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Self-Reported Neurogenic Bowel and Bladder Management In Acute Hospitalized Chronic Spinal Cord Injured Patients: Its Role in Clinical Practice

Mary Lupe Jimenez

California State University, Northern California Consortium Doctor of Nursing Practice

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Self-Reported Neurogenic Bowel and Bladder Management In Acute
Hospitalized Chronic Spinal Cord Injured Patients: Its Role in Clinical Practice

by
Mary Lupe Jimenez,

A Project submitted in partial fulfillment of
the requirements for the degree of
Doctor of Nursing Practice
In the California State University, Northern Consortium DNP Program
California State University, Fresno and San José

May 5, 2014

APPROVED

For the Department of Nursing

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ABSTRACT

Patients with spinal cord injuries and disorders (SCI/D) are at risk for mismanaged bowel care during acute hospitalization, which can lead to numerous medical complications ranging from loss of personal dignity and privacy to many serious medical conditions, some of which are life threatening. Additionally, mismanagement of bowel care during acute hospitalization may lead to costly extended hospital stays. The project was to describe bowel and bladder care for SCI/D patients during acute hospitalization using a self-reported questionnaire submitted by approximately 46.6% of SCI/D patients from the Veterans' Affairs Central California Health Care System. The self-report questionnaire was designed by the author to enable patients to communicate their experiences of care. Using Orem's Self-Care Deficit theory, analysis of these results may assist in the development of a bowel-and-bladder care template for use during hospitalization. This template may contribute to improved outcomes and to higher quality of care during hospitalized. Furthermore, it may result in increased life expectancy and improved quality of life for SCI/D patients.

Keywords: bladder, bowel, neurogenic bladder, neurogenic bowel, incontinence, SCI/D, SCI, spinal cord injury, autonomic dysreflexia

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The idea for this project was sparked by spinal cord injured veterans who shared their thoughts and experiences regarding care, or lack of bowel and bladder care, received during acute hospitalization. It made me realize how much they entrust their lives and privacy to others when not able to/or not allowed to care for themselves. I hope this project contributes a spark of knowledge and awareness regarding the care of spinal cord injured persons. I would like to thank all the veterans who allow me to participate in their health care and lives.

I would also like to thank my committee, Sylvia Miller, Doug Ota, and Lynne Whitney-Caglia, for their advice, feedback, and encouragement throughout my doctoral study. To the leadership and staff of Veteran's Administration Central California Health Care System, thank you, for your care and support of our veterans. The memories made and friendships formed while in the program will be treasured for life. The program had incredible faculty and administrative support that guided me during my doctoral journey.

To my husband, Andre N. Minuth, who filled my life with love, laughter, and unwavering support. I am grateful to him for encouraging me to pursue my dreams, and for showing me, that I am stronger than I ever imagined. To my family and friends, for

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CHAPTER 1: INTRODUCTION

Spinal Cord Injury (SCI) is a dysfunction that demands significant societal resources to address and treat, both worldwide and in the United States. A global estimate indicates that there may be 2.5 million (Fehlings, Wilson, & O'Higgins, 2012; "International Campaign," 2013) to 5 million people living with SCI (Walton Foundation for Independence, 2012). Before World War II, the life expectancy for patients with injuries of the spinal cord was a few weeks to a year.

According to Weaver (2012), 80-95% of soldiers with spinal cord injuries (SCIs) died within the first few weeks after being injured. The causes of death were urinary tract infections or others followed by infectious disease processes. Today, the survival rate of new SCI persons (SCIPs) has increased by 90% due to advancements in medical technology, such as antibiotics and medical screening. Life expectancy for the SCI population now approaches that of individuals without SCI (Samsa, Patrick, & Feussner, 1993; Weaver, 2012). Spinal cord injured persons routinely live for more than 60 years after their injury.

The Veterans Health Administration (VA) and the Spinal Cord Injury Model Systems (SCIMS) are two of the largest providers of care to Americans with SCI. The United States has the most comprehensive system of assistance for veterans of any nation in the world. The VA health care system grew from 54 hospitals in 1930 to 171 medical centers; more than 350 outpatient, community, and outreach clinics; 126 nursing home care units; and 35 domiciliaries in 2013. Veterans Affairs health care facilities provide a broad spectrum of medical, surgical, and rehabilitative care (U.S. Department of Veterans Affairs, 2013). The SCIMS program was established in 1970 to provide comprehensive

rehabilitation services to SCI patients in the United States (Model Systems Centers, n.d.; National Spinal Cord Injury Statistical Center [NSCISC], 2012). There are 14 designated SCIMS and Five Form II Centers that are sponsored by the National Institute on Disability and Rehabilitation Research (NIDRR). In a multi-center analysis of the SCMIS Centers for persons with traumatic SCI, Cardenas, Hoffman, Kirshblum, and McKinley (2004) found that rehospitalizations reported at 1, 5, 10, 15 and 20 year follow-up were caused by diseases in the genitourinary system, including urinary tract infections (UTIs), respiratory, and diseases of the skin (pressure ulcers).

The National Spinal Cord Injury Statistical Center (NSCISC, 2010) database, of the Model Systems of Care suggested that in 2010, the length of stay (LOS) during rehospitalizations at year 1 of injury was 24.7 days, and at 30 years 16.7 days (NSCISC, 2010). The NSCISC database also indicated that 22.65% of 145,386 persons with SCI experienced rehospitalizations in 2010 due to a secondary complication (NSCISC, 2010). The rate for rehospitalizations decreased rapidly from year 1 to year 5, and declined less rapidly thereafter. Samsa, Landsman, and Hamilton (1996) found that in a cohort of veterans with SCI up to 15 years, inpatient hospitalizations were consistent with those of the model systems of care.

The average yearly cost for a high tetraplegia is \$181,328, and for a paraplegia \$67,415 after the first year of injury (NSCISC, 2013). DeVivo and Farris (2011) found that of 430 hospitalizations occurring among 206 persons, the most frequent cause was urinary tract infection complications (26.5%), followed by skin conditions (16.5%). The mean charge per hospitalization in 2009 dollars for UTIs was \$12,617, and skin conditions \$75,872.

The VA delivery of health care is shifting from problem-based health care, which only treats symptoms, to patient-centered care focused on care and healing for the whole person. The new model is patient-driven, evidence-based, and prioritizes health promotion of individual patients and the health of the overall population. This patient-centered model focuses on preventive care. The VA patient-centered model follows the guidelines of the Healthy People 2020 program, which enables Americans to practice healthy behaviors, enjoy a higher quality of life, and live longer lives free of preventable disease, disability, injury, and premature death (U.S. Department of Health and Human Services, 2012).

The United States Department of Veterans Affairs (VA) monitors the incidence of SCI among its military populations. There are approximately 42,000 to 44,000 veterans eligible for VA benefits claiming SCI as the cause of their physical dysfunction. Similarly, the Veterans Health Administration (VHA) provides care to nearly 22,800 veterans with SCI complications, which includes specialized care for approximately 13,000 veterans with spinal cord injuries disorders (SCI/D) (U.S. Department of Veterans Affairs, 2009).

The mission of the SCI/D program is to promote the health, independence, quality of life, and productivity of individuals with SCI/D throughout their entire lives. Spinal cord injury/disorders outpatient centers provide the full spectrum of health maintenance and rehabilitation needed by the SCI/D population. Veterans requiring emergent, or immediate, medical attention in a non-SCI/D center should be evaluated and treated, and if warranted, transferred to an SCI center when safe to do so. In the interim, care in a non-SCI center should be provided by trained staff in the medical care of persons with

SCI, or equivalent experience. It is important during acute hospitalization that providers in non-SCI centers are aware that there are unique conditions and problems that SCI/D patients may develop because of the spinal cord dysfunction.

With advances in medical care contributing to increased life expectancy, SCIPs are at greater risk than the general population for medical problems that require acute hospitalization (Bloemen-Vrencken, deWitte, & Van denHeuval, 2007; DeVivo, 2012; McColl, Charlifue, Glass, Lawson, & Gordana, 2004; Pickelsimer, Shiroma, & Wilson, 2010; Samsa et al., 1996). Multiple studies have found that rehospitalizations (also known as acute hospitalization/ hospitalizations/ unplanned hospitalization) in chronic spinal cord injured persons are due to disorders of muscle and connective tissue, renal and urinary problems, digestive, circulatory, respiratory problems, and pressure ulcers (Cardenas et al., 2004; DeVivo & Farris, 2011; Samsa et al., 1996).

There is a large body of evidence in the literature regarding the prevalence of neurogenic bowel /neurogenic bladder dysfunction and related rehospitalizations/hospitalizations in chronic SCI persons. There is some evidence in the literature about self-reported management of neurogenic bowel and neurogenic bladder dysfunction that is reported separately in community-dwelling chronic spinal cord injured adults. Mismanaged bowel and bladder care can lead to a number of conditions: incontinence (stool or urine); autonomic dysreflexia (AD), which can be life threatening; constipation, dermatitis, mucosal damage, pressure ulcers, urinary tract infections, sepsis and loss of privacy and dignity for the patient. Despite evidence in the literature related to the effects of mismanagement of bowel and bladder care in SCIPs, there is a lack of

literature regarding the actual bowel and bladder management in chronic SCIPs during hospitalization.

Purpose

The purpose of this quality assessment project was to determine if the bowel-and-bladder management was smoothly transitioned from home to acute hospitalization for chronic SCI/D veterans at Veterans Affairs Central California Health Care System (VACCHCS). The quality assessment project will assist in the development of a bowel and bladder template to provide a standardized approach to assure SCI/D person's bowel and bladder management is consistent and smoothly transitioned from home to hospital when an SCI/D person is admitted to the hospital.

Theoretical Framework

The project is guided by Orem's self-care deficit theory, which is well documented in the literature as a basis for nursing practice. The theory's emphasis is on the development of knowledge that is useful for clinical practice. In the late 1960s, Dortha Orem created a general theory of nursing known as the self-care deficit in nursing theory (SCDNT). It was formalized in 1971 in published format: *Nursing: Concepts of Practice*, currently in its sixth edition (2001). Five underlying premises of the SCDNT were formalized, and advanced as true and not merely assumed, as operating principles in 1973.

1. Human beings require continuous, deliberate inputs to themselves and their environments in order to remain alive and function in accord with natural human endowments.

2. Human agency, the power to act deliberately, is exercised in the form of care of self and others in identifying needs for and in making needed inputs.
3. Mature human beings experience privations in the form of limitations for action in care of self and others involving the making of life-sustaining and function-regulating inputs.
4. Human agency is exercised in discovering, developing, and transmitting to other ways and means to identify needs for and make inputs to self and others.
5. Groups of human beings with structured relationships cluster tasks and allocate responsibilities for providing care to group members who experience privations for making required deliberate input to self and others (Orem, 2001).

These underlying premises serve as the framework that expresses essential variables and relationships in nursing. The five premises form a baseline reference for predicting the relationships or universal conditionals implicit in premises 1 to 4, and in premise 5, as it pertains to societies where nursing is established as an available human service. Fundamentally sound in concept for practice, *the self-care deficit theory of nursing* is the synthesis of knowledge that integrates theoretic entities: self-care (and dependent care), self-care agency (and dependent care agency), therapeutic self-care demand, the relational entity self-care deficit, and nursing agency (Orem, 2001).

The concepts of the SCDNT are clearly defined. Hence, it maintains internal validity and external reliability, both in clarity and in utility of its application to the SCI/D population who are subject to a state of health deviation as the result of their spinal cord injuries. The major theoretical concepts of self-care, self-care deficit, and the nursing system will be discussed briefly.

Self-care is defined, by Orem (2001), as

learned, goal oriented activity of individuals. It is behavior that exists in concrete life situations directed by person to self or to the environment to regulate factors that affect their own development and functioning in the interests of life, health, or well-being. (p. 490)

These are the personal abilities and actions that enable individuals to plan, organize, and carry out necessary essential care for themselves on a day-to-day basis. It is paramount in one's life that therapeutic self-care measures be utilized, in order to maintain and promote a quality mode of living. The self-care agent/agency/dependent-care agent is a person or persons providing the self-care.

Self-care deficit is defined as:

the relation between the person's therapeutic self-care demands, and the powers of self-care agency, in which constituent developed self-care capabilities within self-care agency are not operable or not adequate for knowing and meeting some or all components of the existent or projected therapeutic self-care demand. (Orem, 2001, p. 522)

This is when a person or agents providing the self-care cannot adequately meet their own needs. This deficit between capacity and need gives rise to requirements for assistance from a nursing agency.

The nursing agency is,

a complex power of persons, educated and trained as nurses, that is enabling when exercised for knowing and helping others know their therapeutic self-care demands, for helping others meet or in meeting their therapeutic self-care

demands, and in helping others regulate the exercise or development of their self-care agency or their dependent-care agency. (Orem, 2001, p. 491)

Relative to the foregoing definitions, there are three types of nursing systems.

The three types of nursing systems are identified as wholly compensatory, partly compensatory, and supportive-educative:

1. a wholly compensatory system is one in which the nurse is compensating for the patient's total inability to engage in self-care activities;
2. a partly compensatory system is one in which both the patient and nurse perform the measures of self-care;
3. a supportive-educative system is one in which the patient or a dependent caregiver is able to perform the therapeutic self-care, and should learn to do so (Orem, 2001).

The self-care deficit theory has been widely tested. The self-care concept has been used in care-giving work and medication behaviors of elderly, self-care in elderly, hemodialysis, hospitalization and among patients receiving home health (Allison, 1973; Harper, 1984; Simmons, 2009; Soderham & Cliffordson, 2001; Tao, Ellenbecker, Chen, Zhan, & Dalton, 2012). The results substantiate SCDT as a basic tenet in theory and practice that encourages patient self-care as the primary objective, where assistance is provided by the nursing agency when need arises. Research pertaining to spinal cord injuries casts light on applications of this theory to both traditional and non-traditional settings for nursing care. Orem's (2001) theory serves as a broad framework for innovative application of patient care in SCI/D veterans who are at risk of self-care deficit during acute hospitalization.

In this regard, advanced practice nurses (APNs) and nurses caring for veterans in the VACCHCS play key roles in assisting SCI patients with self-care deficits (bowel and bladder care). For SCI patients to maximize an independent lifestyle and optimal health, patients must implement and maintain changes daily. These daily changes include dietary concerns, bowel and bladder elimination, medication regimens, and recognition of the symptoms of potential complications. When SCI/D patients take an active role in their self-care, and are acutely aware of self-care deficits in advance of exhibiting such deficits, the application of Orem's (2001) SCDT is warranted. Application of Orem's SCDT in clinical practice is appropriate to the SCI/D population and the hospital setting of this quality assessment project.

Review of the Literature

This chapter provides a review of the literature pertinent to neurogenic bowel and bladder management in chronic SCI patients during hospitalization. An overview of the literature relevant to the pathophysiology of spinal cord injury, neurogenic bowel dysfunction, neurogenic bladder dysfunction, and hospitalization of chronic spinal cord injury is examined. Autonomic dysreflexia is discussed as it is an unrecognized complication that can be life threatening.

Spinal Cord Injury

Injury to the spinal cord, whether traumatic or non-traumatic, can affect many aspects of care and often requires a proactive approach in managing actual and possible complications in order to achieve the best possible outcome of care. The etiologies of traumatic SCI (TSCI) since 2005 in the United States of America (Figure B1) include motor vehicle accident/crashes (36.5%); falls (28.5%); acts of violence (gunshot and stab

wounds) (14.3%); sports-related/incidence (diving, gymnastics and football are high) (9.2%); and other causes (11.4%) (NSCISC, 2013; Zhang et al., 2013). The proportion of injuries due to sports and violence has decreased, while injuries due to falls have increased. Selvarajah et al. (2014) used the Emergency Department Sample (NEDS) Healthcare Costs and Utilization Project (HCUP) from 2007-2009 and reported that falls (41.5%) are now the leading cause of traumatic spinal cord injury in adults, followed by motor vehicle collisions (35.5%). Adults older than 65 years are more likely to sustain TSCI compared to other age groups.

The average age of injury has also increased to 42.6 years in 2010, from 28.7 years in the 1970s. Men comprise 80.7% of all new injuries. Ethnic distribution of spinal cord injuries since 2010 consists of a majority of Caucasians (67.0%), African Americans (24.4%), Hispanics (7.9%), Asians (2.1%), and Native Americans (0.8%) (NSCISC, 2013).

The prevalence of non-traumatic causes can only be estimated (Sheerin, 2005; Walker, 2009; Walton Foundation for Independence, 2012). Abrams and Wakasa (2013) estimated that the incidence of non-traumatic is three to four times greater than traumatic SCI. Non-traumatic causes include metastatic cancer, tumors, ischemia/infarction of the spinal cord (vascular disorders), surgical complications, inflammatory disease of the spine or cauda equina skeletal malformations, genetic disorders (spino-cerebellar ataxias), vertebral column degenerative disorders, metabolic disorders, and auto-immune diseases (McDonald & Sadowsky, 2002; Smith, Evans, & Weaver, 2010).

According to the NSCISC in Birmingham, Alabama, the incidence of people in the United States afflicted with chronic SCI in 2012 was estimated at 270,000. Chronic

SCI is observed to commence 1 year beyond initial injury (Gulati, Kirshblum, Vorman, & O'Connor, 1998; Kirshblum, Gulati, O'Connor, & Vorman, 1998). In 2004, the Christopher and Dana Reeve Foundation (CDRF), in a cooperative agreement with the U.S. Centers for Disease Control and Prevention (CDC), funded one of the largest population-based studies of disability ever conducted. Approximately 1,275,000 (0.4%) people in the United States were reported being paralyzed due to an SCI (CDRF, 2006).

According to McDonald and Sadowsky (2002), initial injuries to the spine may involve the vertebral column, spinal cord, spinal nerves, or blood vessels that supply the spinal cord. Within minutes, the spinal cord may swell to occupy the entire diameter of the spinal canal at the level of injury. If swelling exceeds venous blood pressure, autoregulation of blood flow ceases, leading to spinal neurogenic shock. Primary injury is the result of ischemia and toxic chemicals, which are released from disrupted neural membranes and shifting electrolytes triggering a secondary cascade that damages or kills neighboring cells (McDonald & Sadowsky, 2002; Walker, 2009). The cascade of excitotoxicity causes additional necrosis in the cord days to weeks after the initial trauma site; this is considered the secondary injury. In non-traumatic SCI, the primary injury is disease-specific, and its secondary injury causes excitotoxicity that contributes to death of cells.

The spinal cord is the main pathway for the transmission of information between the brain and the nerves that lead to muscles, skin, internal organs, and glands. Disruption of the spinal cord alters movement, sensation, and function. The spinal cord originates at the caudal end of the *medulla oblongata* and extends down to about L1-L2 (Figure B2) where it tapers to what is known as the *conus medullaris* (Sheerin, 2005;

Walker, 2009; Zhang et al., 2013). The spinal cord is organized into systems of ascending and descending neuronal pathways.

The ascending pathway carries sensory information from the body to the brain. The ascending tracts are divided into the spinothalamic and dorsal columns. The spinothalamic tracts, which are responsible for sensing pain and temperature, are located laterally and anteriorly in the spinal cord. The dorsal columns are responsible for proprioception and vibration, and are located in the posterior portion of the cord.

The descending tracts are classified into two groups: pyramidal and extrapyramidal tracts. The pyramidal tract is also known as the corticospinal tract and is a major pathway. The descending tract is located primarily in the anterior portion of the spinal cord (Employee Education System, 2006; Zhang et al., 2013), as well as the ventral and lateral column.

Most spinal cord injuries damage both upper and lower body neuronal (neurons) pathways. Upper motor neuron injuries occur just above the conus medullaris causing hyperactive reflexes, increased tone and dorsiflexion, involuntary muscle spasms, and preservation of muscle bulk. Lower motor neuron (LMN) injury result from injuries to the cell bodies or axons of the lower motor neuron causing diminished or absent reflexes, atrophy, fasciculation's, decreased tone, and absent plantar flexion if the L5 motor neuron is damaged. Cauda equina injuries result in LMN findings exclusively.

An accurate neurological examination is required to render appropriate medical care during the acute and chronic stages in spinal cord injured persons. The International Standards for the Neurological Classification of Spinal Cord Injury (ISNCSCI) was initially developed as the ASIA (American Spinal Injury Association [ASIA] Exam

Sheet, 2013) Standards for the Classification of Spinal Cord Injuries in 1982 for the National SCI Statistical Center Database (Figure B3). The impetus for the development of these standards came from the need for a better definition of neurologic levels and the extent of incomplete injury, as well as the need to achieve more consistent and reliable data among the centers that may assist in research activities and improve patient care outcomes. This led to the adoption of key muscles and key sensory points in the neurologic assessment (ASIA Exam Sheet, 2013; Kirshblum et al., 2014). The most recent published revisions of the International Standards were in 2011.

The degree of disability experienced by SCI/D persons is determined by the level, severity, and mechanism of injury. Persons with tetraplegia sustain injuries to one of eight cervical segments of the spinal cord, and paraplegics have lesions to the thoracic, lumbar, or sacral regions. The ASIA impairment scale describes a person's functional impairment because of their spinal cord injury. The use of a standardized classification of SCI enables effective communication among the medical community.

Additionally the ASIA impairment scale includes motor, sensory and class categories. The motor component breaks down the skeletal system into ten key-paired muscle groups, each innervated by the neurons from a single spinal segment. The sensory component provides input to dorsal roots of 28-paired dermatomes on the skin of specific spinal nerves, which are scored separately for light touch and pinprick sensitivity (ASIA Exam Sheet, 2013; Kirshblum et al., 2014; Sheerin, 2005; Zhang et al., 2013).

The ASIA impairment scale defines complete or incomplete SCI. This refers to the absence or presence of sensory and motor function to S4-S5 (sacral segments) (ASIA Exam Sheet, 2013; Kirshblum et al., 2014). Complete means there is no sensory or

motor function preserved in the sacral segments S4-S5. Incomplete refers to sensory, but not motor function preserved below the neurological level and extending through the sacral segments S4-S5 (rectal examination).

According to the Consortium for Spinal Cord Medicine (2008a), the preferred term for levels of injuries in the cervical segment of the spinal cord is tetraplegia (not quadriplegia). Cervical injuries (C1-C8-T1) account for more than 55% of all traumatic injuries and occur more often than thoracic and lumbar injuries (Zhang et al., 2013). Paraplegia causes paralysis of the lower part of the body, which may include the bowel and bladder (Francis, 2007; Walker, 2009; Zhang et al., 2013). Paraplegia results from damage to the thoracic (T1-T11), thoracolumbar (T11-T12 and L1-L2), and lumbosacral (L2-S5) or sacral regions of the spinal cord, and accounts for 15% of cases each (Figure B4). The NSCISC (2013) statistical data revealed that the distribution of classes of acute injury, as determined by neurological level and extent of injury at discharge, were incomplete tetraplegia (40.6%), followed by incomplete paraplegia (18.7%), complete paraplegia (18%) and complete tetraplegia (11.6%).

The autonomic nervous system (ANS) has central and peripheral components. Central components are the hypothalamus, brain stem, and spinal cord. The peripheral components are the nerves that innervate the organs and are classified as either parasympathetic or sympathetic. The sympathetic nervous system supplies the entire body and leaves the cord through roots between T1 and L2 (Employee Education System, 2006; Rhoades & Pflanzner, 1989). The sympathetic system coordinates the body's response to stress -- the *fight or flight* response (i.e., increased heart rate, blood pressure). The parasympathetic outflow comes from opposite ends of the central nervous system:

the vagus nerves and the sacral cell bodies (Figure B5). The parasympathetic is the body's more vegetative state, rest-and-digest.

Neurogenic Bowel Dysfunction

A review of normal bowel function is essential to understand neurogenic bowel dysfunction better (NBD). The bowel has five functions (Getliffe, Dolman, & Moore, 2007) storage, absorption, secretion, synthesis of vitamins, and elimination. Normal colonic transit time is 12-30 hours from ileocecal valve to rectum (Lynch, Anthony, Dobbs, & Frizelle, 2001). The colon is approximately 1.5m long (4.9 feet), closed at one end by the ileocecal valve and the anal sphincter (internal anal sphincter [IAS] and external anal sphincter) at the other. The external anal sphincter (EAS) contracts with the pelvic floor.

Fecal continence is maintained by the resting tone and reflex activity of the IAS, EAS, and the puborectalis muscle (Consortium for Spinal Cord Medicine, 2008b; Lynch et al., 2001; Steins, 2006). Parasympathetic innervation to the colon, rectum, and anus is via the vagus and pelvic splanchnic nerves (from the conus medullaris, sacral level 2-4). This produces propulsive peristalsis. The sympathetic greater splanchnic (T5-9), lesser splanchnic (T10-12), and hypogastric (L1-L3) nerves innervate the stomach and small intestine (Steins, 2006). The somatic pelvic nerve (sacral level 2, 3, and 4) innervates the pelvic floor and the EAS (Figure B6). The enteric (intrinsic) nervous system to the gastrointestinal tract includes the Auerbach's plexus and Meissner's plexus, which coordinate colonic wall movement and advancement of stool through the colon. Three mechanisms perform the motility of the colon; (a) myogenic, (b) chemical

(neurotransmitters and hormones), and (c) neurogenic. The gastrocolonic response or *gastroreflex* is initiated by a fatty or protein meal.

The level of the spinal cord injury and completeness, and whether the deficit is UMN or LMN, determine the effect of colonic motility. Upper motor neuron (UMN), a lesion above the conus medullaris, results in loss of conscious sphincter control and the inability to increase significantly intraabdominal pressure. The UMN injury causes a loss of voluntary defecation and a degree of anorectal dyssynergia. Loss of rectal sensation and spastic EAS require defecation to be anticipated (planned). Upper motor neuron bowel is also known as reflexic bowel. Mechanical or chemical stimulus is required to trigger a reflex defecation (Consortium for Spinal Cord Medicine, 2008b; Lynch et al., 2001; Steins, 2006).

Complete or partial injuries within the conus medullaris, in the cauda equina and pelvic nerve, can result in an LMN injury pattern. Lower motor neuron bowel is caused by an absent EAS tone and decreased or absent reflex peristalsis. This can result in fecal leakage with the valsalva maneuver; thus, the rectal vault needs to be kept empty to avoid incontinence (Consortium for Spinal Cord Medicine, 2008b; Lynch et al., 2001; Steins, 2006). The LMN bowel tends to be flaccid and is known as an areflexic bowel (Ash, 2005). The LMN bowel needs to have the rectal vault stimulated and cleared manually (digital stimulation and removal) of stool more often than the UMN bowel.

The elimination of feces is a vital bodily function and most persons are independent in this function early in life. It is usually a private function, but if a person becomes disabled physically or mentally, assistance may be required to carry out this function. Neurogenic bowel refers to colorectal dysfunction (constipation, incontinence,

and difficulty with defecation) secondary to neurologic conditions of the central nervous system or peripheral nerves (Coggrave, Norton, & Wilson-Barnett, 2009; Correa & Rotter, 2000; Furlan, Urbach, & Fehlings, 2007; Haas, Evers, & Knecht, 2005). Persons with neurogenic bowel dysfunction have no voluntary control over stool elimination, which is of clinical relevance to quality of life in persons with SCI.

Complications reported in the literature are prolonged colonic transit time (colon motility), fecal impaction, abdominal distention, colonic dilation, megacolon, fecal incontinence, autonomic dysreflexia (AD), and constipation (Consortium for Spinal Cord Medicine, 2008b; Faaborg, Christensen, Finnerup, Laurberg, & Krogh, 2008; Lynch et al., 2001; Steins, 2006). The most frequent gastrointestinal complication reported in chronic SCI is altered bowel elimination. According to the literature, neurogenic bowel dysfunction occurs in 20-90% of individuals with SCI (Coggrave et al., 2009; Collins et al., 2005; Correa & Rotter, 2000; DeLooze, Van Laere, Muynck, Beke, & Elewaut, 1998; Faaborg et al., 2008; Glickman & Kamm, 1996; Haas et al., 2005; Kirshblum et al., 1998). Steins (2006) reported that all persons with complete SCI have neurogenic bowel dysfunction and most persons with incomplete SCI have some form of bowel dysfunction.

Glickman and Kamm (1996) assessed 115 consecutive outpatients that attended the Supraregional Spinal Unit at the Royal National Orthopaedic Hospital in London and found an increase of any diagnosed bowel problems pre-injury (18%) to post injury (43%). Other problems included hemorrhoids, anal fissures, diarrhea, nausea, and vomiting. DeLooze et al. (1998) assessed questionnaires from 90 persons with complete SCI lesions for more than five months. Persons were randomly selected from a

rehabilitation center in Ghent, Belgium. The majority of patients suffered from constipation (58%), abdominal pain (33%), hemorrhoidal bleeding (21%), and occasional fecal incontinence (42%).

Correa and Rotter (2000) assessed the state of neurological bowel function and application of a comprehensive management program of 38 SCI patients in an outpatient rehabilitation service in Santiago, Chile. Twelve patients (32%) had complete lesions of more than 5 years. The study was longitudinal and prospective with both pre-and post-intestinal function evaluation. The most frequent symptoms were abdominal distention (53%), abdominal pain (28.9%), flatulence (50%), rectal bleeding (39.5%) and fecal incontinence (50%). Bowel care dependence was 30% before a comprehensive bowel management program was implemented and 23.8% after program implementation. Colonic transit time was distributed accordingly: between 10-15 days (50%), 20 days (14.3%), and greater than 20 days (28.6%). These results were also confirmed by an earlier study by Glickman and Kamm (1996) which found that problems with constipation increased from 4% pre-injury to 26% post-injury.

Collins et al. (2005) conducted a national survey to assess satisfaction with annual comprehensive preventive health evaluation (CPHE) in veterans with SCI. The survey was random with a total response of 853 (35.2%). The CHPE had been completed the previous year by 76% of the respondents. Collins et al., found that responders wished to discuss the following subjects with a health care professional: muscle strength and weakness, bladder care, chronic pain, digestion, bowel care issues, and equipment problems. Similar bladder care and bowel care issues were also found by Glickman and Kamm (1996) as well as Correa and Rotter (2000).

Coggrave et al. (2009) assessed a postal survey from 1,334 community-dwelling individuals in the United Kingdom who had SCI for at least a year. Reported complications with bowel care included constipation (39%), hemorrhoids (36%), and abdominal distention (31%), monthly incontinence (8.4%), autonomic dysreflexia (8.4%), and inflexibility in routine (7.6%). Assistance with bowel care ranged from 11.8% to 22.8%. Those with complete injury were more likely to require complete assistance. Care was provided by nurses (23.8%), personal caregivers (30%), or partners (32%). Coggrave et al. also found that the most common type of bowel intervention (multiple responses possible) was manual evacuation (56%), anorectal stimulation (38%), regular diet (52%), and oral laxatives (48%). Gender-related differences emerged, as women reported more constipation, abdominal pain, and distention than men did. Women were more likely to wear pads than men were. The results of constipation and abdominal distention were supported by Glickman and Kamm (1996), DeLooze et al. (1998), and Correa and Rotter (2000).

Neurogenic Bladder Dysfunction

Micturition involves normal function of the bladder and urethra. A detrusor or normal compliance and a physiologically competent urethral sphincter are both necessary to maintain urinary continence. Micturition involves passive, low filling of the bladder during the urine storage phase while voiding requires the coordination of detrusor contraction with the internal and external urinary sphincter relaxation. The micturition process is controlled by the central nervous coordination of the sympathetic and parasympathetic nervous system activation with the somatic nervous system to ensure normal micturition with urinary continence (Wein, 2007). Voiding dysfunction can result

from any number mechanical or physiologic defects that result in the inability of the urinary sphincter to appropriately increase/decrease its pressure in response to increased bladder pressure.

Neurogenic bladder dysfunction occurs in most spinal cord injured persons. Deaths were due to urinary tract infections (UTIs) decreased from 40% during World War I to 10% during World War II. Genitourinary problems remain common and deaths due to urosepsis are still frequent (Abrams & Wakasa, 2013; Krause, Carter, Pickelsimer, & Wilson, 2008). Management of neurogenic bladder dysfunction has improved over the years, but the goals of management have remained the same: keeping the patient dry and preventing urinary tract complications. The functions of the lower urinary tract (LUT), the bladder and urethra, will be reviewed to understand neurogenic bladder dysfunction better, also known as neurogenic lower urinary tract dysfunction. In the European literature, neurogenic lower urinary tract dysfunction (NLUTD) is a standardized terminology to facilitate understanding and management, and this terminology will be used here.

In spinal cord injured persons, normal LUT function depends on the location and extent of neurologic lesions, as well as the degree of neural integration between the brain, brainstem, pons (pontine micturition center), spinal cord, sacral cord, and peripheral nerves (Stohrer et al., 2013). The lower urinary tract system has two main functions: storage of urine and periodic elimination through a coordinated fashion. The bladder receives urine from the kidneys via the ureters with innervation being somatic and autonomic.

Additionally volitional control of the striated muscle of the external sphincter is innervated somatically via the pudendal nerve (S2-S4). The parasympathetic bladder receptors are called cholinergic, because the primary neurotransmitter is acetylcholine (pelvic splanchnic nerves S2-S4). The somatic and autonomic systems provide detrusor contraction and bladder outlet relaxation. The sympathetic innervation originates at T11-L2 and travels to the bladder and urethra via the hypogastric nerve (Consortium for Spinal Cord Medicine, 2006; Goetz & Little, 2006). Beta-adrenergic receptors in the body of the bladder cause relaxation of smooth muscle, and the alpha-receptors at the base of the bladder and urethra cause contraction of smooth muscle (Figure B7). The overall sympathetic effect is bladder outlet contraction and detrusor relaxation.

According to Samson and Cardenas (2007), there are two basic patterns of NLUTD with respect to the anatomical location of the lesion relative to the sacral cord reflex centers: lower motor neuron (LMN) and upper motor neuron (UMN). Upper motor neuron lesions can be of two types: (a) intracranial (suprapontine) lesions in which detrusor contractility is interrupted while the pontine micturition center is intact and (b) spinal lesions (suprasacral or infrapontine) T11 or higher (above the conus medullaris) sparing the sacral reflex arc. This disrupts the modulation of the detrusor and sphincter activity leading to detrusor-external sphincter dyssynergia (DESD)/detrusor-sphincter dyssynergia (DSD) (Samson & Cardenas, 2007).

Upper motor neuron lesions can cause urinary incontinence with no sensation of bladder feeling or urges to void. Other findings include an intact bulbocavernosus reflex, vesiculo-urethral reflux, absent voluntary sphincter control, spastic bladder, high post void residual and uncoordinated activity of bladder and sphincter. Due to failure to

empty the bladder fully, hydronephrosis and renal failure can occur. Clinical features seen are urinary incontinence (UI), uninhibited bladder contractions causing abdominal pain or discomfort, and *stop/start* voiding with incomplete emptying, and retrograde flow of urine. Injuries T6 and higher can display autonomic dysreflexia (AD), which will be discussed later in detail.

A lower motor neuron lesion is an injury to the spinal cord at or below the sacral micturition center (S2-S4), at or below the conus medullaris and or the cauda equina (T12 or lower), and can affect efferent (motor), afferent (sensory), or both portions of the sacral reflex arc pathway. This results in an areflexic or hyporeflexic detrusor with a normal or underactive external sphincter (Samson & Cardenas, 2007). With a denervated detrusor muscle or underactive external sphincter, coordination of detrusor contraction and sphincter relaxation occurs during bladder emptying. This causes a large bladder capacity since detrusor tone is low. Detrusor areflexia may be accompanied by reduced bladder compliance, which may in turn cause increased intravesical pressure. Clinical features include absent bulbocavernosus, urinary retention, overflow incontinence, elevated post void residual, abdominal distention, and constipation (Employee Education System, 2006).

The devastating effect of spinal cord injury on the bladder has been documented in the literature since the 17th century (Sykes, 2009). Alterations in this function are one of the most problematic consequences of SCI, resulting in urological complications. The mortality rates have decreased in recent decades, yet remain a prominent cause of morbidity (Cameron & Clemens, 2010; Cameron et al., 2011; DeVivo, 2007).

Several long-term studies of bladder management have looked at bladder management of spinal cord injured persons (Cameron & Clemens, 2010; Cameron et al., 2010; El-Masri(y), Chong, Kyriakider, & Wang, 2012). Cameron and Clemens (2010) reviewed the literature from 2007-2008 to determine current therapies used in the United States by SCI persons. Indwelling catheters (including suprapubic catheters), clean intermittent catheterization (CIC), condom catheters, sphincterotomy, ileovesicectomy, continent catheterizable stoma and bladder augmentation, ileal conduit, and botulinum toxin injection were reviewed.

No consensus recommendation was found by the U.S. Centers for Disease Control (CDC), the Spinal Cord Medicine Paralyzed Veterans of America, or the European Urological Association on any one therapy or follow-up for NLUTD patients. However, the Consortium for Spinal Cord Medicine Paralyzed Veterans of America guidelines recommends centers perform annual upper and lower urinary tract evaluations. The European Urological Association and the CDC both endorse CIC/IC as a gold standard when compared to indwelling. Cameron and Clemens (2010) recommended that an individualized approach should take into account relevant clinical data, as well as patient limitations and preferences and CIC with or without oral anti muscarinic agents.

Cameron et al. (2010) reviewed bladder management, using the National Spinal Cord Injury Database, for the United States for the years of 1972-2005, and found that indwelling catheter use is associated with more urological complications. The complications were stones, urinary infection, urethral strictures, and bladder cancer. The choices for bladder management at discharge from rehabilitation for 24,762 patients were (a) indwelling catheter, (b) condom catheter, and (c) CIC.

The use of a condom catheter decreased from a peak of 34.6% in 1972 to a low of 1.5% in 2001 (Cameron et al., 2010). Clean intermittent catheterization increased from 12.6% to in 1972 to a peak of 56.2% in 1991. Indwelling catheter use decreased from 33.1% in 1972 to 16.5% in 1991, but rose back to 23.1% in 2001. Of 12,984 individuals with follow-up data using indwelling catheters, 71% were unlikely to change and continued using an indwelling catheter at 30 years (Cameron et al., 2010).

Of individuals using IC and condom catheters at discharge, only 20%, and 34.6% respectively remained on the same method (Cameron et al., 2010). Cameron et al., mentioned that use of medications was not discussed, as this information was not part of a database at its inception. At initial discharge from the rehabilitation center, use of IC and CIC was used more by women, age of injury, tetraplegia and cervical level motor injury. The number of participants changed due to follow-up and loss of funding by some of the medical centers (26 in 1972 and 16 in 2005).

El-Masri(y) et al. (2012) studied urinary complications in SCI patients followed between years 1984-1989 in the Midlands Center for Spinal Cord Injury (MSCI) in Owesry, United Kingdom, and found there was a total complication rate of 62% during all phases of care in 119 traumatic SCI patients. Phase 1 was preadmission to the MCSI; Phase 2 was the first hospitalization to MCS, and Phase 3 was post discharge.

There were 99 men and 20 women in the study (El-Masri(y) et al., 2012). Thirteen women and 65 men had complications during all three phases. Urinary complications identified were UTI, pyelonephritis, epididymo-orchitis, bladder calculus, urethral problems, and upper urinary tract abnormalities and reflux. The complication rate rose from 38% during hospitalization to 62% post discharge.

A sequential system of supervised bladder management commencing with brief indwelling urethral catheterization (IUC) followed by IC and/or reflex voiding was found effective in keeping the complication rate low (El-Masri(y) et al., 2012). Types of bladder management therapy employed were no intervention, intermittent catheterization (IC), with or without medication, sphincterotomy, reflux voiding, indwelling urethral catheterization (IUC), and suprapubic catheterization. There was a higher incidence of upper urinary tract infections (15%) with reflex and dilation.

Medical complications occurring as a consequence of NLUTD are UTIs, urosepsis, urinary incontinence (UI), hydronephrosis, renal failure, nephrolithiasis, bladder cancer, sexual dysfunction/infertility, destroyed bladder or urethra, pressure ulcers, autonomic dysreflexia (T6 and above), and decreased quality of life (D'Hondt & Everaert, 2011; Gormley, 2010; Hansen, Biering-Sørensen, & Kristensen, 2010; Kalisvaart, Katsumi, Ronningen, & Hovey, 2010).

Gormley (2010) reviewed the urologic complications of NLUTD and found that complications were due to the disease and method of bladder management. Complications discussed included hydronephrosis, renal failure, UTIs, calculus disease, bladder cancer, and sexual dysfunction. Hydronephrosis is due to a high-pressure, poorly compliant bladder that causes upper tract dilation with or without vesicoureteral reflux. Renal failure occurs because of pyelonephritis, hydronephrosis, and renal nephrolithiasis. Gormley also reported that renal deterioration is seen more often in complete lesions (tetraplegia) than paraplegia. Urinary tract infections are a risk regardless of how the bladder is managed. Poor bladder emptying and introduction of bacteria during

catheterization are contributing factors for UTIs. Long-term catheter use can cause urethral strictures, erosion, and urethral fistulas.

Diagnosis of a UTI is difficult, since many are asymptomatic or have a urinary colonization. D'Hondt and Everaert (2011) completed an overview to look at the criteria of UTI in SCIPs, based on the National Institute on Disability and Rehabilitation Research (NIDRR) consensus recommendation:

- $\geq 10^2$ cfu/ml for catheter specimen using IC.
- $\geq 10^4$ cfu/ml clean void specimen from catheter-free males using condom collection device.
- any detectable concentration of uropathogens from indwelling or suprapubic aspirates. (D'Hondt & Everaert, 2011, p. 545)

Quantitatively, these are thought to have optimal sensitivity and specificity and underscore the need to consider a type of bladder drainage system when evaluating bacteruria. The NIDRR listed the following sign and symptoms: pyuria, fever, discomfort or bladder/kidney tenderness, dysuria, UI, increased spasticity, autonomic dysreflexia (AD), cloudy, odor, malaise, and a sense of unease. D'Hondt and Everaert's findings suggested a distinction must be made between asymptomatic bacteruria and symptomatic UTIs, as only the latter need treatment. Choice of treatment should be based on clinical symptoms, UTI timing (chronic or acute), fever, and clinical status. An optimal drainage technique, hydrophilic catheters, and hygiene during CIC were recommended as the most important preventive measures. Other researchers have found frequent UTIs among SCI patients likely due to an indwelling catheter or clean

intermittent catheter use (El-Masri(y) et al., 2012; Pagliacci, Franceschini, Di Clemente, Spizzichino, & GISEM, 2007).

Hansen et al. (2010) conducted an epidemiological study to evaluate urinary incontinence (UI) in 236 patients in the clinic for spinal cord injuries in the Department of Urology in Rigshospitalet, Denmark. They found 43% of patients reported UI. Urinary incontinence occurred at rates from once weekly to daily. Paraplegics reported daily incontinence, compared with tetraplegics. Paraplegics used a higher proportion of clean intermittent catheterization and had a 56% higher incidence of UI. Incontinence was most often managed by condom-catheter, frequent bladder emptying, or use of diapers/sanitary towels. Among the participants in this study, 193 were men (81.7%) and 43 were women (18.2%). Twenty-eight participants (19%) reported the use of medication for UI. This study is supported by Liu, Attar, Gall, Shah, and Craggs (2010), who found UI in 56% of 142 outpatient SCI patients that had returned to the hospital for follow-up care.

Bladder cancer is a well-known phenomenon in SCIPs. The risk of bladder cancer has been reported to be 16-18 times higher than that of the general population (Groah et al., 2002; Kalisvaart et al., 2010; Subramonian, Cartwright, Harnden, & Harrison, 2004; Welk, McIntyre, Teasell, Potter, & Loh, 2013). Kalisvaart et al. (2010) completed a retrospective study to determine if SCI was a risk for bladder cancer. Thirty-two patients with bladder cancer were identified out of 1,319 SCI patients at the Long Beach VA Hospital Spinal Cord Injury Unit, Long Beach, California between 1983 and 2007. The primary forms of bladder management were 44% urethral indwelling catheter (for a mean of 33.3 years from injury to diagnosis), 48% external catheter (for a mean of

37.4 years), and 8% clean intermittent catheterization (for a mean of 24.5 years). Fifty percent of patients diagnosed with bladder cancer did not have an indwelling catheter. This implies that NLUTD, and not the indwelling catheter, may create a risk of bladder cancer.

Hospitalization

Researchers have conducted studies to address the causes and prevalence of acute hospitalization in chronic spinal cord injured persons (Cardenas et al., 2004; DeVivo, 2012; DeVivo & Farris, 2011; Evans et al., 2008; French et al., 2007; Munce et al., 2013; Pickelsimer et al., 2010; Young, Webster, Giunti, Pransky, & Nesathurai, 2006). Hospitalizations are defined as spending an overnight stay in the hospital. Researchers have shown that persons who suffer SCI are at great risk for secondary complications, resulting in frequent contact with physicians and the need for hospitalization after the acute SCI event.

Cardenas et al. (2004) found that the leading causes of hospitalization were problems of the genitourinary system, followed by problems of the respiratory system, as well as skin problems (including pressure ulcers). There were more men (78% - 81%), data at 1, 5, 10, 20 years, hospitalized than women (18.2% - 21.4%). Among hospitalized SCI patients, ethnic distribution was as follows: White 60%-80%, African American 9.4%-29%, Hispanic 4.0%-10%, and others. The average length of stay at 1 year was 14.06 days, and at 20 years 12.43 days. Race was a significant predictor for rehospitalizations at year 5 where Whites and African American patients were more likely to be rehospitalized, and Hispanic and other patients were less likely to be hospitalized. This finding was supported by Krause and Saunders (2009) who found

36.6% ($n = 497$) of participants were hospitalized at least on one occasion during the year and the average number of days hospitalized was 12.

Infections are the leading cause of death in SCI/D population, with pneumonia and septicemia being the leading causes of mortality (DeVivo, 2012). Hospital acquired infection (HAI) is a common complication and is known to cause increased hospital lengths-of-stay (LOS), increased costs and higher mortality rates. Evans et al. (2008) found that the overall incidence of hospital acquired infections (HAIs) is higher in the veteran SCI/D population (33.2%) than that reported for other populations (25.8%).

The definition of a hospital-acquired infection (HAI) provided by the researchers is “any infection that is identified 48 hours after admission to the hospital with no incubating infection at time of admission” (Evans et al., 2008, p. 235). Five hundred and forty-nine hospitalizations were used in the analysis: men (98.2%) and the remainder women. Ethnically, non-Hispanic Whites comprised 56% of the hospitalizations, African Americans 33%, Hispanics 3%, and unknown 8%. The mean length of stay was 33.7 days, which were longer than stays without HAIs. The mean onset of an HAI was 15 days from admission. The most common HAIs were urinary tract infections (25%), blood stream infections (16.9%), bone and joint (15.7%), gastrointestinal (9.9%), central nervous system (9.0%), cardiovascular (7.0%), and respiratory (6.5%).

In Alabama, DeVivo and Farris (2011) found that, between 1986 and 1992, 26% of persons with SCI needed unplanned hospitalization due to primary or secondary complications. The causes of hospitalization were urinary tract complications (38.3%), skin-related complications (16.5%), respiratory problems (12.6%), nervous system problems (8.4%), digestive injuries (8.1%), psychosocial (4.7%), musculoskeletal (4.4%),

cardiac (3.5%), endocrine (3.5%), and other (3.7%). Correspondingly, among 206 persons in this study, 430 hospitalizations occurred. With men comprising 83% of the hospitalizations, Whites 59.5%, and African Americans 40.5%.

At the University of Alabama Birmingham Spinal Cord Injury Care System (UAB-SCIS), a study found that most hospitalizations occurred more than 5 years after initial injury. Urinary tract infections ranked first in study locations and accounted for 25.6% of hospitalizations at UAB-SCIS, but 42.4% of hospitalizations at rural hospitals. Concomitantly, respiratory infections were also higher in rural hospitals. Skin infections had the longest length of stay.

The mean cost per hospitalization in the UAB-SCIS study was \$20,583. The mean range of charge for hospitalizations was \$75,872 for skin, \$69,465 for musculoskeletal, and \$13,530 for endocrine disorders. Tetraplegia (ASIA A) complete injured comprised 76% of all hospitalizations. Patients with lower educational levels were at greater risk for complications during hospitalization. The rate of UTIs in small and rural hospitals was greater. A primary diagnosis of AD occurred only at UAB-SCIS. Pressure sores, UTIs, and AD were common secondary diagnoses during hospitalization.

French et al. (2007) reported a total annual (inpatient and outpatient) care cost for 675 veterans exceeded \$14.47 million, or \$21,450 per patient. The cost of treatment for cases of cervical complete SCI was higher than the cost for cases of thoracic incomplete SCI. During the study, 33% of the patients were hospitalized (some multiple times), accounting for a total 378 hospital admissions at a cost of \$7.18 million. The top five major diagnostic criteria (MDC) were:

1. MDC-1 nervous system;
2. MDC-11 kidney and urinary;

3. MDC-5 circulatory;
4. MDC-6 digestive; and
5. MDC-9 skin, subcutaneous, and breast.

The rates for the incidence of rehospitalizations decreased rapidly in years 2 to 5 and less rapidly thereafter.

People with SCI are still dying at earlier ages compared to the general population because of medically related secondary conditions. Secondary conditions that have traditionally been the focus of prevention, pressure ulcers, UTIs, as well as amputations, fractures, and depressive symptoms are associated with a higher mortality risk.

Autonomic Dysreflexia

Autonomic dysreflexia (AD) is a condition of an imbalanced reflex sympathetic discharge in response to noxious visceral or cutaneous stimuli. All people with complete injuries above T6 can have symptoms of AD. Symptoms are less common and severe in persons with incomplete SCI.

The noxious stimuli activate the nociceptors below the level of the lesion causing a barrage of afferent impulses. Then the sympathetic neurons are activated in the spinal cord below the level of the lesion producing a generalized sympathetic response, *fight or flight*. The sympathetic response generates increased peripheral resistance, circulating blood volume and increased blood pressure. The inhibitory signals from the brain are unable to descend (T6 and above) to the splanchnic vascular beds, which would usually accommodate the increased blood. The parasympathetic system prevails leading to nasal congestion, flushing, and sweating above the level of injury. Then, brainstem vasomotor reflexes attempt to lower blood pressure by increasing parasympathetic stimulation to the heart, which causes bradycardia. The clinical signs and symptoms of

AD are acute onset headache, blurry vision, nasal congestion, sweating, anxiety, sudden onset of elevated blood pressure ($> 20\text{mmHg}$), and bradycardia. Long-standing SCI may not have any symptoms other than the feeling that something is not right. If hypertension with AD is left untreated, it can lead to retinal hemorrhage, cerebral hemorrhage, seizures, cardiac arrest, and death (Consortium for Spinal Cord Medicine, 2001).

Autonomic dysreflexia in patients with lesions at or above T6 has been reported in the literature (Furusawa et al., 2011; McGillivray, Hitzig, Craven, Tonack, & Krassioukov, 2009; Safaz, Kesikburun, Omac, Tugcu, & Alaca, 2010; Wan & Krassioukov, 2014). McGillivray et al. (2009) conducted a cross-sectional descriptive study by self-report mail survey evaluating knowledge of AD in persons with chronic SCI ($N = 100$) and their family members ($N = 16$) in a community dwelling in Toronto, Canada and found gaps in their knowledge about AD. Secondary complications, known to be triggers for AD were reported to have occurred in the previous year by chronic SCI participants. Sixty-eight percent of chronic SCI participants reported having a bladder problem (infection, incontinence, stones), 34.6% reported having a pressure ulcer, 67.4% had bowel problems (e.g., constipation, incontinence, hemorrhoids), 20.5% ingrown toenail, and 71.6% had pain in some part of the body. The findings of this study supported previous studies conducted by Elliot and Krassioukov (2006) and Kirshblum, House, and O'Connor (2002) of secondary complications known to be triggers.

McGillivray et al. (2009) found that the majority of chronic SCI participants, 49% reported never hearing about AD, 29% clearly remembered that AD was a possible complication after SC, 25% had individual/group education on AD causes and management during rehabilitation, 18% reported vague recall that AD was mentioned

during their hospitalization, and 3% did not respond. Patients with traumatic SCI were more likely to have greater knowledge about treating AD than non-traumatic SCI. There were clear indicators that chronic SCI persons (41%) had gaps in their knowledge about AD. Twenty-two percent of individuals with traumatic SCI reported symptoms consistent with unrecognized AD than non-traumatic SCI.

Family members that responded ($N = 16$) were spouses/partners (76%) and parents (12%) of the person with chronic SCI. Seventy-five percent had been caring for their relative for more than 3 years. McGillivray et al. (2009) reported that 69% had some knowledge on either the cause and or symptoms of AD. Family member (65%) and chronic SCI persons (52%) indicated they would like to learn more about secondary complications that are known triggers, and that learning would be best achieved through consultation with health professionals.

Furusawa et al. (2011) conducted a retrospective multicenter study, in 28 hospitals in Japan, to determine if there was a relationship between bowel and bladder management methods and symptomatic AD. Furusawa et al. studied 571 SCI patients that had been hospitalized between April 1997 and March 2007. Autonomic dysreflexia was defined as an elevation of blood pressure (> 20 mmHg), headache, sweating, or flushing above level of injury, nasal congestion, blurred vision and anxiety. Symptomatic AD was diagnosed in 24.7% (141/571) of patients, in 26.7% (113/466) men, 28.5% (28/105) of women and AD was more common among younger patients ($P = .60$).

Furusawa et al. (2011) assessed the level of injury using the American Spinal Cord Injury Association (ASIA) classification and the ASIA impairment scale (AIS) and

found the incidence of symptomatic AD was 43.5% AIS A, 40.0% AIS B, 25.2% AIS C, 25.2% and 10% AIS D. There was no significant difference in the incidence of symptomatic AD with respect to injury level ($P = .06$). Prevalence of voiding methods was 43.3% reflex voiding, 40.0% suprapubic catheterization, 35.4% indwelling urethral catheterization, 29.4% other methods, and 7.1% incontinent spontaneous voiding.

Furusawa et al. (2011) found that the prevalence among bowel management methods were manual removal of stool (39.4%), rectal medication (27.4%), other methods (12%), and continent spontaneous defecation (7.9%). The highest incidence of AD was diagnosed in patients using reflex voiding (43.3%) and manual stool evacuation (39.4%) during hospitalization. The lowest incidence occurred in those with continent spontaneous voiding and continent spontaneous defecation.

A case was reported in Turkey (Safaz et al., 2010) during the hospitalization of a 26-year-old man with C5 tetraplegia secondary to a gunshot wound with a pressure ulcer (PU), who had AD during the insertion of a fecal management system (FMS). The fecal management system was inserted to divert stool from the PU. Two days later the patient developed acute AD. Clinical symptoms were hypertension (180/100), severe headache, facial flushing, palpation, and great apprehension. The FMS was removed, and blood pressure decreased to 110/70. Other symptoms disappeared immediately.

Wan and Krassioukov (2014) conducted a literature search of original articles, case reports, and review articles that had been published from 1965 to 2012 that documented cases of AD associated with life threatening outcomes and death. The purpose was to provide an overview of the most common documented complications associated with episodes of AD. Twenty-six manuscripts describing 32 cases of life

threatening or death associated with episodes of AD were identified. Wan and Krassioukov found that of the 32 cases that described AD associated with a potential life threatening outcome or death, 23 (72%) were central nervous system-related, 7 (22%) were cardiovascular related, and 2 (6%) were pulmonary related.

Death, the most serious outcome, occurred in 7 (22%) documented cases of AD. Intracranial hemorrhage caused fatality in five cases, one case of status epilepticus and one case of pulmonary edema. Prompt resolution of AD after removal of trigger/noxious stimulus occurred in most individuals, in some AD was protracted (several days) in some individuals. The findings of protracted AD have been documented in a previous study by Elliot and Krassioukov (2006) and Krassioukov, Warburton, Teasell, Eng, and SCIRE Research Team (2009). This study and data are limited in that published cases of life-threatening episodes of AD are not based on clinical experience of the actual incidence of life threatening episodes of AD.

Autonomic dysreflexia and silent AD, a well-known and documented effect of SCI at or above T6 and cervical cord, is caused by an array of noxious stimulus. Management of acute AD can be as simple as eliminating the noxious stimulus/triggers, pharmacological, or surgically. Due to potential life threatening outcomes or death from AD SCI persons, caregivers and medical personnel should be made aware of management and diagnosis of AD.

Summary

Presented in this literature review is the pathophysiology and consequences of spinal cord injury, neurogenic bowel dysfunction, neurogenic bladder dysfunction, hospitalization, and autonomic dysreflexia. Discussed are the incidence, prevalence, and

medical complications occurring because of neurogenic bowel dysfunction, bladder dysfunction, hospitalization, and AD. Also examined are the causes and prevalence of acute hospitalization in chronic spinal cord injured persons. Additionally, how chronic spinal cord individuals manage their neurogenic bowel and bladder dysfunction in the community dwelling is covered. A paucity of data exists on how the bowel and bladder are managed in a hospital setting.

Rarely are bowel and bladder management addressed together in the literature. To the best of the author's knowledge, no researchers have addressed the individual bowel and bladder management transition from home to acute hospitalization. Clearly, there is a need to determine and describe if the individualized neurogenic bowel and bladder management that chronic spinal cord injured persons use in the community dwelling are being utilized in the hospital setting.

Methods

This chapter highlights the exploratory descriptive design used to determine if the bowel and bladder management was smoothly transitioned from home to acute hospitalization for chronic SCI/D veterans. This section covers (a) project design/type of project, (b) setting, (c) population and sample, (d) investigative techniques, (e) instrumentation, (f) data collection, (g) data analysis plan, (h) ethical consideration (human subjects), and (i) and summary.

Project Design

Using a convenient sample of chronic SCI/D veterans receiving care at VACCHCS in Fresno, California, an exploratory-descriptive design using a postal survey to describe the experience of bowel and bladder management in chronic SCI patients

during hospitalization was used. This design was appropriate for the current project because the intent was simply to assess and describe characteristics, with no manipulation of data or treatment variables. The advantages are the ease in use of the questionnaire and the opportunity for participants to compare bowel and bladder methods used at home and in the hospital. Disadvantages included the use of a heterogeneous population, in which bias cannot be controlled, which limits generalizability of results and the one-month period to return the questionnaire.

Possible benefits to the respondents were the opportunity for the participant to have a greater awareness of their bowel and bladder management at home and in the hospital. Even though the respondent may not benefit from the project in any direct way, indirectly he or she was contributing to the body of nursing knowledge, health assessment, and care of chronic spinal cord injured patients.

Setting

The Veterans Health Administration (VHA) offers services to SCI veterans in a *hub and spoke* system of care that is comprised of 24 regional centers. The centers (hubs) offer primary care and specialty care by multidisciplinary teams to 134 SCI primary care/support clinics (spokes) at local centers/clinics (Figure B8) (Spinal Cord Injury Centers, 2013; U.S. Department of Veterans Affairs, 2011). The Veteran Affairs Palo Alto Health Care System is the hub for spoke sites in Manila, Philippines; Honolulu, Hawaii; Fresno, California; Martinez/Sacramento, California; Reno, Nevada; and San Francisco, California. There are 124 primary care teams, centers, and long-term care facilities (Spinal Cord Injury Centers, 2013).

Veteran Affairs Central California Health Care System (VACCHCS) catchment area is located in the heart of California. Veteran Affairs Central California Health Care System serves SCI/D Veterans in six counties, which include Tulare County, Kings County, Fresno County, Madera County, Merced County, and Mariposa County. The SCI/D outpatient clinic is located in Fresno, California, also known as the SCI/D support clinic and provides primary care, preventive care, and basic SCI specialty care (U.S. Department of Veterans Affairs, 2011; VA Central California Health Care System, 2014).

Population and Sample

A convenience sample was used. There were approximately 103 veterans with SCI/D in the catchment area of VACCHCS. All 103 patients with a chronic spinal cord injury/disorder receiving care at VACCHCS, Fresno (spoke site) were invited to participate in the project through a postal questionnaire. Forty-eight SCI/D veterans completed and returned the questionnaire, resulting in a 46.6% response rate, with ages ranging from 31 to 79 years.

The overwhelming majority of the respondents were male 47 (98%) and currently married 24 (50%). Thirty-three (69%) reported their race as White, 4 (8.3%) American Indian/Alaska Native 4 (8.3%), and 3 (6.3%) Black/African American, Asian and mixed race each 1 (1%) respectively. Thirteen participants (27%) had completed high school or less, 14 (29%) stated they had completed some college, and 21 (48%) had obtained a technical degree, associate's degree, or higher degree.

Investigative Techniques

The first step in the quality assessment project was to gather evidenced based data by completing an extensive systematic review of the available literature to identify

relevant studies with tools, questionnaires, or surveys regarding bowel and bladder management in chronic SCI persons during hospitalization. In the development of the questionnaire, the following resources were consulted: the BMJ Journal Collection, CINAHL, EBSCOHost database, IngentaConnect Med line, Google Scholar, Cochrane, Ovid Online, and Science Direct. Internet sites of prominent SCI organizations and governmental agencies such as Paralyzed Veterans of America, Christopher and Dana Reed Foundation, National Spinal Injury Association, and the American Spinal Cord Injury Association were also accessed. In particular, data was gathered on chronic spinal cord injured neurogenic bowel, neurogenic bladder, neurogenic bowel, and bladder, neurogenic bowel and bladder continence, neurogenic lower urinary tract dysfunction, SCI bowel and bladder management in community/nonhospital setting, and continence questionnaires/tools. The questionnaire was developed based on previous tools used by O'Connell, Wellman, and Baker (2005); Hansen et al. (2010); National Institute of Neurology Disorders and Stroke (NINDS, 2010) bowel and bladder data sets; and Ostaszkievicz, O'Connell, and Millar (2008).

Instrumentation

No self-report questionnaire or tool was identified in the literature that encompassed both bowel and bladder management in chronic spinal cord injured patients during hospitalization. An extensive literature search was conducted to collect data to develop a questionnaire. The bowel and bladder management during hospitalization questionnaire (BABMDHQ) was developed based on previous tools, questionnaires, and data sets used by Coggrave et al. (2009); O'Connell et al. (2005); Hansen et al. (2010); NINDS (2010) bowel and bladder data sets; and Ostaszkievicz et al. (2008).

Working drafts of the BABMDHQ were circulated to 14 VA SCI specialists in Fresno, Palo Alto, and Washington, D.C. for comments on the appropriateness of the items listed to establish content face validity. The first draft, hard copy or via e-mail, was circulated to a group of SCI specialists that included registered nurses and modifications were made based on input. The second modified draft was circulated again via e-mail to SCI specialists excluding the registered nurses, with modifications implemented. The final draft version was developed and did not include any individual/personal identifiers. The SCI specialists were as follows: SCI clinical nurse specialist (1), SCI RNPs (4), SCI physicians (2), and SCI RNs (5), Wound ostomy and continence specialists (1), urology RNP (1) and researcher scientist (1). The final working final draft was piloted to establish face validity using five lay SCI persons to gain their opinion about the clarity, length of time to complete, and user friendliness of the questionnaire. Amendments were made based on input from the five SCI persons to compose the final questionnaire.

Data Collection

Prior to commencing the quality assessment project, the addresses of the entire SCI/D patient population were accessed. The “application regarding classification of a proposed project as an operations activity,” was submitted, reviewed, and was deemed not research, albeit could be classified as an operations activity by the Associate Chief of Staff (ACOS) Research and Development. The ACOS suggested it be reviewed by the privacy officer and the information security officer (ISO) for thoughts on privacy and confidentiality/data security. The privacy officer/FOIA and ISO reviewed and approved the project. Additionally, California State University; Fresno Department of Nursing IRB Board approval was received.

The data collection timeframe was August 30, 2013 through October 1, 2013.

The following steps were taken in collecting the data:

1. Data collection was closed on October 1, 2013. Completion and return of the survey constituted informed consent for participation.
2. A postcard was written that excluded any medical information, and mailed on August 31, 2013 to all SCI/D (103) veterans inviting them to participate in a voluntary quality assessment project, and informed veterans that within a week they would receive a questionnaire. If interested, they were asked to please complete and return the questionnaire.
3. On September 6 and 7, 2013 the Bowel and Bladder Management During Hospitalization Questionnaire (BABMDHQ) (Appendix C), explanatory cover letter (Appendix D), and a stamped self-addressed return-envelope was mailed to all SCI/D Veterans. The cover letter identified the researcher by name and informed potential respondents (name of participant/patient) of the quality assessment project regarding bowel and bladder management during hospitalization. The veterans were informed that participation was voluntary, and if they agreed to participate, to return the completed questionnaire in the provided stamped and pre-addressed return envelope. If more information about the project were wanted, the veteran could return the perforated/cut portion of the lower portion of the cover letter with name, telephone number, and best time to call in the stamped pre-addressed envelope.

On September 12, 2013, questionnaires were re-sent to five Veterans who were identified as in-patients at VA Palo Alto Health Care System (hub), during a weekly interdisciplinary meeting at the spoke site.

4. A follow-up reminder postcard was mailed on September 15, 2013 to the potential participants. The postcard thanked those who that had returned the voluntary quality assessment questionnaire and reminded those who had not had an opportunity, if interested, to return the completed questionnaire.

Data Analysis

The data were quantified to organize and analyze data utilizing descriptive statistics. The following demographics were abstracted: age, gender, ethnicity, race, education, marital status, level and completeness of injury, etiology of injury, date last hospitalized, reason for most recent hospitalization, length of stay, and type of hospital. Clinical data compiled included: doctor-discussed bowel and bladder (B&B) care on admission, whether a nurse completed a B&B assessment, time before B&B care was started after admission, who completed the patient's B&B care, satisfaction with B&B care, complications during B&B care, and comparison of B&B at home and in the hospital.

The demographic and clinical data were summarized using frequencies or frequency distributions (numbers and percentages), measure of central tendency (mean, median, and mode), and measures of variation (range and standard deviation). All statistical analysis was performed using Statistical Package for Social Science version 20 (IBM Corp., 2011).

Ethical Considerations

All applicable Veteran Health Affairs, VACCHCS, CSU, and Fresno regulations concerning the ethical involvement of human subject volunteers were followed during this project. All privacy guidelines as stipulated per policy and procedures of VACCHCS were maintained. Respondents were informed, on the cover letter (Appendix C), that participation was voluntary, and if the individual agreed to participate, to return the completed questionnaire (response 48/103).

The questionnaires contained no individual identifiers. Respondent's identity was protected by having an advanced practice nurse (not providing care to SCI patients) open the returned questionnaires and separate the returned perforated portion of the cover letter (if returned due to respondent requesting more information of quality assessment project), and placing them in a manila envelope. The author kept respondents' documents stored and locked in a cabinet, in the author's home. The data of all questionnaires were coded by number and all personal information de-identified to protect identities of respondents. The data analysis and computer database according to the privacy guidelines stipulated per policy and procedures of VACCHCS were maintained.

Summary

This chapter contains the description of the project design used to analyze the quantified data to describe the self-reported bowel and bladder management in chronic spinal cord persons from home to hospitalization. Additionally, the steps used, included setting, population and sample selection, investigative techniques, instrumentation, data collection, data analysis, and data management are covered. The chapter concludes with the ethical considerations, including protection of participants, and approval of quality

assessment project. The unique characteristics of this project may describe whether bowel and bladder management is transitioned from home to acute hospitalization in chronic spinal cord individuals that utilize medical care services in the VACCHCS catchment area.

Results

The purpose of this quality assessment project was to determine if the bowel-and-bladder management was smoothly transitioned from home to acute hospitalization for chronic SCI/D veterans at the Veterans Administration Central California Health Care System (VACCHCS). The results include a presentation of demographic findings as related to the participants' sampled and descriptive findings of the participants' responses to survey questions regarding bowel and bladder management in the hospital. Analyses were performed utilizing SPSS (v. 20) (IBM Corp., 2011).

Population and Demographic Findings of Respondents

The Bowel and Bladder Management during Hospitalization survey (BABMDH; Appendix B) was mailed to 103 spinal cord injury and disorders (SCI/D) Veterans who used medical services in the catchment of the Veteran Administration Central California Health Care System (VACCHCS). The response rate was 46.6% (48). Respondent mean age was 60.9 (SD 9.57) with a range of 31-79 years of age; the majority were White 33 (69%), American Indian/Alaska Native 4 (8.3%), Black/African American 3 (6.3%), Asian 1 (1%), and mixed race 1 (1%). The majority were men, 47 (98%). While 24 (50%) were married, 15 (31.3%) were divorced. Four (8.3%) were never married, 2 were (4.2%) separated, 2 (4.2%) widowed, and 1 (2.1%) was in a domestic partnership. The majority, 21 (48%), had obtained a technical degree, associate's degree or higher, 14

(29%) had completed some college, while 13 (27%) had a high school education or less.

Table A1 presents the frequency and percentages of demographics variables for respondents.

Descriptive Findings of Spinal Cord Injury Variables

Table A2 contains frequency counts and percentages pertaining to the respondent's particular type of spinal cord injury and etiology of injury. On average, the year's post injury for participants were 18.9 years (*SD* 14.2 years), ranging from 0 to 46 years. Level of injury included cervical 14 (29%), thoracic 17 (36%), and lumbar 2 (4%). The respondents were fairly evenly divided as to the type of spinal cord injury, with complete 18 (38%), incomplete 12 (25%), unknown 16 (33%), and not reported 2 (4.2%). Injury etiologies were non-traumatic 23 (48%), motor vehicle accidents 9 (19%), falls 5 (10.4%), multiple sclerosis 5 (10.4%), diving accidents 2 (4.2%), transport 2 (4.2%), hit and run 1 (2.1%), and assault 1 (2.1%).

Descriptive Findings of Variables Relating to Most Recent Hospitalization

Results related to most recent hospitalization is found in Table A3. Twenty one respondents (44%) reported 2013 as the year of their most recent hospitalization, and 9 (19%) reported being last hospitalized in 2012. The mean length of stay (LOS) for their most recent hospitalization was 16.9 days (*SD* = 49.5 days). However, length of stay ranged from 0 to 330 days, with 19% reporting an LOS longer than 7 days. A check of the 5% trimmed mean for the LOS variable, which excluded the top and bottom 2.5% of the data, thus excluding patients with LOS of 90 and 330 days (outliers), indicated a mean stay 8.3 days. The trimmed mean was more indicative of the average LOS for the respondents of project.

Results found on Table A3. Almost one-half of the respondents were hospitalized in a VA SCI/D center 22 (46%), VA/Hospital/Center non-SCI 17 (35.4%), Non-VA hospital 8 (16.7%), and 1 (2.1%) none. More than a third of the respondents were hospitalized because of an infection 19 (39.6%), surgery 7 (14.6%), annual exam 7 (14.6%), miscellaneous 6 (12.5%), pressure sore/ulcer 3 (6.3%), pulmonary 3 (6.3%), and unreported 3 (6.3%).

Other questions pertaining to information about their hospital stay addressed the plan of care upon admittance (Table A3):

“Did the professional care provider/doctor discuss how best to manage a bowel and bladder plan while admitted?” Thirty-two (66.7%) reported no, 13 (27.1%) yes, and 3 (6.3%) unreported.

“Did the admitting nurse do a neurogenic bowel and bladder care assessment?” Thirty-two (62.5%) reported no, 13 (27.1%) yes, 3 (6.3%) unknown, and 2 (4.2%) unreported (Table A3).

“How long did it take after admission before a bowel management program was started?” Twenty-four (50%) reported within the first 24 hours of hospital admission, 6 (12.5%) between 24 and 48 hours, greater than 48 hours was reported by 3 (6.3%), greater than 72 hours was reported by 13 (27.2%), and 13 (27.1%) and 1 (2.1%) never started.

“How long did it take after admission before a bladder management program was started?” Twenty-four (50%) reported within the first 24 hours of hospital admission, 6 (12.5%) between 24 and 48 hours, greater than 48 hours was reported by 3 (2.13%),

greater than 72 hours was reported by 11 (22.9%), never started 11 (22.9%), unknown 1 (2.1%), and 1 (2.1%) never started.

“Primarily who completed your bowel and bladder care during hospitalization?”

The nursing staff assisted 23 (48%) of the respondents with their bowel and bladder care during hospitalization, 16 (33.3%) were capable of caring for themselves, and 32 (18.7%) were assisted by a caregiver/family, self/nursing staff or was unreported.

“Were you satisfied with your routine bowel management care during hospitalization?” The majority of the respondents 22 (67%) stated that they were *very satisfied* or *satisfied*; 11 (22.9%) were *dissatisfied* or *very dissatisfied* and 2 (4.2%) unreported.

“Were you satisfied with your routine bladder management care during hospitalization?” The majority reported 38 (79%) that they were very satisfied or satisfied; 5 (10.5%) were dissatisfied or very dissatisfied, and 5 (10.4%) unreported.

Twenty-eight of the respondents 28 (58%) stated they had at least one of the complications associated with bowel and bladder function/care during their hospital stay. The complication with the highest reported frequency was constipation 14 (29.2%), followed by urinary incontinence 11 (22.9%), urinary tract infections 9 (18.8%), abdominal distention 5 (10.4%), diarrhea 5 (10.4%), spasticity 5 (10.4%), stool incontinence 4 (8.3%), pressure ulcer 3 (6.3%), skin rash or irritation 3 (6.3%), rectal bleeding 3 (6.3%), autonomic dysreflexia 2 (4.2%), and breathing problems 2 (4.2%).

Comparison of Bowel Management: at Home versus in Hospital

Five bowel management items were addressed in relation to transitioning from home to hospital admittance: assistance required, frequency, time of day, bowel function

and management, and duration to manage bowel program at home and hospital. The frequency counts and percentages of the respondents' responses are displayed in Table A4.

“Assistance Required” This question was asked to determine if assistance was required during bowel management care at home versus in the hospital. The percentage that required assistance increased during the hospital stay 25 (52.1%) from home 20 (42%).

“Frequency of Bowel Movement” Respondents reported a decrease in the frequency of bowel movements daily in the hospital 22 (45.8%) as compared to home 26 (54.2%). There were slight increases for frequencies of *alternate days* from home 12 (25.0%) to hospital 13 (27.1%); and *other* from home 6 (12.5%) to hospital 9 (18.8%). Only 4 (4.8%) none-selected similar home and hospital.

“Time of Day” Respondents (43.8%) responded that they normally experienced bowel movements in the morning, both in the hospital and at home. Similarities between at-home and in-hospital times of bowel movements were also found for classifications of evening at home 8 (17%) and hospital 7 (15%); both at-home 7 (14.6%) and in hospital 7 (14.6%); and other at-home (20.8%) and in-hospital (20.8%).

“Bowel Function and Management” There was a noticeable difference in the use of digital stimulation at home 20 (41.7%) and during hospitalization 11 (29.2%). Another notable difference was in the occurrence of the use of mini enema; with home 9 (18.8%) and hospital stay 5 (10%). The bowel function items of normal, straining, digital evacuation, suppositories, colostomy, and others were very similar between the at-home and in-hospital environments.

“Duration to Manage Bowel Program” No differences were found for the duration to manage the bowel program between the at-home and in-hospital environments. The majority reported that the duration to manage bowel program was less than 30 minutes at home, 31 (64.6%) and 30 (62.5%) during the hospital stay. Ten (20.8%) responded it took between thirty minutes and 1 hour at home, compared to a rate of 8 (16.7%) in the hospital. Two (4.2%) at home and 3 (6.3%) in the hospital identified greater than one hour, greater than one hour 4 (8.3%) home and 3 (6.3%) in hospital, and none selected 1 (2.1%) at home and 4 (8.3%) in the hospital.

Comparison of Bladder Management: At Home versus in Hospital

Four items that addressed bladder management in relation to transitioning from home to hospital: assistance required, voiding method, number of voids, and duration to manage the bladder as relating to transitioning from home to hospital admittance. The results are displayed in Table A5.

“Assistance Required” Respondents reported that no assistance was needed to void at home decreased between environments: at home 22 (45.8%) and in the hospital 16 (33.3%).

“Voiding Method” The highest frequency was indwelling catheter/foley with frequency increasing slightly from at home 16 (33.3%) to in hospital 18 (37.5%). Intermittent catheterization without meds at home 9 (18.8%) and hospital 8 (16.7%), intermittent catheterization with meds at home 1 (2.1%) and hospital 1 (2.1%), suprapubic at home 1 (2.1%) and hospital 1 (2.1%), and use of external catheters at home 8 (16.7%) and hospital 5 (10.4%). None indicated use of credé/valsalva as a voiding method in either the home or hospital setting.

“Number of Voids” The majority of respondents replied that this item was not applicable to their situation at home (68.8%), or in the hospital (77.1%). There was a relatively noticeable difference between participants reporting that they voided 6 to 8 times per day; at home 6 (12.5%) and in the hospital 3 (6.3%).

“Duration to Manage Bladder Program” The majority of respondents reported that it took less than 30 minutes per day to manage their bladder program at home 32 (66.7%) and in the hospital 33 (68.8%). The other options (30 minutes to 1 hour, 1 to 2 hours, and more than 2 hour per day) demonstrated an even distribution of 3 (6.3%) – 4 (8.3%) participants each; and 4 (8.3%) selected not to answer.

Discussion

There is a large body of evidence on the actual prevalence and nature of neurogenic bowel and bladder management in the community dwelling; by contrast, there is limited data in the acute hospital setting, in chronic spinal cord injured persons. Studies on neurogenic bowel and bladder management have been completed and reported separately. To this author’s knowledge, this is the first project to describe the actual neurogenic bowel and bladder management together from home to acute hospitalization in chronic spinal cord injured persons.

This quality assessment project revealed that veterans with spinal cord injuries and disorders required (a) more assistance with bowel and bladder management, (b) experienced fewer bowel movements, (c) voided more times, (d) experienced no change in time of day bowel movements, (e) the length of time for bowel care less than 30 minutes, and (f) the duration to manage bladder program was less than 30 minutes during hospitalization as compared to home. There was a noticeable decrease in the use of

digital stimulation and mini enema during hospitalization, slight increase in use of indwelling/foley catheters, and increased constipation and urinary incontinence during hospitalization. The majority of veterans also reported being satisfied or very satisfied with their bowel (67%) and bladder (79%) care during hospitalization.

In this project, the majority of respondents reported being hospitalized in a VA SCI/D center (45.8%), closely followed by VA Hospital/Center (non SCI) (35.4%), and non-VA hospital (16.7%). Some of the causes of rehospitalizations reported were infectious diseases, urinary tract infections, pressure ulcers, pulmonary problems, and AD. Cardenas et al. (2004), DeVivo and Farris (2011), and Samsa et al. (1996) have reported similar findings. Other findings in this project that were reported were surgery, annual exam, miscellaneous, and not reported. Annual exams are completed in the VA SCI/D Center as per VHA directive 1176.01 (U.S. Department of Veterans Affairs, 2011).

Autonomic dysreflexia (AD) was reported by 4.5% of respondents during their bowel and bladder care during hospitalization. Autonomic dysreflexia is a known life-threatening outcome and is most commonly triggered by noxious stimuli to urinary bladder and colon. Autonomic dysreflexia has been reported in Japan, Canada, and the United States (Consortium for Spinal Cord Medicine, 2001; Furusawa et al., 2011; McGillivray et al., 2009; Wan & Krassioukov, 2014).

Length of stay (LOS) reported in this project during rehospitalizations ranged 0 to 330 days with a mean of 8 days, which is similar to findings by Cameron et al. (2011), Cardenas et al. (2004), and DeVivo and Farris (2011). Cardenas et al. reported LOS of stay of 12 days utilizing the database of the Model Spinal Cord Injury Systems (MSCIS)

that examined data from 16 MSCIS centers over 20 years. Evans et al. (2008) reported a length of stay of 33 days in a VA SCI/D Center.

The reported complications experienced with or during bowel and bladder care, in the community setting or during hospitalization are consistent with other studies (Coggrave et al., 2009; DeVivo, 2012; Evans et al., 2008; French et al., 2007; Munce et al., 2013; Pagliacci et al., 2007; Pickelsimer et al., 2010). Fifty-eight percent SCI/D Veterans reported having at least one of the following complications associated with bowel and bladder function/care during their hospital stay, descending order with the highest frequency was constipation, urinary incontinence, urinary tract infections, abdominal distention, diarrhea, spasticity, stool incontinence, pressure ulcer, skin rash or irritation, rectal bleeding, autonomic dysreflexia, and breathing problems.

The SCI/D Veterans reported that more assistance was required with bowel management and fewer bowel movements, in the hospital than at home, no change in time of day for bowel movements, length of bowel care less than 30 minutes with similar findings in the United Kingdom, Denmark, and Republic of Korea (Coggrave et al., 2009; Coggrave & Norton, 2010; Faaborg et al., 2008; Glickman & Kamm, 1996; Kim, Koh, Leigh, & Shin, 2012; Pryor & Jannings, 2005). A similar study, but with a smaller inpatient sample (19) and outpatient (4) samples, reported analyzed bowel care diaries received from participants during hospitalization and following discharge identified that bowel care was performed daily, with manual evacuation and less than 30 minutes to complete bowel care (Pryor & Jannings, 2005).

Bowel management methods utilized for evacuation were similar to other studies in the community setting and during acute hospitalization (Coggrave et al., 2009;

Coggrave & Norton, 2010; Glickman & Kamm, 1996; Haas et al., 2005; Kim et al., 2012). Bowel management methods used at home and in the hospital were normal (volitional control), straining/bearing down, digital stimulation, digital evacuation, suppositories, mini enemas, colostomy and others. Significantly, a greater number of SCI/D Veterans reported the use of digital stimulation and mini enemas for bowel function at home (41.7% digital stimulation; 18.8% mini enema) than in the hospital (29.2% digital stimulation; 10.4%, mini enema). These results may suggest that the need for assistance with bowel care can be affected by nursing staff that who do not feel comfortable or have experience with bowel care programs utilized by spinal cord injured patients. It may also reflect the patient not asking for assistance due to invasion of privacy. The reported finding of increased constipation (29.2%) as a complication could be attributed to decreased use of digital stimulation and mini enema use during hospitalization.

Bladder management assistance decreased during hospitalization. There was a slight increase in the number of voiding times per day and duration to manage bladder program less than 30 minutes similar during hospitalization. There was a noticeable increase in use of indwelling catheters/foley in the hospital and a slight decrease in use of external catheter use during hospitalization. Twenty-three percent of respondents reported urinary incontinence. This indicates the importance of focusing on the problem and achieving a positive outcome. A study by Walter et al. (2002) found similar findings in self-reported problems among patients with SCI over 10 years. The data was collected via interview and this project was via postal survey. Hansen et al. (2010) in a self-administered questionnaire reported a higher prevalence of urinary incontinence (54%).

The researchers also found urinary incontinence with use of urethral indwelling catheters, normal bladder emptying, suprapubic catheter, clean intermittent catheter, and external catheter.

The use of indwelling catheters in a spinal cord injured person is well documented as a preferred method. In this project, respondents reported increased use of indwelling catheters during hospitalization. There could be multiple reasons why indwelling catheters were used based on admitting diagnosis: pressure ulcers, if in the sacral or coccyx area and covers a wide surface area may require the use of a catheter to the keep area clean and dry, pre-operative catheters might be required, and sepsis to monitor fluid status and monitor renal function indirectly. If the patient is experiences AD and uses an external catheter or CIC, the bladder needs to be drained.

The use of indwelling catheters is well documented in the literature as a risk of hospital acquired UTIs (Cameron & Clemens, 2010; El-Masri(y) et al., 2012; Pagliacci et al., 2007). Twenty-one percent of the respondents reported being hospitalized due to a UTI and 19% reported a hospital acquired UTI. This clearly demonstrates the risk of UTI associated with indwelling catheter use. El-Masri(y) et al. (2012) reported that 61% of patients developed clinical UTIs. Weld and Dmochowski (2000) reported 93% of patients developed clinical symptoms of lower urinary tract infection. Evans et al. (2008) reported that the most common hospital acquired infection was UTI (25%), at a Midwestern Department of Veterans Affairs spinal cord injury center. Overall, the incidence of hospital-acquired infections in persons with SCI/D was higher than other populations; this confirms increased risk in persons with SCI/D. In the author's experience, not only the type of neurogenic bowel and neurogenic bladder determines the

choice of method. The bowel and bladder management method should be individualized based on the level of injury, hand function, age, and based on patients' self-care deficit.

Limitations

This exploratory, descriptive quality assessment project has several limitations. First, the bowel and bladder management questionnaire was developed by the author and was intended for use among SCI/D patients. Although a concerted effort was made to establish face validity of the questionnaire, further work is required to establish psychometric properties. The questionnaire was piloted with a sample of five spinal cord injured persons and not in MS or ALS persons. Three SCI/D persons from the latter utilized the SCI/D outpatient clinic and two did not. The pathophysiology of multiple sclerosis and ALS are dissimilar to SCI, so the pilot of the bowel and bladder questionnaire should be completed and changes made to reflect the appropriateness in this population. The data obtained was for a quality assessment project and has highly localized significance and results should not be considered generalizable, as the sample was selected from an outpatient SCI clinic (spoke site). The sample may not be representative of the entire cohort of veterans that utilize medical services in the Veterans Affairs health care system. However, the results of this project may provide a general baseline of the bowel and bladder management transitioning from home to hospitalization.

Second, the convenience sample consisted of SCI veterans, who tend to be older, could denote an inherent selection bias. The small sample size, despite the fact that all SCI/D patients that utilize outpatient care services at VACCHCS were invited to participate could denote selection bias. At the time of the data collection (questionnaire

mailing), there were 10 Veterans as in-patients in community dwelling facilities (five in skilled nursing facilities and five as in-patient at SCI VA Palo Alto Health Care System). Additionally, the sample is overwhelmingly male, which is characteristic of veterans in general, but raises concerns about how findings relate to women with SCI/D.

Third, the data was obtained exclusively from self-report and should be interpreted cognizant of the limitations associated with memory and distortion. In addition, the findings for SCI population are limited by lack of comparable data based on general SCI population. Fourth, the self-report nature via postal survey may attribute to low response rate. This is an inherent difficulty with study designs of this type. The author recognized the possibility of response bias, especially as the response rate was less than 50%.

Fifth, another limitation to the project is the inability to compare responders from the non-responders leading to selective attrition. Respondents may have been motivated to respond to the questionnaire. In addition, assistance required completing the questionnaire may also contribute to bias of a return.

Sixth, the inclusion criteria had a short duration of time from the questionnaire mailed to closing. Notwithstanding these limitations, this project provided valuable insights into the potential magnitude of transitioning neurogenic bowel and bladder management from community dwelling (home, skilled nursing facility, place SCI person identifies as residence) to acute hospitalization and clinical practice.

Implications for Nursing Practice

This quality assessment project was designed to attempt to describe whether bowel and bladder management was transitioned from home to acute hospitalization.

The project identified that the communications needs to be improved between SCI individuals, nurses, medical providers, and other interdisciplinary teams members involved in the care from admission to discharge in hopes of decreasing adverse outcomes and improving quality of life. Because of the small sample and geographical location, research should be done and expanded to many regions of the country, and eventually the general SCI population. Foreseeing no changes in SCI population at VACCHCS, it is imperative that nurses, APN's, medical providers, and physicians accept the challenge and work collaboratively in developing individualized care for spinal cord injured persons during acute hospitalizations.

Implementation by nursing requires good assessment techniques, assistance with individualized bowel and bladder management methods, and supplies when assisting with the self-care deficit of bowel and or bladder elimination during hospitalization. Spinal cord injured patients should also be encouraged to select the time and methods and be provided with supplies to complete their own bowel and bladder care, if they choose to do so. Assessing, planning, and preparing for bowel care and bladder care with assistance of the SCI patient and or caregiver is important in planning and developing innovative patient-centered treatment plans that deserve further investigation. Further research is needed with larger samples of spinal injured persons and central neurological disorders (i.e., Parkinson's, stroke) in multiple practice settings to assess if bowel and bladder management is transitioned from community dwelling/home to hospitalization.

The day-to-day care of many persons with neurogenic bowel/bladder dysfunction is part of the heterogeneous caseload of primary care clinicians, and guidelines based on a robust evidence base would be valuable. However, it would be wrong to dismiss the

value of clinical experience and expertise of specialists who use treatments for neurogenic bowel and bladder that are under-researched and that have been individualized to promote positive outcomes and improve the quality of life. Quality assessment projects and research that focus on evidenced based practice can help improve clinical practice and achieve improved patient outcomes as well as patient satisfaction in health care. There is a need in clinical practice for more diligence in addressing bowel and bladder care management upon admission, during the hospital stay, and upon discharge to community dwelling.

Conclusion

This quality assessment project identified that veterans with spinal cord injuries and disorders required more assistance with bowel and bladder management, experienced fewer bowel movements, voided more times, experienced no change in time of day bowel movements, length of time for bowel care less than 30 minutes, and duration to manage bladder program less than 30 minutes during hospitalization as compared to home. There was a noticeable decrease in the use of digital stimulation and mini enema during hospitalization, slight increase in use of indwelling/foley catheters, and increased constipation and urinary incontinence during hospitalization. The majority of veterans also reported being satisfied or very satisfied with their bowel (67%) and bladder (79%) care during hospitalization. Managing bowel and bladder function involves multiple interventions, time, and supplies to have positive outcomes and decreased side effects of the choice of strategies to manage bowel and bladder elimination during acute hospitalization.

Nevertheless, these findings also suggest the need for additional studies and research to identify the actual bowel and bladder management during hospitalization of chronic spinal cord injury, multiple sclerosis, and other central neurological disorders. The exact pattern of symptoms depends on the site of injury, site of lesion, and its extent. Therefore, lifetime care of spinal cord injured persons require attention to multiple bodily systems, sensitivity to the effects of interventions on bowel function/bladder function, and special vigilance due to the tendency of spinal cord injuries to mask problems.

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APPENDIX A: TABLES

Table A1

Frequency Counts and Percentages for Demographic Variables of Study (N = 48)

Variable	<i>f</i>	%
Gender		
Male	47	97.9
Female	1	2.1
Marital Status		
Married	24	50.0
Divorced	15	31.3
Never married	4	8.3
Separated	2	4.2
Widowed	2	4.2
Domestic partnership	1	2.1
Race		
White	33	68.8
American Indian/Alaska Native	4	8.3
Black/African American	3	6.3
Asian	1	2.1
Mixed race (Asian, African American and White)	1	2.1
Unknown	1	2.1
Unreported	5	10.4
Education Level		
Did not complete high school	3	6.3
High school graduate	10	20.8
Some college, no degree	14	29.2
Associate degree: occupational/vocational/ technical degree	3	6.3
Associate degree: academic program	10	20.8
Bachelor's degree	3	6.3
Graduate degree	5	10.4

Table A2

Frequency Counts and Percentages of Variables Relating to Spinal Cord Injury Type and Etiology (N = 48)

Variable	<i>f</i>	%
Level of spinal cord injury		
Cervical 1-7	14	29.2
Thoracic 1-6	8	16.7
Thoracic 7-12	9	18.8
Multiple sclerosis	5	10.4
Lumbar	2	4.2
Amyotrophic lateral sclerosis	1	2.1
Not specified	9	18.8
Spinal cord type		
Complete	18	37.5
Incomplete	12	25.0
Unknown	16	33.3
Unreported	2	4.2
Injury etiology (cause of injury)		
Motor vehicle accident	9	18.8
Non-traumatic spinal cord dysfunction (polio, tumor)	7	14.6
Fall	5	10.4
Multiple sclerosis	5	10.4
Diving accident	2	4.2
Transport	2	4.2
Hit and run	1	2.1
Assault	1	2.1
Other non-traumatic injury	16	33.3

Note: Non-traumatic spinal cord dysfunction and other non-traumatic were combined and included: hematoma, tuberculosis, meningitis, west Nile virus, bleeding, degenerative osteoarthritis, and aortic hematoma.

Table A3

Frequency Counts and Percentages of Questions Relating to Patients' Most Recent Hospitalization (N = 48)

Variable	<i>f</i>	%
What kind of hospital were you in most recently		
VA SCI/D center	22	45.8
VA Hospital/Center (not SCI)	17	35.4
Non-VA hospital	8	16.7
None	1	2.1
Why were you in the hospital?		
Urinary tract infection	10	20.8
Infection	9	18.8
Surgery	7	14.6
Annual exam	7	14.6
Pressure sore/ulcer	3	6.3
Pulmonary	3	6.3
Miscellaneous	6	12.5
Unreported	3	6.3
Did your admitting provider/doctor discuss with you how to best manage your bowel and bladder care while admitted?		
Yes	13	27.1
No	32	66.7
Unreported	3	6.3
Did the admitting nurse do neurogenic bowel and bladder care assessment?		
Yes	13	27.1
No	30	62.5
Unknown	3	6.3
Unreported	2	4.2
How long did it take after admission before a bowel management program was started?		
Less than 24 hours	19	39.6
Between 24 and 48 hours	10	20.8
Greater than 48 hours	3	6.3
Greater than 72 hours	2	4.2
Never started	13	27.1
Unreported	1	2.1

Table A3 (*continued*)

How long did it take after admission before a bladder management program was started?		
Less than 24 hours	24	50.0
Between 24 and 48 hours	6	12.5
Greater than 48 hours	4	8.3
Greater than 72 hours	1	2.1
Never started	11	22.9
Unknown	1	2.1
Unreported	1	2.1
Primarily who completed your bowel and bladder care during hospitalization?		
Self	16	33.3
Caregiver/family	3	6.3
Nursing staff	23	47.9
Self and nursing staff	1	2.1
Caregiver and nursing staff	3	6.3
Unreported	2	4.2
Were you satisfied with your routine bowel management care during hospitalization?		
Very satisfied	10	20.8
Satisfied	22	45.8
Dissatisfied	5	10.4
Very dissatisfied	6	12.5
Unreported	5	10.4
Were you satisfied with your routine bladder management care during hospitalization?		
Very satisfied	12	25.0
Satisfied	26	54.2
Dissatisfied	3	6.3
Very dissatisfied	2	4.2
Unreported	5	10.4
Did you experience any of the following complications with your bowel and bladder care (check all that apply)		
Yes	28	58.3
No	20	41.7

Table A3 (*continued*)

Complications noted by patients		
Urinary incontinence	11	22.9
Autonomic dysreflexia (AD)	2	4.2
Urinary tract infection	9	18.8
Pressure ulcer	3	6.3
Skin rash or irritation to groin	3	6.3
Stool incontinence	4	8.3
Spasticity	5	10.4
Breathing problems	2	4.2
Abdominal distention	5	10.4
Constipation	14	29.2
Diarrhea	5	10.4
Rectal bleeding	3	6.3

Note. VA = Veteran's Administration; SCI/D = Spinal Cord Injury and Disorders.

Items relating to the "Why were you in the hospital?" classification of "Miscellaneous"

could include: Urethral build up, multiple sclerosis exacerbation, motor vehicle accident, neck support, or wheelchair training.

Table A4

Frequency Counts and Percentages of Variables Relating to Bowel Management at Home and at Hospital (N = 48)

Variable	At Home		In hospital	
	<i>f</i>	%	<i>f</i>	%
Assistance Required				
Yes	20	41.7	25	52.1
No	27	56.3	22	45.8
None Selected	1	2.1	1	2.1
Frequency of Bowel movement				
Daily	26	54.2	22	45.8
Alternate Days	12	25.0	13	27.1
Other	6	12.5	9	18.8
None Selected	4	8.3	4	8.3
Time of Day				
Morning	21	43.8	21	43.8
Evening	8	16.7	7	14.6
Both	7	14.6	7	14.6
Other	10	20.8	10	20.8
None Selected	2	4.2	3	6.3
Bowel Function and management (number of yes answers)				
Normal	9	18.8	10	20.8
Straining/bearing down	9	18.8	11	22.9
Digital stimulation	20	41.7	14	29.2
Digital evacuation	13	27.1	12	25.0
Suppositories	13	27.1	14	29.2
Mini enema	9	18.8	5	10.4
Colostomy	3	6.3	3	6.3
Other	1	2.1	---	---
None Selected	---	---	3	6.3
Duration to manage bowel program				
< 30 minutes	31	64.6	30	62.5
30 minutes to 1 hr.	10	20.8	8	16.7
1 hr.	2	4.2	3	6.3
> 1 hr.	4	8.3	3	6.3
None Selected	1	2.1	4	8.3

Note. The bowel function and management item was an item in which participants could choose more than one option, consequently the frequencies and percentages total more than $N=48$ and 100% respectively.

Table A5

Frequency Counts and Percentages of Variables Relating to Bladder Management at Home and at Hospital (N = 48)

Variable	At home		In hospital	
	<i>f</i>	%	<i>f</i>	%
Voiding Method (yes answers)				
Void/Urinate, no assistance	22	45.8	16	33.3
Assistance Required	5	10.4	6	12.5
Intermittent Cath without Meds	9	18.8	8	16.7
Intermittent Cath with Meds	1	2.1	1	2.1
Indwelling Catheter/Foley	16	33.3	18	37.5
Suprapubic Catheter	1	2.1	1	2.1
External Catheter	8	16.7	5	10.4
Crede/Valsalva	---	---	---	---
Other	---	---	1	2.1
Number of voids				
1-2 times/day	1	2.1	1	2.1
4-5 times/day	5	10.4	4	8.3
6-8 times/day	6	12.5	3	6.3
Not applicable	33	68.8	37	77.1
None Selected	3	6.3	3	6.3
Duration to manage bladder program				
< 30 minutes/day	32	66.7	33	68.8
30 minutes to 1 hr./day	4	8.3	3	6.3
1 - 2 hrs./day	4	8.3	4	8.3
> 2 hrs./day	4	8.3	3	6.3
None Selected	4	8.3	5	10.4

Note. The voiding method item was an item in which participants could choose more than one options, consequently the frequencies and percentages total more than 48 and 100% respectively.

APPENDIX B: FIGURES

Figure B1. Etiologies of traumatic SCI.

www.uab.edu/nscisc

Figure B2. Spinal cord.

www.daviddarling.info

Patient Name _____

Examiner Name _____ Date/Time of Exam _____

AMERICAN SPINAL INJURY ASSOCIATION

**STANDARD NEUROLOGICAL CLASSIFICATION
OF SPINAL CORD INJURY**

MOTOR

KEY MUSCLES
(scoring on reverse side)

	R	L	
C5	☐	☐	Elbow flexors
C6	☐	☐	Wrist extensors
C7	☐	☐	Elbow extensors
C8	☐	☐	Finger flexors (distal phalanx of middle finger)
T1	☐	☐	Finger abductors (ring finger)

UPPER LIMB TOTAL (MAXIMUM) ☐ + ☐ = (25) (25) (50)

Comments: _____

L2	☐	☐	Hip flexors
L3	☐	☐	Knee extensors
L4	☐	☐	Ankle dorsiflexors
L5	☐	☐	Long toe extensors
S1	☐	☐	Ankle plantar flexors

Voluntary anal contraction (Yes/No) ☐

LOWER LIMB TOTAL (MAXIMUM) ☐ + ☐ = (25) (25) (50)

SENSORY

KEY SENSORY POINTS

0 = absent
1 = impaired
2 = normal
NT = not testable

	LIGHT TOUCH		PIN PRICK	
	R	L	R	L
C2	☐	☐	☐	☐
C3	☐	☐	☐	☐
C4	☐	☐	☐	☐
C5	☐	☐	☐	☐
C6	☐	☐	☐	☐
C7	☐	☐	☐	☐
C8	☐	☐	☐	☐
T1	☐	☐	☐	☐
T2	☐	☐	☐	☐
T3	☐	☐	☐	☐
T4	☐	☐	☐	☐
T5	☐	☐	☐	☐
T6	☐	☐	☐	☐
T7	☐	☐	☐	☐
T8	☐	☐	☐	☐
T9	☐	☐	☐	☐
T10	☐	☐	☐	☐
T11	☐	☐	☐	☐
T12	☐	☐	☐	☐
L1	☐	☐	☐	☐
L2	☐	☐	☐	☐
L3	☐	☐	☐	☐
L4	☐	☐	☐	☐
L5	☐	☐	☐	☐
S1	☐	☐	☐	☐
S2	☐	☐	☐	☐
S3	☐	☐	☐	☐
S4-5	☐	☐	☐	☐

TOTALS ☐ + ☐ = (56) (56) (112)

Any anal sensation (Yes/No) ☐

PIN PRICK SCORE (max: 112)

LIGHT TOUCH SCORE (max: 112)

NEUROLOGICAL LEVEL
The most caudal segment with normal function

SENSORY ☐ ☐

MOTOR ☐ ☐

COMPLETE OR INCOMPLETE? ☐

Incomplete = Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE ☐

ZONE OF PARTIAL PRESERVATION
Caudal extent of partially innervated segments

SENSORY ☐ ☐

MOTOR ☐ ☐

• Key Sensory Points

Figure B3. ASIA scale.

www.spinalcordinjuryzone.com

Figure B4. Spinal column.

www.disabled-world.com

Figure B5. Autonomic nervous system.

Figure B6. Nerve pathway to bowel.

<http://www.123rf.com/photo>

Figure B7. Nerve pathway to bladder.

<http://www.123rf.com/photo>

Figure B8. Map of Regional Centers HUB and spokes.

http://www.sci.va.gov/Primary_Care_Teams.asp

APPENDIX C: LETTER OF DETERMINATION

DEPARTMENT OF
VETERANS AFFAIRS

Memorandum

Date: June 5, 2013

From: Robert Hierholzer, M.D., ACOS Research and Development

Subj: Determination Regarding Classification of a Proposed Project as an Operations Activity

To: Mary Jimenez, RN, MSN, FNP-BC

I have reviewed your "Application for Classifying a Project as an Operations Activity" as well as the accompanying description for your proposed project "Self-Report Neurogenic Bowel and Bladder Management In Acute Hospitalized Chronic Spinal Cord Injured Patients: Its' [sic] Role in Clinical Practice. Based on these submissions I have determined that your proposed project does not constitute research, and can be classified as an operations activity. In particular, the data collected in this project will only have highly localized significance. The results will not be generalizable even to other VA facilities. This means that your project is not subject to review by our IRB and R&D committees. However, you need to be aware of several important matters:

1. If you make changes to your project, in any way, you need to let me know. I need to be aware of changes because changes in such things as project goals, data sources and study design may result in your project becoming research. You can email me about changes.
2. Findings from operations, activities or projects may be published. **However, publication in peer reviewed journals or peer reviewed presentations outside of the VA of findings from non-research operations activities must be reviewed prior to presentation.** Such review must be documented. (VHA Handbook 1058.05). The ACOS for Research and Development is required to review these publications prior to presentation or publication. Allow at least 10 business days for me to review any proposed publications.
3. Per VHA Handbook 1058.5: "Individuals conducting non-research operations activities [as well as relevant Supervisor and Service Chief] incur a particular obligation to ensure that the safety, rights and welfare of affected patients and staff are appropriately protected. Potential risks (including physical, psychological, social, financial, privacy, confidentiality, and other reasonably foreseeable risks) associated with non-research operations activities must be thoroughly evaluated and appropriate protections must be established to mitigate them. Documentation of risk analysis, consultation, and result in protections is strongly encouraged when more than nominal risk may be involved, or may be perceived to be involved."
4. **Additional Comments:** I draw your attention, in particular, to #3 immediately above. **Even though your project is not research, your project has several risks which you and your supervisors need to be aware of, and (should) manage.** I will highlight some of these. This is not an

exhaustive list. One area of concern is protecting the privacy of the veterans who choose to be involved in your project. Sending a postcard to a veteran about a study which includes information about the veteran's medical condition does not protect the veteran's privacy. There are also concerns about the confidentiality of data: What data will non-VA individuals be receiving? Will they be receiving any VA sensitive data? Finally, you should be aware of a potential conflict of interest. *If* these veterans are individuals that you normally provide care for, then it may be that these veterans will feel some pressure to participate in a project that is associated with your attaining an advanced degree. If this were a research project, attention would be placed on who exactly recruits for this study (you or someone else) and how often attempts are made to contact veterans. As mentioned, this is not an exhaustive list of issues to be managed in such a project. Paragraph 3 provides the general categories of areas for your consideration. Because this is not a research project, neither the Research Office nor the Research and Development Committee is responsible for oversight these issues. At a minimum I suggest you ask the Privacy Officer and the Information Security Officer to review your project for thoughts on privacy and confidentiality/data security, respectively.

If you have any questions about my determination or your particular responsibilities please feel free to contact me (Robert.Hierholzer@va.gov).

cc:

Paul Goebel, MD
Wessel Meyer, MBChB, FCP (SA), FACP
Patricia Richardson, RN, EdD

APPENDIX D: QUALITY ASSESSMENT QUESTIONNAIRE

Department of Veterans Affairs

Veterans Administration Central California Health Care Systems

VACCHCS

2615 E. Clinton Avenue

Fresno, CA 93703-2286

September 7, 2013

Quality Assessment Questionnaire

Dear:

Hello, my name is Mary Jimenez, RN, MSN, FNP-BC, I am completing a Quality Assessment project at the Veterans Health Administration, Fresno Central California Health Care System to improve health care services for Veterans with Spinal Cord Injury. This Quality Assessment Project is important as we want to improve bowel and bladder management during unplanned hospitalizations in Veterans like yourself. Your

participation is voluntary. If you agree to participate, please complete the enclosed questionnaire, "Bowel and Bladder Management during Hospitalization," and return in the provided stamped and pre-addressed return envelope.

If you would like more information about this quality assessment project please complete section below:

Please cut on perforated line and mail back in stamped pre-addressed envelope.

Name: _____

Telephone: _____

Best time to call: _____

Thank you,

Mary Jimenez, MSN, FNP-BC

APPENDIX E: NEUROGENIC BOWEL AND BLADDER MANAGEMENT DURING HOSPITALIZATION

Demographics

- 1) **Date of birth:** ____ / ____ / ____ - ____ - ____
m m d d y y y y
- 2) **Gender:** ☐ Female ☐ Male ☐ transgender ☐ unspecified
- 3) **Ethnicity: (fill in " ONLY one with which you MOST CLOSELY identify)**
- ☐ Hispanic or Latino ☐ Unknown
- ☐ Not Hispanic or Latino ☐ Not Reported
- 4) **Race: (fill in those with which you identify)**
- ☐ American Indian or Alaska Native ☐ White
- ☐ Asian ☐ Unknown
- ☐ Black or African-American ☐ Not Reported
- ☐ Native Hawaiian or Other Pacific Islander

5) Education level: (select the highest level attained)

☐ Never attended/ Kindergarten only	☐ GED or equivalent
☐ 1st Grade	☐ Some college, no degree
☐ 2nd Grade	☐ Associate degree:
occupational/technical/vocational
program
☐ 3rd Grade	☐ Associate degree: academic
program
☐ 4th Grade	☐ Bachelor's degree (e.g., BA, AB,
BS, BBA)
☐ 5th Grade	☐ Master's degree (e.g., MA, MS,
MEng, MEd, MBA)
☐ 6th Grade	☐ Professional school degree (e.g.,
MD, DDS, DVM, JD)
☐ 7th Grade	☐ Doctoral degree (e.g., PhD, EdD)
☐ 8th Grade	☐ Unknown
☐ 9th Grade	
☐ 10th Grade	
☐ 11th Grade	
☐ 12th Grade, no diploma	
☐ High school graduate	

Marital/Partner status:

☐ Never Married	☐ Separated
☐ Married	☐ Divorced
☐ Domestic Partnership	☐ Widowed

Spinal cord injury data

Dates (YYYYMMDD)

Date of Injury ____/____/____

☐ UNKNOWN

Level of your Spinal Cord Injury _____

Spinal Cord injury

☐ Complete ☐ Incomplete ☐ Don't know

Injury Etiology (cause of injury)

☐ MVA

☐ Assault

☐ Fall

☐ Diving Accident

☐ Sports

☐ Assault

☐ Transport

☐ Fall

☐ Other Non-traumatic cause

☐ Non-traumatic spinal cord dysfunction Cause_____

☐ Unspecified or unknown

6. What kind of hospital were you in most recently?

☐ VA SCI/D Center

☐ VA Hospital/Center (not SCI)

☐ Non- VA SCI/D Hospital

☐ Non-VA Hospital

Date of last hospitalization_____ (please write year)

7. How long were you in the hospital?

Number of days_____ (write number)

8. Why were you in the hospital? (Please write response)

9. Did your admitting Provider/Doctor discuss with you how to best manage your bowel and bladder care while admitted?

☐ Yes

☐ NO

10. Did the admitting nurse do neurogenic bowel and bladder care assessment?

☐ Yes

☐ No

11. How long did it take after admission before a bowel management program was started?

- ☐ Less than 24 hour ☐ Less than 48 hours ☐ greater than 48 hours
☐ Greater than 72 hours ☐ Never started

12. How long did it take after admission before a bladder management program was started?

- ☐ Less than 24 hour ☐ Less than 48 hours ☐ greater than 48 hours
☐ Greater than 72 hours ☐ Never started

13. Primarily who completed your bowel and bladder care during hospitalization?

- ☐ Self ☐ Caregiver /family ☐ Nursing Staff ☐ Other

14. Were you satisfied with your routine bowel management care-during hospitalization?

- ☐ Very satisfied. ☐ Satisfied ☐ Dissatisfied ☐ Very dissatisfied

15. Were you satisfied with your routine bladder management-care during the hospitalization?

- ☐ Very satisfied. ☐ Satisfied ☐ Dissatisfied ☐ Very dissatisfied

16. Did you experience any of the following complications with your bowel and bladder care (may mark more than one those with which you identify)

☐ Urinary incontinence	☐ stool incontinence	☐ Constipation
☐ Autonomic Dysreflexia (AD)	☐ Spasticity	☐ Diarrhea
☐ Urinary tract infection	☐ breathing problems	☐ rectal bleeding
☐ Pressure ulcer	☐ Abdominal distention	
☐ Skin/rash irritation to groin		

17. Who answered the questions on this Questionnaire?

- ☐Myself
- ☐Myself (someone helped read/write my answers on form)
- ☐Someone else on my behalf

Bowel Management

AT Home

☐Assistance not required

☐Assistance required

In Hospital

☐Assistance not required

☐Assistance required

Frequency:

☐Daily

☐Alternate days

☐Other

☐Daily

☐Alternate days

☐Other

Time of Day

☐ Morning☐ Evening☐ Other☐ Morning☐ Evening☐ Other

Bowel function and management

☐ Normal☐ Straining/bearing down to empty☐ Digital Stimulation (anal/rectal)☐ Digital Evacuation☐ Suppositories☐ Mini Enema☐ Colostomy

Other _____

☐ Normal☐ Straining/bearing down to empty☐ Digital Stimulation (anal/rectal)☐ Digital Evacuation☐ Suppositories☐ Mini Enema☐ Colostomy

Duration to manage bowel program

30 min or less

30 min to 1 hour

1 hour

>1hour

Duration to manage bowel program

30 min or less

30 min to 1 hour

1 hour

> 1hour

Bladder Management

At Home

☐ Void/urinate with no assistance☐ Assistance required☐ Intermittent Catheterization with no medications☐ # times per day_____☐ Intermittent catheterization with medications☐ Indwelling Catheter/Foley☐ Suprapubic Catheter☐ External (Condom) Catheter☐ Crede/Valsalva

Other_____

Duration to manage bladder per day

Per day:

☐ 30 min more or less/day☐ 30-60 min/day☐ 1-2 hrs/day☐ >2 hrs/day

While in the Hospital

☐ void/urinate with no assistance☐ Assistance required☐ Intermittent Catheterization☐ # times per day_____☐ intermittent catheterization with
medications☐ Indwelling Catheter/Foley☐ Suprapubic Catheter☐ External (Condom) Catheter☐ Crede/Valsalva

Other_____

Duration to manage bladder

Per day:

☐ 30 min more or less/day☐ 30-60 min/day☐ 1-2 hrs/day☐ >2 hrs/day

Thank you very much for completing this questionnaire. Your help is very valuable. If there is anything else you would like to tell us about your experience with bowel and bladder management please do so here:_____