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The Stigma of Obesity: Examining the Relationship Between BMI and the Treatment of Pain in Surgery Patients

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THE STIGMA OF OBESITY: EXAMINING THE RELATIONSHIP BETWEEN BMI
AND THE TREATMENT OF PAIN IN SURGERY PATIENTS

BY

DENNIS H. SEWCHUK JR.

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
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DOCTOR OF PHILOSOPHY DISSERTATION

OF

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ABSTRACT

There is a growing epidemic of obesity in the United States and a corresponding increase in the number of morbidly obese patients receiving healthcare. Despite the increasing focus and research on obesity over the years, the prevalence of obesity in the United States has continued to worsen. A stigma against obesity exists in the general public including among healthcare professionals. Attitudes and bias of healthcare professionals against obesity can negatively affect judgment and choices related to the enactment of care, affecting both the quality of healthcare delivered and patient outcomes. Studies have shown that stigmatization against groups of patients such as minorities affects healthcare outcomes, however there is a paucity of research related to outcomes of stigmatization against obese individuals. The purpose of the study was to determine if there is a difference in quality of nursing care as measured by medicating for pain between obese and non-obese post-surgical patients. It was hypothesized that obese individuals will receive less pain medication than non-obese individuals. An underlying assumption based on the literature was that stigmatization of obesity by nurses would be reflected in reduced administration of post-surgical pain medication. The greater the stigma present, the less pain medication will be administered.

This study used a retrospective chart review of the electronic medical record of three hospitals within a single healthcare system to compare non-bariatric post-surgical pain treatment among normal weight, over-weight, and obese adult patients as a measure of nurses' stigma. The final data set contained a total of 1704 cases, with 21.4% (n=365) normal weight, 21.4% (n=365) overweight, 21.4% (n=365) obesity

class I, 17.1% (n=291) obesity class II, and 18.7% (n=318) obesity class III individuals. BMI scores ranged from 18.5 to 185.9 (M = 33.1, SD = 11.1). Findings showed differences in total dose of day one post-surgical pain medication among the normal, overweight, obesity class I, II, and III patients. Obesity class III patients received less pain medication than the obesity class I and class II patients and significantly less than the overweight patients. Simple linear regression analyses were used to determine the relationship between BMI and pain medication administration on postoperative day one and day two. Hierarchical linear regression was used to determine the relationship between dose on day one and day two and BMI, while taking into account other variables associated with stigma. The relationship between dose of pain medications and BMI was significant and negatively related. For every 1% increase in BMI there was a .17% decrease in the total morphine equivalent dose of narcotic given on postoperative day one. When controlling for other factors related to stigma, there was a .25% decrease in dose for every 1% increase in BMI. Further research is needed to measure attitudes and biases of nurses along with their administration of pain medication to obese patients. Addressing nurses' stigma of obesity is essential to improving the quality of care of obese patients.

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CHAPTER 1

INTRODUCTION

There is a growing epidemic of obesity within the United States (U.S.) as described by the Center for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System from 1990 to 2007 (Center for Disease Control and Prevention, 2008). In 1990, no states had an obesity prevalence of greater than or equal to 15%. By 2007, 30 states had an obesity prevalence of greater than or equal to 25% and three states had a prevalence of greater than or equal to 30%. In 2013, no state had a prevalence of obesity less than 20%, 23 states were between 25% and 30%, 18 states between 30% and 35%, and 2 states (Mississippi and West Virginia) had a prevalence of obesity of 35% or greater. The South had the highest prevalence of obesity (30.2%), followed by the Midwest (30.1%), the Northeast (26.5%), and the West (24.9%) (Center for Disease Control and Prevention, 2015). More than one-third (78.6 million) of U.S. adults are obese.

Over the past decade, there has also been an increase in the number of morbidly obese patients receiving healthcare. This can be seen by examining the literature regarding bariatric surgery. Between 1998 and 2004, there has been approximately a 900% increase (13,386 in 1998 to 121,055 in 2004) in the number of bariatric surgeries, such as gastric bypass and banding procedures, performed (Zhao & Encinosa, 2007). The increase in bariatric surgeries is alarming because it suggests

that there has been a dramatic increase in the number of surgical patients who qualify (i.e., are morbidly obese) for bariatric procedures.

Attitudes and bias of healthcare professionals against obesity can negatively affect judgment and choices related to the enactment of care, affecting both the quality of healthcare delivered and patient outcomes. Stigmatization of obesity has been described as having a negative impact on health and there are a few studies that have shown that obese individuals receive inferior healthcare when compared to that of normal weight individuals. For example, obese patients were less likely to receive pap smears, mammograms, and colorectal cancer screenings (Fagan, Wender, Meyers & Petrelli, 2011), as well as cervical and breast cancer screenings (Wee, McCarthy, Davis & Phillips, 2000). Physicians spend less time with these patients and were found to only give patients a separate diagnosis of obesity 14.4% of the time (Huang et al., 2004, Bleich, Pickett-Blakely & Cooper, 2011). This lack of a separate diagnosis was an important finding because obese patients were less likely to receive weight loss counseling or education without a diagnosis (Tsai & Wadden, 2009).

It is important to study the effect of obesity on healthcare and health outcomes because of the magnitude of individuals that are affected. In order to promote the best health outcomes in obese individuals, it is important to not only describe the stigmatization of obesity that occurs, but also to identify the consequences of that stigma. Despite this increasing focus and research on obesity over the years, the prevalence of obesity in the United States has worsened. Even with this attention, obese individuals still must access healthcare and stigma still exists among healthcare providers. There are research studies that show that stigmatization against other

groups of patients affects healthcare outcomes, but no studies could be found that were related to outcomes of stigmatization against obese individuals related to the treatment of pain. If stigmatization against obese patients and resultant reduction in the quality of healthcare can be documented, then interventions to reduce bias and improve healthcare for obese patients can be developed.

Purpose of Research

The purpose of the study is to determine if there is a difference in quality of nursing care as measured by medicating for pain between normal, overweight, and obesity class I, II, and III post-surgical patients. Treatment of pain is an important quality indicator for hospitals and effective treatment is a requirement of accreditation by the Joint Commission. The amount of pain medication received has been studied in other stigmatized groups, for example racial bias resulting in less pain medication received in the emergency department, but this has never been studied in relation to obesity stigma. It is hypothesized that there is a difference in the amount of pain medication administered between normal, overweight, obesity class I, II, and III patients that results from stigmatization of obesity by nurses. The greater the stigma present, the less pain medication is administered.

Research Questions. The research questions for this study are:

1. What is the difference in the total morphine equivalent dose of post-surgical pain medication administered between normal weight, overweight, and obese (Class I, II, and III) adult non-bariatric surgery patients?
2. What is the relationship between pain medication ordered and administered and the BMI of adult non-bariatric surgery patients?

3. What is the relationship between patients' BMI and the receipt of post-surgical pain medication, when accounting for race, gender, age, insurance status, presence of psychiatric diagnosis, and pain score during hospitalization?

Significance of the Study

This problem was selected because of the increase in obesity in the United States and the increase in the number of obese individuals seeking healthcare. Stigmatization of obesity has no place in healthcare because of the potential to impact the lives of millions of individuals and increase healthcare costs. This study is important because it could contribute to an improvement in quality of care, decrease in healthcare costs, and an increase in quality of life of obese individuals. The study has personal importance due the researcher's twenty-year nursing career in the operating room and being witness to the increased need for consideration of obese patients during care surrounding surgery.

Theory

Symbolic interaction is a useful theory in the development of knowledge related to obesity stigma because it can be used to generate a wide range of researchable hypotheses. Meaning is a central to understanding stigma and its effect on health outcomes. The meaning that nurses attribute to obesity can shape their definitions of situations and perspectives towards the patient. Studying these meanings and the ways of helping individuals to reappraise attitudes and definitions of situations may reduce stigma. The processes of symbolic interaction are useful in describing the range of reference groups utilized by nurses in healthcare, how perspectives and stigma arise within these groups, how these perspectives shape nursing practice, and

how they may change. The focus of future nursing research related to obesity stigma should be on understanding how negative perspectives arise and removing them by altering perspectives and definitions of situations, which should in turn remove stigmatizing actions and improve care provided to obese patients.

Premises and Assumptions

Premise 1. A major premise of symbolic interaction, and this study, is that nurses act toward obese patients based on the meaning they attach to being obese. Negative bias or stigma would be reflected in a reduced pain medication administration. If nurses attach being lazy or lack of self-control to obesity, then biased attitudes may occur.

Premise 2. Another premise is that this meaning arises through interaction with others, for example medical students interacting with biased residents and physicians, or through observing the interactions of others in person or through the media. Negative attitudes toward and interactions with obese individuals can be seen daily through mass media.

Premise 3. The final premise is that meanings are assigned and modified through an interpretive process. The meaning that individuals attach to things is constantly changing. This can be seen in studies that described less negative attitudes towards obesity in individuals who are educated about the uncontrollable causes of obesity.

Assumption. The major assumption of this study is that stigma of obesity is not just an attitude or bias, but translates into behaviors that effect the provision of care given by healthcare providers, meaning that there is a lower quality of care

provided to obese as compared to normal-weight individuals. This assumption reflects Premise 1 of Symbolic Interaction, whereby the meaning attached to something is reflected in actions toward it.

Study Design

Treatment of pain was used as an indicator of obesity bias/stigmatization among healthcare providers in this study. A retrospective chart review was performed that examined data from the data warehouse of a large Rhode Island healthcare system. The warehouse consists of multiple data bases that save data from the multiple electronic medical record applications that are used within the system. Data for this study was collected specifically from the medication administration, the admitting, and the computerized physician order entry application. Data from these systems will be utilized to determine any differences or relationships between a patient's weight status, as measured by their body mass index (BMI), and the amount of postoperative pain medication they receive. The five BMI categories used in this study were determined based on classification by the Centers for Disease Control (2015) of normal (18.5 – 24.9), overweight (25 – 29.9) and the World Health Organization (2014) obesity class I (30 – 34.9), II (35 – 39.9), and III (≥ 40). The association of treatment of pain to obesity stigma has not been studied, but has been studied with other stigmatized groups, for example in minorities (Pletcher, Kertesz, Kohn & Gonzales, 2008; Sabin & Greenwald, 2012).

Summary of Chapters to Follow

In chapter 2, a review of the literature describes the concept of stigma and defines its properties. The prevalence of obesity stigma in healthcare and its effect on

patient care delivered by various types of healthcare providers is reviewed. Various theoretical approaches, and study designs are described. Chapter 3 describes the research design of this study, highlighting the sampling method and the variables chosen. It is important to understand why the variables were chosen and how they could account for other stigmatizing conditions, besides obesity, that may impact pain medication administration. Chapter 4 presents the research findings and reports the results from a one-way ANOVA to compare differences in medication administration, Chi Square to examine relationships between medication ordering and medication between the BMI categories, and regression analyses to determine the relationship between BMI and pain medication administration, while controlling for other variables identified as being associated with bias or stigma. Chapter 5 presents the discussion of the findings, limitations of the study, as well as implications for nursing research, practice, and education.

CHAPTER 2

REVIEW OF LITERATURE

Concept of Stigma

To “stigmatize” has been defined as to describe or identify in opprobrious (vulgar, slanderous, abusive) terms (Merriam-Webster.com, 2013). Link & Phelan (2001) described stigmatization as the convergence of distinguishing and labeling human differences, linking labeled persons to negative stereotypes, separating “them” from “us”, and status loss and discrimination of the labeled person which co-occur in a power situation that allows the components of stigma to unfold.

Stigma, and the resulting stigmatization, is a complicated, multifactorial concept that was first comprehensively examined in the works of Goffman (1963), and later adapted for various situations in psychology, sociology, and various healthcare professional literatures. Stigma has been much studied, but a unified definition remains elusive. Many studies provide no explicit definition, or they quote Goffman’s definition where stigma is an attribute that is deeply discredited (stigmatized). Many studies deconstruct stigma into a list of attributes possessed by the stigmatized, and do not examine it as a language of relationships (Goffman, 1963). The reason for this definitional ambiguity may be the fact that the study of stigma has been multidisciplinary and each discipline has applied a slightly different definition in order to fit a wide variety of professional lenses and situations (Link & Phelan, 2001).

Multiple definitions for this concept may be appropriate given the different research questions being asked, but it does contribute to confusion regarding stigma.

The concept of stigma related to obesity can be defined by describing the stigma, the attitudes and biases related to the stigma, and the effect stigma has related to healthcare. The stigma of obesity sets individuals apart from those who are not obese. The stigma connotes a set of negative attributes for which an obese individual is stigmatized. The obese individual is seen in a negative light due to deficient morals, which causes others to act differently toward the individual. Stigmatization is less likely to occur if there is a perceived cause for the obesity. Research has been conducted that shows that the non-obese react more favorably to obese individuals only if they perceive that the excess weight is beyond the control of the individual, for example the presence of a thyroid condition. This sets up a condition of inequality where those who are perceived to lack control of themselves and do not have any biological excuse for being overweight will be treated less favorably. In a review of literature, Wright & Whitehead (1987) found that fatness was stereotyped and that the more it was perceived that an individual was responsible for their obesity, the more they were disliked. Obese individuals who presented with a condition, such as a thyroid problem, were judged as more likeable, having more self-control, and were judged more attractive than obese individuals who did not have a physical cause to their obesity (DeJong, 1980). Individuals who were educated regarding the controllable causes of obesity are more likely to endorse negative stereotypes than are individuals who were educated about the uncontrollable causes (Puhl, Schwartz & Brownell, 2005).

The nature of stigma is that it is present among groups that exist outside the societal norm. Crocker & Major (1989) described stigmatization as occurring towards oppressed social categories of people toward which others hold negative attitudes, stereotypes, and beliefs, who are vulnerable to being labeled as deviant, and are who targets of prejudice or victims of discrimination. The recipients of stigmatization receive a disproportionately poor interpersonal or economic outcome relative to members of the society at large. Also, a stigmatized group is an out group relative to the dominant group in a culture or society, whereas an out group is defined by reference to any particular in-group, regardless of which group holds the dominant position in the social hierarchy. Puhl & Brownell (2003) suggested that a stigmatized person possesses an attribute or characteristic that conveys a social identity that is devalued in some particular social context. Puhl & Brownell (2006) also associated stigmatization with weight bias and stereotyping. Balogh-Robinson (2011) described stigmatization as a weight bias, prejudice, discrimination, or stereotype. Stigmatization occurs when any personal attribute is deeply discredited to its possessors; including “tribal stigmata,” “abominations of the body,” and “blemishes of individual character” (Goffman, 1963). Goffman also described it as the relationship between an attribute and a stereotype. Lewis & Van Puymbroeck (2008) described stigmatization as the discriminatory acts that result from the social disapproval tied to existing negative attitudes toward people perceived as being overweight.

Stigma and Healthcare

Prevalence. The prevalence of stigma as described within the literature encompasses many examples of socially unacceptable conditions which are stigmatized. In performing a literature search using the Cumulative Index to Nursing and Allied Health Literature (CINAHL) database and “stigmatization” as a key word, 601 results were returned that were published between 1987 and 2013. A vast majority of the literature on stigmatization during this time period was related to mental illness and HIV infection. Stigmatization in obese individuals is the area of interest for this author. There is very little research of this facet of the stigma concept. Performing a literature search using CINAHL and “stigmatization” and “obesity” as keywords returned 29 results between published between 1994 and 2013. Most of the articles focused on the attributes of stigma and the effects of stigmatization of obese individuals.

Groups affected by stigma. Stigma associated with certain groups requiring healthcare is very prevalent within society. It is described as affecting multiple groups of individuals and occurs in every culture. Stigma has been described within multiple groups, such as stigma related to HIV/AIDS (Herek, Capitano & Widaman, 2002; Letamo, 2003; Vanable, Carey, Blair & Littlewood, 2006), mental illness (Alonso et al., 2009; West et al., 2011), illicit drug use (Ahern, Stuber & Galea, 2007), epilepsy (Jacoby & Austin, 2007), smokers (Stuber, Galea & Link, 2008), and skin disorders (Chaturvedi, Singh & Gupta, 2005). The common thread that these different types of stigma share with obesity stigma is that the individual possesses and/or displays a mark or behavior that identifies them as belonging outside what is normal or

acceptable in society. Stigmatization of a group occurs whether it is perceived that the stigma may or may not be the fault of the individual.

The characteristics of stigma are typically defined by the attributes being stigmatized. Stigma related to HIV is associated with homosexuality, promiscuity, and drug use. Stigma related to mental illness can be associated with inappropriate or bizarre behaviors, instability, and lack of personal hygiene. Stigma related to drug use is associated with lack of morals, criminal behavior, and drug addiction as a disease. The stigma of epilepsy is characterized by having a perceived mental illness, being possessed, and lacking intelligence. Stigma related to smoking is associated with lacking willpower and putting one's health, or another's health, at risk. Stigma related to skin diseases is associated with being unclean. Characteristics of stigma such as controllability, concealability, and entitativity, greatly affect psychological and behavior reactions to the stigma (Major & O'Brien, 2005) If the stigma is controllable, then individuals are more likely to possess negative attitudes and bias toward the stigma. Stigma that is concealable is less likely to be stigmatized, yet individuals may feel shame and may spend considerable effort trying to hide stigmatized attributes. Entitativity relates to the cohesiveness of a group. The presence of stigmatized attributes can activate stereotypic beliefs that cause them to be considered not only physically, but psychologically similar to other members of the group. For example, the stereotypic belief that obese individuals are lazy and lack willpower may be applied to all obese individuals.

Effects of stigma. Stigma can greatly affect an individual who is stigmatized and multiple consequences that can occur. Stigma has been described as decreasing

self-esteem, lowering academic achievement, and placing an individual at greater risk for mental and physical health problems (Major & O'Brien, 2005). Link & Phelan (2006) described stigma as affecting employment opportunities, housing, access to medical care, and exposure to chronic stress. Holzemer et al. (2009) described the loss of social support, persecution, isolation, job loss and problems accessing healthcare services resulted from stigma. Self-esteem has been found not to decrease in stigmatized individuals proportionally to the amount they are devalued by society. Crocker, Cornwell & Major (1993) described that self-esteem in overweight women may be increased by externalization of the cause of negative feedback, moving away from blaming oneself. Those who internalized the causes of negative feedback demonstrated lower self-esteem. In academic achievement, stigmatized individuals may receive less attention and support. Stigmatization directly affects health exposing individuals to physical and social environments that are more toxic and stressful and by limiting their access to quality medical care.

Stigma of obesity related to healthcare professionals. Negative attitudes and beliefs related to obesity exist in the literature among healthcare students and professionals. Negative or biased attitudes, such as slow, like food, overeat, are insecure, and have low self-esteem, were described as present in physician assistant students (Wolf, 2010) where 13.6% of the physician assistant students studied displayed a high level of fat phobia. Waller, Lampman & Lupfer-Johnson (2012) described weight bias in nursing and psychology students. Both student groups displayed a significant implicit weight bias that was greater towards women than men. Nursing students were also described as having fat phobia and negative attitudes

toward obese patients (Poon & Tarrant, 2009). Registered nurses were compared to nursing students in the study and had a significantly greater fat phobia. Both groups perceived obese people as liking food, over eaters, shapeless, slow, and unattractive. Dietetic students were more likely to describe a poor health status and diet quality towards obese patients, even with identical health profiles among all individual scenarios (normal and overweight)(Puhl, Wharton & Heuer, 2009). These students displayed a moderate amount of fat phobia and rated obese patients as less likely to comply with treatment. Persky & Ecclesten (2011) described that medical students displayed more negative stereotyping towards obese patients, as well as rating them less likely to comply with treatment recommendations. Students attributed more responsibility to obese patients for potentially weight-related health problems. Few medical students who have fat bias are aware of this bias (Miller et al., 2013). Due to the common lack of explicit bias in healthcare providers, other measures are needed to determine the presence of implicit bias. This could be accomplished with use of a scale that measures implicit bias in combination with a measure of patient outcomes among stigmatized and non-stigmatized groups. The presence of stigmatization in healthcare students is disturbing because of the potential that they will carry these attitudes and biases forward into practice. There may be a great opportunity to change attitudes in healthcare by focusing more study on students. This lack of bias awareness also holds true for other healthcare providers, such as physicians. A review of studies measuring implicit bias in physicians towards stigmatized groups found that obese, black, Hispanic, elderly, and women patients were the target of more bias (Chapman, Kaatz & Carnes, 2013).

Hebl & Xu (2001) described physician responses to mock medical records of patients who were average, overweight, and obese presenting with a migraine headache. Physicians viewed heavier patients more negatively and reported that they would spend less time with them than average weight patients. Physicians were more likely to perceive their obese patients as non-adherent to medications (Huizinga et al., 2010), which has been shown in other studies to affect physician prescribing patterns. Patients perceived as non-adherent may not receive guideline recommended care and may result in a delay in prescribing recommended medications for HIV, acute coronary syndrome, and hemophilia, or intensifying therapy for diabetes. A clinician's own body weight also affects healthcare received. Patients reported less confidence in care provided by overweight physicians (Hash, Munna, Vogel & Bason, 2003) and thin and overweight pediatricians reported more difficulty with weight loss counseling than average weight physicians (Perrin, Flower & Ammerman, 2005). Attitudes and bias of healthcare professionals towards obesity are often not explicitly demonstrated, but implicit (Schwartz et al., 2003). The stigma of obesity may affect healthcare professionals and create implicit bias. This can negatively affect judgment and choices related to the enactment of care, affecting both the quality of healthcare delivered and patient outcomes, as described by several research studies (Óstbyte, Taylor, Yancy & Krause, 2005; Tsai & Waden, 2009; Bertakis & Azari, 2005; Huang et al., 2004). To improve patient outcomes, healthcare providers should raise their awareness of any implicit bias.

Obesity stigma and healthcare outcomes. Stigmatization of obesity has been described as having a negative impact on health and healthcare. Many studies have

shown that obese individuals receive inferior healthcare when compared to normal weight individuals, such as less screenings for mammography or Pap smear (Óstbyte et al., 2005). In a review of literature, Fagan, Wender, Meyers & Petrelli (2011) described a negative association between weight and pap smears, mammography, and colorectal cancer screenings. Overweight and obese women were described as less likely to be screened for cervical and breast cancer (Wee, McCarthy, Davis & Phillips, 2000). Tsai & Wadden (2009) described absence, or less than recommended weight loss counseling in obese patients. Bertakis & Azari (2005) found that primary care physicians spent less time educating their obese patients about their health and spent a greater portion of the visits on technical tasks, such as history taking, performing the physical examine, giving feedback and planning treatment, and performing in-office procedures than with non-obese patients. Huang et al. (2004) found that obesity was documented as a separate clinical diagnosis in only 14.4% of patients with a BMI of 30 or higher. Patients who did receive a diagnosis were more likely to receive weight counseling compared to those did not. Obese patients without a diagnosis are often counseled regarding their weight only if they have other health issues. Patients with a body-mass index (BMI) ≥ 35 or with Type 2 diabetes were more likely to report being counseled to lose weight than those without diabetes or patients with < 35 BMI. Obese patients often do not receive an obesity diagnosis (Bleich, Pickett-Blakely & Cooper, 2011). While diet and exercise counseling were more likely to occur with a diagnosis of obesity, pediatric care providers were more likely to provide diet and exercise counseling than other specialties, including family physicians and general practice providers (Cook, Weitzman, Auinger & Barlow, 2005).

Postoperative Pain. This study examined the treatment of postoperative pain and its relationship to a patient's BMI. Postoperative pain is an important topic to study since it has significant effects on health outcomes, such as increased lengths of hospital stay and delays in returning to activities of daily living (Morrison et al., 2003). Pain greatly affects the patient's ability to ambulate and immobility has been described as increasing 6-month mortality rates (Siu et al., 2006), while early ambulation has been associated with quicker return of functional capacity and a greater discharge to home after surgery (Oldmeadow et al., 2006). Mental status decline in geriatric patients has also been described in relation to the presence of postoperative pain (Lynch et al., 1998; Duggleby & Lander, 1994). A decrease in postoperative myocardial ischemia has been found in elderly patients receiving effective pain control after surgery (Scheinin et. al, 2000).

Stigma and treatment of pain in other stigmatized conditions. While the study of bias and its effect on the treatment of pain has not been studied in obese patients, it has been studied as it relates to other groups. Stigma related to the provision of healthcare and the treatment of pain has been described in association with age, gender, race, and mental illness.

Studies have described that age is a factor in receiving analgesia, with older adult patients receiving less than younger patients (Jones, Johnson & McNinch, 1996). Also, several other age-related factors have been described among older adult patients that may affect the administration of pain medication, such as challenges of assessment of pain in older adults, the under reporting of pain, atypical manifestation

of pain in older patients, and misconceptions regarding tolerance and addiction (Cavalieri, 2005).

Women experiencing more severe pain than men (Cepeda & Carr, 2003), and a gender bias has been describe in pain management, with women receiving more analgesia than men (Fillingim et al., 2009). In a review of the literature, Hoffmann & Tarzian (2001) found that women were less likely to be taken seriously and receive adequate treatment for pain. Pain was often ascribed to psychiatric causes in women. In a study examining the effect of race and gender on physician pain management decisions, Weisse, Sorum & Dominguez (2003) found that physicians treat women less aggressively for pain.

In studies related to bias and race, treatment of pain has been demonstrated to be less in minorities than in white patients (Pletcher et al., 2008; Sabin & Greenwald, 2012) and in black patients, unless they exhibited demanding or angry behavior (Burgess et al., 2008). Mills et al. (2011) described that nonwhite patients who presented to the ED for pain were less likely than whites to receive analgesia and waited longer for their opiate medication. Pletcher et al. (2008) described differential prescribing of opioids by race/ethnicity for all types of pain. In a study examining the effect of implicit bias on pediatric physicians' treatment recommendations, Sabin & Greenwald (2012) found an association between implicit bias and patient's race in prescribing a narcotic medication for pain following surgery. It is possible that treatment of pain may also be lacking in other stigmatized groups, such as in obese patients.

Insurance status has been used in multiple studies (Vijayakumar, et al., 1995; Hong, Baumann, & Boudreaux, 2007) as an indicator of socioeconomic status. Bird & Bogart (2000) have described it as a perceived reason for discrimination during healthcare provision.

Having a psychiatric diagnosis is a stigmatized condition and is associated with poorer healthcare outcomes (Zolnierek, 2009). Patients with psychiatric diagnoses often have their physical health problems attributed to their mental illness (Thornicroft, Rose & Kassam, 2007). Primary care providers have been described as having significantly increased negative attitudes towards patients with mental illness, as described by the presence of stereotyping and attributing of negative attitudes (Mittal et al., 2014).

Theoretical Approaches

There are several theoretical approaches that have been described as guiding research in obesity stigma. Among these are a psychobiological approach, Attribution Theory (Puhl & Brownell, 2003), Social Support Theory (Peterson & Bredow, 2009), and Socioecological Systems model (Steele et al., 2011), Symbolic Interaction (Martins & Burbank, 2011; LaBat & DeLong, 1990; Schroeder, 1981), Critical Social Theory (Martins & Burbank, 2011; Monaghan, 2005), and Critical Interactionism (Martins & Burbank, 2011).

Psychobiological. The Psychobiological approach could provide nurses with insight into the mechanisms that control energy intake and expenditure and has been used by nurses to gain understanding of obesity and to provide education to obese patients. When one understands the causes that lead to weight gain, they can better

modify behaviors or the environment to alleviate these causes. This approach incorporates understanding of the biological effects on weight management, such as hunger, craving, hedonic sensations, appetite, meals and their constituents, metabolism, and interactions with brain. Also incorporated is the idea of negative feedback and that if individuals eat too quickly, they may eat a larger portion before satiety signals are stimulated. The environment is also important in that nurses and patients can identify triggers of overeating and reduce or eliminate them.

Understanding metabolism can help identify ways of increasing activity; taking into account domestic, financial, and environmental factors; which will increase metabolism and decrease the effect of starvation metabolism. Understanding energy intake is also important since self-report food intake is often underestimated.

Additional nutrition-focused education could stress the need for more accurate assessment of energy intake.

Attribution Theory. Attribution Theory deals with beliefs about reasons for obesity and for weight loss failure. Perception of control, both internal and external, is an important concept. Internal control assumes that an individual has a greater control over things, while external control assumes that what happens is out of individual control. Patients who perceive that they have greater control have greater weight loss success. In relation to stigmatization, individuals are more likely to stigmatize obese individuals if they perceive that the cause of the obesity is attributed to controllable causes rather than uncontrollable causes, such as thyroid disease (DeJong, 1980). Those who were educated regarding the uncontrollable causes demonstrated less obesity stigmatization.

Social Support Theory. Environmental stressors, such as stigmatization, can affect health. Social Support Theory explains the mediating effect of support on coping with these stressors. It would be important for nurses to explore with individuals the extent of social contacts and how much perceived support they have. Greater support may potentially reduce environmental stress. Support can be in the form of emotional, informational, instrumental, or appraisal (Peterson & Bredow, 2009).

Socioecological Systems Models. Obesity stigma is a multifactorial issue and a socioecological model would be useful in determining the individual, family, nurse/clinician, institutional, and societal factors that may increase or decrease stigma (Steele et al., 2011). These systems exist as nested structures, moving from the innermost structure outward. The structures are microsystems, mesosystems, exosystems, macrosystems, and chronosystems (Bronfenbrenner, 1994). In relation to obesity stigma, microsystems consist of activities, roles, and relationships experienced by the obese individual in a given setting with specific physical, social, and symbolic attributes that permit or inhibit engagement or activity in the immediate environment. Mesosystems are made up of the linkages and processes between two or more settings containing the obese individual, such as the relationship between home and a particular healthcare setting. Exosystems are comprised of linkages and processes that occur between two or more settings where at least one does not contain the obese individual, but where events occur that affect them. Macrosystems are comprised of the overall pattern of micro, meso, and exosystems and could be considered “as a societal blue-print for a particular culture or subculture” (Bronfenbrenner, 1994, p.

40). The chronosystem comprises the change over time of characteristics of an individual and their environment.

Symbolic Interaction. One commonly used theoretical perspective that is helpful in guiding research in the area of obesity stigma is symbolic interaction. Following the theoretical framework, the actions of human beings toward things are based on the meaning that human beings attribute to them. This meaning is the result of social interaction and can change based on how humans interpret encounters with others (Blumer, 1969). The world exists separately from the individual, but can only be interpreted through the use symbols in the process of interaction. Objectivity can only be approximated because the world is seen through the lens of meaning derived by many individuals.

There are three main premises that underpin symbolic interaction. The first is that humans act toward things based on the meaning that they attach to them. The second is that meaning comes from social interaction. The third premise is that meanings are assigned and modified through an interpretive process. In relation to obesity stigma, nurses act toward obese patients based the meaning they attach to being obese. If nurses attach being lazy or lacking of self-control to obesity, then biased attitudes may occur. This meaning may arise through interaction with others, for example medical students interacting with biased residents and physicians, or through observing the interactions of others in person or through the media. Negative attitudes toward and interactions with obese individuals can be seen daily through mass media. The meaning that individuals attach to things is constantly changing.

This can be seen in studies that described less negative attitudes towards obesity in individuals who are educated about the uncontrollable causes of obesity.

Within situations, actions arise based on an individual's own interpretation of meaning. Stigmatizing actions by nurses towards obese individuals can be explained using this symbolic interaction process (Burbank & Martins, 2010). Following the process, nurses have interactions with reference groups that shape their perspectives regarding obese individuals. These groups can be medical and healthcare organizations, or society at large. When an obese individual enters into the healthcare system and interacts with the nurse, negative perspectives fostered by these reference groups can help define the situation. An important definition of the situation with nurse-obese patient interactions is the attribution of the causes of obesity and whether or not the obese individual is in control of their weight gain. The perspectives and definitions of the nurse drive actions, and obese individuals may receive less care if it is perceived that the cause of their obesity was within their control. Nurses would feel justified in their negative perspectives if the obese individual meets the nurse's expectations of someone who lacks self-control and is not taking an active role in reducing their weight by displaying healthcare avoidance behaviors or poor self-esteem/depression, and they would continue to display a negative perspective or bias towards obese patients.

Critical Social Theory. "Karl Marx believed any understanding of human societies must begin with the material conditions of human existence, or the economics of producing the necessities of life. The economic mode of production, due to its importance, influences other aspects of life, such as political organization,

ideology, religion and culture: ‘the ideas of the ruling class are in every epoch the ruling ideas: that is, the class which is the ‘ruling material force’ of society, is at the same time its ruling intellectual force’” (Marx & Engels, 1994, p. 15). Marxist writers authors would analyze obesity stigma as a social problem that is directly linked to the changing mode of production: definitions of obesity stigma and other social problems are influenced by both the economic and social structures and the core values of particular modes of production existing in a historical time period. The goal of critical theory is to create a life free from unnecessary domination (Kim & Holter, 1995).

Habermas described a framework for knowledge specified within three categories; technical, practical, and emancipatory cognitive interest (Kim & Holter, 1995). Technical interest is achieved through the application of empirical-analytic science and predictive knowledge is obtained. Understanding in social life is the orientation of practical interest and is achieved through reflective judgement and interpretive understanding evident in the historical-hermeneutic sciences. Knowledge gained through these two categories is not sufficient for full understanding of social phenomenon. Critical theory goes beyond knowledge gained through empirical-analytical and historical-hermeneutic sciences by examining power relationships and creating knowledge oriented toward liberating individuals from domination through a process of self-enlightenment.

The medicalization of obesity is evidenced by the increase focus on obesity as a health problem. Much effort and money is spent in the media, weight loss supplements and programs, and bariatric surgeries. Even with all this effort, stigma exists because obesity exists as both a medical and a social problem. The stigma of

obesity could be considered a result of ideological hegemony, or how relationships of domination and exploitation are embedded within the dominant ideas of society (Burbank & Martin, 2010). The implicitness of negative attitudes regarding obesity in healthcare relates how society has internalized the idea that obesity is brought upon oneself by sloth and overindulgence. Obese patients accessing healthcare are in a vulnerable position and possess little social power in the nurse/clinician-patient relationship. Patient encounters, such as the administration of pain medication by a nurse to a patient, exist on the micro level. Habermas' communicative action theory, which emerged from critical theory, would allow linkage of macro societal/organizational issues to the micro level of the patient encounter.

Critical Interactionism. Another framework that would be useful in the study of obesity stigma would be critical interactionism. Critical social theory and symbolic interaction are combined, taking into consideration both downstream and upstream factors when developing research related to obesity stigma. Martins & Burbank (2011) compared and contrasted symbolic interaction and critical social theory and described areas of divergence and synergy (Table 1). Obesity stigma is a complex health issue and involves the individual and professional groups, healthcare organizations, and society at large. Both micro and macro approaches need to be incorporated into interventions designed to alleviate the stigma.

Other theories. Other theoretical approaches included theories on self-fulfilling prophesy, attributional ambiguity, stigma-induced identity threat model (Major & O'Brien, 2005), social consensus model (Puhl & Brownell, 2003). Bos,

Pryor, Reeder & Stutterheim, (2013) proposed a model of stigma that incorporated structural, public, and self-stigma and stigma by association.

Measures of Stigma

Negative attitudes exist within stigmatized groups, such as obese individual. Scales have been used to assess attitudes of obese individuals towards obesity and obese patients. Friedman et al. (2005) described the use of the Attitudes Toward Obese Persons Scale, has been used to assess internalization of anti-fat attitudes by obese patients, and the Beliefs About Obese Persons Scale which assesses beliefs about the controllability of weight. Wang, Brownell & Wadden (2004) used the Implicit Association Test (IAT) to investigate the internalization of anti-fat bias among overweight individuals.

Scales have also been used to assess attitudes of healthcare providers. The Fat Phobia Scale has been used to assess attitudes toward obese patients (Poon & Tarrent, 2009; Puhl, Wharton & Heuer, 2009; Wolfe, 2010). The Weight Implicit Association Test (IAT) has been used in studies (Miller et al., 2013; Schwartz et al., 2003) to assess implicit weight bias. Poon & Tarrent (2009) described the use of the Attitudes Toward Obese Adult Patients (ATOAP) scale to assess attitudes toward the management of care of adult obese patients. Measuring the length of visual contact has also been used to assess attitudes toward obese patients (Persky & Eccleston, 2011).

Many studies described the sole use, or use with a scale, of surveys created by the researchers for the particular study. Wadden et al. (2000) administered a questionnaire to women participating at obesity trials and assessed views of weight control management provided by their primary care physician to compared satisfaction

scores and association with weight. Foster et al. (2003) conducted a self-reported survey of physicians' attitudes about obesity and its treatment that assessed beliefs about causes of obesity, attributes of obese individuals, beliefs about treatment, attitudes about weight loss outcomes, and beliefs about the efficacy of obesity treatment. Brown et al. (2007) used a questionnaire to determine nurses' practice, beliefs and attitudes related to obesity management and assessed clinical practice activities of assessment, advice, support, and referral, beliefs about causes and consequences of obesity, attitudes toward obese patients or clients, and views on obesity-related practice development, organizational support and training. Sack et al. (2009) used a mail survey, adapted from a survey assessing physician attitudes, to determine the attitudes of physical therapists related to attitudes and management of obese patients. Forman-Hoffman, Little & Wahls (2006) used a focus group survey to determine physician barriers to obesity care. Puhl, Wharton & Heuer (2009) created a survey rating dietary quality, receptivity of treatment recommendations based on patient profiles in order to assess weight bias among dietetic students.

While relatively easy to administer, a majority of scales used in studies to assess attitudes toward obese patients are self-reported measures. Study participants that have concerns related to privacy issues, or how they might personally be perceived, may have a tendency to under report negative attitudes and over report positive attitudes. Participants may feel more motivated to bias their responses if they are expressing socially undesirable behaviors, the questions are of a highly sensitive nature, the participants have a disposition to give socially desirable answers, or there is pressure on the participant to give desirable answers.

Tests that are designed to measure implicit bias that participants may not even be aware of can alleviate the issues of self-reported measures. The IAT works by measuring the length of time it takes to categorize a list of words. Pairing of word and category is easier if the pairing matches the participant's attitude. Shorter pairings are attributed to a greater bias, whether positive or negative. Measurement of visual contact, for example between a healthcare provider and an obese patient, also could be an unconscious indicator of attitude. For these two methods to be effective, participants would need to be unaware of the purpose of the measurements. Length of time it takes to create word-category category pairings, or visual contact time, could be consciously increased by participants in order not to appear biased. Measurement equipment must be incorporated into the study and may reduce flexibility of administration. Paper surveys can be administered anywhere, but these types of measures may be limited to a particular area that has computers, particular software, or hardware such as the cameras to measure visual contact.

Surveys created by researchers are highly specific for answering research questions, yet most often are not tested for validity or reliability. The specificity may prevent results from being generalizable. On the other hand, if researchers create questions that are too general, they may not apply to participant as they should. Some studies have described the use of tested scales in addition to these created surveys to lend more validity. Surveys, whether self-administered or administered by an interviewer, are self-reporting, therefore would be subject to the same variances related to bias as all self-reporting measures.

The issue of social desirability is an important consideration for all self-reported measures that assess negative or sensitive issues (Krumpal, 2013). The likelihood of participants telling the truth depends on the perceived risk related to socially undesirable situations. Participants may fear embarrassment, reactions of an interviewer, reactions from family and friends present, or retribution such as loss of job or position. A threat to one's self concept may occur in answering questions negatively that may make them look bad. Nurses want to believe that they treat everyone equally and holistically.

There are several ways to minimize and control for the effect of social desirability bias (Nederhof, 1985). A self-administered survey may increase the likelihood of accurate reporting since there is a higher degree of anonymity than if the survey was administered by an interviewer, although there may be issues with participants not answering sensitive questions if there is a perceived risk of privacy breach. Anecdotally, healthcare staff often expressed concern about the privacy of certain workplace surveys they are asked to take, such as employee satisfaction surveys, even when they are reassured of the anonymity of the survey. During interviewer-administered surveys, responders may alter answers based on the perceived expectations and norms of the interview. For example, a participant would be less likely to express negative attitudes towards obese individuals if an obese individual were administering the survey. Bias may also affect interviewers, who may skip questions they feel uncomfortable asking. To decrease this effect, sensitive questions could be answered in private and sealed in an envelope before being given to the interviewer, thereby assuring a higher degree of privacy. Social desirability bias

may be affected by bystanders, especially if the study participant does not want to share the information. An example of this would be asking a teen about birth control in front of their parents, or asking about sexually transmitted disease in front of a spouse or significant other. Other methods to decrease social desirability bias would to neutrally word questions to minimize concerns on how answers would be judged, or to embed sensitive questions among unoffending questions related to the topic of interest. Another way to minimize bias would be to increase the subjective cost of misreporting by making the participant believe that there was a method being employed that would detect misreporting, such as with a lie detector. Social desirability bias may also be decreased by having the participant act as an informer on others behavior or attitudes, or by use of someone who knows the target of the study well. This may work because the participant is not expressing their own beliefs, attitudes, or behaviors. The informant method may not be effective if there is a perceived lack of privacy and the participant has fear of repercussions. Another method includes the randomized response technique where respondents use a randomizing device, such as a die or coin, to decide which questions they will answer. The interviewer does not know which question was selected by the participant or their response. Also, the unmatched count technique could be used. Participants are divided into two groups, where one group answers a list of non-sensitive questions and the other answers the same list plus the sensitive questions. Questions that participants answered “Yes” to would be counted and that number reported to the interviewer.

Another method that may be used to decrease social desirability bias would be to include a social desirability bias scale within a questionnaire, for example Latner et

al. (2008) described the use of the Marlowe-Crowne Social Desirability Scale when measuring for bias toward obese, homosexual, and Muslim individuals. A higher score on the scale would indicate that a participant may be more likely to under report negative attitudes. Based on the score, researchers would have the opportunity to discard the data, adjust the data to account for the bias, or merely recognize that social desirability bias was a factor within the study and mention it as a limitation.

While the presence of stigma is apparent from studies of obese individuals, the evidence that stigmatization occurs is less conclusive from studies of healthcare providers. It is difficult to assess stigma directly from healthcare providers because of social desirability. Explicit measures of bias are difficult to obtain because subjects may be reluctant to report negative attitudes. It is possible to indirectly measure the presence of bias based on measuring the results of the bias. There is an association between attitude and behavior and the quality of healthcare obese patients receive, for example less screenings for mammography or Pap smear (Østbye et al., 2005) or the absence of weight loss counseling (Tsai & Waden, 2009). Measurement of these healthcare inequalities would provide a way to identify the presence of stigmatization while decreasing the effect of social desirability. The issue of privacy is not an issue since individual healthcare providers are not directly observed or questioned.

There are several pros and cons to doing studies that link healthcare outcomes to attitude and biases. Biases, such as social desirability, associated with individuals responding to surveys or interviews would be eliminated. Researchers would be studying what was documented and not directly studying healthcare providers. Studies can be done retrospectively potentially giving the researcher access to more data. If

more data is required, researchers can look back over a broader period. This would be easier, for example, than trying to recruit more participants to take a survey. There are less ethical issues related to human subjects, such as ensuring confidentiality and the need to obtain informed consent, in retrospective record reviews. Such studies would be measuring actual healthcare outcomes to determine the presence and effect of bias rather than the results of an experiment. These studies can find associations between variables. The strength and direction of the relationships can be determined, opening the way for further study and possibly the determination of causative factors.

The cons of using this type of study are that it would measure an association, which would not demonstrate that obesity bias is a causal factor in obese patients receiving less pain medication and that many other unknown factors may be affecting pain medication administration besides bias. For example, a patient may have other health issues that are causing increased pain and results in increased pain medication administration, or possibly the patient has a higher tolerance for pain, or other non-medication pain relief are being used. Another con related to doing these studies retrospectively is that the researcher is relying on the accuracy of the data. Anecdotally, healthcare providers do not consistently paint a vivid clinical picture with their documentation. Patient information is often missing, either in error or because it was never assessed.

Chapter Summary

The concept of stigma and its presence in healthcare was explored. Within healthcare, obesity is a condition of excess adipose tissue that is stigmatized. There were few studies found that examined obesity stigma in healthcare, although it has

been described in relation to other healthcare conditions, such as HIV/AIDS, mental illness, illicit drug use, epilepsy, and smoking. Obesity stigma has multiple consequences on healthcare outcomes, both from the patient perspective (e.g., decreased self-esteem, healthcare avoidance, etc.) and from a healthcare provider perspective (fewer referrals for screenings, less time spent with the patient, etc.). Selection of pain medication administration was based on the findings of the effect the presence of stigma has on patients receiving less medication. Pain medication administration has been studied in other stigmatized groups, but has not been studied in regards to obesity stigma. Pain medication was also selected in order to reduce the effects of social desirability. After review of multiple theoretical frameworks associated with the study of stigma, symbolic interaction was selected for this study. The selection was based on the frameworks alignment with other studies that explored the meaning individuals held regarding obesity and how it affected attitude.

Following exploration of the concept and theoretical framework, the electronic medical records related to patient demographics, ordering, and medication administration were queried. The measurement of dependent and independent variables is described in Chapter Three. Also described in the next chapter are sample selection, data analysis, and ethical consideration.

CHAPTER 3

METHODOLOGY

Treatment of pain has been used as an indicator of bias/stigmatization among healthcare providers in several studies (Sabin & Greenwald, 2012; Mills et al., 2011; Burgess et al., 2008; Pletcher et al., 2008), was used in this study. Undertreated post-operative pain is associated with negative healthcare outcomes such as longer hospital stays, missed or shortened physical therapy sessions, and less ability to ambulate (Morrison et al., 2003). The relationship of pain treatment to obesity stigma has not been studied, but as described in the previous section has been studied with other stigmatized groups.

Research Questions

This quantitative study was designed to answer the following research questions:

1. What is the difference in the total morphine equivalent dose of post-surgical pain medication administered between normal weight, overweight, and obese (Class I, II, and III) (World Health Organization, 2014) adult non-bariatric surgery patients?
2. What is the relationship between pain medication ordered and administered and the BMI of adult non-bariatric surgery patients?
3. What is the relationship between patients' BMI and the receipt of post-surgical pain medication, when accounting for race, gender, age, insurance status, presence of psychiatric diagnosis, and pain score during hospitalization?

Design

This study used a retrospective chart review to compare pain treatment among normal weight, over-weight, and obese patients as a measure of stigma. This design supported the intent of the study, which is to examine the differences in pain medication administration based on BMI, the relationships of pain medication ordering (as entered by the physician) and administration (as documented by the nurse) between different categories of BMI, and if there is a relationship between BMI and the amount of pain medication administered.

Sample

The sample was obtained through Information System (IS) query of the hospital system data warehouse, which contains data from electronic medical records from three hospitals and has been used by the healthcare system going back to 1993. The IS analyst employed through the hospital system from where the data was taken was given specific inclusion and exclusion criteria to extract the data.

Inclusion criteria for the study were adult patients, 18 years of age, who must have been specifically admitted for a surgical procedure. Patients who were admitted for bariatric surgery, such as gastric bypass or gastric banding surgery, or were admitted for medical reasons, but ended up needing surgery, were excluded from the study. The reason for excluding bariatric surgery was that prior studies have described that patients who were considered at fault for their obesity were more likely to generate negative attitudes from study participants than patients that were described as not being responsible for their obesity, such as in patients with thyroid conditions (Dejong, 1980). Also, it was possible that nurses working in the specialty of bariatric

surgery may display less bias related to an increased exposure to obese patients. Patients who were admitted to the hospital for medical reasons were excluded because their pain may have been influenced by factors other than surgery. Patients undergoing bariatric surgery could be considered as taking responsibility for their weight and taking action, therefore may experience less stigmatization than non-bariatric patients. Underweight patients were excluded from the study since being underweight may be associated with other healthcare issues that may impact pain during hospitalization. Patients who had patient-controlled analgesia ordered in the electronic medical record by a licensed independent practitioner during the post-operative period were excluded since they administer their own pain medications and nurses do not.

Certain variables were measured to control for the effects of stigma against other groups documented in the literature, such as age, race, gender, socioeconomic status (inferred from insurance status), and psychiatric diagnosis. Also, data was collected in order to ensure the proper sample. For this study, patients being hospitalized for other reasons than surgery were excluded. Therefore admission diagnoses that were surgery-related were necessary. Comparing the date of admission to the procedure date also helped in sampling to ensure that patients were hospitalized for surgery and not for other reasons. Patients selected were admitted on the same day as their surgery. The type of surgical procedure was recorded in order to exclude bariatric surgery patients. It was also important to identify discharge date. Patients discharged on the same day were excluded from the study as their surgery would have minimal interactions with healthcare professionals and pain medication administration would be strictly limited to the immediate surgical recovery period.

Patients were selected from a healthcare system that includes three tertiary, acute-care hospitals that provide services to Rhode Island, Massachusetts, and Connecticut. In 2013, 14,884 inpatient surgeries were performed within the system. The sample was obtained from the historical database system, which files extend back to 1993. Equal numbers of patients were selected for the normal weight, overweight, obese I, obese II, and obese III groups, starting with December 31, 2013 and went back temporally. The final sample consisted of patients who had surgery from January 1, 2013 through December 31, 2013. It was important that the sample be acquired prior to 2014, since the use of insurance status as an indicator for socioeconomic status would not have been reliable due to the provision in the Affordable Care Act that all Americans have access to affordable health insurance options.

A power analysis was performed using SPSS Power 3. The power analysis for a one-way, fixed effects analysis of variance with 5 levels (normal weight, overweight, obese class I, obese class II, and obese class III) was performed. The outcome was that 365 cases per level for a total of 1825 cases were needed. The criterion for significance (alpha) was set at 0.05. The analysis of variance is non-directional (i.e. two-tailed) which means that an effect in either direction will be interpreted. For analysis of variance the effect size (f) was 0.10, which yielded a power of 0.95. A small effect size for BMI was selected because there were no previous studies conducted related to BMI and pain medication administration from which effect size could be inferred. The sample was obtained from patients having surgery during 2013. Data was de-identified by the Information System (IS) staff prior to delivery for data analysis and each patient was assigned a unique ID number. Variables in the study

included age (continuous), gender (categorical), race (categorical), BMI (continuous and categorical), insurance status (categorical), psychiatric diagnoses during admission (categorical), pain medication frequency and dose ordered, frequency and dose of pain medication administration by the nurse, type of drug administered (narcotic/non-narcotic), and pain score during hospitalization (categorical). After removal of duplicate cases and cases with no height or weight entry, a random sampling of BMI categories that contained greater than 365 cases was performed to achieve the number determined by the power analysis.

Measurement of Dependent Variables

Pain Medication Administration. Data related to pain medication administered during the first (postoperative day one) and second (postoperative day two) 24-hour period, for a total of 48 hours after surgery, was collected. This included the number of times that intravenous narcotics, oral narcotics, and non-narcotics were administered, as well as the average dose during each 24-hour period. The electronic medication administration records for the sample were examined to determine which pain medications were administered and are described in Table 2. Pain medications were identified from a list extracted from the electronic medical record data based and if any of these medications that were administered during postoperative day one or day two the patients were included in the study. Intravenous narcotics of interest during review of the medical record included morphine, hydromorphone, fentanyl and meperidine. Non-intravenous narcotics included hydrocodone and oxycodone. Non-narcotics included acetaminophen, ibuprofen, ketorolac, and diclofenac. Since it is difficult to do an overall comparison of pain medication due to differing amounts,

strengths, and doses used between the IV and PO pain medications, narcotic equivalency used in this study. This method has been used in other studies to facilitate analysis between different opioid medications (Olson, Hanson, & Michaud, 2003, Fillingim, Doleys, Edwards, & Lowery, 2003, Allen, et al., 2003). Conversion tables should be taken as approximations and not as absolute doses. Tables often describe different conversion and dose calculations and caution is prescribed when using these in actual clinical practice (Shaheen et al., 2009). The conversion table used for this study was based on information from GlobalRPh (2015). Narcotic equivalency is an approximation and compares a given oral or intravenous pain medication dose to the equivalent dose of oral morphine and approximations used in this study are listed in Table 3. For example, oxycodone is 1.5 times stronger than oral morphine; therefore 10 mg of oxycodone would be equivalent to approximately 15 mg of oral morphine. Conversions were done for each medication and added together to determine the total equivalent dose of oral morphine that each patient received during the first and second 24-hour period after surgery.

Measurement of Independent Variables

Age. Age was measured in years and was selected as a variable because of its potential effect on the treatment of pain. Older adult patients have been shown to receive less pain medications than younger patients (Jones, Johnson & McNinch, 1996), therefore it was important to account for age as a potential bias contributing to the amount of medication received by the patient.

Gender. Gender was measured as male or female. This variable was chosen because the described differences in the experience of pain between men and women.

It was necessary to measure gender to account for bias since women were less likely to be taken seriously, receive adequate treatment for pain, have pain ascribed to psychiatric causes, and be treated less aggressively.

Race. Race, as valued within the electronic medical record, was described as White, Black, Asian, and All Other. This variable was selected because other studies, described within the literature review, have described race as a bias related to decreased administration of pain medications.

BMI. Body Mass index (BMI) was calculated from recorded height and weight on admission. BMI is an indicator of body fatness and is calculated by dividing weight (kg) by height squared (m^2). BMI is described by the Centers of Disease Control and is used to classify individuals into the different weight categories used in this study; normal (18.5 – 24.9) and overweight (25 – 29.9) (Center for Disease Control and Prevention, 2015). Definitions of obesity used were broken down by the World Health Organization as Class I (30 – 34.9), Class II (35 – 39.9), and Class III (≥ 40) (World Health Organization, 2014). In this study, the difference in pain medication administration was compared between normal weight patients and overweight, obese class I, obese class II, and obese class III patients. Also, the relationship between pain medication administration and BMI was explored.

Insurance Status. Insurance status included private insurance, Medicare, Medicaid, Worker's Compensation, or no insurance categories. This variable was used as an indicator for socioeconomic status and has been used in multiple studies (Vijayakumar, et al., 1995, Hong, Baumann, & Boudreaux, 2007) and has been perceived as a reason for discrimination during healthcare provision. Use of insurance

status is not an exact measure of socioeconomic status, but status may be inferred. For example, Medicare is offered to low income individuals.

Psychiatric Diagnosis. Presence of psychiatric diagnosis was positive if any psychiatric diagnosis listed in the Diagnostic and Statistical Manual of Mental Disorders exists for the patient during the hospitalization. Mental illness has been described as a stigmatized condition and therefore it was important to account for it during this study.

Pain Score. Patients with higher pain scores receive more pain medication, so it was important to account for pain score to understand if less pain medication is administered to obese patients. Pain was assessed on a scale of 0-10, with 0 being no pain and 10 being the worst possible pain ever. This scale is a subjective measure of pain that is reported to the nurse by the patient. Pain score was entered by the nurse into the medication administration as ordinal values and were described as mild (1-2), moderate (3-4), moderate/severe (5-7), and severe (8-10).

Data Analysis

IBM SPSS Statistics 23 was used to analyze data for this research study. Data for the first research question was analyzed using one-way ANOVA. The dependent variable was pain medication administration and the independent variable was BMI category. Pain medication administration was divided into total narcotic equivalency doses, and the total dose of intravenous and oral narcotic and non-narcotic medications given during a first and the second day postoperative period. The groups used were the BMI classifications of normal weight, overweight, and obese class I, obese class II, and obese class III.

In addressing the second research question, the number of intravenous and oral narcotic, and non-narcotic medications ordered and administered were compared between the five BMI categories. A chi-square test was used to determine if there was a significant difference between expected (ordered by a licensed independent practitioner) and observed (administered by the nurse) medication, dose, and frequencies.

Regression analyses were used to address the third research question. Simple linear regression was used to determine the relationship between the total morphine equivalent dose and BMI. Separate analyses were performed for the dose on postoperative day one and day two to determine if there were any differences in the relationship between days. Hierarchical linear regression was used to determine the relationship between dose on postoperative day one, and then the dose on day two, and BMI after controlling for other factors related to stigma and to the amount of pain each patient reported. The independent variables for each regression analysis will be BMI (continuous), race (categorical), gender (categorical), age (continuous), insurance status (categorical), presence of psychiatric diagnosis (categorical), and average pain score during hospitalization (categorical). Dummy variables were created for each of the categorical variables within the regression analysis.

Ethical Considerations

Institutional Review Board approval was obtained from both the hospital system (Appendix A) and the University of Rhode Island (Appendix B) prior to conducting this study. Consent was not obtained because this was a retrospective chart review using de-identified data, posing no more than minimal risk, not affecting the

rights and welfare of the subjects, and the consent would have been the only documentation linking the study to the patient. A waiver would not adversely affect the rights and welfare of the subjects since the study was a retrospective chart review and all identifiers was removed. The sample size required was large and including only those samples/records/data for which consent can be obtained would prohibit conclusions to be drawn or bias the sample such that conclusions would be skewed. Also, since the potential time period being looked at was ten years, the proportion of individuals likely to not be able to be contacted due to having relocated or died would be a significant percentage of the subject population and the research results may not be meaningful and lose statistical power. All data points were supplied by IS query and did not contain one of the 18 HIPAA identifiers (U.S. Department of Health and Human Services, 2012). All data points were supplied by IS query and were de-identified by the Information System (IS) staff prior to delivery for data analysis and each patient was be assigned an identification (ID) number. Chart review was not performed remotely. The study did not include the use of investigational drugs, devices, or psychological interventions. Breach of confidentiality would have been the only possibility, but was prevented by the use of de-identifying the data. The potential benefits to research subjects as a result of the study would be the identification of obesity stigma as a problem as related to post-operative pain medication administration, creating an impetus to develop interventions aimed toward healthcare providers, thereby improving outcomes and the quality of care.

CHAPTER 4

FINDINGS

Data received from IS staff contained 56,384 observations with 2734 unique cases that spanned 1/1/2013 to 12/31/2013. Multiple observations occurred for individual cases due to several ICD-9 procedure codes/descriptions being listed for a single surgical visit. Other than the procedure, data such as age, BMI, race, insurance status, psychiatric diagnosis, and pain score was identically entered for each duplicate observation. Procedures were separated out into a different dataset and duplicate observations were removed. Cases were also removed that contained no height or weight entries, that had no pain medication documented during the first 48 hours, or indicated patients on a ventilator. These ventilator patients were removed from the data set because it was found that they only had intravenous sedation medication, to maintain a state of unconsciousness, and no pain medication administrations documented during postoperative day one or two. A total of 1939 cases remained. The normal, overweight, and obesity class I groups had an excess of cases, from which a random sampling was performed to achieve 365 cases. With this initial exclusion of cases, the obesity class II and III groups contained less than 365 cases. The final data set contained a total of 1704 unique cases, with 21.4% ($n=365$) normal weight, 21.4% ($n=365$) overweight, 21.4% ($n=365$) obesity class I, 17.1% ($n=291$) obesity class II, and 18.7% ($n=318$) obesity class III individuals. BMI scores ranged from 18.5 to 185.9 ($M = 33.1$, $SD = 11.1$). A total of 4203 procedures were performed on the 1704

patients. The procedures, and their frequencies of being performed, are listed in Table 4. The table lists ICD 9 procedure code descriptions that were performed on more than one patient. The descriptive statistics for each variable based on BMI are listed in Table 5.

Dependent Variable

Pain medications documented as given during the first 48 hours after a procedure were hydromorphone, morphine, fentanyl, meperidine, oxycodone, ketorolac, acetaminophen, and ibuprofen. A breakdown of frequency can be seen in Table 6, which displays the pain medication that were listed as being administered, as well as the number of patients that the medication was given to. Hydromorphone was a common pain medication during the first 48 hours after surgery and was given to 86.7% ($n=1478$) of patients during the first 24 hours and 18.2% ($n=310$) during the second 24 hours. Descriptive statistics in Table 7 describe the range of doses for each pain medication administered. These doses were used to calculate the total oral morphine equivalency dose given. During postoperative day one, the minimum oral morphine equivalent dose was 1.25 mg and a maximum of 1015 mg ($M = 21.2$, $SD = 35.6$). The minimum dose during the postoperative day two was .63 mg and a maximum of 525 mg ($M = 20$, $SD = 30.5$). Table 8 breaks down the descriptive statistics for total morphine equivalent dose of pain medication by BMI category.

Independent Variables

Age. The age of the study population ranged from 18 to 96 ($M = 57.1$, $SD = 15.9$). Descriptive statistics for age within each BMI category are listed in Table 9. There was a significant difference in the mean age of each group, $F(4, 1699) = 32.9$, p

< .0001). Post hoc comparisons (Table 10) using the Tukey HSD test indicated that the mean age for normal BMI ($M = 60.1$, $SD = 17.9$) was significantly greater than the mean age of the obesity class II ($M = 55.2$, $SD = 15.6$) and obesity class III ($M = 49.1$, $SD = 13.9$) groups. The mean age of the overweight group ($M = 61$, $SD = 15.1$) was also significantly greater from the mean age of the obesity class II and III groups. The mean age of the obesity class III group ($M = 49.1$, $SD = 13.9$) was significantly less than all other groups.

Gender. There was a significant relationship between gender and the five BMI groups, $X^2(4, N= 1704) = 57.3$, $p <.0001$. There were a higher proportion of females than males in the obesity class III group, which consisted of 30% male ($n= 94$) and 70% female ($n = 224$) (Table 11). The obesity class III group had a larger proportion of females than all the other BMI groups and the overweight group had a larger proportion of males than all the other BMI groups (Table 12).

Race. There was no relationship between race and the five BMI groups although overall, a vast majority of cases, 86.9% ($n=1481$) listed a race of “White”. The other race categories made up far less of the total population, with 7.2% “Black”, .3% “Asian”, and 5.5% “All Other”.

Insurance Status. There was a significant relationship between insurance status and the five BMI groups, $X^2(16, N = 1704) = 33$, $p = .007$. There were a higher proportion of overweight (.22), obesity class I (.23), and obesity class III patients (.2) with private insurance than the normal BMI group (.19) (Table 13).

Pain Scores. Pain scores were only recorded in 48% ($n=824$) of cases and overall frequencies of mild, moderate, moderate/severe, and severe pain are listed in

Table 14. There was a significant relationship between BMI category and moderate pain, $X^2(4, N = 1704) = 12.6, p = .01$. The overweight group had a higher proportion of reported moderate pain (.26) than the obesity class II group (.13), $t(654) = 3.12, p = .002$ (Table 15). There were no other significant differences in moderated pain between the BMI groups. There was no significant relationship between BMI and mild pain. No groups had a pain score of moderate/severe or severe recorded.

Research Question

Research Question One. What is the difference in the total morphine equivalent dose of post-surgical pain medication administered between normal weight, overweight, and obese (Class I, II, and III) adult non-bariatric surgery patients?

Data for the total postoperative day one and postoperative day two oral morphine equivalent dose of pain medication contained several extreme outliers which were removed prior to performing an analysis. These outliers showed dose values approaching 1015 mg. High doses such as these could harm patients and were most likely documented in error. Doses greater than 120 mg were removed because many dosing guidelines recommend a maximum morphine equivalent dose of 120 mg per day (Franklin et al., 2012, Braden et al., 2010). These high doses may have been entered in error, or represented patients with high tolerance to narcotics. A significant difference was not found among the BMI groups related to total doses greater than 120 mg. Descriptive statistics of the study sample after removal of outliers are listed in Table 16.

Histograms and Q-Q plots for postoperative day one and day two values demonstrated a positive skew (Figures 1 through 4) and were transformed to

approximate a normal distribution. A Box-Cox transformation (Osborne, 2010) was used to obtain normally distributed values for postoperative day one and day two total morphine equivalent dose. The value of lambda that yielded the smallest value for mean square residual was 0 for the postoperative day one total morphine equivalent dose and for the postoperative day two total morphine equivalent dose. Therefore, a natural logarithmic transformation was performed on the two variables. After transformation, both variable histograms and Q-Q plots (Figures 5 through 8) better approximated a normal distribution, although the assumptions of normality and homogeneity of variance were not met. The Shapiro-Wilks and Levine statistics demonstrated a significant difference from normality and from homogeneity of variances and therefore the Brown-Forsythe robust test of means was used determine the difference in mean between the BMI categories (Brown & Forsythe, 1974). Games-Howell's procedure was used for post hoc multiple comparisons due to the heterogeneity of variances (Keselman & Rogan, 1978). A one-way ANOVA was performed with the log-transformed total postoperative day one oral morphine equivalent dose of pain medication dependent variable and the BMI classification independent variable and there was a significant difference in the mean dose of pain medication given for each of the BMI categories, $F(4, 1468) = 2.72, p = 0.03$. Games-Howell's post hoc test (Table 17) revealed that the geometric mean of the total postoperative day one oral morphine equivalent dose for overweight individuals was significantly different ($p = .004$) and 1.22 times as much as for obesity class III individuals (95% CI: 1.05 to 1.42 times as much). While there was not a significant difference with the other groups, there was a downward trend in dose between the

overweight group and the obesity class I and II groups (Figure 9). The postoperative dose for the normal BMI group was 1.1 times as much as the obesity class I group, and 1.01 times as much as the obesity class II group. There was not a significant difference in dose between the normal BMI and all other groups.

A one-way ANOVA was performed with the log-transformed total postoperative day two oral morphine equivalent dose of pain medication dependent variable and the BMI classification independent variable. The analysis resulted in no significant difference in mean dose of pain medication given for each of the five BMI categories.

Research Question Two. What is the relationship between pain medication ordered and administered and the BMI of adult non-bariatric surgery patients?

Two-way contingency table analyses were conducted to evaluate if pain medication ordering and administration were related to BMI. There were two separate electronic medical record systems used to for ordering and medication administration and the dose and frequency were not documented in equivalent units between each system. The medication ordering system used “Units” while the medication administration system used “mg”. Also, documentation of medication administration tended to be grouped by the nurse. Multiple doses were grouped into one dose that would span an eight-hour shift. Because of this the comparison between dose/frequency ordered and administered to determine if they were related was not possible.

The two variables were pain medication ordered and administered (Not Ordered – Not Administered, Not Ordered – Administered, Ordered – Not

Administered, Ordered – Administered) and BMI (Normal, Overweight, Obesity Class I, Obesity Class II, Obesity Class III). Pain medication ordered/administered and BMI were found to be significantly related for hydromorphone, $X^2(8, N=1680) = 23.03, p = .003$, morphine, $X^2(12, N=1682) = 46.77, p < .0001$, meperidine, $X^2(8, N=1682) = 29.93, p < .0001$, oxycodone, $X^2(12, N=1682) = 21.1, p = .05$, and acetaminophen, $X^2(12, N=1682) = 49.2, p < .0001$. There was a borderline significant relationship with ketorolac, $X^2(8, N = 1682) = 15.22, p = .055$. A significant relation was not found between fentanyl ordering/administration and BMI. Follow-up pairwise comparisons were conducted to evaluate the difference among these proportions. Tables 18 and 19 show the number and proportion results of the crosstabulation. Independent sample t-tests were performed for crosstabulation table columns. All t-tests had a significant result for Levine's test for equality of variances; therefore the value when equal variances are not assumed was used. The results of the t-tests are listed in Table 20. While there were significant differences in proportion found, there were none found that suggest that the higher BMI groups consistently had smaller proportions for ordering and administration when compared to the lower BMI groups.

Hydromorphone. In the overweight BMI category, the proportion of hydromorphone ordered and administered (.96) was greater than the proportion not ordered and not administered (.006), $t(986) = 7.37, p < .0001$. Overweight individuals had a higher proportion of hydromorphone ordered and administered (.23) than the normal (.21), $t(673) = 2.55, p = .01$, obesity class I (.21), $t(666) = 2.78, p = .006$, and obesity class II (.16), $t(481) = 3.62, p < .0001$, categories. The obesity class III (.19)

category had a higher proportion ordered and administered than the obesity class II (.16) category, $t(557) = 2.16, p = .03$.

Morphine. The proportion of morphine not ordered and not administered (.74) was greater than the proportion ordered and administered (.21) in the overweight category, $t(1127) = 4.35, p < .0001$. The overweight, $t(585) = 5.69, p < .0001$, obesity class I, $t(610) = 3.16, p = .002$, and obesity class III, $t(591) = 4.33, p < .0001$, categories had higher proportions (.25, .22, and .20 respectively) of morphine that was not ordered and not administered than obesity class II (.14). The proportions of the overweight (.25), $t(720) = 4.34, p < .0001$, and obesity class III (.20), $t(677) = 2.94, p = .003$, groups for morphine not ordered and not administered were greater than the proportion of the normal BMI group (.20). The proportion of morphine that was ordered and administered for the normal BMI category (.25) was greater than in the overweight (.15), $t(710) = 4.05, p < .0001$, and the obesity class III (.15), $t(680) = 2.77, p = .006$, categories.

Meperidine. In the overweight category, there was a higher proportion of meperidine not ordered and not administered (.98) than ordered and administered (.01), $t(67) = 3.78, p < .0001$. The proportion of meperidine not ordered and not administered was higher among overweight (.22) than obesity class II individuals (.16), $t(427) = 4.31, p < .0001$. There was a higher proportion of medication ordered and administered among obesity class II individuals (.39) than overweight (.07), $t(362) = 3.93, p < .0001$, and obesity class I (.14), $t(429) = 3.10, p = .002$.

Oxycodone. Within the obesity class II category, the proportion of oxycodone ordered and administered (.24) was greater than medication not ordered and not

administered (.15), $t(282) = 2.80, p = .006$. The proportion of medication not ordered and not administered (.61) was greater than ordered and not administered (.26) among obesity class III individuals, $t(1185) = 2.67, p = .008$. The obesity class III group had a higher proportion (.21) of oxycodone not ordered and not administered than the obesity class II group (.15), $t(600) = 3.06, p = .002$.

Ketorolac. Within the obesity class III group, the proportion of ketorolac that is not ordered and not administered (.84) was greater than the proportion ordered and administered (.12), $t(448) = 2.87, p = .004$. The obesity class I group had a greater proportion of ketorolac ordered and administered (.26) than the obesity class III group (.13), $t(675) = 3.21, p = .001$.

Acetaminophen. There is a greater proportion of acetaminophen not ordered and not administered in the obesity class III category (.33) than the proportion ordered and administered (.09), $t(805) = 4.34, p < .0001$. Also within the same BMI category, the proportion of medication ordered but not administered (.58) was greater than the proportion ordered and administered (.09), $t(816) = 5.99, p < .0001$. The overweight category had a smaller proportion of medication ordered and administered (.27) than not ordered and not administered (.31), $t(590) = 3.34, p = .002$, or ordered and not administered (.42), $t(482) = 4.45, p < .0001$. The normal (.26), $t(646) = 5.08, p < .0001$, overweight (.31), $t(631) = 6.35, p < .0001$, and obesity class I (.20), $t(666) = 3.47, p < .0001$, categories had a greater proportion of medication ordered and administered than the obesity class III category (.09). The overweight category also had a greater proportion ordered and administered (.31) than the obesity class II category (.14), $t(654) = 3.70, p < .0001$. Obesity class III has a greater proportion of

medication ordered but not administered (.22) than the normal (.21), $t(669) = 270$, $p = .007$, and overweight (.18), $t(667) = 4.01$, $p < .0001$, categories.

Research Question Three. What is the relationship between patients' BMI and the receipt of post-surgical pain medication, when accounting for race, gender, age, insurance status, presence of psychiatric diagnosis, and pain score during hospitalization?

Separate analyses were performed for the total oral morphine equivalent dose during the first 24-hours (postoperative day 1) and for the second 24 hours (postoperative day 2) after surgery. Simple linear regression was used to determine the relationship between the independent variable total postoperative oral morphine equivalent dose and the dependent variable BMI. Hierarchical multiple regression analysis was then performed to determine the relationship after controlling for other factors related to stigma such as age, gender, race, insurance status, psychiatric diagnosis, and also factors related to the amount of pain each patient reported (pain score).

Total postoperative day one morphine equivalent dose. Extreme outliers were found that had cutoff values for Cook's Distance greater than .0024 (Fox, 1991) and Leverage values greater than .0023 (Montgomery, Peck & Vining, 2012). In examining the outliers, BMI was found to be greater than 151 in four of the cases. While the weight of these patients appeared to be realistic adult weights, 55 kg – 87 kg (121 – 192 lbs.), the heights were all measured as less than .724 m (2.37 ft.). Most likely the height values were entered in error and therefore these four values were removed prior to all regression analyses.

Simple linear regression assumptions. A simple linear regression was performed and the assumption of normality of residuals was not met, as shown in positively skewed histogram (Figure 10) and non-linear P-P plot (Figure 11). Also, the assumption of homogeneity of variances (homoscedasticity) was not met as seen by a non-random distribution of points on a scatterplot of studentized residuals against the predicted value (Figure 12). The variances appeared to increase as a function of the predicted value.

After performing a natural log transformation of the total postoperative day one oral morphine equivalent dose, heteroscedasticity was still apparent after transformation (Figure 13), therefore the independent variable BMI was also transformed using a natural logarithmic transformation. After transformation of BMI, the scatterplot of studentized residuals against predicted values (Figure 14) demonstrated a relatively random display of points that were spread fairly constant over the range of values of the total postoperative day one oral morphine equivalent dose provided evidence of homogeneity of variances. Also, the assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 15) and linear P-P plot (Figure 16). The scatterplot of total oral morphine equivalent dose and BMI indicated that the assumption of linearity was reasonable with point roughly symmetrical in distribution around the fit line (Figure 17). Figure 14 provided further evidence of linear relationship through a scatterplot of standardized residuals versus predicted values that demonstrated a random distribution of points distributed with roughly constant variance around the horizontal line.

The Durbin-Watson statistic was used to determine independence of errors, $d = 1.97$, which was between 1.5 and 2.5 (Hutcheson & Sofroniou, 1999) and therefore the null hypothesis was not rejected and it could be concluded that the errors were not autocorrelated (Montgomery, Peck & Vining, 2012) and the assumption of independent errors was met.

Simple linear regression model. The results of the simple linear regression suggested a significant relationship between the postoperative day one total oral morphine equivalent dose and BMI, $F(1, 1622) = 5.6, p = .018$, and accounted for approximately .3% of the variance of the equivalent dose ($R^2 = .003, Adjusted R^2 = .003$). The total postoperative day one oral morphine equivalent dose was equal to $3.32 + (-.184)(BMI)$ mg. Every one percent increase in BMI would result in a .18% decrease in pain medication administration on postoperative day one, $p = .018$, 95% CI [-.337, -.032].

Hierarchical multiple regression. Hierarchical multiple regression was performed to investigate the relationship between the total postoperative day one oral morphine equivalent dose and BMI, after controlling for other factors related to stigma, such as age, gender, race, insurance status, and presence of psychiatric diagnoses, and also controlling for level of pain. Table 21 contains descriptive statistics for variables used.

Seventy-four extreme outliers were found that had large cut off values for Mahalanobis Distance, $p < .001$. Out of these, twenty-eight cases were highly influential and had high leverage with Cook's Distances greater than .0024 and leverage values greater than .018. No clinical significance of the outliers was readily

apparent, therefore analyses were run first without removal of outliers and then after outliers had been removed to examine any differences or patterns. When all outliers were removed, Asian, Medicaid, and Workers Compensation patients were no longer accounted for within the sample. The moderate/severe and severe pain independent variables were not used in any of the regression analyses since there were no cases in the sample where the presence of moderate/severe or severe pain was reported.

Hierarchical regression assumptions described with outliers intact.

Preliminary analyses were conducted to ensure no violations of the assumptions of normality of variances, linearity, and homoscedasticity. The assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 18) and linear P-P plot (Figure 19). Evidence of linearity was provided by scatterplots of standardized residuals versus predicted values that demonstrated a random distribution of points that were distributed with a roughly constant variance for the total model (Figure 20) and each of the continuous independent variables, age and BMI, in partial regression plots (Figures 21 and 22).

Examination of the correlation matrix (Table 22) and the variable inflation factor (VIF) values for the independent variables suggested that multicollinearity was not an issue (Montgomery, Peck & Vining, 2012). There was little to low correlation between the independent variables. VIF values were all less than 10 (1.013 – 1.310). Most Eigenvalues were well above zero; however the values for moderate pain and BMI were close to zero (.042 and .002). The Condition Index for moderate pain was 10.66 suggesting a weak to moderate degree a multicollinearity and the value for the log transformed BMI was above 30 (44.682) suggesting a high degree (Callaghan &

Chen, 2008). No evidence of multicollinearity was assumed since only one independent variable had large variance proportions corresponding to each large condition indices.

The bivariate and partial correlations showed small but significant relations to total oral morphine equivalent dose and are shown in Table 23. As can be seen, BMI and age were negatively and significantly correlated, indicating that as BMI and age increase the amount of pain medication on postoperative day one decreased.

Hierarchical regression model with outliers intact. In the first step of hierarchical multiple regression, twelve predictors were entered: age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain). There were no cases of patients reporting moderate to moderate/severe pain, therefore these variables were not entered into the regression equation. The prediction model for the morphine equivalent dose during postoperative day one was significant, $F(12, 1568) = 5.4, p < .001$, and accounted for approximately 4% of the variance of the equivalent dose ($R^2 = .040, Adjusted R^2 = .032$). After entry of the natural log transformed BMI at step 2 the total variance explained by the model as a whole was 4.5% ($R^2 = .045, Adjusted R^2 = .037$), $F(13, 1567) = 5.7, p < .001$. The introduction of BMI explained an additional .6% of the variance in total dose, after controlling for age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain), $R^2 Change = .006, F(1, 1567) = 9.66, p = .002$. The regression coefficients are listed Table 24 and show that BMI was a

significant predictor in the model when controlling for the other variables. In the final model five out of thirteen predictor variables were statistically significant. Patients with a greater BMI received less postoperative day one pain medication, $\beta = -.25$, $p = .002$. While keeping all other variables constant, every one percent increase in BMI would result in a .25% decrease in pain medication administration on postoperative day one, 95% CI [-.408, -.092]. Gender was a statistically significant predictor variable, $\beta = -.142$, $p = .001$, and being female would result in a 14.2% decrease in pain medication administration, 95% CI [-.223, -.061], keeping all other variables constant. Age was also a significant predictor of receiving less pain medication, $\beta = -.005$, $p < .0001$. While keeping all other variables constant, every one year increase in age would result in a .5% decrease in pain medication, 95% CI [-.008, -.003] . Worker's Compensation patients received 90.8% more pain medication and patients with a psychiatric diagnosis received 23.2% more, $p < .0001$, 95% CIs [.553, 1.283] and $p = .001$, [.092, .372] respectively when keeping all other variables constant.

Hierarchical regression assumptions described with outliers removed.

Preliminary analyses were conducted to ensure no violations of the assumptions of normality of variances, linearity, and homoscedasticity. The assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 23) and linear P-P plot (Figure 24). Evidence of linearity was provided by scatterplots of standardized residuals versus predicted values that demonstrated a random distribution of points displaying a roughly constant variance around the horizontal line for the total model (Figure 25) and each of the continuous independent variables, age and BMI, in partial regression plots (Figures 26 and 27).

Examination of the correlation matrix (Table 25) and the variable inflation factor (VIF) values for the independent variables suggested that multicollinearity was not an issue (Montgomery, Peck & Vining, 2012). There was little to low correlation between the independent variables. VIF values were all less than 10 (1.013 – 1.291). Most Eigenvalues were well above zero; however the values for moderate pain and BMI were close to zero (.041 and .002). The Condition Index for moderate pain was 10.68 suggesting a weak to moderate degree a multicollinearity and the value for the log transformed BMI was above 30 (44.581) suggesting a high degree (Callaghan & Chen, 2008). No evidence of multicollinearity was assumed since only one independent variable had large variance proportions corresponding to each large condition indices.

The bivariate and partial correlations showed small but significant relations to total oral morphine equivalent dose and are shown in Table 26. As can be seen, BMI and age were negatively and significantly correlated, indicating that as BMI and age increased the amount of pain medication on postoperative day one decreased.

Hierarchical regression model with outliers removed. In the first step of hierarchical multiple regression, nine predictors were entered: age, gender, race (black, all other), insurance status (Medicare, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain). The prediction model for the morphine equivalent dose during postoperative day one was significant, $F(9, 1503) = 3.73, p < .001$, and accounted for approximately 2.2% of the variance of the equivalent dose ($R^2 = .022, Adjusted R^2 = .016$). After entry of the natural log transformed BMI at step 2 the total variance explained by the model as a whole was 2.8% ($R^2 = .028$,

*Adjusted R*² = .021), *F* (10, 1502) = 4.28, *p* < .001. Even with the outliers removed, the introduction of BMI continued to explain an additional .6% of the variance in total dose, after controlling for age, gender, race (black, all other), insurance status (Medicare, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain), *R*² *Change* = .006, *F* (1, 1502) = 9.09, *p* = .003. The regression coefficients are listed Table 27 and show that BMI remained a significant predictor in the model when controlling for the other variables. In the final model four out of ten predictor variables were statistically significant. Patients with a greater BMI received less postoperative day one pain medication, $\beta = -.25$, *p* = .003. While keeping all other variables constant, every one percent increase in BMI would result in a .25% decrease in pain medication administration on postoperative day one, 95% CI [-.409, -.087]. Gender was a statistically significant predictor variable, $\beta = -.142$, *p* = .001, and being female would result in a 14.2% decrease in pain medication administration, 95% CI [-.224, -.059], keeping all other variables constant. Age was also a significant predictor of receiving less pain medication, $\beta = -.005$, *p* < .0001. While keeping all other variables constant, every one year increase in age would result in a .5% decrease in pain medication, 95% CI [-.008, -.002] . Patients with a psychiatric diagnosis received a 23.7% higher dose, *p* = .002, 95% CIs [.091, .384] when keeping all other variables constant.

Total postoperative day two morphine equivalent dose. The four extreme outliers found with BMI greater than 151 were also removed in examining the postoperative day two morphine equivalent dose. These were most entered in error and therefore these four values were removed prior to the analysis. The mean BMI after

removal of the outliers was 32.8, $SD = 9.01$, with a minimum BMI of 18.5 and a maximum of 97.3. Fifty-five cases were highly influential and had high leverage with Cook's Distances greater than .0024 and leverage values greater than .018. One extreme outlier was found that had large cut off values for Mahalanobis Distance, $p < .001$. No clinical significance of the outliers was readily apparent, therefore analyses were run first without removal of outliers and then after outliers had been removed to examine any differences or patterns. The moderate/severe and severe pain independent variables were not used in the regression analysis since there were no cases in the sample where the presence of moderate/severe or severe pain was reported.

Simple linear regression assumptions. A simple linear regression was performed and the assumption of normality of residuals was not met, as shown in positively skewed histogram (Figure 28) and non-linear P-P plot (Figure 29). Also, the assumption of homogeneity of variances was not met as seen by a non-random distribution of points on a scatterplot of studentized residuals against the predicted value (Figure 30). The variances appeared to decrease as a function of the predicted value.

After performing a natural log transformation of the total postoperative day two oral morphine equivalent dose, heterogeneity of variances was still apparent after transformation (Figure 31), therefore the independent variable BMI was also transformed using a natural logarithmic transformation. After transformation of BMI, the scatterplot of studentized residuals against predicted values (Figure 32) demonstrated a relatively random display of points that were spread fairly constant over the range of values of the total postoperative day two oral morphine equivalent

dose provided evidence of homogeneity of variances. Also, the assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 33) and linear P-P plot (Figure 34). The scatterplot of total oral morphine equivalent dose and BMI indicated that the assumption of linearity was reasonable since the points were roughly symmetrical in distribution around the diagonal line (Figure 35).

The Durbin-Watson statistic was used to determine independence of errors, $d = 1.86$, which was between 1.5 and 2.5 (Hutcheson & Sofroniou, 1999) and therefore the null hypothesis was not rejected and it could be concluded that the errors were not autocorrelated (Montgomery, Peck & Vining, 2012) and the assumption of independent errors was been met.

Simple linear regression model. The results of the simple linear regression suggest that there was no significant relationship between the postoperative day two total oral morphine equivalent dose and BMI, $F(1, 519) = 1.93, p = .275$. BMI did not significantly account in the variability of the postoperative day two dose. This relationship remained insignificant after removal of the fifty-five influential cases with high leverage and one case with Mahalanobis D^2 value $p < .001, F(1, 465) = 3.03, p = .082$.

Hierarchical multiple regression. Hierarchical multiple regression was performed to investigate the relationship total postoperative day two oral morphine equivalent dose and BMI, after controlling for other factors related to stigma, such as age, gender, race, insurance status, and presence of psychiatric diagnoses, and also controlling for level of pain. Table 28 contains descriptive statistics for variables used.

Hierarchical regression assumptions described with outliers intact.

Preliminary analyses were conducted to ensure no violations of the assumptions of normality of variances, linearity, and homoscedasticity. The assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 36) and linear P-P plot (Figure 37). Evidence of linearity was provided by scatterplots of standardized residuals versus predicted values that demonstrated a random distribution of points that displayed a roughly constant variance around the horizontal line for the total model (Figure 38) and each of the continuous independent variables, age and BMI, in partial regression plots (Figures 39 and 40).

Examination of the correlation matrix (Table 29) and the variable inflation factor (VIF) values for the independent variables suggested that multicollinearity was not an issue (Montgomery, Peck & Vining, 2012). There was little to low correlation between all of the independent variables. VIF values were all less than 10 (1.019 – 1.401) Most Eigenvalues were well above zero; however the values for moderate pain and BMI were close to zero (.039 and .002). The Condition Index for moderate pain was 10.66 suggesting a weak to moderate degree a multicollinearity and the value for the log transformed BMI was above 30 (44.194) suggesting a high degree (Callaghan & Chen, 2008), but multicollinearity was not assumed since only one independent variable had large variance proportions corresponding to the large moderate pain and BMI condition indices.

The bivariate and partial correlations showed no significant relations among the continuous independent variables to total oral morphine equivalent dose and are shown in Table 30.

Hierarchical regression model with outliers intact. In the first step of hierarchical multiple regression, twelve predictors were entered: age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain). There were no cases of patients reporting moderate to moderate/severe pain, therefore these variables were not entered into the regression equation. The prediction model for the morphine equivalent dose during postoperative day two was significant, $F(12, 498) = 2.32, p = .007$, and accounted for approximately 5.3% of the variance of the equivalent dose ($R^2 = .053, Adjusted R^2 = .030$). After entry of the natural log transformed BMI at step 2 the total variance explained by the model as a whole remained 5.3% ($R^2 = .053, Adjusted R^2 = .029$), $F(13, 497) = 2.16, p = .01$. The introduction of BMI did not add significantly to the model. The addition explained an additional .1% of the variance in total dose, after controlling for age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain), $R^2 Change = .001, F(1, 497) = .263, p = .608$. The regression coefficients are listed Table 31 and show that BMI was a not a significant predictor in the model when controlling for the other variables. In the final model two out of thirteen predictor variables were statistically significant. Gender was a statistically significant predictor variable, $\beta = -.219, p = .009$, and being female would result in a 21.9% decrease in pain medication administration, 95% CI [-.384, -.054], keeping all other variables constant. Worker's Compensation patients received

83.4% more pain medication, 95% CIs [.553, 1.283] when keeping all other variables constant.

Hierarchical regression assumptions described with outliers removed.

Preliminary analyses were conducted to ensure no violations of the assumptions of normality of variances, linearity, and homoscedasticity. The assumption of normality of residuals was reasonable based on a normally distributed histogram (Figure 41) and linear P-P plot (Figure 42). Evidence of linearity was provided by scatterplots of standardized residuals versus predicted values that demonstrated a random distribution of points and a roughly constant variance around the horizontal line for the total model (Figure 43) and each of the continuous independent variables, age and BMI, in partial regression plots (Figures 44 and 45).

Examination of the correlation matrix (Table 32) and the VIF values for the independent variables suggested that multicollinearity was not an issue (Montgomery, Peck & Vining, 2012). There was little to low correlation between the independent variables and VIF values were all less than 10 (1.012 – 1.404) Most Eigenvalues were well above zero; however the values for moderate pain and BMI were close to zero (.038 and .002). The Condition Index for moderate pain was 11.2 suggesting a weak to moderate degree a multicollinearity and the value for the log transformed BMI was above 30 (50.22) suggesting a high degree (Callaghan & Chen, 2008). No evidence of multicollinearity was assumed since only one independent variable had large variance proportions corresponding to each large condition indices.

The bivariate and partial correlations showed small but significant relations to total oral morphine equivalent dose and are shown in Table 33. As can be seen, gender

was negatively and significantly correlated, indicating that when the gender was female, the amount of pain medication on postoperative day one decreased. There was a positive and significant correlation between the dose of pain medication and Worker's Compensation. Patients with Worker's Compensation tended to receive a higher dose of pain medication. BMI was not significantly correlated with the dose of pain medication.

Hierarchical regression model with outliers removed. In the first step of hierarchical multiple regression, twelve predictors were entered: age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain). There were no cases of patients reporting moderate to moderate/severe pain, therefore these variables were not entered into the regression equation. The prediction model for the morphine equivalent dose during postoperative day two was significant, $F(12, 444) = 1.66, p = .075$, and accounted for approximately 4.3% of the variance of the equivalent dose ($R^2 = .043, Adjusted R^2 = .017$). After entry of the natural log transformed BMI at step 2 the model remained significant, $F(13, 443) = 1.65, p = .068$, and the total variance explained by the model as a whole 4.6% ($R^2 = .046, Adjusted R^2 = .018$). The introduction of BMI did not add significantly to the model. The addition explained an additional .4% of the variance in total dose, after controlling for age, gender, race (black, Asian, all other), insurance status (Medicare, Medicaid, Worker's Compensation, no insurance), presence of psychiatric diagnosis, and level of pain (mild pain, moderate pain), $R^2 Change = .004, F(1, 443) = 1.71, p = .192$. The regression coefficients are listed Table 34 and show

that BMI was not a significant predictor in the model when controlling for the other variables. In the final model two out of thirteen predictor variables were statistically significant. Gender was a statistically significant predictor variable, $\beta = -.190$, $p = .025$, and being female would result in a 19% decrease in pain medication administration, 95% CI [-.356, -.024], keeping all other variables constant. Worker's Compensation patients received 73.8% more pain medication, 95% CIs [.074, 1.402] when keeping all other variables constant.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Obesity is a stigmatized condition and since other stigmatized groups have been shown to receive less pain medication it was hypothesized that obese individuals would receive less pain medication postoperatively than lower BMI groups. This study set out to explore ordering and administration practices of pain medication between normal, overweight, obesity class I, obesity class II, and obesity class II groups and has identified differences and relationships between groups. The literature on patient outcomes related to pain and obesity stigma is non-existent. The intention of this study was to begin exploration into obesity as a stigmatized condition that affects pain management and answer three questions:

1. What is the difference in the total morphine equivalent dose of post-surgical pain medication administered between normal weight, overweight, and obese (Class I, II, and III) adult non-bariatric surgery patients?
2. What is the relationship between pain medication ordered and administered and the BMI of adult non-bariatric surgery patients?
3. What is the relationship between patients' BMI the receipt of post-surgical pain medication, when accounting for race, gender, age, insurance status, presence of psychiatric diagnosis, and pain score during hospitalization.

Independent Variables

There were differences in age (Tables 9 and 10), gender (Tables 11 and 12), insurance status (Table 13), and pain score (Tables 14 and 15). The differences in age, with the mean age decreasing as BMI increased, was most likely due to the heaviest patients dying earlier than the lighter patients since there numerous diseases associated with an increased weight (e.g., heart disease, cancer, etc) (Peeters et al., 2003).

Another explanation for the decreasing age could have been due to the heavier patients needing to be hospitalized and needing surgery at an earlier age due to the presence of obesity-related diseases. Women are more susceptible to becoming obese and there are approximate three obese women for every two obese men (Wells, Marphatia, Cole & McCoy, 2012) and the higher proportion of obese females supports this. A greater proportion of private insurance in the overweight and obese groups compared to the normal BMI group may be explained by the sampling and types of surgeries performed. The sample included patients who were admitted on the same day as their surgeries and a vast majority of these surgeries are planned and scheduled ahead of time through the surgeons' offices. Patients who schedule elective surgeries may be more likely to have private insurance. Also, another explanation could have been that the heavier patients were also younger and therefore may still have been employed and receiving private insurance through their employer. The findings related to pain scores were important since it showed that the obese III group was not complaining of moderate pain more or less than the normal, obesity class I, and obesity class II groups and there were no differences in mild pain between all groups. This variable may not have added much understanding of stigma since there were no moderate/severe or

severe pain scores recorded. In 2013, the healthcare system had multiple locations for which pain score may have been documented, including a paper record. One explanation for the low percentage of pain scores recorded in the medication administration system may have been that they were documented on paper. Also, it is possible that the pain scores recorded in the medication administration system could have been pain scores recorded after the administration of medication. They may have only been reflecting the improvement of pain, but it was not possible to determine this from the data set.

Research Question One

While there was a general downward trend of the mean dose of pain medication, the overweight, obesity class I, II, and III groups did not receive significantly less than the normal BMI group. It cannot be inferred that patients with high BMI received less pain medication (i.e., are stigmatized) than normal BMI patients. Taking into consideration the 37.3% of adults in Rhode Island (28.3% nationally) who are overweight and the 27.3% (28.3% nationally) who are obese, higher weights are becoming the norm. (Centers for Disease Control and Prevention, 2015). Studies have described a tendency to perceive higher weights as normal (Tschanler, Conn, Cook & Halterman, 2009, De La O et al., 2009, Johnson, Cooke, Croker & Wardle, 2008). In a study examining perceived discrimination, Carr & Friedmnan (2005) found no difference between normal and overweight groups. In addition to using a normal BMI population as a comparison group, comparing overweight patients to the heaviest patients may also be appropriate. Examining the results from this perspective, there was a significant difference in the dose of pain

medication given on postoperative day one between the overweight and obesity class III groups. The overweight group received more pain medication than the obesity class I and II groups and significantly more than the obesity class III group. Since the heaviest patients received less pain medication, stigmatization associated with patient weight may be present. This receipt of less pain medication by the heaviest groups may be as a result to negative attitudes from the healthcare providers. This would fit with Lewis & Van Puymbroeck's (2008) description of discriminatory acts tied to negative attitudes.

Research Question Two

Comparing overall pain medication ordering and administration practices among the five BMI categories was inconclusive in demonstrating clear patterns and differences in proportion between groups. A greater proportion of acetaminophen was ordered and not administered to obesity class III patients than normal and overweight BMI patients, which does support the literature related to less pain medication administration for stigmatized groups, although this may not be a significant finding since acetaminophen is usually not the primary choice for postoperative pain medication. Another interesting finding was that there were a proportion of patients that were administered hydromorphone, morphine, fentanyl, meperidine, oxycodone, and acetaminophen without the medication having been ordered by a licensed independent practitioner. It is possible that these drugs may have been administered to patients as a result of a verbal order that never was entered into the electronic medical record. Finding an overall relationship among all medications that supported bias towards higher weight patients was difficult. This may have been due to other factors,

such as most pain medications are ordered on an “as needed” basis and clinicians have different interpretations of the intent of these orders (Gordon et al., 2008). Also, the “habitus” may have differed between postoperative units (Lauzon Clabo, 2008). For example, some units may treat pain while taking into consideration the individual needs of the patient, while other units may have treated pain more from the standpoint of pain associated with a particular type of surgical procedure and not weighted the patient’s experience as heavily. In future research this question needs to be approached differently, taking dose into consideration. Other factors besides stigma may also need to be accounted for when examining ordering and administration practices, such as level of knowledge regarding pain management or opioid safety and addiction. Also, since most patients have postoperative medications ordered, it may be more illuminating to examine the physician ordering practices in relation to recommended guidelines. Physician attitudes toward obese patients have been shown to affect prescribing patterns (Huizinga, 2012). Further study is needed to determine if ordering of pain medication is affected by weight.

Research Question Three

There was a significant relationship found between the total postoperative oral morphine equivalent dose administered on postoperative day one and BMI, while controlling for other variables related to other stigmatizing conditions. BMI was the highest weighted predictor. It has been described that obese patients do not need any more pain medication than normal BMI patients (Patanwala, Holmes & Erstad, 2014), but this study found that there was a decrease in pain medication dose as BMI increased. Age was not as weighted a predictor of receiving less pain medication as

being black or being female, although it could be considered comparable to these when accounting for the scale. For example, the gender and racial category could only increase by a unit of one, since the variables were measured as either being black or not and being male or being female. There was a larger range of possible increases with age. Worker's Compensation patients and patients with a psychiatric diagnosis received a much greater proportion of pain medication dose, 90.8% and 23.2% more respectively. This finding may have been due to the characteristics of each group, such as being more demanding for pain medication or having surgical procedures that may be inherently more painful, but it may have also been due to the low amount of cases within the groups. There were only 19 Worker's Compensation patients and 149 patients with a psychiatric diagnosis in the sample. The findings of this study support the hypothesis that BMI is related to the treatment of pain and that increased weight, i.e. obesity, contributed to a lesser dose of pain medication administered. Past studies have linked stigma of race, gender, and age to pain medication administration practices that resulted in the receipt of less pain medication. While there was a low percent of the variance in total morphine equivalent dose explained by regression model (.6%) and a very low correlation between independent and dependent variables, this was understandable when taking into account the many factors in healthcare and human behavior which may impact the dose of medication received by the patient. BMI and the other independent variables were only a small portion of what may account for the dose of pain medication. The purpose of this study was to understand the relationship between the variables and small but significant relationships were found. These findings are supported by past research and there was persuasive initial

evidence that obesity, also a stigmatized attribute, may have impacted the administration of medications for pain when taking into account other factors related to stigmatization.

Limitations

There were several limitations that affected this study. After removal of duplicate cases and cases with missing information, the obesity class II and III groups contained fewer cases than the other groups, 291 and 318 respectively, and therefore those groups did not achieve the needed cases to yield a power of .95 and the possibility of incorrectly rejecting the null hypothesis is higher. Also, the number of patients receiving pain medication on postoperative day two was less than on day one. There were only 525 patients for which pain medication was documented on postoperative day two. If interested in determining if any differences total dose of pain medication continued past postoperative day one then ensuring that there are more patients who received pain medication on day two are included in the sample would increase the probability of finding a significant result.

Another limitation was that data was not collected through a random sample, but through IS query based on criteria. Sampling from three different hospitals did strengthen the generalizability of this study; however non-random sampling decreases the ability of the results to be generalized to a larger or different population. While differences in independent variables could be explained from the literature, some of these differences may have introduced sampling bias since the sample was not equally balanced. Also there was an unequal sample size among the five categories. The

obesity class II and III groups had fewer cases than the other groups due to exclusion and removal.

The use of BMI was another limitation. BMI is a measure of weight status that depends upon a patient's height and weight to determine a value that places them within a category that can be used to flag the patient as being under weight, normal weight, overweight, or obese. A patient may have a very low percentage of body fat, but be considered obese by measurement if they have a large muscle mass combined with a shorter stature. Some patients falling into this category may be present in the sample, but it was impossible to determine this based on the data acquired.

Another limitation was that pain score was recorded in the electronic medical record for only 48% of the cases. This may have been due to the multiple locations that nurses document pain, including both paper and electronic records. Also, the pain scores that were recorded in the medication administration system were categorical, grouping pain scores into categories, and not continuous. This would not precisely capture pain scores reported by each patient. There was not an adequate representation of each patient's pain as there would be if an integrated electronic medical record existed.

Finally, the categorization of race within the electronic medical record was suspect. There were a large proportion of patients classified as "White" within the study. Many of these patients had languages other than English listed as a primary language. "White" therefore was not an accurate representation of race since it appeared that Hispanic, as well as other race designations, were most likely included in the variable category.

Symbolic Interaction

The actions that healthcare providers take toward their patients are based on the meaning that they attribute to them or their conditions. If there is a negative meaning attributed, then care of the patient may be adversely affected. This was described in past studies examined the impact of racial bias on pain medication administration. This study supports the premise that meaning is reflected in action since there was a difference in the amount of pain medication a patient received based on their BMI. As BMI increased, the amount of pain medication administered decreased. Stigma related to obesity may have been a factor. Since a difference was found, further research that incorporates measures of attitude or bias is important in determining the presence and extent of obesity stigma, and the meanings that are held by healthcare providers. The third premise of symbolic interaction, that meanings are assigned and modified through an interpretive process, will be important in developing interventional studies designed to modify meanings that are attached to obesity. The decision to use symbolic interaction, and not critical theory or critical interactionism, as a framework to guide meaning and assumptions was based on the micro-level view of the research. Pain medication administration was viewed at the individual perspective. The assumption that nurses derive meaning from obesity which creates stigma and negatively affects healthcare outcomes, i.e. pain medication administration, was central in this study. Pain medication administration had never been examined in relation to obesity stigma; therefore it was important to first understand if there were any differences in administration based on BMI. Future research could incorporate

critical social theory, using a critical interactionist perspective to address the individual/micro level as well as the organizational/societal/macro level.

Implications for Research

The findings of this study did show that there was a difference in the receipt of pain medication depending on BMI, and that as BMI increased the dose of medication decreased. Only an implied association of these findings to stigmatization can be made and more research is needed to strengthen the evidence. Mixed-methods research that combines the measurement of outcomes with a tool to measure attitudes and biases would be valuable in strengthening the theory that obesity stigma negatively affects the treatment of pain. Also, expanding the study to include different patient or healthcare facility types would increase the generalizability of any findings. Incorporation of qualitative research examining the meaning of obesity and its effect on pain control would contribute to the usefulness of symbolic interaction as an explanatory theory regarding the under treatment of pain in obese patients. Further research using the theory would be useful in developing interventional studies. Studies that use “priming” as an intervention may be effective in reducing stigma/stereotyping that impacts patient care (Burgess, van Ryn, Crowley-Matoka & Malat, 2006). “Priming” can be described as providing the subject(s) of interest with information that generates a specific attitude desirable by the researcher.

Implications for Education

Prior research involving students has described the presence of weight bias. Biases may continue on into clinical practice, maintaining an environment where stigma is perpetuated. Educational interventions aimed at students would improve

attitudes, decrease bias, and ultimately may improve pain management in obese patients. It would be important to incorporate education designed to decrease obesity stigma into nursing curriculum. Continuing education for clinicians may also decrease obesity stigmatization. Bariatric sensitivity training has been used successfully in decreasing weight bias in nurses (Falker & Sledge, 2001) and may have a positive impact on the treatment of pain.

Implications for Practice

Negative attitudes and bias toward obese patients have been described as often being implicit among healthcare providers. They are unaware of the impact of negative beliefs on decision making and care provided. Other studies have described individuals as being less likely to have negative attitudes toward obesity if education was provided on the uncontrollable causes of obesity (DeJong, 1980). Interventions designed to change attitudes may also have a positive impact on pain management. This study begins to shed light on the effect of BMI on nurses' attitudes and behaviors related to the treatment of pain. Reducing bias would improve the quality of care. Pain management is of crucial importance to clinicians, especially due to quality of care and interest by government and accrediting agencies. Aspects of pain management are often included by hospitals as quality improvement measures. The Centers for Medicare and Medicaid Services include pain as an indicator in its Hospital Consumer Assessment of Healthcare Providers and Systems survey (CMS.gov, 2014). Pain management is also a concern of The Joint Commission (The Joint Commission, 2015). The results of this study indicate that there are differences in the treatment of

pain based on BMI, which if improved would also improve survey results and the quality indicators.

Healthcare, caring for our patients, and providing care are examples of terms/phrases that healthcare providers use when describing what they do as a profession. Caring and stigma should be considered mutually exclusive concepts. The meaning providers attach to being obese affects their thought and actions. By allowing stigma, either consciously or unconsciously, to have an impact on care we are setting up situations of inequality. All patients deserve to receive the very best quality of care regardless of weight.

“Our prime purpose in this life is to help others. And if you can’t help them, at least don’t hurt them.” Dalai Lama.

Table 1.

Comparison of Symbolic Interaction, Critical Social Theory, and Critical Interactionism

	Symbolic Interactionism	Critical Social Theory	Critical Interactionism
Discipline	Social psychology	Sociology	Cross-disciplinary
Level of focus	Downstream and micro	Upstream and macro	Upstream and downstream, macro and micro
Ontology	Pragmatism (originally), Relativism	Critical realism	Pragmatism
Epistemology	Subjective, relative to those who observe them (Mead) Reality is socially constructed (interpretivism)	Subjectivism Value-laden observation	Subjectivism Interpretivism
Goal	Objective relativism (Morris) Understand human actions based on definitions and meanings they have of world around them	Emancipation, interventions to promote egalitarian balance of power	Understanding and intervening at both downstream and upstream levels examining both meanings and organizational and societal repressive structures
Major concepts	Meaning, self, interaction, symbols, acts, perspectives	Power, social class, ideology, oppression, emancipation	Meaning and power Upstream—social class, ideology, oppression, emancipation Downstream—self, interaction, symbols, acts, perspectives
Perspectives	Derived from reference groups and orientational others Looking glass self—viewing ourselves as others see us	Ideological hegemony—pervasive dominant thinking that permeates society at all levels	Derived from reference groups and orientational others who perpetuate pervasive dominant thinking
View of human beings	I and me, socially constructed, free to make meaning of social world and to choose responses	Socially constructed, limited freedom to choose response, and result of power relations that constrain their responses	I and me, socially constructed, with varying degrees of socially constrained freedom to make meaning of their worlds and choose responses
Health	Focuses on individual's experiences of health, illness, and health care and the meanings surrounding them	Focuses on power inequities that manufacture and perpetuate illness and its treatments	Focuses jointly on the individual's and society's contributions to and responsibility for health and illness
Actions/interventions	Defining and reinterpreting situations for more healthy outcomes, individual behavior change	Balancing power inequities, restructure manufacturers of illness to promote health	Changing societal constraints on redefining situations and supporting positive individual behavior change while working to change manufacturers of illness

Source: Martins, & Burbank (2011).

Table 2.

Post-operative pain medications

Medication	Classification	Indication	Dosage Frequency
Morphine	Therapeutic: opioid analgesics	Severe pain	Intramuscular, Intravenous, Subcutaneous (Adults ≥ 50 kg): Usual starting dose for moderate to severe pain in opioid-naïve patients—4–10 mg every 3–4 hours. For very severe pain additional smaller doses may be given every 3–4 hours.
Hydromorphone	Therapeutic: opioid analgesics	Moderate to severe pain (alone and in combination with nonopioid analgesics)	Intravenous, Intramuscular, Subcutaneous (Adults ≥ 50 kg): 1.5 mg q 3–4 hr as needed initially; may be \uparrow .
Hydrocodone	Therapeutic: opioid analgesics	Used mainly in combination with nonopioid analgesics (acetaminophen/ibuprofen) in the management of moderate to severe pain.	Oral (Adults): Analgesic—2.5–10 mg q 3–6 hr as needed; if using combination products, acetaminophen dosage should not exceed 4 g/day and should not exceed 5 tablets/day of ibuprofen-containing products
Fentanyl Citrate	Therapeutic: opioid analgesics	Preoperative and postoperative	Intramuscular, Intravenous (Adults and Children > 12 yr): 50–100 mcg; may repeat in 1–2 hr.
Meperidine	Therapeutic: opioid analgesics	Moderate or severe pain (alone or with nonopioid agents).	Oral, Intramuscular, Subcutaneous (Adults): Analgesia—50 mg q 3–4 hr; may be \uparrow as needed (not to exceed 600 mg/24 hr).
Oxycodone	Therapeutic: opioid analgesics	Moderate to severe pain	Oral (Adults ≥ 50 kg): 5–10 mg q 3–4 hr initially, as needed.
Acetaminophen	Therapeutic: antipyretics, non-opioid analgesics	Oral, Rectal: Treatment of: Mild pain. Intravenous: Treatment of: Mild to moderate pain, Moderate to severe pain with opioid analgesics.	Oral (Adults and Children > 12 yr): 325–650 mg q 4–6 hr or 1 g 3–4 times daily or 1300 mg q 8 hr (not to exceed 4 g or 2.5 g/24 hr in patients with hepatic/renal impairment). Intravenous (Adults and Children ≥ 13 yr and ≥ 50 kg): 1000 mg q 6 hr or 650 mg q 4 hr (not to exceed 4 g/day or less than 4 hr dosing interval).

Source: Nursing Reference Center, (2015).

Table 2.

Post-operative pain medications (cont'd).

Medication	Classification	Indication	Dosage Frequency
Ibuprophen	Therapeutic: antipyretics, antirheumatics, non-opioid analgesics, nonsteroidal anti-inflammatory agents	Oral, Intravenous: Treatment of: Mild to moderate pain, Fever. Oral: Treatment of: Inflammatory disorders including rheumatoid arthritis (including juvenile) and osteoarthritis, Dysmenorrhea. Intravenous: Moderate to severe pain with opioid analgesics.	Oral (Adults): Anti-inflammatory—400–800 mg 3–4 times daily (not to exceed 3200 mg/day). Analgesic/antidysmenorrheal/antipyretic—200–400 mg q 4–6 hr (not to exceed 1200 mg/day). Intravenous (Adults): Analgesic—400–800 mg q 6 hr as needed (not to exceed 3200 mg/day); Antipyretic—400 mg initially, then 400 mg q 4–6 hr or 100–200 mg q 4 hr as needed (not to exceed 3200 mg/day).
Ketorolac	Therapeutic: nonsteroidal anti-inflammatory agents, non-opioid analgesics	Short-term management of pain (not to exceed 5 days total for all routes combined).	Intravenous (Adults <65 yr): Single dose—30 mg. Multiple dosing—30 mg q 6 hr (not to exceed 120 mg/day). Intravenous (Adults ≥65 yr, <50 kg, or with renal impairment): Single dose—15 mg. Multiple dosing—15 mg q 6 hr (not to exceed 60 mg/day).
Diclofenac	Therapeutic: non-opioid analgesics, nonsteroidal anti-inflammatory agents	Oral: Management of inflammatory disorders including: Rheumatoid arthritis, Osteoarthritis, Ankylosing spondylitis. Primary dysmenorrhea. Relief of mild to moderate pain. Acute treatment of migraines (powder for oral solution).	Oral (Adults): Rheumatoid arthritis (delayed-release [enteric-coated] tablets)—50 mg 3–4 times daily or 75 mg twice daily (usual maintenance dose 25 mg 3 times daily). Rheumatoid arthritis (extended-release tablets)—100 mg once daily; if unsatisfactory response, dose may be ↑ to 100 mg twice daily. Osteoarthritis (delayed-release [enteric-coated] tablets)—50 mg 2–3 times daily or 75 mg twice daily. Osteoarthritis (extended-release tablets)—100 mg once daily. Ankylosing spondylitis (delayed-release [enteric-coated] tablets)—25 mg 4 times daily, with an additional 25 mg given at bedtime, if necessary.

Source: Nursing Reference Center, (2015).

Table 3.

Narcotics and their Narcotic Equivalency to Oral Morphine

Equianalgesia (morphine, PO)		
Analgesic	Strength (relative)	Equivalent Dose (10 mg)
Morphine (IV/IM)	3	3.33 mg
Codeine	1/10	100 mg
Meperidine	1/3	28 mg
Hydrocodone	1	10 mg
Oxycodone	1.5	6.67 mg
Hydromorphone	5	2 mg
Fentanyl	50–100	0.1–0.2 mg
Ketorolac	30	10 mg

Source: GlobalRPh (2015).

Table 4.

Procedures performed on more than one patient.

Procedure	Count
LAPAROSCOPIC GASTROENTEROSTOMY	106
FUSION OR REFUSION OF 2-3 VERTEBRAE	100
RADICAL PROSTATECTOMY	89
LAPAROSCOPIC CHOLECYSTECTOMY	81
OTHER LYSIS OF PERITONEAL ADHESIONS	71
REGIONAL LYMPH NODE EXCISION	70
IV DISC EXCISION	68
OTHER PARTIAL RESECTION OF SMALL INTESTINE	65
PROCEDURE ON SINGLE VESSEL	60
EXCISION OF OTHER BONE FOR GRAFT, EXCEPT FACIAL BONES	59
LUMBAR AND LUMBOSACRAL FUSION OF THE POSTERIOR COLUMN, POSTERIOR	55
NEPHROURETERECTOMY	53
LAPAROSCOPIC LYSIS OF PERITONEAL ADHESIONS	52
LAPAROSCOPIC APPENDECTOMY	51
LAPAROSCOPIC RIGHT HEMICOLECTOMY	49
ENDARTERECTOMY OF OTHER VESSELS OF HEAD AND NECK	47
OTHER OPEN INCISIONAL HERNIA REPAIR WITH GRAFT OR PROSTHESIS	47
INSERTION OF INTERBODY SPINAL FUSION DEVICE	45
SIMPLE EXCISION OF OTHER LYMPHATIC STRUCTURE	44
OTHER CERVICAL FUSION OF THE ANTERIOR COLUMN, ANTERIOR TECHNIQUE	41
PARTIAL NEPHRECTOMY	41
OTHER EXPLORATION AND DECOMPRESSION OF SPINAL CANAL	40
CLOSURE OF STOMA OF SMALL INTESTINE	38
LAPAROSCOPIC REPAIR OF DIAPHRAGMATIC HERNIA, ABDOMINAL APPROACH	37
LAPAROSCOPIC SIGMOIDECTOMY	35
THORACOSCOPIC EXCISION OF LESION OR TISSUE OF LUNG	33
FIBER-OPTIC BRONCHOSCOPY	32
OTHER OPERATIONS ON BONE MARROW	32
THORACOSCOPIC LOBECTOMY OF LUNG	30
INTRAOPERATIVE CHOLANGIOGRAM	28
EXTERIORIZATION OF SMALL INTESTINE	27
LAPAROSCOPIC PROCEDURES FOR CREATION OF ESOPHAGOGASTRIC SPHINCTERIC	27
OTHER INCISION WITH DRAINAGE OF SKIN AND SUBCUTANEOUS TISSUE	27
COMPLETE THYROIDECTOMY	26
INSERTION OF INTERCOSTAL CATHETER FOR DRAINAGE	26
OTHER RESECTION OF RECTUM	26
OTHER ANTERIOR RESECTION OF RECTUM	25
ENDARTERECTOMY OF LOWER LIMB ARTERIES	23

Table 4.

Procedures performed on more than one patient.

Procedure	Count
OTHER (PERIPHERAL) VASCULAR SHUNT OR BYPASS	23
OTHER BRONCHOSCOPY	23
PERCUT NEPHROST-NO FRAG	23
PROCEDURE ON TWO VESSELS	23
RETROGRADE PYELOGRAM	23
ANGIOPLASTY OF OTHER NON-CORONARY VESSEL(S)	22
OTHER LOBECTOMY OF LUNG	22
BIOPSY OF LYMPHATIC STRUCTURE	21
LAPAROSCOPIC VERTICAL (SLEEVE) GASTRECTOMY	21
LARGE-TO-LARGE INTESTINAL ANASTOMOSIS	21
ARTERIOGRAPHY OF FEMORAL AND OTHER LOWER EXTREMITY ARTERIES	20
FORMATION OF CUTANEOUS URETERO-ILEOSTOMY	20
CLOSURE OF STOMA OF LARGE INTESTINE	19
OTHER LAPAROSCOPIC UMBILICAL HERNIORRHAPHY	19
RADICAL CYSTECTOMY	19
OTHER ENDOSCOPY OF SMALL INTESTINE	18
PROCEDURE ON VESSEL BIFURCATION	18
EXCISION OF LESION OF OTHER SOFT TISSUE	17
LAPAROSCOPIC LYSIS OF PERIRENAL OR PERIURETERAL ADHESIONS	17
OPEN AND OTHER SIGMOIDECTOMY	17
PERCUTANEOUS ABDOMINAL DRAINAGE	17
TOTAL KNEE REPLACEMENT	17
UNILATERAL THYROID LOBECTOMY	17
EXCISION OR DESTRUCTION OF PERITONEAL TISSUE	16
LAPAROSCOPY	16
OPEN AND OTHER RIGHT HEMICOLECTOMY	16
OTHER SMALL-TO-LARGE INTESTINAL ANASTOMOSIS	16
CHOLECYSTECTOMY	15
ENDOVASCULAR IMPLANTATION OF OTHER GRAPH IN ABDOMINAL AORTA	14
OTHER OPEN UMBILICAL HERNIORRHAPHY	14
SINGLE INTERNAL MAMMARY-CORONARY ARTERY BYPASS	14
TRANSURETHRAL REMOVAL OF OBSTRUCTION FROM URETER	14
OTHER AND OPEN REPAIR OF OTHER HERNIA OF ANTERIOR ABDOMINAL WALL WITH	13
OTHER CYSTOSCOPY	13
OTHER LOCAL EXCISION OR DESTRUCTION OF LESION OR TISSUE OF	13
OTHER LYSIS OF PERIRENAL OR PERIURETERAL ADHESIONS	13
OPEN AND OTHER LEFT HEMICOLECTOMY	12
OPEN AND OTHER REPLACEMENT OF AORTIC VALVE WITH TISSUE GRAFT	12
OTHER INCISION OF PLEURA	12

Table 4.

Procedures performed on more than one patient.

Procedure	Count
REMOVAL OF INTERNAL FIXATION DEVICE FROM OTHER BONE,	12
UNILATERAL EXTENDED SIMPLE MASTECTOMY	12
ANASTOMOSIS OF SMALL INTESTINE TO ANUS	11
CLOSURE OF FISTULA OF SMALL INTESTINE, EXCEPT DUODENUM	11
COLOSTOMY, NOT OTHERWISE SPECIFIED	11
FUSION OR REFUSION OF 4-8 VERTEBRAE	11
INCISION OF ABDOMINAL WALL	11
INSERTION OF ENDOTRACHEAL TUBE	11
LAPAROSCOPIC REMOVAL OF GASTRIC RESTRICTIVE DEVICE(S)	11
LAPAROSCOPIC TOTAL INTRA-ABDOMINAL COLECTOMY	11
ESOPHAGOMYOTOMY	10
INSERTION OF BREAST TISSUE EXPANDER	10
INSERTION OF NON-DRUG-ELUTING PERIPHERAL (NON-CORONARY) VESSEL STENT(S)	10
LAPAROSCOPIC LEFT HEMICOLECTOMY	10
OTHER HERNIA REPAIR	10
OTHER TRANSURETHRAL PROSTATECTOMY	10
PERCUT NEPHROST W FRAGMN	10
PERCUTANEOUS PYELOGRAM	10
ARTERIOGRAPHY OF OTHER INTRA-ABDOMINAL ARTERIES	9
CLOSURE OF SKIN AND SUBCUTANEOUS TISSUE OTHER SITES	9
INCISIONAL HERNIA REPAIR	9
INSERTION OF OTHER (NASO-)GASTRIC TUBE	9
OTHER KIDNEY TRANSPLANTATION	9
OTHER PARATHYROIDECTOMY	9
OTHER PROCTOPEXY	9
RADICAL EXCISION OF OTHER LYMPH NODES	9
REPAIR OF OTHER HERNIA OF ANTERIOR ABDOMINAL WALL	9
TOTAL SPLENECTOMY	9
CORRECTION OF URETEROPELVIC JUNCTION	8
FLEXIBLE SIGMOIDOSCOPY	8
OTHER REPAIR AND PLASTIC OPERATIONS ON SPINAL CORD STRUCTURES	8
OTHER TRANSURETHRAL EXCISION OR DESTRUCTION OF	8
REVISION OF STOMA OF SMALL INTESTINE	8
(AORTO)CORONARY BYPASS OF ONE CORONARY ARTERY	7
(AORTO)CORONARY BYPASS OF TWO CORONARY ARTERY	7
AORTOGRAPHY	7
EXCISION OR DESTRUCTION OF LESION OR TISSUE OF ABDOMINAL	7
ILEOSTOMY, NOT OTHERWISE SPECIFIED	7
INJECTION INTO THORACIC CAVITY	7
INSERTION OF ONE VASCULAR STENT	7

Table 4.

Procedures performed on more than one patient.

Procedure	Count
LAPAROSCOPIC CECECTOMY	7
LUMBAR AND LUMBOSACRAL FUSION OF THE ANTERIOR COLUMN, POSTERIOR	7
NONEXCISIONAL DEBRIDEMENT OF WOUND, INFECTION, OR BURN	7
OTHER AND UNSPECIFIED PARTIAL EXCISION OF LARGE INTESTINE	7
OTHER ENDOVASCULAR PROCEDURES ON OTHER VESSELS	7
OTHER REPAIR OF ANAL SPHINCTER	7
RECONSTRUCTION OF URINARY BLADDER	7
REPAIR OF PERICOLOSTOMY HERNIA	7
THORACOSCOPIC SEGMENTAL RESECTION OF LUNG	7
UNILATERAL SIMPLE MASTECTOMY	7
AORTA-ILIAC-FEMORAL BYPASS	6
APPLICATION OR ADMINISTRATION OF AN ADHESION BARRIER SUBSTANCE	6
CLOSED BIOPSY OF LIVER	6
COLONOSCOPY	6
EXCISION OF AXILLARY LYMPH NODE	6
INTRAVENOUS PYELOGRAM	6
LAPAROSCOPIC INCISIONAL HERNIA REPAIR WITH GRAFT OR PROSTHESIS	6
OTHER EXCISION OF JOINT OF OTHER SPECIFIED SITE	6
OTHER EXCISION OR DESTRUCTION OF LESION OR TISSUE OF BRAIN	6
OTHER GASTROSTOMY	6
OTHER MAMMOPLASTY	6
OTHER PARTIAL THYROIDECTOMY	6
OTHER PERMANENT ILEOSTOMY	6
OTHER PROSTATECTOMY	6
OTHER REPAIR OF CEREBRAL MENINGES	6
PELVIC EVISCERATION	6
PROCEDURE ON THREE VESSELS	6
RETROPUBIC PROSTATECTOMY	6
SUTURE OF LACERATION OF SMALL INTESTINE, EXCEPT DUODENUM	6
TRANSPLANT FROM CADAVER	6
DILATION OF URETHRA	5
EXCISIONAL DEBRIDEMENT OF WOUND, INFECTION, OR BURN	5
EXPLORATORY LAPAROTOMY	5
LAPAROSCOPIC ABDOMINOPERINEAL RESECTION OF THE RECTUM	5
MEDIASTINOSCOPY	5
OPEN ABDOMINOPERINEAL RESECTION OF THE RECTUM	5
OTHER AND OPEN REPAIR OF UMBILICAL HERNIA WITH GRAFT OR PROSTHESIS	5
OTHER APPENDECTOMY	5
OTHER ENTEROSTOMY	5
OTHER GASTROENTEROSTOMY WITHOUT GASTRECTOMY	5

Table 4.

Procedures performed on more than one patient.

Procedure	Count
OTHER INCISION OF SMALL INTESTINE	5
OTHER LOCAL DESTRUCTION OR EXCISION OF RENAL LESION OR TISSUE	5
OTHER PROCEDURES FOR CREATION OF ESOPHAGOGASTRIC	5
OTHER SKIN GRAFT TO OTHER SITES	5
PARTIAL GASTRECTOMY WITH ANASTOMOSIS TO JEJUNUM	5
PARTIAL HEPATECTOMY	5
REOPENING OF RECENT LAPAROTOMY SITE	5
REPLACEMENT OF VENTRICULAR SHUNT	5
REVERSE TOTAL SHOULDER REPLACEMENT	5
SMALL-TO-SMALL INTESTINAL ANASTOMOSIS	5
THERAPEUTIC APHERESIS NEC	5
THORACENTESIS	5
ABD AORTA RESECT W REPL	4
ABDOMINAL PROCTOPEXY	4
ANTERIOR RESECTION OF RECTUM WITH SYNCHRONOUS COLOSTOMY	4
ARTERIOGRAPHY OF CEREBRAL ARTERIES	4
ATTACHMENT OF PEDICLE OR FLAP GRAFT TO OTHER SITES	4
BILATERAL SIMPLE MASTECTOMY	4
ELECTROMYOGRAPHY	4
ENDOVASCULAR IMPLANTATION OF BRANCHING OR FENESTRATED GRAFT(S) IN AORTA	4
EXCISION OF BONE FOR GRAFT, UNSPECIFIED SITE	4
EXCISION OR DESTRUCTION OF LESION OF CHEST WALL	4
EXCISION OR DESTRUCTION OF LESION OF SPINAL CORD	4
EXCISION OR DESTRUCTION OF LESION OR TISSUE OF MEDIASTINUM	4
INCISION OF LOWER LIMB ARTERIES	4
INCISION OF PERIRECTAL TISSUE	4
ISOLATION OF SEGMENT OF SMALL INTESTINE	4
LAPAROSCOPIC LIVER BIOPSY	4
LOCAL EXCISION OF OTHER LESION OR TISSUE OF STOMACH	4
MULTIPLE SEGMENTAL RESECTION OF SMALL INTESTINE	4
NEPHROTOMY	4
OTHER AMPUTATION BELOW KNEE	4
OTHER AND OPEN REPAIR OF INDIRECT INGUINAL HERNIA WITH GRAFT	4
OTHER AND UNSPECIFIED TOTAL ABDOMINAL HYSTERECTOMY	4
OTHER AND UNSPECIFIED TOTAL INTRA-ABDOMINAL COLECTOMY	4
OTHER CERVICAL FUSION OF THE POSTERIOR COLUMN, POSTERIOR TECHNIQUE	4
OTHER FASCIECTOMY	4
OTHER GENITOURINARY INSTILLATION	4
OTHER INCIDENTAL APPENDECTOMY	4
OTHER PULL-THROUGH RESECTION OF RECTUM	4

Table 4.

Procedures performed on more than one patient.

Procedure	Count
OTHER REPAIR OF ABDOMINAL WALL	4
OTHER REVISION OF VASCULAR PROCEDURE	4
OTHER SUTURE OF MUSCLE OR FASCIA	4
PARTIAL CYSTECTOMY	4
PARTIAL EXCISION OF PITUITARY GLAND, TRANSSPHENOIDAL APPROACH	4
PERITONEAL LAVAGE	4
REFUSION OF LUMBAR AND LUMBOSACRAL SPINE, POSTERIOR COLUMN, POSTERIOR	4
RESECTION OF OTHER THORACIC VESSELS WITH REPLACEMENT	4
RIGID PROCTOSIGMOIDOSCOPY	4
SUPRAPUBIC PROSTATECTOMY	4
THORACOSCOPIC DECORTICATION OF LUNG	4
ARTERIOGRAPHY OF OTHER SPECIFIED SITES	3
ARTHROCENTESIS	3
CLIPPING OF ANEURYSM	3
CLOSED BIOPSY OF BRONCHUS	3
CLOSED REDUCTION OF MANDIBULAR FRACTURE	3
CLOSURE OF ANAL FISTULA	3
CLOSURE OF OTHER GASTRIC FISTULA	3
COMPLETE SUBSTERNAL THYROIDECTOMY	3
CONTROL OF HEMORRHAGE, NOT OTHERWISE SPECIFIED	3
DECAPSULATION OF KIDNEY	3
DECOMPRESSION OF TRIGEMINAL NERVE ROOT	3
INCISION WITH REMOVAL OF FOREIGN BODY OR DEVICE FROM SKIN AND	3
INSERTION OF TWO VASCULAR STENTS	3
LAPAROSCOPIC INCIDENTAL APPENDECTOMY	3
LOCAL EXCISION OF RECTAL LESION OR TISSUE	3
OPEN AND OTHER REPLACEMENT OF AORTIC VALVE	3
OPEN HEART VALVULOPLASTY OF AORTIC VALVE WITHOUT REPLACEMENT	3
OPEN OSTEOPLASTY (OSTEOTOMY) OF MANDIBULAR RAMUS	3
OPEN TOTAL INTRA-ABDOMINAL COLECTOMY	3
OTHER AND OPEN REPAIR OF DIRECT INGUINAL HERNIA WITH GRAFT	3
OTHER AND UNSPECIFIED SEGMENTAL RESECTION OF LUNG	3
OTHER LAPAROTOMY	3
OTHER LOCAL EXCISION OR DESTRUCTION OF LESION OF KNEE JOINT	3
OTHER OPERATIONS ON LUNG	3
OTHER OPERATIONS ON THORAX	3
OTHER REPAIR OF ANEURYSM	3
OTHER REPAIR OF CHEST WALL	3
OTHER REPAIR OF PENIS	3
PARATHYROID TISSUE REIMPLANTATION	3

Table 4.

Procedures performed on more than one patient.

Procedure	Count
REMOVAL OF INTERNAL PROSTHESIS OF PENIS	3
REMOVAL OF PYELOSTOMY AND NEPHROSTOMY TUBE	3
REOPENING OF LAMINECTOMY SITE	3
REPAIR OF COLOVAGINAL FISTULA	3
REPAIR OF RECTOVAGINAL FISTULA	3
REPAIR OF VERTEBRAL FRACTURE	3
REVISION OF URETEROINTESTINAL ANASTOMOSIS	3
SIZE REDUCTION PLASTIC OPERATION	3
SUBTOTAL MASTECTOMY	3
SUTURE OF ARTERY	3
SUTURE OF DUODENAL ULCER SITE	3
THORACOSCOPIC DRAINAGE OF PLEURAL CAVITY	3
TOTAL HIP REPLACEMENT	3
TRANSPLEURAL THORACOSCOPY	3
ULTRASONIC FRAGMENTATION OF URINARY STONES	3
URETERONEOCYSTOSTOMY	3
URETEROSCOPY	3
VIDEO AND RADIO-TELEMETERED ELECTROENCEPHALOGRAPHIC MONITORING	3
AMPUTATION ABOVE KNEE	2
ANASTOMOSIS OF HEPATIC DUCT TO GASTROINTESTINAL TRACT	2
APPLICATION OF EXTERNAL FIXATOR DEVICE, TIBIA AND FIBULA	2
APPLICATION OF OTHER WOUND DRESSING	2
ASPIRATION OF OTHER SOFT TISSUE	2
BIOPSY OF ABDOMINAL WALL OR UMBILICUS	2
CLOSED BIOPSY OF BLADDER	2
COMPUTER ASSISTED SURGERY WITH CT/CTA	2
DEBRIDEMENT OF OPEN FRACTURE OF TIBIA AND FIBULA	2
DENTAL WIRING	2
DERMAL REGENERATIVE GRAFT	2
DISTAL PANCREATECTOMY	2
DORSAL AND DORSOLUMBAR FUSION OF THE ANTERIOR COLUMN, ANTERIOR TECHNI	2
DORSAL AND DORSOLUMBAR FUSION OF THE POSTERIOR COLUMN, POSTERIOR	2
ENDARTERECTOMY OF ABDOMINAL ARTERIES	2
ENDOSCOPIC CONTROL OF GASTRIC OR DUODENAL BLEEDING	2
ENDOSCOPIC INSERTION OF STENT (TUBE) INTO BILE DUCT	2
ENDOVASCULAR (TOTAL) EMBOLIZATION OR OCCLUSION OF HEAD AND NECK VESSE	2
ESOPHAGOGASTRODUODENOSCOPY (EGD) WITH CLOSED BIOPSY	2
EXCISION OF DEEP CERVICAL LYMPH NODE	2
EXCISION OF HEMORRHOIDS	2
EXCISION OF INGUINAL LYMPH NODE	2

Table 4.

Procedures performed on more than one patient.

Procedure	Count
EXCISION OF LESION OR TISSUE OF CEREBRAL MENINGES	2
EXCISION OF LESION OR TISSUE OF DIAPHRAGM	2
EXCISION OR DESTRUCTION OF OTHER LESION OR TISSUE OF HEART, OPEN	2
EXTRACRANIAL-INTRACRANIAL (EC-IC)VASCULAR BYPASS	2
FASCIOTOMY	2
FAT GRAFT OF SKIN AND SUBCUTANEOUS TISSUE	2
GASTROPEXY	2
IMPLANTATION OR REPLACEMENT OF PERIPHERAL NEUROSTIMULATOR LEAD(S)	2
INCISION OF ABDOMINAL VEINS	2
INCISION OF CEREBRAL MENINGES	2
INCISION OF PERIANAL ABSCESS	2
INCISION OF UPPER LIMB VESSELS	2
INSERTION OF CATHETER INTO SPINAL CANAL FOR INFUSION OF THERAPEUTIC	2
INSERTION OF RECOMBINANT BONE MORPHOGENETIC PROTEIN	2
INSERTION OR REPLACEMENT OF EXTERNAL VENTRICULAR DRAIN (EVD)	2
INTRA- ABDOMINAL MANIPULATION OF LARGE INTESTINE	2
LAPAROSCOPIC REMOVAL OF BOTH OVARIES AND TUBES AT SAME OPERATIVE EPISOI	2
LATISSIMUS DORSI MYOCUTANEOUS FLAP	2
LOBECTOMY OF LIVER	2
LOCAL EXCISION OF LESION OR TISSUE OF OTHER BONE, EXCEPT	2
NEPHROSCOPY	2
NEPHROSTOMY	2
OBLITERATION AND TOTAL EXCISION OF VAGINA	2
OPEN AND OTHER RESECTION OF TRANSVERSE COLON	2
OPEN BIOPSY OF BRAIN	2
OPEN REDUCTION OF MANDIBULAR FRACTURE	2
OTHER ABDOMINOPERINEAL RESECTION OF THE RECTUM	2
OTHER AND OPEN REPAIR OF DIRECT INGUINAL HERNIA	2
OTHER AND OPEN REPAIR OF INDIRECT INGUINAL HERNIA	2
OTHER AND UNSPECIFIED PNEUMONECTOMY	2
OTHER AND UNSPECIFIED ROBOTIC ASSISTED PROCEDURE	2
OTHER AND UNSPECIFIED SUBTOTAL ABDOMINAL HYSTERECTOMY	2
OTHER AND UNSPECIFIED THORACOSCOPIC OPERATIONS ON THYMUS	2
OTHER CRANIAL OSTEOPLASTY	2
OTHER CRANIOTOMY	2
OTHER ELECTRIC ERSHOCK OF HEART	2
OTHER IRRIGATION OF WOUND	2
OTHER LAPAROSCOPIC REPAIR OF OTHER HERNIA OF ANTERIOR ABDOMINAL WALL	2
OTHER MYECTOMY	2
OTHER PARTIAL PANCREATECTOMY	2

Table 4.

Procedures performed on more than one patient.

Procedure	Count
OTHER PYLOROPLASTY	2
OTHER REPAIR OF BLADDER	2
OTHER REPAIR OF INTESTINE	2
OTHER REPAIR OF STOMACH	2
OTHER REVISION OF STOMA OF LARGE INTESTINE	2
OTHER SUPRAPUBIC CYSTOSTOMY	2
OTHER UNILATERAL FEMORAL HERNIORRHAPHY	2
OTHER UNILATERAL SALPINGO-OOPHORECTOMY	2
OTHER URETHROSCOPY	2
PEDICLE GRAFT TO BREAST	2
PERCUTANEOUS ASPIRATION OF KIDNEY (PELVIS)	2
PLICATION OF VENA CAVA	2
PULL-THROUGH RESECTION OF RECTUM, NOT OTHERWISE SPECIFIED	2
PULMONARY ARTERY WEDGE MONITORING	2
RADICAL GROIN DISSECTION	2
RADICAL NECK DISSECTION, UNILATERAL	2
REFUSION OF LUMBAR AND LUMBOSACRAL SPINE, ANTERIOR COLUMN, ANTERIOR	2
REMOVAL OF TRANSPLANTED OR REJECTED KIDNEY	2
REOPENING OF WOUND OF THYROID FIELD	2
REPAIR OF DIAPHRAGMATIC HERNIA WITH THORACIC APPROACH,	2
REPAIR OF DIAPHRAGMATIC HERNIA, ABDOMINAL APPROACH, NOT OTHERWISE	2
REPAIR OF FISTULA INVOLVING BLADDER AND INTESTINE	2
REPAIR OF RECTOCELE	2
REVISION OF AMPUTATION STUMP	2
REVISION RHINOPLASTY	2
SEGMENTAL OSTEOPLASTY (OSTEOTOMY) OF MAXILLA	2
SUTURE OF GASTRIC ULCER SITE	2
SUTURE OF LACERATION OF DIAPHRAGM	2
SUTURE OF LACERATION OF LIP	2
SUTURE OF LACERATION OF RECTUM	2
THORACOSCOPIC PLEURAL BIOPSY	2
TOTAL URETERECTOMY	2
TRANSPLANT FROM LIVE NON-RELATED DONOR	2
TRANSURETHRAL CLEARANCE OF BLADDER	2
UNILATERAL ADRENALECTOMY	2
UNILATERAL REPAIR OF INGUINAL HERNIA WITH GRAFT OR	2
URINARY DIVERSION TO INTESTINE	2
VAGINAL RECONSTRUCTION	2
VENTRICULAR SHUNT TO ABDOMINAL CAVITY AND ORGANS	2
(AORTO)CORONARY BYPASS OF THREE CORONARY ARTERIES	1

Table 5.

Descriptive statistics for categorical independent variables (Mean & (SD) or %).

	Total 24 Hour Equivalent Dose	Total 48 Hour Equivalent Dose	BMI	Age	Gender Female	Psychiatric Diagnosis		Pain Score	
						Mild	Moderate	Mild	Moderate
Normal	20.87 (23.57)	16.39 (20.63)	22.63 (1.8)	60.15 (17.94)	20.9%	22.1%	20.1%	21.3%	
Overweight	18.75 (12.08)	24.42 (56.42)	27.53 (1.46)	61.03 (15.13)	16.3%	15.4%	24.4%	25.5%	
Obesity Class I	22.03 (35.42)	19.2 (19.87)	32.16 (1.41)	58.66 (13.67)	20.8%	15.4%	22.0%	19.1%	
Obesity Class II	26.81 (67.65)	21.08 (21)	37.14 (1.39)	55.21 (15.62)	17.9%	21.5%	16.0%	13.4%	
Obesity Class III	18.05 (17.67)	20.14 (22.1)	48.79 (15.04)	49.15 (13.88)	23.9%	25.5%	17.6%	20.7%	
Insurance Status									
	Race			Insurance Status					
	W	B	Other	Private	Medicare	Medicaid	Comp	None	
Normal	88.5%	6.6%	4.1%	60.3%	31.0%	2.7%	1.4%	4.7%	
Overweight	87.4%	7.9%	4.4%	71.8%	23.8%	0.8%	0.5%	3.0%	
Obesity Class I	86.6%	6.6%	6.8%	72.6%	21.9%	1.6%	0.8%	3.0%	
Obesity Class II	88.3%	5.8%	5.5%	65.6%	24.1%	3.1%	2.1%	5.2%	
Obesity Class III	84.0%	9.1%	23.4%	74.5%	17.9%	1.9%	0.9%	4.7%	

Table 6.

Frequency of postoperative day one and two pain medications.

Medications		Postoperative Day 1	Postoperative Day 2
IV Narcotic	Hydromorphone	1478 (86.7%)	310 (18.2%)
	Morphine	478 (28.1%)	114 (6.7%)
	Fentanyl	49 (2.9%)	17 (1%)
	Meperidine	52 (3.1%)	4 (.2%)
PO Narcotic	Oxycodone	92 (5.4%)	144 (8.5%)
IM Non-Narcotic	Ketorolac	131 (7.7%)	151 (8.9%)
IV Non - Narcotic	Acetaminophen	243 (14.3%)	69 (4%)
PO Non-Narcotic	Ibuprophen	0 (0%)	2 (.1 %)

Table 7.

Descriptive statistics for total dose in mg of each pain medication administered during postoperative day one and two.

Medications	Postoperative Day 1				Postoperative Day 2			
	Mean	Min	Max	Std Dev	Mean	Min	Max	Std Dev
Hydromorphone	2.44	0.25	203	5.53	2.19	0.25	105	6.75
Morphine	7.84	0.25	60	6.31	7.55	1	45	8.21
Fentanyl	170.37	0.25	700	171.65	187.67	2.5	850	212.45
Meperidine	29.33	12.5	225	30	90.63	12.5	225	93.19
Oxycodone	28.07	5	380	51.1	18	5	95	14.74
Ketorolac	28.4	1	90	13.33	27.65	15	105	14.2
Acetaminophen	1068.72	650	2000	269.53	1030.68	10	2000	261.45

Table 8.

Descriptive statistics of total postoperative day 1 and day 2 morphine equivalent dose.

BMI Category		Total 24-Hour Morphine Equivalent Dose	Total 48-Hour Morphine Equivalent Dose
Normal	N	352.0	115.0
	Mean	20.9	16.4
	Minimum	1.3	2.5
	Maximum	232.5	157.5
	Std. Deviation	23.6	20.6
	% of Total N	21.6%	22.0%
Overweight	N	346.0	95.0
	Mean	18.8	24.4
	Minimum	2.5	0.6
	Maximum	117.3	525.0
	Std. Deviation	12.1	56.4
	% of Total N	21.3%	18.2%
Obesity Class I	N	349.0	125.0
	Mean	22.0	19.2
	Minimum	1.3	2.5
	Maximum	570.0	142.5
	Std. Deviation	35.4	19.9
	% of Total N	21.4%	23.9%
Obesity Class II	N	278.0	97.0
	Mean	26.8	21.1
	Minimum	1.3	1.3
	Maximum	1015.0	84.0
	Std. Deviation	67.7	21.0
	% of Total N	17.1%	18.5%
Obesity Class III	N	303.0	91.0
	Mean	18.1	20.1
	Minimum	2.5	2.5
	Maximum	103.8	142.5
	Std. Deviation	17.7	22.1
	% of Total N	18.6%	17.4%
Total	N	1628.0	523.0
	Mean	21.2	20.0
	Minimum	1.3	0.6
	Maximum	1015.0	525.0
	Std. Deviation	35.6	30.5
	% of Total N	100.0%	100.0%

Table 9.

Descriptive statistics of age by BMI category

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Normal	365	60.15	17.944	.939	58.30	61.99	18	96
Overweight	365	61.03	15.133	.792	59.47	62.59	20	95
Obesity Class I	365	58.66	13.673	.716	57.25	60.07	18	87
Obesity Class II	291	55.21	15.621	.916	53.41	57.01	18	88
Obesity Class III	318	49.15	13.877	.778	47.62	50.68	19	85
Total	1704	57.12	15.918	.386	56.37	57.88	18	96

Table 10.

Multiple comparisons between Age and BMI.

Dependent Variable: Age						
Tukey HSD						
(I) BMI Category		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Normal	Overweight	-0.88	1.136	.937	-3.99	2.22
	Obesity Class I	1.48	1.136	.687	-1.62	4.59
	Obesity Class II	4.936*	1.206	.000	1.64	8.23
	Obesity Class III	10.997*	1.178	.000	7.78	14.21
Overweight	Normal	0.88	1.136	.937	-2.22	3.99
	Obesity Class I	2.37	1.136	.227	-.73	5.47
	Obesity Class II	5.821*	1.206	.000	2.53	9.12
	Obesity Class III	11.882*	1.178	.000	8.67	15.10
Obesity Class I	Normal	-1.48	1.136	.687	-4.59	1.62
	Overweight	-2.37	1.136	.227	-5.47	.73
	Obesity Class II	3.451*	1.206	.035	.16	6.75
	Obesity Class III	9.512*	1.178	.000	6.30	12.73
Obesity Class II	Normal	-4.936*	1.206	.000	-8.23	-1.64
	Overweight	-5.821*	1.206	.000	-9.12	-2.53
	Obesity Class I	-3.451*	1.206	.035	-6.75	-.16
	Obesity Class III	6.062*	1.245	.000	2.66	9.46
Obesity Class III	Normal	-10.997*	1.178	.000	-14.21	-7.78
	Overweight	-11.882*	1.178	.000	-15.10	-8.67
	Obesity Class I	-9.512*	1.178	.000	-12.73	-6.30
	Obesity Class II	-6.062*	1.245	.000	-9.46	-2.66

*. The mean difference is significant at the 0.05 level.

Table 11.

Crosstabulation between BMI and Gender.

BMI Category		Gender		Total
		Male	Female	
Normal	Count	169	196	365
	% within BMI Category	46.3%	53.7%	100%
	% within Gender	22.0%	20.9%	21.4%
Overweight	Count	212	153	365
	% within BMI Category	58.1%	41.9%	100%
	% within Gender	27.6%	16.3%	21.4%
Obesity Class I	Count	170	195	365
	% within BMI Category	46.6%	53.4%	100%
	% within Gender	22.1%	20.8%	21.4%
Obesity Class II	Count	123	168	291
	% within BMI Category	42.3%	57.7%	100%
	% within Gender	16.0%	17.9%	17.1%
Obesity Class III	Count	94	224	318
	% within BMI Category	29.6%	70.4%	100%
	% within Gender	12.2%	23.9%	18.7%
Total	Count	768	936	1704
	% within BMI Category	45.1%	54.9%	100%
	% within Gender	100%	100%	100%

Table 12.

Crosstabulation between Gender and BMI category.

Gender	BMI Category					Total
	Normal	Overweight	Obesity Class I	Obesity Class II	Obesity Class III	
Male						
Count	169	212	170	123	94	768
Expected Count	164.5	164.5	164.5	131.2	143.3	768.0
% within Gender	22.0%	27.6%	22.1%	16.0%	12.2%	100.0%
% within BMI	46.3%	58.1%	46.6%	42.3%	29.6%	45.1%
% of Total	9.9%	12.4%	10.0%	7.2%	5.5%	45.1%
Standardized	.4	3.7	.4	-.7	-4.1	
Female						
Count	196	153	195	168	224	936
Expected Count	200.5	200.5	200.5	159.8	174.7	936.0
% within Gender	20.9%	16.3%	20.8%	17.9%	23.9%	100.0%
% within BMI	53.7%	41.9%	53.4%	57.7%	70.4%	54.9%
% of Total	11.5%	9.0%	11.4%	9.9%	13.1%	54.9%
Standardized	-.3	-3.4	-.4	.6	3.7	
Total						
Count	365	365	365	291	318	1704
Expected Count	365.0	365.0	365.0	291.0	318.0	1704.0
% within Gender	21.4%	21.4%	21.4%	17.1%	18.7%	100.0%
% within BMI	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
% of Total	21.4%	21.4%	21.4%	17.1%	18.7%	100.0%

Table 13.

Crosstabulation between Insurance Status and BMI category.

Insurance Status	BMI Category						Total
	Normal	Overweight	Obesity Class I	Obesity Class II	Obesity Class III		
Private	Count 220	262	265	191	237	1175	
% within Insurance Status	18.7%	22.3%	22.6%	16.3%	20.2%	100%	
% within BMI Category	60.3%	71.8%	72.6%	65.6%	74.5%	69.0%	
Medicare	Count 113	87	80	70	57	407	
% within Insurance Status	27.8%	21.4%	19.7%	17.2%	14.0%	100%	
% within BMI Category	31.0%	23.8%	21.9%	24.1%	17.9%	23.9%	
Medicaid	Count 10	3	6	9	6	34	
% within Insurance Status	29.4%	8.8%	17.6%	26.5%	17.6%	100%	
% within BMI Category	2.7%	.8%	1.6%	3.1%	1.9%	2.0%	
Workers Comp	Count 5	2	3	6	3	19	
% within Insurance Status	26.3%	10.5%	15.8%	31.6%	15.8%	100%	
% within BMI Category	1.4%	.5%	.8%	2.1%	.9%	1.1%	
No Insurance	Count 17	11	11	15	15	69	
% within Insurance Status	24.6%	15.9%	15.9%	21.7%	21.7%	100%	
% within BMI Category	4.7%	3.0%	3.0%	5.2%	4.7%	4.0%	
Total	Count 365	365	365	291	318	1704	
% within Insurance Status	21.4%	21.4%	21.4%	17.1%	18.7%	100%	
% within BMI Category	100%	100%	100%	100%	100%	100%	

Table 14.

Reported pain frequencies between BMI categories

	BMI Category						Total
	Normal	Overweight	Obesity Class I	Obesity Class II	Obesity Class III		
Mild Pain							
Count	74	90	81	59	65	369	
% within	20.1%	24.4%	22.0%	16.0%	17.6%	100.0%	
Moderate Pain							
Count	97	116	87	61	94	455	
% within	21.3%	25.5%	19.1%	13.4%	20.7%	100.0%	
Moderate/Severe Pain							
Count	0	0	0	0	0	0	
% within	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Severe Pain							
Count	0	0	0	0	0	0	
% within	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Count	171	206	168	120	159	824	

Table 15.

Crosstabulation between moderate pain and BMI

Moderate Pain	No	Count	BMI Category					Total
			Normal	Overweight	Obesity Class I	Obesity Class II	Obesity Class III	
No	Count	268	249	278	230	224	1249	
	Expected Count	267.5	267.5	267.5	213.3	233.1	1249.0	
	% within Moderate Pain	21.5%	19.9%	22.3%	18.4%	17.9%	100.0%	
	% within BMI Category	73.4%	68.2%	76.2%	79.0%	70.4%	73.3%	
Yes	Count	97	116	87	61	94	455	
	Expected Count	97.5	97.5	97.5	77.7	84.9	455.0	
	% within Moderate Pain	21.3%	25.5%	19.1%	13.4%	20.7%	100.0%	
	% within BMI Category	26.6%	31.8%	23.8%	21.0%	29.6%	26.7%	
Total	Count	365	365	365	291	318	1704	
	Expected Count	365.0	365.0	365.0	291.0	318.0	1704.0	
	% within Moderate Pain	21.4%	21.4%	21.4%	17.1%	18.7%	100.0%	
	% within BMI Category	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
	% of Total	21.4%	21.4%	21.4%	17.1%	18.7%	100.0%	

Table 16.

Postoperative day one total morphine equivalent dose descriptive statistics

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
					Lower Bound	Upper Bound	Minimum	Maximum
Normal	349	19.45	17.68	.95	17.59	21.31	1.25	120.00
Overweight	346	18.75	12.08	.65	17.47	20.03	2.50	117.25
Obesity Class I	345	19.45	16.59	.89	17.70	21.21	1.25	115.00
Obesity Class II	275	21.01	17.50	1.06	18.93	23.09	1.25	110.50
Obesity Class III	303	18.05	17.67	1.02	16.06	20.05	2.50	103.75
Total	1618	19.31	16.37	.41	18.51	20.10	1.25	120.00

Table 17.

Multiple comparisons between the log transformed postoperative day one total oral morphine equivalent dose and BMI.

(I) BMI Category		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Normal	Overweight	-.11	.05	.30	-.25	.04
	Obesity Class I	-.01	.06	1.00	-.18	.16
	Obesity Class II	-.05	.07	.96	-.24	.14
	Obesity Class III	.09	.06	.57	-.08	.27
Overweight	Normal	.11	.05	.30	-.04	.25
	Obesity Class I	.10	.05	.36	-.05	.25
	Obesity Class II	.06	.06	.89	-.11	.23
	Obesity Class III	.20*	.06	.00	.05	.35
Obesity Class I	Normal	.01	.06	1.00	-.16	.18
	Overweight	-.10	.05	.36	-.25	.05
	Obesity Class II	-.04	.07	.97	-.23	.15
	Obesity Class III	.10	.06	.52	-.07	.27
Obesity Class II	Normal	.05	.07	.96	-.14	.24
	Overweight	-.06	.06	.89	-.23	.11
	Obesity Class I	.04	.07	.97	-.15	.23
	Obesity Class III	.14	.07	.26	-.05	.33
Obesity Class III	Normal	-.09	.06	.57	-.27	.08
	Overweight	-.20*	.06	.00	-.35	-.05
	Obesity Class I	-.10	.06	.52	-.27	.07
	Obesity Class II	-.14	.07	.26	-.33	.05

Table 18.

Comparison of the number and proportion of each individual pain medication between BMI categories.

		BMI Category				Total
		Normal	Overweight	Obesity Class I	Obesity Class II	
Hydromorphone	Not Ordered-Not Given	19 (29.2%)	2 (3.1%)	18 (27.7%)	17 (26.2%)	65
	Not Ordered-Given	16 (19%)	14 (16.7)	21 (25.5%)	20 (23.8%)	84
	Ordered-Not Given	0	0	0	0	0
	Ordered-Given	325 (21.2%)	344 (22.5%)	323 (21.1%)	249 (16.3%)	1531
Morphine	Not Ordered-Not Given	212 (19.6%)	267 (24.7%)	234 (21.6%)	151 (13.9%)	1083
	Not Ordered-Given	11 (27.5%)	4 (10%)	11 (27.5%)	8 (20%)	40
	Ordered-Not Given	16 (24.2%)	16 (24.2%)	12 (18.2%)	11 (16.7%)	66
	Ordered-Given	122 (24.7%)	74 (15%)	105 (21.3%)	116 (23.5%)	493
Fentanyl	Not Ordered-Not Given	344 (21.5%)	347 (21.7%)	346 (21.6%)	276 (17.3%)	1599
	Not Ordered-Given	0	0	0	0	0
	Ordered-Not Given	5 (20.8%)	4 (16.7%)	7 (29.2%)	3 (12.5%)	24
	Ordered-Given	12 (20.3%)	10 (16.9%)	9 (15.3%)	7 (11.9%)	59
Meperidine	Not Ordered-Not Given	338 (21.4%)	352 (22.3%)	339 (21.5%)	253 (16.1%)	1576
	Not Ordered-Given	10 (20.4%)	5 (10.2%)	15 (30.6%)	11 (22.4%)	49
	Ordered-Not Given	0	0	0	0	0
	Ordered-Given	13 (22.8%)	4 (7%)	8 (14%)	22 (38.6%)	57
Oxycodone	Not Ordered-Not Given	192 (20.6%)	213 (22.9%)	197 (21.1%)	139 (14.9%)	932
	Not Ordered-Given	1 (33.3%)	0 (0%)	1 (33.3%)	1 (33.3%)	3
	Ordered-Not Given	128 (24.1%)	109 (20.5%)	119 (22.4%)	95 (17.9%)	531
	Ordered-Given	40 (18.5%)	39 (18.1%)	45 (20.8%)	51 (23.6%)	216
Ketorolac	Not Ordered-Not Given	277 (21.1%)	281 (21.4%)	268 (20.4%)	228 (17.3%)	1315
	Not Ordered-Given	0	0	0	0	0
	Ordered-Not Given	13 (15.9%)	23 (28%)	19 (23.2%)	13 (15.9%)	82
	Ordered-Given	71 (24.9%)	57 (20%)	75 (26.3%)	45 (15.8%)	285
Acetaminophen	Not Ordered-Not Given	108 (20.2%)	111 (20.8%)	124 (23.2%)	88 (16.5%)	534
	Not Ordered-Given	0	0	1 (100%)	0	1
	Ordered-Not Given	169 (20.5%)	151 (18.3%)	171 (20.8%)	153 (18.6%)	824
	Ordered-Given	84 (26%)	99 (30.7%)	66 (20.4%)	45 (13.9%)	323
Total		361	361	362	286	1682

Proportions represent a comparison of proportion of each separate pain medication ordered administered between BMI categories.

Table 19.

Number and proportion of BMI category across each individual pain medication

	Hydromorphone			Morphine			Fentanyl			Meperidine			
	NO/G	NO/G	O/G	NO/G	NO/G	O/G	NO/G	NO/G	O/G	NO/G	NO/G	O/G	
Normal	19 (5.3%)	16 (4.4%)	325 (90.3%)	212 (58.7%)	11 (3%)	16 (4.4%)	344 (95.3%)	0	5 (1.4%)	12 (3.3%)	338 (93.6%)	10 (2.8%)	13 (3.6%)
Overweight	2 (.6%)	14 (3.9%)	344 (95.6%)	267 (74%)	4 (1.1%)	16 (4.4%)	347 (96.1%)	0	4 (1.1%)	10 (2.8%)	352 (97.5%)	5 (1.4%)	4 (1.1%)
Obesity Class I	18 (5%)	21 (5.8%)	323 (89.2%)	234 (64.6%)	11 (3%)	12 (3.3%)	346 (95.6%)	0	7 (1.9%)	9 (2.5%)	339 (93.6%)	15 (4.1%)	8 (2.2%)
Obesity Class II	17 (5.9%)	20 (7%)	249 (87.1%)	151 (52.8%)	8 (2.8%)	11 (3.8%)	276 (96.5%)	0	3 (1%)	7 (2.4%)	253 (88.5%)	11 (3.8%)	22 (7.7%)
Obesity Class III	9 (2.9%)	13 (4.2%)	290 (92.9%)	219 (70.2%)	6 (1.9%)	11 (3.5%)	286 (91.7%)	0	5 (1.6%)	21 (6.7%)	294 (94.2%)	8 (2.6%)	10 (3.2%)

* NO/NG = Not Ordered/Not Given, NO/G = Not Ordered/Given, O/NG = Ordered/Not Given, O/G = Ordered/Given

Proportions represent the percentage of medication ordered/administered status by BMI category within each separate pain medication and not across all pain medications.

Table 19.

Number and proportion of BMI category across each individual pain medication (cont'd).

	Oxycodone			Ketorolac			Acetaminophen		
	NO/NG	NO/G	O/G	NO/NG	NO/G	O/G	NO/NG	NO/G	O/G
Normal	192 (53.2%)	1 (.3%)	128 (35.5%)	277 (76.7%)	0	13 (3.6%)	108 (29.9%)	0 (46.8%)	169 (23.3%)
Overweight	213 (59%)	0	109 (30.2%)	281 (77.8%)	0	23 (6.4%)	111 (30.7%)	0 (41.8%)	151 (27.4%)
Obesity Class I	197 (54.4%)	1 (.3%)	119 (32.9%)	268 (74%)	0	19 (5.2%)	124 (34.3%)	1 (.3%)	171 (47.2%)
Obesity Class II	139 (48.6%)	1 (.3%)	95 (33.2%)	228 (79.7%)	0	13 (4.5%)	88 (30.8%)	0 (53.5%)	153 (18.2%)
Obesity Class III	191 (61.2%)	0	80 (25.6%)	261 (83.7%)	0	14 (4.5%)	103 (33%)	0 (57.7%)	180 (9.3%)

* NO/NG = Not Ordered/Not Given, NO/G = Not Ordered/Given, O/NG = Ordered/Not Given, O/G = Ordered/Given

Proportions represent the percentage of medication ordered/administered status by BMI category within each separate pain medication and not across all pain medications.

Table 20.

Results of independent sample t-tests.

Dependent Variable	Independent Variable	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	t-test for Equality of Means	
							Lower	Upper
Overweight	Hydromorphone Ordered - Given	3.501	1560	.000	.17698	.05055	.07783	.27613
	Hydromorphone Not Ordered - Not Given	7.374	97,557	.000	.17698	.02400	.12953	.22461
Hydromorphone Ordered - Administered	Overweight	2.549	728	.011	.05205	.02042	.01196	.09215
	Normal	2.549	673,097	.011	.05205	.02042	.01196	.09215
Hydromorphone Ordered - Administered	Overweight	2.779	728	.006	.05733	.02071	.01688	.09818
	Obesity Class I	2.779	666,023	.006	.05733	.02071	.01688	.09819
Hydromorphone Ordered - Administered	Overweight	3.783	654	.000	.08680	.02394	.04175	.13184
	Obesity Class II	3.620	481,438	.000	.08680	.02398	.03969	.13391
Hydromorphone Ordered - Administered	Obesity Class III	2.180	607	.030	.05628	.02582	.00538	.10698
	Obesity Class II	2.160	557,234	.031	.05628	.02606	.00509	.10747
Overweight	Morphine Not Ordered - Not Administered	4.052	1537	.000	.08816	.02176	.04548	.13084
	Morphine Ordered - Given	4.947	1127,232	.000	.08816	.02028	.04837	.12796
Morphine Not Ordered - Not Administered	Overweight	5.759	654	.000	.21261	.03692	.14011	.28510
	Obesity Class II	5.681	584,520	.000	.21261	.03742	.13911	.28610
Morphine Not Ordered - Not Administered	Obesity Class I	3.177	654	.002	.12220	.03846	.04668	.19772
	Obesity Class II	3.163	610,154	.002	.12220	.03864	.04631	.19808
Morphine Not Ordered - Not Administered	Obesity Class III	4.345	607	.000	.16978	.03907	.09304	.24652
	Obesity Class II	4.330	590,976	.000	.16978	.03921	.09278	.24678
Morphine Not Ordered - Not Administered	Overweight	4.335	728	.000	.15068	.03476	.08244	.21893
	Normal	4.335	719,761	.000	.15068	.03476	.08244	.21893
Morphine Not Ordered - Not Administered	Obesity Class III	2.928	681	.004	.10786	.03684	.03553	.18019
	Normal	2.941	677,216	.003	.10786	.03668	.03584	.17987
Morphine Ordered - Administered	Normal	4.048	728	.000	.13151	.03249	.06773	.19529
	Overweight	4.048	710,159	.000	.13151	.03249	.06773	.19529
Morphine Ordered - Administered	Normal	2.748	681	.006	.09525	.03466	.02719	.16331
	Obesity Class III	2.767	680,050	.006	.09525	.03442	.02766	.16284

Table 20.

Results of independent sample t-tests.

Dependent Variable	Independent Variable	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	t-test for Equality of Means	
							Lower	Upper
Overweight	Meperidine Not Ordered-Not Given	2.499	1593	.013	.13464	.05388	.02895	.24032
	Meperidine Ordered-Given	3.776	66,628	.000	.13464	.05365	.06346	.20581
Meperidine Not Ordered - Not Admin	Overweight	4.578	654	.000	.09497	.02075	.05423	.13570
	Obesity Class II	4.308	42,689	.000	.09497	.02204	.05164	.13829
Meperidine Ordered - Admin	Obesity Class II	4.268	654	.000	.06464	.01515	.03490	.09438
	Overweight	3.928	361,695	.000	.06464	.01645	.03228	.09700
Meperidine Ordered - Admin	Obesity Class II	3.292	654	.001	.05368	.01631	.02166	.08571
	Obesity Class I	3.100	428,668	.002	.05368	.01732	.01965	.08772
Obese Class II	Oxycodone Ordered-Given	3.121	1120	.002	.08913	.02836	.03310	.14516
	Oxycodone Not Ordered-Not Given	2.798	28,215	.006	.08913	.03186	.02642	.15183
Obese Class III	Oxycodone Not Ordered-Not Given	2.580	1428	.010	.05552	.02152	.01331	.09773
	Oxycodone Ordered-Not Given	2.666	1185,424	.008	.05552	.02083	.01465	.09638
Oxycodone Not Ordered - Not Admin	Obesity Class III	3.061	607	.002	.12297	.04018	.04406	.20187
	Obesity Class II	3.058	599,913	.002	.12297	.04021	.04399	.20194
Obese Class III	Ketorolac Not Ordered-Not Given	2.585	1561	.010	.06745	.02609	.01627	.11863
	Ketorolac Ordered-Given	2.868	448,283	.004	.06745	.02352	.02122	.11367
Ketorolac Ordered - Admin	Obesity Class I	3.156	681	.002	.08913	.02824	.03368	.14457
	Obesity Class III	3.206	675,300	.001	.08913	.02780	.03454	.14371
Obese Class III	Acetaminophen Not Ordered-Not Given	4.020	838	.000	.10346	.02574	.05294	.15398
	Acetaminophen Ordered-Given	4.342	804,835	.000	.10346	.02383	.05669	.15023
Obese Class III	Acetaminophen Ordered-Not Given	5.133	1115	.000	.13180	.02568	.08142	.18219
	Acetaminophen Ordered-Given	5.987	816,223	.000	.13180	.02202	.08859	.17502
Overweight	Acetaminophen Not Ordered-Not Given	3.142	838	.002	.09399	.02992	.03527	.15327
	Acetaminophen Ordered-Given	3.037	590,431	.002	.09399	.03094	.03522	.15476
Overweight	Acetaminophen Ordered-Not Given	4.871	1115	.000	.12792	.02626	.07944	.17639
	Acetaminophen Ordered-Given	4.449	482,318	.000	.12792	.02875	.07142	.17142

Table 20.

Results of independent sample t-tests.

Dependent Variable	Independent Variable	t	df	Sig. (2-tailed)	t-test for Equality of Means			
					Mean Difference	Std. Error Difference	Lower	Upper
Acetaminophen Ordered - Admin	Normal	4.954	681	.000	.13894	.02804	.08388	.19401
	Obesity Class III	5.080	646.030	.000	.13894	.02735	.08323	.19265
Acetaminophen Ordered - Admin	Overweight	6.171	681	.000	.18004	.02917	.12276	.23732
	Obesity Class III	6.348	630.938	.000	.18004	.02836	.12434	.23574
Acetaminophen Ordered - Admin	Obesity Class I	3.400	681	.001	.08963	.02636	.03787	.14139
	Obesity Class III	3.467	666.206	.001	.08963	.02585	.03886	.14039
Acetaminophen Ordered - Admin	Overweight	3.614	654	.000	.11659	.03226	.03325	.17994
	Obesity Class II	3.698	653.727	.000	.11659	.03152	.05469	.17830
Acetaminophen Ordered - Not Admin	Obesity Class III	2.697	681	.007	.10302	.03820	.02802	.17802
	Normal	2.698	669.282	.007	.10302	.03818	.02805	.17800
Acetaminophen Ordered - Not Admin	Obesity Class III	4.015	681	.000	.15234	.03795	.07783	.22685
	Overweight	4.013	667.040	.000	.15234	.03796	.07780	.22688

Table 21.

Descriptive statistics for postop day 1 regression variables.

	Mean	Std. Deviation	N
Log transformed total morphine equivalent	2.6788	0.8167	1581
Age	56.9798	15.8488	1581
Log transformed BMI	3.4575	0.2610	1581

Table 22.

Bivariate correlation - hierarchical regression outliers intact - postop day 1.

	ln_total_24_equiv	age	ln_bmi
Pearson Correlation ln_total_24_equiv	1.000		
age	-.077**	1.000	
ln_bmi	-.059*	-.264***	1.000

* p<.05. **p<.01. ***p<.001.

Table 23.

Bivariate and partial correlations between log transformed total morphine equivalent dose on postop day 1 and predictor variables – hierarchical regression outliers intact.

	Bivariate Correlation	Partial Correlations
Age	-.077**	-.095***
ln_bmi	-.059*	-.078**

* p<.05. **p<.01. ***p<.001.

Table 24.

Summary of hierarchical multiple linear regression - outliers intact - postop day 1.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics		
	B	Std. Error	Beta	Sig.			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF	
1														
	(Constant)	3.017	.092		32.941	.000	2.838	3.197						
	age	-.004	.001	-.086	-3.122	.002	-.007	-.002	-.077	-.079	-.077	.808	1.238	
	Gender	-.153	.041	-.093	-3.717	.000	-.234	-.072	-.087	-.093	-.092	.969	1.032	
	Black	-.066	.079	-.021	-.841	.401	-.220	.088	-.022	-.021	-.021	.972	1.029	
	Asian	.421	.467	.022	.900	.368	-.496	1.338	.023	.023	.022	.987	1.014	
	All Other	.033	.090	.009	.370	.712	-.143	.210	.019	.009	.009	.936	1.068	
	Medicare	-.006	.051	-.003	-.126	.900	-.107	.094	-.032	-.003	-.003	.855	1.170	
	Medicaid	-.128	.147	-.022	-.868	.386	-.416	.161	.002	-.022	-.021	.951	1.051	
	Workers Comp	.911	.192	.118	4.754	.000	.535	1.287	.129	.119	.118	.987	1.013	
	No Insurance	-.069	.106	-.017	-.653	.514	-.278	.139	-.003	-.016	-.016	.932	1.073	
	psych_diag_yes_no	.223	.071	.078	3.134	.002	.084	.363	.084	.079	.078	.977	1.023	
	Mild Pain	-.012	.052	-.006	-.231	.818	-.114	.090	.016	-.006	-.006	.893	1.120	
	Moderate Pain	-.078	.048	-.042	-1.614	.107	-.173	.017	-.039	-.041	-.040	.892	1.121	
2														
	(Constant)	3.939	.310		12.699	.000	3.330	4.547						
	age	-.005	.001	-.107	-3.773	.000	-.008	-.003	-.077	-.095	-.093	.763	1.310	
	Gender	-.142	.041	-.087	-3.440	.001	-.223	-.061	-.087	-.087	-.085	.961	1.040	
	Black	-.065	.078	-.021	-.833	.405	-.219	.088	-.022	-.021	-.021	.972	1.029	
	Asian	.372	.466	.020	.799	.425	-.542	1.287	.023	.020	.020	.985	1.015	
	All Other	.037	.090	.011	.412	.680	-.139	.213	.019	.010	.010	.936	1.068	
	Medicare	-.006	.051	-.003	-.123	.902	-.107	.094	-.032	-.003	-.003	.855	1.170	
	Medicaid	-.134	.147	-.023	-.916	.360	-.422	.153	.002	-.023	-.023	.951	1.051	
	Workers Comp	.908	.191	.118	4.751	.000	.533	1.283	.129	.119	.117	.987	1.013	
	No Insurance	-.075	.106	-.018	-.711	.477	-.283	.132	-.003	-.018	-.018	.932	1.073	
	psych_diag_yes_no	.232	.071	.082	3.262	.001	.092	.372	.084	.082	.081	.976	1.025	
	Mild Pain	-.016	.052	-.008	-.299	.765	-.117	.086	.016	-.008	-.007	.893	1.120	
	Moderate Pain	-.082	.048	-.044	-1.694	.090	-.176	.013	-.039	-.043	-.042	.891	1.122	
	ln_brr1	-.250	.081	-.080	-3.108	.002	-.408	-.092	-.059	-.078	-.077	.919	1.088	

a. Dependent Variable: ln_total_24_equiv

Table 25.

Bivariate correlations - hierarchical regression outliers removed - postop day 1.

		ln_total_24_equiv	age	ln_bmi
Pearson	ln_total_24_equiv	1.000		
Correlation	age	-.067**	1.000	
	ln_bmi	-.059**	-.261***	1.000

p<.01. *p<.001.

Table 26.

Bivariate and partial correlations between log transformed total morphine equivalent dose on postop day 1 and predictor variables – hierarchical regression outliers removed.

	Bivariate Correlation	Partial Correlations
Age	-.067**	-.090***
ln_bmi	-.059**	-.078**

p<.01. *p<.001.

Table 27.

Summary of hierarchical multiple linear regression outliers removed - postop day 1.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	95% Confidence Interval for B			Correlations			Collinearity Statistics		
	B	Std. Error	Beta				Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF		
1	(Constant)	3.003	.093		32.197	.000	2.820	3.186							
	age	-.004	.001	-.081	-2.885	.004	-.007	-.001	-.067	-.074	-.074	.820	1.220		
	Gender	-.152	.042	-.094	-3.623	.000	-.234	-.070	-.082	-.093	-.092	.976	1.025		
	Black	-.092	.082	-.029	-1.121	.262	-.253	.069	-.028	-.029	-.029	.987	1.013		
	All Other	.004	.096	.001	.046	.963	-.183	.192	.012	.001	.001	.958	1.044		
	Medicare	-.009	.051	-.005	-.174	.862	-.110	.092	-.022	-.004	-.004	.861	1.162		
	No Insurance	-.126	.118	-.028	-1.064	.287	-.358	.106	-.015	-.027	-.027	.963	1.038		
	psych_diag_yes_no	.231	.075	.079	3.076	.002	.084	.377	.080	.079	.078	.986	1.014		
	Mild Pain	-.020	.053	-.010	-.380	.704	-.124	.084	.006	-.010	-.010	.894	1.119		
	Moderate Pain	-.064	.049	-.035	-1.293	.196	-.160	.033	-.032	-.033	-.033	.892	1.121		
	2	(Constant)	3.916	.317		12.365	.000	3.295	4.537						
age		-.005	.001	-.102	-3.518	.000	-.008	-.002	-.067	-.090	-.090	.775	1.291		
Gender		-.142	.042	-.087	-3.378	.001	-.224	-.059	-.082	-.087	-.086	.969	1.032		
Black		-.095	.082	-.030	-1.157	.247	-.256	.066	-.028	-.030	-.029	.987	1.013		
All Other		.007	.095	.002	.075	.941	-.180	.194	.012	.002	.002	.958	1.044		
Medicare		-.009	.051	-.005	-.179	.858	-.110	.091	-.022	-.005	-.005	.861	1.162		
No Insurance		-.141	.118	-.031	-1.193	.233	-.373	.091	-.015	-.031	-.030	.961	1.040		
psych_diag_yes_no		.237	.075	.081	3.177	.002	.091	.384	.080	.082	.081	.985	1.015		
Mild Pain		-.023	.053	-.012	-.440	.660	-.127	.080	.006	-.011	-.011	.893	1.119		
Moderate Pain		-.068	.049	-.037	-1.384	.167	-.164	.028	-.032	-.036	-.035	.892	1.122		
ln_bmi		-.248	.082	-.080	-3.015	.003	-.409	-.087	-.059	-.078	-.077	.922	1.085		

a. Dependent Variable: ln_total_24_equiv

Table 28.

Descriptive statistics for postop day 2 regression variables.

	Mean	Std. Deviation	N
Log transformed total morphine equivalent	2.5287	.93357	511
Age	55.64	16.213	511
Log transformed BMI	3.4499	.26474	511

Table 29.

Bivariate correlations - hierarchical regression outliers intact - postop day 2.

	ln_total_48_equiv	age	ln_bmi
Pearson ln_total_48_equiv	1.000		
Correlation Age	-.079	1.000	
ln_bmi	.043	-.214***	1.000

***p<.001.

Table 30.

Bivariate and partial correlations between log transformed total morphine equivalent dose on postop day 2 and predictor variables – hierarchical regression outliers intact.

	Bivariate Correlation	Partial Correlations
Age	-.079	-.077
ln_bmi	.043	.023

* $p < .05$. ** $p < .01$.

Table 31.

Summary of hierarchical multiple linear regression - outliers intact - posttop day 2.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Correlations			Collinearity Statistics		
	B	Std. Error	Beta				Zero-order	Partial	Part	Tolerance	VIF	
1												
(Constant)	2.946	.188			15.634	.000						
Age	-.005	.003	-.093		-1.826	.069	-.079	-.082	-.080	.730	1.369	
Gender	-.216	.084	-.115		-2.579	.010	-.109	-.115	-.112	.962	1.040	
Black	.121	.163	.033		.741	.459	.030	.033	.032	.970	1.030	
Asian	-.111	.656	-.007		-.169	.866	-.015	-.008	-.007	.986	1.014	
All Other	-.210	.175	-.055		-1.198	.232	-.035	-.054	-.052	.891	1.122	
Medicare	.008	.105	.004		.073	.942	-.036	.003	.003	.798	1.253	
Medicaid	.233	.256	.041		.911	.363	.065	.041	.040	.946	1.057	
Workers Comp	.838	.296	.124		2.825	.005	.133	.126	.123	.981	1.019	
No Insurance	-.141	.205	-.032		-.687	.492	-.018	-.031	-.030	.881	1.136	
Psych_diag_yes_no	.159	.125	.056		1.271	.204	.067	.057	.055	.972	1.029	
Mild Pain	-.168	.106	-.074		-1.586	.113	-.079	-.071	-.069	.870	1.150	
Moderate Pain	.028	.096	.014		.289	.773	.057	.013	.013	.861	1.162	
2												
(Constant)	2.650	.607			4.366	.000						
Age	-.005	.003	-.089		-1.727	.085	-.079	-.077	-.075	.714	1.401	
Gender	-.219	.084	-.116		-2.609	.009	-.109	-.116	-.114	.956	1.046	
Black	.115	.164	.031		.704	.482	.030	.032	.031	.966	1.035	
Asian	-.087	.658	-.006		-.132	.895	-.015	-.006	-.006	.982	1.019	
All Other	-.217	.176	-.057		-1.235	.218	-.035	-.055	-.054	.886	1.129	
Medicare	.010	.106	.005		.093	.926	-.036	.004	.004	.797	1.255	
Medicaid	.224	.257	.039		.873	.383	.065	.039	.038	.942	1.062	
Workers Comp	.834	.297	.124		2.809	.005	.133	.125	.123	.980	1.020	
No Insurance	-.138	.205	-.031		-.670	.503	-.018	-.030	-.029	.880	1.137	
Psych_diag_yes_no	.151	.127	.053		1.189	.235	.067	.053	.052	.955	1.048	
Mild Pain	-.168	.106	-.074		-1.580	.115	-.079	-.071	-.069	.870	1.150	
Moderate Pain	.030	.096	.015		.314	.754	.057	.014	.014	.859	1.164	
ln_bmi	.083	.161	.023		.513	.608	.043	.023	.022	.908	1.101	

a. Dependent Variable: ln_total_48_equir

Table 32.

Bivariate correlations - hierarchical regression outliers removed - postop day 2.

		ln_total_48_ equiv	age	ln_bmi
Pearson	ln_total_48_equiv	1.000		
Correlation	Age	-.076	1.000	
	ln_bmi	.074	-.184***	1.000

***p<.001.

Table 33.

Bivariate and partial correlations between log transformed total morphine equivalent dose on postop day 2 and predictor variables – hierarchical regression outliers removed.

	Bivariate Correlation	Partial Correlations
Age	-.076	-.063
ln_bmi	.074	.062

* $p < .05$.

Table 34.

Summary of hierarchical multiple linear regression - outliers removed - postop day 2.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta				Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1													
(Constant)	2.847	.190			14.993	.000	2.474	3.220					
Age	-.004	.003	-.083		-1.513	.131	-.010	.001	-.076				.724
Gender	-1.186	.084	-.105		-2.209	.028	-.352	-.021	-.103	-.104			.956
Black	1.149	.178	.039		.838	.402	-.201	.499	.033	.040	.039		.988
Asian	-.092	.626	-.007		-.148	.883	-1.322	1.138	-.016	-.007	-.007		.984
All Other	-.106	.179	-.029		-.592	.554	-.458	.246	-.007	-.028	-.027		.882
Medicare	.010	.108	.005		.089	.929	-.202	.221	-.029	.004	.004		.793
Medicaid	.176	.254	.033		.690	.490	-.324	.676	.056	.033	.032		.939
Workers Comp	.718	.338	.100		2.126	.034	.054	1.382	.108	.100	.099		.976
No Insurance	-.095	.205	-.023		-.465	.642	-.497	.307	-.007	-.022	-.022		.876
Psych_diag_yes_no	.133	.127	.050		1.050	.294	-.116	.383	.063	.050	.049		.969
Mild Pain	-.147	.107	-.068		-1.370	.171	-.358	.064	-.081	-.065	-.064		.880
Moderate Pain	.067	.097	.034		.686	.493	-.124	.258	-.079	.033	.032		.866
2													
(Constant)	1.975	.693			2.848	.005	.612	3.337					
Age	-.004	.003	-.073		-1.336	.182	-.010	.002	-.076				.712
Gender	-1.190	.084	-.107		-2.251	.025	-.356	-.024	-.103	-.106	-.104		.955
Black	1.154	.178	.040		.863	.388	-.196	.503	.033	.041	.040		.988
Asian	-.028	.627	-.002		-.045	.964	-1.261	1.204	-.016	-.002	-.002		.978
All Other	-.117	.179	-.032		-.654	.513	-.469	.235	-.007	-.031	-.030		.880
Medicare	.018	.108	.009		.171	.864	-.193	.230	-.029	.008	.008		.790
Medicaid	1.149	.255	.028		.582	.561	-.353	.650	.056	.028	.027		.932
Workers Comp	.738	.338	.103		2.184	.029	.074	1.402	.108	.103	.101		.974
No Insurance	-.082	.205	-.020		-.401	.688	-.484	.320	-.007	-.019	-.019		.874
Psych_diag_yes_no	1.109	.128	.041		.851	.395	-.143	.361	.063	.040	.040		.949
Mild Pain	-.140	.107	-.065		-1.306	.192	-.351	.071	-.081	-.062	-.061		.878
Moderate Pain	.077	.097	.040		.793	.428	-.114	.269	.079	.038	.037		.860
In_bmi	2.45	.188	.063		1.308	.192	-.123	.614	.074	.062	.061		.918

a. Dependent Variable: ln_total_48_equiv

Figure 1.

Frequency distribution of total postoperative day 1 oral morphine equivalent dose prior to transformation.

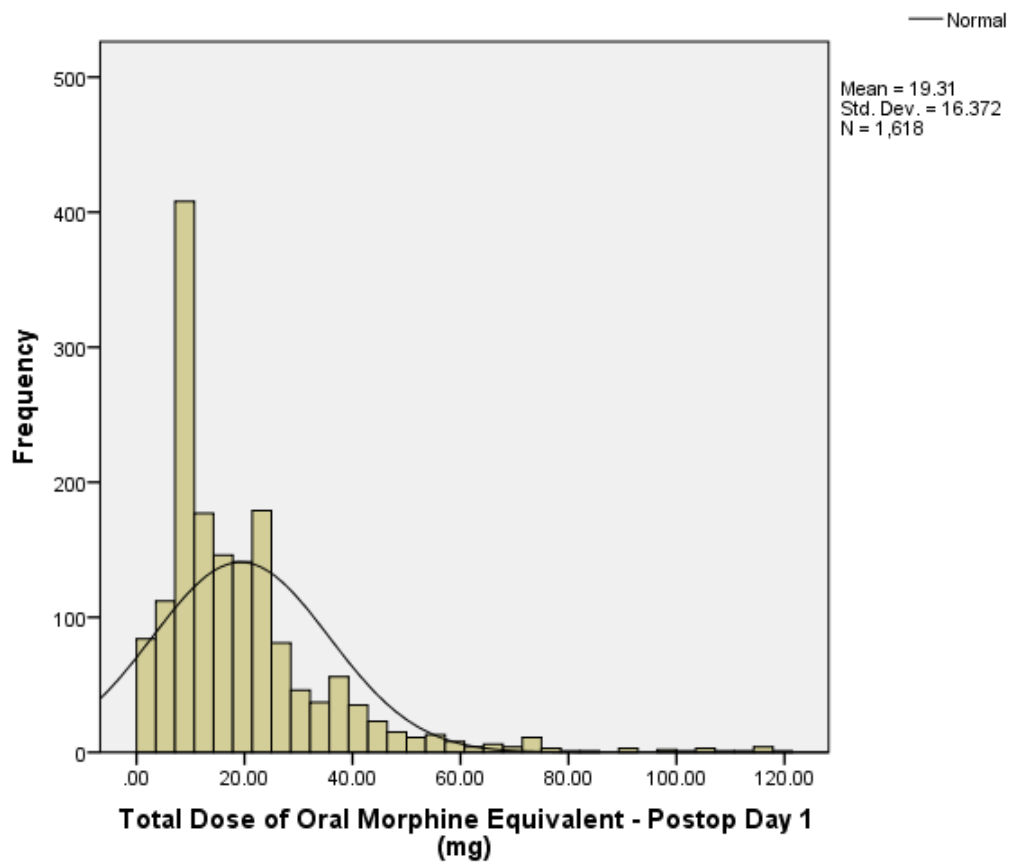


Figure 2.

Frequency distribution of total postoperative day two oral morphine equivalent dose prior to transformation.

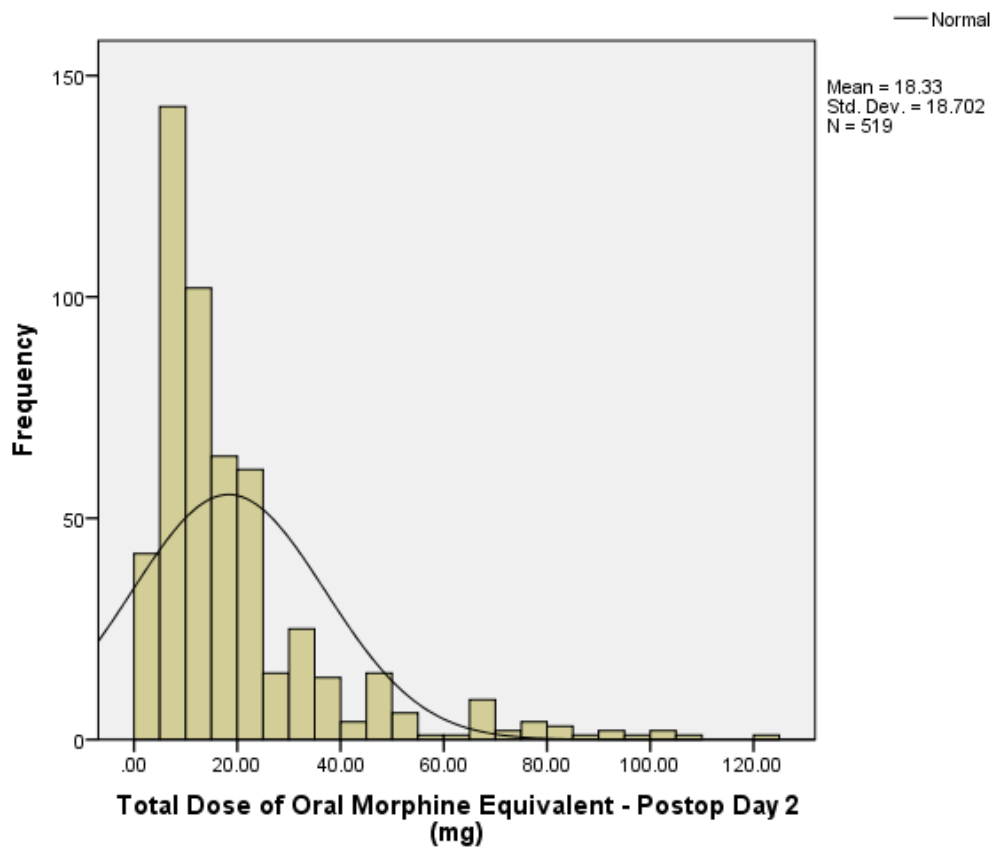


Figure 3.

Q-Q of total postoperative day one oral morphine equivalent dose prior to transformation.

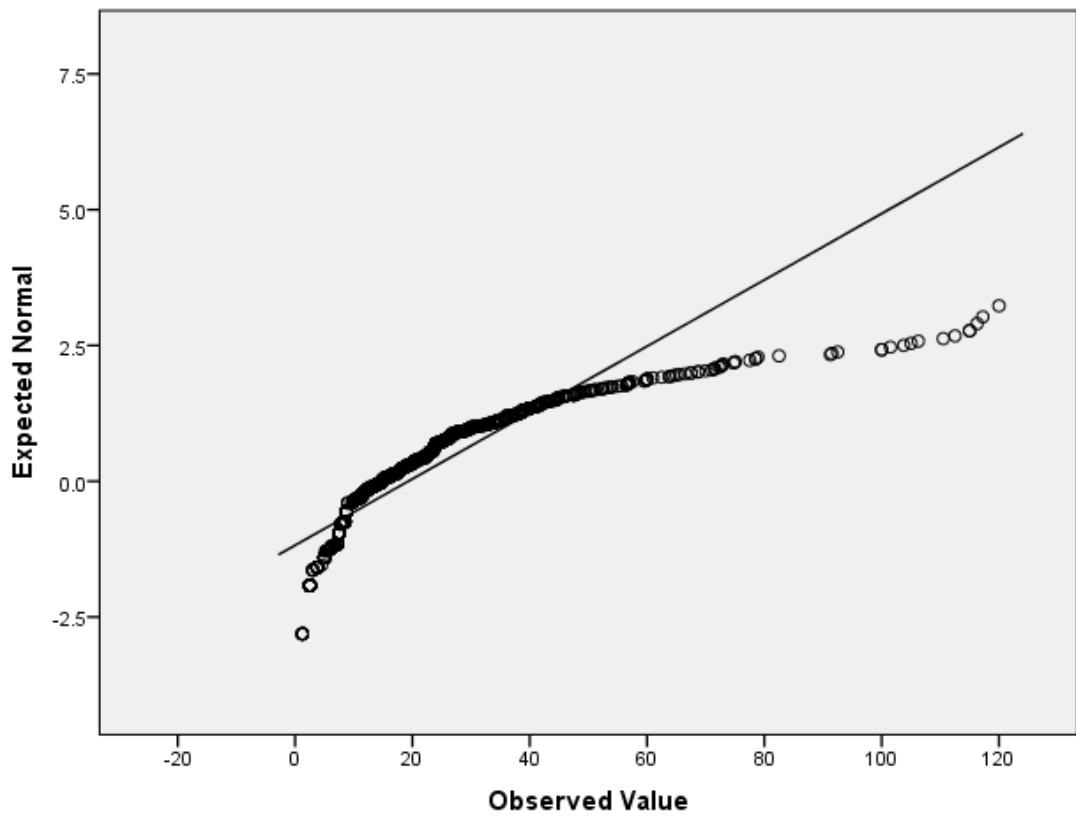


Figure 4.

Q-Q of total postoperative day two oral morphine equivalent dose prior to transformation.

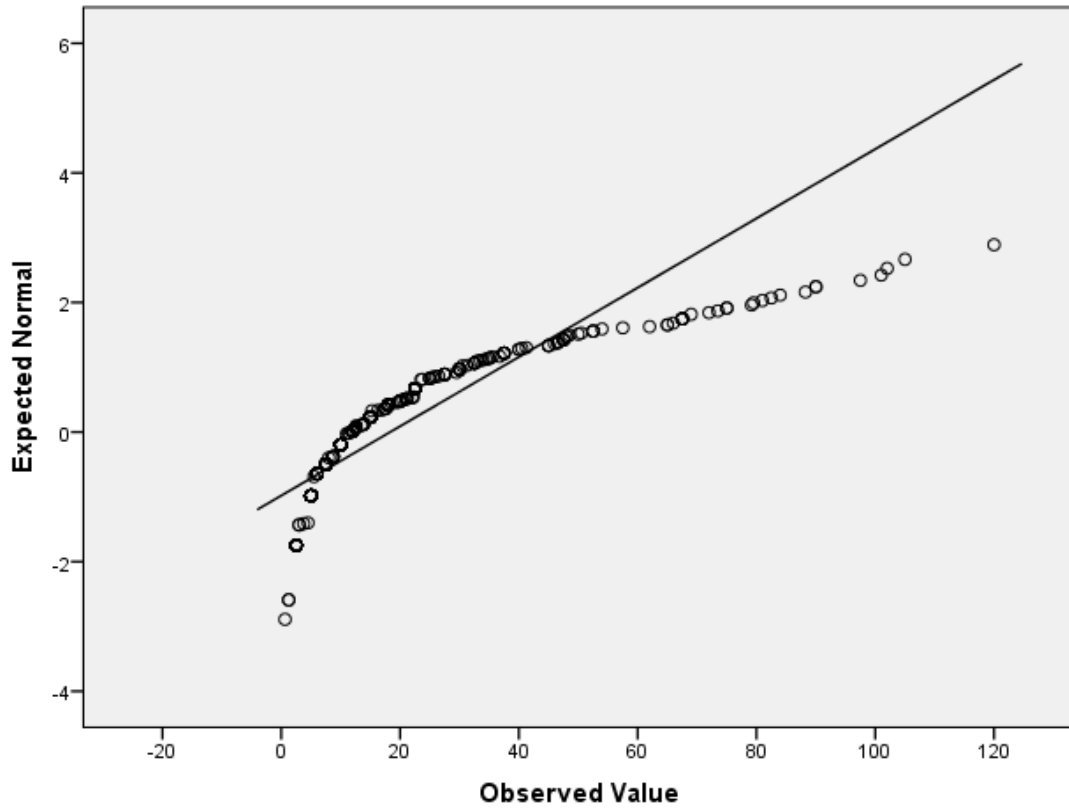


Figure 5.

Logarithmic transformed total postoperative day 1 oral morphine equivalent dose.

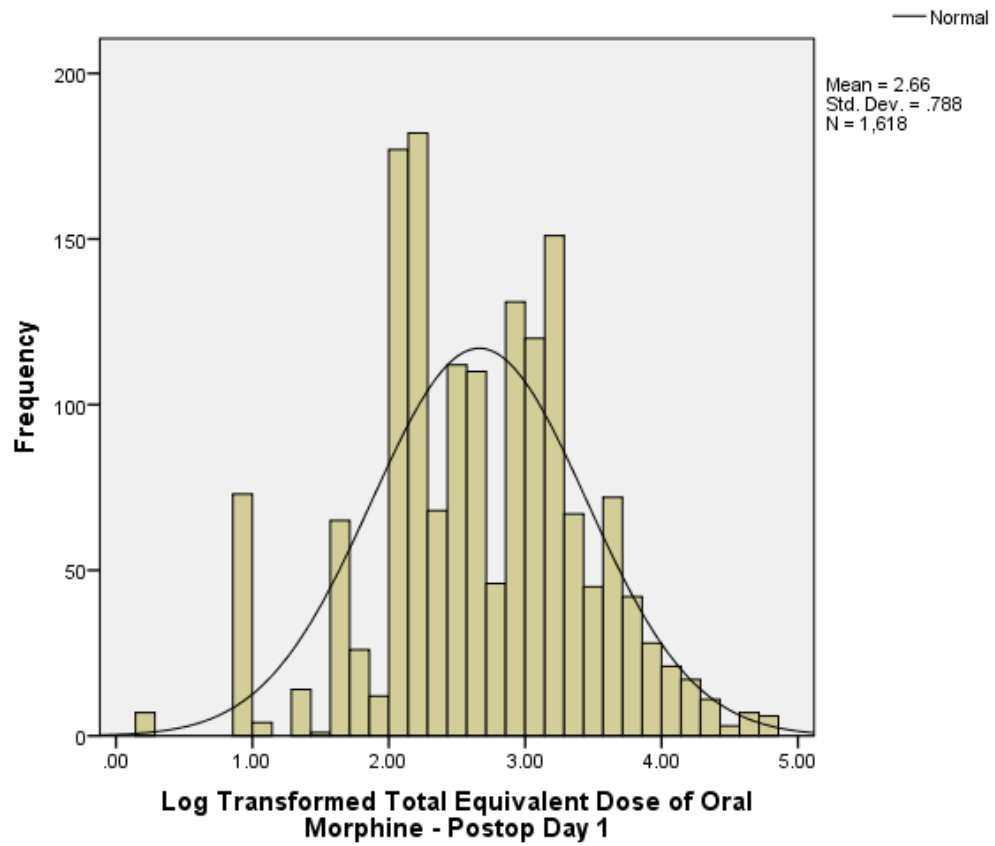


Figure 6.

Logarithmic transformed total postoperative day 2 oral morphine equivalent dose.

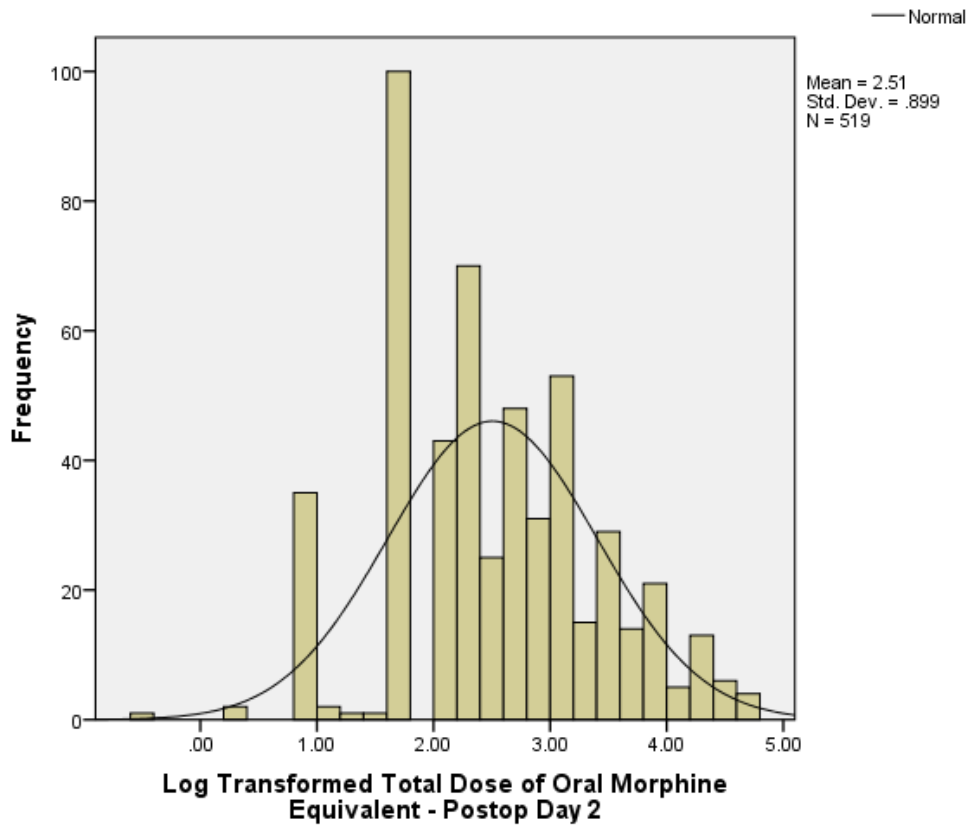


Figure 7.

Q-Q of log transformed total postoperative day one oral morphine equivalent dose.

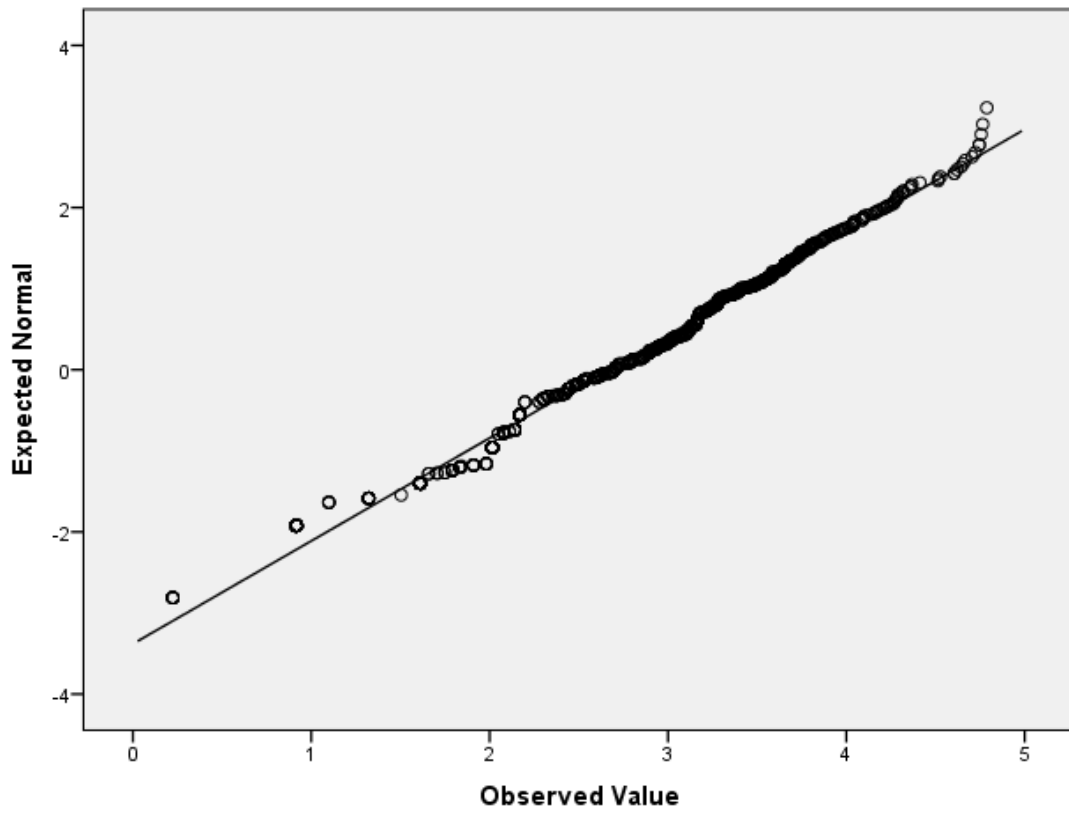


Figure 8.

Q-Q of log transformed total postoperative day one oral morphine equivalent dose.

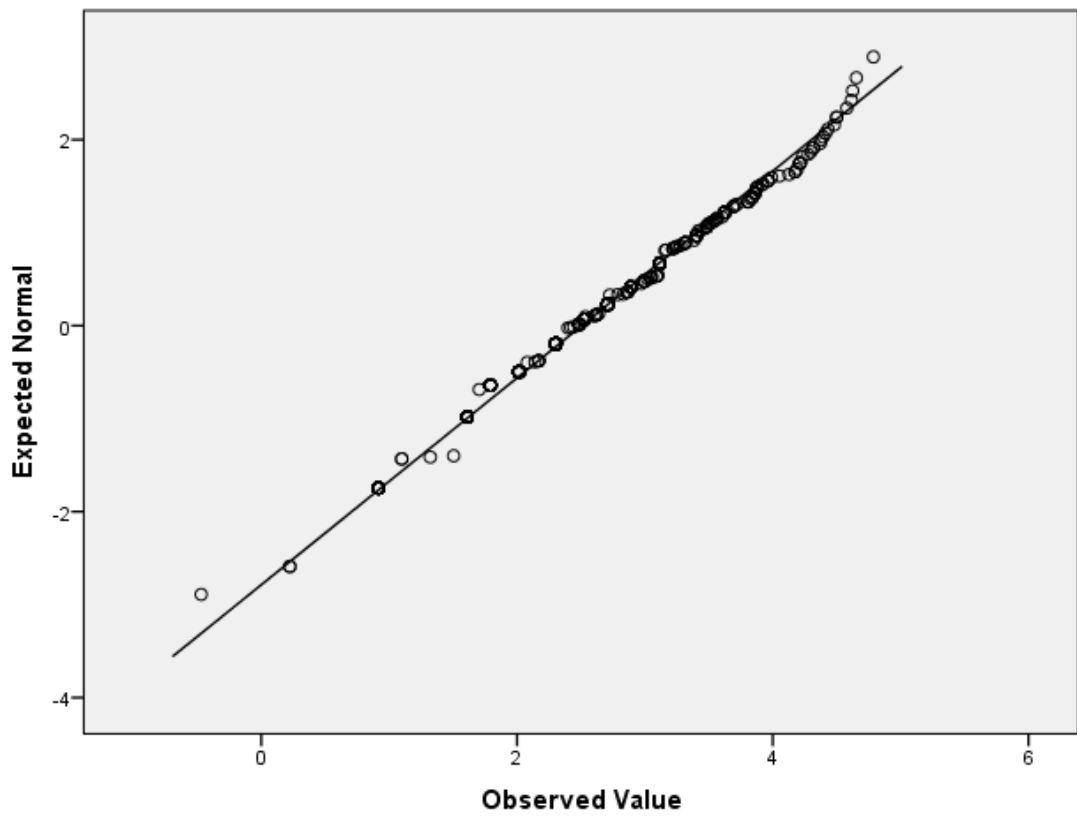


Figure 9.

Mean plot of the log transformed total postop day one morphine equivalent dose X

BMI.

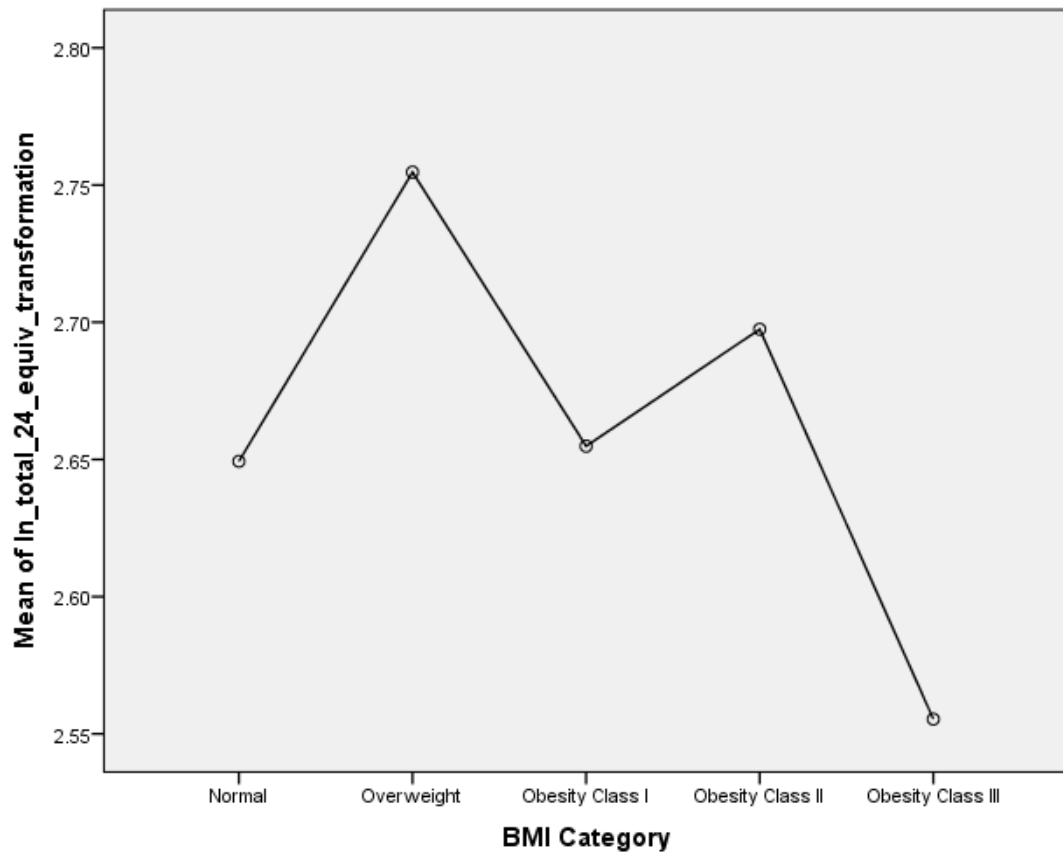


Figure 10.

Residual histogram for total postop day 1 morphine equivalent dose.

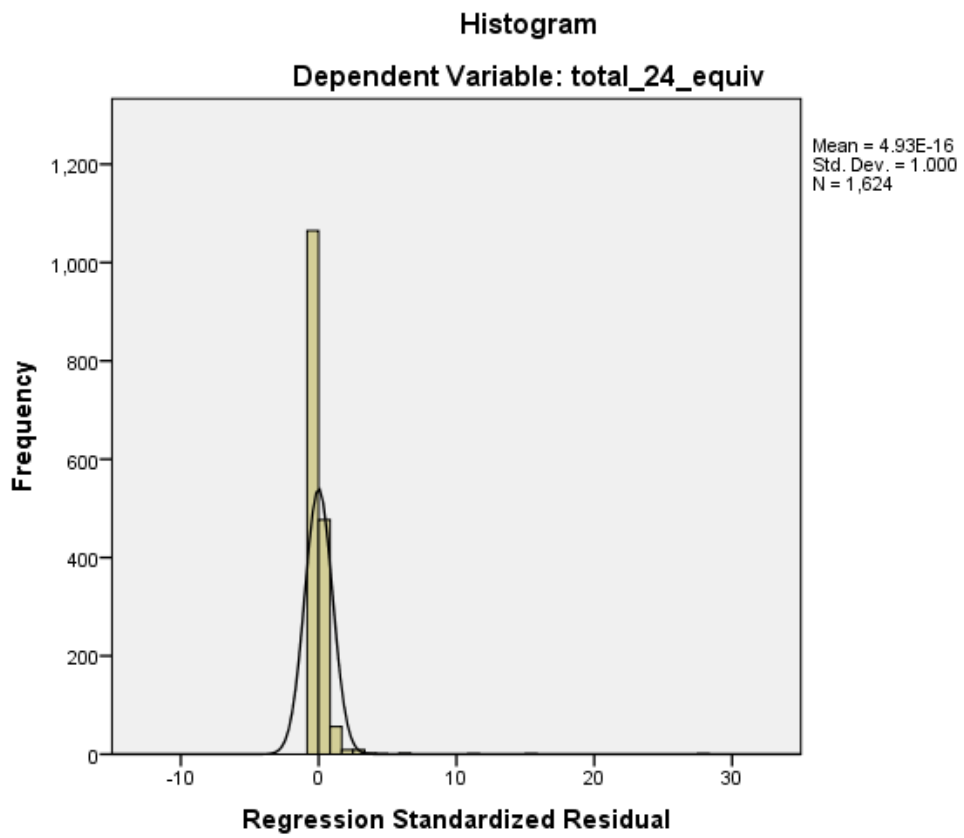


Figure 11.

P-P plot of regression standardized residual for total postop day 1 morphine equivalent dose.

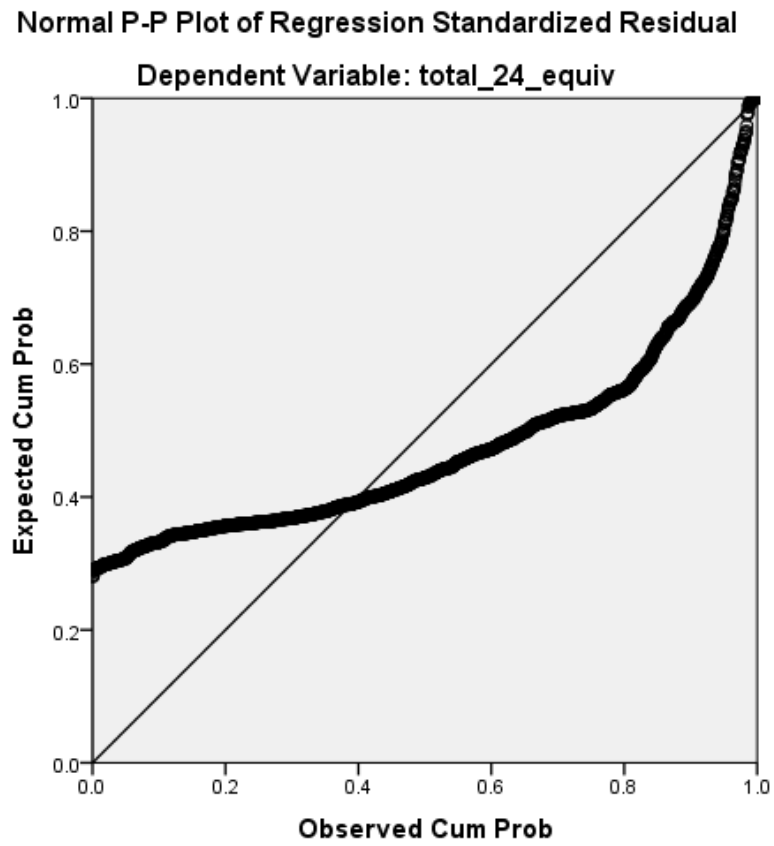


Figure 12.

Scatterplot of standardized residuals and standardized predicted values of total postop day 1 oral morphine equivalent dose.

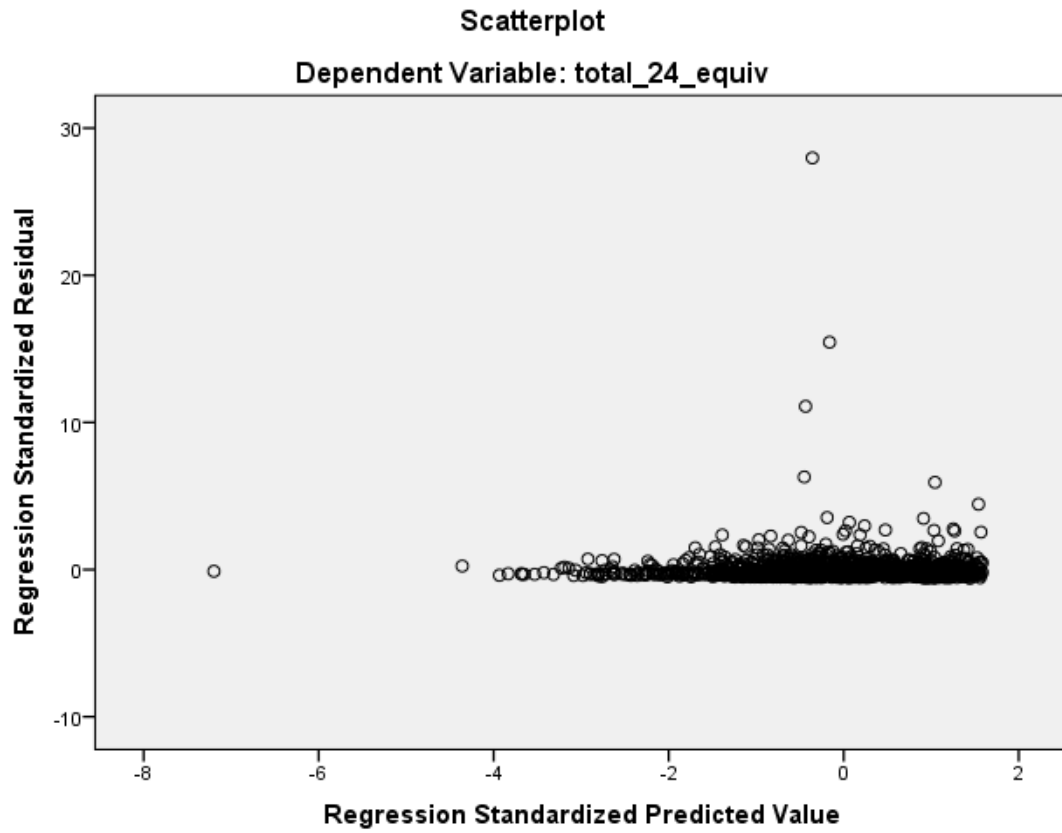


Figure 13.

Scatterplot of standardized residuals and standardized predicted values of the natural log transformed total postop day 1 oral morphine equivalent dose.

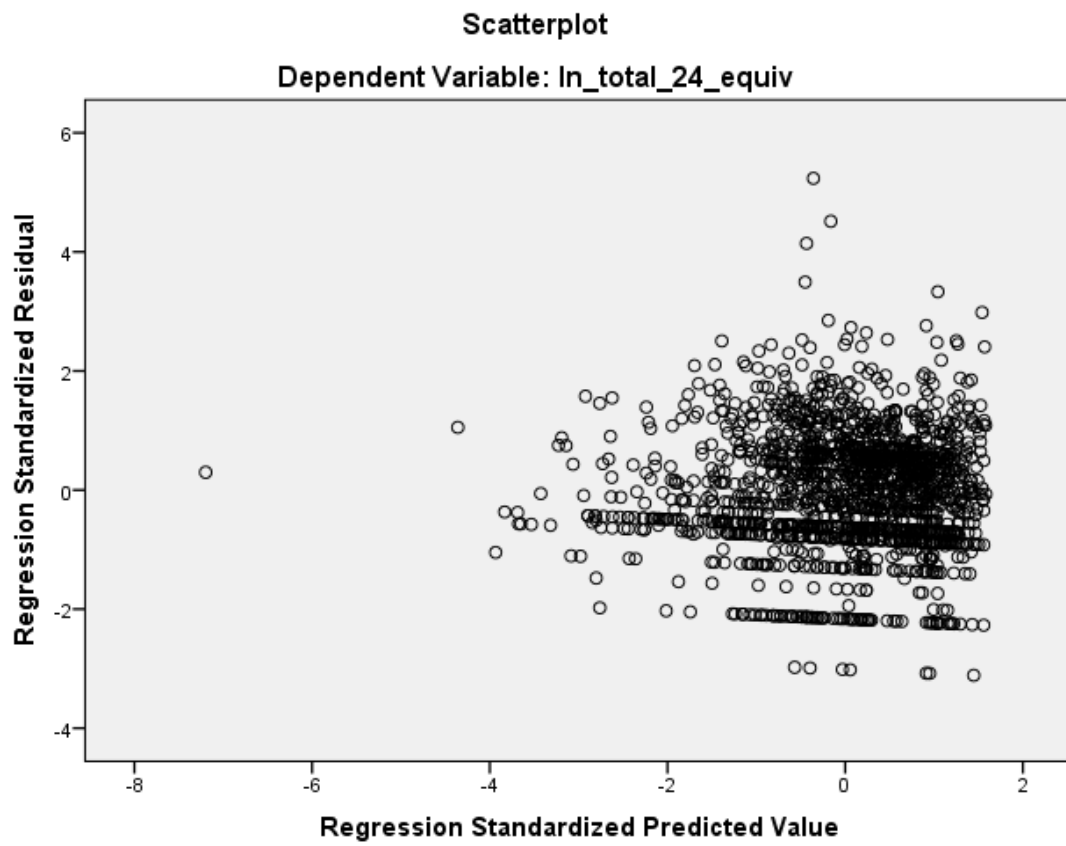


Figure 14.

Scatterplot of standardized residuals and standardized predicted values of the natural log transformed total postop day 1 oral morphine equivalent dose DV and natural log transformed IV, BMI.

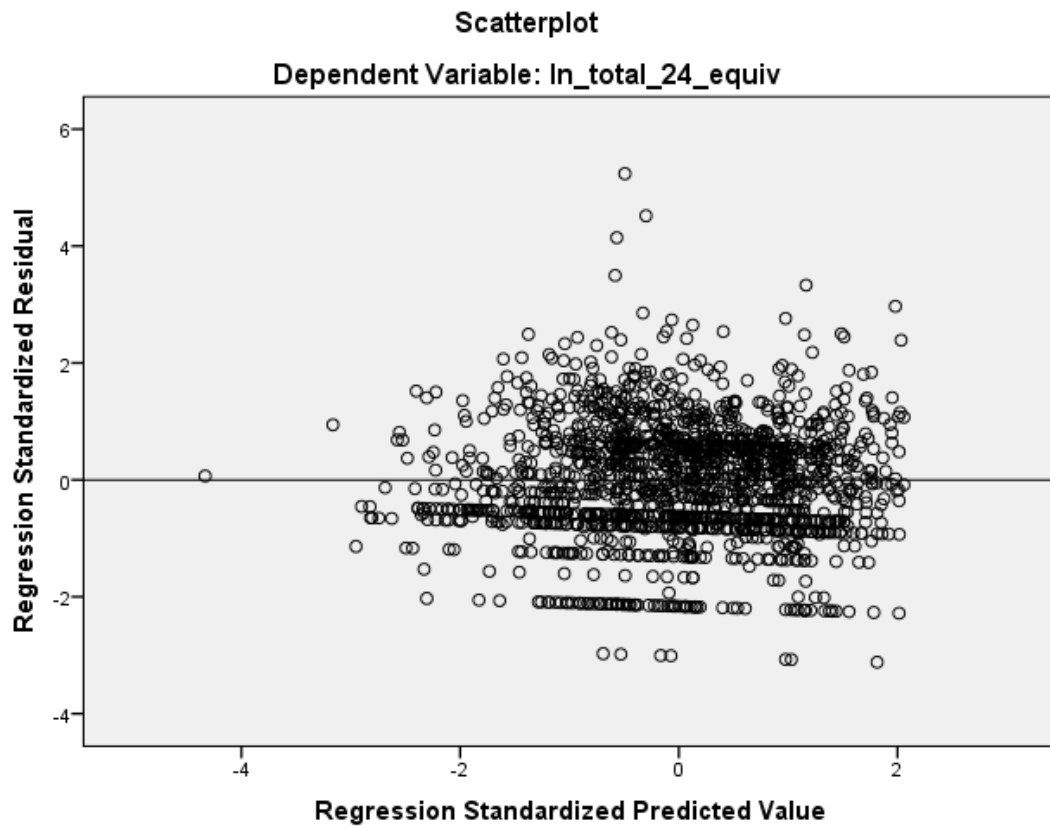


Figure 15.

Normal distribution of regression standardized residual for the natural log transformed total postop day 1 morphine equivalent dose DV and the natural log transformed IV, BMI.

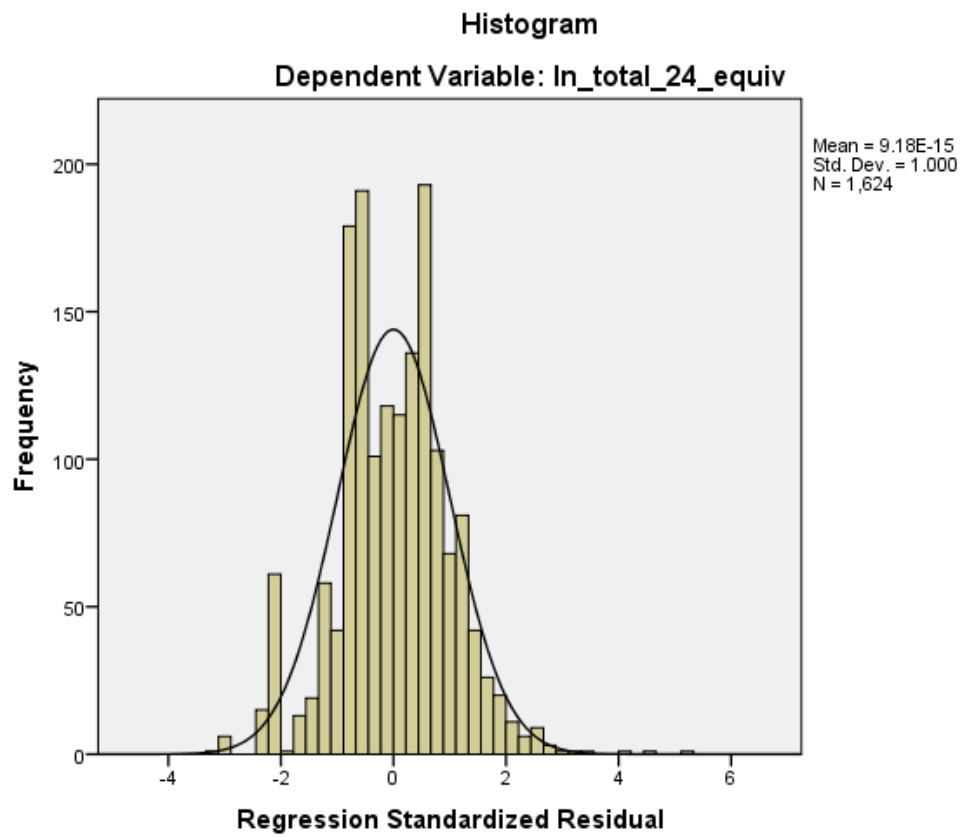


Figure 16.

P-P plot of regression standardized residual for the natural log transformed total postop day 1 morphine equivalent dose and natural log transformed BMI.

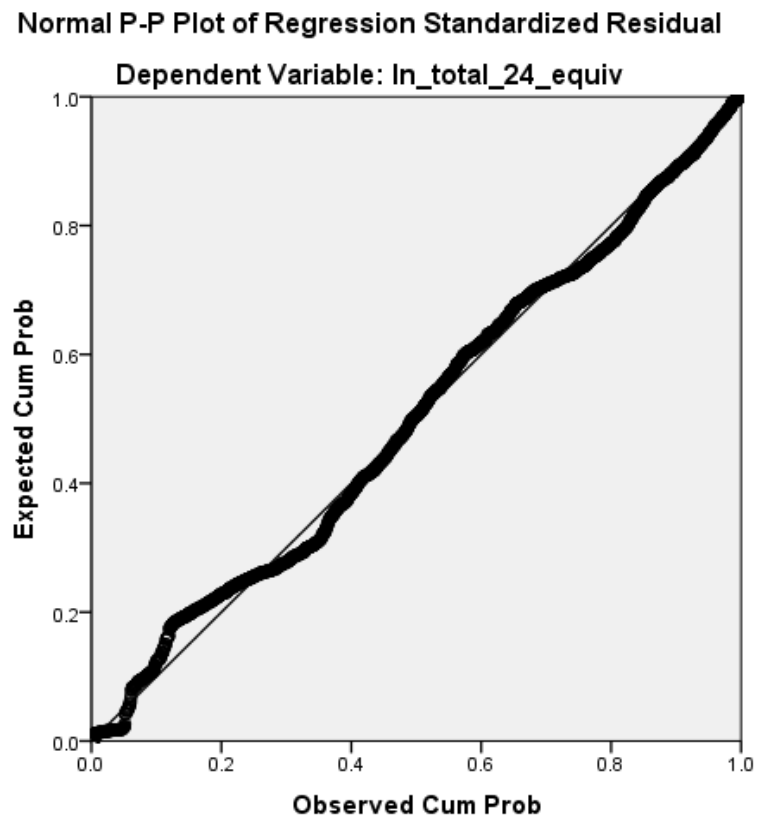


Figure 17.

Scatterplot of natural log transformed total postop day 1 morphine equivalent dose and transformed BMI variables.

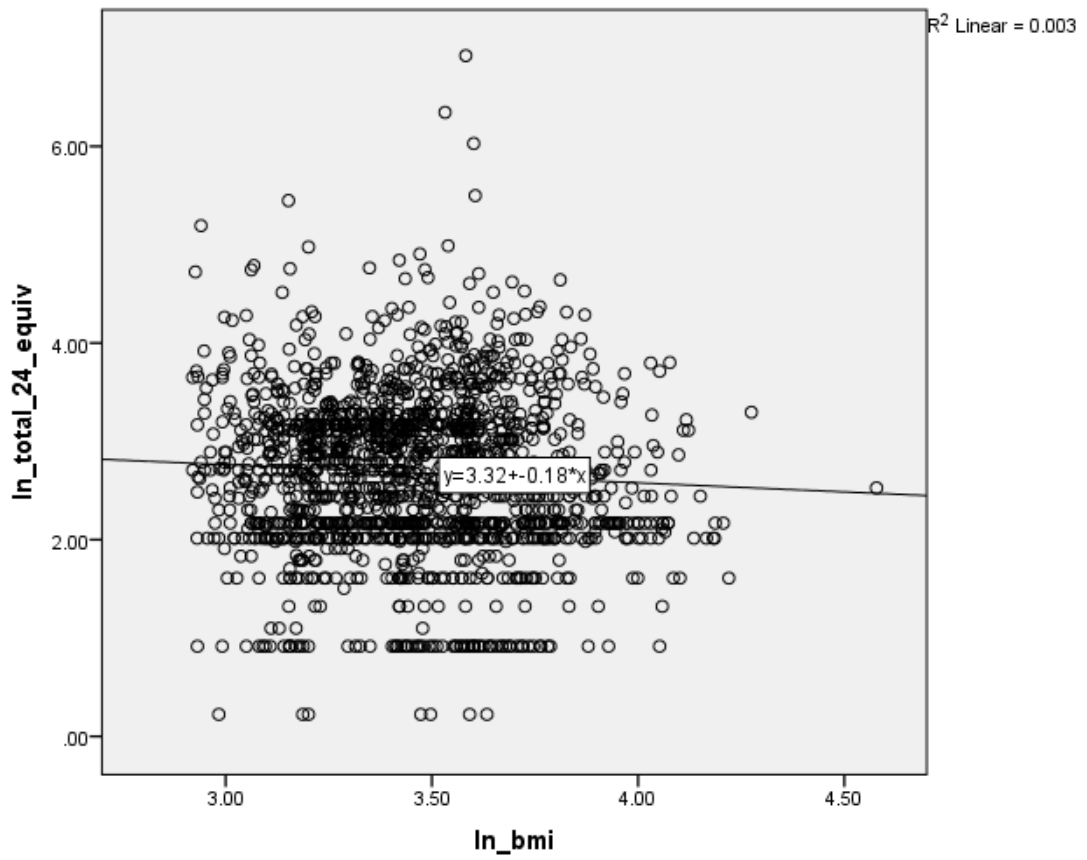


Figure 18.

Normal distribution of regression standardized residual – hierarchical regression with outliers intact – postop day 1.

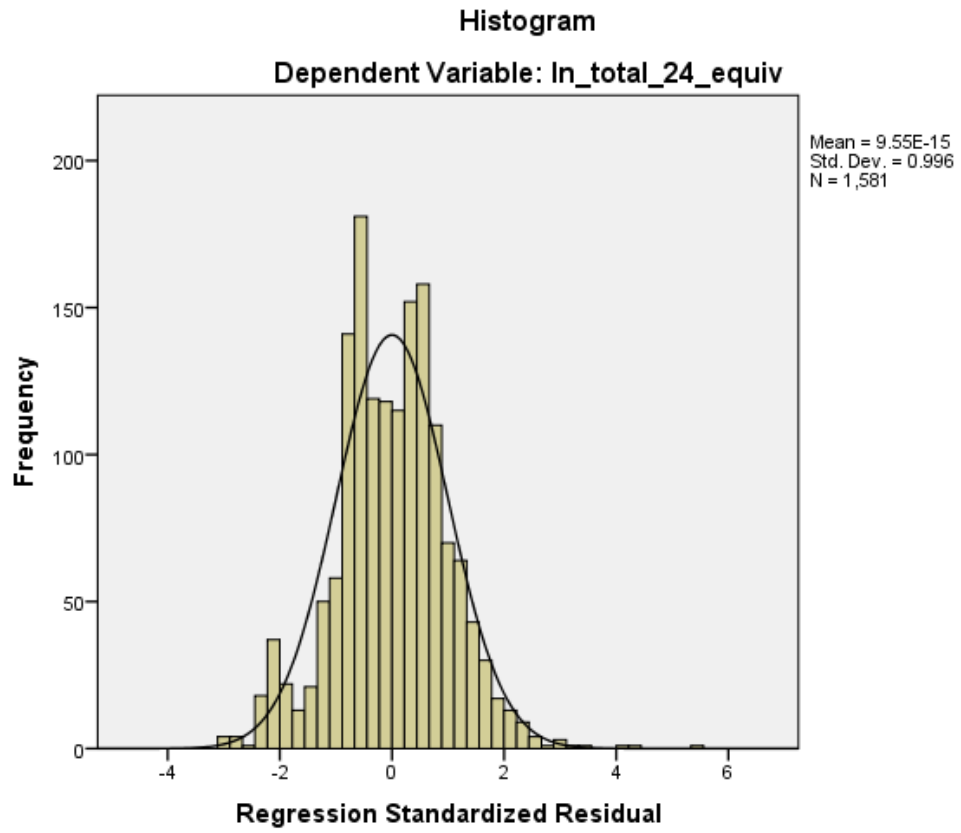


Figure 19.

P-P plot of regression standardized residual – hierarchical regression outliers intact – postop day 1.

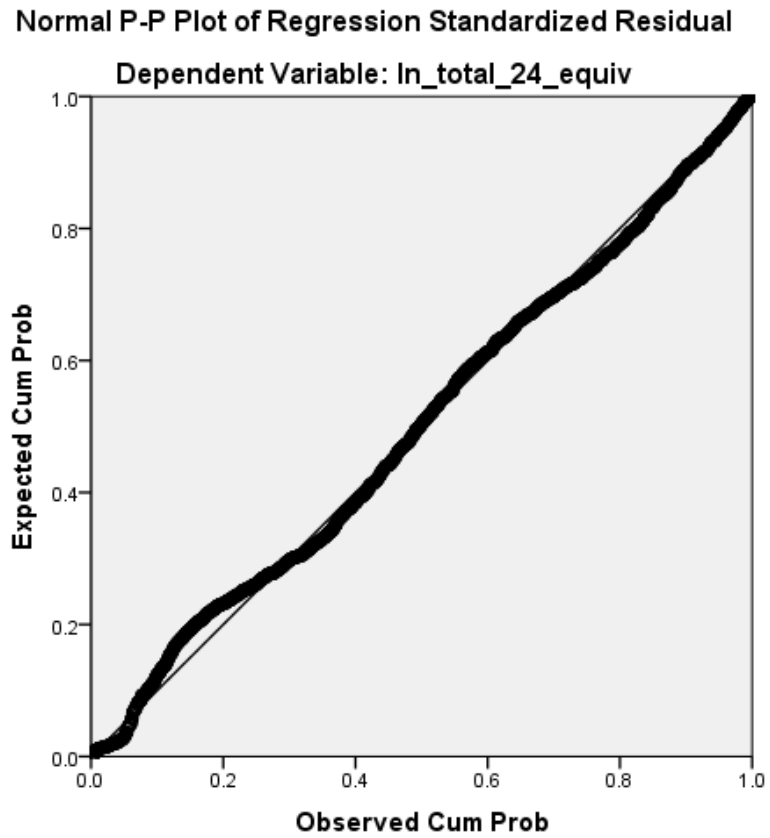


Figure 20.

Scatterplot of standardized residuals and standardized predicted values – hierarchical regression outliers intact – postop day 1.

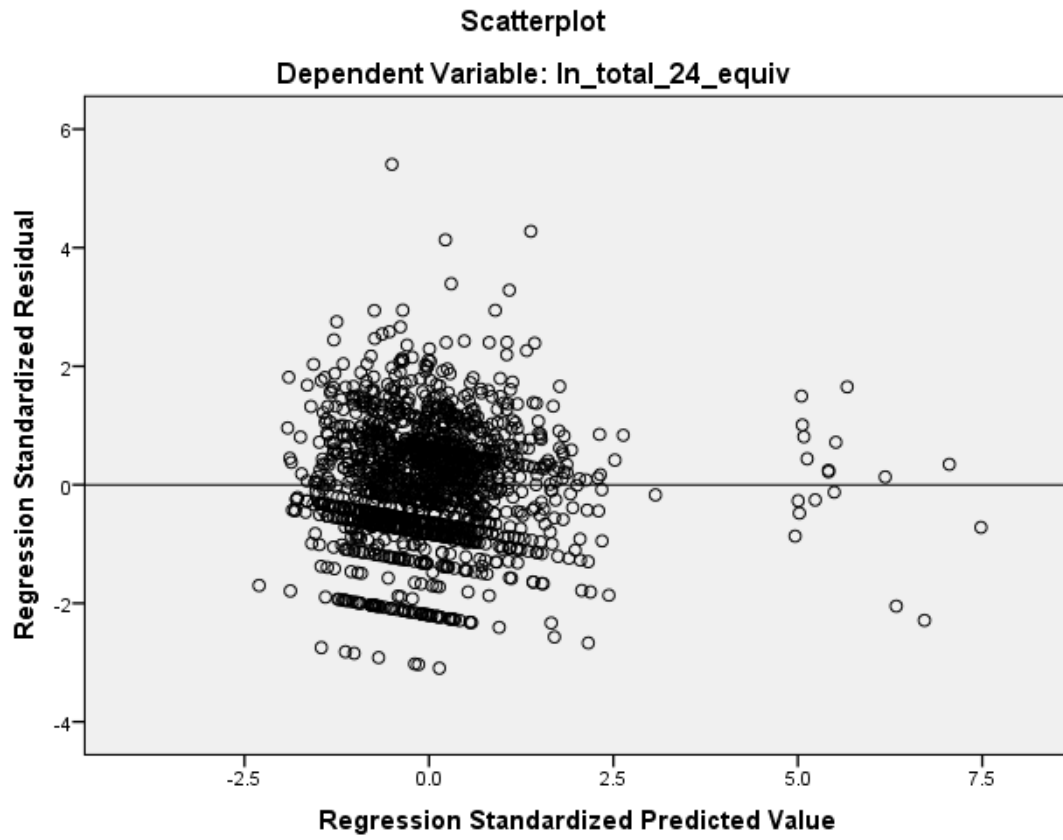


Figure 21.

Partial regression plot of log transformed total postop day 1 morphine equivalent dose

X age – hierarchical regression outliers intact.

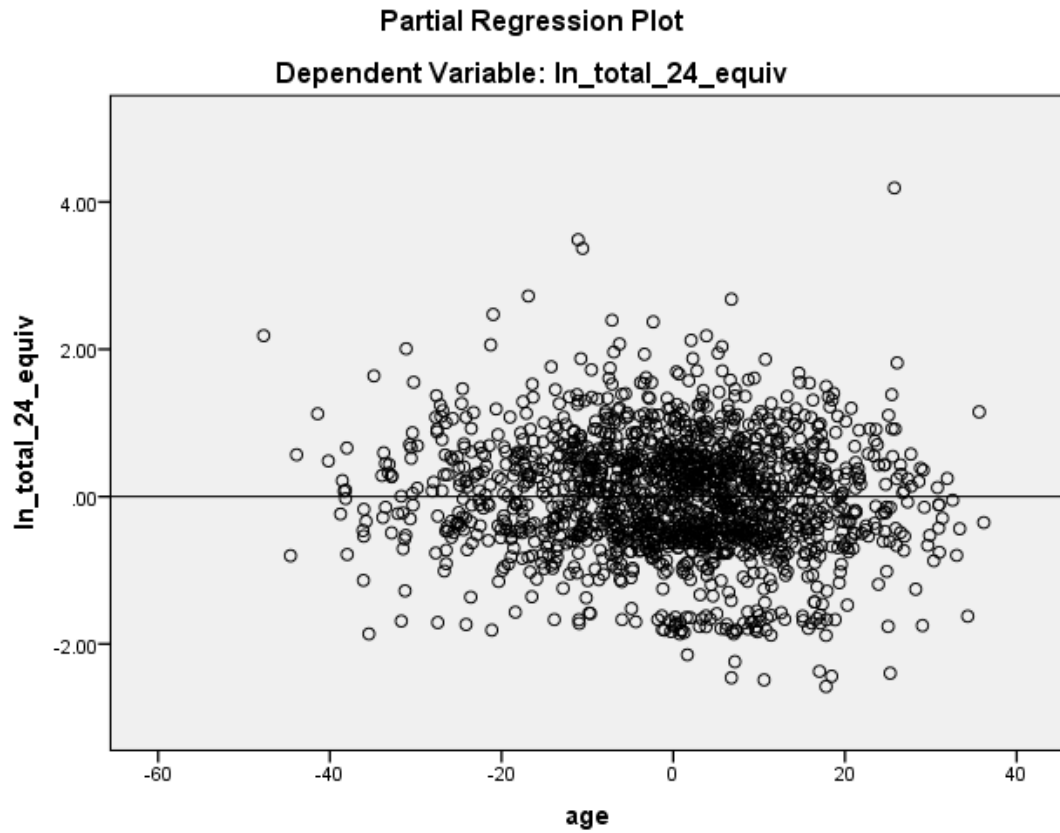


Figure 22.

Partial regression plot of log transformed total postop day 1 morphine equivalent dose

X log transformed BMI – hierarchical regression outliers intact.

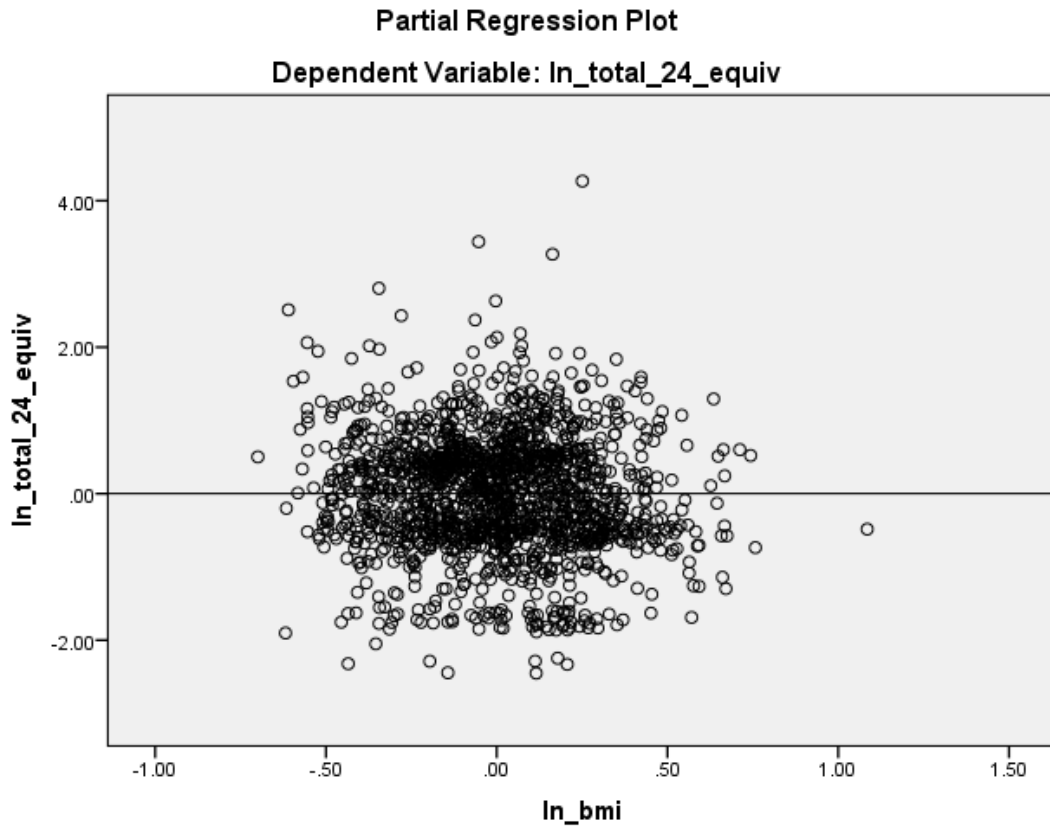


Figure 23.

Normal distribution of regression standardized residual – hierarchical regression with outliers removed – postop day 1.

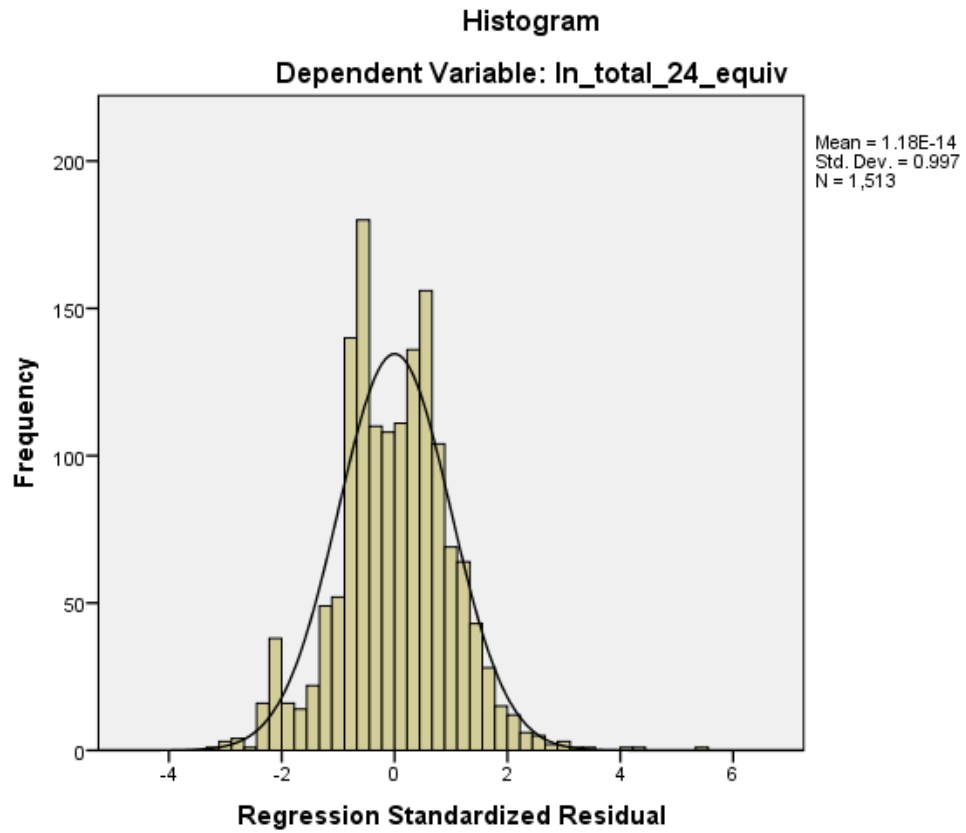


Figure 24.

P-P plot of regression standardized residual – hierarchical regression outliers removed

– postop day 1.

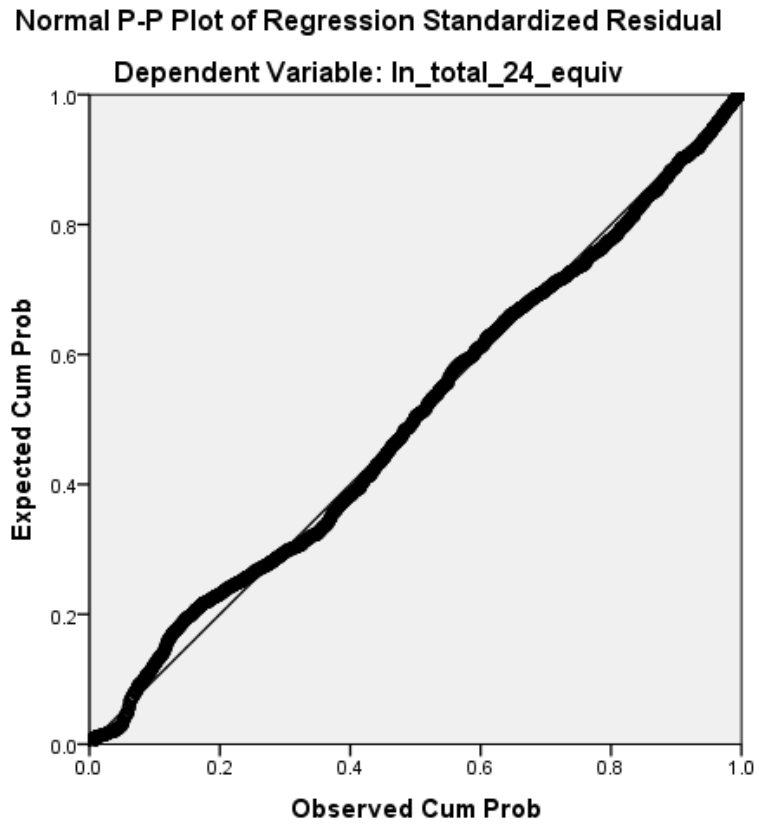


Figure 25.

Scatterplot of standardized residuals and standardized predicted values – hierarchical regression outliers removed – postop day 1.

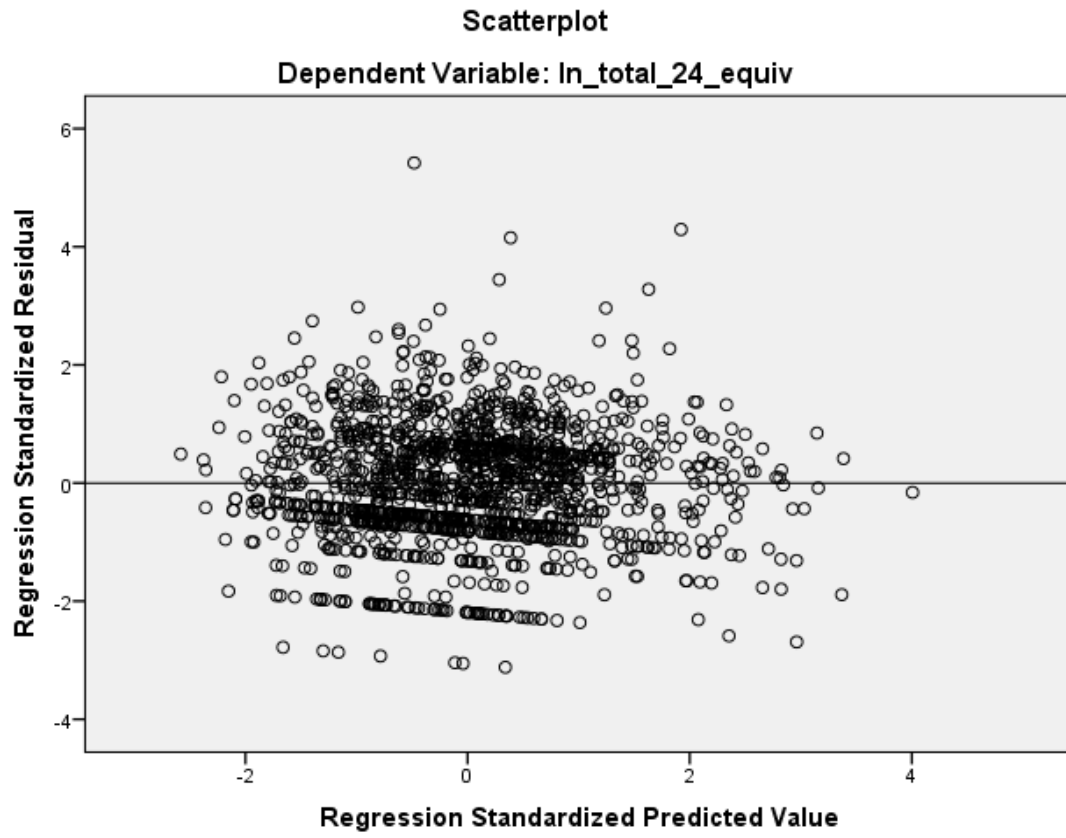


Figure 26.

Partial regression plot of log transformed total postop day 1 morphine equivalent dose

X age – hierarchical regression outliers removed.

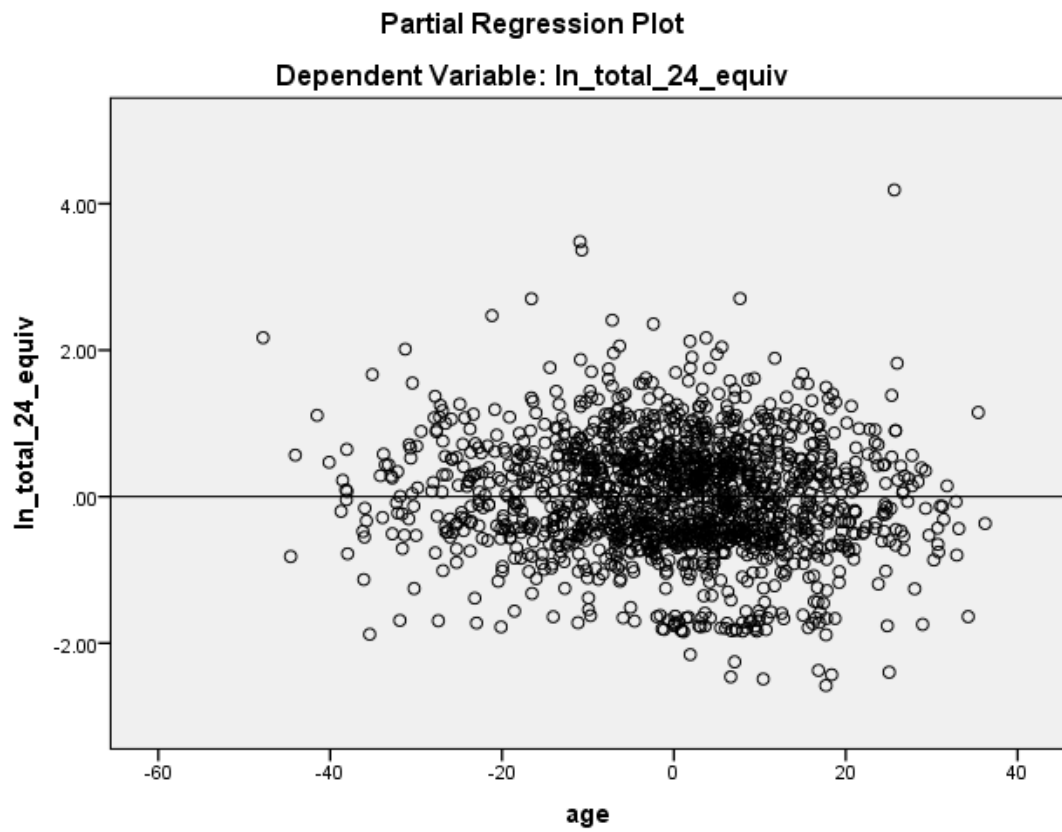


Figure 27.

Partial regression plot of log transformed total postop day 1 morphine equivalent dose

X log transformed BMI – hierarchical regression outliers removed.

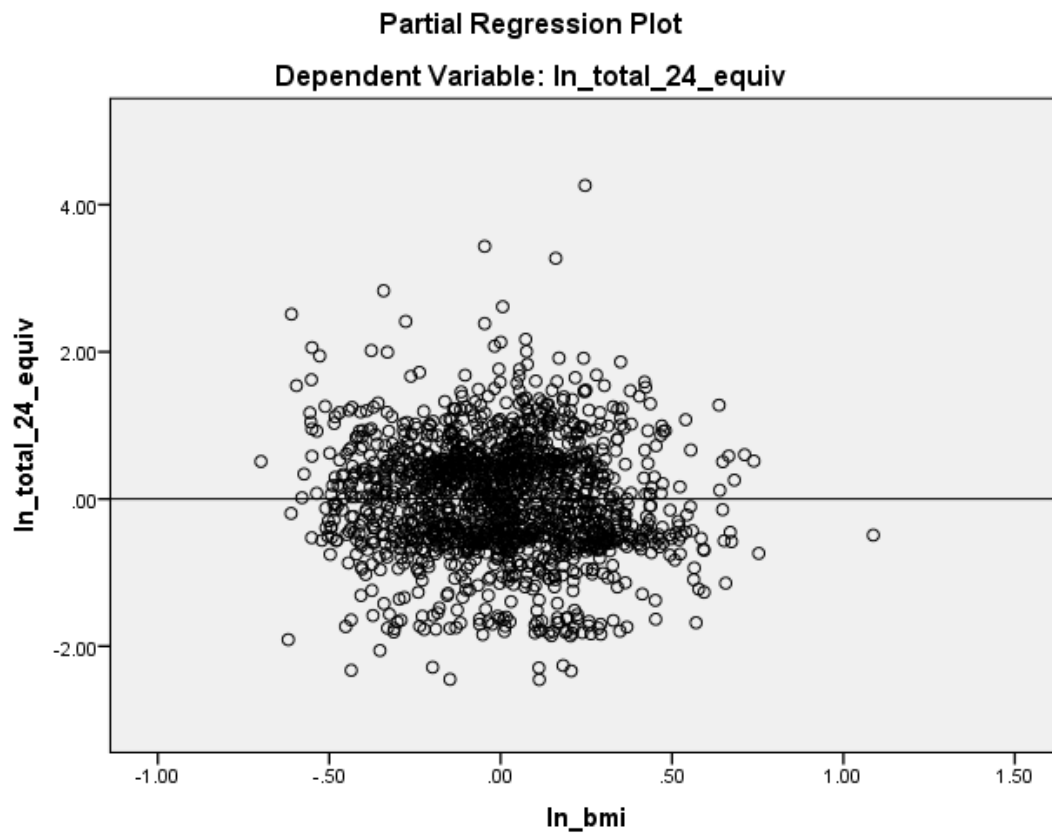


Figure 28.

Residual histogram for total postop day 2 morphine equivalent dose.

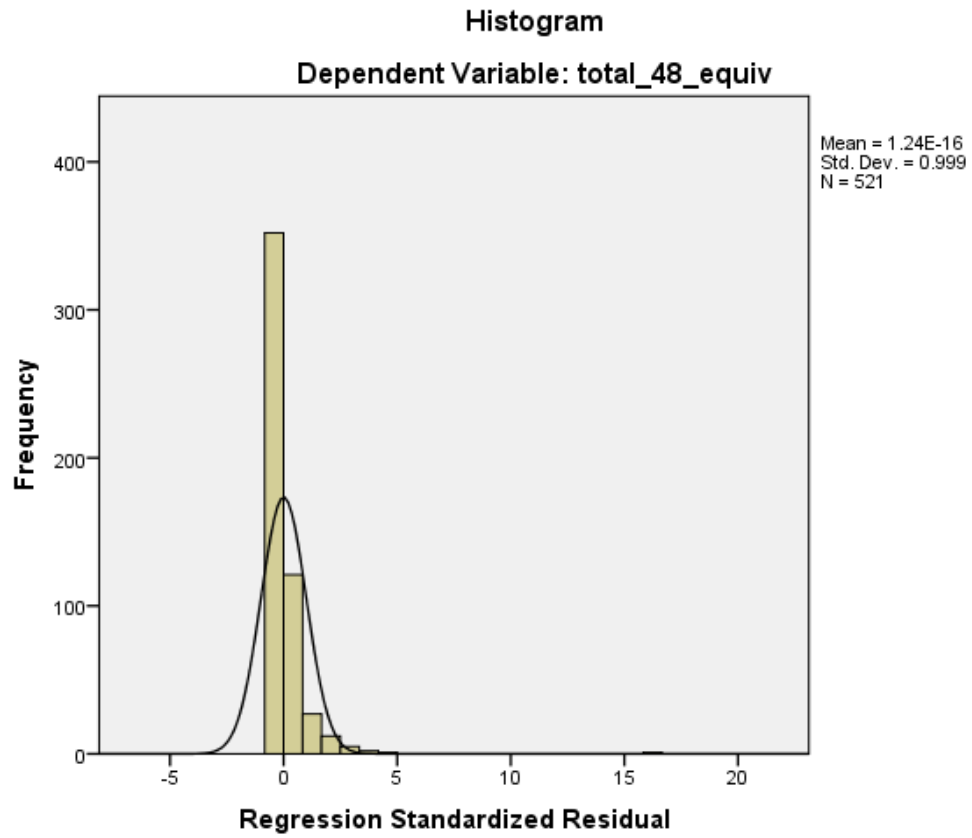


Figure 29.

P-P plot of regression standardized residual for total postop day 2 morphine equivalent dose.

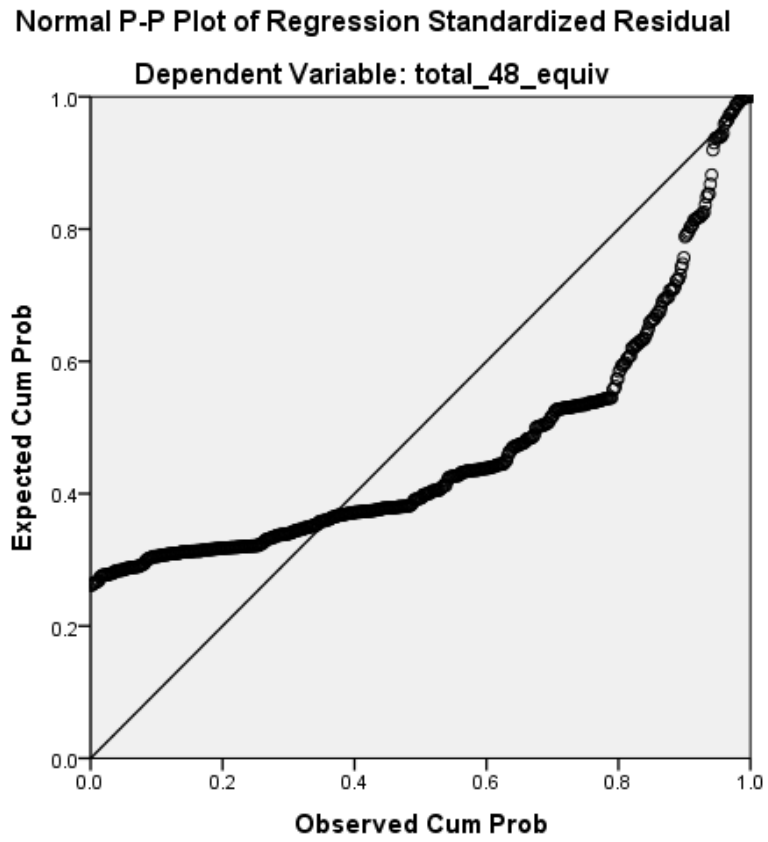


Figure 30.

Scatterplot of standardized residuals and standardized predicted values of total postop day 2 oral morphine equivalent dose.

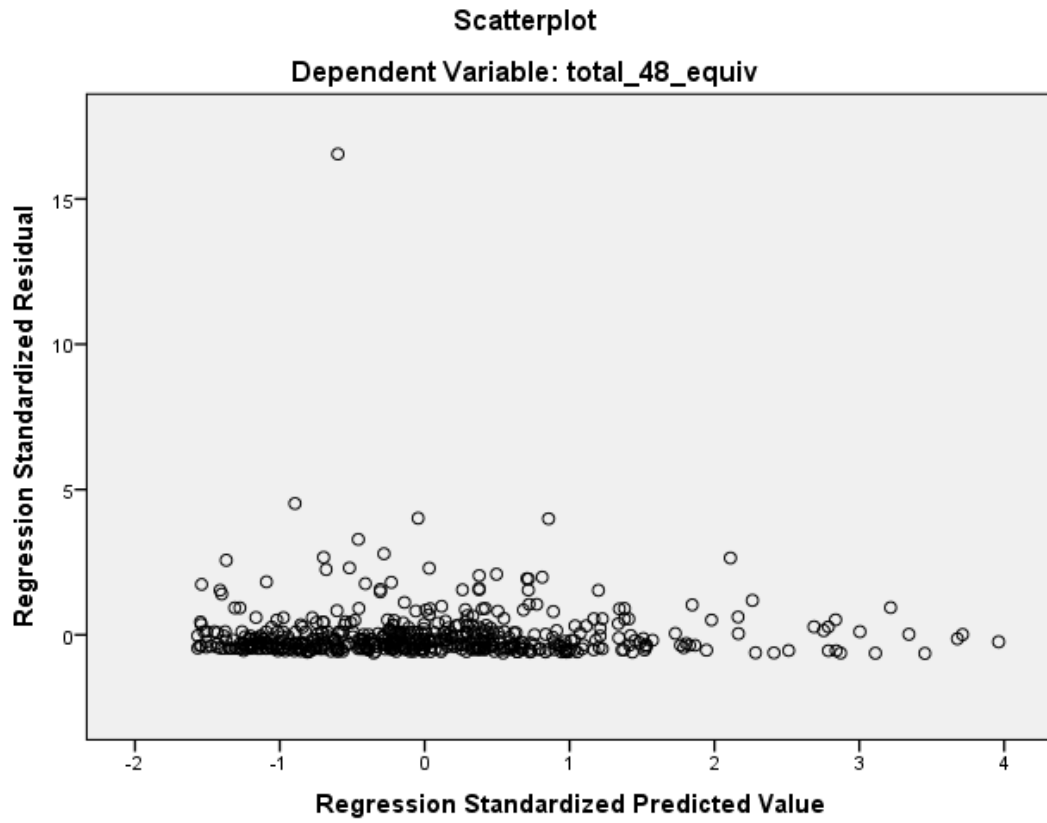


Figure 31.

Scatterplot of standardized residuals and standardized predicted values of the natural log transformed total postop day 2 oral morphine equivalent dose.

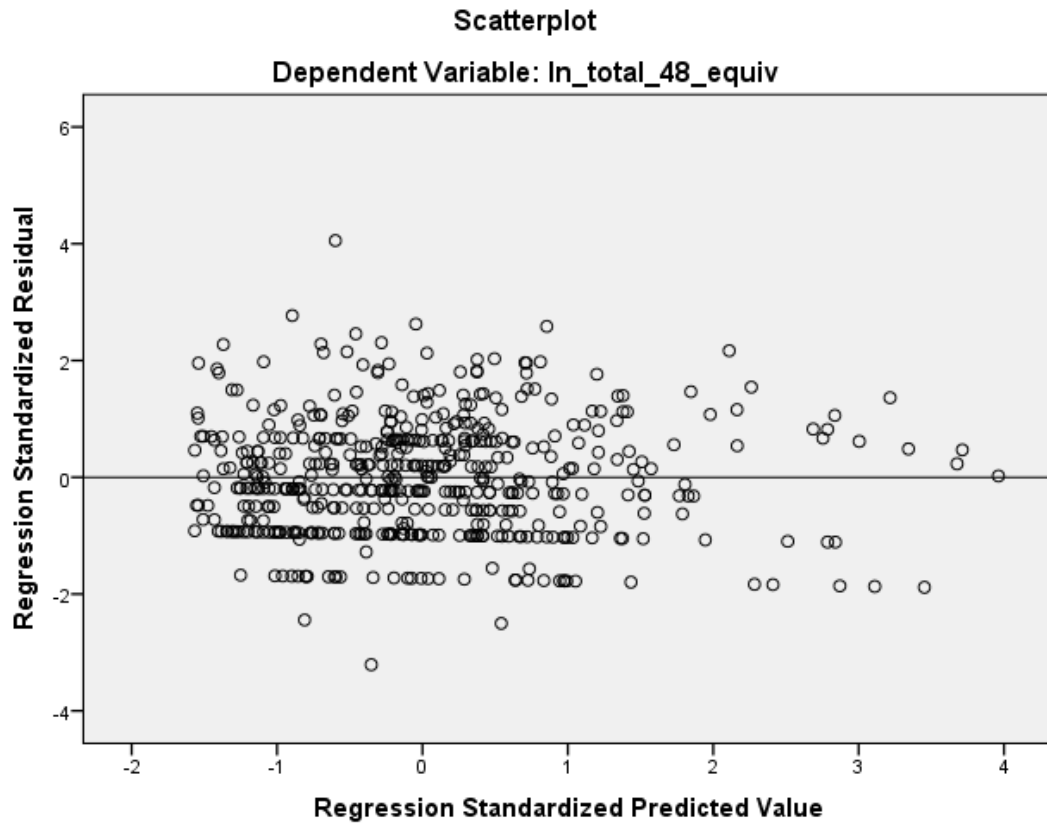


Figure 32.

Scatterplot of standardized residuals and standardized predicted values of the natural log transformed total postop day 2 oral morphine equivalent dose DV and natural log transformed IV, BMI.

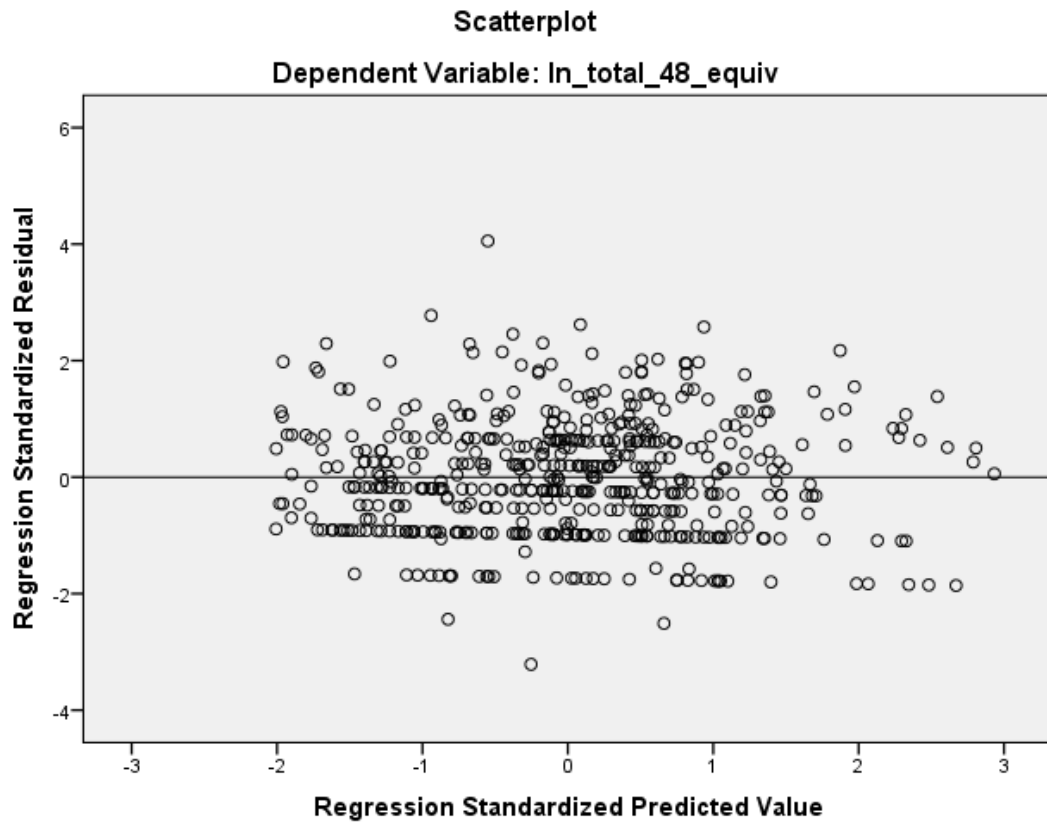


Figure 33.

Normal distribution of regression standardized residual for the natural log transformed total postop day 2 morphine equivalent dose DV and the natural log transformed IV, BMI.

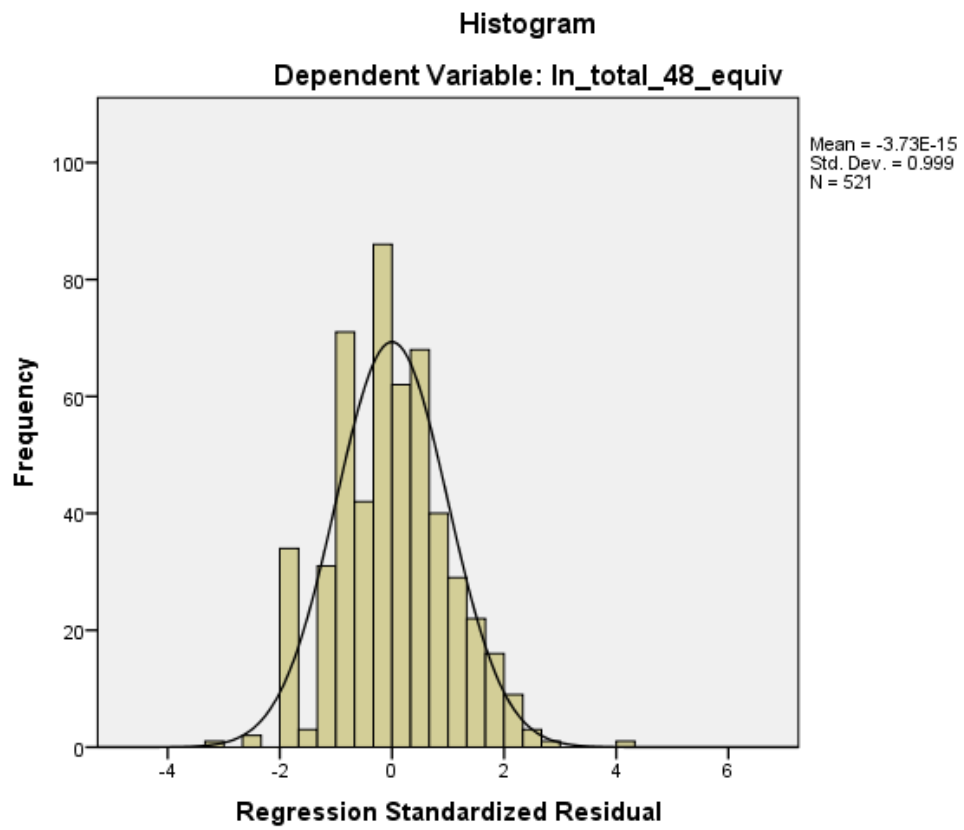


Figure 34.

P-P plot of regression standardized residual for the natural log transformed total postop day 2 morphine equivalent dose and natural log transformed BMI.

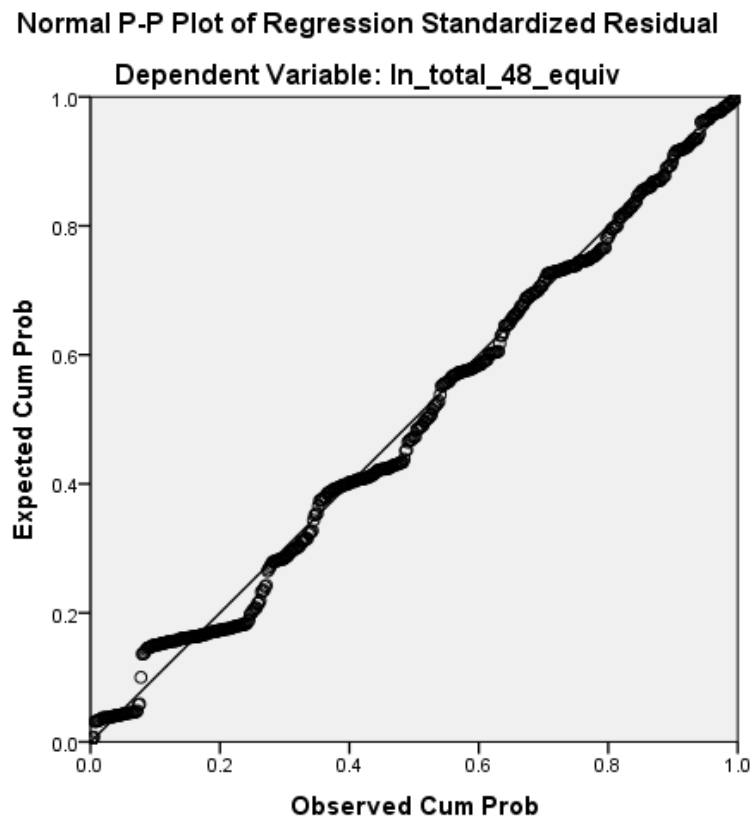


Figure 35.

Scatterplot of natural log transformed total postop day 2 morphine equivalent dose and transformed BMI variables.

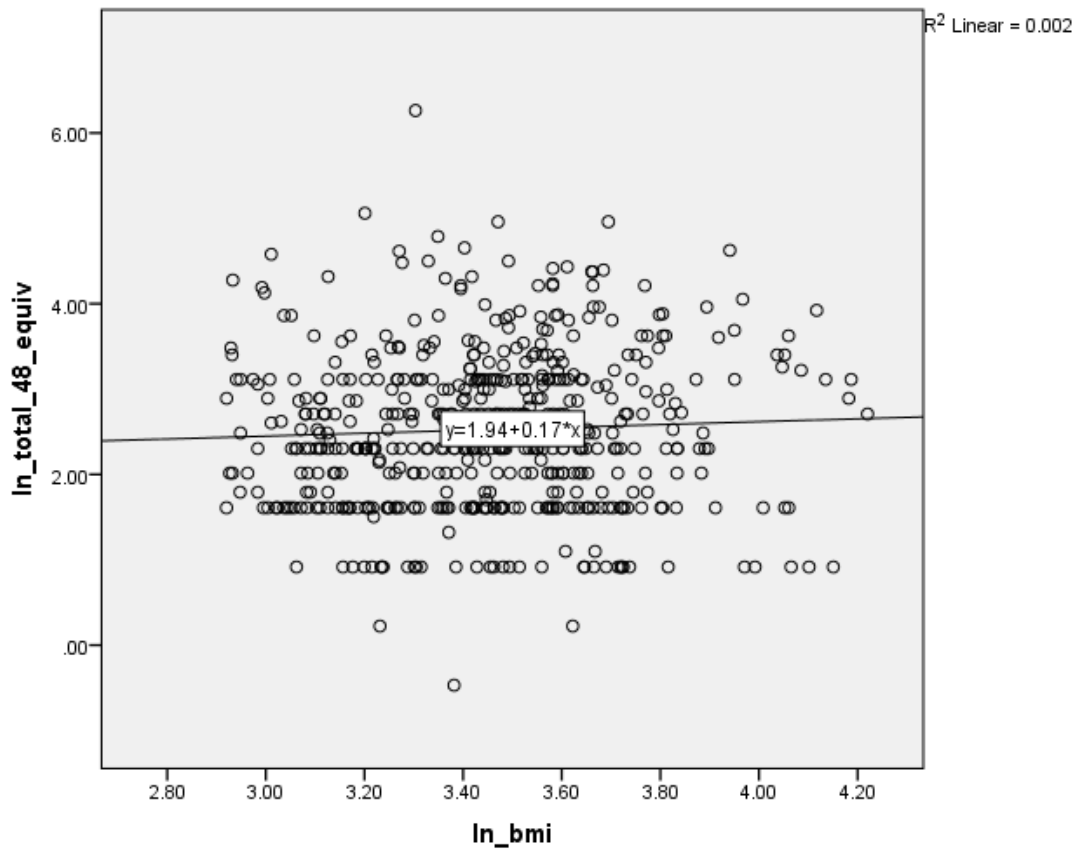


Figure 36.

Normal distribution of regression standardized residual – hierarchical regression with outliers intact – postop day 2.

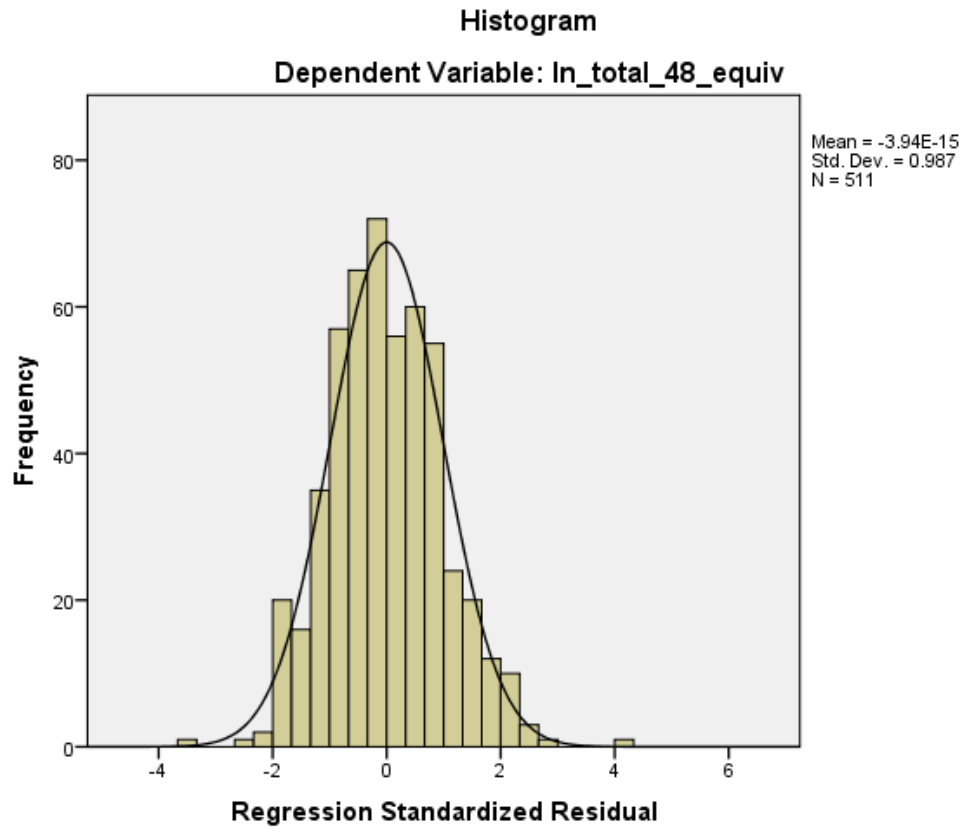


Figure 37.

P-P plot of regression standardized residual – hierarchical regression outliers intact – postop day 2.

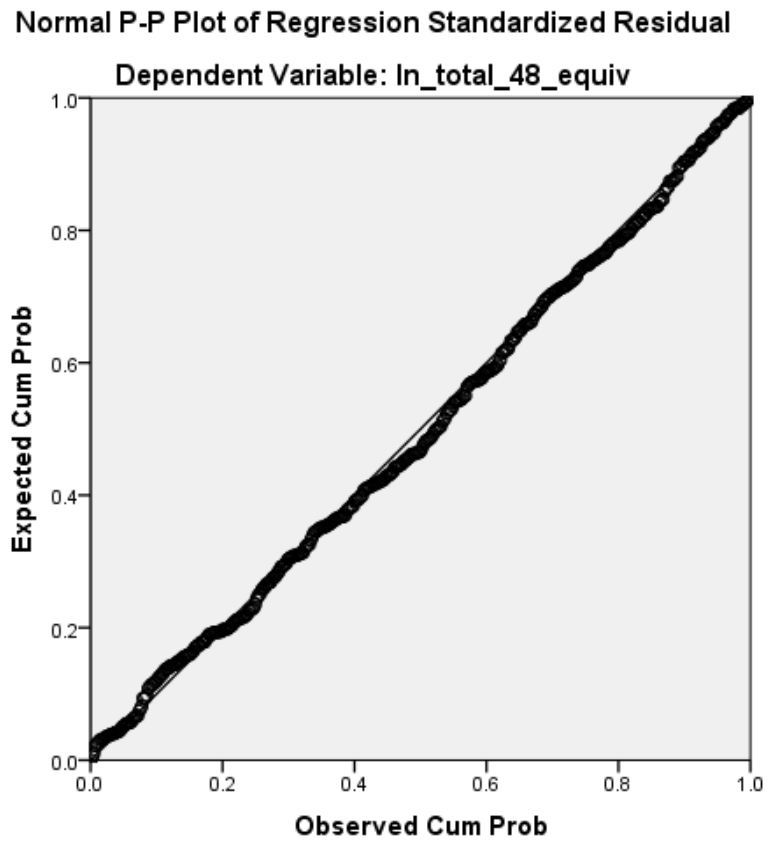


Figure 38.

Scatterplot of standardized residuals and standardized predicted values – hierarchical regression outliers intact – postop day 2.

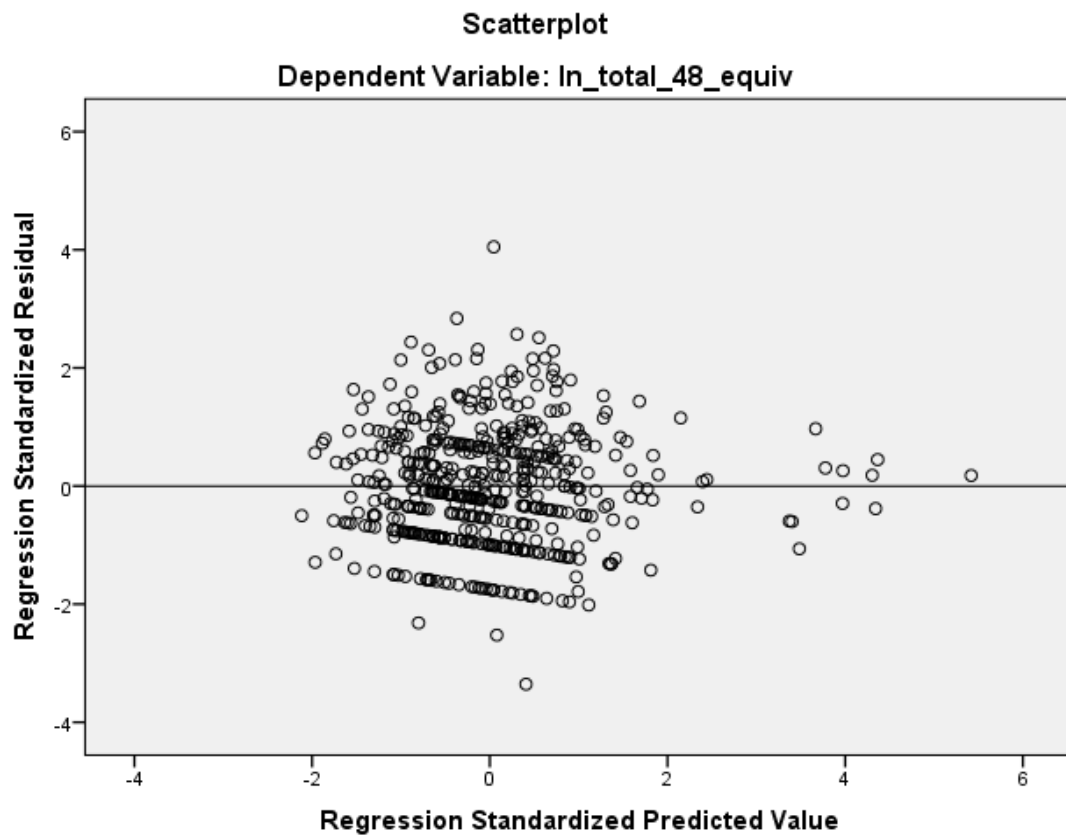


Figure 39.

Partial regression plot of log transformed total postop day 2 morphine equivalent dose

X age – hierarchical regression outliers intact.

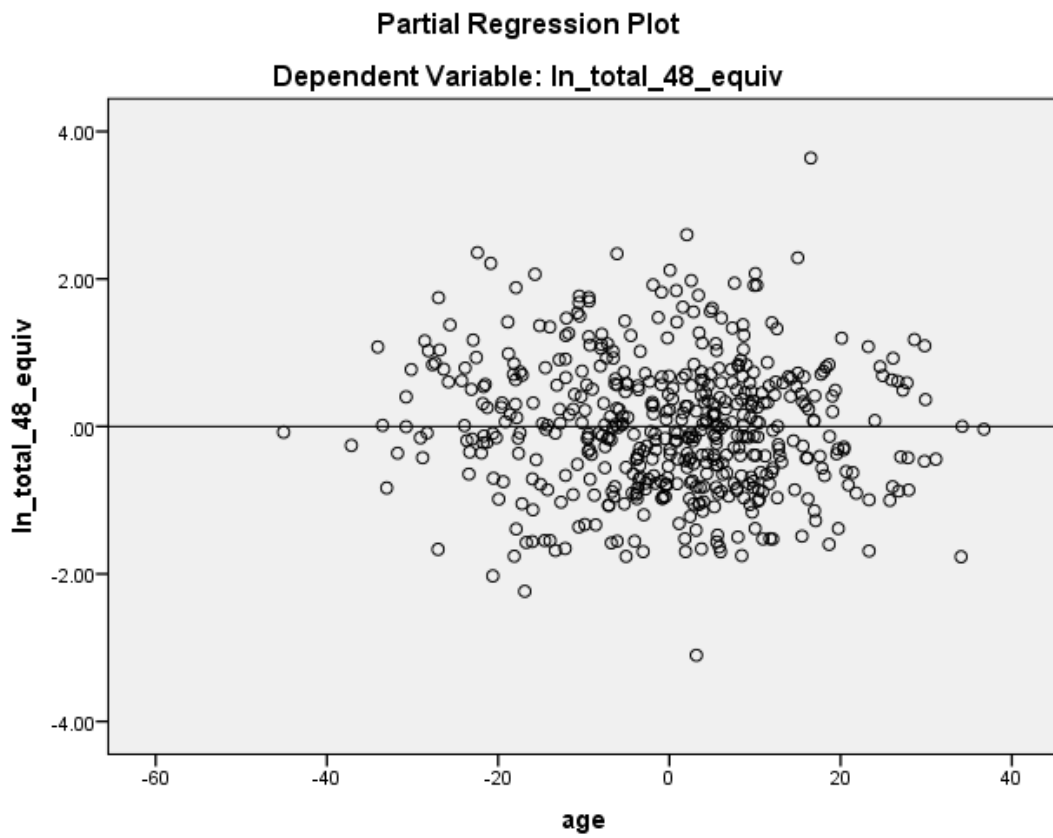


Figure 40.

Partial regression plot of log transformed total postop day 2 morphine equivalent dose

X log transformed BMI– hierarchical regression outliers intact.

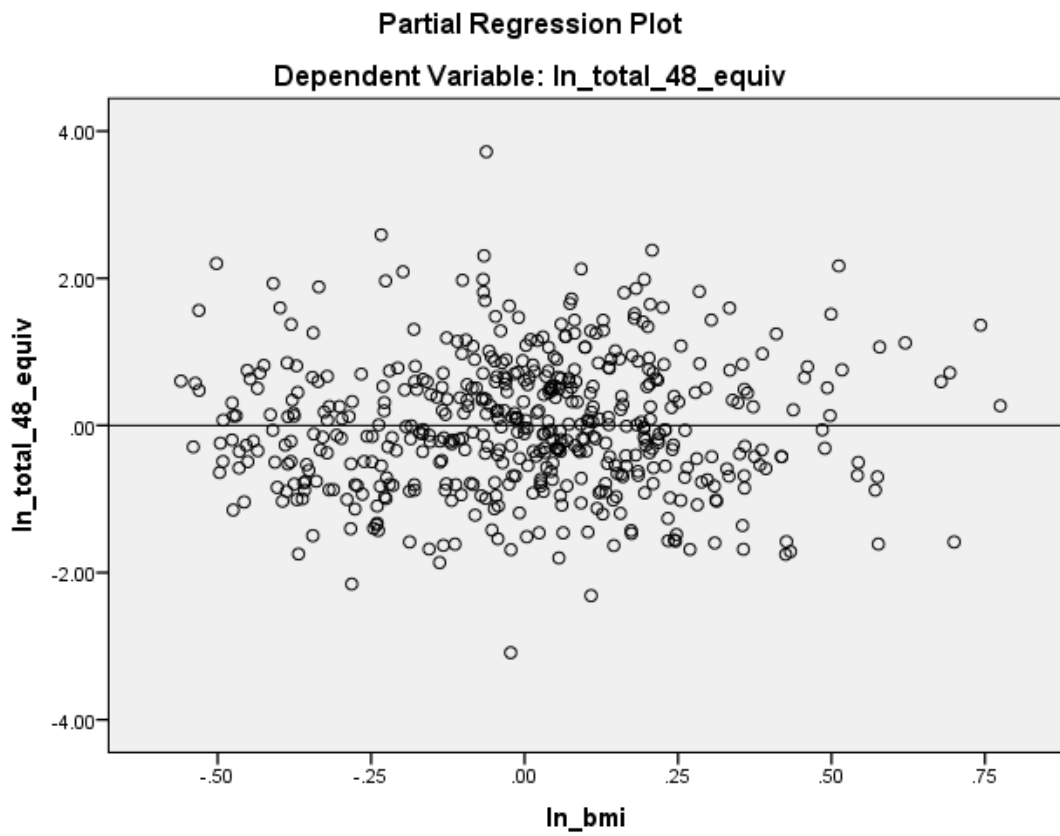


Figure 41.

Normal distribution of regression standardized residual – hierarchical regression with outliers removed – postop day 2.

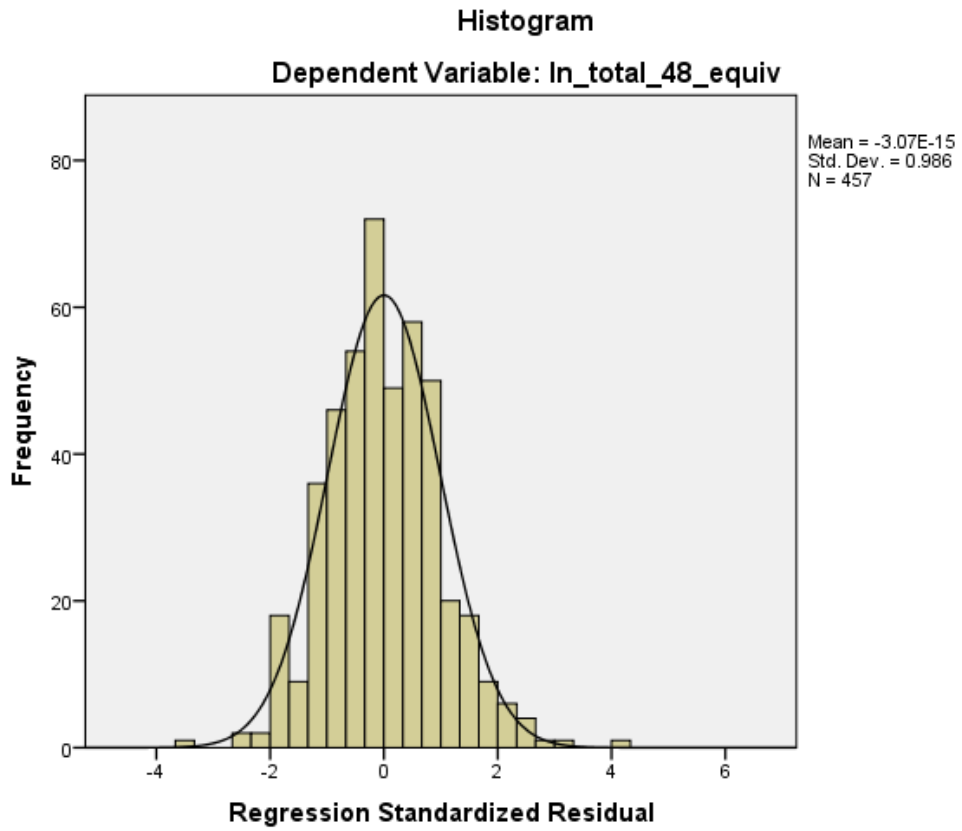


Figure 42.

P-P plot of regression standardized residual – hierarchical regression outliers removed
– postop day 2.

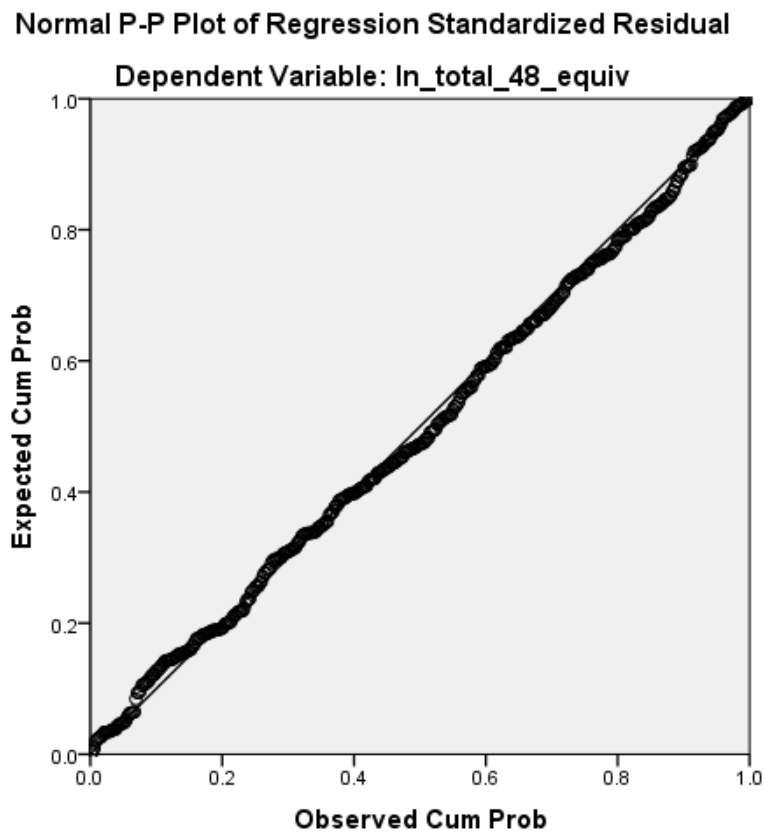


Figure 43.

Scatterplot of standardized residuals and standardized predicted values – hierarchical regression outliers removed – postop day 2.

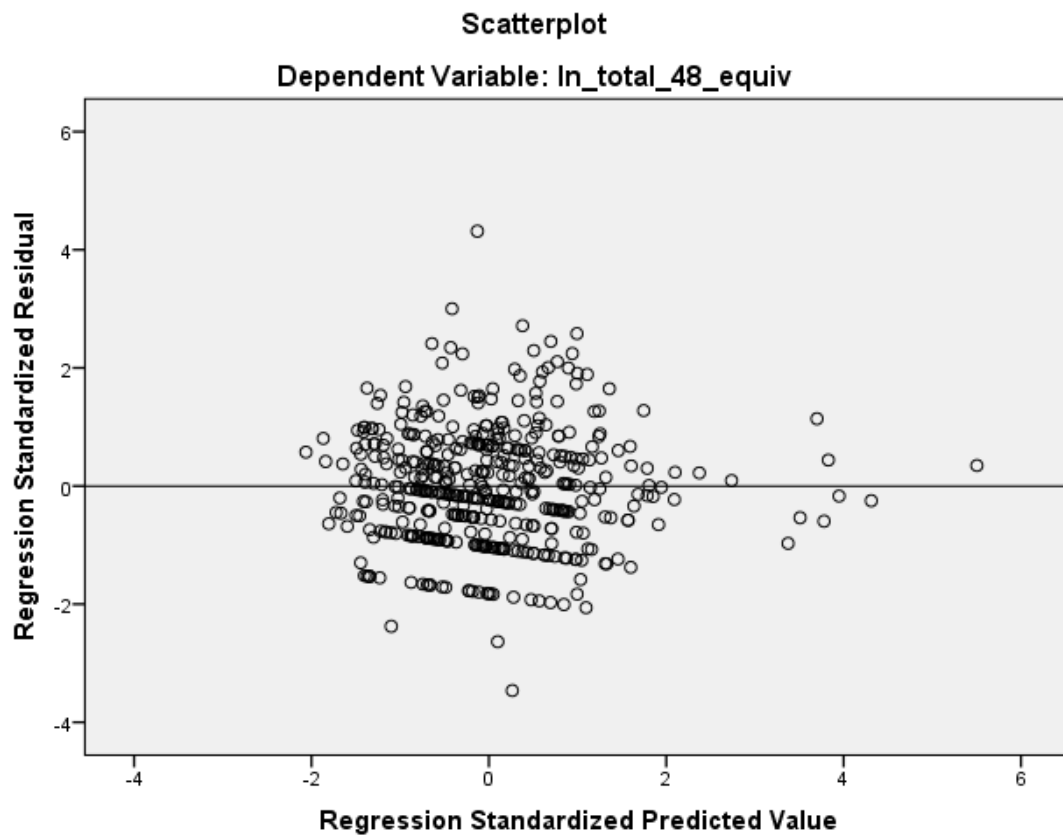


Figure 44.

Partial regression plot of log transformed total postop day 2 morphine equivalent dose

X age – hierarchical regression outliers intact.

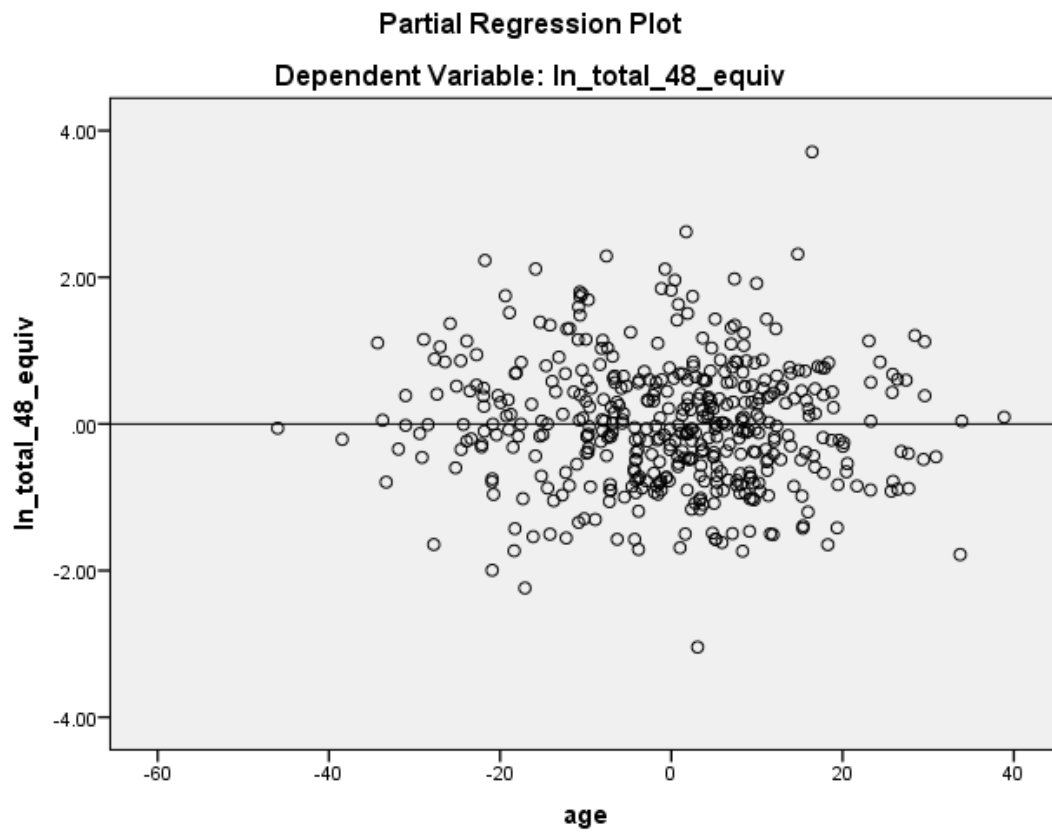
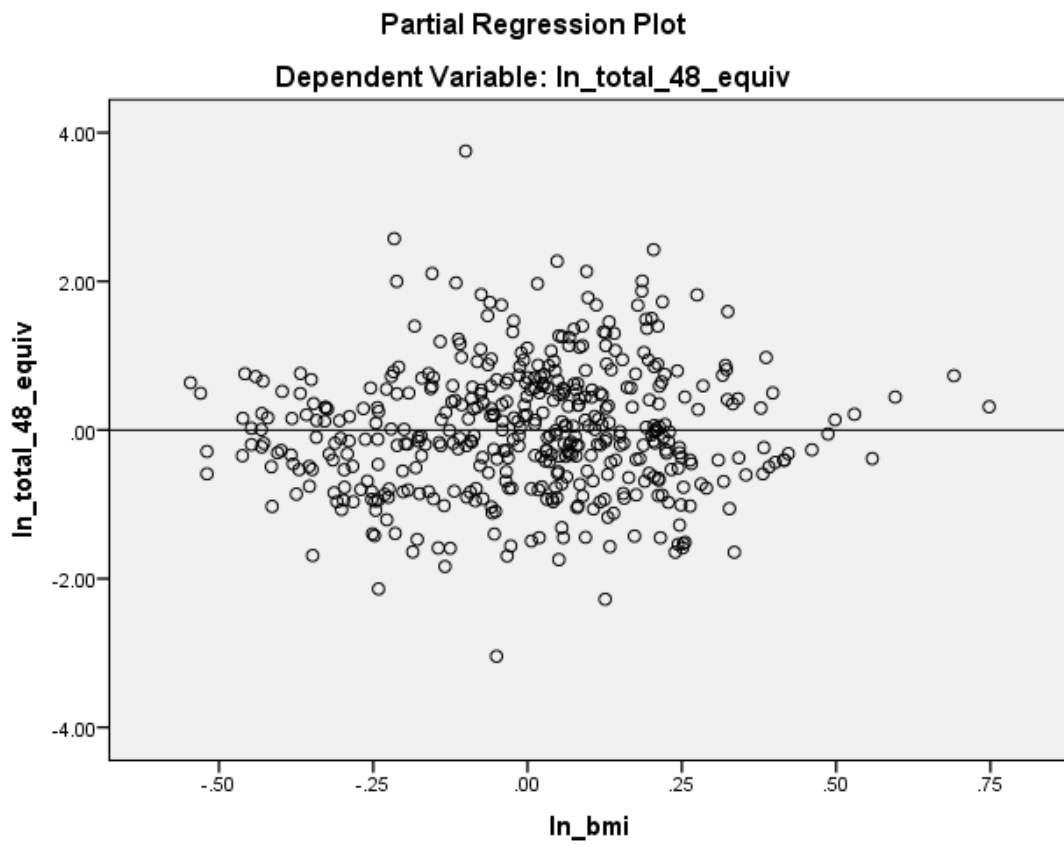


Figure 45.

Partial regression plot of log transformed total postop day 2 morphine equivalent dose

X log transformed BMI– hierarchical regression outliers removed.



APPENDIX A

Lifespan IRB Approval Letter

Sewchuk, Dennis H.

From: Beverly Mason <no-reply@irbnet.org>
Sent: Thursday, March 12, 2015 12:58 PM
To: Chrostek, Cynthia; Spangenberg, Sara; Sewchuk, Dennis H.; Rebocho, Isabel; Mason, Beverly; Muratori, Janice; Ducharme, Maria; Frater, Susan
Subject: IRBNet Board Action

Please note that Lifespan - The Miriam Hospital IRB has taken the following action on IRBNet:

Project Title: [668409-3] Obesity Stigma: The relationship between BMI and the treatment of pain in surgery patients
Principal Investigator: Dennis Sewchuk, MS

Submission Type: Response/Follow-Up
Date Submitted: March 9, 2015

Action: APPROVED
Effective Date: March 10, 2015
Review Type: Expedited Review

Should you have any questions you may contact Beverly Mason at bmason@lifespan.org.

Thank you,
The IRBNet Support Team

www.irbnet.org

APPENDIX B

URI IRB Approval Letter

Generated on IRBNet



OFFICE OF RESEARCH INTEGRITY
70 Lower College Road, Suite 2, Kingston, RI 02881 USA
p: 401.874.4328 f: 401.874.4814 uri.edu/research/tro/offices/researchintegrity

FWA: 00003132
IRB: 00000599
DATE: May 20, 2015

TO: Patricia Burbank, DNSc
FROM: University of Rhode Island IRB

STUDY TITLE: Obesity Stigma: The relationship between BMI and the treatment of pain in surgery patients
IRB REFERENCE #: 707382-2
LOCAL REFERENCE #: HU1415-144
SUBMISSION TYPE: Revision

ACTION: APPROVED
EFFECTIVE DATE: May 20, 2015
EXPIRATION DATE: May 19, 2016
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 5

Thank you for your submission of Revision materials for this research study. The University of Rhode Island IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation 45 CFR 46 and 21 CFR 50 & 56.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate **Appendix S - Event Reporting** for this procedure. All FDA and sponsor reporting requirements must be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office. Please note that all research records must be retained for a minimum of five years after the project ends.

Based on the risks, this project requires Continuing Review by this office by May 19, 2016. Please use the **CONTINUING REVIEW FORM** for this procedure.

If you have any general questions, please contact us by email at researchintegrity@ds.uri.edu. For study related questions, please contact us via **project mail through IRBNet**. Please include your study title and reference number in all correspondence with this office.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document unless the signature requirement has been waived by the IRB.



Andrea Rusnock, Ph.D
IRB Chair

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