Summer 2023

Improving Patient Safety Associated with Intramuscular Injections by Educating Nurses on Recommended Practice: A Quality Improvement Project

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Nursing 952: Clinical Nursing Leadership

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August 1, 2023

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Abstract

Background: Intramuscular (IM) injections are used to deliver medication quickly and efficiently. However, the Centers for Disease Control has changed their guidelines on how to administer medication using the IM injection route. A quality improvement was conducted at Wildcat Hospital that focused on increasing healthcare professionals' IM injection knowledge.

Methods: A pre-intervention survey was administered to RNs, LPNs, and Paramedics to assess their knowledge and IM injection technique. After the initial survey, an educational PowerPoint was presented to staff and management. This was followed with pamphlets that reviewed the information covered in the presentation. A post-intervention survey was administered to measure the effects of the intervention.

Results: This quality improvement project did not influence the use of the Z-track method, massaging the injection site, or aspirating before injection. However, after the intervention there was a 27% increase in vastus lateralis injection site usage. Additionally, there was a 19% increase in ventrogluteal injection site usage. Finally, there was a 36% increase in recognizing that that the ventrogluteal injection site is safe and is unlikely to damage the sciatic nerve.

Conclusion: This QI project positively influenced some aspects of IM injection technique. It increased the usage and knowledge of the vastus lateralis and ventrogluteal injection sites. Additional Plan Do Study Act (PDSA) cycles should be executed to further improve IM injection technique.

Keywords: Intramuscular injection, emergency department, RN education, Registered Nurse, Quality Improvement, Emergency Room, injection technique, aspiration, Z-track, Emergency Department

Introduction

Problem Description

Intramuscular (IM) injections are an important and essential skill that nurses must be able to administer effectively. IM injections are a common way to administer medications and involve inserting a needle into the musculature to deliver medication (Frandsen et al., 2021). The purpose of IM injections is to onset the action of the medication. In addition, intramuscular injections allow for a prolonged release of medication which may be necessary for medications such as vaccines. IM injections also allow for relatively larger volumes of medication to be administered when compared to subcutaneous injections (Frandsen et al., 2021). The procedure is relatively quick when compared to intravenous therapy, a patient can receive an injection and be discharged quickly. Some common IM injections administered in the emergency department setting include antibiotics such as ceftriaxone, vaccines such as a tetanus shot, or antipsychotics such as haloperidol.

IM injections are efficient and are typically well-tolerated by patients (Frandsen et al., 2021). However, healthcare professionals need to follow proper injection techniques to minimize risk of harming the patient (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). Some important steps include proper needle size and length selection, injection site selection, and identifying anatomical landmarks. There are also patient specific factors that need to be taken into account. Factors to take into consideration include muscle mass, skin imperfections such as scarring or burns, and tolerance of injections.

Both the Centers for Disease Control (CDC) (*ACIP Vaccine Administration Guidelines for Immunization,* 2023) and the World Health Organization (WHO), have recently updated the guidelines regarding IM injections. Such changes include the removal of aspiration before

injection. Aspiration of the syringe is thought to alert the healthcare professional to potential and accidental venous puncture (Baran et al., 2022). Recent literature has called into question the reliability and necessity of aspiration (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). Additionally, both the CDC and WHO updated what injection sites are recommended. This includes the addition of the ventrogluteal site and the removal of the dorsogluteal site. The ventrogluteal site minimizes risk by being a greater distance away from large vasculature and nerves. On the contrary, the dorsogluteal site carries additional risk due to closer proximity.

While at Wildcat Hospital the author observed on multiple occasions that the staff were not following best IM injection practices recommended by the CDC and WHO. Both paramedics, and registered nurses at Wildcat hospital continue to aspirate the plunger when administering IM injections and choose the dorsogluteal site.

Available Knowledge

A literature review was conducted to explore current evidence regarding the proper administration of IM injections. Three databases were utilized to gather evidence, Cumulative Index to Nursing and Allied Health Literature (CINAHL) Complete, Semantic Scholar, and Medline. Key search terms used were vaccination, intramuscular injection, IM injection, aspiration, protocol, nurses, and nursing staff. Boolean operators used were “AND” as well as “OR”. Year limits were applied to range from 2018 to 2023. Papers that were peer reviewed were included. Papers not written in English were excluded. In addition, an available PDF limiter was also utilized in Semantic Scholar. There were 70 potential papers available after initial exclusion. An additional 50 papers were reviewed and excluded. 19 papers maintained too narrow of a patient population that were limited to neonates. 16 papers that were not written in

English were filtered out in the initial exclusion process.10 papers were excluded because they related to aspiration in different procedures other than IM injections. As well as other types of injections such as subcutaneous. Five papers were duplicates and as such were excluded. After exclusion 20 articles were analyzed and seven articles were selected to be included in the literature review (Appendix A).

The operational definition of aspiration of the injection is when a healthcare professional draws back on the plunger of the syringe for 5-10 seconds after insertion of the needle, but before injection of the medication (Baran et al., 2022; Sepa, et al., 2014). If there is blood return in the syringe, the healthcare professional would then stop the administration process. Blood return signifies that the needle is not in a muscle but is instead in a blood vessel. The healthcare professional would then select a different injection site and repeat the process (Baran et al., 2022). In the past, aspirating before injecting was common practice and taught in nursing school. The current guidelines state that healthcare professionals should focus on accurate placement of the needle using anatomical landmarks and inject the medication as soon as the needle is in the muscular tissue (*ACIP Vaccine Administration Guidelines for Immunization,* 2023).

It is essential to understand the indications to give an IM injection instead of a subcutaneous (SC) injection. Subcutaneous injections are used for medications that only require a low volume to be effective, such as heparin (Frandsen et al., 2021). SC injections require a short 5/8ths inch needle and might be less painful to the patient. However, some drawbacks of utilizing SC injections include the fact that only 1mL of solution can be given, it has the slowest absorption rate of the injections, and medications are irritating to the tissue. IM injections allow for a larger volume to be injected (up to 3mL per site), have quicker absorption than SC injections, and take less time. The disadvantage of an IM injection is the potential of damaging a

vessel or nerve if the injection is done incorrectly. There might be more pain felt by the patient who receives an IM injection (Frandsen et al., 2021).

Some medications, such as epinephrine, if given in a vessel such as a vein or artery, could harm the patient (Frandsen et al., 2021). According to the CDC, major blood vessels are not present at current recommended injection sites, such as the deltoid muscle and the vastus lateralis. In addition to the change in syringe manipulation, the CDC and WHO have updated the recommended injection sites. As part of these updates, the dorsal gluteal was removed from the list of recommended sites for IM injections, and the ventrogluteal was added. The changes were made to ensure there are fewer blood vessels and nerves in the area of injection (*ACIP Vaccine Administration Guidelines for Immunization,* 2023)). Due to possible complications associated with dorsogluteal injections, most healthcare facilities have removed the dorsogluteal as a recommended injection site (Frandsen et al., 2021). The main reason behind the procedural change is to avoid unnecessary pain experienced by the patient (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). There are multiple ways to reduce pain during the procedure, including injection without aspiration, which has been shown to decrease perceived pain (Gol, 2020).

An interesting observation was made by Gol (2020) while conducting their randomized controlled trial, which demonstrated that there was a direct positive correlation between perceived pain and fear of the injection. In the self-report survey, patients who were more fearful reported higher levels of pain than their peers. Increased fear being correlated to increased pain is not a new discovery; in 2003 a similar study was conducted by Nir (2003) that found similar results. Another descriptive study by Turgut (2022) had results that further confirmed the author's observation that increased fear of injection correlates to increased associated pain. One

limitation of all three of these studies is the reliance on self-reporting of both pain and fear to gather data. Self-reporting can be unreliable for two main reasons. Firstly, patients may purposefully under- or over-report their symptoms. Secondly, everyone perceives pain differently, and as a result, pain cannot be measured objectively. Another limitation of these studies is the focus on pediatric and young adult populations, which does not accurately reflect the greater population. However, having three randomized, controlled trials focusing on similar populations and attaining similar results demonstrates congruence.

A perceived benefit of aspiration is that the healthcare professional is able to ensure that the medication will not be given intravenously (Crawford & Johnson, 2012). Some medications, such as epinephrine, have different concentrations depending on the route of administration. With epinephrine, there is the intravenous concentration typically used in a cardiac event, and the more potent IM dose. The IM dose is typically used for an anaphylactic reaction. If the IM dose is mistakenly given, the patient could have a cardiac event. The meta-analysis by Crawford and Johnson (2012) found there were mixed results regarding the effectiveness of aspiration across 23 studies. The authors recommended the discontinuation of aspiration because the evidence presented demonstrated that there was no meaningful positive impact when aspirating the syringe (Crawford & Johnson, 2012). In addition, aspiration has been known to cause additional pain to the patient. A narrative review by Sepah et al. (2014) came to a similar conclusion; that there is no strong evidence for routine use of aspiration. However, for some medications that carry a higher risk of complications, aspiration may be a beneficial safeguard that could prevent a serious reaction (Sepah et al., 2014).

A common technique for a healthcare professional to employ prior to administering an injection is to apply a topical anesthetic such as lidocaine gel (Salari et al., 2018). However,

nonpharmacological methods of reducing pain may be preferred by physicians, nurses, patients, and parents. Nonpharmacological techniques, such as applying traction or the use of ice to numb the intended injection site, have shown to be effective (Salari et al., 2018). An interesting device called ShotBlocker, a horseshoe shaped device with numerous contact points, has been shown to reduce anxiety and pain in pediatric populations (Aykanat Girgin et al., 2020). ShotBlocker states that the design of the device stimulates the nerves of the surrounding tissue. Stimulation of the surrounding nerves distracts the patient from pain signals, ultimately resulting in less pain perceived by the patient. Another more effective device called Buzzy utilizes vibration and a small reusable cold pack (Aykanat Girgin et al., 2020). Both the ShotBlocker and Buzzy reduced not only pain, but also anxiety (Aykanat Girgin et al., 2020; Salari et al., 2018). One criticism of the trial is that only the pediatric population were evaluated. However, both the ShotBlocker and Buzzy can be utilized in adult and geriatric populations. (Aykanat Girgin et al., 2020; Salari et al., 2018).

Current CDC guidelines recommend the deltoid, the vastus lateralis, and the ventrogluteal as injection sites (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). The dorsogluteal was removed from the CDC's list of recommended injection sites due to close proximity to the sciatic nerve and inferior gluteal artery (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). When selecting an injection site, the nurse should base their decision on volume of injection, distance from infections or burns, patient preference (Frandsen et al., 2021). Typical accepted volumes are 2mL or less in each deltoid, 3mL or less for the ventrogluteal sites, and up to 5mL in the vastus lateralis sites. Distance from infections, burns, or other disorders of the skin are also important considerations for a couple of reasons. If a patient

has partial thickness burns limited to their right side, the nurse should only administer medications on the patient's left as to avoid causing the patient additional pain or discomfort.

A nurse may also use their own discretion regarding the irritation of a medication. For example, a common adult dose of ketorolac is a 2 mL injection of 30 mg/mL (Vallerand & Sanoski, 2023). While technically allowed to be injected into the deltoid, a nurse may opt for a larger muscle, such as the ventrogluteal. Ketorolac has a tendency to irritate surrounding tissue, whereas a larger muscle group can potentially reduce the amount of irritation experienced (*Ketorolac injection: Medlineplus Drug Information* 2021).

Technique in this context will refer to how *the site* is manipulated, not how *the plunger* is manipulated. F. Zeta track involves the nurse using their non-dominant hand to stretch the skin and anchor the syringe in place (Sblendorio, 2023). The nurse's dominant hand will then be used to insert the needle perpendicular to the tissue and push down on the plunger. The nurse should wait 5 to 10 seconds after the plunger is completely depressed to allow for absorption of the medication. The Z track method is preferred for three reasons. First, it isolates the muscle by pulling it in a Z formation. Second, it helps anchor the needle in place; moving the needle around after it is inserted will further irritate the tissue and cause unnecessary pain. Lastly, it helps prevent the medication from leaking back out and into the subcutaneous tissue (Sblendorio, 2023). In some cases, particularly in older adults or pediatrics who do not have a lot of muscle mass, the "bunching technique may be used.". The bunching technique involves squeezing the muscle with the non-dominant hand to ensure the muscle becomes easier to puncture (Salari et al., 2018). It is important to squeeze the muscle and not the subcutaneous tissue for IM injections (Salari et al., 2018).

In a meta-analysis by Ayinde, Hayward, and Ross (2021), the researchers explored similar techniques, such as the application of pressure, rhythmic tapping, or a combination of the two. Such techniques were shown to be effective in decreasing pain. Like ShotBlocker, the rationale of these techniques is to stimulate the underlying nerves to distract the patient and reduce pain. All three techniques were found to be effective at reducing pain. The greatest benefit of these techniques is that there are no materials or costs associated with its utilization. However, Ayinde, Hayward, and Ross (2021) recognize that there may be some significant bias within the smaller studies examined, as well as a lack of consistency with how the studies were conducted.

Evidence Synthesis

Most of the literature regarding pain and IM injections was written and performed on the pediatric and young adult populations. While the literature should be able to generalize to adult and geriatric populations without issue, that inference cannot be confirmed without further studies. There was no research found that explicitly showed the effectiveness of aspiration (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). In the event of aspirating blood into the syringe, is it possible that the blood could be coming from smaller vessels, such as capillaries (*ACIP Vaccine Administration Guidelines for Immunization,* 2023). The current literature on IM injections focuses too much on pain and how it can be reduced, but not enough on the reasoning behind aspiration. If there were studies regarding aspirations' lack of effectiveness on confirming venipuncture, it would further support the reasoning behind the CDC’s decision to remove aspiration from their guidelines.

Additional research should examine the effectiveness of manual pressure and rhythmic tapping techniques on the reduction of pain associated with IM injections. While there were 10

studies included in the meta-analysis by Ayinde, Hayward, and Ross (2021), the researchers described two key limitations, including there being a high risk of bias and lack of congruence between the studies. A larger study with a more standardized control method would be beneficial in examining the effectiveness of IM injections in reducing pain and potential costs associated with the injection of medication.

Aspiration of the syringe is thought to create unnecessary trauma to the musculature by creating a vacuum (*ACIP Vaccine Administration Guidelines for Immunization*, 2023). Additionally, aspiration cannot be conducted there is a wider adoption of auto-disable syringes (Sepah, et al., 2014). Auto-disable syringes do not allow for aspiration, nor have they been linked to adverse effects.

The additional change of removing the dorsogluteal site and replacing it with the ventrogluteal site is to reduce complications (*ACIP Vaccine Administration Guidelines for Immunization*, 2023). The dorsogluteal site poses a risk of accidentally damaging the sciatic nerve (Small, 2004). Additionally, using the dorsogluteal as an injection site also creates the potential of puncturing the superior and inferior gluteal artery (*ACIP Vaccine Administration Guidelines for Immunization*, 2023). In order to minimize these potential complications, the CDC and WHO have removed the use of the dorsogluteal site and aspiration from recommended guidelines.

Rationale

The model used for this quality improvement project was the plan, do, study, act (PDSA) model. The aim was to improve healthcare professional adherence to CDC recommended guidelines by 15%. During the plan stage, a pre-intervention survey, education session, post-intervention survey, pamphlet, and protocol were created. The do stage included the execution of

the pre-intervention survey that was administered to healthcare professionals. This was then followed by an education session. Pamphlets were distributed to the ED healthcare professionals the same day as the education session. The pamphlets contained information that was covered in the education session to be used as a reference as well as inform those who were unable to attend the education session. A post-intervention survey was administered to the healthcare professionals. The study stage included a mixed method design that monitored the successfulness of the impact the intervention made. Comparison of the results and desired outcomes were made alongside prominent patterns and trends. The study stage collected feedback from the healthcare professionals who provided comments and concerns regarding the new information and how it was perceived. This aided in the modifications made during the act stage. A summarization of findings and unexpected outcomes was documented. In the act stage if the success rate of a 15% increase of healthcare professional adherence is met then opportunities for improvement will be identified. It is important to identify if there were any trends between professionals and adoption of new practices. Some groups may be more or less likely to adopt new practices. Professional groups such as licensed practical nurses, paramedics, and registered nurses and their education could influence their likelihood of adopting best practice. Shift time may also influence the success of adopting practice, the author built a greater rapport with the overnight professionals. Years of experience could also influence If the 15% increased adherence is not achieved then key stakeholder feedback will be gathered to expand upon the downfalls of the intervention. The next PDSA cycle will be planned to build upon the success and failures of this cycle.

Global Aim

The global aim of this quality improvement project was to update Wildcat hospital's IM injection protocol to adhere to best practice.

Specific Aim

The specific aim of this quality improvement project was to increase healthcare professional adherence to CDC IM injection technique by 15%.

Methods

Context

Wildcat Hospital's ED is a 27-bed department that provides emergency medical care to patients in the southern New Hampshire area. Wildcat Hospital's ED is a level III trauma center and provides 24/7 care. A level III trauma center has 24-hour on-site emergency physician coverage, with the ability to quickly bring in general surgeons and anesthesiologists. For more intricate cases Wildcat Hospital may need to transfer the patient to a facility that offers specialties during the night shift. During the day shift there is one paramedic or licensed practical nurse, one to three registered nurses, one to two advanced practice providers, and one to two physicians. During the overnight shift there is one paramedic or licensed practical nurse, one to three registered nurses, and one physician.

There currently is no protocol located in Wildcat Hospital's internal website to guide new or experienced healthcare workers who want to continue best practice according to policy. It was observed by the author on various occasions by different workers that best practices were not followed. Practices such as injections into the dorsogluteal muscle as well as aspiration before injection.

Cost Benefit Analysis

Fortunately, a major benefit of the project is an exceptionally low cost to those affected. The intervention did not cost the company anything as all resources were provided by the author.

The only costs to the author were informational papers provided to the staff. The monetary value was less than $10. The largest cost was the time from staff members, however, the overall time taken was no more than 20 minutes. The 20 minutes were divided into three sections, a pre-intervention survey, a presentation and question period, and a post-intervention survey. The education session and questions took 10 minutes. The pre-intervention survey and post-intervention survey took no more than five minutes of the participants' time per session.

Interventions

The intervention included a pre-intervention survey, educating staff of current guidelines, and post-intervention survey. One week before the demonstration, the pre-intervention survey was administered to registered nurses, licensed practical nurses, and paramedics who wished to be involved in the quality improvement project. These professionals were selected because it was within their scope of practice to administer IM injections.

The education of staff was a two-faceted approach, the first was an education session and the second was physical literature. The education of staff was conducted by the author during the monthly staff meeting. The meeting was held by the director of nursing in person and via Zoom. The author presented a PowerPoint presentation at the end of the meeting. The PowerPoint contained the updated CDC and WHO recommended guidelines as well as a brief rationale supporting those changes. The demonstration was then followed by a five-minute block for questions, there were no questions posed, the meeting then concluded. The author stayed several hours after the presentation to allow staff to ask further clarifying questions.

The second action was pamphlets were placed in the nurses’ station, the pamphlets contained a brief synopsis of the presentation as well as some common questions and concerns. In addition, the pamphlets had a quick response (QR) code that could be scanned by the phones

of nurses and paramedics. The QR code hyperlinked them directly to the Qualtrics post-intervention survey. The post-intervention survey was made available immediately after the question segment of the presentation and was accessible for one week after.

Study of Interventions

Both surveys asked about the healthcare professionals' experience, scope of practice, and essential knowledge of IM injections. The post-intervention survey asked an additional question regarding if the intervention influenced them to change their practice. The survey was created by Fekonja et al. (2021); however, it was modified by the author in order to increase participation by reducing potential survey burden.

Measures

The survey was developed to detect current knowledge about IM injections before the education, their impact and how the healthcare professionals will go forward in their practice. The questions posed were used to assess how the staff's training and experiences have influenced their perception regarding the performance of IM injections. The survey contained 15 questions regarding their background, injection site preference, and injection technique (Appendix B). Some staff may have had two separate scopes of practice, for example, someone may have done a paramedic to registered nurse bridge program. The question asked to specify their license type while operating at Wildcat Hospital. There was an additional question in the post-intervention survey that was open-ended and free response. It asked the healthcare professional if there are any changes they would have made to the intervention. The question was asked to determine if there was a readiness to try a new technique. The final question asked about how the demonstration can be improved. The answers to the question were reviewed for themes on confidence and the benefits of education. To be analyzed for any future quality improvement

projects. The survey was created using *Qualtrics*™ and was made available to staff through a QR code that could be scanned by their phone.

Analysis

A mixed method design was used for all data collected in the surveys. The free text answers were examined for common themes and concerns. The objective was to determine if the educational demonstration changed the staff's IM injection technique. All data collected was categorical and charted for frequency. A bar graph was used as a visual aid and was utilized to compare adoption of best practice and background. In addition, a frequency table was created to demonstrate a change in response values for all survey questions.

Ethical Considerations

Before engaging in the pre-intervention survey and post-intervention survey, the staff was informed of what the test included, what information was gathered, and why the test was conducted. All responses were anonymous, which was emphasized to the staff that wished to participate. The quality improvement project was reviewed by the University of New Hampshire Department of Nursing Quality Review Committee and was determined that it was exempt from the Institutional Review Board review process.

Results

Initial Steps

No modifications to the QI project occurred at any point. An unforeseen challenge was the changing of the ED department director. The workflow (Figure 1) of the QI project was broken down into three sections pre-intervention, intervention, and post-intervention. All previous communications had to be reestablished in order to receive permission with the new director. The initial pre-intervention survey was distributed on a poster describing the QI project,

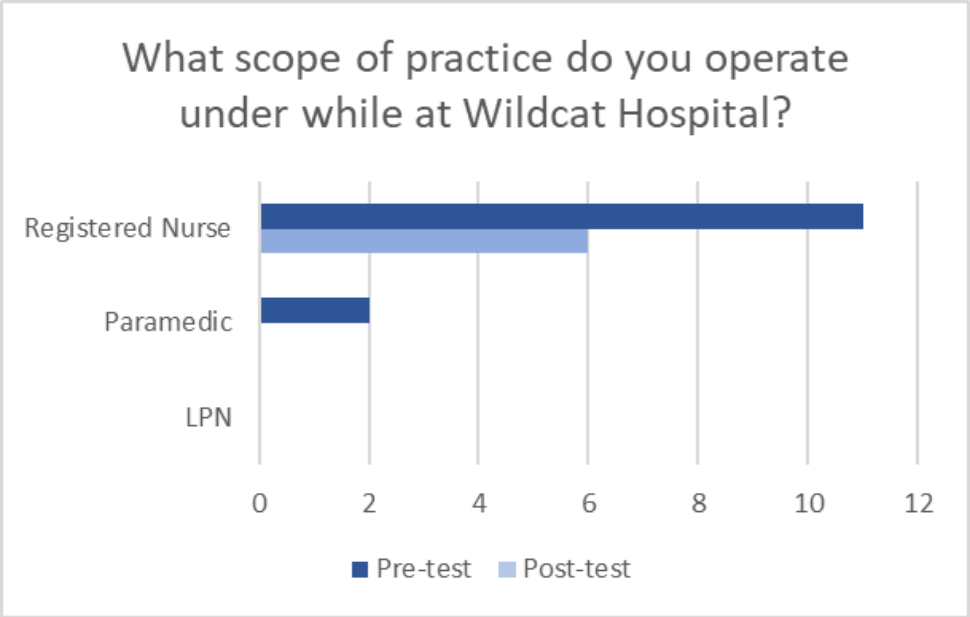
the poster contained a QR code that would be linked to the pre-intervention survey. Multiple posters were left in the nurse's station. During the intervention phase, a presentation was conducted at a monthly staff meeting. However, only five nurses and two paramedics attended the staff meeting. The author visited the hospital on three separate occasions to educate the healthcare professionals on recommended techniques as well as answer questions regarding IM injections and the QI project. In addition to the presentation and education, educational pamphlets were placed on the unit. The pamphlets had key highlights as well as a QR code that would link to a video from the Journal of Visualized Experiments that demonstrated updated IM injection technique. The pamphlet also contained a QR code that would link to the post-intervention survey.

Process Measures

Surveys were utilized and answered by the healthcare professionals on their both their pre-intervention knowledge and their post-intervention IM injection knowledge. The project leader visited the hospital on three different occasions, once during a day shift and two on a night shift to encourage staff to participate. There was a total of 33 potential healthcare professionals available within the department. 14 full time registered nurses, five per diem registered nurses, seven traveling registered nurses, and two full time licensed practical nurses. Two full time paramedics and 3 per diem paramedics were also eligible to participate. The pre-intervention survey garnered 13 responses over the period of one week, a 39% participation rate. Unfortunately, the post-intervention survey received only six responses, equaling an 18% participation rate.

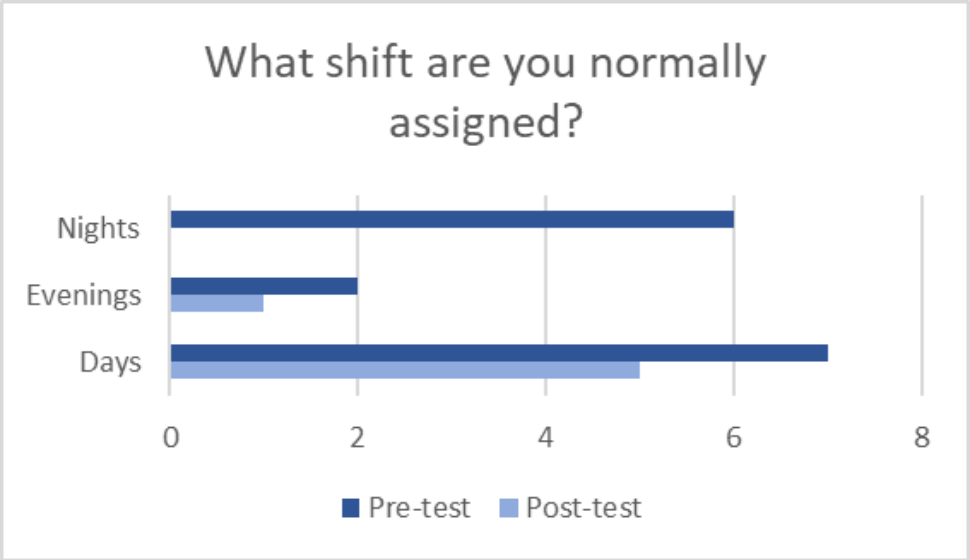
Quantitative Process Measures and Outcomes

Figure 1: What Scope of Practice do you Operate Under while at Wildcat Hospital?



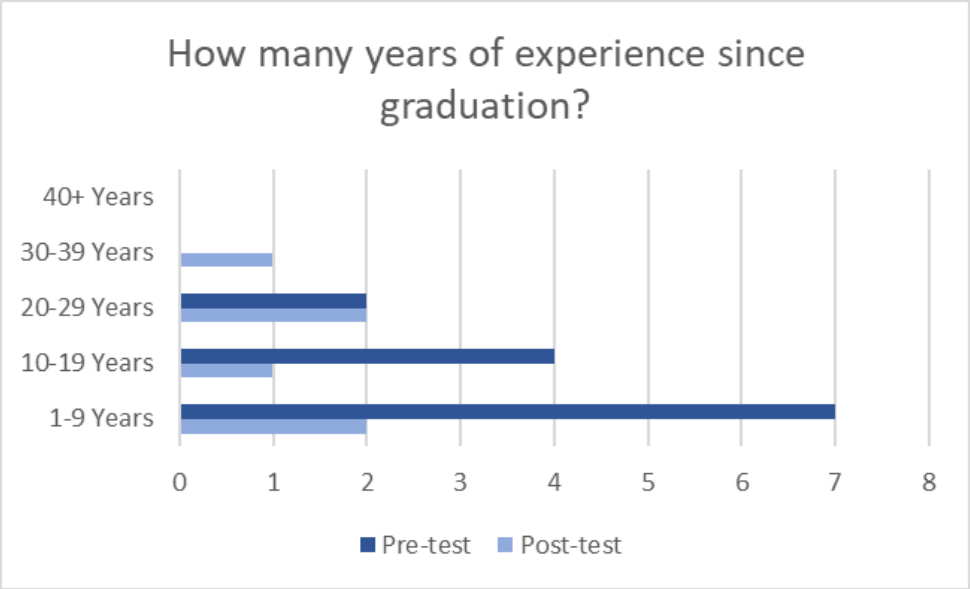
During the pre-intervention survey 11 registered nurses and two paramedics responded. In the post-intervention survey all six participants were registered nurses.

Figure 2: What Shift are you Normally Assigned?



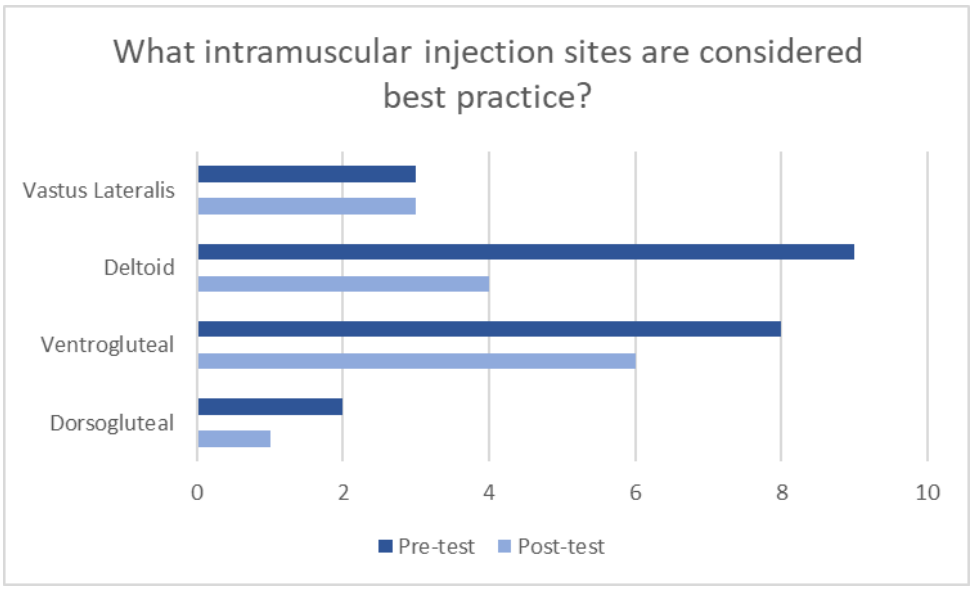
During the pre-intervention survey six participants work the night shift, two work the evening shift, and seven work the day shift. In the post-intervention survey one participant works the evening shift and five work the day shift.

Figure 3: How Many Years of Experience Since Graduation?



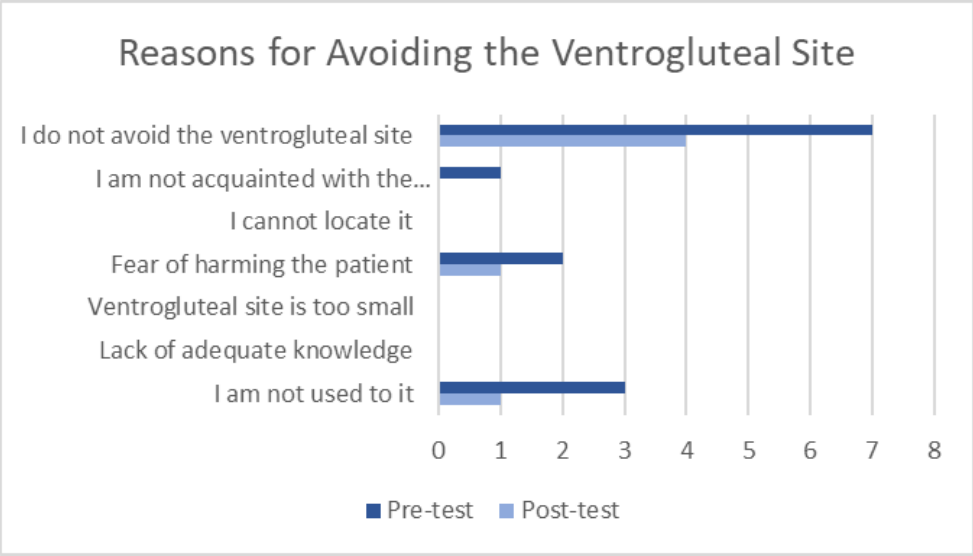
During the pre-intervention survey seven participants have 1-9 years of experience, four have 10-19 years of experience, and two with 20-29 years' experience. In the post-intervention survey, there were two participants with 1-9 years of experience, one with 10-19 years of experience, two with 20-29 years of experience, and one with 30-39 years of experience.

Figure 4: What Intramuscular Injection Sites are Considered Best Practice?



There was a proportional increase in ventrogluteal and vastus lateralis injection site acceptance. In the pre-intervention survey 62% of healthcare professionals stated they use the ventrogluteal injection site. While in the post-intervention survey 100% of healthcare professionals stated they use the ventrogluteal injection site. In the pre-intervention survey 23% of healthcare professionals answered that the vastus lateralis is considered best practice. The responses that included the vastus lateralis increased to 50% in the post-intervention survey.

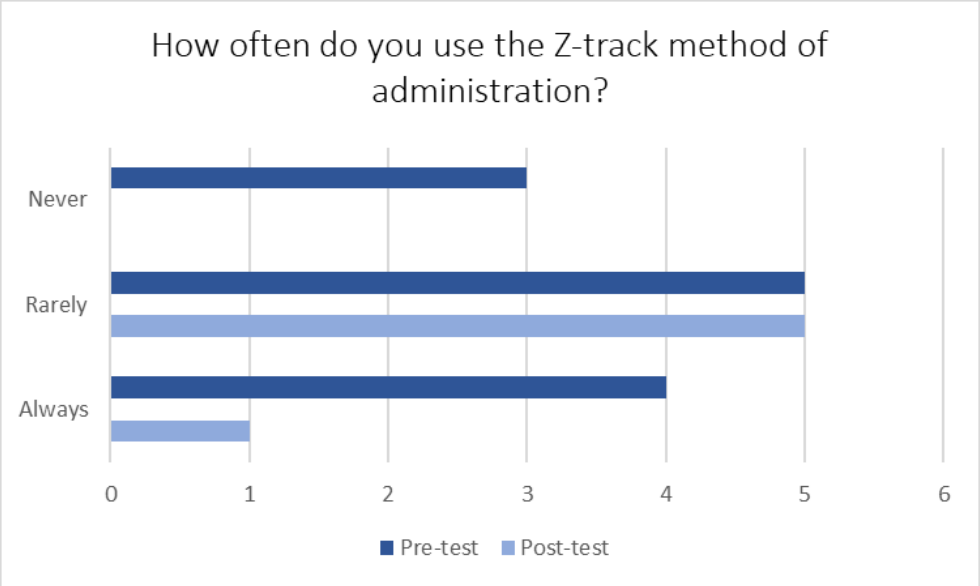
Figure 5: Reasons for Avoiding the Ventrogluteal Site



In the pretest 54% of healthcare professionals marked that they do not avoid the ventrogluteal site. In the post-intervention survey 67% of healthcare professionals answered that they do not avoid the ventrogluteal injection site. In the pre-intervention survey 8% answered that they are not acquainted with the ventrogluteal injection site. While in the post-intervention survey 0% answered that they are not acquainted with the injection site. 15% of healthcare professionals answered that they had a fear of harming the patient in the pre-intervention survey. While 17% answered they have a fear of harming the patient in the post-intervention survey. In

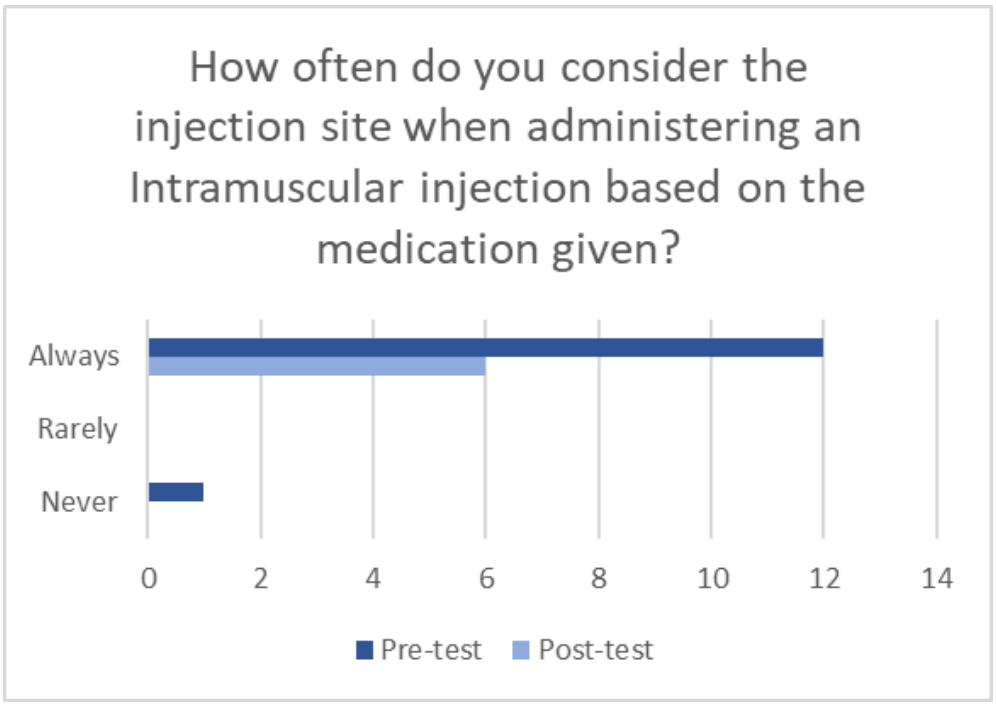
the pre-intervention survey 23% of healthcare professionals answered that they were "not used to it (ventrogluteal injection site)" this was reduced to 17% in the post-intervention survey.

Figure 6: How often do you use the Z-track Method of Administration



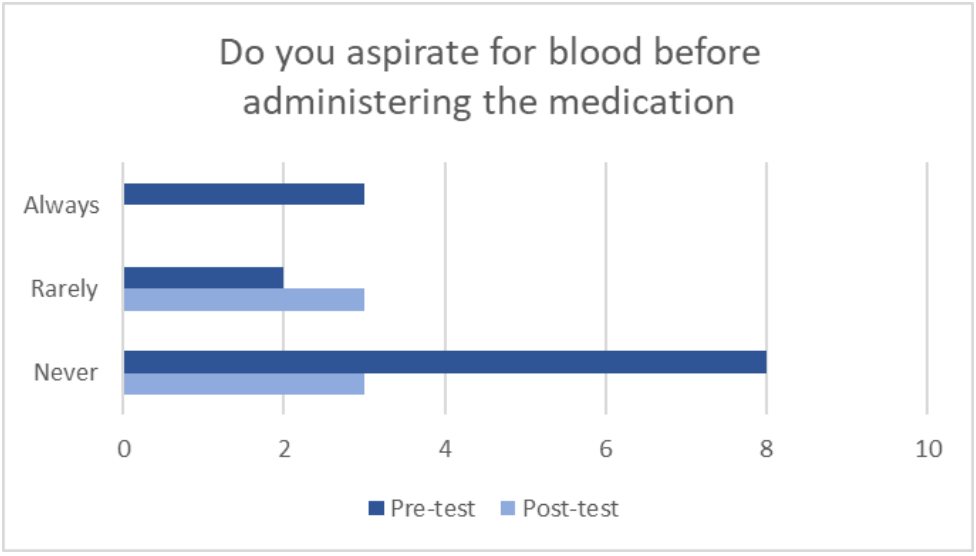
The "never" category had a 23% response rate in the pre-intervention survey. In the post-intervention survey this was reduced to 0%. Which is a desirable change. The "Always" category had a 30% response rate in the pre-survey but was reduced to 16% after the intervention. This is not a desirable change. The "rarely" category changed from 38% in the pre-intervention survey up to 83% after the intervention.

Figure 7: How often do you consider the Injection Site when Administering an Intramuscular Injection based on the Medication given?



There were 92% of healthcare professionals who answered that they take injection sites into consideration before giving medication. This increased to 100% after the intervention. While reducing the "never" category from 8% to 0%.

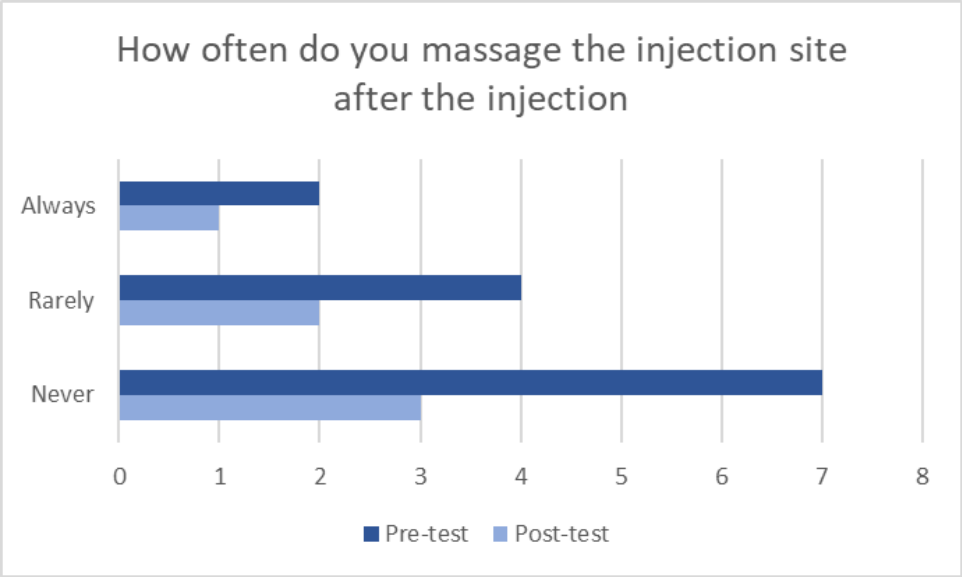
Figure 8: Do you Aspirate for Blood before Administering the medication?



In the pre-intervention survey 23% of healthcare professionals reported that they aspirated every time they gave an injection there no healthcare professionals responded that they

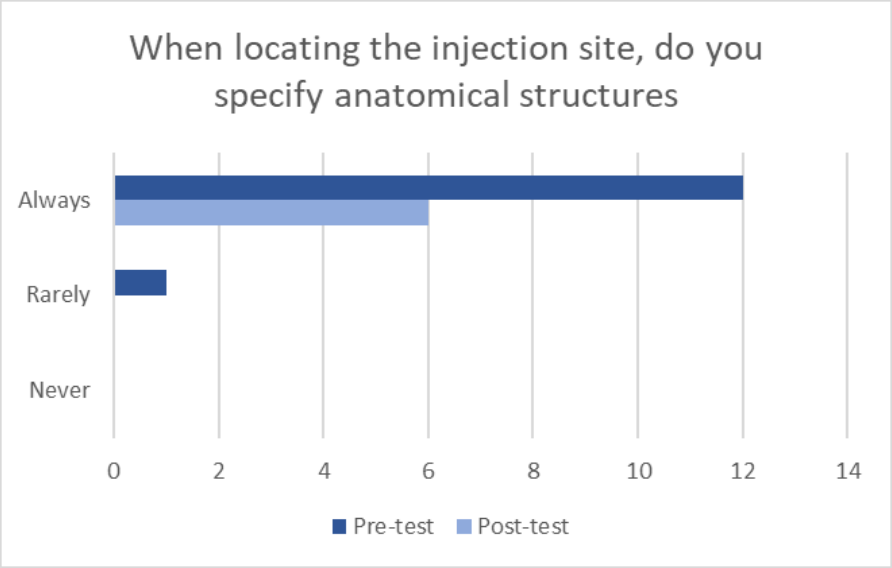
aspirate for blood before injecting every time. This was reduced to 0% after the intervention. 15% of healthcare professionals answered that they "rarely" aspirated before injection. This was increased to 50% after the intervention. Finally, 62% of healthcare professionals answered that they "never" aspirate before injecting a medication. This was reduced to 50% after the intervention.

Figure 9: How often do you massage the injection site after the injection?



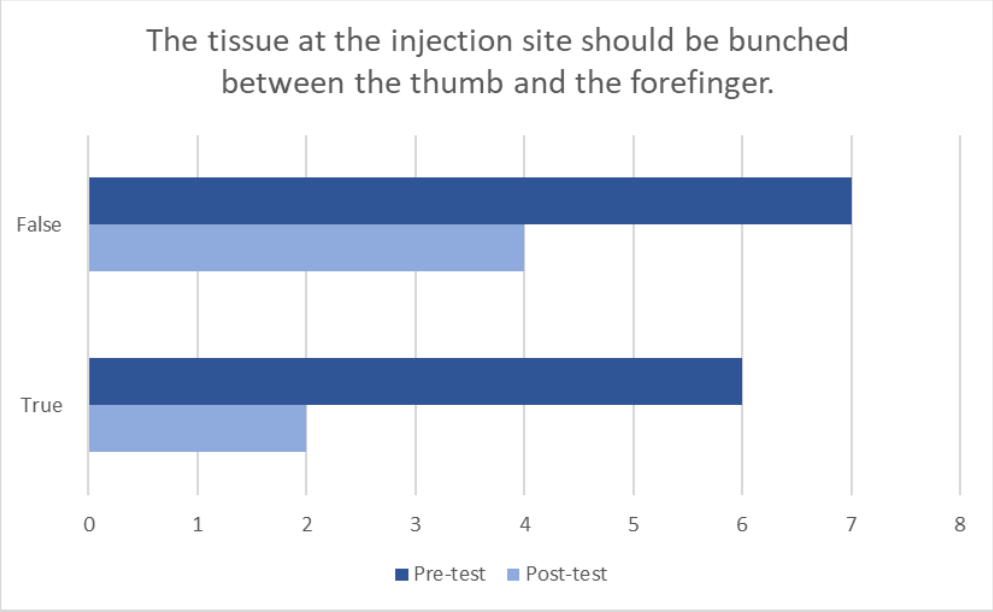
15% of healthcare professionals answered that they always massage the injection site in the pre-intervention survey. This increased to 17% after the intervention. 30% of healthcare professionals reported that they "rarely" massaged the injection site. This increased to 33% during the post-intervention survey. 54% of healthcare professionals reported that they never massage the injection site. This decreased to 50% following the intervention.

Figure 10: When locating the injection site, do you specify anatomical structures?



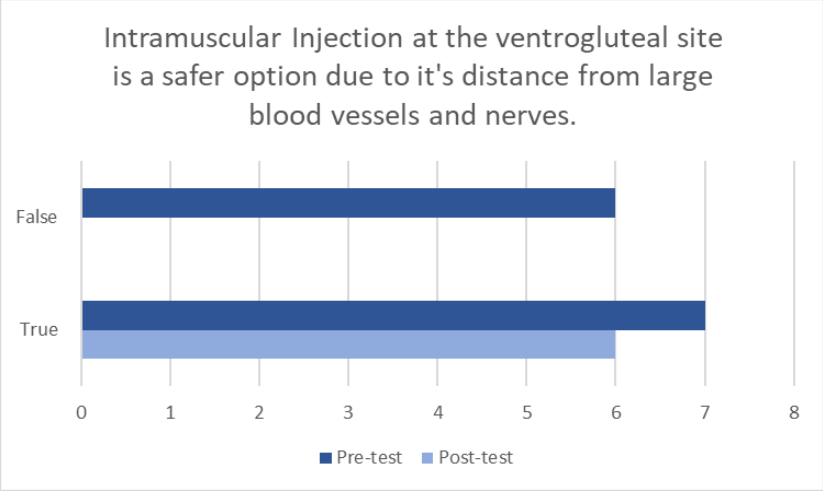
92% of healthcare professionals would always specify anatomical structures before injecting. This increased to 100% after the intervention.

Figure 11: The Tissue at the Injection Site should be Bunched between the thumb and the forefinger.



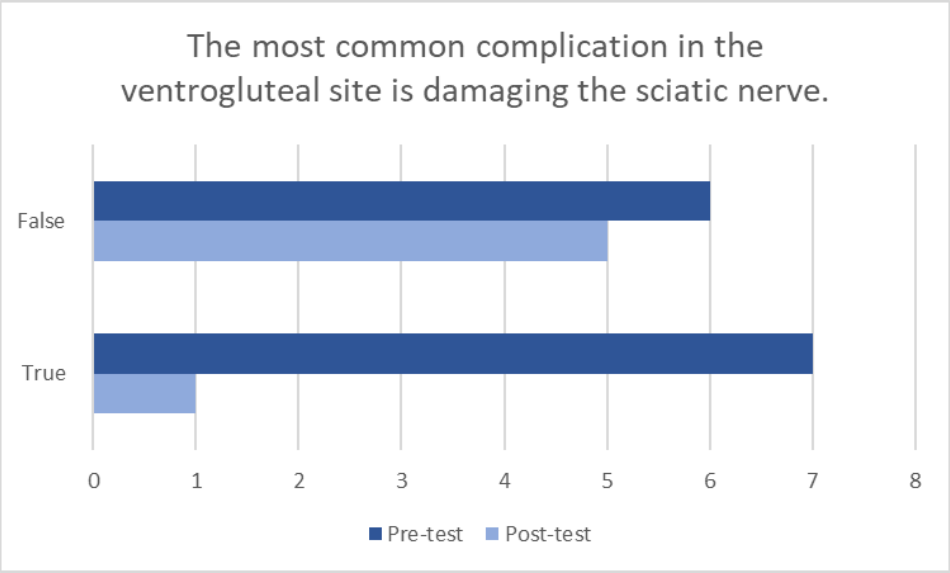
The answer to this question is false with 54% of healthcare professionals getting the answer correct before the intervention. This increased to 67% of healthcare professionals answering correctly after the intervention.

Figure 12: Intramuscular Injection at the Ventrogluteal site is a Safer Option due to it's Distance from Large Blood Vessels and Nerves



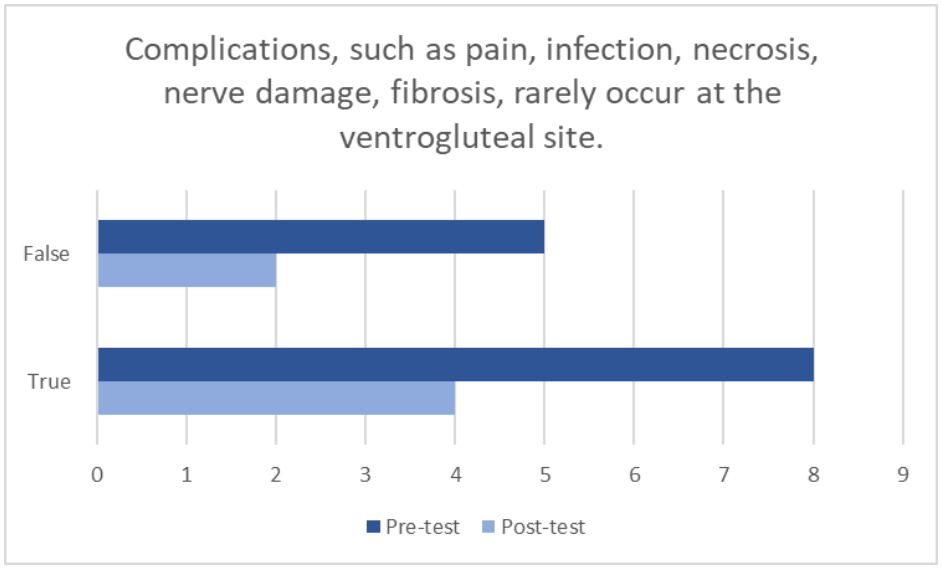
The correct answer to this question is true. 54% of the healthcare professionals answered this question correctly before the intervention. After the intervention the number of healthcare professionals answering correctly increased to 100%.

Figure 13: The most Common Complication in the Ventrogluteal site is Damaging the Sciatic Nerve.



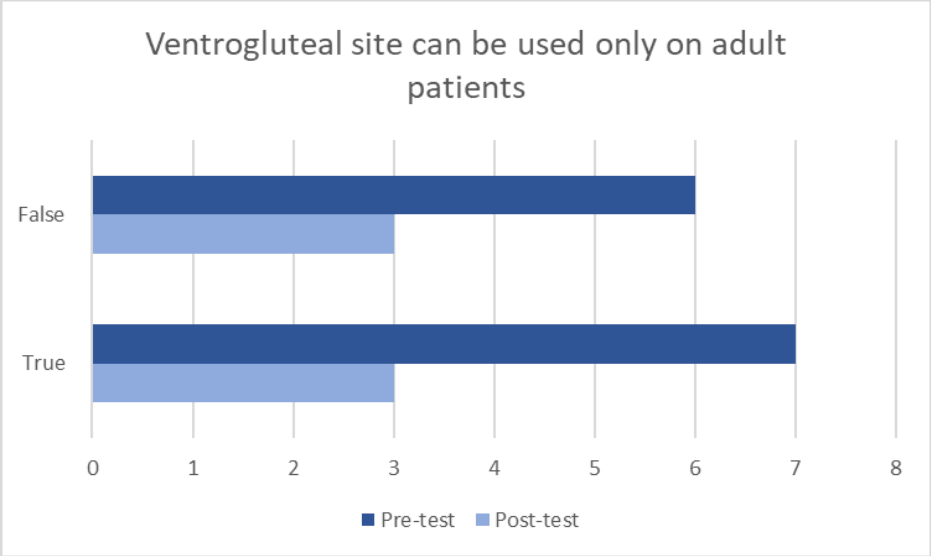
The correct answer to this question is false. 46% of the healthcare professionals answered this question correctly before the intervention. After the intervention 86% of the healthcare professionals answered this question correctly.

Figure 14: Complications, such as pain, infection, necrosis, nerve damage, fibrosis, rarely occur at the ventrogluteal injection site.



The correct answer to this question is false. 38% of healthcare professionals answered this question correctly before the intervention. After the intervention 33% of healthcare professionals answered this question correctly.

Figure 15: The ventrogluteal site can be used only on adult patients.



The correct answer to this question is false. 46% of the healthcare professionals answered this question correctly before the intervention. After the intervention 50% of the healthcare professionals answered this question correctly.

Unintended Consequences

An unintended consequence was the lack of participants at the monthly staff meeting. With only six in attendance, the presentation was only distributed to 18% of the unit population. The pamphlets were designed to reach out to those who were not in attendance. However, it is uncertain as to how many read and absorbed the information presented. An unintended benefit was the effectiveness of the QR code. The staff are required to carry a hospital provided phone for messaging purposes. The phone provided by the hospital has the ability to scan QR codes and then the healthcare professional filled? out the survey. When the project leader visited the

hospital and spoke to the staff, each member was interested and stated that they enjoyed learning about how to best improve their own practice.

Contextual Elements

One contextual element that may have hindered this QI project include the potential breakdown in communication that there was both a pre-intervention survey and post-intervention survey. There were no written statements in the post-intervention survey about there being confusion. However, when visiting the hospital to encourage staff to participate, some had mentioned that they already filled out the survey. Indicating that there was a lack of communication between the project leader and the hospital staff. This could potentially be remedied by sending various emails to the entire department about which stage the QI project is in.

Another contextual element that is not quantifiable is the organizational culture of the ED. The ED is known to be fast paced with a near constant influx of patients and urgency, thus making it difficult to not only grab the attention of the healthcare professional but for them to also have the time to fill out the survey. A potential solution could be to distribute more posters and pamphlets in the breakroom for the healthcare professionals to fill out while they are on their break.

Missing Data

Some missing data include the lack of responses during the post-intervention survey. The survey contained 16 questions, with a total of 33 questions between both the pre and post surveys. This may cause survey fatigue; the healthcare professionals may not wish to complete the second survey. An additional question that was removed from the survey asked whether they were full time or contract traveling nurses. This would have provided valuable insight as to who

was answering the questions if being a permanent employee of Wildcat Hospital influenced willingness to learn and participate. A potential point of missing data is that each survey was only available for one week. Additional surveys could have been filled out had the project allowed for more time.

Discussion

Summary

Key Findings

The data gathered in this quality improvement project indicates that healthcare professionals commonly follow best practice procedures. The initial specific aim for this quality improvement project was to increase healthcare professional adherence to CDC IM injection technique by 15%. The global aim was the implementation of an evidenced based IM injection protocol. However, there are multiple facets to IM injection technique. Aspiration, site selection, and needle size selection all contribute to administering a safe IM injection. This quality improvement project did not have a significant change on healthcare professionals choosing to aspirate, correct injection site selection, massaging the injection site, using the Z-track method, or if the ventrogluteal site can be used on pediatric patients. In the pre-intervention survey 23% of healthcare professionals selected the vastus lateralis injection site, which is a correct response. After the intervention 50% of healthcare professionals selected the vastus lateralis. Additionally, 81% selected the ventrogluteal which is a correct response in the pre-intervention survey. After the intervention 100% selected the ventrogluteal site. When asked about ventrogluteal injection site safety and its distance from major blood vessels and nerves 47% of the healthcare professionals answered correctly before the intervention. After the intervention 83% of healthcare professionals answered correctly. When asked about the likelihood of damaging the

sciatic nerve 47% of the healthcare professionals answered correctly before the intervention. After the intervention 83% of healthcare professionals answered correctly. The specific aim of increasing IM injection technique by 15% was not met.

Relevance to Rationale

This PDSA cycle proved valuable in making some positive changes. The planning phase of this quality improvement project utilized observation to identify the key issue that healthcare professionals were not adhering to best practice. Additionally, the project leader noticed the absence of a formal IM injection protocol. The planning phase involved collaboration with leadership in identifying how to effectively carry out the "do" phase. The "do" phase used a pre-intervention survey of all healthcare professionals within the ED that administer IM injections. In the pre-intervention survey 39% of the eligible participants responded to the survey. While the post-intervention survey had an 18% participation rate a two-pronged intervention strategy of presentation and literature dissemination was used. Both parts of the intervention addressed the different variables of proper IM injection technique. The study phase highlighted the importance of gaining the favor of not only key stakeholders but also the healthcare professionals who were participating in the project. The action phase included the presentation of the proposed protocol to the quality improvement team at Wildcat Hospital. In addition, the action phase was to be used to set up a potential future PDSA cycle.

Relevance to Specific Aim

The specific aim of this quality improvement project was to improve injection technique of healthcare professionals by 15%. It would have been best to focus on a single aspect of injection technique. For example, what percentage of healthcare professionals' aspirate before

injection. This quality improvement project did positively influence some aspects of IM injection technique. It did increase the acceptance of the vastus lateralis and ventrogluteal injection sites by 27% and 21% respectively. As well as increase the knowledge that the ventrogluteal injection site is safe. Injection site selection is one of the more important aspects of IM injection administration.

Project Strengths

This project's main strength was that the participants were engaged when filling out the surveys and listening to the intervention. Many asked clarifying questions and verbally stated that they found the pamphlets to be useful. The project demonstrated that the healthcare professionals at Wildcat Hospital do have a desire to improve their own skills and knowledge. In addition, there was the discovery of new key stakeholders. A new key stakeholder was the new nursing manager. The nursing manager of the department had changed shortly before the quality improvement project started. In addition, some nurses acted as key stakeholders who previously were not a part of the ED nursing staff. These new key stakeholders acted as advocates in participation and continued to ask their peers to fill out surveys when the project leader was not present on the unit. Furthermore, this project would be best served as preliminary observation to establish a baseline for future PDSA cycles.

Interpretation

Impact of the Intervention on Intramuscular Injection Technique

The most positive impact the intervention made was the awareness brought to the ventrogluteal and vastus lateralis injection sites. In the pre-intervention survey, intervention, and post-intervention survey healthcare professionals asked questions regarding the ventrogluteal and

vastus lateralis injection sites. Questions included location, necessary anatomical landmarks, and reasons for using the injection sites. It was reported by not only other staff members but by management that this segment of the project was beneficial and increased awareness of updated CDC IM injection guidelines.

Unexpected Outcomes

An unexpected outcome was the participation of the day shift nurses compared to night shift nurses. The project leader also collaborated with night shift more than day shift. In the pre-intervention survey both shifts participated equally. However, in the post-intervention survey zero-night shift healthcare professionals participated compared to the six-day shift healthcare professionals who did participate.

Reasons for Differences Between Observed and Anticipated Outcomes

The post-intervention survey had a lower response rate than the pre-intervention survey. This could be due to the healthcare professionals confusing the pre-intervention survey and post-intervention survey. When the project leader inquired with staff about their participation, many answered that they already filled out a survey. Sending an email to the healthcare professionals asking for their participation in the post-intervention survey may have provided superior results and participation numbers by reducing confusion. Another reason staff may have not participated is due to their own time constraints while working.

Limitations

The most substantial limitation was minimal sample size in the post-intervention survey. In the post-intervention survey, 18% of the 33 healthcare professionals participated, equaling a

small sample size. Low survey response rates reduce the validity of the results and as such do not represent the unit as a whole. In addition to the small sample size, there is no ability to track if the six participants in the post test took part in the pre-intervention survey. However, this was to provide anonymity to the healthcare professionals participating in the surveys. An additional limitation was the inability to send a unit wide email to update the staff on each phase of the project. Potentially limiting the number of responses due to lack of communication. An additional limitation is the lack of a tool to effectively measure IM injection technique. In the next PDSA cycle it would be beneficial to pick one facet of IM injections and attempt to positively influence healthcare professionals to adopt best practice in that aspect. Due to a limited timeline only one PDSA cycle was able to be performed. Additional time would allow for a second or third PDSA cycle allowing for an increase in both accuracy and validity.

Conclusion

Usefulness of Work

IM injections are used in nearly all healthcare settings and healthcare professionals have a responsibility to use them in a safe manner. Following best practice IM injection technique increases patient safety and may decrease patient perceived pain. This quality improvement project can be used in a variety of settings and may be useful in future PDSA cycles at both Wildcat Hospital and in other settings.

Sustainability

A major factor potentially halting the sustainability of this project and projects similar to this is survey fatigue. The healthcare professionals involved may be less likely to participate if every PDSA cycle contains two surveys. One way to prevent this is to keep future surveys short. Keeping the surveys short may increase the likelihood of the healthcare professionals filling

them out. An additional measure to maintain the positive strides gained in this project is the creation of an IM injection protocol that future healthcare professionals can both learn and refer to. However, that protocol will have to be continuously updated to CDC recommended guidelines.

Potential for Spread to other Contexts

IM injections are a core route of medication delivery and are used in a variety of healthcare settings. This quality improvement project can be used as a template for any inpatient or outpatient setting that uses IM injections. If attempting to increase adherence to best practice in another setting, a preliminary survey should be conducted. This survey will be able to allow the project leader to pinpoint where their healthcare professionals are not following best practice.

Implications for Practice and for Further Study in the Field

Improvements to be made in this project include narrowing the specific aim of each PDSA cycle. Following current guidelines has been shown to decrease perceived pain by patients. However, it may be beneficial for Wildcat Hospital to incorporate devices such as ShotBlocker in their practice. A PDSA cycle could be dedicated to the teaching and incorporation of these devices.

Suggested Next Steps

The next step towards having all healthcare professionals following best practice would be an additional PDSA cycle. This PDSA cycle would focus on one part of giving a safe IM injection. The next PDSA cycle should focus on improving Z-track technique usage. Increasing Z-track usage may reduce felt pain by future patients. This PDSA cycle could use a similar intervention that uses both a presentation and a pamphlet to disseminate information. However,

during this cycle using email to disseminate educational information and the various stages the project is in would be beneficial to the healthcare professionals.

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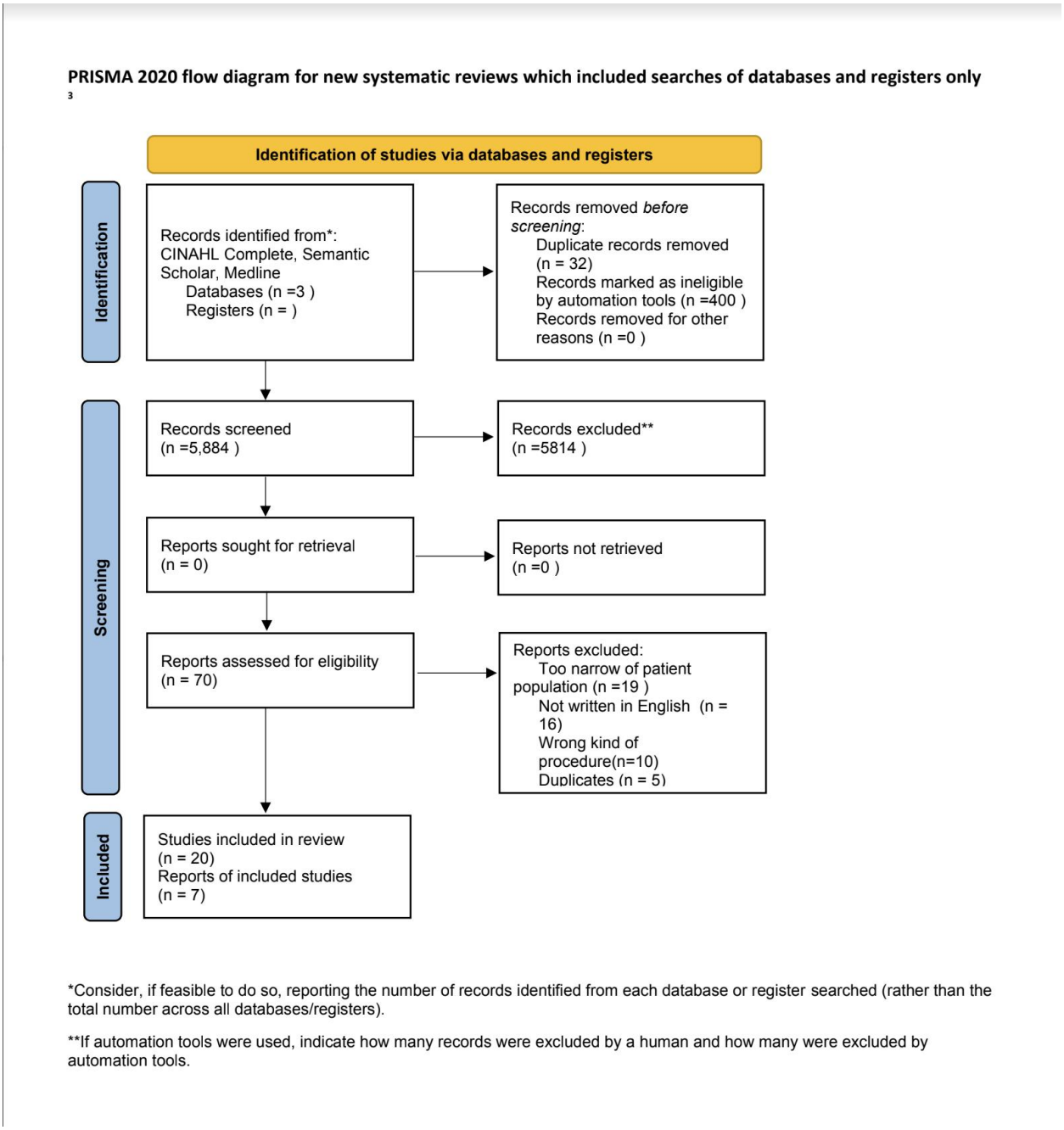
Appendix A



Note. Prisma flowsheet to demonstrate how sources were obtained.

Appendix B

Answer	Licensed Practical Nurse	Paramedic	Registered Nurse
Licensed Practical Nurse			
Paramedic			
Registered Nurse			
Days			
Evenings			
Nights			
1-9 Years			
10-19 Years			
20-29 Years			
30-39 Years			
40+ Years			
Answer	Licensed Practical Nurse	Paramedic	Registered Nurse
I am not used to it			
Lack of adequate knowledge			
Ventrogluteal site is too small			
fear of harming the patient			
I cannot locate it			
I am not acquanted with ventrogluteal site			
Never			
Rarely			
Always			
Never			
Rarely			
Always			
Never			
Rarely			
Always			
Never			
Rarely			
Always			
Never			
Rarely			
Always			
Correct Answer	Licensed Practical Nurse	Paramedic	Registered Nurse
False is correct answer			
True is correct answer			
False is correct answer			
True is correct answer			
True is correct answer			
False is correct answer			

Note. Questions to be used for both pre-intervention survey and post-intervention survey.

Appendix C

Guideline to Administer Intramuscular Injections

Key Area of Emphasis or Change: To create a formal outline of the steps to perform an intramuscular injection.

Purpose: To provide an outline of the steps healthcare professionals take to perform intramuscular injections safely and effectively.

Definitions:

1. **Aspiration:** Aspiration of the injection is when a healthcare professional draws back on the plunger of the syringe for 5-10 seconds.
2. **Blunt-needle:** Needles used for drawing medication and are not used for injections.
3. I**ntramuscular Injection:** An intramuscular injection is a shot of medicine given into a muscle
4. **Sharps:** Devices with sharp points or edges that can puncture or cut skin.
5. **Z-Track:** A technique used to prevent medication leakage, particularly for oily injections. Displace the skin and subcutaneous tissue by pulling the skin laterally or downward from the injection site. Holding it taut, quickly and smoothly insert the needle into the muscle at a 90-degree angle. This technique is preferred in adult/ adolescent patients.

Preparation:

1. Wash hands or use an alcohol-based sanitizer before beginning the procedure.

2. Verify the patient's identity by visually inspecting their identification band as well as scanning the barcode. Always verbally confirm their name and date of birth.

3. Ask and review the patient's medical history, allergies, and current medications to identify any contraindications.

4. Select the appropriate injection site based on the patient's age, size, and condition, as well as the specific medication being administered.

5. Prepare and administer only medications and dosages that have been prescribed by an authorized healthcare provider.

6. Follow clean technique guidelines during procedure to lower risk of infection

Ensure Proper disposal of sharps and other contaminated materials as per hospital guidelines

Equipment and Supplies:

1. Appropriate medication in the prescribed dosage.

2. Sterile disposable syringe and appropriately sized needle. Use a 22-25 gauge needle. See Appendix A for needle suggested needle length.

3. Clean gloves

4. Alcohol swabs

5. Gauze pad

6. Adhesive bandage

Procedure for Administration of Intramuscular Injection:

1. Position the patient to expose the injection site while maintaining their privacy.

2. Identify the selected injection site and clean the area using an alcohol swab in a circular motion, starting from the center and moving outward.

3. Allow the alcohol to air dry .

4. Use the smallest volume syringe possible for the amount of medication to be administered.

5. Attach a blunt-needle to the syringe to draw up the appropriate amount of medication.

6. Cap the blunt-needle using the scoop technique.

7. Attach appropriately sized needle to syringe.

8. Remove the needle cap without contaminating the needle and avoid touching the exposed needle.

9. For adults, use a Z-track technique (displace the skin laterally) to reduce pain and minimize the risk of medication leakage.

10. With one hand, stretch the skin around the injection site, stabilizing the underlying muscle.

11. Hold the syringe like a dart and insert the needle quickly at a 90-degree angle into the muscle.

Note. Aspiration before injection is no longer recommended by the CDC.

12. Once the medication is administered, withdraw the needle swiftly and apply gentle pressure with a gauze pad to the injection site.

13. Engage the safety on the needle using the edge of a surface such as a table or counter.

14. Discard the used needle and syringe into a sharps container.

15. Provide the patient with appropriate post-injection care instructions.

16. Document the procedure including the injection site, medication, dosage, date, and time.

17. Monitor the patient for any immediate adverse reactions or complications following the injection.

If you have to give more than one injection, utilize a different injection site.

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Adults (≥19 years)		
Men and women, <60 kg (130 lbs)	1 inch (25 mm)[d]	Deltoid muscle of arm
Men and women, 60-70 kg (130-152 lbs)	1 inch (25 mm)	
Men, 70-118 kg (152-260 lbs)	1-1.5 inches (25-38 mm)	
Women, 70-90 kg (152-200 lbs)		
Men, >118 kg (260 lbs)	1.5 inches (38 mm)	
Women, >90 kg (200 lbs)		
Men and women, any weight	1.5 inches (38 mm)[e]	Anterolateral thigh

Note. CDC suggested size of needle based on weight (*ACIP Vaccine Administration Guidelines for Immunization*, 2023).

Note. The suggested protocol to be implemented.