, and 11.7% Hispanic. The median household income is $44,167 for the county, and the median age is 41 years of age. Of the population, 38.7% of the population is below the level of poverty with 53% of children below poverty. The lower socioeconomic status also contributes to the lowered health status of the residents. Primary areas of health-oriented concerns for the county include (Montgomery County

Public Health, 2016):

- Lack of Transportation
- Substance abuse
- Mental Health
- Nutrition, Physical Activity & Weight
- Cancer
- Heart Disease & Stroke
- Diabetes
- Access to Healthcare Services
- Respiratory Diseases
- Injury & Violence
- Potentially Disabling Conditions

Oneida County

The Oneida County Health Assessment (2017) reports the county as having both rural and urban populations. There are three major cities in the county: Utica (62,000), Rome (33,000), and Sherrill. There is a reported 67% of the population which resides in an urban area whereas 33% are in a rural area. The median age of the population is 41.2 years of age with 16.8% being over the age of 65 years of age. The racial diversity is also limited: White (84.9%), Black (5.5%), Asian (4.0%), and Hispanic/ Latino (5.5%). Perhaps more pertinent, there is a large refugee resettlement agency which has resettled over 15,000 individuals in the city of Utica with varying nationalities such as: Vietnamese, Russian, Bosnian, Somali Bantu, Burmese, Nepali, etc. Furthermore, the

county houses the Oneida Indian Nation as well as pockets of both Amish and Mennonite individuals. Economically 11.7% of the population is below the poverty level, of those individuals, 20.8% are below the age of 18 years, and 9.1% are over the age of 65 years. Major health concerns of the county are reported as limited access to primary care (engagement, appointments, etc.), access to health insurance, access to specialty services, and access to dental care. Community health concerns were listed as obesity, allergies, heart disease, lack of exercise, Alzheimer's disease, Lyme disease, mental health, Chronic pain, Osteoporosis, Sexually Transmitted Diseases, illicit drugs, pollution, lead poisoning, Anemia, and personal hygiene (Oneida County Health Department, 2017).

Otsego County

The Otsego County Health Department published the Community Health Assessment (2016) is a predominantly rural county with a population of 60,636 individuals. Racial demographics are reported as: 94.4% White, 2.3% African American, 0.2% American Indian and Alaska Native, and 1.5% Asian. The county's economy relies primarily on agriculture (predominantly dairy farming), mining, forestry, chemical/heavy industry, and tourism. Tourism stems from the presence of the National Baseball Hall of Fame, numerous museums, and large summer camps; all of which bring a large number of tourists from all over the world each year. Furthermore, there are two large colleges in the county: Hartwick College and the State University of New York at Oneonta. Economically 16.4% of residents are below the poverty level with the median household income is $47,884. Health concerns and determinants for the county are listed as (Otsego

County Health Department, 2016):

- Premature deaths
- Preventable hospitalizations
- Access to care (medical and dental)
- Limited Primary Care Providers
- Obesity
- Chronic Disease
- Tobacco use
- Cancer (Lung/Oral)
- Limited Transportation
- Low access to grocery stores
- Preventable injury (occupational, violence, etc.)

Schoharie County

The Schoharie County Community Health Assessment (2016) has published the county as being predominantly rural but it bordered by both rural and urban communities. The reported county population is 31,330 with 95.9% White, 1.6% Black, 0.3% American Indian, and 0.8% Asian; of this population 3.2% are Hispanic. Economically, the county is dependent upon mining, forestry, agriculture, chemical industry, heavy industry, manufacturing, and professional services. Tourism also largely contributes to the county's economy due the college and presence of several natural tourist destinations. The reported median household income is $51,873, of this 12.9% are living under the poverty level. Health concerns of the county include (Schoharie County

Public Health, 2016)

- Premature death
- Lack of dentists
- Lack of primary care physicians
- Obesity
- Poor diet
- Physical Inactivity
- Tobacco use
- Cancer
- Diabetes
- Heart Disease
- Arthritis
- Lack of transportation
- Lack of access to grocery stores
- Lack of exercise opportunities
- Drug abuse
- Low maternal child health
- Alcohol abuse
- Low childhood immunization rate

History of Opioids in the United States

Opium use has been documented as far back at 5000 BC in numerous populations throughout the world and had a constant presence in history (University of Minnesota,

n.d.). In the United States, opioids had an early presence in the country right from the beginning. During the Civil War and after, opium became a common substance utilized for its' ability to make people feel good, operate as a cough suppressant and painkiller which eventually became a constant staple in many elixirs, tonics, and medicines which were commonly sold in general stores, apothecaries, and so forth (University of Minnesota, n.d.). Eventually, the usage of opioids turned into more liberal and illicit through the presence of 'opium dens' which were available in nearly every town and city in the country (University of Minnesota, n.d.). Due to this common access and presence of social acceptance, there is an estimated 500,000 Americans who were addicted to opium by the end of the 19th century (University of Minnesota, n.d.). The presence of opioids continued to grow in the United States for treatment of many acute pains and cancer-related pains. In 1987 MC Contin (Morphine sulfate) was approved by the FDA as the first formulation of opioid pain medication with an allowed dose of every 12 hours (FDA, 2018). In 1990 Duragesic (fentanyl transdermal system) was approved to deliver opioid medication through a skin patch which would be changed every 3 hours (FDA, 2018). As of 1995 Oxycodone controlled-released was approved which was formulated to permit dosing every 4-6 hours. This dosing is the focal point of opioid abuse escalation (FDA, 2018).

While the FDA was continuing to approve new formulation and dosing for opioid classed drug, the promotion of opioid prescribing started to increase. According to Kolodny et al, during the years of 1996 to 2002, Purdue Pharma was the funding source for over 20,000 pain-oriented education programs through grants or sponsorship while

also launching a multi-phased campaign which encouraged the utilization of long-term opioid pain relievers (OPRs) for non-cancer patients. The multi-phased campaign provided financial support to the following organizations: American Pain Society, American Academy of Pain Medicine, Federation of State Medical Boards, Joint Commission, pain patient groups, as well as other relevant groups. In response to this funding, these groups worked toward aggressive identification for OPR pain treatment. In 1995 the American Pain Society promoted the campaign "Pain is the Fifth Vital Sign." This campaign requested that healthcare professionals approach pain assessment with the same level of importance or tenacity as they do the other four vital signs: temperature, pulse, blood pressure, and respiratory rate. Shortly after implementation the Department of Veterans Affairs (VA), Joint Commission, and the American Academy of Pain Medicine began to endorse the campaign by issuing statements of support. In addition, these organizations outwardly and overly exaggerated the benefits of long-term OPR use (Kolodny et al., 2015). As a result of the program promotion, the opioid epidemic has grown at an alarming rate.

In the early 2000s the U.S. federal government started acknowledging reports of the increase deaths and overdoses related to opioids so in 2001 an inter-agency collaboration began between the Federal Drug Administration (FDA), SAMHSA, the NIDA, and Center for Substance Abuse Treatment (CSAT) to come up with intervention and education campaigns. The multi-agency collaboration resulted in programs such as the Patient Package Insert (PPI) were given with OxyContin and other formulations which provided a written documentation of how to safely use the drug in addition to

dangers for the patient (FDA, 2018). A warning letter was also eventually sent to manufacturers of OxyContin such as that of Purdue Pharma, which identified their misleading advertisements and how the company was failing to warn patients of the clearly present dangers associated with the drug (FDA, 2018). However, according to data from the FDA, by 2009 there were reports of about 1.2 million emergency department (ED) visits which were associated with misuse or abuse of pharmaceutical opioids which was a 98% increase from the same reports in 2004 (FDA, 2018).

Mechanisms of Opioid Addiction

The National Institute of Drug Abuse (NIDA) has stated that Opioids are an extremely addictive and dangerous class of medication (National Institute of Drug Abuse, 2014). The organization describes the addiction mechanism of opioids as the drug acts by attaching itself to specific proteins called opioid receptors which are part of nerve cells in the brain, spinal cord, gastrointestinal tract, and other organs of the body (National Institute of Drug Abuse, 2014). Upon attaching to the brains' receptors, there is a reduction of perceived pain and an increase of an overall feeling of well-being by impacting the reward centers of the brain (National Institute of Drug Abuse, 2014). Additional impacts of opioid usage can include drowsiness, confusion, nausea, and constipation (National Institute of Drug Abuse, 2014). NIDA has also stated that "the effects of opioids are typically mediated by specific subtypes of opioid receptors (mu, delta, and kappa) that are activated by the body's own (endogenous) opioid chemicals (endorphins, encephalin) (National Institute of Drug Abuse, 2014). With repeated administration of opioid drugs (prescription or heroin), the production of endogenous

opioids is inhibited, which accounts in part for the discomfort that ensues when the drugs are discontinued (*i.e.*, withdrawal)" (National Institute of Drug Abuse, 2014). As the production of the endogenous opioids are inhibited, individuals will also often seek to increase usage to overcome the "tolerance". This need for increased usage often forces individuals to use the drugs in ways other than prescribed such as crushing the pills or taking to high of a medication dose (National Institute of Drug Abuse, 2014).

Opioid Abuse in New York State and in the United States

According to the CDC (2017), 15,000 Americans died of a prescription opioid overdose in 2015. Between years of 1999 to 2015, a total of 183,000 individuals died from prescription opioid overdose (CDC, 2017). Furthermore, in 2012, 2.1 million Americans suffered from a substance abuse disorder related to prescription opioids (analgesic opioids) (Volkow, 2014).

In New York State, the opioid analgesic-related deaths increased from 2010-2015. In 2013 there were 952 opioid analgesic-related deaths which was up more than 30% from 2009 (NYSDOH, 2015). Overall the opioid-related deaths amounted to 2,175 in 2013 which was more than a 40% increase from 2009 (NYSDOH, 2015).

Current Policy and Interventions

Numerous state and federal programs have recently been implemented to try and stop or at least reduce the devastating rate of morbidity and mortality statistics related to opioids. The CDC reports a total of 29 funded states throughout the United States at which an opioid prevention program is present (CDC, October 2017). These are four-tiered programs which address prescription drug monitoring programs (PDMPs), state

policy evaluations, rapid response projects, and community, insurer or health system interventions. PDMP includes actions toward universal registration, easier access, improved reporting, and a greater understanding of the epidemic through information provided (CDC, October 2017). Community or insurer/health system interventions provide technical assistance for high-burden areas, and enhancement of evidence-based (EVBD) opioid prescribing guidelines (CDC, October 2017).

New York State not only supports a Prescription Drug Monitoring Program (PDMP) as is federally sponsored but also maintains a Heroin and Opioid Crisis taskforce which is an ongoing effort to monitor and intervene in 4 categories: Prevention, Treatment, Recovery, and Enforcement as the opioid epidemic evolves throughout the state (New York State, June 2016).

Determinants of Opioid Abuse and Addiction

Predictive determinates of opioid abuse/addiction remain an area of need. The biggest struggle in data collection, of course, being the inherent nature of data collection. Individuals are required to self-report illegal behavior which is otherwise challenging to capture. A systematic review conducted by King et al. (2014) has determined a few demographics that seem to show higher than usual rates of abuse. In general, men, non-Hispanic Whites, American Indian/ Alaska Natives, middle-aged individuals, individuals living in rural communities, and those in a lower SES tend to have a higher rate of opioid abuse. Furthermore, King et al noted that educational interventions at time of prescription have proven to reduce analgesic opioid abuse in some cases (King et al, 2014). Roskos et al evaluated impacts of literacy from a perspective of opioid contracts.

Roskos et al's findings suggest that individuals of a low literacy are less likely to understand the expectations outlined in their opioid contract regarding usage (Roskos et al, 2007). A separate study from Ratycz et al performing a review of medical school education on the topic of opioid and heroin abuse, found that individuals need to be more cognizant of patient needs to include learner knowledge and capabilities; there is currently a gap in training for adaptability of learning method and learning barriers (Ratycz, 2018).

Evaluating the differences between rural and urban populations in regards to nonmedical prescription opioid use and abuse, Keyes et al determined that those in a rural environments are more likely to abuse opioids due to the associated rural stressors such as limited access to care, transportation, or potentially lowered SES. There were four factors found by Keyes et al to explain the increase in opioid abuse in rural areas over urban areas (Keyes, et al, 2014):

1. Increased prescription (sales) of analgesic opioids in rural areas leading to a greater availability for nonmedical use.
2. Economic deprivation due to "out-migration of upwardly mobile young adult" causing a aggregation of high risk young adults
3. Social networks and tight-knit relationships leading to a diffusion of nonmedical prescription opioids throughout the high-risk population.
4. Increased economic deprivation and increased unemployment rates leaving to a stressful situation for rural residents

Regarding patient portals, a study from Manganello et al looked at the associated

between health literacy and usages of digital technologies. It was determined that level of health literacy did not seem to have an impact on utilization of technology for health information search (Manganello et al, 2017). While this does not direct related to patient portals, it does elude to the fact that literacy preferences and rates may not have an impact on patient portal usages but still may influence the potential for analgesic opioid abuse.

Medical insurance coverage has the ability to dictate an individual's medical choices based off of cost or accessibility. Sullivan et al have stated that of those who are commercially insured, 24% are likely to misuse analgesic opioids where as 20% of Medicaid patients are likely to misuse (Sullivan et al, 2011).

In a NIDA report there to be numerous factors contributing to the growing rate of opioid abuse associated with prescription opioids (analgesic opioids), these factors include: an increased number of prescriptions written and dispensed, greater social acceptance, in addition to aggressive marketing by the pharmaceutical companies (Volkow, 2014).

Gaps in the Literature

While programs on the state and federal level to monitor and limit the number of prescription opioids which provides large amounts of related data, there remains a literature gap on the interpersonal risk factors that lead to analgesic opioid abuse in those who are prescribed or those who obtain the drug illegally (CDC, October 2017). As Volkow (2014) has stated there is a greater social acceptance influencing the increase of opioid abuse, this research will breach the research gap in determining if learning

methods, learning barriers, and access to medical information/ services such as patient access portals is leading to a decreased understanding of risk factors or instructions, therefore, increasing likelihood of abuse due to a dependence on social beliefs. Furthermore, most interventions and policies remain in the early stages therefore it is difficult to determine the efficacy of the interventions overall and in the varied population densities or access to specific services.

Added gaps in determinant literature include access to care, transportation services, access to medical insurance, and the limitations of learning barriers and methodologies.

Definitions

Access to care: The variable that defines the ability of an individual to access personal health services in a timely manner in order to achieve the best health outcomes. Components of access to care include insurance coverage, health services, and timeliness of care (Healthy People 2020, n.d.).

Access to transportation: The variable that describes access to reliable personal or public transportation.

Analgesic opioid abuse: The variable that describes the misuse of prescription opioids (National Institutes of Health, January 2016).

Barriers to learning: The variable that describes barriers to individuals' learning or understanding of information (Newton et al., 2009). Examples of learning barriers include reading, language, visual, hearing, physical, emotional, cognitive, financial,

spiritual, or cultural.

County-level limitations: Limitations that are reported in the specific community health assessments. These include social risks factors including access to transportation, access to care, and county-level SES.

Learning ability: The variable that accounts for one's ability to synthesize information to improve aptitude on the subject (Woodrow, 1946).

Opioids: A drug class including illegal drugs such as heroin and synthetic opioids such as fentanyl as well as prescription pain relievers such as oxycodone, hydrocodone, codeine, and morphine (National Institutes of Health, n.d.).

Patient access portal: The variable that gives patients web access to a secure online medical record which enables them to request medical appointments, view a summary of health information, view test results, request prescription renewals, access health resources, and communicate electronically with their medical care team (Mary Imogene Bassett Hospital, n.d.).

Population density: The variable that describes the population distribution of an area. The measure is most frequently expressed as the number of people per square mile (U.S. Census Bureau, 2015). Urbanized areas (UAs) are those with 50,000 or more people per square mile. Rural areas (Ras) are a population below 50,000 per square mile (Health Resources & Services Administration, 2017).

Preferred method of learning: The variable showing the method by which an individual synthesizes information (Johnson et al., 2015). Examples of preferred method

of learning include listening, reading, demonstration, and pictures/video.

Assumptions

A key assumption in this study is that the documentation of learning barriers and method of learning is accurate. Data collection of this information was conducted through a questionnaire administered by the healthcare staff and asked of the patient or member of relationship such as a Co-learner, family member, guardian, or personal non-familial individual. Underlying assumptions are that the individual providing information is an accurate judge of learning capabilities and responded honestly in addition to the assumption that the medical staff can effective assess the patients' learning capabilities. Any collection of learning information is going to subjective in the healthcare clinic setting, therefore, this assessment is the best due to the restrictions of time and patients' level of acceptable participation.

An added assumption is that the provider coded the patient as having a current or history of analgesic opioid abuse in their medical record for data collection which is needed as most individuals are not inclined to self-report their abuse otherwise.

Scope and Delimitations

This study focused on the Bassett Healthcare Network patient population which resides in upstate New York; this has a stratified population density and is still in its' infancy of implementing a viable and notable intervention to reduce the climbing rate of analgesic opioid abuse. This study provided necessary research regarding analgesic opioid abuse to assist in opioid prescribing practices and preventive interventions. By focusing on this area, there is a legitimate sample of both rural versus urban influences,

with the same data collection methodology, and is influenced by the same state and local laws that are focused on opioid abuse therefore permitting prescribers to understand each patient's individual risks. Individuals who are not a member of the Bassett Healthcare Network were excluded from this study in order to simplify data collection and maintain a consistent methodology for data collection and coding.

Significance

As mentioned previously the opioid abuse epidemic continues to grow throughout the nation. The NYSDOH reported the rate of opioid-related overdoses to increase from 5.4 per 100,000 in 2010 to 10.8 per 100,000 in 2015 (NYSDOH, 2017). In New York State, the opioid analgesic-related deaths increased from 2010-2015. In 2013 there were 952 opioid analgesic-related deaths which was up more than 30% from 2009. Overall the opioid-related deaths amounted to 2,175 in 2013 which was more than a 40% increase from 2009 (NYSDOH, 2015). There is a definite gap in evidence-based research suggesting determinants leading to rising analgesic opioid abuse rates. A lack of understanding of how and why the epidemic continues to grow, limits the ability to predict patient outcomes.

This study addressed the gaps in opioid abuse determinants as well as provide a larger picture of how rural populations in upstate New York are impacted by the dwindling resources that accompany rural areas as compared to their urban counterparts. By utilizing the information found in this study, prescription practices involving information distribution and policy development can have a base for changing how patients are educated when given an opioid prescription. By having this determinant

information, there is a potential for positive social change as patients can now receive more appropriate methods of education that can be customized to the patient needs and/or change the rate of opioid prescriptions if alternate methods are appropriate for the patient.

From a perspective of public health, this research provides necessary information to effectively plan community health interventions geared at reducing the rate of opioid abuse and effectively reduce the rates of overdose while also potentially limiting the risk of infectious disease related to opioid abuse, for example Hepatitis C or HIV from IVDU which could further spread through the surrounding community and economically impact the county.

Summary and Conclusions

In this Section, I conducted a literature review of current research, determined gaps in research, and determined the overall scope of the problem. The SEM is applied as a theoretical framework for the study and was herein justified. Finally, the determination of potential social change was described.

As the opioid abuse epidemic continues to grow, there is a need for individual determinate information as well as provide an understanding of the impact that population density can have on healthcare along with opioid impacts. Data from NYSDOH continues to show the rate of opioid-related injury or death increasing regardless of the current interventions in place. Furthermore, the national data suggests that this is not a local problem. Through the utilization of SEM, this study will determine risk factors for analgesic opioid abuse and therefore will impact the criteria for predicting if patients are acceptable candidate for an opioid prescription and assist in funding

distribution for potential impacts where there may be a greater need for support. In the next section of this study, study design, methodology, and data analysis plan will be presented.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to determine if learning capabilities and/or learning medium preference can be correlated with analgesic opioid abuse in the population of patients serviced by the Bassett Healthcare Network. I also evaluated if analgesic opioid abuse has a correlation with factors such as location (rural vs. urban), age, sex, race, insurance status, and county-level risk factors. This section includes information on the study design, methodology, threats to validity, ethical considerations, and the management of data processes.

Research Design and Rationale

I performed a secondary data analysis for this study using data from Bassett Healthcare Network electronic health records. The utilization of a secondary data source is cost effective and time effective with no data reliability issues or ethical considerations (National Institutes of Health, 2018). The purpose of this study was to determine if there is a correlation between preferred education method (independent variable), population density (independent variable), learning barriers (independent variable), access to a patient access portal (independent variable), county-level risk factors (independent variable) and the presence of analgesic opioid abuse (dependent variable). The covariates were age, sex, race, education status, and socioeconomic status.

Methodology

In this section, I describe how the study was conducted; define the study

population and techniques for sampling; and discuss the secondary data management, threats to validity, and ethical considerations.

Population

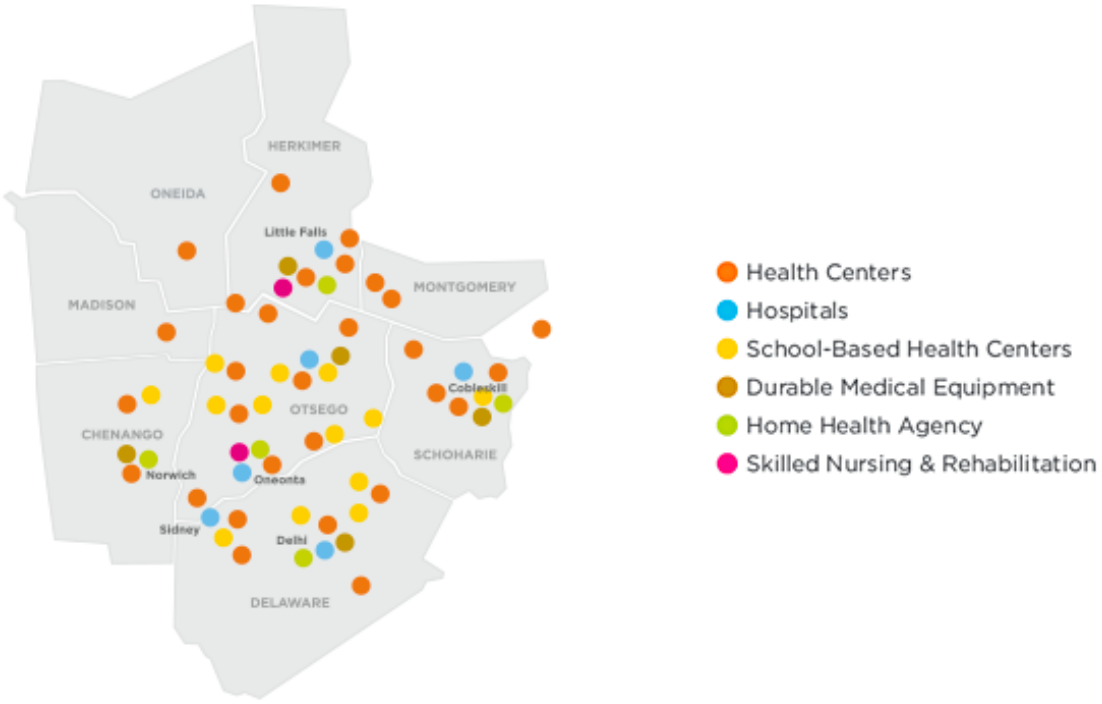
The focus of this study was on a population in Upstate New York that has a stratified population density (rural or urban population density) and access to health-related resources. This area afforded a legitimate sample as it provides both rural and urban population determinants, with the same data collection methodology, and is influenced by the same state and local laws pertaining to opioid abuse. I excluded individuals who were not a member of the Bassett Healthcare Network from this study in order to simplify data collection and maintain a consistent methodology for data collection and coding.

The Bassett Healthcare Network spans 5,600 square miles of New York State. The service area consists of eight counties: Chenango, Delaware, Herkimer, Madison, Montgomery, Oneida, Otsego, and Schoharie. Figure 1 shows the location of Bassett

Health services throughout the target area (Bassett Healthcare Network, n.d.)

Figure 1

Bassett Healthcare Network



Sampling and Sampling Procedures

I used purposive sampling to compile the data set. The target population must have met specified inclusion criteria in order to be evaluated. The sampling procedure was conducted through utilization of the Bassett Healthcare Network electronic medical records. Inclusion criteria for the sample population included individuals who received care from the Bassett Healthcare Network in the past 5 years (2014-2019). Additional information that was solicited included if there was a documented learning assessment in the system, if there was a history of an ICD-10 code related to opioid use or abuse (F11.0,

F11.2, or F11.3; World Health Organization, 2009) in the last 5 years or ICD-9 code related to opioid use or abuse (304.00, 304.01, 304.02, 304.03, 304.70, 304.71, 304.72, 304.73, 304.80, 304.81, 304.82, 304.83, 305.50, 305.51, 305.52, or 305.53; Missouri Department of Social Services, n.d.) in the last 5 years, or a problem list item related to opioid abuse. Data related to learning and learning barriers were subjectively collected through a learning assessment conducted by medical staff and patient input. The learning assessment is a series of questions embedded in the electronic health record; these questions ask about preferred type of learning, which, if any, learning barriers are present, if an interpreter is needed, and the preferred language of the learner. The learning assessment questions can be seen in Table 3. Additional information solicited included

- age
- gender
- race
- town or city of residence
- learning assessment results
- patient portal access

Secondary Data Management

Access to this secondary data set required permission from the Bassett Healthcare Network Institutional Review Board (IRB) office. The data were deidentified and, as such, there were no impacts on health of human subjects and no requirement for training. This source was ideal because the inclusion of the study is the main healthcare provider for the target population's area of residence.

Power Analysis

According to the power analysis conducted through G*Power, the minimum required sample size for the regression was 503 individuals (power = 0.9503087) as can be seen in Table 1. I used the G*Power calculator to perform an a priori power analysis for a logistic regression. The effect size was chosen based on previous studies with similar RQs (Fisher et al, 2014). I heeded Fisher et al.'s (2014) recommendation of an odds ratio of 1.5.

Table 1

*Power Analysis Using G*Power*

	Type	Value
Input	Tails	2
	Odds ratio	1.5
	α err prob	0.05
	Power (1-β err prob)	0.95
	R^2 other X	0
	X distribution	Normal
	X parm μ	0
	X parm σ	1
Output	Critical Z	1.9599640
	Total sample size	503
	Actual power	0.9503087

Instrumentation

The Bassett Healthcare Network electronic health record is the data source for this study. Although the electronic health record is not a published data source, it was ideal for the study requirements as the network is the main healthcare provider in the target population making it a most complete secondary data source.

Operationalization of Variables

Table 2 is a depiction of the variable breakdown of the analysis as it relates to the definition and type of measurement. Data related to preferred learning method and learning barriers were subjectively collected by assessment of medical staff (nurses or doctors), patient input, or an approved medical advocate (e.g., family member) through a questionnaire.

Table 2

Operational Definitions of Variables

Name	Type of measurement	Definition	Levels/Categories
Opioid abuse (Dependent)	Categorical	Presence of an opioid abuse diagnosis code	Yes No
Learning assessment (Independent)	Categorical	Learning assessment was completed	Yes No
Method of learning (Independent)	Categorical	Preferred learning method	Listening Reading Demonstration Pictures/Video Other
Learning barrier (Independent)	Categorical	Barriers to learning new information	No barrier Reading Language Visual Hearing Physical Emotional Cognitive Financial Spiritual Cultural Other
Population density (Independent)	Categorical	Area of residence is urban population (more than 50,000 residents per square mile) or rural population (fewer than 48,000 residents per square mile)	Urban Rural
Age (Independent)	Categorical	Years of age at time of abuse	12-17 years 18-24 years 25-34 years 35-44 years 45-54 years 55-64 years 65 years and older

(*table continues*)

Name	Type of measurement	Definition	Levels/Categories
Sex (Independent)	Categorical	Gender	Male Female
Race (Independent)	Categorical	Reported race and ethnicity	White non-Hispanic African American non-Hispanic Hispanic Native American Other
Patient Access Portal (Independent)	Categorical	Access to the internet-based medical record with medical provider communication tools	Yes No
County Level Limitation	Categorical	Limitations identified throughout the county of residence	Access to public Transportation Access to care
Insurance (covariates)	Categorical	Type of insurance coverage	Medicaid/Medicare Private
Transportation (covariates)	Categorical	Public transportation in the county of residence	Yes No

Table 3 lists the questions asked for each variable and the responses.

Table 3

Learning Assessment

Question	Answer	
Relationship	Patient Family Significant Other Co-learner Mother	Father Guardian Foster Parent Other
Does the primary learner have any barriers to learning?	No Barrier Reading Language Visual Hearing Physical Emotional	Cognitive Financial Spiritual Cultural Other
What is the preferred language of the primary learner?	English Spanish Chinese Japanese Vietnamese	Russian Arabic Hmong Other
Is an interpreter required?	Yes No	
How does the primary learner prefer to learn new concepts?	Listening Reading Demonstration Pictures/Video Other	

Data Analysis Plan

Through the utilization of IBM SPSS Statistics version 23, three phases (descriptive statistics, bivariate analysis, and multivariable analysis) of analysis were

conducted to evaluate the hypotheses for the RQs:

RQ1: Is there an association between a learning assessment being accomplished and analgesic opioid abuse in population of upstate New York.

Bivariate analysis: Chi-square between “accomplished learning assessment” and “analgesic opioid abuse”. If found significant association, this predictor will be included in the regression model (please see below phase 3).

RQ2: Is there an association between preferred method of learning (listening, reading, demonstration, pictures/video, and unspecified) and analgesic opioid abuse in New York state.

Bivariate analysis: Chi-square between “preferred method of learning” and “analgesic opioid abuse”. If found significant association, this predictor will be included in the regression model (please see below phase 3).

RQ3: Are there any learning barriers (language, visual, hearing, physical, emotional, cognitive, financial, spiritual, cultural, no learning barriers and unspecified barriers) that show an association with analgesic opioid abuse?

Bivariate analysis: Chi-square between “learning barriers” and “analgesic opioid abuse”. If found significant association, this predictor will be included in the regression model (please see below phase 3).

RQ4: Is there an association between population density (rural vs. urban) and analgesic opioid abuse?

Bivariate analysis: Chi-square between “population density” and “analgesic opioid abuse”. If found significant association, this predictor will be included in

the regression model (please see below phase 3).

RQ5: Is there an association with between limitations in the county of residence (access to transportation or access to care)?

Bivariate analysis: Chi-square between "limitations in county of residence" and "analgesic opioid abuse". If found significant association, this predictor will be included in the regression model (please see below phase 3).

RQ6: Is there an association between analgesic opioid abuse and demographic/SES (age, gender, insurance coverage, and race)?

Bivariate analysis: Chi-square between "age, gender, insurance coverage, access to public transportation and race" and "analgesic opioid abuse". If found significant association, this (these) predictor(s) will be included in the regression model (please see below phase 3).

RQ7: Is there an association between opioid abuse and increased access to medical advice through access to a medical patient access portal?

Bivariate analysis: Chi-square between "Patient Access Portal" and "analgesic opioid abuse". If found significant association, this predictor will be included in the regression model (please see below phase 3).

Data was coded into the categories as was referenced in Table 2. Potential confounding variable, insurance coverage and access to public transportation is included in this study as they may be responsible for an individual seeking responsible care for injuries

requiring pain management.

Phase 1: Descriptive statistics: Determine the frequency percentage of all the variables in the study.

Phase 2: Bivariate analysis: Utilize a Chi-Square test to determine the association between the independent (learning assessment, preferred learning method, learning barriers, population density, demographics, access to patient portal) and dependent variables (opioid abuse).

Phase 3: Multivariable analysis: Binomial logistic regression analysis to include all predictors and covariates (access to transportation and health insurance) of the outcome variable (analgesic opioid abuse).

Threats to Validity

Internal Validity

Internal validity is measured by the elimination of bias, confounding, and random error.

Bias

The sample population is the Bassett Healthcare Network patient population which spans across numerous rural counties and is the main source of care for those counties. In addition, the sub-population being evaluated is any patient with a history of opioid abuse as well as those who have had a learning assessment conducted. While the inclusion is not limited by anything other than patient status, documentation however can be a source of bias. Documentation in the electronic medical record is subject to the discretion of the medical professionals providing care. Standardization of documentation and expectations is held through the organization due to regulatory standards providing

the assumption that documentation bias is addressed.

Confounding

In this study, there are two potential confounding variables that are being accounted for: access to transportation and access to insurance (healthcare coverage). In the statistical analysis, these variable means are compared to determine if there are legitimate concerns of confounding influence.

Random Error

Random error is reduced in this study by the inclusion of both rural and urban populations as well as a large geographical area which has varied influences which may or may not impact the study itself. Finally, the target area in which the sample population resides is influenced by tourism, second homeowners, and pockets of immigrant populations.

External Validity

Due to the target population being large and diverse, there is a high level of external validity. However, the diverse nature of the population and area of residence does ensure that the results of this study can be applied with merit to other rural populations outside of New York State, therefore, any generalization of the results should be done with caution.

Ethical Procedures

Prior to initiation of this dissertation study, a conversation was had with the Bassett Healthcare Network Director of the Research Institute to ensure the information needed was available and accessible. For obtaining the secondary data from this source, a letter describing data needs was provided through the IRB committee to the source.

Data are historical, documented health information in the electronic health record.

Ethical considerations are typically immense when evaluating human subjects. According to the UCLA Center for Health Policy Research, minimal risk to human subjects must be pursued. There are four areas of potential risk to be considered: Social risk, Psychological harm, Economic risk, and Physical harm (UCLA, n.d.). In this study, there was minimal risk to the human subjects. The data collected are de-identified health information from the electronic health record with no direct contact, therefore, there is no impact on the human subjects and does not violate any HIPAA regulations. In addition, approval from Walden IRB was sought in accordance with the Walden University policies.

Summary

In this study a cross-sectional quantitative approach was taken utilizing a secondary data source from the Bassett Healthcare Network electronic health record of deidentified patient data specific to the RQ variables described. The purpose of this study was to determine if there is a correlation between the level of preferred education method (independent variable), population density (independent variable), learning barriers (independent variable), access to a patient access portal (independent variable), county-level risk factors (independent variable), and the presence of analgesic opioid abuse (dependent variable). The covariates are age, sex, race, and insurance status.

Sampling was conducted by utilizing a Stratified Random Sample based off of county of residence. Sampling procedure is conducted through utilization of the Bassett Healthcare Network electronic medical record. Inclusion criteria for the sample

population included individuals who receive care from the Bassett Healthcare Network, have a documented learning assessment in the system, and have a history of an ICD-10/ ICD-9 code related to opioid use or abuse in the last 5 years. Additional information evaluated includes: Age, Gender, Race, Income, Town or city of residence, and Learning assessment results. In Section 3 there is an evaluation of the study results.

Section 3: Presentation of the Results and Findings

Introduction

In this study, I evaluated the potential correlation between learning preference/barriers along with other demographic attributes of rural communities and the presence of analgesic opioid abuse. My goal was to bring to light determinants found in rural communities that may be impacting the rate of opioid abuse. The information may assist policy makers in policy development and perhaps improve the standard of care protocols. This section includes a presentation of the results of data analysis.

Research Questions

RQ1: Is there an association between a learning assessment being accomplished to determine learning capabilities and analgesic opioid abuse in a population of upstate New York?

RQ2: Is there an association between the preferred method of learning identified on the learning assessment (reading, listening, demonstration, pictures/video, and unspecified) and analgesic opioid abuse in New York state?

RQ3: Are there any learning barriers from the learning assessment (language, visual, hearing, physical, emotional, cognitive, financial, spiritual, cultural, no learning barriers, and unspecified barriers) which can be identified as determinants of analgesic opioid abuse?

RQ4: Is there an association between population density (rural vs. urban) and analgesic opioid abuse?

RQ5: Is there an association between specific limitations in the county of

residence (access to transportation or access to care) and analgesic opioid abuse?

RQ6: Is there an association between analgesic opioid abuse and demographic/SES (age, gender, insurance coverage, and race)?

RQ7: Is there an association between opioid abuse and increased access to medical advice through access to a medical patient access portal?

Secondary Data Collection

The focus of this study was on a population in Upstate New York, an area which has a stratified population density (rural or urban population density) and access to health-related resources. This area offered a legitimate sample as it provides both rural and urban population determinants, with the same data collection methodology, and is influenced by the same state and local laws related to opioid abuse. I sampled Bassett Healthcare Network electronic medical records. Inclusion criteria for the sample population included individuals who received care from the Bassett Healthcare Network in the past five years (2014-2019). Additional information solicited included if there was a documented learning assessment in the system, if there was a history of an ICD-10 code related to opioid use or abuse (F11.0, F11.2, or F11.3; World Health Organization, 2009) in the last five years or ICD-9 code pertaining to opioid use or abuse (304.00, 304.01, 304.02, 304.03, 304.70, 304.71, 304.72, 304.73, 304.80, 304.81, 304.82, 304.83, 305.50, 305.51, 305.52, or 305.53; Missouri Department of Social Services, n.d.) in the last five years, or a problem list item related to opioid abuse. Data related to learning and learning barriers were subjectively collected by assessment of medical staff and patient input. The learning assessment is a series of questions embedded in the electronic health record;

these questions ask about the preferred type of learning, which, if any, learning barriers are present, if an interpreter is needed, and the preferred language of the learner. On September 26, 2019, I obtained IRB approval from the Walden University IRB committee (approval no. 09-26-19-0340821). The Bassett Healthcare Network IRB committee approval was completed on October 23, 2019 (approval no. 1509394-1). In total, 170,880 participants met the criteria and were included in this study**.**

Confounding

In this study, two potential confounding variables were accounted for: access to transportation and access to insurance (healthcare coverage). I included these variables in the models for the statistical analysis to determine if there were legitimate concerns of confounding influence.

Random Error

Random error was partly reduced in this study by the inclusion of both rural and urban populations as well as a large geographical area that has varied influences. Finally, the target area in which the sample population resides is influenced by tourism, second homeowners, and pockets of immigrant populations.

Results

Descriptive Analysis

For the descriptive analysis, I offer a breakdown of each variable considered in the study (see Table 4). The variable age shows that the population was primarily 65 years and older (30.3%) or between 18-34 years of age (21.8%). Sex showed a fairly equal distribution, 53% female and 47% male. Regarding race and ethnicity, the target

population was rather homogenous being primarily White/Caucasian (94.6%), 1.4% Black/African American, and 4% Other/unknown. County of residence showed a larger concentration of residence in Otsego County (26.6%); the percentages for the other counties were as follows: Chenango (12.2%), Delaware (14.4%), Herkimer (17.9%), Madison (4%), Montgomery (5.4%), Oneida (6.9%), and Schoharie (12.6%). Looking at population density, 71.2% of the participants resided in a rural county, and 28.8% resided in an urban county. Most (67.6%) of the population had access to public transportation, and 32.4% had no access to public transportation. Access to care limitations could be found in 78.1% of the population, and 29.1% had no limitations. Patient portal access seemed to be limited in the population, with 66% having no access to a portal and 34% having access. Insurance was primarily dominated by Medicare/Medicaid (39.3%) and private plans (36.8%); however, 21.4% were documented with an insurance status of None and 2.4% with a status of Other.

Regarding the history of opioid abuse, .9% had a documented diagnosis of opioid abuse, and 99.1% had no opioid abuse diagnosis in the past five years. However, 65.4% have been prescribed opioids, whereas 34.6% have not been prescribed opioids in the past five years. Most of the population (63%) had a documented learning assessment, and 37% had no documented learning assessment. Of those who had a learning assessment documented, 93.7% reported no learning barriers, and 6.3% reported a learning barrier. Learning preferences were rather spread out: 37% reported no learning preference, 16.8% preferred listening, 8.2% preferred listening/reading/demonstration, 8.1% preferred listening/reading/demonstration/video/picture, 7.9% preferred listening/reading, 5.2%

preferred demonstration, 4.9% preferred reading, 2.8% preferred learning/demonstration, and 9.1% preferred other combinations of learning.

Table 4
Descriptive Statistics of the Sample (N = 170,880)

Variable	N	%
Age		
18-34 years of age	37278	21.8
35-44 years of age	23254	13.6
45-54 years of age	26402	15.5
55-64 years of age	32235	18.9
65 years and older	51711	30.3
Sex		
Female	90549	53.0
Male	80310	47.0
Race		
Black African Americans	2457	1.4
White Caucasians	161613	94.6
Other/unknown	6810	4.0
County		
Chenango County	20811	12.2
Delaware County	24610	14.4
Herkimer County	30606	17.9
Madison County	6860	4.0
Montgomery County	9228	5.4
Oneida County	11818	6.9
Otsego County	45458	26.6
Schoharie County	21489	12.6
Patient Portal		
No	112775	66.0
Yes	58105	34.0
Insurance		
Medicare/Medicaid	67235	39.3
None	36547	21.4
Private	62951	36.8
Other	4147	2.4
History of Opioid Abuse		
No	169330	99.1
Yes	1550	.9
Prescribed Opioid		
No	59087	34.6
Yes	111793	65.4
Learning Assessment Performed		
No	63246	37.0
Yes	107634	63.0
Learning Barriers		

No	160185	93.7
Yes	10695	6.3
Learning Preference		
Demonstration	8923	5.2
Listening	28750	16.8
Listening and Demonstration	4768	2.8
Listening and Reading	13436	7.9
Listening and Reading and Demonstration	13941	8.2
List and Read and Demons and Video and Picture	13811	8.1
None	63266	37.0
Reading	8428	4.9
Other combination	15557	9.1
Access to Public Transportation		
No	55327	32.4
Yes	115553	67.6
Access to Care		
No	133414	78.1
Yes	37466	21.9
Population Density		
Rural	121596	71.2
Urban	49284	28.8

Bivariate Chi-Square Analysis

A chi-squared test for association was conducted between the variables (age, sex, race, patient portal access, insurance, prescribed opioids, learning assessment, learning barriers, learning preference, population density, access to public transportation, and access to care) and the presence of opioid abuse (Table 5). Age range shows a highly significant association with Opioid abuse ($X2 = 394.532$, $p=.000$) but a weak effect size ($\varphi=.048$). The age range of 18-34 years of age has the highest number of documented opioid abuse, with 37.7% (584 cases). Sex provided non-significant results ($p=.146$). The variable, race, presented the greatest percentage of opioid abusers as being White/Caucasian (94.4%), results are statistically significant ($X2=10.606$, $p=.005$) with a weak effect size ($\varphi=.008$). The county of the residence resulted as highly significant ($X2=71.875$, $p=.000$) with a weak effect ($\varphi=.021$). Among the county of residence,

Otsego County presented the highest percentage (0.3%) of positive opioid diagnosis among the total and 29.2% of the opioid cases. Patient portal access returned 65.5% of opioid abusers do not have access to portal access, and 37.5% do have access to a portal; these results are highly significant (X2=8.444, p=.004) with a weak effect size (φ=.007). Insurance status presented Medicare/Medicaid users with the highest percentage of opioid abuse (71.2%); other values showed: None (13.1%), Other (2.5%), and Private (13.3%). The results showed high significance (X2=688.128, p=.000) and weak effect size (φ=.063). The variable prescribed opioids 64.1% of users have not prescribed opioids, and 35.9% were prescribed opioids. These results showed a high significance (X2=603.821, p=.000) but showed a weak effect (φ=.059). Of the learning assessment completion, 87.2% of opioid abusers had a learning assessment completed, and 12.8% did not; results show a high significance (X2=394.161, p=.000) with a weak effect (φ=.048). The presence of learning barriers resulted in 91.1% of opioid abusers had no barriers to learning, and 8.9% of abusers did have a barrier. Results of the learning barrier showed high significance (X2=18.644, p=.000) with a weak/no effect (φ=.010). The variable of learning preference had varied returns on opioid users learning preferences (Demonstration 7%, Listening 26.2%, Listening/Demonstration 5.0%, Listening/Reading 9.7%, Listening/Reading/Demonstration 10.8%, Listening/Reading/Demonstration/Video/Picture 13.7%, None 12.8%, Reading 4.1%, and Other combination 10.8%) which presented highly significant results (X2=453.501, p=.000) and a weak/no effect (φ=.052).

Access to public transportation showed non-significant results. Access to care

resulted in 82.6% of opioid abusers not having access to care and 17.4% having access to care with highly significant results (X2=19.088, p=.000) with weak effect (φ=.011). Population density presented 77.9% of opioid abusers resided in rural areas (22.1% opioid abusers from urban areas), which also showed high significance (X2=35.002, p=.000) with weak effect (φ=.014).

Table 5.
Bivariate Analysis (Chi-square) Between Opioid Abuse and the Independent Variables of the Study

Independent variables	Opioid Abuse No N (%)	Opioid Abuse Yes N(%)	Total	X^2	P	Cramer's V
Total	169330 (99.1)	1550 (.9)	170880			
Age Range				394.532	.000	.048
18-34 years of age	36694 (21.7)	584 (37.7)	37278			
35-44 years of age	22933 (13.5)	321 (20.7)	23254			
45-54 years of age	26199 (15.5)	203 (13.1)	26402			
55-64 years of age	32013 (18.9)	222 (14.3)	32235			
65 year and older	51491 (30.4)	220 (14.2)	51711			
Sex				2.114	.146	
Female	89756(53)	793(51.2)	90549			
Male	79553(47)	757(48.8)	80310			
Race				10.606	.005	.008
Other/Unknown	6772(4)	38(2.5)	6810			
Black African American	2439(1.4)	18(1.2)	2457			
White Caucasians	160119(94.6)	1494(94.4)	161613			
County of Residence				71.875	.000	.021
Chenango County	20564(12)	247(0.1)	20811			
Delaware County	24366(14.3)	244(0.1)	24610			
Herkimer County	30404(17.8)	202(0.1)	30606			
Madison County	6793(4)	67(0.0)	6860			
Montgomery County	9178(5.4)	50(0.0)	9228			
Oneida County	11745(6.9)	73(0.0)	11818			
Otsego County	45006(26.3)	452(0.3)	45458			
Schoharie County	21274(12.4)	215(0.1)	21489			
Patient Portal Access				8.444	.004	.007
No	111806(66)	969(65.5)	112775			
Yes	57524(34)	581(37.5)	58105			
Insurance				688.128	.000	.063
Medicare/Medicaid	66132(39.1)	1103(71.2)	67223			
None	36344(21.5)	203(13.1)	36547			

Other	4109(2.4)	38(2.5)	4147			
Private	62745(37.1)	206(13.3)	62951			
Prescribed Opioids				603.821	.000	.059
No	58093(34.3)	994(64.1)	59087			
Yes	111237(65.7)	556(35.9)	11793			
Learning Assessment				394.161	.000	.048
No	63048(37.2)	198(12.8)	63246			
Yes	106282(62.8)	1352(87.2)	107634			
Learning Barriers				18.644	.000	.010
No	158773(93.8)	1412(91.1)	160185			
Yes	10557(6.2)	138(8.9)	10695			
Learning Preference				453.501	.000	.052
Demonstration	8815(5.2)	108(7)	8932			
Listening	28344(16.7)	406(26.2)	28750			
Listening and Demonstration	4691(2.8)	77(5.0)	4768			
Listening and Reading	13286(7.8)	212(9.7)	13436			
Listening, Reading, and Demonstration	13773(8.1)	168(10.8)	13941			
Listening, Reading, Demonstration, Video, and Picture	13599(8)	212(13.7)	13811			
None	63068(37.2)	198(12.8)	63266			
Reading	8364(4.9)	64(4.1)	8428			
Other combination	15390(9.1)	167(10.8)	15557			
Access to Public Transportation				.152	.697	
No	54818(32.4)	509(32.8)	55327			
Yes	114512(67.6)	1041(67.2)	115553			
Access to Care				19.088	.000	.011
No	132133(78)	1281(82.6)	133414			
Yes	37197(22)	269(17.4)	37466			
Population Density				35.002	.000	.014
Rural	120388(71.1)	1208(77.9)	121596			
Urban	48942(28.9)	342(22.1)	49284			

Multivariable Logistic Regression

To address the RQs, I performed a binomial logistic regression to determine the effects of age, insurance status, prescription of opioids, learning assessment presence, learning barriers, learning preferences, access to care, and population density (the ones with the highest significance level found in the bivariate analysis (p=.000<.00001) have on the likelihood of participants to present a diagnosis of opioid abuse. Hosmer and

Lemeshow test was statistically significant (*p*=.000), indicating the model is a poor fit for prediction. Nagelkerke resulted in 13.8% of the variance in the presence of opioid abuse and correctly classified 99.1% of cases. For this test of the eight predictor variables included in the model, only five showed statistical significance: age, insurance status, prescribed opioids, learning preference, and population density (Table 6).

Results show that all participants of 18-64 years age groups are more likely to have an opioid abuse diagnosis than the >65 years age group (18-34 y: OR:9.13, 95%CI: 7.667-10.596; 35-44 y: OR:6.892, 95%CI: 5.777-8.223; 45-54 y: OR:4.015, 95%CI: 3.303-4.881). County of residence showed that Chenango county (p=.001) is 1.359 times more likely to have an opioid abuse diagnosis over Schoharie county (OR: 1.359, 95%CI: 1.127-1.639). Medicare/Medicaid insurance status and No insurance showed a 6.757 and 3.317 times, respectively, a high chance of opioid abuse than those with Private insurance (OR:6.757, 95%CI: 5.799-7.874; OR: 3.317, 95%CI: 2.700-4.075, respectively). Not being prescribed opioids presented results of 2.478 times more likely to have an opioid abuse diagnosis than those who have been prescribed opioids (OR:2.478, 95%CI: 2.219-2.766). Learning preference showed statistical significance for the following methods; Listening, Listening and Demonstration, and Listening, Reading and Demonstration with similar ORs (OR: 1.313, 95%CI: 1.091-1.579; OR: 1.410, 95%CI: 1.070-1.859; OR: 1.328, 95%CI: 1.078-1.635, respectively). Population density resulted in high significance (p=.000); residents in rural settings are less likely to have an opioid abuse diagnosis compared to urban environments (OR: .690, 95%C: .543-.878).

Table 6

Logistic Regression Predicting Likelihood of Opioid Abuse based on Age, County of

Residence Insurance status, Prescribed opioids, Learning preference, and Access to care, Population Density

	B	SE	Wald	*df*	*p*	Odds Ratio	95% CI for OR Lower	Upper
Age Range *ref: > 65 years*			783.170	4	.000			
18-34 years of age	2.199	.083	709.173	1	.000	9.013	7.667	10.596
35-44 years of age	1.930	.090	459.346	1	.000	6.892	5.777	8.223
45-54 years of age	1.390	.100	194.668	1	.000	4.015	3.303	4.881
55-64 years of age	1.172	.097	145.922	1	.000	3.228	2.669	3.904
County of Residence *ref: Schoharie Co.*			1116.560	7	.000			
Chenango Co.	.307	.095	10.325	1	.001	1.359	1.127	1.639
Delaware Co.	.104	.096	1.167	1	.280	1.109	.919	1.339
Herkimer Co.	-.573	.100	32.792	1	.000	.564	.464	.686
Madison Co.	-.007	.143	.003	1	.958	.993	.750	1.314
Montgomery Co.	-.692	.159	18.922	1	.000	.501	.367	.684
Oneida Co.	-.324	.138	5.536	1	.019	.723	.552	.947
Otsego Co.	.027	.085	.105	1	.746	1.028	.870	1.214
Insurance status *ref: Private*			625.871	3	.000			
Medicare/Medicaid	1.911	.078	599.441	1	.000	6.757	5.799	7.874
None	1.199	.105	130.328	1	.000	3.317	2.700	4.075
Other	1.107	.179	38.480	1	.000	3.027	2.133	4.295
Prescribed Opioid *ref: Yes* (No vs Yes)	.907	.056	260.346	1	.000	2.478	2.219	2.766
Learning Assessment *ref: Yes* (No vs Yes)	14.746	8724.625	.000	1	.999	2535605.742	.000	.
Learning Barriers *ref: No* (No vs Yes)	.012	.093	.016	1	.899	1.012	.843	1.215
Learning Preference *ref: Other*			22.034	8	.005			
Demonstration	.058	.126	.215	1	.643	1.060	.828	1.357
Listening	.272	.094	8.312	1	.004	1.313	1.091	1.579
Listening and Demonstration	.344	.141	5.967	1	.015	1.410	1.070	1.859
Listening and Reading	.145	.115	1.590	1	.207	1.156	.923	1.449
Listening, Reading, and Demonstration	.061	.112	.300	1	.584	1.063	.854	1.324
Listening, Reading,	.283	.106	7.092	1	.008	1.328	1.078	1.635

Demonstration, Video, and Picture								
None	-15.915	8724.625	.000	1	.999	.000	.000	.
Reading	-.123	.150	.676	1	.411	.884	.659	1.186
Population Density *ref: Urban* (Rural vs Urban)	-.371	.123	9.157	1	.002	.690	.543	.878
Access to care *ref: Yes* (No vs Yes)	.130	.134	.934	1	.334	1.138	.875	1.480
Constant	-7.657	.189	1643.442	1	.000	.000		

Research Questions and Evaluation of Hypotheses

RQ1: Is there an association between a learning assessment being accomplished to determine learning capabilities and analgesic opioid abuse in the population of upstate New York.

Upon evaluating the chi-square test results, the variable learning assessment completion showed a high significance (X^2=394.161, p=.000) with a weak effect (φ=.048) for the association. While the effect size is weak, there is a presence of association; therefore, we reject the null hypothesis.

Ha1: The presence of a learning assessment is associated with analgesic opioid abuse.

RQ2: Is there an association between the preferred method of learning identified on the learning assessment (reading, listening, demonstration, pictures/video, and unspecified) and analgesic opioid abuse in New York?

Learning preference showed statistical significance using logistic regression for the following methods; Listening, Listening and Demonstration, and Listening, Reading and Demonstration with similar ORs (OR: 1.313, 95%CI: 1.091-1.579; OR: 1.410, 95%CI: 1.070-1.859; OR: 1.328, 95%CI: 1.078-1.635, respectively); specific learning

preferences do show an association with opioid abuse; therefore, the null hypothesis is rejected.

Ha2: There is a higher rate of analgesic opioid abuse among specified preferred methods of learning.

RQ3: Are learning barriers (language, visual, hearing, physical, emotional, cognitive, financial, spiritual, cultural, no learning barriers, and unspecified barriers) associated with analgesic opioid abuse?

The presence of learning barriers resulted in 91.1% of opioid abusers had no barriers to learning, and 8.9% of abusers did have a barrier. Chi-squared results in the learning barrier showed high significance (X^2=18.644, p=.000) with a weak effect (φ=.010). The null hypothesis is rejected as there does seem to be an association.

Ha3: There is a higher rate of analgesic opioid abuse among specific learning barriers.

RQ4: Is there an association between population density (rural vs. urban) and analgesic opioid abuse?

Population density resulted in high significance (p=.000) in the logistic regression; residents in rural settings are less likely to have an opioid abuse diagnosis compared to urban environments, which showed a small OR of .690 over rural settings (OR: .690, 95%C: .543-.878); the null hypotheses are rejected.

RQ5: Is there an association between specific limitations in the county of residence (access to transportation or access to care) and analgesic opioid abuse?

This RQ refers to three separate independent variables: access to care, transportation, and county of residence. The county of residence resulted in high

significance (X^2=71.875, p=.000) with a weak effect size (φ=.021) showing a weak association. Access to public transportation provided statistically insignificant results (p=.697). Regarding access to care, results are significant with a weak effect size (X^2=19.088, p=.000, φ=.011). While the association is weak, there is a presence of association for both county of residence and access to care; the null hypothesis is rejected.

Ha5a: There is an association between analgesic opioid abuse and county level limitations

RQ6: Is there an association between analgesic opioid abuse and demographic (age, sex, insurance coverage, and race)?

The demographic information is comprised of 4 variables: age, sex, insurance coverage, and race. Results of the logistic regression show that all participants of 18-64 years age groups are more likely to have an opioid abuse diagnosis than the >65 years age group (18-34 y: OR:9.13, 95%CI: 7.667-10.596; 35-44 y: OR:6.892, 95%CI: 5.777-8.223; 45-54 y: OR:4.015, 95%CI: 3.303-4.881). Medicare/Medicaid insurance status and No insurance showed a 6.757 and 3.317 times, respectively, a higher chance of opioid abuse than those with Private insurance (OR:6.757, 95%CI: 5.799-7.874; OR: 3.317, 95%CI: 2.700-4.075, respectively).

An association is present among the variables; the null hypothesis is rejected.

RQ7: Is there an association between opioid abuse and increased access to medical advice through access to a medical patient access portal?

The variable, patient portal access, revealed significant results for the Chi-square

test with a weak size effect (X^2=8.444, p=.004, φ=.007), indicating a relationship among variables, the null hypothesis is rejected.

Summary

Evaluation of each of the RQs yielded significant and actionable results that have a potential to effect social change. The presence of a learning assessment did show an association with opioid abuse; while the impact was found relatively low there is warrant for further investigation. Preferred learning method and learning barriers also showed a significant association with a weak effect, again, suggesting further investigation. Population density revealed that urban environments are more likely to have a higher rate of opioid abuse suggesting that opioid abuse can impact rural and urban populations differently. County of residence characteristics (access to care and access to public transportation) showed significant results suggesting the organizational and community levels of the SEM are impacting the community opioid abuse rates. Regarding demographic information, the variables age, race, and insurance status showed significant results revealing an association with opioid abuse. Finally, access to a patient portal also showed a significant association with opioid abuse showing there is a level of SEM influence providing influence outside of the healthcare system.

As opioid abuse continues to plague communities, it is essential to evaluate not only patient attributes but also how external factors such as population density, social determinants to health, and so forth can impact an individual's likelihood to make ill-advised health and/or lifestyle choices. These findings are meant to inform for future enhancement the standard of care and interventional work. Section 4 will discuss the

application these results can have on profession practice and the implications for social change.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

Serving the health-related needs of rural communities is an ongoing struggle in the field of healthcare and public health. Rural populations have unique challenges that can impact treatment, access to care, and access to resources, all of which can affect the overall health of the population (Winters, 2013). Regarding the ongoing opioid epidemic in rural communities, Keyes et al. (2014) noted that rural communities experience unique challenges in this area as well. In their study, Keyes et al. acknowledged that there are four factors that seem to influence the growing problem: (a) a greater number of opioid prescription in rural areas which increases availability to the drug throughout illegal means, (b) out-migration of young adults, (c) greater rural social network connections that facilitate drug distribution, and (d) economic stressors. Although Keyes et al.'s work is comprehensive, information gaps remain in determining all factors related to the growing rate of analgesic opioid abuse.

This study may lead to social change by clarifying known factors contributing to analgesic opioid abuse in rural America. Findings may also reveal if there is linkage to learning preferences/barriers, age, sex, race, insurance status, location, provider accessibility (local care or patient portal) as well as access to necessary services (access to care, access to transportation). By using this information, stakeholders can promote social change by developing a more comprehensive plan for the methodology to identify at-risk populations and educate the public on the dangers of opioid misuse. Findings may also assist stakeholders in policy creation. Using study findings, they may be better able

to evaluate the level of medication adherence by providers upon prescribing opioids which could result in a lowered rate of opioid abuse or diversion while also limiting the health danger to the opioid user community and the surrounding community members. Finally, and perhaps most impactful, this study brings to light the need for additional infrastructure in rural communities to support the improvement of healthcare through the identification of lacking areas in social determinants of health.

Although the study revealed associations among all of the RQs, there is more to know about the nature of the associations. Results showed opioid abuse to have an association with a learning assessment being present, learning preferences, learning barriers, population density, county of residence limitations (access to care and access to public transportation), certain demographic information, insurance status, and access to a patient portal.

Interpretation of the Findings

As referenced in Section 1, there is a large gap in research regarding determinants of opioid abuse/addiction. Documentation of opioid abuse often relies on self-reporting from the abusers. This is a barrier as misuse and abuse of opioids is illegal; therefore, identifying determinants is hindered.

This study confirms and challenges much of what was found in the literature review. Data from this analysis show that in the target population, there is no association between gender and opioid abuse. Race did not reveal a highly significant association among the variables, which may or may not be a result of the homogenous target population (94.6% White). Regarding age, those individuals aged 18-34 years of age

were 9.13 times more likely to abuse opioids than the age group of 65 years of age and older. The age group, 35-44 years of age, resulted in an odds ratio of 6.892 times more likely than the 65 years of age and older group. These results are in contradiction to King et al. (2014), who determined that men, non-Hispanic Whites, American Indian/Alaska Natives, and middle-aged individuals have a higher rate of opioid abuse. Also, I found that those living in rural counties are slightly more likely to abuse opioids than those living in an urban environment, which is in accordance with King et al. who reported that individuals living in rural communities have a higher rate of opioid abuse.

This study revealed an association with a learning assessment presence and opioid abuse, which further confirms King et al.'s (2014) finding that educational interventions at the time of prescription reduce analgesic opioid abuse in some cases. Roskos et al.'s (2017) findings suggest that individuals of low literacy are less likely to understand the expectations outlined in their opioid contract regarding usage; this study shows that when a learning assessment was performed, 91.1% of opioid abusers had no barriers to learning. In regard to medical insurance, Sullivan et al. (2011) stated that of those who are commercially insured, 24% are likely to misuse analgesic opioids whereas 20% of Medicaid patients are likely to misuse. The findings of this study showed that those with Medicare/Medicaid insurance had the highest percentage of opioid abuse (71.2%); other groups had smaller percentages: None (13.1%), Other (2.5%), and Private (13.3%). In fact, Medicare/Medicaid insurance status and no insurance status respectively showed an odds ratio of (OR:6.757, 95% CI: 5.799-7.874; OR: 3.317, 95% CI: 2.700-4.075, respectively) over those with private health insurance.

This study's insurance status results are in agreement with other published articles--for example, Tardelli et al. (2019), who stated that the Medicaid population is at a higher risk of abusing prescription and nonprescription opioids. The CDC (2020) has documented that as the number of opioid prescriptions has increased throughout the United States so has the rate of opioid use disorder. In this study, individuals who were not prescribed opioids presented results showing that they were 2.478 times more likely to have an opioid abuse diagnosis than those who have been prescribed opioids, which is not supported by published research (CDC, 2020 March). Although one would expect those with an opioid diagnosis to be associated with an opioid prescription, the presence of "doctor shopping" has remained constant throughout the nation. The term *doctor shopping* refers to a practice of going from medical facility to medical facility complaining of various injuries in hopes of obtaining an opioid prescription (Young et al, 2018). Although New York State does have an electronic prescribing monitoring system that has shown to have a positive impact in reducing abuse (Danovich et al., 2019), there is still the opportunity for individuals to obtain prescriptions in surrounding states or from individuals selling their own prescribed drugs.

Regarding county-level determinants and access to care concerns, Wright et al. (2014) found that both access to healthcare and the county level or local health systems is a major determinant of opioid access and therefore a risk factor for high opioid abuse rates. The variables county of residence, access to care, and access to transportation provided similar results to that of Wright et al. Although access to transportation showed no association to opioid abuse for this research, both county of residence and access to

care showed a significant association and therefore agree with previous studies. Dasgupta et al. (2018) evaluated many of the determinants to opioid abuse to include access to healthcare. Having limited access to care can increase the risk of opioid abuse. Further, one notable item is that previous research suggests that having access to a patient portal can improve opioid mindfulness and provide additional education necessary to reduce the rate of opioids (Warren & Huang, 2016). However, the results of this study showed a weak association between the presence of an opioid abuse diagnosis and access to a patient portal.

Theoretical Framework

I applied the SEM to this study. The SEM is often used to explain the association between individual practices, social factors, physical environment, and so forth as they relate to a specific health behavior (Thomas et al, 2020). The framework explains the interaction between these levels which are identified through varied relationships: intrapersonal or individual, interpersonal, organizational, community, and public policy (Bronfenbrenner, 1979). Regarding what is known regarding opioid abuse determinants, Volkow (2014) also stated that greater social acceptance has an influential part in the increase of opioid abuse, indicating that relationships can impact abuse rates. The results of this study concur with the SEM. As mentioned previously, participants living in rural communities were .690 times more likely than urban participants to abuse opioids. Volkow stated that a greater social acceptance of opioid abuse could increase the likelihood of abuse.

CDC (2017) indicates that they have limited access to care, lower health literacy,

low literacy, high unemployment, and low transportation services will be at a higher risk of abuse. Many rural communities meet the determinants mentioned by the CDC, as seen in the Community Health Assessment and Community Health Improvement Plan by each of the county health departments in the participant pool. The study findings and peer-reviewed research indicates that rural community members would rely more heavily interpersonal relations for medical decision making. From the SEM, this suggests that there may be a significant influence from the levels: interpersonal (social groups), community (organizations), and public policy (local and state). Furthermore, reviewing the logistic regression of counties in the participant pool, there are specific counties that reflect a higher odds ratio over others (Chenango OR: 1.359, Delaware OR: 1.109, and Otsego OR: 1.028) which indicates that there is a relationship on the organizational level as well as public policy. The presence of a learning assessment relates to the organizational level as it is a policy of the healthcare institution due to the relationship between the organization and the patient. Learning preference and learning barriers reference the capabilities of an individual and therefore fall into the individual level. Insurance status is a reference to the both the policy and organizational levels.

This study's results revealed that Medicare/Medicaid insurance status and no insurance showed a 6.757 and 3.317 times, respectively, higher chance of opioid abuse than those with private insurance (OR:6.757, 95%CI: 5.799-7.874; OR: 3.317, 95%CI: 2.700-4.075, respectively). The qualifications to meeting insurance status, the availability of access to care, and the relationship with the insurance company (private or government) all apply to the organization level of the model. Access to patient portal

relates to both the organizational level and the policy level. In this instance the Chi-square test revealed an association with access, this access is provided by the organizational relationship with the healthcare institution as well as the accessibility to internet through the infrastructure supported by public policy. These results suggest that there is a level of the SEM influencing opioid abuse which can be found in any level of the SEM.

Limitations of the Study

The study has some limitations. First, the dataset was large as it was all patients for a five year period of time. While the power analysis suggests a sample size of 503, the sample size ended up being 170,880. With the spanning across numerous counties that have various population densities, it seems detrimental to reduce the number of records and risk the exclusion of certain county participants. Including the large sample possible, seemed to reduce some bias by reducing the chance of underrepresentation. However, with such a homogenous racial population (primarily White/Caucasian), oversampling can cause bias to the results.

Furthermore, the responses for the learning assessment provided a challenge. Many individuals provided multiple responses to learning preferences and learning barriers. In other words, the participant would list more than one learning barrier and/or learning preference. Having such a large dataset that included multiple responses made the processing of the results for analysis difficult to manage and ensure data integrity throughout.

Another limitation includes the diagnosis of opioid abuse relies upon an individual self-reporting their illegal behavior of abuse in addition to acknowledging they are abusing the drug. As Volkow (2014) discussed, greater social acceptance can influence an increased rate of abuse; therefore, greater acceptance reduces sensitivity for a need to report. Additionally, it is not possible to measure an individual who obtains opioids from a source outside of the primary care provider or outside of a medical facility. Again, use reporting would rely on the individual admitting they have committed a crime or "doctor shopped" by looking for other providers to prescribe the medication. In either scenario, it is not possible to evaluate if learning needs were met to provide education.

Regarding the data that was available for this study, the participant information came from the care provided at the same healthcare network with the same standards of care and documentation systems. While the learning assessments and personal action of the healthcare providers are subjective and can therefore limit some reliability, the expectation is that documentation of opioid prescriptions and assessments is trustworthy due to the standardization.

Recommendations

Future research is certainly necessary as the opioid crisis continues to grow; there is a great need to fill in identifying the determinants which lead to analgesic opioid abuse and their level of influence for intervention policy and action. For instance, identifying that there is a relationship with the county of residence and analgesic opioid abuse, local public health groups can provide better harm-reduction based programs or revise policy

to support a healthier community. A suggestion for future studies can be that health literacy rates should be evaluated on the same community to assess if there is a capacity to assimilate the health information. An individual with literacy can still have low health literacy. Determinant information should also remain a focus, all areas of social determinants of health should be assessed to investigate if there are other rural related associations that are impacting rates of abuse. An example of this could be accessibility to the internet or other health information tools. Rural communities may not have adequate access to internet or cell phones to contact their healthcare provider requesting information care therefore putting an individual risk to follow community beliefs that may be inaccurate. Along with a review, each of these determinants should be applied to a more exact location such as town to look at what levels of the SEM are having the greatest impact on the overall outcomes of opioid abusers. Finally, a review should be conducted of access to high-speed internet and/or mobile network strength as this can better elude to any potentials access to care.

Implications for Professional Practice and Social Change

Professional Practice

As mentioned, the results of this study challenge much of what was previously published regarding the opioid abuse determinants. Professional recommendations would suggest a re-evaluation of how urban and rural determinants are uniquely impacting those susceptible to opioid abuse. Healthcare facilities should consider better an evaluation of current standardization practices for determining learning barriers and preferences while accommodating them; results indicated that there is an association with opioid abuse and

these variables. Nearly 9% of the those with an opioid abuse diagnosis reported a learning barrier. Additionally, a more comprehensive clinical practice-oriented evaluation of health literacy is needed along with industry standardization to make a unified approach; while learning barriers may be few for a patient, their ability to synthesize medical information may still be lacking.

From a practice analytics perspective, risk scores based on the town of residence and the surrounding social determinants of health could assist providers in identifying which of the SEM may be impacting patient compliance. This study showed a significant relationship among the characteristic surrounding specific county residence. This simple tool could help health care managers and providers to predict when a patient may be lacking in important areas of social determinants. Finally, better collaboration with Centers for Medicare & Medicaid Service (CMS) to identify determinants that make their population the most at risk for opioid abuse. As noted previously, Medicare/Medicaid insurance status showed a 6.757 times greater chance of opioid abuse than those with private insurance. Working with CMS to further study the characteristics of their population will not only identify further opioid abuse determinants but also contribute to a better care model for those falling in the Medicare/Medicaid catchment. CMS sponsored Care Management staff should play a large role in investigating these determinants and providing the interventional work necessary.

Positive Social Change

With the apparent lack of research regarding risk factors of opioid abuse, there is a need to improve safeguards for opioid abuse prevention, which will overall have an

enormous social change impact on prevention techniques as well as tertiary treatment methods. This study has utilized the socio-ecological model (SEM) to evaluate the social levels of influence for addiction or abuse in order to limit abuse, illness, injury, and economic burdens. By applying the SEM to this data, the healthcare community and governmental infrastructure can now see there is a need to better sort out the learning needs of the analgesic opioid population in addition to identifying external influences placing the population more at risk. Furthermore, identifying varied social determinants of health can now provide for clinical practice-based tools that will assist providers in quickly categorizing patients that may require further monitoring and education when prescribing opioids.

As can be seen in this study, there are levels of social determinants of health, individual capabilities, and residential characteristics putting individuals more at risk for opioid abuse before they even receive a prescription. For instance, this study revealed an association with opioid abuse and the following variables: population density, county of residence, access to care, age, insurance coverage, and patient portal access. Creating an analytics tool that utilizes these risk factors of abuse, a healthcare provider will be able to know if there are barriers to compliance before the patient leaves and therefore provide an intervention.

Conclusion

Analgesic opioid abuse continues to have large impacts on population health and the economy which are having permanent impacts on the nation. This study provided new information that can lead to better standardization practices, informatics tools, and

screening methods for ensuring those with prescribed opioids will receive the support needed. Furthermore, looking at the characteristics of urban and rural communities has shown there to be a discrepancy in access that may not have been as clear previously suggesting a need to re-evaluate the localize infrastructures outside of the healthcare system. Further research is needed however since the application of the SEM has provided a roadmap to determine how this information is impacting the opioid population as a whole. SEM provided the tools to identify where interventional work may need to be applied to limit opioid abuse, as it reveals the impact of several opioid abuse risk factors, such as insurance coverage status, at organization and public policy level.

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