

Protecting Arms from Medical Errors by Implementing the NoNo Sleeve

David Britts BSN, RN

Grand Canyon University

NUR – 699

January 12, 2014

Abstract

Medical errors plague the healthcare industry. These errors place a financial strain on the healthcare system as a whole, but more importantly, these errors take an emotional and financial toll on patients. The negative impact these errors have on the patient's outcome cause the patient to need additional medical care to reverse the damage done by the medical error. In some cases, there is no reversing the medical error when the error causes the patient's untimely death. The healthcare industry must combat the epidemic of medical errors that affects patients all across the country. This evidence-based project (EBP) will investigate the use of the NoNo Sleeve in a busy emergency department and more importantly, the staff's opinion of the NoNo Sleeve as the best method for preventing medical errors from occurring to patients with upper extremities that cannot be used for medical procedures. Gaining support from the frontline staff caring for these patients will ensure that every patient identified that needs a NoNo Sleeve will receive one.

Background

Protecting Arms from Medical Errors by Implementing the NoNo Sleeve

Emergency departments are often chaotic environments with a widely diverse patient population. There are the most critical patients receiving high-level medical treatments to save lives and patients with sore throats who just need an antibiotic. With the passing of the Emergency Medical Treatment and Labor Act in 1986, patients cannot be turned away from an

emergency department and, at bare minimum, must at least receive a medical screening exam to determine the extent of the patient's complaint. With a constant stream of patients, emergency departments often face overcrowding and limited resources. This type of environment can be a breeding ground for medical errors. In fact, in a study of medical errors across 62 emergency departments, it was found that the error rate was 4.1 errors per 100 patient visits (Camargo et al., 2012).

This EBP serves to address the elimination or reduction of a particular medical error—the use of a patient's compromised upper extremity for a medical procedure such as a blood draw, intravenous catheter (IV) placement, and blood pressure reading. Patients with a dialysis shunt, mastectomy, or cellulitis should also not have procedures performed on those extremities. In the emergency department, this information may not always be communicated as patients get handed off between staff members or even when patients are transferred from the emergency department to other units in the hospital. This EBP will look to implement the NoNo Sleeve in an emergency department over a five-week timeframe with the support of the emergency room nursing staff. To deem this EBP a success, it will have to be proven that the NoNo Sleeve is easily, quickly, and accurately used to identify and protect patients that have upper extremities that cannot be used in medical procedures.

Organizational Culture and Readiness Assessment

The emergency department at Sutter Delta Medical Center contains a busy, frenetically-paced emergency room (ER) that averages 60,000 patient visits a year. It has 32 licensed beds and is part of a 145-bed community based medical center serving the population of the eastern section of Contra Costa County in Northern California. People of

every socioeconomic status and ethnic origin are served here, including a large proportion of individuals of a lower socioeconomic status. This emergency department faces many of the same challenges as other emergency departments around the country—limited resources and overcrowding—and increasingly needs to provide safe quality care to patients. As in many ERs, there have also been medical errors reported to the risk management department.

Within the last year, the emergency department had an incident of a wrong arm medical error. A nurse, who had been practicing for only a few months, mistook an arteriovenous (AV) fistula for a vein and stuck an IV catheter into a patient's AV fistula. In this instance, the error was not only because of the novice nurse's error. The intake nurse was also at fault in that he/she noted the patient was a dialysis patient, but failed to perform an assessment of the AV fistula upon intake to discover the arm with the AV fistula and notate the affected arm on the patient's chart. This instance required the patient to undergo a surgical procedure to replace the AV fistula which required an additional length of stay in the hospital. The hospital then had to absorb the expense of the care related to this medical error. Additionally, the nurse now has the traumatic experience of causing a severe medical error on a patient. This instance brought to light an understudied area in medical care and the need for emergency departments to address wrong arm medical errors and develop a solution to eliminate their occurrence. The goal of this study is to end wrong arm errors from occurring within emergency departments, thereby adopting a zero tolerance for avoidable medical errors. The rest of this section will describe the stakeholders and the results of the readiness assessment.

Stakeholders

The ultimate goal of this EBP is to ensure that a patient never suffers a medical error to an upper extremity that is not to be used for medical treatments. Patients would be considered the ultimate stakeholder for that purpose, but the nursing staff that cares for these patients is the focus stakeholder for this project. The nurses in the ER work in a challenging setting and must deliver safe care to the numerous patients that pass through the doors of the emergency department. It is a core belief that healthcare providers do no harm to patients, but flaws in the system can cause medical errors to occur. Other stakeholders in this EBP are the members of the hospital administration and management staff, as well as the physicians. Keeping patients free from harm while receiving care in the hospital should be a top priority for the entire staff.

The hospital already deploys tools in the emergency department to help stop medical errors from occurring such as electronic health records, smart IV pumps, barcode scanning for medication administration, and computerized physician order entry. Studies have shown that use of technology can help reduce medical errors from occurring in the hospital setting. The staff took a voluntary readiness assessment prior to any attempt to implement the NoNo Sleeve as the method to stop wrong arm errors from occurring. Poe and White (2010) stated that it is essential for hospital personnel to work as a unified team in order to ensure the success of an evidence-based program. Therefore, a readiness assessment was conducted for the emergency department to learn if the implementation of the NoNo Sleeve would be successful or if there were any obstacles to implementation.

The Attributes of a Professional Practice Environment Staff Evaluation

(Appendix A) was used to determine the readiness of the nursing staff in the emergency department in beginning the journey of this EBP. The readiness assessment includes 22 attributes that represent the continuum of a professional practice environment. The scale is 0 (lowest) to 10 (highest). The researcher was able to have 21 emergency department nurses complete the readiness assessment, with the average response for the survey at 6.8 (rounded on a scale of 1–10). The researcher feels that this reflects an environment that will be open to participating in this EBP.

Problem Description

Medical errors are costly. Colie (2001) and Grim (2001) estimated that medical mistakes are responsible for between 44,000 and 98,000 deaths each year. No medical institution is exempt from contributing to this statistic, stated Colie, even ones who have a reputation for high quality of care. The financial burden that medical mistakes impose are high, according to Colie, even for cases where the patient survives—approximately 18 billion dollars annually. Most importantly, medical errors cause needless suffering to patients.

Shaub DiLorenzo and King Strausinger (2010) stated that it is the responsibility of phlebotomists and nurses to communicate effectively with their patients. In doing so, many medical errors can be avoided. It behooves all hospitals to devise a systematic approach to detecting patterns of medical errors and to pool the efforts of their entire staff to reduce medical mistakes, because increasing the quality of care to the patient results in increased financial success (Colie, 2001; Fedder 2001; Grim 2001), as well as improves healthcare outcomes and patient well-being.

In blood collection, wrong arm errors can produce two different consequences for two different populations of patients: damage to AV fistulas or other types of artificially implanted device such as shunts or catheters, and lymphedema. Both populations of patients are more susceptible to infection, especially if blood is drawn on an inappropriate site (Arbique, 2008).

Wrong arm errors can cause damage to AV fistulas. Patients who have AV fistulas are most likely diabetic, are experiencing kidney failure resultant of their illness, and have undergone an operation in order to place an AV fistula in their arm to accommodate the high demands of intravenous use in hemodialysis (Fistula First, 2009). Damage to fistulas because of wrong arm blood collection can cause interruption of a patient's treatment. As Fistula First observed, surgically implanting a fistula in a patient's arm requires time and planning, and the fistula must be mature in order for it to be used and for a patient to begin hemodialysis. Damage to the AV fistula can cause delays in treatment.

The second population potentially vulnerable to wrong arm errors is women who had mastectomies or a malignant tumor removed from the breast and are undergoing radiation therapy or chemotherapy for the treatment of cancer, staff of John Hopkins Medicine (n.d.) stated. These patients often develop secondary lymphedema. John Hopkins Medicine describes secondary lymphedema in the following manner. Secondary lymphedema, characterized by the swelling of an extremity because of inadequate fluid drainage due to damaged or removed lymph nodes, is a cause for concern for many different patients undergoing treatment for cancer, but it is of primary concern for women who had a malignant tumor removed in the breast area or a mastectomy. Often, breast

tissue plus lymph nodes underneath the arm are removed on the side of the affected area.

If blood pressure or blood is taken on the compromised arm, lymphedema can result because of the restriction blood pressure collars impose and also because the small prick from the needle can overburden the lymphatic system, according to Cohen, Payne, and Tunkel (2001). As Cohen et al. stated, lymphedema can be caused by a small wound, and infection, such as cellulites, of that wound. Wounds can also be resultant of lymphedema.

Shih, Xu, Cormier, Giordano, Ridner, Buchholz, Perkins, et al. (2009) found that women with breast cancer undergoing chemotherapy doubled their chances of having lymphangitis or cellulitis, two complications of lymphedema. Their cost of care was between \$14,877 and \$23,167 higher than other patients. According to Cohen et al. (2001), lymphedema can progress and produce a number of conditions, such as fibrosis within the affected area and elephantitis if the condition is left untreated or becomes chronic. Lymphangitis can cause sepsis, which can be life threatening (Phillips, 2012). Cellulitis, if left untreated, can be equally as life threatening, spreading from the skin to tissues and the lymphatic system (National Center for Biotechnology Information, 2011). Diabetics are already susceptible to skin infections, and lymphedema compounds the potential complications for patients with fistulas undergoing hemodialysis due to diabetes if the patient also has cancer and is undergoing chemotherapy.

Emergency rooms are more susceptible to errors occurring because in emergency situations, it may not be possible to identify the patient at times (Arbique, 2008). The problem of overcrowding in the United States ERs is becoming a big problem and has safety consequences (Trzeciak & Rivers 2003). A nurse or a phlebotomist might be assisting patients

who are gravely ill and need their blood drawn with immediacy (Arbique, 2008). Errors in this type of environment are more likely to occur, Arbique stated. This EBP study will aim to implement the use of a device called the NoNo Sleeve in order to help nurses and healthcare staff improve communication for patient needs and end needless damage to fistulas and shunts and causation of secondary lymphedema in patients with cancer.

Since a dialysis patient did experience a wrong arm medical error in the emergency department, it was determined that there needs to be an improved process to quickly and safely identify patients with restricted upper extremities. This intervention needs to be based on evidence and have buy-in from the emergency room staff to ensure acceptance of the new method. It was decided to investigate and implement a highly visible method for staff to identify the extremity that cannot be used. Secondly, it is extremely important that this process is developed along with the emergency room staff so that they have a stake in the ongoing success of this process. After reviewing several methods to identify restricted extremities, the NoNo Sleeve patient safety product was selected for trial in the emergency department. Key to the NoNo Sleeve's success will be the staff's thoughts on the effectiveness of the NoNo Sleeve and the willingness to use the NoNo Sleeve over the current method used to identify restricted extremities. This will be important to ensure the success of the NoNo Sleeve if it is chosen as the method to identify "do not use" upper extremities. Lastly, a qualitative study of the emergency room nursing staff will need to be completed to determine their perceptions of the NoNo Sleeve as the best method to identify and prevent errors in patients with restricted extremities.

Literature Support

Wrong arm medical errors are an understudied area in research. The literature available on preventing the use of the wrong arm for blood collection, administering of intravenous (IV) medication, and blood pressure reading is sparse, if not nonexistent. This reveals a gaping hole in the literature available for wrong arm use errors, statistics available for costs associated with wrong arm use errors, and the effect these errors have upon patients and their families.

This literature review must draw from other areas of medical error research in order to explain and validate the incorporation of the NoNo Sleeve into the emergency department's culture. After many searches on research involving wrong arm medical error and emergency department perceptions on patient safety devices, it is obvious that this is a largely understudied area of research in the medical community. Furthermore, there is absolutely no research published on the NoNo Sleeve and whether or not the NoNo Sleeve is effective in preventing or reducing wrong arm medical errors. This research is highly exciting as this EBP has the potential to be the first of its kind. The focus of this EBP's literature support is on studies that are available in the arena of the reduction of medical errors and emergency department staff's opinion on patient safety. First, an explanation of key phrases and terms used for this literature review will be explained. The literature will be synthesized to explain the areas that have been addressed in medical research in terms of blood collection medical errors and the nurses' role in medical error prevention. Since there is a lack of literature available specifically related to wrong arm medical errors, the literature review will be used instead to learn the progress of medical error reduction, failures in devices used in hospitals presently, and how the NoNo Sleeve will address the issues experienced in wrong arm errors. Also, the process of

problem solving will be explained and how it was applied to the emergency department for wrong arm medical errors.

Key Search Terms

The following search terms were inputted into EBSCOHOST, CINAL, Cochrane Library, Clinical Practice Guidelines, and PUBMED:

- To research medical errors, including wrong arm errors: medical errors, medical mistakes, wrong arm medical errors/mistakes, nurse's role in prevention of medical errors/wrong arm errors, wrong arm IV medical errors.
- To research medical errors in ER: medical errors/mistakes in ER, wrong arm medical errors in ER, emergency medicine medical errors, emergency medicine medical error prevention, emergency medicine medical error factors, miscommunication and ER medical errors/mistakes.
- To research fistulas/catheters/shunts: fistulas, AV fistulas, damage to AV fistulas/catheters/shunts in blood collecting/collection, complications with AV fistulas/catheters/shunts in arm, hospital safety procedures and AV fistulas/catheters/shunts, protection of AV fistulas/catheters/shunts in arm.
- To research lymphedema: lymphedema, secondary lymphedema, complications from lymphedema, breast cancer and lymphedema, lymphedema and blood collection.
- To research blood collection and blood collection errors: blood collection and secondary lymphedema/fistulas, preventing blood collection errors/mistakes, bedside errors and blood collection, bedside identification errors and blood collection, blood collection and wrong arm errors/devices, blood collection errors/problems,

errors/mistakes in venipuncture site selection, incorrect upper extremity/arm selection and blood collection.

- To research hospital safety procedures, hospital safety procedures and: prevent wrong arm use in blood collection; prevent damage to AV fistulas, protection to AV fistulas, protection to AV fistulas during blood collection, breast cancer and secondary lymphedema.
- To research breast cancer and: blood collection and lymphedema.
- To research safety devices to prevent medical errors: use of patient safety products to reduce medical errors, safety products and patient misidentification and blood collection, use of wristbands in hospitals for medical alerts, use of wristbands hospitals for medical information.
- To research measuring blood pressure and: secondary lymphedema and AV fistulas.

Synthesis of the Literature

After a search of the key search terms above, it was apparent that there isn't any research on wrong arm use for medical errors. Instead, several areas of well-researched subjects, while important areas, appeared under the search criteria but are not the focus of this study. For instance, a search under blood collection errors yields a plethora of literature in errors in blood transfusion, most likely because of the high mortality rates this type of mistake brings about. Searches under medical errors yielded many results, but most had to do with medication errors including medicine dosing, correct prescription medication dosage, and correct patient identification and medication administration. Most importantly, anything regarding the use of the wrong arm and its role in the causation of fistula damage or

secondary lymphedema was not found under these search terms. Through the search term “measuring blood pressure and secondary lymphedema and AV fistulas,” one article explained the reason to use caution and pay attention to arm use, rather than it being a study that produced information in the study of wrong arm medical errors.

Some searches did not yield any results, especially when the key phrases “wrong arm,” “protect AV fistulas,” and “error prevention in AV fistulas.” “Measuring blood pressure” was a better phrase for obtaining the very few studies available for breast cancer patients and secondary lymphedema. However, none of the research efforts above yielded any information for wrong arm medical errors or the prevention of wrong arm medical errors, or any similar meaning terms or research that would provide a basis to use for evidence-based clarification and justification of the use of the NoNo Sleeve. The search term “venipuncture site selection” combined with “emergency room errors” was also not fruitful. These search terms produced many instructive websites and materials used in the course of phlebotomy and nursing education.

Therefore, this study must draw from different arenas to justify the incorporation of the NoNo Sleeve in the emergency room and for use in this study. Several areas of study were depicted below for their role in directing the use of the NoNo Sleeve to prevent wrong arm medical errors. The following areas of study were selected because of their usefulness in guiding the researcher for this project towards the implementation of the NoNo Sleeve: the role of the researcher in the reduction of medical errors, the nurses’ role in preventing medical errors, and medical error prevention devices. It is the hope of this researcher that more research will be added to clarify the issue of wrong arm medical errors and the use of

the NoNo Sleeve and its effectiveness in the prevention of wrong arm medical errors.

The Role of Research in the Reduction of Medical Errors

Research has played a significant role in medical error prevention for a number of deadly and costly errors and conditions resultant of those errors. Many protocols are regularly practiced as a result of this research. For instance, hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are conditions patients acquire within a hospital setting within 48 hours of their stay. Contraction of the infection is usually due to medical error, such as incorrect positioning of the patient and failure to maintain oral cleanliness of the patient. The development of the protocol resulted in hospitals achieving zero rates of VAP occurrences (The Pennsylvania Patient Safety Advisory, 2009). Moreover, these protocols are almost entirely dependent upon nurse compliance. (APIC, n.d.).

Nurses' Role in Preventing Medical Errors

Since the Institute of Medicine's report on hospitals and medical errors in 1999, the pressure has been on hospitals to increase attention to the prevention of medical errors (Colie, 2001). Centers for Medicare and Medicaid Services (CMS) (2013) expressed the importance of correcting medical errors in financial terms. Deductions for reimbursement of services are applied if it is found the procedure was necessary because of medical error.

According to Henneman, Gawlinkski, Blank, Henneman, Jordan, and McKenzie (2010), the research in how nurses contribute to prevention of medical errors is a fairly new area of study, although nurses' importance in error prevention was delineated a decade ago. Nurses are in a prime position to catch and prevent potential errors because of their continuous contact with the patients. Understanding factors in medical errors, system wide errors or

human errors help to define the role the NoNo Sleeve will play in the prevention of medical errors in this study.

Errors are common in emergency or intensive care situations, Henneman et al. observed. Henneman et al. stated that medical errors come from on-the-spot human errors, such as an error in judgment, and errors arising from systems of operation and procedures within a department. However, it is thought that most errors occur because of a failure in a hospital's procedural system. Henneman et al. found that nurses identified several factors that contribute to dangerous errors in emergency departments: increased volume, understaffing, and lack of resources. No longer do nurses know everything about patients as their attention is spread thin, observed Henneman et al. Another factor Henneman et al. reported was negative communications with other employees, often resulting in a lack of communication. Lack of team cohesion is a systemic and cultural area to address in correcting medical mistakes as well.

As Henneman et al. (2010) pointed out, since system flaws contribute to a majority of medical errors, nurses are on the front line of prevention of medical errors when medical protocols fail. In their study, Henneman et al. sought to discover the nurse's role in medical error prevention in the strategies they use to delineate mistakes, stop them from occurring, and fixing the mistakes so they do not occur a second time. The following is a list of their findings. It is important to keep in mind that the tactics Henneman et al. observed are influenced according to the working environments. For instance, observing the environment of the room has different meanings between emergency departments and intensive care units. In identification of errors, Henneman et al (2010) found the following to be important:

- Researching and learning patient history
- Learning the sort of plans physicians are likely or not likely to implement
- Checking over their patients' progress from the previous shift, such as medications administered
- Notating the patient care strategy and making adjustments where necessary
- Observing the condition of the patient and the condition of the patient's surroundings (for instance, a messy room could indicate a critically ill patient where the nurse had trouble meeting demands, or nurse's personal tendency towards disorganization, which could lead to medical errors)
- Protocols were not observed or learned
- Checking all patient plans and actions with colleagues to ensure a mistake was not made

To stop errors, Henneman et al. (2010) stated nurses expressed that because of negative experiences, such as not having enough self-esteem to stand up when they knew an error was about to occur, or having a colleague ignore their input, they employed some strategies to prevent errors from lack of knowledge or failure to follow protocols. The list below explains the strategies Henneman et al. found nurses utilize to prevent errors:

- Offering to help, and to lead by example, such as putting on a mask then offering their colleague one
- Using questions in order to elicit colleagues to think and explain why they implemented a plan of action
- Verbally communicating the urgency to a colleague or physician the need to cease

their actions, and discussing the matter outside of the patients' room

In order to correct mistakes, Henneman et al. (2010) discussed that nurses found that pain management was often a source of frustration. Since they are at the side of the patient for extended periods, they often see when the needs of the patient are not being met.

According to the Centers for Medicare and Medicaid Services (CMS) (2013b), meeting basic patient needs is a nonfatal aspect of medical mistakes that has increased in importance.

Hospitals and healthcare centers are eligible for funding from Medicare and Medicaid if they score well on the national standardized survey, the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS).

Mistakes can occur when patient needs are not met. For example, if a patient needs to eliminate and cannot access a nurse for a bedpan, injuries from falling are more likely to occur. This is an error resultant from negligence. Henneman et al. described the way nurses prevent these types of errors and other types of errors from occurring:

- Nurses actively pursue the solution with *determination* until the needs of the patient are met, such as the need to increase medication for pain management
- Physical gestures, such as physically blockading a person's passage, in order to get their point across
- Questioning recovery protocols when mistakes are observed
- Making suggestions to avoid humiliating other team members
- Referring to research to make their point
- Motivating other team members to collaborate to solve the problem, particularly when the problem was a systematic based problem

Nurses often use these strategies when protocol evidences a gap in safety. It is the hope that the NoNo Sleeve will be a simple addition to procedures and protocols that will help eliminate wrong arm medical errors and fit within the framework of how nurses prevent medical errors by providing a physical blockade to prevent wrong arm use.

Medical Errors and the ER

Many factors contribute to medical errors in the ER. While none of the sources mention wrong arm medical errors specifically, the factors described below are relevant in medical errors in the ER and the research available in their prevention. Swihart (2002) defined four different types of medical mistakes: “adverse events, close calls (near misses), intentional unsafe acts, and sentinel events” (p. 100). Schenkel (2000) reported on the types of mistakes that have been studied in medical error prevention.

In emergency medicine (EM), error detection has focused on subjects of high liability: missed myocardial infarctions, missed appendicitis, and misreading of radiographs. Some system-level efforts in error prevention have focused on teamwork, on strengthening communication between pharmacists and emergency physicians, on automating drug dosing and distribution, and on rationalizing shifts. (Abstract) Weingart, Wilson, Gibberd, and Harrison (2000) added that medical errors stem from mistakes in diagnosis, bad judgment calls, prescribing the incorrect medications, and undiagnosed conditions. Also, Weingart et al. (2000) referenced clinician inexperience as contributing to higher rates of medical errors. Swihart (2002) delineated the role of miscommunication, clinician inexperience, and documentation errors in the occurrences of medical errors. Miscommunication and lack of communication in every regard of medical practice, from intake to communications among staff members to

follow up with patients, can all contribute to medical errors, and emergency departments are particularly vulnerable to communication errors. Documentation errors are also a factor in medical errors and are most subject to litigation. As Swihart pointed out, medical documents contain the entirety of a patient's medical history and documentation of every action taken by the staff in charge of the patient's care. They are also considered legal documents and are often used to prove or refute litigation for medical error cases. Clinician inexperience, lack of communication, and documentation errors were all contributing factors in the wrong arm error that occurred this past year in the emergency department used in this EBP.

The patient's inherent risk factors for certain illnesses or medical mistakes factor into the occurrence of medical errors, Weingart et al. (2000) stated. Weingart et al. found that the more advanced the age of the patient, the higher the risk of medical errors. This is due to a decrease of robustness and the severity of illness. Also, case complexity was a factor in increased risk of medical errors, and geriatric patients are more likely to have multiple health problems, stated Weingart et al.

In emergency medicine, Weingart et al. (2000) explained that systematic problems are more likely to cause medical errors. As Weingart et al. pointed out, the nature of emergency services is situational, where continuity of care is not emphasized. Also, staffing practices encourage situational care rather than continuous care. Because of the personnel shortages in EDs, administrators fill staffing needs with temporary, part-time staff, which makes client-centered approaches a constant challenge.

However, Weingart et al. (2000) found that the study of medical errors is compromised. There isn't any standardization of procedures and data calculations, which

makes study in the medical error prevention field arduous. Moreover, study in medical errors and the medical error prevention field is rarely epidemiological. The Institute of Medicine published studies on error prevention, one in 1999, which began the flurry of literature available in medical error prevention and is one of only a handful of epidemiological studies available, according to Weingart et al. (2000). This makes it difficult for generalization of studies in medical error and error prevention. More research is needed to define systematic patterns within the practice of medicine in order to define how errors occur and how to prevent them.

Croskerry and Sinclair (2001) highlighted the need to examine all possible systematic errors rather than blaming individuals for errors. Croskerry and Sinclair expressed the need to change ER workplace culture to one that constantly finds ways to improve upon processes as well as engage in continuing education. This study uses staff education to elucidate the problem of wrong arm error for personnel in the emergency department and the proper use of the NoNo Sleeve and new triage procedures to accommodate its use. Also, the use of the sleeve provided corrective action while removing fault-blaming behaviors from its use and implementation.

One of the areas of medical error improvement that follows logically from systematic errors is in the area of teamwork and integrated medicine. Healthcare clinics that provide an integrated team of professionals working together to help the patient achieve their health goals was found to increase patient satisfaction, reduce medical errors, and provide continuity of care for the patient (Stokowski, 2012). The Institute of Medicine (2007) encourages a team approach to improving medical errors, particularly in medication, and to examine the

systematic factors that contribute to the occurrences of medical mistakes. Some devices have been produced to combat the problem of medical errors with radio frequency devices and barcoding systems being the most common and most commonly applied to medication and patient identification and medications to be administered. The next section describes these devices and some of the problems associated with their application.

Understanding Medical Error Prevention Devices and Tactics

Medical errors are thought to arise from several different sources: those arising from medical procedures and protocols and those arising from errors from individuals. At times, it is a combination of both. In certain situations, healthcare workers can adjust the procedures they perform in the course of direct care with a patient to prevent an event or illness from occurring. Examples include increasing patient rounding to hourly rounds to meet the basic needs of patients and prevent falls and accidental injuries from patients attempting to use the bathroom unassisted (Woodard and Sobaski, Abraham, Fillmore, McFall, and Davidhizar, 2008) or ensuring a ventilated patient is lying at a 45 degree angle to prevent ventilator-associated pneumonia (APIC, 2009).

In the 1990s, before barcoding and radio devices came about, the simple wristband was used for proper patient identification. Renner, Howanitz, and Bachner (1993) found when they surveyed over 700 hospitals, there was a certain degree of expected error, between 2 percent and 10 percent in some hospital settings, which produced errors in misidentification. Some of the types of errors Renner et al. found associated with the wristbands were missing wristbands, which accounted for half of all errors; multiple wristbands providing confusing or unclear information; and wristbands with unreadable, incomplete, or wrong information.

Dzik (2007) stated that barcoding and radio frequency devices have assisted the field of phlebotomy. While these technologies have also assisted other industries such as the airline industry, and even the grocery retail industry, these advances have not filtrated down to the rest of the hospital departments. At times, this is understandably so as Dzik stated, because there are some drawbacks with these technologies that make their application at the patient's side more arduous than simply passing groceries through a scanner. For instance, Dzik noted one shortcoming of barcode technology is that the barcode must be flat in order to be scanned properly. However, the barcode does not sit flat on a patient's wrist. The nurse must put down the IV bag in order to scan the barcode, which leaves the nurse without an available hand to assist the patient.

Notably absent from studies such as Dzik's (2007), is the inclusion of the prevention of wrong arm errors in this technology. Studies of this sort refer to patient identification. While this is an important aspect of medical error prevention and saves lives, it does not speak to wrong arm medical errors.

The NoNo Sleeve is an obvious deterrent to medical errors. It provides a physical blockade to the arm that should not be accessed for IVs, blood pressure, or blood collection. For the staff in the emergency department, the NoNo Sleeve will assist with improving identification of these patients in the hospital as well as eliminating any factors contributing to individual errors, such as lack of experience. Moreover, the NoNo Sleeve does not have any of the difficulties associated with barcoding and radio frequency. It utilizes a tactic nurses use for preventing medical errors when all other attempts fail—a physical blockade—as previously described. This study will strive to establish the NoNo Sleeve as an effective

deterrent of medical mistakes while increasing patient satisfaction, an area that has recently been highlighted in literature due to the HCAHPS.

There was a published research article found during the literature search on safety and medical errors in 62 emergency departments that was published by the *Annals of Emergency Medicine*. This research journal article focused on the incidence of medical errors across 62 EDs in urban settings in 20 different states in the U.S. This study identified 402 adverse events and 532 near misses during the review of almost 10,000 medical records and over 3,500 random ED staff surveys (Camargo et al., 2012). This study only focused on three medical conditions—myocardial infarction, asthma exacerbation, and joint dislocation—and the study's conclusion found that in emergency departments across the country, medical errors are quite common.

This study also surveyed the staff's opinions on medical errors and the importance of developing processes to reduce medical errors among emergency departments' patient populations. This lends credibility to the emergency department staff's opinion on the effectiveness of the NoNo Sleeve as the preferred method for indicating to staff not to use a particular arm for medical treatments. The next section will describe how the NoNo Sleeve will be incorporated into the emergency department's practice in an attempt to prevent wrong arm medical errors from occurring within the facility.

Solution Description

It is well documented in literature that medical errors exist in the healthcare industry across the U.S., especially in emergency rooms across the country where large volumes of patients and often-chaotic scenes increase the probability that errors can take place. This is why staff that work in high-pressure departments need processes and devices that quickly and safely identify patients that have special precautions. As Fedder (2001) pointed out, increasing communication with the patient needs to be utilized in order for quality care to be delivered. Increasing communication between patients and healthcare providers helps cut down on medical errors, Fedder stated. Patients and their families need to be looked upon as partners in their healthcare, where a patient's active participation in their own health is encouraged. However, patients can't always communicate with their healthcare providers. They have no choice but to rely on the expertise of the healthcare workers to help them recover. The NoNo Sleeve helps prevent medical errors stemming from personnel communications and patient communications. The following sections will describe the product (the NoNo Sleeve), the theory that serves as a basis for this study, and the decision-making process employed in evidence-based practice.

Product Description

According to nonosleeve.com (2013), the NoNo Sleeve is a simple red tube (the same color used for stop signs), made of cloth material and placed upon the arm of the patient to indicate that blood pressure should not be taken and blood collection should not be drawn. It also helps communicate to all members of staff across all shifts to not use the arm of a

patient because of AV fistulas or mastectomy. Staff can write the name of the patient on the sleeve, and which arm the sleeve should be on (left or right).

Created by nurses, the NoNo Sleeve provides insurance against some of the systematic errors addressed in the review of the literature and within the description of the problem of wrong arm errors. The NoNo Sleeve ensures that failure in systematic issues such as changes in shift communication and employee shortages, which limit a nurse's ability to maintain an intimate knowledge about a patient; and individual errors such as lack of experience and exhaustion, do not adversely affect patients. Also, the NoNo Sleeve is useful for gravely ill individuals in either emergency care or intensive care units (ICU), where it is easier to miss a message on the wristband of a patient or make mistakes because of the stressful conditions of these departments.

Theoretical Basis

As Polit and Beck (2012) indicated, theory-based approaches to research ensure best utilization of resources and protection to patients. For this study, Virginia Henderson's Nursing Need Theory was used as the driving motor for change. As nursingtheory.com (2013) explained, Henderson's model gave structure to the practice of nursing. The needs model postulated patients fall in between extremes on a health continuum. One extreme is that the patients cannot do for themselves due to illness or injury, and on the other end, the patients are healthy and independent. The nurse's role is to take care of all patients along this continuum, doing for gravely ill patients what they cannot do for themselves and taking care of patients until they can once again be independent. Nurses should do everything they can to promote the health of the individual until patients have improved their health.

One of the 14 points Henderson explains, a needs hierarchy drawn from other disciplines such as Maslow's needs hierarchy, is that it is the nurse's job to protect the patient from harm when the patient cannot protect himself (nursingtheory.com, 2013). This idea is central to this study. The intention behind the use of the NoNo Sleeve is to protect the patient from harm and provide a blockade to protect patients even when they temporarily do not have the ability to protect their arms themselves.

Evidence-Based Decision Making Process

While there is a noticeable lack of research available in wrong arm medical errors, a decision-making process often employed in evidence-based practice can still be used to make sound decisions in the implementation and utilization of the NoNo Sleeve. As Ridner (2007) expressed, nurses and other healthcare workers often follow procedures that are not evidence-based, but are instead based upon other knowledge, such as physiological knowledge, to create logically sound guidelines. An example of this, Ridner offered, was the set of guidelines often provided to breast cancer patients for preventing the occurrence of lymphedema, which is an understudied research area. Ridner correctly emphasized that until research proves guidelines erroneous, it is better that personnel follow those procedures than none at all, or procedures that do not logically draw from other knowledge bases. The next section, change models, will describe the evidence-based practices utilized for this study to ensure careful planning, successful implementation, sustained success, and patient safety in the implementation of the NoNo Sleeve.

Change Models

Evidence-based practice not only strives to use studies to implement procedural

changes and to solve problems, but to also follow a set of “gold standard” procedures that ensure maximum benefit and success of making a change in a healthcare setting while protecting and enhancing the health of the patients. The Sensemaking Model was used as a process to analyze the problem of wrong arm medical errors, in general and within the hospital. A gap analysis was performed to indicate the difference in present hospital practice and the desired practice. The PICOT format was used to create a research question. The Iowa Model of Evidence-Based Practice to Promote Quality of Care was used to formulate a series of actions to implement the use of the NoNo Sleeve.

The Sensemaking Model

The Sensemaking Model, Battles, Dixon, Borokanics, Rabin-Fastmehn, Kaplan, H. S. (2006) and Battles (2005) explains, describes the systematic process one reasons through problems and is considered an important part of evidence-based practice. The model contains a three-step process and is said to help promote patient safety. The three steps are described below along with the explanation of how these concepts were applied to this situation.

The first step, according to Battles (2005), is to identify the problem. The problem that occurred in the emergency department arose when a hemodialysis patient was identified as such on her chart, but the arm with the AV fistula was not notated on the chart. An inexperienced nurse did not recognize the AV fistula and punctured the fistula, mistaking it for a vein. Battles describes different types of errors, from life threatening to those that were caught in time. The error that occurred in the emergency department caused some pain and anguish for the patient and was costly to the hospital. It is not an error the hospital was willing to risk happening a second time.

The second step in the Sensemaking Model, Battles (2005) describes, is to identify from hospital records the potential factors that contribute to error events or near-miss events that present a hazard. The hazard was obvious from the event, the damage to the AV fistula. A review of the hospital's quality assessment record was performed over the last 180 days looking for any other reports of wrong arm errors involving patients.

The third step in the Sensemaking Model according to Battles (2005), is in analysis and risk assessment. Provided in Appendix C is the form used for the gap analysis in the ER. Upon completion of the form, it was found that the staff used inconsistent processes to identify patients that have upper extremities not to be used for medical treatments. Some nurses hung signs over beds, while other nurses followed hospital policy using a pink sticker on the patient's armband to signify that the patient had an upper extremity restriction. There was never a clear process on how it was communicated to other staff that the patient had a restricted upper extremity that was not to be used for medical procedures.

Root Cause Analysis

The process of a root cause analysis was explained by Swihart (2002). A root cause analysis is a process for delineating the factors contributing to medical error events, including events that almost occurred but were prevented, and events that did not cause harm but were committed. In order for a root cause analysis to be valid, it must not contain contradictions, must entail the personnel closest to the error plus the administration, all areas of inquiry must be satisfied, the literature on the subject must be researched, and corrective actions must be fully supported from the administrative staff to the healthcare employees.

Risk management performed a root cause analysis after the error involving the AV fistula. The hospital administration is included in this evidence-based study and has approved the research into the area of wrong arm medical errors and the most recent incident of the damage to the AV fistula. The review of the literature has been used in all decisions made to prevent errors from occurring in the future, and all salient points were demarked in the literature review. The entire department will partake in the new initiatives and the use of the NoNo Sleeve within its protocol routines.

Gap Analysis

The Agency for Healthcare Research and Quality (AHRQ) (n.d.) recommended that healthcare organizations conduct a gap analysis in order to promote change in healthcare practices within an organization. A gap analysis was performed for this error involving the patient having their AV fistula punctured accidentally by a novice nurse and the form is provided in Appendix C. A comparison between the emergency department's present practice and the desired implementation of the NoNo Sleeve was performed. Even though there is a lack of literature to support the use of the NoNo Sleeve, the sleeve will solve the identification problem the emergency department had this past year in identifying patients that have arms that should not be used for blood collection and blood pressure. Use of the NoNo Sleeve was determined to fix the systematic flaws in the emergency department's ability in ensuring upper extremities are identified and communicated to all staff.

In order to implement the NoNo Sleeve, a change will take place at the point of the intake/triage nurse's procedures. Presently, the triage nurse is to note the patient history on the intake form. However, since a compromised arm was missed this past year, it was found

that the best practice for preventing these errors, in addition to in-house training on the purpose and use of the NoNo Sleeve to increase awareness of the likelihood of compromised arms for hemodialysis patients and breast cancer patients, is to ensure that the sleeve will be administered and used for all eligible patients.

Iowa Model of Evidence-Based Practice to Promote Quality of Care

The evidence-based practice model used for this study is the Iowa Model of Evidence-Based Practice to Promote Quality of Care, as explained by Titler, Kleiber, Steelman, Rakel, Budreau, Everett, Buckwalter, et al. (2001) in the following way. The government agency, Agency for Healthcare Research and Quality, supports the use of this model as a way for organizations to improve quality of care. The model takes into account the point of view of healthcare workers and their organizations. The model is a results-based process, the result being the delivery of the best possible healthcare services to the patient, producing the best possible health status of the patient, and ensuring safe practice and delivery of healthcare services to the patient.

Moreover, this model is appropriate to use for this study because it takes into account how plans must be disseminated verbally and in written form (Wilson, Petticrew, Calnan, & Nazareth, 2010). While the lack of information on the subject of wrong arm medical errors prevents the utilization of the last part of this theory, to base improvements to medical protocols upon previous research, the usefulness of this model will be applied to the process of inquiry, application, and implementation of the changes, and monitoring progress to eliminate the problem of wrong arm medical errors. According to Dontie (2007), the prompt for using the Iowa Model of Evidence-Based Practice to Promote Quality of Care (Titler et al.,

2001) can be based upon a problem or upon discovering a new and more efficient way to improve the practice of healthcare delivery. The purpose for conducting this study is to solve the problem of wrong arm medical errors from occurring in the emergency department. The implementation plan will be based upon the following actions according to the Iowa Model of Evidence-Based Practice to Promote Quality of Care (Titler et al., 2001). Utilizing this methodology of change, Titler et al. expressed, will ensure that the wellness of the patient is at the center of all intended changes. The Iowa Model of Evidence-Based Practice to Promote Quality of Care prevents the waste of time and facility assets. It creates efficiency in the problem-solving and change implementation process, which allows researchers to focus upon the solution rather than the process of problem solving.

Organize the Facts Relating to the Intended Change

Dontie (2007) expressed that a good research question is needed in order to frame a plan for research and investigation. Dontie suggests using the PICOT format to formulate a research question for evidence-based practice.

PICOT Format Research Question. According to Dontie (2007), the PICOT format is desirable to use in comprising an evidence-based research question. The following is the PICOT question for this evidence-based question:

Nurses working in the emergency room feel that the use of the NoNo Sleeve on a “do not use” upper extremity reduces the risk of a medical error (such as IV start, lab draw, or blood pressure taken) as compared to using a sticker on the patient’s armband or a sign over the patient’s gurney over a five-week timeframe.

Identify the Stakeholders. In the Organizational and Cultural Readiness

Assessment section of this project, the stakeholders and their readiness to implement and sustain the use of the NoNo Sleeve in the emergency department (ED) were identified.

Appraise the Literature. According to Dontie (2007), the literature available upon the best practice should be evaluated. For this study, no appraisal could be performed because of the lack of information available on wrong arm medical errors and the NoNo Sleeve.

Make Recommendations. According to Titler et al. (2001), one should make recommendations according to what was learned in the research phase. The research of the literature, while barren of the specific subject of wrong arm medical errors, did reveal an important finding. In the past, wristbands were known to have a steady percentage of identification errors. Even though barcoding was implemented, barcoding systems are used mainly for medication rather than identification for blood drawing, as is the case in this emergency department, and was not at all instrumental in preventing the most recent transgression. The NoNo Sleeve addressed the issues with identifying vulnerable arms that should not be used for medical procedures such as blood pressure and blood collection.

Define How Recommendations Will Fit. In this step, Titler et al. (2001) suggests delineating how the recommendations can fit within the scope of practice of the healthcare facility. The appeal of the NoNo Sleeve is ease of use and simple implementation into ER procedures. The device requires minimal training yet has the potential to yield maximum efficiency. For a busy ER, the ease of use and simple implementation was a good fit.

Track Progress. Titler et al. (2001) and Dontie (2007) recommend tracking the progress of the implementation, noting successes and areas that necessitate improvement. Part of the

NoNo Sleeve program is a survey that was given to 37 nurses in the emergency room (provided in Appendix D). This survey was designed to elicit the nurses' opinions and feelings about the NoNo Sleeve as a viable solution in stopping medical errors involving at-risk extremities.

Analyze the Results. Titler et al. (2001) and Dontie (2007) expressed the importance of a continual process of assessing and analyzing the results of an evidence-based practice change. After implementation and four weeks of using the NoNo Sleeve, the data will be analyzed and adjustments made to the use of the NoNo Sleeve.

Periodic Reporting to the Stakeholders. The results of this EBP will be reported to the emergency department staff at the completion of the EBP. In the following section, the implementation plan for the NoNo Sleeve is described.

Implementation Plan

The implementation of the NoNo Sleeve in the emergency department will be as follows. This research project will track the initiation and incorporation of the NoNo Sleeve. The duration of this phase will be for five weeks. During these five weeks, the researcher will accomplish a list of goals for the initiation and evaluation of the NoNo Sleeve.

Steps for NoNo Sleeve Incorporation into the Emergency Department

Once the research is done and the project receives approval from administration, it is time to move the project forward and actually put the new process in place. The implementation of the NoNo Sleeve is no different and with the backing of the vice president of Patient Care Services, on December 1, 2013, the NoNo Sleeve was placed in the emergency room as a trial to protect patients from medical errors. The trial of the NoNo Sleeve was

scheduled to last five weeks or as long as the initial order of 50 NoNo Sleeves was exhausted. The NoNo Sleeve was only stocked in the emergency room; this meant that all patients receiving a NoNo Sleeve for this project would initiate from the nursing staff working in the emergency department. Since patients often leave the emergency department for diagnostic tests and admission to other departments, the other departments were to receive in-service training on the new process.

Pre NoNo Sleeve Rollout

Before the NoNo Sleeve was officially placed in the emergency department, there had to be some processes put in place to help ensure a successful implementation of the NoNo Sleeve. The first step in the process was to build excitement for the study. This was accomplished by rounding with a NoNo Sleeve flyer to inform the emergency department that they had been selected to trial a new patient safety product. This was done over two weeks at various times during the last two weeks of November in the emergency department. Once the initial introduction of the NoNo Sleeve is done with the emergency department, then will come the next phase of the implementation of the NoNo Sleeve. The emergency department staff will be trained in-house for all shifts (AM and PM). They will learn in what situations to use the NoNo Sleeve and how to use it. The educational materials that will be used are in Appendix D.

Steps for NoNo Sleeve Incorporation

Now that the emergency department staff had been introduced and educated on the NoNo Sleeve and when/how to use the product, it was time to release the NoNo Sleeve to the emergency department. The NoNo Sleeves were ordered from nonosleeve.com and the

company kindly sent 50 NoNo Sleeves at a cost of \$150 to the researcher. This put the cost of the NoNo Sleeve at \$3 per sleeve. Since this was a product trial and the NoNo Sleeve cost less than \$5, patients were not charged for the product. Once the NoNo Sleeves arrived, several processes had to be put in place to ensure that staff had access to the NoNo Sleeve and to track the distribution of the NoNo Sleeves to patients. The NoNo Sleeves arrived and it was decided that the sleeves would be stored in the charge nurse's desk. This provided one central location for the storage of the sleeves. Along the with NoNo Sleeves, the patient's NoNo Sleeve discharge instructions and a NoNo Sleeve patient tracking form (Appendix H) were also kept in a red NoNo Sleeve folder next to the NoNo Sleeves in a drawer in the charge nurse's desk. Involving the charge nurses in the emergency department provided a level of oversight to ensure that staff was marking on the NoNo Sleeve distribution list when a sleeve was being used on a patient.

With the NoNo Sleeves stocked in the emergency department and the staff educated on their use and purpose, the staff was able to place NoNo Sleeve on patients identified with extremities that could not be used for medical treatments. There were no restrictions placed on the staff to limit the use of the NoNo Sleeve. The triage or primary nurse will identify the arm that the sleeve will be placed on of the patient with an upper extremity that cannot be used. The instructions for use will be explained to the patient. The patient will be able to take the NoNo Sleeve home after discharge. During the NoNo Sleeve trial, a NoNo Sleeve product survey (Appendix E) was provided to the emergency department nurses to gauge their feelings on the NoNo Sleeve and if they had experienced a medical error involving extremities.

Soon after the NoNo Sleeve was introduced in the emergency department, other units were educated on the NoNo Sleeve. This was accomplished by rounding on other units on both AM/PM shifts and by presenting an informational session to the nurse managers. Informational flyers on the NoNo Sleeve were also placed throughout the various units in the breakrooms to serve as reminders to the hospital staff about the new product. During the five-week trial, the emergency department took the lead on ensuring the NoNo Sleeve was distributed to patients in need of a sleeve and ensuring that when a patient left the emergency department, the receiving unit was informed that the patient had a NoNo Sleeve on their extremity to protect it from being used for medical treatment. The entire hospital was completely supportive and the product was accepted without any barriers for use. The goal is to have NoNo Sleeve be the method used throughout the hospital as the method to identify and protect patients' extremities that are not to be used for medical treatments.

Documenting Progress

To track NoNo Sleeve use, all patients that were provided a NoNo Sleeve had their patient sticker placed upon the patient tracking form provided in Appendix H. This allowed the researcher to monitor how many NoNo Sleeves were distributed to patients for this study. Over the five-week timeframe of this EBP, the emergency department placed 45 NoNo Sleeves on patients that were identified by the nursing staff as having an "at-risk" arm that needed to be protected from use for medical procedures.

A survey for the nurses to complete is provided in Appendix E. Thirty-seven emergency department nurses filled out anonymous five-question surveys for this research project. By keeping the surveys anonymous, the researcher is hoping staff will feel safe in

answering the questions and truly reflect their opinions of medical errors and the NoNo Sleeve. This will help the researcher learn about their experience with the NoNo Sleeve.

Evaluation of Process

The nurses' surveys will be tallied, and the results will be tracked on the form in Appendix F. This will help the researcher discover if the end users of the NoNo Sleeve will deem the device useful and effective. Since the initial phase will be for five weeks, the data obtained and placed in the data collection form will then be represented in pie charts and percentages for each question on the survey. This will allow the researcher to quickly disseminate the qualitative properties of the responses from the nursing staff to see if the sleeve has made a difference in the months following this EBP. This survey will also measure the nurses responses to: accidentally using an "at risk arm" for medical procedures, having a patient remind a nurse not to use their "at-risk arm," forgetting to communicate an "at-risk" arm to coworker at handoff, and the general opinion of the NoNo Sleeve as the superior method to identify a patient with an "at risk arm." The charts reflecting the staff's answers to the survey questions are located in Appendix G. The goal of this EBP was to have the emergency department staff feel that the NoNo Sleeve was the best method to identify an "at- risk arm" over the other methods typically used to identify these extremities. When the results were tallied, the NoNo Sleeve had a "yes" response rate of 100% to question 5, which is whether or not the NoNo Sleeve is useful in avoiding errors to "at-risk arms." The NoNo Sleeve also captured a 97% "yes" result as being superior to current methods used to identify an "at-risk arm" in the emergency department.

The researcher feels with these two results, the NoNo Sleeve has won the staff over as

being the preferred method to identify “at- risk arms.”

An error report will also be run using Midas+ Solutions, a software program created for healthcare organizations that helps record the entirety of a hospital’s statistics and generates meaningful reports for hospitals to use in analyzing everything from financial status to error incidences (Midas+ Solutions, 2013). Between these sources of information, the analysis of the staff survey forms and the Midas+ generated report, a complete picture of the NoNo Sleeve will be obtained. The hard data is coupled with qualitative-like feedback to garner staff opinions on the effectiveness of the NoNo Sleeve according to their recent experiences. During this EBP, there were no reported errors in Midas+ involving “at-risk arms” or any reported errors involving the NoNo Sleeve.

Conclusions

A patient suffered a tragic incident of a wrong arm medical error that resulted in damage to a patient’s AV fistula while receiving care in the emergency department. While site selection is emphasized in most rudimentary training manuals, EDs are highly stressful environments due to overcrowding, understaffing, and increased demand, allowing errors to occur more often here than in the rest of the hospital. Upon completing a root cause analysis, using the review of literature which explored various areas of emergency medicine and medical errors, and examining similarities in wrong arm medical errors experienced in the emergency department, it was determined the error was due to a multitude of factors, the main being a systematic error and individual errors. A review of the literature also emphasized the need for further research for this understudied and underemphasized

medical error.

To prevent wrong arm medical errors from occurring and achieving zero rates of medical errors involving at risk upper extremities, the NoNo Sleeve was selected by 97% of the nursing staff that participated in this EBP as the superior method in preventing wrong arm medical errors and protecting the arms of patients who have a compromised arm due to breast cancer, AV fistulas, shunts, and catheters. The NoNo Sleeve, upon research of the literature, was found to work well within the nursing paradigm and tactics nurses use for preventing medical errors. While no research was available for the NoNo Sleeve and wrong arm medical errors, evidence-based protocols were utilized to ensure thoroughness in research, soundness of judgment in use the sleeve, successful implementation and continuation of the use of the new protocol, continuous tracking and reporting upon progress, and safety to the patient. Hopefully, long-term success of this project will reveal the effectiveness of the NoNo Sleeve and encourage further research into wrong arm medical errors.

References

- Agency for Healthcare Research and Quality (AHRQ). (n.d.). *Instructions: Gap analysis*. Retrieved from <http://www.ahrq.gov/professionals/systems/hospital/qitoolkit/d5-gapanalysis.pdf>
- Arbique, J. C. (2008). Venipuncture model 6: Venipuncture complications and special circumstances. *Arbique-Rendell On Site Training and Consulting*. Retrieved from http://arotraining.com/images/Documents/Venipuncture%20Module%206_Venipuncture%20Complications%20and%20Special%20Circumstances.pdf
- Association for Professionals in Infection Control and Epidemiology (APIC). (2009). *Guide to the elimination of ventilator associated pneumonia*. Retrieved from http://www.apic.org/Resource_/EliminationGuideForm/18e326ad-b484-471c-9c356822a53ee4a2/File/VAP_09.pdf
- Battles, J. B. (2005). Sense making and patient safety event data. In R. Tartaglia, S. Bagnara, T. Bellandi, & S. Albolino (Eds.), *Healthcare systems ergonomics and patient safety*. London, UK: Taylor & Francis Group.
- Battles, J. B., Dixon, N. M., Borokanics, R. J., Rabin-Fastmehn, B., & Kaplan, H. S. (2006). Sensemaking of patient safety risks and hazards. *Health Services Research*, 41(4), 1555–1575.
- Camargo, C., Tsai, C., Sullivan, A., Cleary, P., Gordon, J., Guadnoli, E., Kaushal, R., ... & Blumenthal, D. (2012). Safety climate and medical errors in 62 U.S. emergency departments. *Annals of Emergency Medicine*, 60(5), 555–563.
- Centers for Medicare and Medicaid Services (CMS). (2013a). *Details for title: CMS issues FY 2014 inpatient payment rule*. Retrieved from <http://www.cms.gov/Newsroom/MediaReleaseDatabase/Press-Releases/2013-Press-Releases-Items/2013-08-02.html>

Centers for Medicare and Medicaid Services (CMS). (2013b). *HCAHPS survey*. Retrieved from

<http://www.hcahpsonline.org/files/HCAHPS%20V8.0%20Appendix%20A%20-%20HCAHPS%20Mail%20Survey%20Materials%20%28English%29%20March%202013.pdf>

CNA Health Pro (n.d.). Emergency department liability: Sound risk control strategies can reduce

misdiagnosis. *Vantage Point*, 08(3), 1–20. Retrieved from http://www.cna.com/vcm_content/CNA/internet/Static%20File%20for%20Download/Risk%20Control/Network%20Security/emergencydepartmentliabilitysoundriskcontrolstrategiescanreducemisdiagnosis.pdf

Colie, R. C. (2001). Quality pays: A case for improving clinical care and reducing medical errors.

Journal of Healthcare Management, 46(3), 156–160.

Cohen, S. R., Payne, D. K., & Tunkel, R. S. (2001). Lymphedema: Strategies for management.

Cancer, 92(Supplement 4), 980–987. doi:10.1002/1097-0142(20010815)92:4+<980::AID-CNCR1410>3.0.CO;2-E

Croskerry, P., & Sinclair, D. (2001). Emergency medicine: A practice prone to error? *CJEM*,

3(4), 271–6.

Dontie, K. J. (2007). Evidence-based practice: Understanding the process. *Topics in Advanced Nursing*

Practice eJournal. Retrieved from http://www.medscape.com/viewarticle/567786_4

Dzik, S. (2007). Radio frequency identification for prevention of bedside errors. *Transfusion*,

47(s2), 125S–129S. doi:10.1111/j.1537-2995.2007.01367.x

Fedder, M. S. (2001). The role of patients and families in reducing medical errors. *Medsurg*

Nursing, 10(4), 163–164.

Fistula First. (2009). *Preparing for an AV fistula*. Retrieved from

<http://fistula.memberpath.com/Patients/PreparingforanAVFistula.aspx>

Grim, S. A. (2001). Six sigma business strategy aims at improving quality of care. *Journal of Healthcare Compliance*, May-June, 73–74.

Henneman, E. A., Gawlinski, A., Blank, F. S., Henneman, P., Jordan, D., & McKenzie, J. B. (2010).

Strategies used by critical care nurses to identify, interrupt, and correct medical errors. *American Journal of Critical Care*, 19(6), 500–509.

Institute of Medicine. (2007). Preventing medication errors. In P. Aspden, J. A. Wolcott, J. L. Bootman, & L. R.

Cronenwett (Eds.), *Quality chasm series*. Washington, DC: The National Academies Press.

Johns Hopkins Medicine. (n.d.). *Lymphedema following a mastectomy*. Retrieved from

http://www.hopkinsmedicine.org/healthlibrary/conditions/breast_health/lymphedema_following_a_mastectomy_85,P00148/

Midas+ Solutions. (2013). Who we are. *Xerox*. Retrieved from

<https://www.midasplus.com/pages/AboutUs/AboutUs.aspx>

National Center for Biotechnology Information. (2011). *Cellulitis*. Retrieved from

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001858/>

Nursingtheory.com. (2013). Nursing theory. Retrieved from [nursing-theory.org/theories and-models/henderson-need-theory.php](http://nursing-theory.org/theories-and-models/henderson-need-theory.php)

Pennsylvania Patient Safety Advisory. (2009). Successful Reduction of Ventilator-Associated Pneumonia. *Pa Patient Saf Advis*, 6(2):63-8.

Phillips, N. (2012). Lymphangitis. *Healthline*. Retrieved from

<http://www.healthline.com/health/lymphangitis>

- Poe, S., & White, K. M. (2010). *Johns Hopkins nursing evidence-based practice: Implementation and translation*. Indianapolis, IN: Sigma Theta Tau International.
- Polit, D. F., & Beck, C. T. (2012). *Nursing research: Generating and assessing evidence for nursing practice* (9th ed.). Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins.
- Renner, S. W., Howanitz, P. J., & Bachner, P. (1993). Wristband identification error reporting in 712 hospitals. *Arch Pathol Lab Med*, 117, 573–577.
- Ridner, S. H. (2007). Breast cancer lymphedema: Pathophysiology and risk reduction guidelines. *Oncology Nursing Forum*, 29(9). doi:10.1188/02.ONF.1285-1293
- Schenkel, S. (2000). Promoting patient safety and preventing medical error in emergency departments. *Academic Emergency Medicine*, 7(11), 1204–1222. doi:10.1111/j.1553-2712.2000.tb00466.x
- Shaub DiLorenzo, M., & King Strausinger, S. (2010). *Blood collection: A short course*. Philadelphia, PA: F. A. Davis and Company.
- Shih, Y-C. T., Xu, Y., Cormier, J. N., Giordano, S., Ridner, S. H., Buchholz, T. A., Perkins, G. A., et al. (2009). Incidence, treatment costs, and complications of lymphedema after breast cancer among women of working age: A 2-year follow-up study. *American Society of Clinical Oncology*, 27(12). doi:10.1200/JCO.2008.18.3517 JCO
- Stokowski, L. A. (2012). Nurse practitioners and medical homes: A natural fit. *Medscape*. Retrieved from <http://dhhs.ne.gov/publichealth/licensure/documents/MedicalHomes.pdf>
- Swihart, D. (2002). First do no harm: Preventing medical errors. *The Learning Scope*, 4(6), 100.
- The Internet Pathology Laboratory for Medical Education. (n.d.). Blood collection: Routine venipuncture and specimen handling. *Mercer University School of Medicine*. Retrieved from <http://library.med.utah.edu/WebPath/TUTORIAL/PHLEB/PHLEB.html>

- Titler, M. G., Kleiber, C., Steelman, V. J., Rakel, B. A., Budreau, G., Everett, L. Q., Buckwalter K.C., et al. (2001). The Iowa model of evidence-based practice to promote quality care. *Crit Care Nurs Clin North Am*, 13(4), 497–509.
- Trzeciak, S., & Rivers, E. P. (2003). Emergency department overcrowding in the United States: An emerging threat to patient safety and public health. *Emerg Med J*, 20, 402–405. doi:10.1136/emj.20.5.402.
- Weingart, S. N., Wilson, R. M., Gibberd, R. W., & Harrison, B. (2000). Epidemiology of medical error. *BMJ*. 2000 March 18; 320(7237): 774–777. PMCID: PMC1117772.
- Wilson, P. M., Petticrew, M., Calnan, M. W., & Nazareth, I. (2010). Disseminating research findings: What should researchers do? A systematic scoping review of conceptual frameworks. *Implementation Science* 5:91. doi:10.1186/1748-5908-5-91.
- Woodard, J. (2009). Effects of rounding on patient satisfaction and patient safety on a medical-surgical unit. *Clinical Nurse Specialist*, 23(4), 200–206. doi:10.1097/NUR.0b013e3181a8ca8a.

Appendix A

Attributes of a Professional Practice Environment

Staff Evaluation

Following are 22 attributes describing extreme degrees of a professional practice environment. Each attribute has been placed on a **continuum** reflecting the two extremes. Please score how your unit performs on the continuum as it is best represented today.

1	Each staff member delivers care in a manner he/she sees fit. Patient outcomes are not viewed as important as getting all the tasks done.	0 1 2 3 4 5 6 7 8 9 10	Staff actions are driven by the Core Beliefs, unit vision, and patient's unique needs and requests
2	Destructive communication is predominant: backstabbing, negative comments, telling lies, pitting one colleague against another belittling	0 1 2 3 4 5 6 7 8 9 10	Staff consistently uses open and supportive communication. Dialogue skills are used to fully understand perspectives and issues.
3	Staff are self-focused: decisions are made based on what is best for the staff at the expense of what is best for the patient.	0 1 2 3 4 5 6 7 8 9 10	Staff consistently base decisions on what is best for the patient
4	Past patterns (the way we have always done things) dictate when & what care is given. There is a lack of judgment regarding who can most effectively provide care	0 1 2 3 4 5 6 7 8 9 10	Care is planned and delivered based on priority of needs and appropriate delegation within the team
5	Staff have a tendency to practice in isolation and are not open to colleagues' feedback. Staff feel insulted if anyone questions their practice	0 1 2 3 4 5 6 7 8 9 10	Staff seek input outside of themselves regarding care practices. Staff is open and welcome feedback from others. Peer evaluations are supported.

6	The general attitude that staff know what is best for the patient. Patients are not involved in planning or prioritizing their care	0 1 2 3 4 5 6 7 8 9 10	On every shift staff consistently establish mutual goals and plans of care with the patient and Family
7	Staff routinely take sides or set up adversarial relations with others	0 1 2 3 4 5 6 7 8 9 10	Staff own their behavior and are accountable for their actions
8	Asking for help or consultation is discouraged. Asking for help is seen as ineptness	0 1 2 3 4 5 6 7 8 9 10	Staff frequently use experts/consultants or seek out the opinion of knowledgeable team Members
9	Staff look at those outside their unit with suspicion.	0 1 2 3 4 5 6 7 8 9 10	The unit acts as an open system. Involvement from multiple departments and disciplines is Welcomed
10	Staff play the victim/rescuer roles. Mediocre performance is covered up and thus allowed to continue.	0 1 2 3 4 5 6 7 8 9 10	Individual and unit development is emphasized. There is a common goal to be the best one can be. All staff participate in ongoing development – both personal and clinical.
11	Staff do not seek and use appropriate resources. Staff are left to find solutions independently.	0 1 2 3 4 5 6 7 8 9 10	Staff consistently demonstrate appropriate use of available resources
12	How our unit is different from others is emphasized. As a result, the unit has limited partnerships with others within the organization	0 1 2 3 4 5 6 7 8 9 10	Networking is valued. Staff look for similarities with others. Staff participate in house wide performance improvement groups
13	Staff are ridged, unbending, and not open to new ideas	0 1 2 3 4 5 6 7 8 9 10	Staff are flexible. They experiment with new and different approaches and are open to trying new ways of doing things
14	Staff are usually pessimistic and negative about change efforts	0 1 2 3 4 5 6 7 8 9 10	Staff are optimistic and positive about change efforts. They ask, “How can we make this work?”

15	Staff solely focus on the physical needs of	0 1 2 3 4 5 6 7 8 9 10	Delivery of care supports holistic care of each
16	Decision-making is based on authority rules, majority rules, and vote taking. Input into decision making is restricted to those present in the room at the time	0 1 2 3 4 5 6 7 8 9 10	Decision making process uses consensus. Input from 1:1 contacts are brought into decision making
17	Staff lack professional initiative. Staff attend only mandatory in-services. Entitlement mentality is pervasive	0 1 2 3 4 5 6 7 8 9 10	Staff consistently demonstrates professional initiative. A learning attitude prevails
18	Staff believe "others" are responsible when things do not go as planned. Staff believe they have no power or influence on organizational decisions	0 1 2 3 4 5 6 7 8 9 10	Staff believe "all" are responsible and demonstrate intrinsic ownership. Staff believe they have the power to make a difference.
19	Patient care is driven by policy and usual patterns of practice	0 1 2 3 4 5 6 7 8 9 10	Patient care is driven by mission, vision, best care standards, and individual patient needs
20	Staff do not participate in the organization or management of their unit. Staff see manager as responsible for everything and blame him/her if the work environment is not to their liking.	0 1 2 3 4 5 6 7 8 9 10	Staff actively practice and participate in shared- governance. Manager is accountable for administrative issues. Partnership council is accountable for the quality of care delivered to patients
21	Patients do not routinely participate in planning their care. Documentation is frequently left to the end of the shift. Evaluation of patient progress and teaching documentation is frequently missed	0 1 2 3 4 5 6 7 8 9 10	Staff plan their patient's care with the patient. Staff routinely assess and update the patient plan of care, evaluate outcomes, and assess need for patient/family education. Documentation is completed when the care is provided
22	Management is not fully aware of practice issues and inconsistently provides adequate resources to support professional practice	0 1 2 3 4 5 6 7 8 9 10	Management supports the work of the partnership councils by ensuring adequate resources to support professional practice

Source: Wesorick, Bonnie. Partnership Field Book. Grand Rapids: Practice Field Publishing, 1997

Appendix B

Methodological Matrix and Evaluation Matrix

Author	Pub Year	Country	Theory	Dependent Variables	Independent Variables	Study Design	Sample Size	Sampling Method	Data Collection
Camargo, C. et al.	2012	USA	Quantitative	Medical errors	Adverse events	2-level random – effect model National Emergency Department Safety Study	9,821 retrospective chart reviews 3,562 staff surveys	Random staff surveys Chart reviews of MI, asthma, joint dislocations	Data was performed with Stata version 10 software and presented in proportions
Henneman, E., Gawlinski, A., Blank, F., Henneman, P., Jordon, D., & Mckenzie, J.	2010	USA	The Eindhoven Model	N/A	Focus groups		5 focus groups consisting of 20 nurses per focus group	Audio taping focus groups of nurses discussing strategies to identify, interrupt, and correct medical errors	Data was collected by posing predetermined questions to 5 focus group sessions. The questions were developed by the researchers on the basis of their clinical experience, theoretical knowledge of error recovery, and results of a study on medical error recovery in the emergency department.

Appendix C

Gap Analysis

Best Practice	Best Practice Strategies	How Your Practices Differ From Best Practice	Barriers to Best Practice Implementation	Will Implement Best Practice (Yes/No, Why Not?)
Identify At Risk Arms	Consistent handoff between caregivers	Not consistent in the ED	Ensuring staff buy in to the process	NoNo Sleeve will bring one method to communicate at-risk arms
	High visual identification product	Use of signs when staff remember to post them over bed	Depending on the staff to remember to hang sign	NoNo Sleeve is bright red and stays with the patient as a constant reminder of the “at- risk” arm

Appendix D

Staff Education Handout

The NoNo Sleeve was developed with patient safety in mind!

Who Should Use the *NoNo Sleeve*?

Any patient who has an arm that cannot be used for labs, IV placement and blood pressures. Examples:

- AV fistula or impending placement of AV fistula
- Post mastectomy with axillary lymph node biopsy or dissection
- Pre and post PICC line placement

Features:

- Bright red – visual reminder - the universal color for **STOP**
- Fits over the forearm
- Latex free material
- **Non-compressive fit** - *NoNo Sleeve* is not intended to be used as a compression sleeve. Two fingers should fit comfortably under the sleeve at all times while in use.
- *NoNo Sleeve* logo is located at the bottom of the arm for maximum visibility and allows the patient/clinician to write their name and circle the affected side

Instructions:

- Remove from packaging
- Document patient name on designated line
- Circle “left” or “right” to indicate at risk arm
- Apply *NoNo Sleeve* to at risk arm with the logo placed on the anterior wrist
- Confirm two fingers can fit comfortably under the *NoNo Sleeve*
- Educate patient on the purpose of the *NoNo Sleeve* – reminding them to leave the *NoNo Sleeve* intact throughout hospitalization
- *NoNo Sleeves* are intended for arm use only
- Document according to hospital policy and procedures



Appendix E

NoNo Sleeve Staff Survey

1. Have you ever accidentally used or been aware of the use of an “at risk” arm for medical procedures?

Yes No

2. Has a patient ever had to remind you not to use their “at risk” arm?

Yes No

3. Have you ever forgotten to report to your coworker that the patient had an AV fistula or mastectomy?

Yes No

4. Do you think the NoNo Sleeve is superior to the current methods use to protect “at risk” arms, e.g., signs above beds and/or no stick wristbands?

Yes No

5. Do you think the NoNo Sleeve will be helpful in avoiding medical errors to “at risk” arms?

Yes No

Appendix F

Data Collection Form

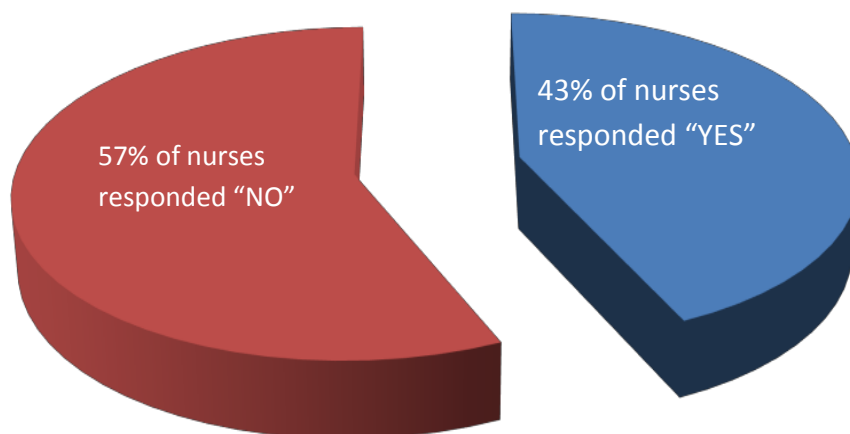
Data Analysis Form		
Staff Survey Results		
Question	Yes	No
1. Have you ever accidentally used or been aware of the use of an “at risk” arm for medical procedures?	16	21
2. Has a patient ever had to remind you not to use their “at risk” arm?	33	4
3. Have you ever forgotten to report to your coworker that the patient had an AV fistula or mastectomy?	23	14
4. Do you think the NoNo Sleeve is superior to the current methods use to protect “at risk” arms, e.g., signs above beds and/or no stick wristbands?	36	1
5. Do you think the NoNo Sleeve will be helpful in avoiding medical errors to “at risk” arms?	37	0

Appendix G

Survey Results - Charts

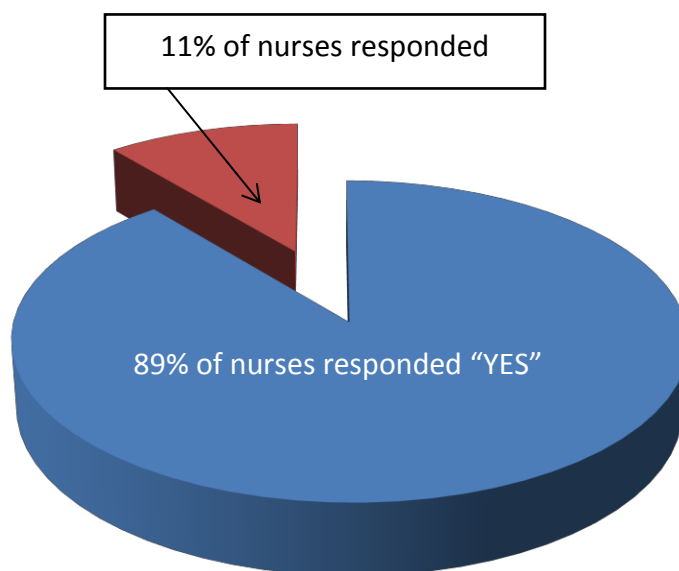
1. Have you ever accidentally used or been aware of the use of an “at risk” arm for medical procedures?

Yes	No
16	21



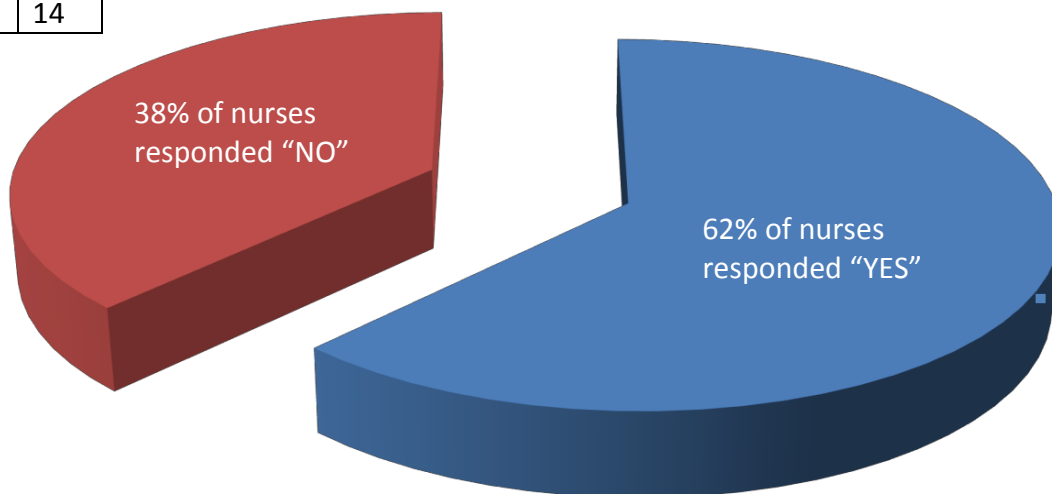
2. Has a patient ever had to remind you not to use their “at risk” arm?

Yes	No
33	4



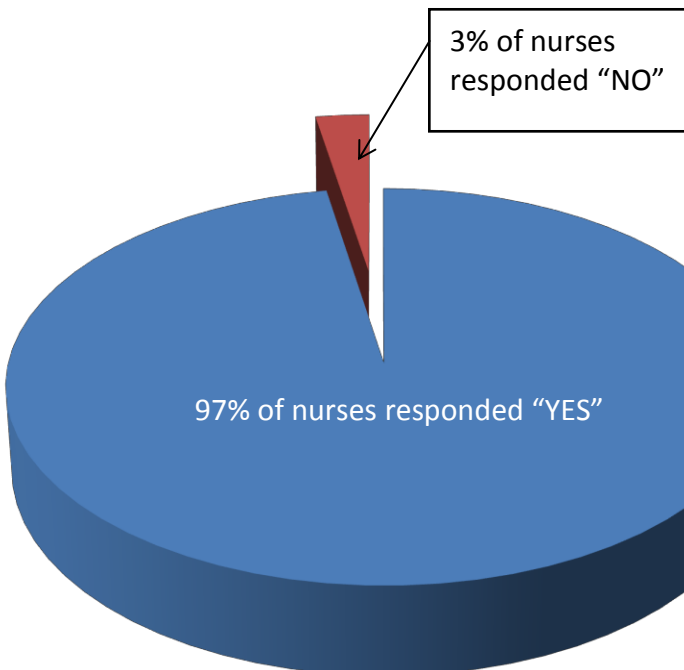
3. Have you ever forgotten to report to your coworker that the patient had an AV fistula or mastectomy?

Yes	No
23	14



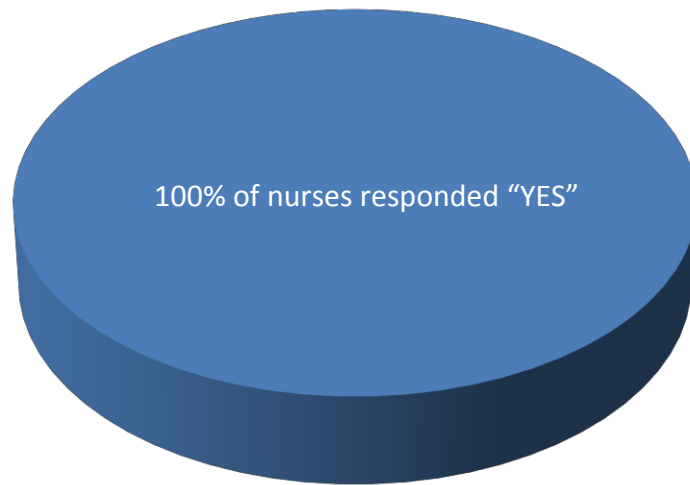
4. Do you think the NoNo Sleeve is superior to the current methods used to protect "at risk" arms, e.g., signs above beds and/or no stick wristbands?

Yes	No
36	1



5. Do you think the NoNo Sleeve will be helpful in avoiding medical errors to “at risk” arms?

Yes	No
37	0



Appendix H

NoNo Sleeve Patient Collection Form

NoNo Sleeve Sticker	Patient Sticker

Author Note

I would like to thank the nursing staff of the emergency department who participated in the NoNo Sleeve evidence-based project to help ensure that patients are free from medical errors involving upper extremities that are not to be used for medical treatment.

