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## **Access to Care Barriers to Sacral Neuromodulation Implantation in Adults With Overactive Bladder From Georgia**

Tamara Lynn Wojciechowski  
*Walden University*

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# Walden University

College of Health Sciences and Public Policy

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Tamara L. Wojciechowski

has been found to be complete and satisfactory in all respects,  
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Walden University  
2025

Abstract

Access to Care Barriers to Sacral Neuromodulation Implantation in Adults With  
Overactive Bladder From Georgia

by

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MSA, Rush University Medical College, 1995

BS, Northern Illinois University, 1987

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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## Abstract

Sacral neuromodulation (SNM) is a safe and physically well-tolerated third-line treatment using an implantable device for the management of overactive bladder syndrome (OAB). Other first- and second-line treatments for OAB are frequently ineffective and often poorly tolerated. SNM implantation appears to be underutilized compared to other third-line treatments even though SNM has been rated more effective in OAB symptom mitigation with fewer side effects. Thus, the purpose of this quantitative correlational cross-sectional study was to explore whether health services factors are barriers to utilizing SNM implantation as the third-line treatment for OAB in adults. Andersen's behavioral model of health services use provided the theoretical framework for this study. The research questions addressed whether distance to the urologist, wait time to see the urologist, educational attainment, insurance type, and facility attributes were predictors of SNM device implantation, the dichotomous dependent variable. A purposeful convenience sample of secondary data from a urology clinic and a community hospital within the state of Georgia was used to analyze 204 cases. A binomial logistic regression was conducted to test for an association between the independent and dependent variables using SPSS Version 29. A statistically significant association was found between wait time to see the specialist at less than 51 days (OR .231,  $p = .002$ ) and between 52-59 days (OR .202,  $p < .001$ ). Educational attainment at the college level was also found to be a statistically significant predictor (OR 14.834,  $p < .001$ ) for SNM implantation.

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## Chapter 1: Introduction to the Study

### **Introduction**

Overactive bladder syndrome (OAB) and lower urinary tract symptoms absent neurological disorders or traumatic injury have long been recognized for their biopsychosocial, financial, and quality-of-life impact on individuals and their families in the later decades of life. While recognition has improved, the prevalence remains underestimated due to the stigma and lack of awareness that this is a disease or a condition with potential treatment (Sadri et al., 2023). OAB is a chronic medical problem for which many afflicted do not seek medical help and the syndrome can consist of various complaints in relation to the urinary tract including urgency, frequency, incomplete emptying, and leakage, as examples (Shaw & Wagg, 2021). OAB affects both men and women, and the National Overactive Bladder Evaluation Program (NOBLE) showed a prevalence of over 33 million individuals with OAB in the United States alone (Scarneciu et al., 2021). There is a hierarchy of treatments aimed at controlling the manifestations of OAB beginning with non-invasive modalities or medication, and more advanced therapies have been shown to be safe and reliable for the reduction of symptoms in patients who have been refractory to initial treatments, or have suffered intolerable side effects from alternative modalities (Scarneciu et al., 2021). Sacral neuromodulation (SNM) from the list of more advanced, called third-line treatments delivers a slight electrical impulse to the sacral nerves thereby reducing overactivity of the bladder (Scarneciu et al., 2021). This involves permanent placement of a neuromodulation device that obtained U.S. Food and Drug Administration (FDA)

approval in 1997 (Zhang et al., 2021). Following multiple modifications of the device for non-life-threatening side effects, the technology has been proven to be highly effective at mitigating OAB symptoms with few if any, adverse effects (Feloney et al., 2023).

Urology specialists treating OAB recently published their perspective that the third-line treatment SNM has gone underutilized for OAB, according to the Canadian Urological Association (Gariscak et al., 2023). Their qualitative study was performed exclusively in Canada and was conducted to determine associations for both under-referral and underutilization of SNM. By detecting potential barriers to the utilization of an effective modality for OAB, modification of barriers may improve healthcare access to the device or facilitate the tempering of barriers determined to impact access.

Chapter 1 includes background information, the problem statement, purpose of this study, research questions and hypotheses, the theoretical framework, the nature of the study, along with definitions, assumptions, limitations, scope and delimitations, and finally the significance of the present study.

## **Background**

OAB is not a condition that generates high levels of interest like trauma or contagious disease, and there aren't many public safety messages about the diagnosis of OAB, yet it impacts 20% of the world's population (Wang et al., 2023). Adult incontinence products, regulated by the FDA classify adult incontinence products as Class 1 medical devices, with clinical safety guidance and end-point testing to evaluate for hazardous disposal (Krause et al., 2023). The National Diaper Bank Network Distribution Program allocates and disburses adult incontinence products and in 2021,

two-million products were distributed every 30 calendar days to 4,125 adults admitting the use of diapers in the United States exclusively (National Diaper Bank Network, 2024). These numbers indicate the widespread nature of this condition's impact on adults over 40 years of age, just in the U.S. As the disorder progresses, OAB-related traumatic events such as falls, fractures, and subdural hematomas have increased steadily as more individuals experience longevity and develop symptoms of OAB (Zillioux et al., 2023). Traumatic injuries occur either with hasty movements to the bathroom or resulting from side effects of medications causing unsteadiness of gait (Zillioux et al., 2023). A negative impact on health-related quality-of-life along with the urgent need to empty one's bladder describes OAB and symptoms worsen as an individual ages, without treatment or intervention (Scarneciu et al., 2021).

There are varying remedies for OAB, known as first, second, and third-line therapies that involve balancing benefits, symptom control, and adverse effects. SNM was approved for third-line treatment as an implanted neuromodulator by the FDA in 1997 and was proven safe and effective in a multicenter study (Carleton et al., 2023). Undesirable effects were documented in 30 % of subjects during the device's early development, but since FDA approval, multiple revisions and improvements to the technology have addressed the adverse effects, limiting them significantly (Zhang et al., 2021). Two other third-line therapies include Botulinum (Botox) toxin injections and percutaneous tibial nerve stimulation (PTNS) and until recently, no formal, direct comparison showed whether SNM, Botox, or PTNS was best for reducing OAB symptoms. Only within the past 24 months have researchers determined at 12 weeks

posttreatment, SNM produced the most significant reduction in OAB symptoms without life-threatening adverse effects (Meng et al., 2023).

Considering that SNM produced the most efficacious reduction in symptoms as a guideline-recommended treatment, and it was shown to have the fewest adverse effects, it remains unclear why more than one half of surveyed urologists reported that SNM is underutilized by individuals who have OAB (Gariscak et al., 2023). The same researchers postulated that institutional properties such as qualified nursing staff, operating equipment, and surgical unit availability may be factors, and they encouraged additional training for urologists experienced in treating OAB to become more familiar with SNM (Gariscak et al., 2023).

Further, Kapur et al. (2022) asserted there are certain factors that influence patient preference when choosing an OAB treatment modality, yet they were not explored in research until recently. They analyzed elements believed to be considered by patients when choosing a third-line OAB treatment and concluded that the patients with exceedingly severe symptoms voiced the most interest in SNM (Kapur et al., 2022). Yet during the follow up phase, not all the patients who opted for SNM actually underwent treatment with SNM and the reasons were not determined. The authors then deduced there are factors that influence a patient's affinity towards a specific plan for OAB treatment, and additional research is needed to determine what those factors are (Kapur et al., 2022). To conclude, both studies indicated that SNM was effective and possess a positive safety profile with very minimal adverse effects, so additional research is needed to determine what barriers exist to choosing SNM for OAB.

### **Problem Statement**

While SNM has been proven to be a safe, reliable, and well-tolerated implantable device for OAB symptom mitigation, a recent qualitative study suggests that health-systems infrastructure challenges and lack of available urologist-specialists may contribute to the underuse of SNM implantation for adults with OAB diagnoses in Canada (Gariscak et al., 2023). There is little research looking at health-services factors as potential barriers to implanting SNM, whether in Canada or the United States for the diagnosis of OAB.

### **Purpose of the Study**

The purpose of this quantitative correlational cross-sectional study was intended to fill a gap in understanding whether specific health-services delivery factors are predictors of undergoing SNM implant for OAB. The cross-sectional design was applied to measure five independent variables including the distance to the urologist, wait time to see the urologist, educational attainment, health insurance type, and facility attributes on the outcome variable, implantation of SNM for OAB. Capili (2021) stated the primary purpose of cross-sectional observational studies is to examine independent and dependent variables in a population sample and to analyze for statistically significant associations between them. Therefore, based on the number of individuals affected by this condition, this research facilitated understanding whether health services-related determinants demonstrated an association with SNM implantation in adults with OAB.

### Research Question and Hypotheses

RQ1: What is the association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_01$ : There is no statistically significant association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_a1$ : There is a statistically significant association between distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ2: What is the association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_02$ : There is no statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_a2$ : There is a statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ3: What is the association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia?

$H_03$ : There is no statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

$H_a3$ : There is a statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

RQ4: What is the association between insurance coverage type (no insurance, Medicare, and private/employer-sponsored/Affordable Care act [ACA]), and SNM implantation in adults with OAB in the state of Georgia?

$H_04$ : There is no statistically significant association between insurance coverage type (no insurance, Medicare, and private/employer-sponsored/Affordable Care act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

$H_a4$ : There is a statistically significant association between insurance coverage type (no insurance, Medicare, and private/employer-sponsored/Affordable Care act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

RQ5: What is the association between facility attributes (anesthesia coverage, operating room (OR) availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia?

$H_05$ : There is no statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

$H_a5$ : There is a statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

### **Theoretical Framework for the Study**

Andersen's behavioral model of health services use (BMHSU) provided the theoretical framework for this study. First developed by Ronald Andersen himself in 1968, after multiple revisions along the way, this model still serves as a guide for health

services research by looking at access and utilization of health services. Andersen proposed that the manner in which an individual utilizes health services can be understood and predicted if his theoretical framework is applied, which maintains there are three stages that define how persons consume health services (Alkhaldeh et al., 2023). Now referred to as Andersen's BMHSU, the three stages include predisposing, enabling, and need factors, and the overall utilization of health services is thought to be predicted by each of these stages (Seidu, 2020). In addition, this model was suitable because it has been applied in a wide array of research surrounding illnesses, looking at multiple points within a health system, and has been utilized to analyze varying cultures and differences in health service utilization within those differing populations (Seidu, 2020).

The three stages in Anderson's BMHSU along with the operational variables from each stage complemented the independent variables, the research questions, and the outcome variable in this study which looked at predictors for SNM implantation for OAB in adults. The independent variables of wait time to see the urologist, distance to travel to see the urologist, and educational attainment, were embodied in the social and demographic characteristics that are considered part of the predisposing stage of Anderson's model (Pengid et al., 2022). Insurance type, another independent variable in this study, was represented in Anderson's second stage as an enabling characteristic, because the second stage begins when the individual considers actual use of health services, which can be directly impacted by the type of insurance coverage or having insurance coverage at all (Brandeo et al., 2022). Finally, Andersen's third stage focuses

on need, where individuals are thought to actively evaluate their symptom severity, or need for treatment. Illness level or severity, both as subcomponents of the third stage can lead an individual to follow through with engagement in treatment, based upon illness severity that interferes with the individual's function and activities of daily living. Severe symptom ratings may predict an individual's decision to implant SNM for severe OAB symptoms that restrict that person's activities (Pengid et al., 2022).

There are examples of other studies that have applied Anderson's model to successfully distinguish predictors of health services utilization. During the Coronavirus pandemic, non-urgent use of emergency room (ER) services for Coronavirus testing contributed to ER overcrowding and depletion of testing supplies, quickly compromising services needed for critically ill individuals. Huang et al. (2023) sought to understand health-seeking behaviors by applying Anderson's model to identify which enabling factors contributed to unnecessary Coronavirus testing, despite imperatives to mitigate ER overcrowding. Huang et al. (2023) applied each of the three stages and determined the particular health services predictors for seeking non-urgent testing included age, employment status (being unemployed), and the individual's perceived severity of the illness. These predictors were useful in identifying measures to reduce unnecessary testing in the ER going forward.

In another example, Brandeo et al. (2022) used predisposing, enabling, and need factors to predict healthcare utilization in persons 80 years of age and older. They found that having multiple existing comorbidities, a higher number of prescription medications, and being of male gender all served as predictors for use of health services. With

similarities to this study which looked at health service predictors for choosing SNM or not, use of Anderson's model aided in identifying potential predictors according to each of the three stages. Anderson's BMHSU will be reviewed in further detail in Chapter 2 along with how it aligns with this study.

### **Nature of Study**

This research was comprised of a quantitative correlational cross-sectional design put in place to examine relationships between the independent variables and the dependent variable of SNM implantation for OAB in adult patients. This design type is often applied in healthcare and social investigations, which is useful for analyzing associations between several independent variables and a dependent variable at one point in time (Capili, 2021). Cross-sectional studies can also be applied to measure phenomenon over a specified period of time, referred to as serial cross-sectional research. Cross-sectional studies are either descriptive or analytic with descriptive methods measuring prevalence and frequency, which can lay the foundation for a causal relationship (Capili, 2021).

Advantages of quantitative correlational cross-sectional designs include quicker results because experimenters are not required to await results, and random sampling of participants in cross-sectional designs is not required, although if used, it can lend to more generalizability to the general population. Researchers using correlational cross-sectional designs will not 'lose' participants who choose not to participate because data collection occurs at one point in time, not over an extended period, and there is very little risk for participant harm (Capili, 2021). Research can be conducted in an efficient

manner with a smaller time investment and little cost, which is often considered the major benefit of this design. Yet lower cost and quicker results can limit application or generalization to larger populations, which is the well-recognized drawback of this design (Capili, 2021).

Once data retrieval was completed, a binomial logistic regression analysis was used to measure the statistical significance of the association between the different independent variables and the binary categorical dependent variable. Logistic regression models for binary response variables allows estimation of the probability of an outcome, in this case, a ‘yes-or-no’ to SNM implantation, based upon the values of the independent variables (Littler, 2024). Calculating the probability or p-value helps the researcher to learn the probability of something occurring, in order to determine the corresponding odds of the outcome (Littler, 2024). Running the regression model assigned a probability or p-value to each predictor variable in this study. If the regression showed statistical significance, this represented how likely it was that the given data occurred under the assumption that the null hypothesis was true (Littler, 2024). Chapter 3 will discuss these statistical applications and their relevance to this study in more depth. Definitions, scope, and assumptions will be covered in the next few paragraphs.

### **Definitions**

*Affordable Care Act (ACA)*: The Patient Protection and Affordable Care Act was a law passed in 2010 with the primary goal of establishing universal health coverage, making care more affordable and expanding Medicaid at the discretion of state governing bodies (Centers for Medicare and Medicaid, n.d.).

*Anticholinergic*: A medication substance that blocks the action of the acetylcholine neurotransmitter in the central and peripheral nervous system, inhibiting the parasympathetic nervous system (Shaw & Wagg, 2021).

*Botulinum toxin*: A neurotoxin made with the bacteria clostridium botulinum that interferes with neural transmission by blocking the release of acetylcholine, the principal neurotransmitter at the neuromuscular junction, causing muscle paralysis (Kapur et al., 2022).

*Beta 3 agonist*: A medication or substance which binds selectively to  $\beta_3$ -adrenergic receptors (Shaw & Wagg, 2021).

*Bladder retraining*: Scheduled bladder emptying at certain time intervals (Shaw & Wagg, 2021).

*Chemical denervation*: The application of a chemical agent directly to a nerve to intentionally interfere with nerve conduction (Kapur et al., 2022).

*Detrusor muscle*: Longitudinal and circular smooth muscle fibers located in the wall of the bladder that contract to empty urine from the bladder (Scarneciu et al., 2021).

*Incontinence*: Lack of voluntary control over urination (American Urologic Association, 2024).

*Lead*: An insulated wire that connects to a monitoring device or an apparatus that delivers or elicits an impulse (Feloney, 2023).

*Medicaid*: A joint federal and state program that provides health coverage for individuals with limited income and resources (Centers for Medicare and Medicaid, n.d.).

*Medicare*: Federal health insurance for anyone age 65 and above and for some individuals with certain conditions or disabilities (Centers for Medicare and Medicaid, n.d.).

*MRI*: A diagnostic scanner tube with a stretcher inside that uses strong magnetic fields and radio waves to generate images of the organs in the body (Bhide et al., 2020).

*Neurostimulator*: An electronic device that delivers electrical signals to the brain or elsewhere in the nervous system in order to block pain or nerve impulses (Kapur et al., 2022).

*Nocturia*: Frequent nighttime urination, often awakening the individual from a sleep state (Scarneciu et al., 2021).

*Overactive bladder syndrome (OAB)*: A collection of symptoms that includes urinary frequency, urgency, nocturia, and incontinence (Scarneciu et al., 2021).

*Pelvic floor therapy*: Physical therapy focusing on the rehabilitation of certain muscles in the pelvic floor (pelvis) which aids in controlling the bowels, bladder, urethra, rectum, and vagina (Scarneciu et al., 2021).

*Percutaneous*: Through the skin (Bhide et al., 2020).

*Sacral neuromodulation (SNM)*: Medical electrical nerve stimulation that involves implantation of a neurostimulator device, allowing communication between the brain and bladder (Feloney, 2023).

*Sacral plexus*: A group of nerves providing sensory/motor control over the parts of the pelvis, posterior thigh, most of the lower leg, the entire foot (Bhide et al., 2020).

*Sciatic nerve:* The largest sensory/motor nerve in the body that originates in the lumbar spine (low back) and extends caudally (towards the tailbone) to the heel (Bhide et al., 2020).

*Subdural hematoma:* A collection of blood under one of the protective layers of the brain (Pierre & Kondamudi, 2023).

*Tibial:* Relating to the tibia, the largest bone in the lower leg below the knee, commonly known in layperson terms as the shin (Bhide et al, 2020).

*Urinary frequency:* Urinating more than seven times per day, and more than once per night (Scarneciu et al., 2021).

*Urinary urgency:* A sudden, compelling urge to urinate that is difficult to defer (Scarneciu et al., 2021).

*Urologist:* A physician and surgeon specifically trained for the diagnosis and treatment of genitourinary diseases (American Urologic Association, 2024).

### **Assumptions**

There were several assumptions in this research study with the first being the efficacy of SNM as a relieving mechanism for OAB symptoms. Several scientific literature publications have reported SNM benefits such as improved bladder symptoms with significantly less bladder leaks at 12 months (Scarneciu et al., 2021) and again by Meng et al. (2022) who reported safety and symptom reduction in a more recent and longer-term study.

The second assumption was related to sample size, which is an important part of assuring validity and reliability in research. The word population in research is defined as

an entire group of events or individuals of interest to a research question. Since it is often impossible to survey an entire population, researchers select what is referred to as a sample, which is a subset of the entire population of interest (Gumpili & Das, 2022). Factors considered included balancing the sample size, which if too small, the sample might not represent the population. A sample size too large may produce sample size saturation, where despite the recruitment of additional participants, no new information is revealed (Gumpili & Das, 2022).

The third assumption in this study involved what is referred to as participant comprehension, which is the process whereby each participant understands what is being asked of them. This begins with recognition that OAB is a type of disorder, not simply the normal ageing process. Further, the participants had to discern that SNM is a treatment option for OAB and determine whether or not they would proceed with treatment using SNM for OAB. Recall that Sadri et al. (2023) reported that bladder dysfunction is underestimated because patients either do not know that bladder dysfunction is a disorder, or they are simply embarrassed to discuss bladder function with their provider. Nikolopoulou (2023) also reported a type of bias on patient questionnaires where instead of providing the answer that's true, participants may provide a socially desirable response. When topics are considered by patients as being sensitive, including bowel, bladder, and sexual function questions, the extent of misreporting anything potentially embarrassing can result in respondent editing, a phrase used to describe a type of misreporting, which can impact internal validity of the research.

When using binary logistic regression as in this study, there are statistical assumptions to meet including the assumption that the dependent variable is binary or dichotomous, and the independent variables number one or more and are either categorical, continuous, or a combination of (Harris, 2021). The next statistical assumptions require an independence of observations, meaning one observation in the data set is completely unrelated to the other(s) in the data set. The next addresses the need for no perfect multicollinearity among the independent variables, meaning there is no statistical correlation with the other independent variables, and the variables cannot be redundant, or measuring the same thing. The final assumption assumes a linear relationship between the continuous independent variables, and there were none in this study (Harris, 2021). A more robust discussion of these statistical assumptions is in Chapter 3.

### **Scope and Delimitations**

The scope of any research study aims to identify the topic under investigation, review the framework for the study, and it indicates each variable, along with the parameters within which the study is conducted (George, 2023). The scope of this quantitative cross-sectional design that used a logistic regression analysis was aimed at identifying any associations between health-services related factors and implantation of SNM for OAB in adults. The dichotomous dependent variable was categorical (SNM implantation; either yes or no) and the independent variables included travel distance to the urologist, wait time to see the urologist, educational attainment of the participant, insurance coverage of the patient, and facility attributes. The data analysis in this study

took place using de-identified patient charts/medical records from a privately owned urology practice and a hospital facility in the mid-central portion of the state of Georgia.

Delimitations are constraints imposed upon the study by the researcher(s) and they aid in identifying particulars included and excluded in the study (George, 2023). Delimitations are often referred to as boundaries in research and for this particular study, participants were limited to the two facilities mentioned with the diagnosis of non-neurogenic, atraumatic OAB, and pertaining only to the bladder. The second delimitation excluded pediatric or adolescent populations.

### **Limitations**

Limitations in a study refer to design flaws or weaknesses in research that may limit the generalizability of findings to a broader population. Limitations may be beyond the control of a researcher and yet they can serve as a foundation for future research (George, 2023). The initial limitation in this study involved the use of convenience sampling, which also carried the advantage of low cost, convenience as implied, and it was efficient for collecting and analyzing data. The drawback however was the lack of generalizability to a larger population, given it was from two counties exclusively in central Georgia. It is recognized that small sample sizes from potentially narrow geographic regions can impact external validity (Campbell et al., 2020). To potentially address this limitation, this study pursued multiple convenience samples from two entirely different practice settings.

A second limitation of this study involved the potential for unrealized errors in documentation. Initial documentation in the medical record generally begins with intake

by non-physician nursing or medical assistant staff. Following the urologist evaluation, dictation or transcription entries are made either in an electronic medical record (EMR) format or using manual documentation and each are associated with the potential for errors. EMRs encompass use by individuals with varying skill sets and Bell et al. (2020) reported that 21% of patients who reviewed their own medical record in the EMR format found an error; 42% of those errors were considered serious, and therefore it is evident that EMRs can impact medical record validity (Ross & Zaidi, 2019). If these errors can occur but are unrealized, correction of the limitation may be difficult, but the limitation must still be reported (Ross & Zaidi, 2019).

Another limitation associated with this research was the lack of previous research studies on the specific topic of health-services related barriers to using SNM for OAB. Although this is considered by peer-reviewed journals as a limitation (Ross and Zaidi, 2019), it also served as the research gap for this study.

### **Significance**

The primary objective of this study was to identify if there were health-services related barriers to the implantation of SNM for adults with OAB. While Gariscak et al. (2023) speculated on the underutilization of SNM for OAB, exact barriers to the implantation of SNM for OAB have not been identified. There is a scarcity of research identifying whether potential barriers are medical or demographic in nature or related to health-services challenges. These may include the availability of specialists, ORs, travel distance or wait times, education levels and insurance coverage, yet none of these have been fully explored. Given that many researchers have confirmed the widespread nature

and significant impact of OAB in adults in the later decades of life, identification of health-services related barriers to accessing SNM could close the gap in knowledge and affect strategies to eliminate those barriers, allowing easier and more efficient access to treatment.

### **Summary**

The widespread impact of OAB has finally been recognized in the literature, along with OAB's elusive relief of symptoms. Although successful modalities for treatment such as SNM have been published, there is merely a small amount of data looking at health services factors that might impact SNM implantation. The gap in knowledge about potential barriers has been understudied, and the results may help identify obstacles to treatment. Chapter 2 will provide a literature review looking the independent predictor variables, the dichotomous dependent variable, and the impact health services factors may have on implantation of SNM for OAB in adults.

## Chapter 2: Literature Review

### **Introduction**

Scarneciu et al. (2021) has defined OAB as an intense, chronic and disabling condition with physical, psychological, and social consequences that impact the quality of life of millions of patients worldwide. Known as OAB, the symptoms range from inconvenient to endangering, and the diagnosis has been reported as frustrating for both patients and the medical teams treating this disorder (Scarneciu et al., 2021). Many treatment options have been developed with varying degrees of effectiveness and one of the more advanced treatments known as SNM has been deemed both effective and free of serious adverse effects (Lo et al., 2020). Yet some urologists have postulated this successful treatment modality has been underutilized (Gariscak et al., 2023).

An estimated 18% of Canadians have the diagnosis of OAB, and approximately 24% of those individuals reported difficulty adhering to pharmacotherapy (Gariscak et al., 2023). The Canadian Urological Association treatment guidelines that are nearly identical to those in the United States have a stepwise algorithm for treating adult OAB. Third-line treatments are utilized when first and second-line treatments including lifestyle modification, physical therapy, and medications either fail or produce side-effects too difficult to tolerate (Scarneciu et al., 2021). These third-line modalities include intradetrusor onabotulinumtoxin A (Botox) injections, PTNS, and SNM.

Following conduction of their qualitative review, Gariscak et al. (2023) determined the most common limitations to using SNM were lack of available specialists, fiscal barriers, and levels of expertise surrounding SNM management (Gariscak et al.,

2023). Their first step in understanding potential impediments to using SNM highlighted that health services related factors were potential obstacles, but that further research was needed to pinpoint and modify those confines to recommend SNM confidently. While the current published knowledge on health services-related barriers to implanting SNM for OAB is extremely limited, this search did not identify any publications that analyzed health service factors as barriers to using SNM for OAB in the United States.

Considering the limited dissemination on this topic, this paper explored if there is an association between health services predictors and implantation of SNM in adults for OAB.

Chapter 2 provides the literature search strategy used to examine peer-reviewed publications on the use of SNM for OAB, and potential health services related barriers to implantation. Search terms and phrases around the independent variables, and SNM implantation as the dependent variable were reviewed. It has been established in the literature that SNM is an effective strategy to employ in adults with non-neurogenic OAB and the adverse-effect profile is minimal (Liu et al., 2022). This prompted further research to learn if a significant association was found between health services-related variables and implantation of SNM in adults for OAB.

### **Literature Search Strategy**

A literature search was performed online beginning with the use of Google Scholar for a basic understanding of current publications regarding the use of SNM for OAB. The terms *overactive bladder*, *sacral neuromodulation*, and *peer-reviewed* beginning with 2020 yielded 1,320 results. Next, terms associated with the dependent and

independent variables in this study were added individually, and by applying a varied combination of key words. Selecting and de-selecting the all-text option with articles restricted to the English language, having the terms *adults, anesthesia, anesthesiology, anesthesia staffing, anesthesia coverage, sedation, health, health services, health services delivery, health services cost, neuromodulation, sacral neuromodulation, sacral nerve stimulation, overactive bladder, overactive bladder symptoms, OAB, urine incontinence, lower urinary tract symptoms, sacral nerve, sacral nerve modulation, sacral nerve device, sacral nerve device implant/explant, implant removal, device complications, barrier, hindrance, obstacle, encumbrance, referral, specialist, urologist, gynecologist, geographic distance, distance, wait time, wait time in doctor's office, wait time for referral, demographic, sociodemographic, income, background, hospital, hospital type, facility type, operating room, procedure room, healthcare organization, organization type, rural, health insurance, insurance, insurance coverage, financial, finances, Medicare, Medicaid, ACA, Affordable Care Act, education level, degree, degree attainment, education attainment, Andersen, Andersen's behavioral model, theoretical, theoretical foundation, and foundations* yielded 1,108 published articles. A search using the Walden University Library using the identical search terms, opting for English language, de-selecting full-text, with publication dates from 2020 until May 2025 identified 346 academic journal articles and abstracts. Use of the identical search terminology with Google Scholar produced 333 works and to ensure a complete and thorough search, this was explored using CINAHL, Cochrane, EBSCO Advanced Searches, Elsevier, Embase, Medline, ProQuest Dissertations, Thesis Global, and

Ulrich's Periodicals Directory, CINAHL, Cochrane, and Walden University yielded duplicate articles and abstracts, therefore, for this particular study, Google Scholar and Walden University Library offered the most thorough search results. Once the 333 publications were obtained from Google Scholar and Walden University's library, manual review of each abstract was required to exclude fecal incontinence, concurrent fecal and urinary incontinence, pediatric, pediatric patients, pediatric participants, neurogenic bladder, and neurologic comorbidities (Parkinson's, Multiple Sclerosis), and other forms of research that was not original and/or peer-reviewed. Duplicate publications were excluded, and manual review of the remaining sources was completed.

## **Theoretical Foundation**

### **Behavioral Model of Health Services Use**

OAB impacts many individual pursuits including the simplest of ventures, such as dressing, driving, ambulating, performing hygiene, and adhering to scheduled appointments (Marcue et al., 2024). Andersen's BMHSU has been applied extensively to both predict and explain health services utilization. Initially developed in the 1960s, it has undergone many revisions according to how healthcare has evolved, both in delivery and in policy, and the model was expanded to include three major stages including predisposing, enabling, and need, the last representing the need for and engaging in medical care (Lederle et al., 2021).

#### ***Predisposing Attributes***

Seidu (2020) described predisposing factors as conditions or circumstances that might prompt an individual to consider use of health services without directly causing the

use of healthcare services. His research looked at age, education level, and marital status in men who were considering HIV testing. When analyzing his results, he found that while marital status was not considered a cause for testing, it may have nudged or predisposed the individuals to undergo testing.

Predisposing characteristics can also be demographic factors such as race, gender, or ethnicity, and these have been shown in numerous studies to influence health care service utilization (Alkhaldeh et al., 2023). Employment status, civil standing, and number of children born were also identified as major variables considered as predisposing characteristics in a large number of studies analyzing healthcare utilization (Alkhaldeh et al., 2023). Tsiu (2024) conducted research where age was a predisposing factor for OAB, where adults greater than 40 years old were widely impacted with a steady rise in OAB incidence. As age progressed, detrusor muscle activity was shown to diminish as an individual ages (Tsiu, 2024).

### ***Enabling Attributes***

Enabling attributes are the second stage of Andersen's model which describes a set of circumstances that facilitate or make it more likely an individual will utilize health services. Patients who possess enabling attributes have traits or resources that aide or promote a particular use of health services, which can be in the form of finances, insurance coverage, or place of residence (Seidu, 2020). Insurance status, income levels, and distance to nearest healthcare facility were frequently observed as enabling attributes when looking at patterns of healthcare use (Alkhaldeh et al., 2023). If distance to the nearest healthcare facility were an enabling factor in a community without a hospital or

clinic, the particular individuals in that community may be less likely to use the faraway facility if they also lacked the appropriate transportation to travel the distance, or the physical conditioning required to walk to the healthcare center. This can be used to describe how enabling attributes such as transportation and physical ability might impact health services use.

### ***Need Level***

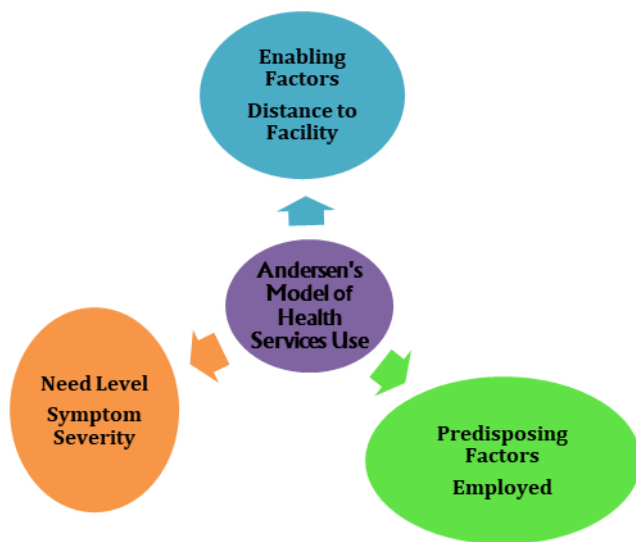
Need level is the third stage in Andersen's model. Need level was described as the level of necessity or severity of symptoms that may prompt the need to actually utilize health services (Seidu, 2020). An example of need can be observed in an individual with symptom severity, which is described as *symptom bother* in the urology literature. Mseke et al. (2024) quantified symptom severity and need by describing such symptoms as they interfere with activities of daily living in the individual's life, which then prompts the individual to engage in health services use. Characteristics of need level or symptom bother in accordance with this behavioral model included the degree of OAB symptoms, and the amount of interference in the individual's activities of daily living, thereby inducing that individual to seek out treatment.

Andersen's model has widespread recognition of its applicability in many healthcare settings and in multiple disciplines where predisposing attributes, enabling factors, and need level are all applied to explain healthcare utilization in a certain setting (Lederle et al., 2021). This applicability makes it easily utilized for this study and in the field of urology as well. Given that fiscal matters can also impact healthcare utilization, Andersen's model underwent a revision that incorporated finance as another element that

can explain healthcare utilization, making it even more appropriate for this research. According to Lederle et al., (2021), all the core factors intertwine and impact the use of healthcare services, which is demonstrated in Figure 1. In this particular case, financial status can enable access to healthcare, or entrance to specialists, and finances in the form of income can be considered an enabling factor for accessing health services as well. Insurance status and the costs associated with being insured, such as out-of-pocket amounts may influence access to healthcare and may have an impact on the decision whether to use SNM implantation for OAB.

### Figure 1

*Depiction of Andersen's Model of Health Services Use in This Study*



### Appropriateness to Current Study

Individuals living with OAB often become connected with, then engaged in, and finally cleaved to the healthcare system as they continue to age, and as symptoms progress, and engaging with the health services system may provide the best fit for

individuals to maximize health status. Researchers within the field of urology have successfully applied Andersen's model to demonstrate how OAB symptoms aren't simply due to aging, to promote that there may be treatment to augment healthy living, and to aid other disciplines, in addition to urology to predict engagement in healthcare and necessary treatments.

For this particular research, Andersen's model provided a construct to look for associations between the variables and the decision to implant SNM for OAB. This model incorporates three stages including predisposing, enabling, and illness severity or need factors that are often applied in research to explain choices individuals make about healthcare. This study analyzed the specific choice of whether or not to implant SNM for OAB by evaluating for relationships or associations between each of the study's predictors that included distance to and wait time to the urologist, insurance coverage type, education level, and facility attributes, and were analyzed for their prospective connection to choosing SNM for OAB by applying the elements of the model.

### **Literature Review Related to Key Variables**

Health services factors have been shown to impact health services utilization, according to Alkhaldeh et al. (2023). Healthcare utilization refers to individuals actively engaging with the healthcare system to prevent and treat health issues, enhance overall health, and maintain well-being (Krzyz et al., 2023). Access to healthcare services has a considerable effect on overall health at all stages of life and when healthcare services are sufficiently utilized, this allows for earlier detection and diagnosis of health problems so they may be addressed more proactively (Coombs et al., 2021). Revisions

are frequently made to health policy to improve healthcare access as was planned in the United States when the 2010 ACA was enacted. The aim was to improve access and quality of healthcare services for U.S. citizens by reducing out-of-pocket spending, eliminating missed medications, and by fostering increased utilization of healthcare services (Coombs et al. 2021). In contrast, issues with longer wait times, scheduling conflicts, and lack of trained specialists have come up and these factors may actually serve as barriers to utilizing healthcare services (Coombs et al., 2021).

This literature review will look at each of the variables to determine if a statistically significant association exists specifically between health services related factors and implantation of SNM for OAB in adults. Researchers have demonstrated the efficacy and safety of SNM for OAB already (Meng et al., 2022); yet other researchers have postulated that despite these findings, the third-line treatment of SNM remains underutilized (Gariscak et al., 2023). There are numerous clinical studies looking at variables such as gender, cognition, and medical comorbidities such as hypertension or diabetes and use of SNM for OAB, yet none were shown as predictors for implantation of SNM for OAB (Kapur et al., 2022).

### **Travel Distance to the Urologist**

The distance to travel to access health services has been shown to be a predictor of health services utilization by many researchers around the globe (Chen et al., 2022). Coste and Bousmah (2023) surveyed participants needing to access healthcare in Senegal and distance to travel was regarded as a predominant barrier to healthcare utilization. When analyzing travel distance, respondents residing more than 4.8 km away from the

nearest health structure stated that any distances further served as a barrier to utilization. Seidu (2020) queried men needing human immunodeficiency virus (HIV) testing and their responses regarding the travel distance between their residence and the testing facility indicated that shorter distance was an enabling factor, and longer distances revealed a lower likelihood of testing. In another study, Hahn et al. (2023) surveyed veterans to measure travel burden and healthcare access using sleep medicine specialists to quantify travel-related barriers. Factors included facility distance between the veteran's home and the Veteran's Administration (VA) facility. Hahn et al. (2023) concluded that travel distance was shown to be a major barrier for veterans and care was fragmented due to inconsistent scheduling and attendance of visits.

Not only veterans are impacted according to recent research. Healthcare access and distances from healthcare appears to be a world-wide challenge as researchers in many geographic areas have considered this topic. The Organization for Economic Co-operation and Development (OECD, 2023) determined that access to healthcare for individuals of all socioeconomic levels is essential globally. Efforts to determine barriers impacting healthcare utilization began by noting travel distance to and wait times for specialists. Lack of access due to these factors has been found to reduce healthcare utilization and it burdens primary care providers to absorb this care (OECD, 2023).

Additional research looking at the impact of geographic distance on healthcare access was done by Labban et al. (2023). This research was based on their premise that geographic access and the mode of transportation for healthcare remains understudied. They determined that certain racial and ethnic populations who reside a considerable

distance from the nearest healthcare facility relied solely on public transportation to obtain healthcare (Labban et al., 2023). Further, they identified poor public transportation infrastructure, the cost of personal vehicles, and time absent from the workplace were all been predictors of lower health service utilization for illnesses such as diabetes and heart disease.

There is further evidence to show an association between geographic distance and access to healthcare. Hierink et al. (2021) analyzed geographic accessibility to infectious disease testing and noted that increased distances to healthcare structures fostered only passive surveillance of disease burden when actually individual in-person tally is optimal. They also noted that poor geographic access to healthcare facilities increased actual infectious disease incidence thereby contributing to additional widespread infection (Hierink et al., 2021). A greater distance was shown to reduce numbers of individuals who actually presented for testing and treatment.

When considering the presentation for treatment, Sadehi et al. (2024) initiated research looking at treatment delays specifically for lung cancer. Their research was intended to promote that standardized, efficient healthcare delivery models are needed for better outcomes in lung cancer treatment. When analyzing potential barriers to timeliness of care, they uncovered that greater distances to healthcare facilities were actual barriers to care, not just timeliness of treatment (Sadehi et al., 2024).

When looking at research surrounding urological disease specifically, Narang et al. (2023) examined health-related quality-of-life in patients with urolithiasis (kidney stones) based on travel distance to a facility for treatment. Because symptom resolution

often requires pain control and definitive treatment, individual levels of stress and anxiety were measured based on travel distance to their facility with a significant negative correlation found between patients' Wisconsin Stone Quality of Life (WISQOL) score and distance to treatment (Narang et al., 2023). Sebesta et al. (2022) determined that various unmet needs impacted treatment access in patients with OAB including the distance to the urologist and modes of transportation available in this population.

Research has shown a link between travel distance and healthcare utilization by measuring straight-line travel distance, which was done back in 1995 (Phibbs & Luft, 1995). By asking Medicare beneficiaries about travel distance and use of healthcare services, this prompted another inquiry about actual unimpeded travel distance versus vehicle congestion, and road conditions. While this dates back to 1995, it carries relevance because both measurements were compared, and the straight line road computations showed very high correlations with actual travel time. Both were deemed acceptable and it served as a reference for measuring travel time going forward.

### **Wait Time to See the Urologist**

Accessibility and availability are important characteristics of health service utilization (Marshall et al., 2023). Waiting for an appointment with a specialist has been shown to impose physical burdens on wellness and disease status, and time spent waiting for health care presents a potential barrier to health system engagement, according to the OECD (2023). Wait time as described by Stafinski et al. (2022) is the time from the decision to undergo evaluation by a specialist, until the time that evaluation takes place by the specialist. Wait times occur because of varied geographic dispersion of specialists,

a mismatch of the demand for services and the supply of services. Aside from experiencing wait time, there is evidence of an unequal wait-time burden by socioeconomic status across all areas of the globe (Stafinski et al., 2022). Subsequently, prolonged time spent waiting for initial contact with specialist care leads to a negative impact on patients' health incentives to pursue the specialist access at all (Marshall et al., 2023). Researchers have demonstrated the consequences of specialist wait times, which result in negative outcomes, reduced patient satisfaction, and a reduced adherence to treatment from missed appointments (Stafinski et al., 2022). Long times spent waiting for healthcare serves as a hurdle to health care access and engagement to sustain continuity of the health care service (McIntyre & Chow, 2020). Gagliardi et al. (2021) further demonstrated negative outcomes from frustration when attempting access to health systems without responses, telephone call backs, or with delayed acknowledgment. This occurred because individuals reportedly gave up on pursuing access to certain health specialists' services, noting physical stressors and anxiety, further contributing to a physical worsening of the patient's medical diagnoses (Gagliardi et al., 2021).

Interestingly, this challenge of wait times has been noted by researchers to be a problem globally (OECD, 2023). The OECD has undertaken measures to examine healthcare access and utilization by looking at travel and distance as determinants of utilization. Research has demonstrated the negative association between prolonged wait times to establish with a specialist, and utilization of services, maintaining continuity-of-care, and promoting increased overall life expectancy (OECD, 2023). While none of this research has been directed at SNM specifically, the factors of prolonged waiting and

negative health services utilization may show a similar association as with other conditions, including SNM for OAB.

### **Educational Attainment**

The above two independent variables of distance to travel and wait time to see a specialist have shown significant associations for the utilization of health services by many researchers. Education level or educational attainment has also been analyzed to reveal similar associations by other researchers. Commonly thought of as a predisposing factor when applying Andersen's model, education level showed a significant association with health services use in many studies (Alkhaldeh et al., 2023). Seidu (2020) analyzed education levels and HIV testing among sexually active men in Ghana. His research surveyed no education, primary education, secondary education, and higher education when looking for predictors for HIV testing and education level was shown to be significantly associated with higher levels of HIV testing (Seidu, 2020). Similarly, investigators linked education level with positive utilization of available health systems (Whitman et al., 2022), and Qudah et al. (2024) found that education levels were inversely correlated with the tendency to report OAB symptoms.

Rigorous evidence on the relationship between education and healthcare utilization has been considered limited, until research by Yue et al. (2020). Their work demonstrated a strong association between higher education and a lower probability of utilizing health services and included research on unplanned hospital admissions. Applying Andersen's BMHSU, the model's framework helped to identify the education-

healthcare relationship with educational attainment identified as a predictor for health services use to prevent unnecessary hospitalizations (Yue et al., 2020).

Knowing that educational attainment has been associated with the adoption of health services in general, the examination for an association between health services utilization and a specific disease is a logical progression. Wang et al. (2021) concluded that maternal education levels are crucial for the utilization of health services for both prenatal and antenatal care in the Democratic Republic of the Congo. Slåtsve et al. (2020) showed research that concluded when participants resided in a country with equal access to healthcare services, educational attainment was associated with higher health service use and a lower incidence of heart disease and kidney failure in adults with diabetes. Raghupathi and Raghupathi (2020) performed research looking at educational attainment as a predictor for health service utilization and the impact on overall health measurements. Using data from the World Bank listing 26 OECD countries, it was determined that educational attainment at the tertiary level fostered the awareness that health services are available.

These findings can be extrapolated and applied to many health settings when considering educational attainment and its effect on health services utilization. While educational attainment and education levels have been linked with more appropriate use of health services systems (Whitman et al., 2022), none have been conducted to evaluate health services utilization by adults with OAB and the modality of SNM.

## **Insurance Coverage Type**

In addition to wait times, travel distances, and educational attainment, insurance coverage whether public or private has been postulated to impact utilization of health care services. For example, research shows higher levels of health service utilization by individuals with some type of insurance coverage, whether public or universal (Docrat et al., 2020). While many countries have expanded medical coverage to include social, national, or community-based coverage, in the United States, expansion of coverage has not always equated to increased use of healthcare resources (Narita, 2023). Exact predictors for the use of healthcare services in the United States is still under investigation, yet some factors have been linked including age, gender, out-of-pocket expenses, and personal bankruptcies (Narita, 2023). Personal bankruptcy maintains its relevance because medical debt has accounted for greater than 50% of all personal bankruptcies in the United States. Greater out-of-pocket expenses for healthcare services have been associated with less frequent utilization of healthcare services (Narita, 2023). When analyzing a different population but with similar health concerns, migrants in China who had health insurance coverage demonstrated a positive trend in health service utilization, compared to those individuals having no coverage (Dong, 2024). Farrell and Gottlieb (2020) from the Office of the Assistant Secretary for Health in the United States confirmed that their agency carries the responsibility for public health programs within the United States. Their research showed trends of increased utilization of health services following the expansion of insurance coverage with the ACA. Ochieng and Biniek (2022)

analyzed health service utilization following initiation of the ACA and concluded that health services utilization increased among the insured, with very similar findings.

While the above sources demonstrated increased utilization of healthcare services congruent with having insurance coverage, other sources have demonstrated excessive cost burden from patient portions and out-of-pocket fees for insured patients. Wray et al. (2021) surveyed individuals in the United States with multiple coverage types including private, employer-sponsored coverage, Medicare, ACA coverage including expanded Medicaid. Conclusions after performing a pairwise multivariable comparison analysis demonstrated that individuals with private, employer-sponsored plans were significantly more likely to report medical debt, paying out-of-pocket at every doctor visit, experiencing more difficulty seeing physicians, having higher fees at physician visits, and not adhering to medication regimens because of costs to patients assigned by insurers (Wray et al., 2021). In stark contrast, those with Medicaid reported higher patterns of consistent care with a physician, having little or zero out-of-pocket expense for medications, and absent medical debt (Wray et al., 2021).

Similarly, Dugan (2020) analyzed the effect of health insurance type and found that adults with private insurance were far more likely to use office-based health services, and less likely to access ER services because of high out-of-pocket fees for ER treatment. Those individuals having Medicaid or ACA coverage were more likely to utilize emergency room services because of no out-of-pocket costs for emergency treatment, and the same population utilized the least cost-effective mixture of health services (Dugan,

2020). Finally, those with no insurance coverage were the least likely to access any healthcare services at all (Dugan, 2020).

To summarize, it is known that insurance coverage has been shown to be a potential predictor for utilizing certain health care services, yet it is not an exclusive predictor. In addition, the availability of healthcare facilities, or the type of facility has been considered as another variable that may be associated with utilization of health services. However, there has been no definitive research demonstrating either insurance or facility traits as specific predictors for implanting SNM for OAB in the adult population. Therefore, the next section will examine facility attributes and the potential association for implanting SNM for OAB in adults.

### **Facility Attributes**

As described above, Gariscak et al. (2023) mentioned facility attributes or facility characteristics that could serve as barriers to referring patients for SNM implantation for OAB in adults in Canada. Feloney (2023) wrote that SNM intervention requires a specially trained professional team or a collaborative effort among several healthcare professional teams to optimize patient outcomes. This includes OR availability, the most recent urology and surgical equipment, surgical and anesthesia providers, specially trained surgical technicians, and nursing staff to recover patients following implant procedures. In addition to SNM surgery and urology personnel, a clinical representative from the device company needs to be present for device interrogation and management of settings upon implantation and Gariscak et al. (2023) considered the above elements to be part of the challenge.

Abiyu et al. (2024) analyzed data looking for an association between health service utilization and facility availability. They defined elective surgery as a non-emergency surgical procedure that can be postponed for a minimum of 24 hours, yet it is medically required and necessary for the well-being of the patient. The World Health Organization (WHO) reported over one third of scheduled surgeries globally has resulted in at least one delay, and the WHO publication in 2024 reported that countries at all levels of socioeconomic development have experienced OR and facility shortages because of resource shortages (WHO, 2024). These shortages or inadequacies have been attributed to limitations in facilities' ability to meet safety standards and to fill workforce deficiencies in healthcare positions taking 8 years or more for training and education (WHO, 2024). Finally, rural facilities in many geographic locations worldwide may have limited socioeconomic investment in their hospitals to safely and competently offer surgical services. Administrators and healthcare leaders have been faced with ongoing predicaments of allocating resources, and rural areas with unmet health needs have patients who must travel long or even unattainable distances to arrive at qualified facilities for their healthcare (WHO, 2024). Abiyu et al. (2024) drew a parallel with the availability of trained personnel at such facilities and as an example, reported that anesthesiologists were present anywhere between 71.8%–92.5% of the time while procedures were performed, in adequately staffed locations. Meeting these requirements long-term are ongoing financial and manpower challenges for rural facilities (Abiyu et al., 2024).

The above sources highlight the fact that facilities and health personnel are attributes that may affect facility usability. This calls attention to the potential importance of the availability of specialists at certain facilities. The lack of anesthesia providers and intensivists for many types of surgical specialties to operate, or the number of providers for limited hours of coverage can influence healthcare utilization at particular facilities (Pappada et al., 2022). Equally, operating schedule congestion and lower availability of specialists can lead to deferred utilization of health services by patients or administrators. Similar to findings from Pappada et al. (2022), this may present more than a simple inconvenience (Moir and Barua, 2021).

While a good number of these articles focused on OR or procedure capacity scheduling, conclusions about the impact of OR congestion and the utilization of health services have been similar, according to Moir and Barua (2021). They concluded the lack of available procedure suites, ORs and specialists can transition potentially reversible illnesses or injuries into chronic, irreversible conditions, or permanent disability can result from delays. They also reported patients may have to face the risk of income loss while waiting, which can serve as another significant barrier to obtaining treatment at all (Moir & Barua, 2021).

To summarize, facility-related barriers can impact the use of health services, yet these have not been researched by specific specialty. One can conclude that the same barriers could impact SNM implantation for OAB, and further research was needed to examine if facility availability showed any association with the implantation of SNM for OAB.

## Summary and Conclusions

OAB is a challenging medical problem in the United States and globally. According to WHO, OAB impacts individuals of all regions, races, and those in all socioeconomic brackets, impacting daily life, sleep quality, and activities of daily living. OAB can lead to other serious comorbidities when individuals attempt to manage the symptoms, and medications taken to mitigate OAB manifestations may have serious side effects all their own (Sadri et al., 2023). The SNM treatment modality has been shown to control OAB symptoms without life-threatening adverse effects (Meng et al., 2022), yet rates of SNM implantation have been hypothesized to be underutilized. Because the reasons for underuse have been inconclusive, this study aimed to learn of the health services related barriers that may be associated with the implantation of SNM for OAB in adults. Chapters 1 and 2 described the research question, hypotheses, the theoretical foundation, and the literature review that supported research into the problem. Chapter 3 covers the methodology, a description of the population under study, sampling procedures, the sample size number and calculation, and the statistical analysis. After review of the statistics, threats to validity and ethical treatment standards will be discussed.

## Chapter 3: Research Method

### Introduction

OAB has a significant prevalence among patients over the age of 50, according to researchers around the globe. In one example, Oudah et al. (2023) studied 940 patients in Jordan and among those individuals, 27.4% had OAB symptoms classified as very bothersome. In another publication, Scarneciu et al. (2021) reported on research performed in Europe in 2011 with 10,000 patients. Among those surveyed, 36% of the men and 43% of the women, all over 40 years of age, complained of OAB symptoms that markedly impaired their quality of life. NOBLE showed a prevalence of more than 33 million individuals with OAB in the U.S. population in 2003. While both reports are mature dating back to 2003, in 2024, Abuorouq et al. studied 525 medical students in Jordan and 44.5% of those individuals complained of OAB symptoms that physically impacted their daily lives, corroborating reports of a notably prevalent condition. The purpose of reviewing these research studies was not to generalize results to wider populations but to underscore the large numbers of individuals affected by OAB symptoms. By sharing numbers of patients impacted, the need for treatment options becomes very evident. While SNM has been proven highly effective at mitigating OAB symptoms with very few adverse effects (Feloney et al., 2023), SNM is underutilized as a third-line treatment for OAB for reasons that remain unknown (Gariscak et al. 2023). The gap in knowledge about barriers to using SNM has been understudied thus the purpose of this study was to identify health-services related factors as potential barriers to selecting SNM for treatment of OAB.

This chapter presents a detailed description of the quantitative design, rationale, and research methods, and includes a section where the sample population, sampling procedures, and use of the G\*Power instrument for sample size will be reviewed. Variables are discussed and the techniques used to perform the measurements (operationalization) are reported. The statistical analysis, assumptions, threats to validity, and a review of participant protections will be examined for this study.

### **Research Design and Rationale**

This study investigated whether there was a relationship between the independent variables of the distance in miles to the urologist, wait time in weeks to see the urologist, educational attainment levels, insurance coverage type, and facility attributes including anesthesia hours of coverage, the number of ORs with SNM equipment available, and the availability of specially trained staff to care for SNM patients. The dichotomous outcome variable was whether SNM was chosen as the treatment for OAB.

The independent variable in the first research question investigated the distance from the patient's residence to the urologist's office in miles. The independent variable in the second research question was wait time in weeks to see the specialist, and the independent variable in the third research question measured educational attainment. The fourth research question looked insurance coverage type, and the independent variable in the fifth research question examined facility attributes including anesthesia services coverage in hours, OR numbers having the appropriate equipment and accessibility, and employment of specialized staff for SNM patients. All five independent variables were

compared to the dichotomous dependent variable for this study which was implantation of SNM for OAB in adults in the state of Georgia.

A quantitative design was selected and used to measure the potential relationships or associations between the variables. Quantitative designs are useful to test hypotheses using statistical methods, and to apply the results to generalize findings to a larger population (Harris, 2021). The goal of this study was to determine the significance of any associations found between the multiple independent variables and the dichotomous dependent variable of implantation of SNM using a quantitative cross-sectional correlational design for the data collection portion of this research.

A quantitative cross-sectional correlational design refers to the collection of data for a study from a group of participants at a single point in time. Cross-sectional studies are observational, and researchers can conduct concomitant comparisons of sample populations and a distribution of variables leading to efficiency in both time management and cost, compared to other research designs (Maier et al., 2023). Cross-sectional correlational designs are non-experimental approaches allowing researchers to gather information from sample populations such as trait prevalence or other characteristics and apply them to describe variables or to identify potential connections between either participants or variables (Maier et al., 2023).

Cross sectional studies obtain participants by utilizing convenience sampling, which entails participant selection based upon availability or willingness to participate, in contrast to random sampling. Convenience samples are easily accessible and often, happen to be available, where random sampling is a systematic method ensuring that each

member of the general population has an equal chance of being selected for the sample (Maier et al., 2023). It is most often utilized in surveys, experiments, and market research, and as the name implies, a convenience sample is considered an advantage of using cross-sectional research designs, as in this study. Another reason this can be deemed a convenience sample is because the data has already been collected by someone else, for another purpose. That is the definition of secondary data (Maier et al., 2023), and how and why the data were available is described in the next paragraphs.

For this particular study, the data were administratively collected during the process known as patient registration, which is the initial process in healthcare revenue cycle management. This includes patient identification, verification of insurance coverage, and eligibility for services. This verification is seen as crucial by health facilities to prevent identity theft, insurance fraud, and billing errors and the data are either entered into the EMR or manually recorded (Delice et al., 2021). Medical history, referral date and provider, primary care provider data, consent for treatment, and other demographic information is gathered, and can also be inclusive of family history, education level, housing or living arrangements, hobbies, and gender assignment (Delice et al., 2021). Further, peer-reviewed data as well as the Centers for Medicare and Medicaid Services (CMS, n.d.) encourages and financially supports the use of EMR data for research, and provides access to Medicare claims data via the Research Data Assistance Center (ResDAC) if needed. CMS has incentivized the adoption of EMRs through certain programs, which encourages healthcare providers to use EMRs to input, capture, exchange, and report specific demographic and clinical data specifically for

research purposes. Therefore, EMR data are seen as a valuable resource for medical research, providing insights into patient demographics, diagnoses, treatments, and outcomes.

Although convenient, a major disadvantage of using a cross-sectional correlational design includes the researcher's inability to track changes over time. The data are both entered and collected at a single point in time, and yet a recognized drawback is its failure to provide a dimensional picture of the sample group or cohort at that time. However, researchers can address this by conducting repeat cross-sectional studies, each done at another single point in time, leading to the tracking of changes, but this requires additional research (Wang & Cheng, 2020).

Another disadvantage associated with cross-sectional designs surrounds the possibility of small sample size. Maier et al. (2023) explained that small sample sizes can lead to unreliable results that can't be generalized to a wider population. The lack of sufficient data to represent a large population might also limit statistical power of the findings (Maier et al., 2023).

Cross-sectional designs possess a third weakness which involves the inability of the researcher to infer causality. Because of the observational nature and collection of data at one point in time, it is not possible for causality to be determined. Causality refers to a direct relationship where one variable demonstrably causes a change in another, linking the exposure to an outcome (Haber et al., 2022). Despite the advantages and disadvantages, this design choice was consistent with the goal of answering each research question to close the information gap for this study within a reasonable time frame. The

medical records described were from select OAB patients who were referred from primary care providers and other urologists to facilities that have urologists trained in SNM implantations in Georgia.

In this study, no intervention was performed, and a logistic regression analysis was planned to analyze the association between each of the independent predictor variables and the binary dependent outcome variable.

## **Methodology**

### **Population**

The study population included a group of individuals with OAB who were referred to urologists trained in SNM, and who failed other conservative treatments. Considering that secondary data were used, the target population size was an estimation of a minimum of 200 individuals, based upon the Food and Drug Administration Manufacturer and User Facility Device Experience Database (Carlton et al., 2023). Patients were referred for specialist evaluation from 2020 -2023.

### **Sampling and Sampling Procedures**

The sampling frame for this research study consisted of a list of patients referred to urologists skilled in SNM implantation for adults with OAB, licensed to practice medicine and surgery in the state of Georgia. A sampling frame is defined as a list from which a researcher selects a sample of participants from a larger population of interest (Szwarcwald, 2023). The selection process uses a purposive sampling strategy, also referred to as a nonprobability sampling method where participants are selected based on qualifications or characteristics selected by the researcher (Szwarcwald, 2023). Purposive

sampling utilizes participants that are chosen based on the ease of access and inclusion for the researcher, and the sample is usually achieved efficiently and with little cost financially or in terms of time investment (Szwarcwald, 2023). Aside from these benefits however is the potential for bias when selecting the participants, as well as the risk that the findings may not be generalizable to the larger population. To avoid potential bias in participant selection, blind record or chart reviews are recommended, or as in this study, other individuals without knowledge of the research intent selected the sample population (Bradley et al., 2020).

### **Sampling Frame**

Patients from this sampling frame with both medical and demographic data in their records also having the necessary implant data (yes or no) to address the research questions were selected (drawn) for this study by facility-appointed clinicians. Among the medical records drawn by the facility clinicians, a second review was performed by each facility's appointed clinician to ensure if the researcher had administered an anesthetic to the patient in the past, and if so, this met criteria for automatic exclusion. Among the variable categories, if any of the variable characteristics such as facility, insurance, or educational attainment were not legible, or were duplicates, the profiles would require exclusion.

### **Power Analysis and Sample Size**

Determination of adequate sample size can be challenging, and sample size determination has gained widespread attention in recent literature (Kang, 2021). Accurate sample sizes are important to obtain reliable study findings that are generalizable to a

larger population, and inadequate sample sizes may not represent the population under study. Too-small sample sizes can contribute to challenges in detecting true statistical relationships (Type II error), and sample sizes too large can lead to a Type I error or rejecting the null hypothesis when it is actually true (In et al., 2020). From an economic and time-management standpoint, inaccurate sample sizes can waste financial resources, and hinder time management affecting both researchers and participants. The development of sampling tools, like the G\*Power sample size application, which is a free downloadable statistical software package allows users to determine statistical power based upon on a variety of statistical tests to calculate the minimum sample size (Kang, 2021). The G\*Power tool performs an a priori power analyses, allowing a researcher to select the appropriate statistical test and calculate the required sample size based on input parameters such as effect size, alpha level, and desired power level.

An a priori analysis is a sample size calculation that is conducted prior to performing the research, and ideally before the design and planning takes place, which provides a method for controlling type I and II errors (Kang, 2021). A post-hoc analysis encompasses sample size determination after the completion of the study, but caution is advised with the post-hoc method. The post-hoc analysis controls significance level, and not power, which can lead to type II errors and faulty conclusions about the necessary power (Kang, 2021). In this case, an a priori analysis using the G\*Power software was conducted and more will be discussed about Type I and Type II errors on the following page.

As stated, a priori sample sizes are determined by three elements including effect size, statistical significance levels, and power analysis (In et al., 2020). The effect size applies a number that is used to quantify the strength of a relationship among variables. Jacob Cohen, an American statistician developed this scale of effect size using the number (coefficient) to describe the strength of the effect, whether small, medium, or large, with corresponding numbers 0.2, 0.5, and 0.8. Cohen's  $d$  analyzes effect sizes between groups, and Pearson's coefficient, which is denoted as  $+1 -0 -1$ , is used to explain effect sizes between the variables (In et al., 2020). Healthcare researchers generally use medium effect sizes (In et al., 2020).

Another element referred to as statistical significance measures the likelihood that the results in a study were due to a chance occurrence, instead of a true relationship. To measure statistical significance in statistical terms, a  $p$ -value is assigned, and that predetermined value aids in determining whether a result is statistically significant. If the  $p$ -value is below the chosen significance level, usually (0.05), the result is considered statistically significant, indicating there is enough evidence to reject the null hypothesis (and agreeing there is enough evidence to suggest an effect. A null hypothesis ( $H_0$ ) is basically a statement that there is no significance or relationship of importance between two variables in a population (Tenny & Abdelgawad, 2023). If the  $p$ -value is above the significance level of 0.05, the result is not statistically significant, and the researcher must fail to reject the null hypothesis (Tenny & Abdelgawad, 2023).

Interpretation of the above statistics can aid researchers in either accepting or rejecting their hypotheses. Alpha levels are generally set at .05 in the lower range to help

researchers minimize the occurrence of a type I error (Kang, 2021). Type I errors occur when researchers conclude there is a statistically significant relationship when there isn't, also known as a false positive (Kang, 2021). Type II errors occur when the researcher does not detect a statistically significant association, yet one exists. Type II errors are also referred to as false negatives and the researcher may incorrectly reject the null hypothesis (Kang, 2021). The incidence of Type II errors is represented by Beta ( $B$ ) which is directly related to the power of a statistical test and occurs when the researcher accepts a false null hypothesis (Tenny & Abdelgawad, 2023). The power of a statistical test is represented as  $1-B$ , which means as the probability of a Type II error increases, the power of the test decreases. A high power signifies a lower probability of making a Type II error, meaning the statistical test is more likely to correctly identify a true effect (Tenny & Abdelgawad, 2023).

Sample size calculations for this study using the above parameters are shown below.

#### Sample Size Calculation

Z-tests = Test family

Two tails

Odds ratio 2.2500000 (H1 0.60 Ho 0.40)

Pr (y=1)(x=1)Ho=0.40

Effect size=0.05

Power 0.80

R-squared=0

Binomial distribution

197 Sample Size minimum

Based upon the aforementioned sample size calculations applied to each RQ for logistic regression using the z-tests family and a binomial distribution, the minimum sample size required for this research is 197 participants.

### **Procedures for Recruitment, Participation, Using Secondary Data Collection**

Recruitment is the term used for the initial contact between researcher and participant, or researcher and participating facilities, and initial contact can be via email, phone calls, face-to-face encounters, or online announcements. Schneider et al. (2023) pointed out that complexities in participant recruitment and circumstances around contact between researcher and partner organizations can influence the decision to use primary or secondary research. Primary data are gathered by the researcher(s), and secondary data refers to material collected by someone other than the researcher, often for purposes other than research (Schneider et al., 2023). Archived data, generally in the form of legal records, medical information, or EMRs, is secondary data that has been professionally stored or intentionally preserved (Schneider et al., 2023). Both types require Institutional Review Board (IRB) approval, which ensures external verification that ethically sound practices protect participants under study (Baldwin et al., 2022).

The decision to use primary or secondary data is often made by comparing the advantages and disadvantages of each, and a major drawback of secondary data involves the potential for bias (Schneider et al., 2023). Aside from bias, when the researchers collect their own data, there are practical challenges such as maintaining participant

contact, and the benefit of primary data is the achievement of real-life valid data, according to Baldwin et al. (2022). Secondary data use is a more convenient form of data collection yet gaining access to secondary or archived data in a quantity that is sufficient can also be challenging.

For the purposes of this study, there was no primary data collection by the researcher, no pilot study was performed, and no interventions were conducted. To address the five research questions in this study, archived secondary data were utilized from a health-system-owned community hospital and a privately owned urology practice established in 1993.

### **Informed Consent**

When preparing for permission to share patient data of any type, whether from patients, participants, or organizations, informed consent must be obtained. The U.S. Department of Health and Human Services (USDHHS, 2022) identified permitted uses and disclosures where informed consent specifically for research may not be required from patients or participants. Limited data sets and de-identified demographic information may be used for the purposes of public health, healthcare research, and organizational purposes (USDHHS, 2022). Consent for this study was not a mandate as each facility's data were de-identified and already obtained. Each data set concealed elements that would identify participants and removed them completely. There were no remaining identifiers linked to participants.

Considering the vast amounts of demographic data that are now available due to EMRs, some researchers have expanded their views regarding consent with data that are

strictly demographic. Gelinas et al. (2016) promoted that research without consent can be justified when obtaining consent is impracticable, or if the gravity of the rights infringement is minor and outweighed by the expected social value of the research. More recently, Schneider et al. (2023) waived consent for anonymized data, absent actions on human subjects. Song (2024) identified consent bias as a type of selection bias and promoted waiving consent in observational studies using existing data. While many researchers still promote obtaining consent for the sharing of information, the use of de-identified patient data has prompted alternative consent models to facilitate research that may be beneficial for others (Song, 2024). For this particular study, the consent process was not indicated for those whose data were examined, considering the data were secondary, anonymized and de-identified. Therefore, because no data points could be associated with a specific individual, consent was not a requirement, with exception of obtaining data use agreements with the participating facilities.

### **Instrumentation and Operationalization of Constructs**

Operationalization in research is a term for placing data or observations into a measurable format to limit subjectivity, and reduce researcher bias (Barroga & Matanguihan, 2022). Constructs are an expression of events, results, or responses that are being measured, and instrumentation is the directive given by researchers to describe how variables will be measured (Barroga & Matanguihan, 2022). In this study, five independent variables were identified separately and assigned a number, a process referred to as coding. The numbers 1–0 were applied to track the yes-or-no dichotomous dependent variable of SNM implantation, with the digit 1 corresponding with a yes to

SNM implantation, and 0 for no. In the paragraphs below, the rationale for how each variable was coded and measured is described.

***RQ1: Distance to Provider***

The first RQ measured the independent variable distance traveled in miles from the patient's residence to the urologist specialist's office location. Each address was entered and geo-coded with latitude and longitude by the facility-appointed staff to enable calculation of exact miles. The miles were then placed into categories of miles to facilitate quantification of the variables in SPSS. Recall that distance to see a specialist has been shown to impact healthcare access in some studies (Mseke et al., 2024), and other peer reviewed research showed that patients were comfortable traveling for healthcare within a 20-mile radius (Yen, 2013). While Yen's (2013) information dates back more than a decade, it aided in determining intervals for measuring categories of miles for distance to the urologist. Each was assigned a coding number that represented ranges of distance traveled in miles to the urologist which was evaluated for significant association with SNM implantation (Yes -1 or No-0). Table 1 shows the first increment as the digit 1, which represents the distance between one mile and 20 miles to the urologist's office, and so on as seen in the SPSS data set.

***RQ2: Wait Time***

The independent variable in RQ2 measured wait time in weeks for the initial appointment with the urologist specialist. Wait time in weeks is a discrete variable which can only assume a finite number of values, and it has no relationship with any other numbers or values (Statistics How-to, 2024). Kharraz (2023) showed average wait times

for other specialists including cardiology, dermatology, and orthopedics were tallied using number-of-week intervals. Another study looking at access to urologists measured wait times in weeks ranging from 10 weeks in Canada and 13 weeks in England (Witherspoon et al., 2017). Access to urology in the U.S, has not been studied, but other research aided in determining this study's plan for measurement in weeks. Chart analysis gathered initial referral date to the urologist and the date the patient was initially seen, allowing tabulation of time in weekly intervals, measured against whether the individual underwent SNM implantation. As an example, individual #16 waited 11 weeks and 4 days and had no SNM, corresponding with the code = 0.

#### ***RQ3: Education Attainment***

The independent variable in RQ3 analyzed educational attainment and implantation of SNM. Participants were measured based upon three levels of this categorical variable to include no high school diploma, having high school completion, or a college degree, with subsequent coding for each education level. Postgraduate degrees were combined in college education and compared to SNM implantation.

#### ***RQ4: Insurance Coverage***

The independent variable in RQ4 underwent comparison to SNM with the following categories: No insurance coverage, Medicare, and the third category which included private, employer sponsored, or Affordable Care Act (ACA) plans, and all others. Insurance coverage is a categorical variable where each level of insurance coverage is placed in a group, but the grouping has no order or value to it. Insurance coverage was assigned a corresponding code for planned analysis with SNM. Stoink and

Orrico (2019) noted that physician reimbursement in the United States for procedures such as SNM is largely determined by Medicare, which is the most dominant healthcare payer in the United States. Medicare itself was one level of insurance coverage and was coded as the digit 2.

***RQ5: Facility Attributes***

The independent variable in RQ5 contained three levels or subcategories, each associated with a facility characteristic inclusive of availability of anesthesia coverage, the number of ORs both available and having equipment suitable for the SNM implant, and the presence or not of SNM specialty-trained staff with unique training for SNM, all of which are determined by hospital administration. Analysis of the data set with the corresponding coding demonstrates whether anesthesia coverage is 24/7 or of limited hours, the numbers of ORs in facilities, grouped, and whether or not there is specially trained staff.

**Table 1***Summary of Research Variables*

RQ	Variable	Variable type	Variable coding
		Categorical dependent variable	SNM implant = 1 Yes SNM implant = 0 No
1	Patient residence to clinic in miles	Numeric categorical independent variable	1 = 1–20 miles 2 = 21–50 miles 3 = > 50 miles
2	Wait time in weeks	Nominal categorical independent variable	1 = 1–7 weeks 2 = 8–14 weeks 3 = > 15 weeks
3	Educational attainment	Ordinal categorical independent variable	0 = No high school 1 = HS diploma 2 = College/Postgraduate
4	Insurance status	Nominal categorical independent variable	0 = No coverage 1 = Private/employer 2 = Medicare
5	Facility attributes	Nominal categorical independent variable	OR1 = 1–2 ORs OR2 = 3–5 ORs OR3 = >5 ORs ANES Limited hours = 0 24/7 = 1 Specialty staff No = 0 Yes = 1

**Data Analysis Plan**

Prior to conducting the actual regression analyses and after organizing and coding all secondary data, the manual task of visually inspecting data entries for simple typographical errors, misspellings, grammatical errors, and validating entries against misinformation such as addresses without valid postal codes, or duplicate addresses, are examples of the initial steps in preparing data for analysis. The second step involves more formal data cleansing, which is defined as the process of identifying and removing

corrupt entries, incomplete digits, and blank fields by, utilizing software to scan text content, string-search text for repetitive content or variable-specific outliers (Shi et al., 2021). Microsoft Excel offers both a free and low-cost data-cleaning tool for this process and was used to aid in data cleaning for this study. Following this process, data were merged from Excel to The Statistical Package for the Social Sciences (SPSS) Version 29. SPSS was used to conduct both the descriptive and inferential analyses, and the inferential portion was applied to test the hypotheses for answers to each RQ. A binary logistic regression analysis was planned to analyze for any association between the five independent variables and one dependent dichotomous outcome variable. To elucidate the potential associations, statistical analyses were performed to address the following research questions:

RQ1: What is the association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_01$ : There is no statistically significant association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_a1$ : There is a statistically significant association between distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ2: What is the association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_02$ : There is no statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_{a2}$ : There is a statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ3: What is the association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia?

$H_{03}$ : There is no statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

$H_{a3}$ : There is a statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

RQ4: What is the association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia?

$H_{04}$ : There is no statistically significant association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

$H_{a4}$ : There is a statistically significant association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

RQ5: What is the association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia?

$H_05$ : There is no statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

$H_a5$ : There is a statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

### ***Covariates***

Covariates are independent variables that are known to influence outcomes of statistical trials but are not the independent variables under study. If covariates are detected, they are most often added to the statistical model, so the effect is accounted for (Andrade, 2024). When analyzing existing research surrounding the use of SNM for OAB, numerous variables have been postulated to be potential covariates for successful use of SNM, inclusive of age, gender, medical comorbidities, body mass index (BMI), and concurrent psychiatric diagnoses. Schönburg et al. (2020) questioned whether age above 70 could be a predictor of either success or failure of SNM and concluded it could be safely used in individuals over 70 but found no significant differences in SNM success based on age. Regarding gender, Nguyen et al. (2018) found both men and women experienced significant improvement in symptoms but there were no statistically significant differences accounting for covariate status. Research continues given the wide

applicability of SNM for both urinary and fecal disorders along with the numerous varying patient-specific predictors, and for these reasons, no covariates were included in this study.

### **Interpretation of Results**

The objective of this study was to look for an association between each of the five health-services-related independent variables and the dependent dichotomous outcome of implantation of a SNM device for OAB in adults. A binary logistic regression analysis is a commonly applied statistical analysis that analyzes for potential relationships between predictor and dichotomous outcome variables in research. The binary portion describes the analysis that has a dichotomous dependent or outcome variable, as in this study, which is a yes or no (Castro and Ferreira, 2023). Overall, the interpretation of these results will help to understand the impact of the predictor variables on the odds of implanting SNM. Results will be reported and interpreted in Chapter 4 by presenting key statistics including odds ratios, confidence intervals, *p* values, and measures of overall model fit for each predictor. Because categorical variables were used, the odds ratios will be compared to the constant. The regression model will help determine if any of the variables were significant predictors of the outcome of implanting SNM.

### **Threats to Validity**

The term validity is defined as the extent to which an instrument measures what it is intended to measure, and there are two types including internal and external validity. External validity is the extent to which the results of research can be generalized from the sample population to the entire population; internal validity is considered the degree of

confidence that a study's data supports the results and findings can actually be attributed to a cause-and-effect relationship (Tenny & Abdelgawad, 2023). External validity examples include experimenter or researcher bias, or the Hawthorne effect where participants reply or react differently than they may have if not for being observed. Internal validity examples encompass errors in measurement or issues with the instrument itself, or use of an inappropriate instrument to measure data (Tenny & Abdelgawad, 2023). Observational studies such as this study often work with smaller sample sizes, which can be disadvantageous because bias can be a factor, especially if the researcher selected the sample. In this study, the sample participant medical records were selected based upon certain data points being available in the chart, which was verified by each partner organization's appointee, and were not chosen by the researcher.

In logistic regression, multicollinearity and overfitting of data are more common threats to validity with this model type (Tenny & Abdelgawad, 2023). For this particular study, impact on this data analysis was possible given the number of independent variables yet the statistical test checking for multicollinearity resulted in variance inflation factors just slightly over 1.0. Other sources state that use of the Variance Inflation Factor for multicollinearity may allow interpretation of the dummy variables as a single entity therefore use of chi-square testing may be more appropriate (Castro and Ferreira, 2023). Randomization was optimized as much as possible, and all of these results were demonstrated and interpreted in Chapters 4 and 5.

### **Ethical Procedures**

There are numerous sources that cite the importance of the ethical treatment of human research subjects (White, 2020). For this research study, simple methods using de-identified secondary data, which cannot be traced back or linked to any of the participants. In this case, independent approval from the Walden University Institutional Review Board was granted (IRB Approval Number 04-25-25-0273229) and both data participants provided data use agreements, Cowles Clinic (Data use agreement, 2025), and Putnam General Hospital (Data use agreement, 2025). Both can be viewed in Appendix A and B, attached to this document.

Other ethical issues as applicable require strict monitoring by the researcher(s). These can include the conduction of research within one's work environment, conflicts of interest with regards to financial compensation, relationships with medical device organizations, and the withholding of negative study results, according to Johnston and Brumbaugh (2022).

This study's data as well as the findings will be stored for 7 years on a password-protected computer network that is monitored by the virus scanning software McAfee. In addition, the data and the study's findings will be secured by both a hardware and software firewall.

### **Summary**

Chapter 3 was tasked with providing a description of the quantitative correlational cross-sectional designed study with a binomial logistic regression analysis. The research design and rationale, the methodology, sample size determination and the plan for data

collection, coding and analysis was specified. The examination for potential relationships between the independent and dependent variables was detailed and Chapter 4 included an illustration of the data, along with statistical analysis and interpretations of the analyzed data in appendices. Finally, Chapter 4 narrates the relationships between health services factors and the implantation of SNM for the treatment of OAB in adults.

## Chapter 4: Results

### Introduction

The purpose of this study was to determine if there was a statistically significant association between the health services factors of distance to the urologist in miles, wait time to see the urologist in days, educational attainment, insurance coverage type, and facility attributes, and SNM device implantation for OAB in adults in Mid-Central Georgia. The research questions and their associated hypotheses were the following:

RQ1: What is the association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_01$ : There is no statistically significant association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_a1$ : There is a statistically significant association between distance to the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ2: What is the association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia?

$H_02$ : There is no statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

$H_a2$ : There is a statistically significant association between wait time to see the urologist and SNM implantation in adults with OAB in the state of Georgia.

RQ3: What is the association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia?

$H_03$ : There is no statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

$H_a3$ : There is a statistically significant association between educational attainment (no high school, high-school diploma, and college education) and SNM implantation in adults with OAB in the state of Georgia.

RQ4: What is the association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia?

$H_04$ : There is no statistically significant association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

$H_a4$ : There is a statistically significant association between insurance coverage type (no insurance/public aid/Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia.

RQ5: What is the association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia?

$H_05$ : There is no statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

$H_a5$ : There is a statistically significant association between facility attributes (anesthesia coverage, OR availability, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia.

The binary outcome variable was implantation of a SNM device in adults with OAB. Chapter 4 includes the data collection methodology, a display containing the statistical results, and a discussion of the results related specifically to each research question. For the purposes of this research, there was no pilot study and no intervention conducted.

### **Data Collection**

Approval to conduct this study was granted by Walden University Institutional Review Board on April 25, 2025 (IRB Approval Number 04-25-25-0273229).

Discussions regarding the purpose of this study, data points needed to conduct the research, and the strict requirement for use of de-identified patient information was undertaken with two prospective data partner organizations in November and December 2024. Formal Data Use Agreements (DUAs) were requested April 1, 2025, and submitted for signatures following IRB approval. Participating partner organization signatures were received on April 26, and on April 29, 2025, respectively. Data were received from both participating organizations on the same date, April 30, 2025.

### **Initial Collection of Secondary Data**

The data provided by the partner organizations was initially collected by administrative personnel at each location for patient intake and registration purposes during 2020, 2021, 2022, and 2023, making this use of secondary data. The data tracking of SNM implantation was recorded by staff registered nurses working with each urologist during this time frame. The number of responses totaled 280, and according to the minimum sample size calculation using the G\*Power minimum sample size formula, 197 cases were needed.

### **Data Cleaning**

Of the total cases, three were removed because of incomplete entries. Two contained duplicate numbers and were removed using Excel's "remove duplicates" feature (Microsoft Excel, 2021), and one entry was missing whether the device was implanted or not, thus the remaining cases numbered 277. All categorical data were coded for SPSS and the files from both partner organizations were merged (Dr. David Segal, Walden University, personal communication, April 26, 2025). The calculated power requirements were met.

### **Data Collection Discrepancies**

There were no data collection discrepancies.

## **Results**

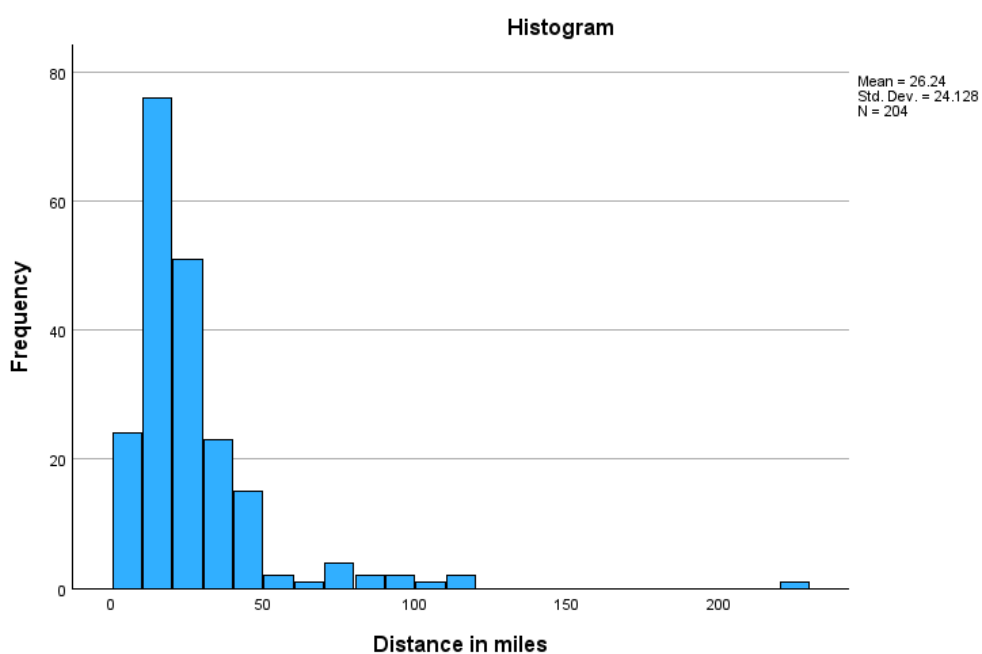
### **Demographics of the Sample**

The description of demographic data used in research, along with the presentation of case descriptives that were influential, statistically significant, or those that moderated

other variables serves to familiarize readers with the data set, and allows the researcher(s) to both present a summary of the data and to conduct a thorough review (Laerd Statistics (2018). The first variable looks at distance from the patient's residence to the specialist in miles and data are shown in histogram format in Figure 2.

**Figure 2**

*Distance in Miles (Binned)*



Distance to the urologist in miles was initially collected as a continuous variable using actual miles to the tenth of a mile. The data set contained multiple data points and initial visualization appeared cluttered. To simplify the data analysis, make visualization optimal, and lend to interpretability, binning the miles into categorical variables made the mileage more suitable for the binary logistic regression. By defining the categories, the nonlinear relationship was built into the model, and the data set was more manageable

absent decimals (Rahman, 2024). Table 2 shows distance in miles to the urologist's office had a mean and median of 2.50, indicating a symmetrical distribution. The symmetrical distribution can also be seen in Table 3 by looking at the skewness (.002), which is near zero (Laerd Statistics, 2018).

**Table 2**

*Distance in Miles (Binned)*

	N	%
<= 12.6	52	25.5%
12.7–21.2	50	24.5%
21.3–32.2	51	25.0%
32.3+	51	25.0%

**Table 3**

*Statistics: Distance in Miles (Binned)*

N	Valid	204
	Missing	0
Mean		2.50
Median		2.50
Skewness		.002
Std. error of skewness		.170
Kurtosis		-1.374
Std. error of kurtosis		.339
Range		3
Minimum		1
Maximum		4

The second research question analyzed wait time to see the urologist. Data in Tables 4 and 5 was initially retrieved in weeks plus days but to capture nonlinear, nonmonotonic relationships between the day and the outcome, the variable was transformed into number of days and binned. Non-monotonic relationships describe

relationships between given variables that do not consistently change in the same direction, such as when one variable increases the other decreases. A monotonic relationship can vary in the direction of change (Harris, 2021). Looking at the data also indicates the data are skewed to the right, which means most of the days fell within a certain range. Table 5 indicated a large number of days (up to four months or 120 days), although this was less frequent.

**Table 4**

*ActualDays (Binned)*

	N	%
<= 51	55	27.0%
52–59	48	23.5%
60–82	54	26.5%
83+	47	23.0%

**Table 5**

*Statistics: Wait Time Coded*

N	Valid	204
	Missing	0
Mean		2.68
Median		3.00
Skewness		.260
Std. error of skewness		.170
Kurtosis		-.523
Std. error of kurtosis		.339
Range		4
Minimum		1
Maximum		5

When reviewing the data, in addition to changing measurement of wait time from weeks to number of days, the outcome variable of SNM implantation revealed a heavily

imbalanced data set with 175 individuals who chose implantation, and 102 who did not. In medical literature, this is referred to as class imbalance whereby the prevalent class is overrepresented and referred to as the majority, and the less frequent class is the minority (Salmi et al., 2024). The imbalanced data set can be defined by a disproportionate distribution between classes resulting in potentially inaccurate results, biased conclusions, or ultimately treatment inaccuracies or additional unnecessary research (Salmi et al., 2024).

Machine analysis such as the Statistical Package for the Social Sciences (SPSS) or Stata offers wide ranges of statistical analysis for clinical research, yet the algorithms may suffer inaccuracies with unbalanced or uneven data sets, leading to inaccurate results (Salmi et al., 2024). When training a classification model on an imbalanced binary data set, randomly balancing it can improve the model's ability to accurately predict the less-common outcome. A balanced data set prevents the model from developing a bias toward the majority class, which would otherwise lead to poor performance and low sensitivity for the minority class (Salmi et al., 2024). For this reason, random undersampling was performed for the majority (SNM-yes) which allowed more reliable results.

Subsequently, Table 6 demonstrates the balanced sample of 204 cases.

**Table 6**

*Case Processing Summary*

Unweighted cases a		N	Percent
Selected cases	Included in analysis	204	100.0
	Missing cases	0	.0
	Total	204	100.0
Unselected cases		0	.0
Total		204	100.0

### **Sample Representativeness of Population**

The population of nonprobability convenience sampling in this study was selected based upon participants' diagnoses and the option to undergo SNM as a treatment for OAB. The data were extracted from patient medical records seen in two urology centers, located in two different but adjacent counties within the state of Georgia between 2020 - 2023. To address the chief complaint of OAB in these counties, patients having the diagnosis of OAB, who failed at minimum, two conservative treatments were referred to a specialist specifically to consider SNM. Surrounding the complaint of OAB, determining the number of individuals having OAB in the general population compared to those under study can be a distinct challenge, according to the published literature (AUA, 2024). Many individuals are convinced this is a normal part of aging or are too embarrassed to discuss this with their medical provider, thereby making generalizability predictions a challenge. The National Institutes of Health (NIH, n.d.) stated that rates of OAB requiring SNM are not precisely tracked, but rather ranges of successful implantations, complications or adverse effects, and re-intervention numbers are monitored. Researchers individually have reported the incidence of OAB in men age 40-59 at 14.5% (Cheng et al., 2024). Before Cheng et al. (2024), the NOBLE program was initiated to better understand the prevalence and burden of OAB in a broad spectrum of the United States population. Results indicated the incidence of 16.5% for both men and women, which translated to an impact on 33 million adults (Leron et al., 2018).

When examining the representativeness of this study's sample to the general population within the state of Georgia, use of the data for the third research question more clearly demonstrated representativeness to the general population, as compared to analyzing numbers of OAB diagnoses. Insurance coverage type for this study's sample revealed the highest number of individuals undergoing evaluation for SNM had Medicare coverage ( $n = 178$ ), or 87.2 % of those in the study (Table 7). In the general population of the two counties, the number of individuals having Medicare coverage in the first county totaled 7,352, or 33.5% of the population numbering 21,944 residents (Centers for Medicare and Medicaid, 2025; U.S. Census Bureau, 2024). The second county under evaluation had 6, 524 inhabitants who reported having Medicare from the population of 23, 521, or 27.7% (Centers for Medicare and Medicaid, 2025; U.S. Census Bureau, 2024). Use of Medicare claims for the procedure code of SNM implantation within the two Georgia counties could be compared to the overall state of Georgia or the local coverage area of the southeastern states to compare numbers to the general population. This might also be another area for future research.

**Table 7**

*Insurance Code Comparing Sample Representativeness*

		Frequency	Percent	Valid percent	Cumulative percent
Valid	None_PA	12	5.9	5.9	5.9
	OtherVAPr	14	6.9	6.9	12.7
	Medicare	178	87.3	87.3	100.0
	Total	204	100.0	100.0	

Table 8 shows data surrounding cases in the sample compared to the general population regarding educational attainment. The most recent comprehensive educational attainment statistics for the first county revealed that 90.2% of the residents possess a high school diploma (Atlanta Regional Commission, 2024), and 36.4% hold a college or post-baccalaureate degree. The second county records revealed 89.9% of the residents have a high school education and 28.3% possess a college degree or higher (Atlanta Regional Commission, 2024). The sample population educational attainment levels compare to those of the general population, which shows the majority of the sample participants have a high school education followed by a college degree, and only a small minority have not completed high school.

**Table 8**

*Education Code*

		Frequency	Percent	Valid percent	Cumulative percent
Valid	NHS	15	7.4	7.4	7.4
	HS	117	57.4	57.4	64.7
	COL	72	35.3	35.3	100.0
	Total	204	100.0	100.0	

**Assumptions for Binary Logistic Regression**

A binomial logistic regression analysis was used to examine the relationship between the health services factors of distance to the urologist, wait time to see the urologist, educational attainment level, insurance coverage type, and facility attributes, against the binary outcome of undergoing a SNM device for OAB in adults. This statistical test was selected because the outcome or dependent variable is binary, with a

yes or no result that has only two possible results. One or more predictor variables can be used in binary logistic regression, and this particular study has five independent variables, with one being a composite variable (facility attributes), possessing more than one item or level being measured (Laerd Statistics, 2018). All the variables in this research were categorical making this test an appropriate choice (Laerd Statistics, 2018). There were several assumptions to satisfy prior to performing the binary logistic regression analysis including (a) a dichotomous dependent or outcome variable, (b) one or more predictor variables, (c) independence of observations, (d) no perfect multicollinearity among the independent variables, and (e) continuous predictors are linearly related, or there is a linear relationship between the predictors and the log-odds of the outcome (Laerd Statistics, 2018). The linearity assumption did not apply because the decision was made to measure distance and wait time using binned data and using categorical analysis.

Independence of observations was confirmed, demonstrating that each observation was unrelated to the others in the data set, no participant or data point existed in more than one group, and the value of one observation did not change or alter the value of the others (Harris, 2021).

To address the assumption of no perfect multicollinearity among the independent variables, the absence of multicollinearity in a regression model requires an analysis applying the variance inflation factors (VIFs) test with 1 indicating absence of any correlation, and multicollinearity is the term used when predictor variables are highly correlated and Tables 9 and 10 show the results (Harris, 2021). Each categorical variable was coded using dummy variables, which was the process of assigning a numeric

representation to each of the categorical independent predictors (Harris, 2021). If multicollinearity were detected, applying Cramer's V, a measurement of the strength of an association would help determine how strong the association was (Harris, 2021), however, none of the variables in this study were associated.

**Table 9**

*Collinearity Coefficients for Variables Miles and Wait Days*

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
1 (Constant)	.707	.093		7.566	<.001		
ActualMileage	.000	.000	-.082	-1.171	.243	.998	1.002
Waitweeks_nowdays	-.001	.000	-.144	-2.063	.040	.998	1.002

**Table 10**

*Collinearity Coefficients for Education and Insurance Type*

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
1 (Constant)	.189	.130		1.452	.148		
Education code	.322	.056	.381	5.752	<.001	.976	1.025
Insurance code	-.055	.064	-.057	-.864	.388	.976	1.025

Knowing that all assumptions were met, the steps below were used to address each research question using a binary logistic regression, beginning with the analysis of model fit using goodness-of-fit tests, Omnibus coefficients, variables in the equation, output presenting odds ratios for each predictor relative to the constant or reference level, and confidence intervals (Harris, 2021), as seen in Tables 11-14.

Tables 11 and 12 show goodness-of-fit tests including both the Nagelkerke R-squared and the Cox and Snell R-squared for use in a binary logistic regression analysis with results ranging from 0-1 (Harris, 2021). Table 11 indicates a result of .293, revealing a moderate relationship between the predictors and the outcome variable. The Cox and Snell (a pseudo-R-squared value) with the result of .220 demonstrates a model fit that is significantly better than the model having no predictors. The next goodness-of-fit test is the Hosmer and Lemeshow test which has a significance level of  $p = .299$ . A  $p$  value without statistical significance indicates a good model fit (Laerd Statistics, 2018).

**Table 11**

*Model Summary for Goodness-of-Fit RQ1*

Step	-2 log likelihood	Cox & Snell R square	Nagelkerke R square
1	231.018 a	.220	.293

a Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

**Table 12**

*Hosmer and Lemeshow Test Goodness-of-Fit RQ1*

Step	Chi-square	df	Sig.
1	9.535	8	.299

The Omnibus test of model coefficients in Table 13 shows a statistically significant result ( $p < .001$ ) indicating that overall, the model with its predictors was a better fit than with no predictors. It also revealed at least one of the predictors in this

model was a significant predictor of the outcome (Laerd statistics, 2018), yet which variable is not specified by this test.

**Table 13**

*Omnibus Tests of Model Coefficients*

		Chi-square	df	Sig.
Step 1	Step	50.395	14	< .001
	Block	50.395	14	< .001
	Model	50.395	14	< .001

After analyzing model fit, looking at *Variables in the Equation* output (Table 14) where the odds ratio is presented for each predictor. Odds ratios show the multiplicative change in odds for a one-unit increase in the predictor, or the odds of the binary outcome (SNM) occurring for a one-unit increase in the predictor variable. For research question 1, the first distance in miles binned revealed an odds ratio of Exp (B)- 1.081, indicating the odds of SNM occurring were 8.1% higher at this mileage level, (within the first binned group) compared to the constant. This odds ratio does contain 1.0, therefore results are not statistically significant, and it is uncertain whether this mileage affects odds of SNM. Finally, confidence intervals (CI) are presented in the same SPSS output and exhibit a range of values that likely contain the true population parameter, according to Laerd Statistics (2018). For the identical binned miles level discussed above, the CI ranges from .434–2.69, or with 95% certainty, the true value lies between .434 – 2.69. For each research question, the interpretation of the confidence intervals completed the analysis and for each subsequent research question, the findings are presented in order below.

**Table 14***Variables in the Equation*

		B	SE	Wald	df	Sig.	Exp(B)	95% CI for EXP(B)	
								Lower	Upper
Step 1 a	Distance in miles (Binned)			.744	3	.863			
	Distance in miles (Binned)(1)	.078	.465	.028	1	.867	1.081	.434	2.691
	Distance in miles (Binned)(2)	-.187	.467	.161	1	.688	.829	.332	2.071
	Distance in miles (Binned)(3)	-.283	.462	.376	1	.540	.753	.305	1.863
	ActualDays (Binned)			14.339	3	.002			
	ActualDays (Binned)(1)	-1.463	.476	9.436	1	.002	.231	.091	.589
	ActualDays (Binned)(2)	-1.600	.471	11.551	1	< .001	.202	.080	.508
	ActualDays (Binned)(3)	-.827	.475	3.039	1	.081	.437	.173	1.108
	Education code			25.899	2	< .001			
	Education code(1)	.979	.752	1.696	1	.193	2.662	.610	11.615
	Education code(2)	2.697	.787	11.741	1	< .001	14.834	3.172	69.374
	Insurance code			1.525	2	.466			
	Insurance code(1)	.338	.966	.123	1	.726	1.402	.211	9.308
	Insurance code(2)	-.424	.720	.346	1	.557	.655	.160	2.686
	Anesthesia coverage hours (1)	-.526	.582	.818	1	.366	.591	.189	1.847
	Number of operating rooms			.076	2	.963			
	Number of operating rooms(1)	.156	.573	.074	1	.785	1.169	.380	3.597
	Number of operating rooms(2)	.067	.588	.013	1	.910	1.069	.338	3.381
	Specialty staff(1)	.093	.503	.034	1	.853	1.098	.410	2.940
	Constant	-.082	1.013	.007	1	.935	.921		

a Variable(s) entered on Step 1: Distance in miles (Binned), ActualDays (Binned),

Education code, Insurance code, Anesthesia coverage hours, Number of operating rooms,

Specialty staff.

Before reporting individual results from each research question, review of the classification table demonstrated an overall model fit of 72.9, as seen in Table 15. This indicates the model had an overall accuracy of 72.9%, or it correctly predicted the outcome for 72.9% of the cases in this model (Laerd Statistics, 2018).

**Table 15***Classification Table for RQ1*

	Observed	Predicted			
		SNM implant		Percentage correct	
		NoSNM	YesSNM		
Step 1	SNM implant	NoSNM	74	27	73.3
		YesSNM	28	74	72.5
	Overall percentage				72.9

a The cut value is .500

**Research Question Analysis and Results**

Research Question 1 asked: What is the association between the distance to the urologist and SNM implantation in adults with OAB in the state of Georgia? The binary logistic regression was conducted to analyze each group of miles that corresponded with the following insignificant values: (OR=1.081; CI 95% .434-2.691;  $p = .867$ ), (OR =.829; CI 95% .332-2.071;  $p = .688$ ), (OR =.753; CI 95% .305-1.863;  $p = .540$ ). By applying the steps aforementioned, it was determined that there is no statistically significant association between distance to the urologist in miles and the null hypothesis will be accepted.

Research Question 2 asked: What is the association between wait time in days to see the urologist and SNM implantation in adults with OAB in the state of Georgia? A binary logistic regression analysis was conducted to determine if there was a statistically significant association between wait time in days to see the specialist and implantation of SNM. The *Omnibus Test* showed statistical significance for the model overall ( $p = <.001$ ). As seen in Table 14 under *Variables in the Equation*, the categorical variable of wait time in days had two levels with statistically significant values (OR =.231; CI 95% .091-.589;  $p = .002$ ), and (OR=.202; CI 95% .080-.508;  $p = <.001$ ). Days binned in levels

one and two had odds ratios less than one so for every one unit increase in number of days, the odds of the outcome, implanting SNM, decreased. The third level of that categorical variable (OR=.437; CI 95%.173-1.108;  $p = .081$ ) did not show a statistically significant association. In conclusion, in the series of hypothesis tests for number of days to see the urologist, there is strong statistical evidence to reject the null hypothesis for the first two levels of number of actual days ( $p = .002$  and  $p < .001$ ). The third level of days spent waiting does not show a statistically significant association ( $p = .081$ ) favoring the alternative hypothesis, or failure to reject the null hypothesis.

Research Question 3 asked: What is the association between educational attainment (no high school, high-school diploma, and college education), and SNM implantation in adults with OAB in the state of Georgia? A binary logistic regression analysis was conducted to determine if there was statistically significant association between educational attainment and implanting SNM for OAB. One level of educational attainment showed a statistically significant association, as seen in the *Variables in the Equation* Table 14. In addition to the overall model significance, the second education level (college) demonstrated statistical significance (OR=14.834; CI 95% 3.172 – 69.374;  $p < .001$ ). This can be interpreted as the odds of the outcome (SNM) increase as the education level (college) increases. Because the entire 95% confidence level is of above 1.0, it was concluded that the association was strongly statistically significant at the 0.05 level showing higher educational attainment is significantly associated with the implantation of SNM for OAB by nearly 15 times, compared to the other education levels, keeping the other variables constant. The other level of education did not reveal

statistical significance (OR =2.662; CI 95% .610-11.615;  $p = .193$ ) so for this level, failure to reject the null hypothesis is appropriate.

Research Question 4 asked: What is the association between insurance coverage type (no insurance coverage or Medicaid, Medicare, and private/employer-sponsored/Affordable Care Act [ACA]), and SNM implantation in adults with OAB in the state of Georgia? It was hypothesized that insurance coverage type would be a significant predictor of the decision to implant SNM for OAB for adults in Georgia. However, the logistic regression analysis did not support statistical significance (OR = 1.402; 95% CI .211, 9.308;  $p = .726$ ). Similarly insignificant findings occurred with the second level of insurance coverage (OR =.655; CI 95% .160-2.686;  $p = .557$ ) and neither provided enough evidence to conclude that an association exists. However, the *Classification Table* in Block 1 showed model improvement from 50.2 % correct to 72.9% correct and some cases were more accurately classified. To address this research question, there was not enough statistical evidence to determine an association, therefore, failure to reject the null hypothesis is the appropriate strategy.

Research Question 5 asked: What is the association between facility attributes (anesthesia coverage, OR, and specialty staff), and SNM implantation in adults with OAB in the state of Georgia? This research question applied a binary logistic regression to query whether a statistically significant association existed between facility attributes and implanting SNM for OAB. Preliminary research suggested there may be an association between these predictors but as seen in the *Variables in the Equation* table, facility characteristics did not show a statistical significant association (OR =.591; CI

95% .189-1.847;  $p = .366$ ; OR =1.169; CI 95% .380 -3.597;  $p =.785$ ; 1.069; CI 95% .338 -3.381;  $p =.910$ ; OR =1.098; CI 95% .410 -2.940;  $p =.853$ ). Despite moderately favorable model fit statistics, (Hosmer and Lemeshow  $p = .299$ , Cox and Snell and Nagelkerke R-squared .220 and .293 respectively), there was insufficient evidence to reject the null hypothesis.

To summarize, this chapter provided the statistical results for each of the five research questions for this multivariate binary logistic regression. The *Omnibus Test of Model Coefficients* was statistically significant ( $p < .001$ ) demonstrating the overall set of predictors improved prediction of the outcome (SNM) when compared to predicting it without the variables (the null model). The independent variable of educational attainment (OR =14.834; CI 95% 3.172-69.374;  $p < .001$ ) was the statistically significant result and the  $p$  value was below the chosen significance level of  $p < .05$ . For the remaining predictors, the effects were not strong enough to conclude they were different from the null, but perhaps they aided in highlighting the effect of the educational attainment predictor.

Chapter 5 will provide interpretation of the statistical findings, a review of the limitations of this study, and recommendations for future research following these findings. Social change can result from these findings, and this will be examined.

## Chapter 5: Discussion, Conclusions, and Recommendations

### **Introduction**

The key purpose of this quantitative correlational cross-sectional study was to explore whether health services factors serve as potential barriers to utilizing SNM implantation as a third-line treatment for OAB in adults. The health services factors were distance to the urologist from the patient's residence in miles, wait time in days to see the urologist, health insurance coverage type, educational attainment levels, and facility attributes including the number of available ORs with equipment suitable for SNM implantation, anesthesia coverage schedules directed by the hospital or clinic, and the employment of specialty staff trained to manage SNM patients. There is a hierarchy of treatments aimed at controlling OAB and some of the more advanced (third-line) therapies other than SNM have been associated with side effects. SNM has been shown to be a safe and reliable treatment for the reduction of symptoms for OAB with little to no adverse effects, yet there are reports in research indicating its underutilization. Based upon the number of individuals impacted by the diagnosis of OAB, it is important to understand if health services factors are potential barriers to undergoing SNM for OAB. Using secondary data provided by a privately owned urology practice and a facility having urology services and SNM implant facilities, the data were analyzed to address each of the research questions. After addressing each research question, results will be compared to other research in this domain, and limitations of this study will be reviewed. The final part will discuss potential social change implications along with practical as well as practice applications of the findings.

## Interpretation of the Findings

### Research Question 1

For RQ1, a binary logistic regression analysis was performed to determine if there was a statistically significant relationship between the distance in miles to the urologist and implanting SNM for OAB. There was no statistically significant relationship found (OR=1.081; CI 95% .434-2.691;  $p = .867$ ), (OR =.829; CI 95% .332-2.071;  $p = .688$ ), (OR =.753; CI 95% .305-1.863;  $p = .540$ ) and the null hypothesis was accepted. While many researchers have demonstrated a statistically significant relationship between travel distance and selecting medical treatments, the findings of this study were not consistent with those of Sadehi et al., (2024) who uncovered that greater distances to healthcare facilities were actual barriers to care, in addition to reducing timeliness of treatment (Sadehi et al., 2024). Seidu (2020) queried men needing human immunodeficiency virus (HIV) testing and shorter travel distance was an enabling factor for HIV testing and longer distances revealed those individuals were less likely to be tested. Finally, Saadat and Elterman's (2025) findings were contrary to this study's results because they reported the same impediments with relation to travel distance and use of SNM. Their adoption of virtual visits in lieu of in-person visits aimed to eliminate the barrier of distance reported in their editorial.

While the above researchers reported the significance of travel distance in miles, Buhn et al. (2020) reached differing conclusions. Their findings were more closely aligned with this study as they determined that travel distance was one of many factors that influence treatment selection, which minimized the importance of that one variable.

They identified that many patients actually chose treatment at a facility, despite greater travel distance if that institution had reduced morbidity scores and a better reputation.

### **Research Question 2**

To address RQ2, a binary logistic regression analysis was performed because this study analyzed all categorical data against a binary outcome variable. RQ2 measured the relationship between wait time in days to see the specialist and implanting SNM for OAB. This result yielded statistical significance for two levels of this variable (OR =.231; CI 95% .091-.589;  $p = .002$ ), and (OR=.202; CI 95% .080-.508;  $p = <.001$ ) and statistical insignificance with the third level (OR=.437; CI 95%.173-1.108;  $p = .081$ ), therefore, the null hypothesis was rejected for the first two levels of the number-of-days variable, and accepted for the last level. Rejecting the null hypothesis indicated that the effect of days in the first two levels could be due to a true statistical relationship.

Wait time as described by Stafinski et al. (2022) is the time from the decision to undergo evaluation by a specialist, until the time that evaluation takes place by the specialist, and wait times occur because of a mismatch between demand for services and the supply of services. The Organization for Economic Cooperation and Development (OECD, 2023) identified several impacts related to waiting for specialists including diminished levels of wellness, increasing severity of disease processes while waiting, and even reduced engagement or willingness to follow through with the efforts needed to see a specialist. More alarmingly, since the beginning of this research study, Limiri (2025) that showed just this year, the wait time for medical care has not only persisted, it has worsened. These worsening circumstances have led to further physical deterioration in

patients' status, and critical bed occupancy has increased, thereby increasing wait times for inpatient beds. Since this author's findings concur with this study's results, and other publications have noted the negative effects of wait time, this RQ's results may contribute to knowledge surrounding wait time as potential barrier to pursuing SNM.

### **Research Question 3**

RQ3 adopted a binary logistic regression that examined whether education levels have a statistically significant relationship with choosing SNM for OAB and one level of educational attainment showed a statistically significant association (OR=14.834; CI 95% 3.172 – 69.374;  $p < .001$ ). The other level of education did not reveal significance (OR =2.662; CI 95% .610-11.615;  $p =.193$ ).

Contradictory findings within one variable may be explained by either methodological differences, or variances among study groups as in this case. Comparison of education level among groups of individuals with OAB can be considered a form of triangulation and may explain opposing findings within a variable (Valencia, 2022). Valencia (2022) accorded this as a comparison of dissimilar groups adding validity to the findings that are opposing in a predictor. Expanding on the results which found education levels to be significantly associated with the outcome (SNM), college education as a predictor was one similarity to work by Seidu (2020). Men needing HIV testing were significantly more likely to test when having higher educational attainment than those with lower levels of education. Seidu (2020) also utilized a binary outcome variable to predict prior testing for HIV with the goals of identifying the population(s) requiring more targeted education, bearing similarity to the potential implications of this study.

Further, Ouda's (2024) findings were consistent with this study's that education levels positively impacted the reporting of OAB symptomatology. Their research methods utilized primary data instead of secondary, and their findings were congruent with this research study. Wang et al. (2023) acknowledged the role of education within the realm of OAB, even though their research did not involve actual patients. In contrast, their research analyzed global progress regarding research in this field, and contributions were made regarding predictors of recognizing OAB as a disease by education level. Each of these studies showed consistency in their findings by highlighting how education level impacted their study population. The role of higher education can be seen in many publications noting the impact on health literacy as well as health outcomes (National Library of Medicine, 2020). Yao's (2024) findings also underscore a substantial inverse correlation between education and OAB prevalence which are consistent with this study's findings. Understanding that additional research is needed, educational attainment may guide the development of preventative and therapeutic strategies for OAB to include SNM.

The above content discussed research findings that concur with the statistical significance of this particular research question's findings of statistical significance associated with college education. However, no statistical significance was found for those having a high school education but not with those having a high school diploma (OR =2.662; CI 95% .610-11.615;  $p =.193$ ). Healthy People 2030 (Office of Disease Prevention and Health Promotion, 2020) issued their key takeaway that stated while

completion of high school education remains a milestone in our country, having only high school education is insufficient to achieve optimal health literacy.

#### **Research Question 4**

RQ4 utilized binary logistic regression to analyze if insurance showed a statistically significant relationship with choosing SNM for OAB and results were statistically insignificant (OR = 1.402; 95% CI .211, 9.308;  $p = .726$ ; OR = .655; CI 95% .160-2.686;  $p = .557$ ). Neither provided enough evidence to conclude that an association exists.

Insurance coverage has been postulated to impact the use of health services, and although this particular study did not find insurance to have a statistically significant relationship with the use of SNM, there are other authors who have also examined the effect of insurance on health care service utilization and concluded the same. While this study looked at application of one device, the conclusion for this research question was similar to Narita's (2023), who analyzed the impact of health insurance on healthcare consumption. Finding it difficult to isolate the variable of insurance when observing choices for healthcare services, Narita's conclusion was limited by other confounders and the need for a completely randomized controlled trial to determine the impact of insurance type. This could explain the lack of any association with implanting SNM, based upon insurance coverage type in this study.

Wray et al. (2021) conducted a survey examining individuals' responses when comparing publicly funded insurance with private employer-based coverage and the use of healthcare services. Although they combined Medicare and Medicaid which differed

from this study, they separated those individuals having private insurance. Contrary to this study's findings, Wray et al. (2021) found statistical significance with private pay showing an inverse relationship between this insurance coverage and use of healthcare services.

### **Research Question 5**

For RQ5, a binary logistic regression was conducted to analyze if facility attributes denoted a statistically significant relationship with choosing SNM for OAB and results were statistically insignificant (OR =.591; CI 95% .189-1.847;  $p = .366$ ; OR =1.169; CI 95% .380 -3.597;  $p =.785$ ; 1.069; CI 95% .338 -3.381;  $p =.910$ ; OR =1.098; CI 95% .410 -2.940;  $p =.853$ ). The three attributes included the number of ORs available and equipped for SNM, hours of anesthesia coverage within the facility, and the employment of specially trained staff, and were all considered statistically insignificant. For this reason, for each level of this predictor, the null hypothesis was accepted.

Some researchers have formally speculated these attributes are significant barriers to this type of treatment. Gariscak et al. (2023) were the first to look at the availability of procedure rooms and qualified staff as potential barriers to implanting SNM, yet this study didn't find a statistically significant relationship between these factors and the study's outcome. The results of this research didn't compare to findings by Abiyu et al. (2024) who reported the availability of special-trained personnel such as anesthesia providers may affect facility usability in other medical settings. Further, Pappada et al. (2022) found that for many types of surgical specialties to operate, the number of anesthesia providers with limited hours of coverage can influence utilization at a

particular facility, yet this study's results were not comparable to those findings. Further, WHO reported limitations in facilities' ability to fill health workforce deficiencies in positions taking 8 years or more for training and education, which would address the need for and presence of specially trained staff for SNM. This was not found to be a statistically significant association in this study. Each of the researchers surrounding the topic of facility attributes found the availability of trained personnel, inadequacies in OR availability, and other facility-related barriers as significant, yet this study did not. This stipulates that more research may be needed in this area to pinpoint whether facility attributes truly do impact SNM utilization.

Specialists in the field of urology have known of the widespread incidence of OAB and the ever-increasing longevity of the general population has highlighted this problem (Scarneciu et al., 2021). While there are a multitude of treatments for OAB and some that have the potential for relatively severe side effects, SNM has been rated in the literature as both effective and as having few-to-no adverse effects (Feloney et al., 2023). Given that it is considered safe, effectual, and well-established, questions may arise as to the origin of reports that SNM is underutilized (Gariscak et al., 2023). Following a thorough review of literature examining indications for use along with demographic and comorbidities that may preclude its use, there was no research looking at health services related factors that may be potential barriers to using SNM for OAB. This study was the first to specifically examine health services factors including distance to the facility, wait times to see the urologist skilled in SNM, and facility characteristics including OR availability and suitability, and hours of anesthesia coverage in the United States. The

results of this study may further contribute to the knowledge about barriers to choosing SNM as a treatment for OAB in adults in the state of Georgia.

### **Interpretation of the Findings in Relation to the Theoretical Framework**

The theoretical framework used in this research was Andersen's BMHSU. Andersen both developed and later expanded his model to explain the utilization of health services by adding three levels to his model, including predisposing, enabling, and illness or disability level (Siedu, 2020). Predisposing characteristics include age, gender, marital status, as examples, and enabling factors are conditions that facilitate use of health services. These may be access to health facilities, financial status or occupation, or health insurance. The third level is referred to illness or level of disability, or the degree to which the illness interferes with daily functionality, and this includes actual engagement in or use of health care services (Alkhaldeh et al., 2023).

In this study, education level was statistically significant as a possible predisposing factor for choosing SNM for OAB (OR=14.834; CI 95% 3.172 – 69.374;  $p < .001$  which paralleled characteristics of predisposing factors in Andersen's model because higher levels of education is generally considered a predisposing factor in health services use. The other statistically significant result demonstrated that wait time to see the urologist was significant (OR =.231; CI 95% .091-.589;  $p = .002$ ), and (OR=.202; CI 95% .080-.508;  $p = <.001$ ) and when wait time further increased, statistical significance was lost, meaning the higher number of days corresponded with less likelihood of implanting SNM (OR=.437; CI 95%.173-1.108;  $p =.081$ ). Wait time to see a specialist is generally considered an enabling factor according to Andersen's model, which can either

prompt an individual to use health care services or impede use. In this case, when the number of days increased, it became a disincentive for SNM use.

### **Limitations of the Study**

There were certain limitations of this study that occurred despite meticulous planning. The first research question looking at distance to the urologist was limited to the field of urology, and other specialists such as urogynecologists and other neuromodulation-trained surgeons were not included in the study. The second research question found a statistically significant association between wait time to see the urologist and the outcome of SNM, yet the population under study was limited to the mid-portion of the state of Georgia. The third research question that addressed educational attainment was also statistically significant however, education level is an emissary for higher income, better employment opportunity and improved health literacy, and these factors were not included in the measurement. The fourth research question analyzed for a potential association of insurance coverage type and implanting SNM for OAB. This predictor was found to be insignificant despite general suppositions that it is a factor. Limitations in this study were likely due to the relatively small data set from two counties having a constrained number of data points. Finally, the fifth research question evaluated for an association between health care institutional attributes and none were statistically significant. Explanation of these findings could result from selection bias where the individuals in the study had only certain options for the healthcare procedure under investigation. An additional hindrance may have resulted from the socioeconomic characteristics of this particular data set. Finally, a consequential limitation may be

related to the providers in the study who performed the procedure who may also possess certain clinical judgments or preferences. Physician recommendations can limit a patient's choice in facilities and treatment, and the number of facilities offering this treatment as a while may also be a factor. Patients' understanding of medical information, or their health literacy, can vary, affecting their ability to engage in decision-making and choosing this treatment. All of these elements can lead to limitations in the results of this study. Physician recommendations can limit a patient's choice in facilities and treatment, and the number of facilities offering this treatment as a while may also be a factor. Patients' understanding of medical information, or their health literacy, can vary, affecting their ability to engage in decision-making and choosing this treatment. All of these elements can lead to limitations in the results of this study.

To address internal and external validity, using purposeful convenience sampling methodology as implied, is convenient, yet it can reduce the external validity of any study as well as the generalizability of the results (Andrade, 2020). Impacting internal validity, selection bias occurs when the study sample is not representative of the overall population. Given the sample size included residents from a portion of one state (Georgia), the results of this study may have failed to detect a relationship between the variables, when in fact there was one, known as a type II error (Andrade, 2020).

### **Recommendations**

Of major importance to most researchers, as well as in this study, it is crucial to understand if the results of the research can be consistently duplicated by other

researchers, which should bring about improved awareness and management surrounding this diagnosis.

Additional research should be conducted for a further analysis of the potential relationship between insurance coverage type and choosing SNM for OAB. While results of this study demonstrated no statistically significant relationship with insurance coverage type, the outcome also reported the predominance of Medicare coverage, compared to other types of coverage. In this analysis, Medicare was one category, and the second category was inclusive of anything but Medicare, including no coverage, Medicaid, Affordable Care Act (ACA) plans, private, and employer-based coverage. It is possible that future research might examine the role of Medicare replacement policies and/or gap coverage, but that degree of detail would require a larger population because of geographic influences on coverages available.

### **Implications for Social Change**

SNM is considered a well-established, safe, effective, and minimally invasive treatment for OAB in adults. It has been deemed especially advantageous for patients who have not seen improvement with conservative treatments such as physical therapy, medications, or lifestyle adaptations. As people age and as longevity increases in more advanced nations globally, this treatment has the potential to become widely recognized and utilized sooner in the evolution and treatment of this diagnosis. Hopefully this research will prompt additional exploration looking at both the health services that were identified as having a statistically significant relationship, such as education level. Recognizing that participants having college or postgraduate education demonstrated a

statistically significant relationship with selecting SNM, this may indicate the need for adjustments in patient education surrounding this treatment, with the goal of making patient teaching around this treatment easily understood for all populations with OAB. This in turn could offer a wider net of availability for an increasingly comprehensive population of individuals.

### **Conclusion**

Advances in treatment for medical disorders have improved the lives and well-being of many individuals impacted by diseases that become increasingly evident as our society's longevity increases. One diagnosis known to impact millions of individuals is OAB and through advances using physicians, research scientists, and medical technology progress, treatment options are steadily improving. SNM has been with little explanation. While demographics factors and comorbid diseases were thought to negatively influence SNM's use, research has not entirely confirmed these as factual. By performing this research, we now suspect that education levels and wait times to see specialists may be significant contributors to the adoption of SNM. Hopefully these findings will initiate further research on the possible inverse relationship between education level and SNM use, and ways in which patients can access specialty care in a more efficient manner.

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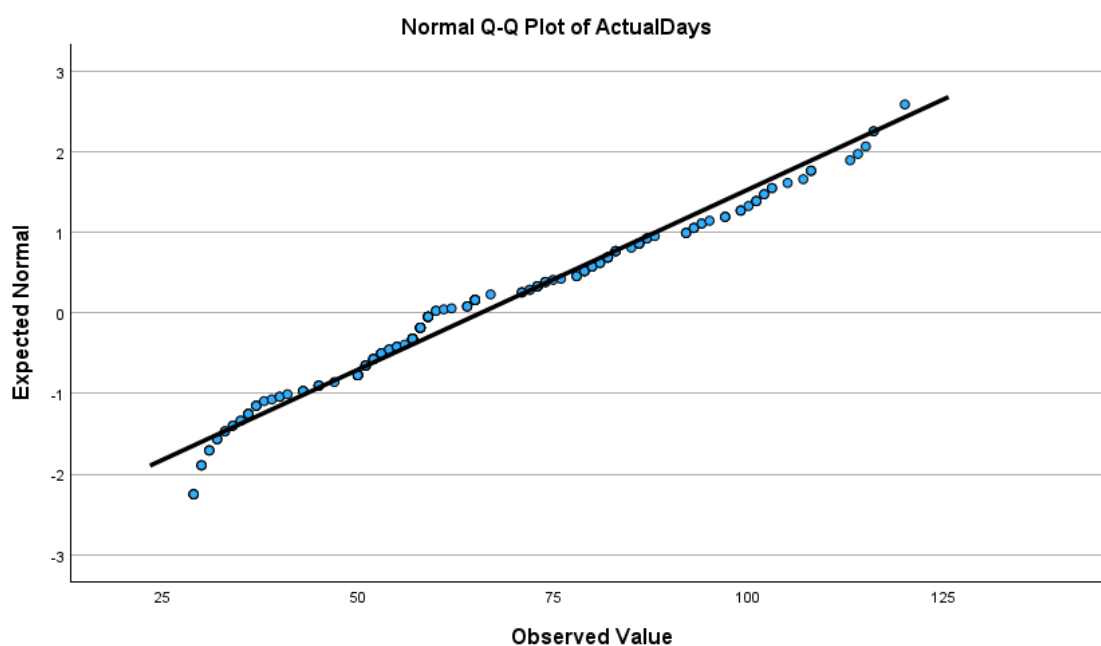
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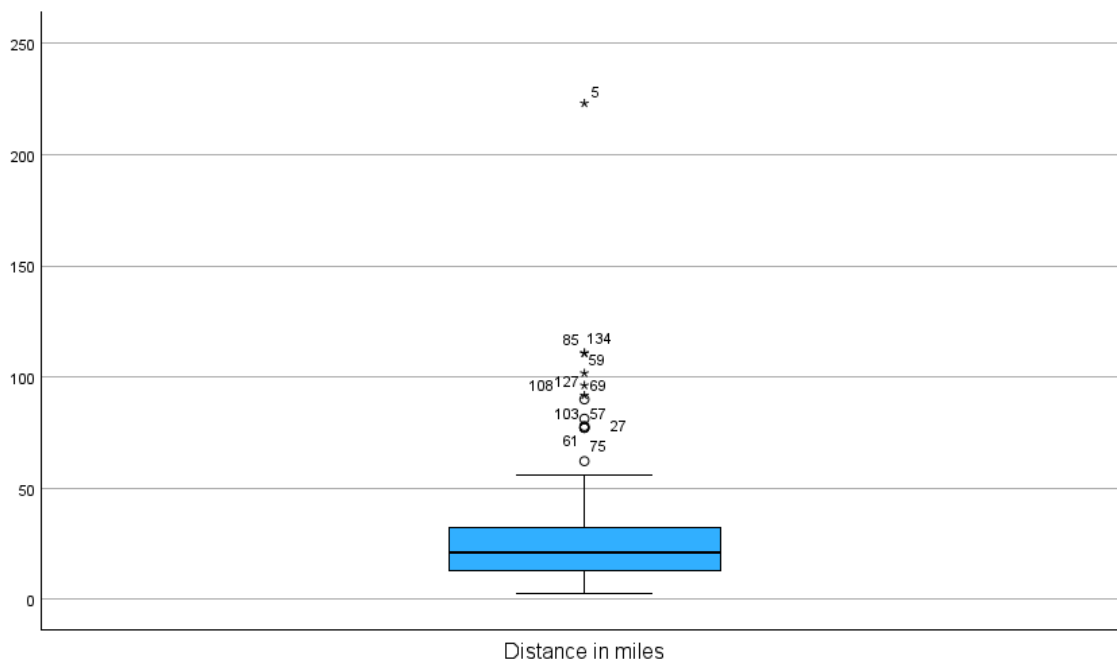
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## Appendix A: Descriptives

*Categorical Variables Codings*

		Parameter coding			
		Frequency	(1)	(2)	(3)
Education code	0	15	.000	.000	.000
	1	116	1.000	.000	.000
	2	66	.000	1.000	.000
	3	6	.000	.000	1.000
Insurance code	0	6	.000	.000	.000
	1	14	1.000	.000	.000
	2	176	.000	1.000	.000
	3	7	.000	.000	1.000
Number of operating rooms	1	147	.000	.000	
	2	18	1.000	.000	
	3	38	.000	1.000	
Specialty staff	0	26	.000	.000	
	1	176	1.000	.000	
	6	1	.000	1.000	
Anesthesia coverage hours	0	165	.000		
	1	38	1.000		



## Appendix B: Logistic Regression Analysis

*Logistic Regression Results**Case Processing Summary*

Unweighted Cases <sup>a</sup>		N	Percent
Selected Cases	Included in Analysis	203	99.5
	Missing Cases	1	.5
	Total	204	100.0
Unselected Cases		0	.0
Total		204	100.0

a. If weight is in effect, see classification table for the total number of cases.

*Dependent Variable Encoding*

Original Value	Internal Value
NoSNM	0
YesSNM	1

*Categorical Variables Codings*

		Frequency	Parameter coding		
			(1)	(2)	(3)
Distance in miles (Binned)	<= 12.6	52	.000	.000	.000
	12.7 - 21.2	49	1.000	.000	.000
	21.3 - 32.2	51	.000	1.000	.000
	32.3+	51	.000	.000	1.000
ActualDays (Binned)	<= 51	55	.000	.000	.000
	52 - 59	48	1.000	.000	.000
	60 - 82	53	.000	1.000	.000
	83+	47	.000	.000	1.000
Education code	NHS	15	.000	.000	
	HS	116	1.000	.000	
	COL	72	.000	1.000	
Insurance code	None_PA	12	.000	.000	
	OtherVAPr	14	1.000	.000	

	Medicare	177	.000	1.000
Number of operating rooms	1-2ORs	147	.000	.000
	3-5ORs	18	1.000	.000
	>5ORs	38	.000	1.000
	Limited	165	.000	
Anesthesia coverage hours	24_7	38	1.000	
Specialty staff	NoSpecStaff	27	.000	
	YesSpecStaf	176	1.000	
	f			

Block 0: Beginning Block

*Classification Table<sup>a,b</sup>*

Observed		Predicted		
		SNM implant		Percentage Correct
		NoSNM	YesSNM	
Step 0	SNM	0	101	.0
	implant	0	102	100.0
Overall Percentage				50.2

a. Constant is included in the model.

b. The cut value is .500

*Variables in the Equation*

	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 0	Constant	.010	.140	.005	1	.944	1.010

*Variables not in the Equation*

	Variable	Score	df	Sig.
Step 0	Distance in miles (Binned)	.845	3	.839
	s	.205	1	.651
	Distance in miles (Binned)(1)	.198	1	.656
	Distance in miles (Binned)(2)	.722	1	.395
	Distance in miles (Binned)(3)	16.073	3	.001
	ActualDays (Binned)			

ActualDays (Binned)(1)	1.851	1	.174
ActualDays (Binned)(2)	4.491	1	.034
ActualDays (Binned)(3)	.289	1	.591
Education code	29.223	2	<.001
Education code(1)	14.202	1	<.001
Education code(2)	27.347	1	<.001
Insurance code	1.477	2	.478
Insurance code(1)	1.186	1	.276
Insurance code(2)	.155	1	.694
Anesthesia coverage hours (1)	2.170	1	.141
Number of operating rooms	2.230	2	.328
Number of operating rooms(1)	.000	1	.983
Number of operating rooms(2)	2.170	1	.141
Specialty staff(1)	1.126	1	.289
Overall Statistics	45.268	14	<.001

Block 1: Method = Enter

*Omnibus Tests of Model Coefficients*

		Chi- square	df	Sig.
Step 1	Step	50.395	14	<.001
	Block	50.395	14	<.001
	Model	50.395	14	<.001

*Hosmer and Lemeshow Test*

Step	Chi- square	df	Sig.
1	9.535	8	.299

*Contingency Table for Hosmer and Lemeshow Test*

		SNM implant = NoSNM		SNM implant = YesSNM		Total
		Observed	Expected	Observed	Expected	
Step 1	1	16	17.877	5	3.123	21
	2	19	16.650	3	5.350	22
	3	14	14.137	6	5.863	20
	4	12	12.684	8	7.316	20
	5	14	11.135	6	8.865	20
	6	9	8.597	11	11.403	20
	7	6	6.528	12	11.472	18
	8	2	6.273	17	12.727	19
	9	6	4.900	14	15.100	20
	10	3	2.219	20	20.781	23

*Classification Table<sup>a</sup>*

		Predicted			
		SNM implant		Percentage Correct	
		NoSNM	YesSNM		
Observed					
Step 1	SNM	NoSNM	74	27	73.3
	implant	YesSNM	28	74	72.5
Overall Percentage					72.9

a. The cut value is .500

*Variables in the Equation*

		B	S.E.	Wald	df	Sig.	95% C.I. for EXP(B)	
							Exp(B)	Lower
Step	Distance in miles (Binned)			.744	3	.863		
1 <sup>a</sup>	Distance in miles (Binned)(1)	.078	.465	.028	1	.867	1.081	.434 2.691
	Distance in miles (Binned)(2)	-.187	.467	.161	1	.688	.829	.332 2.071
	Distance in miles (Binned)(3)	-.283	.462	.376	1	.540	.753	.305 1.863
	ActualDays (Binned)			14.339	3	.002		
	ActualDays (Binned)(1)	-1.463	.476	9.436	1	.002	.231	.091 .589

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ActualDays (Binned)(2)	-1.600	.471	11.551	1	<.001	.202	.080	.508
ActualDays (Binned)(3)	-.827	.475	3.039	1	.081	.437	.173	1.108
Education code			25.899	2	<.001			
Education code(1)	.979	.752	1.696	1	.193	2.662	.610	11.615
Education code(2)	2.697	.787	11.741	1	<.001	14.834	3.172	69.374
Insurance code			1.525	2	.466			
Insurance code(1)	.338	.966	.123	1	.726	1.402	.211	9.308
Insurance code(2)	-.424	.720	.346	1	.557	.655	.160	2.686
Anesthesia coverage hours	-.526	.582	.818	1	.366	.591	.189	1.847
(1)								
Number of operating rooms			.076	2	.963			
Number of operating rooms(1)	.156	.573	.074	1	.785	1.169	.380	3.597
Number of operating rooms(2)	.067	.588	.013	1	.910	1.069	.338	3.381
Specialty staff(1)	.093	.503	.034	1	.853	1.098	.410	2.940
Constant	-.082	1.013	.007	1	.935	.921		

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a. Variable(s) entered on step 1: Distance in miles (Binned), ActualDays (Binned), Education code, Insurance code, Anesthesia coverage hours, Number of operating rooms, Specialty staff.