Medication Error: A Case of Wrong Administration Route for Potassium Chloride

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The promotion of patient safety has been an ongoing objective of the healthcare system. In the absence of patient safety, there may be a threat to achieving quality care. The Joint Commission is responsible for reviewing an agency's response to sentinel events to improve patient safety and the quality of healthcare services. A sentinel event is defined as a "patient safety event that results in death, permanent harm, or severe temporary harm" (Joint Commission, n.d.). Common sentinel events include wrong-site surgery, foreign object retention, medication errors, and falls (Joint Commission, n.d.). The following paper will discuss an overview of sentinel events, review a case study involving a medication administration error. Please note that additional details have been added to the original case to provide a thorough root cause analysis. A literature review will then be conducted on medication administration error to formulate a corrective action plan, which will demonstrate the application of evidence-based solutions and leadership skills.

Sentinel Events

The Harvard Medical Practice Study of 1984 was the first documented effort to estimate the number of medical errors. In this study, 30,000 discharge records were randomly selected from 51 New York hospitals and the results concluded that 58% of serious adverse events were preventable and 13.6% resulted in patient death (James, 2013). This statistical finding was challenged by a newer report that suggests approximately 210,000 to 400,000 deaths each year in hospitals are attributable to error and avoidable (Murray, 2017).

All accredited hospitals are encouraged to report sentinel events to the Joint Commission (TJC). TJC defines reviewable occurrences as events that resulted in sudden death or permanent loss of function. Therefore, an adverse outcome that is directly related to the natural course of a

patient's condition is not reportable except for suicide (Joint Commission, 2020). Although self-reporting is voluntary, these reports are added to a TJC sentinel event database, which alerts other hospitals to avoid making similar mistakes and decrease the risk of reoccurrence. In addition to an immediate investigation, an appropriate response to a sentinel event may include a formalized team that stabilizes the patient, disclosure of the event to the patient and family, support for the family and staff involved, and notification to the hospital leadership (Patra & De Jesus, 2020).

According to Joint Commission (2020), if the sentinel event is deemed reviewable by TJC, the hospital is expected to perform a thorough root cause analysis and action plan within 45 calendar days of the event. However, if the determination that an occurrence is reviewable took place 45 days after the event, TJC will permit additional 15 calendar days for the response. Failure to submit the root cause analysis within the established time frame will jeopardize the accreditation of the hospital (Joint Commission, 2020). After TJC has decided that the root cause analysis and corrective action plan are acceptable, the hospital will be assigned with a follow-up activity (Joint Commission, 2020).

Because sentinel events result in unintended or unexpected harm, these events inevitably pose a negative influence on both patients and nurses. While patients may suffer from serious physical harm or death, nurses may suffer from psychological trauma that affect their practice and personal life. A constant fear of committing the same mistake could shatter one's confidence, which potentially leads to declined performance at work. Due to such psychological distress, some nurses might choose to switch units, step down from the leadership role, or leave the profession (Stone, 2019).

Case Study: Potassium Chloride IV Injection

The Institute for Safe Medication Practices (2021) published a case of concentrated potassium chloride (KCl) injection during a code. A 70-year-old female, identified as L.S., was admitted into Santa Barbara Cottage Health ICU and diagnosed with a highly contagious infectious disease. The patient's O_2 saturation was at 90% with ventilator-use and her heart rate was trending between 30-50 bpm for an hour. As L.S. underwent a cardiac arrest, the code was not announced hospital-wide to minimize staff exposure to the infectious disease. A small team that consisted of an ICU intensivist, a pharmacist, a nurse fellow, and his preceptor responded to the code. Because this incident happened during the COVID-19 pandemic, the intensivist was already burned out from working 70 hours during the week.

The patient's chemistry panel was significant for hypokalemia. The intensivist verbally ordered for "KCl 20 mEq IV" to correct the patient's hypokalemic state. As there were loud background noises from infusion pump and cardiac monitors, the pharmacist had a hard time listening the verbal order. Without questioning the order, the pharmacist assumed that the intensivist did not want to give KCl through an IV infusion because this route would take an hour to complete. Therefore, the pharmacist supposed that this high-alert medication was meant to be given undiluted via IV push. Although the pharmacist knew that concentrated KCl would trigger cardiac dysrhythmia, he again assumed that it was a new treatment intended to save the patient during the code. This code response was the first collaboration between the intensivist and pharmacist, so the pharmacist was hesitant to raise any concerns. Since the nurse preceptor was busy with placing the patient on continuous renal replacement therapy (CRRT), she assigned the nurse fellow to help with drug administration. However, the nurse fellow did not verify the

IV push order with the intensivist prior to administration, which led to patient developing asystole.

Root Cause Analysis

To examine the causes of the case scenario presented above, a root cause analysis is conducted in the following section. Please see the fishbone diagram in Appendix A for a visual representation that aims to illustrate the cause-and-effect relationship between the root causes and the fatal medication error.

Root Cause 1: People

Physician burnout was one of the contributing factors. As the event took place during the pandemic at an ICU, the intensivist already accumulated long working hours during the week and was not well-rested. In addition, the intensivist failed to facilitate safety culture and exemplified poor leadership. It was evident that the pharmacist was hesitant to voice his concerns since it was his first time working with the intensivist. The intensivist was known for his authoritarian personality and expected respect from others. The nurse fellow, on the other hand, was newly hired and only a few weeks into the training program. It was also his first time participating in a code and had not received advanced cardiac life support (ACLS) training. The inexperienced nurse fellow was left with the responsibility of administering medications unsupervised since his preceptor was busy helping other patients receiving CRRT.

When the intensivist made the order of “KCl 20 mEq IV”, she assumed everyone on the code team recognizes that this medication can only be given through a diluted IV infusion instead of an IV push. After the verbal order was made, the pharmacist presumed that KCl was meant to be given via IV push for instant effect. Based on the assumption that IV infusion would take an hour to complete and that the patient requires immediate intervention, the pharmacist

prepared concentrated KCl into a syringe. With a series of false assumptions, details that should have been included were repeatedly left out.

Root Cause 2: Communication

Effective communication is a crucial component in healthcare, but there was an obvious communication failure among the code team members involved in this scenario. The intensivist failed to communicate the indication of using KCl. Although the recent lab report revealed low serum potassium level, this finding was not effectively discussed among the team members. While KCl is not a conventional ACLS medication, no one questioned the potential cardiac damage that could result from this high-alert medication, especially when the patient was already in cardiac arrest. After the intensivist made the verbal order, the pharmacist did not perform an order read back to clarify the route of administration. Lastly, the nurse fellow also failed to verify the route of administration with the intensivist. If the nurse fellow announced aloud, “giving KCl 20 mEq via IV push now”, experienced team members might have the opportunity to catch the error in time.

Root Cause 3: Process

Delayed rapid response activation was a major mistake during this event. A rapid response should have been activated when L.S.'s abnormal heart rate was observed, but the rapid response team was activated more than an hour after the onset of L.S.'s bradycardia. The ICU lacked a clear protocol for treating contagious patients other than COVID-19. In the absence of a defined protocol, the ICU decided to follow COVID-19 code protocols to minimize staff exposure to the infectious disease. Therefore, the code was only announced within the ICU instead of across the hospital. Other than the attending physician and pharmacist, a rapid response team would normally include a respiratory therapist to maintain patent airway, a scribe

to document the event, a supervisor to monitor the code, and a minimum of two experienced nurses to monitor cardiac rhythm and administer medications (Robert Wood Johnson Foundation, 2006).

Root Cause 4: Environment

ICU is a fast-paced and intense environment. As patients admitted in ICU are critically ill and require continuous monitoring of various body systems, it is common to see cardiac monitors, ventilators, and multiple infusion pumps in use. With constant mechanical noises in the background, the pharmacist had a hard time receiving the verbal order. Despite that, the pharmacist did not read back to confirm the route of drug administration.

Literature Review

Medication safety has been identified as a priority among hospitals and facilities. High-alert medications are drugs that have the potential to cause significant harm to patients even when used as intended. Recent studies suggest that approximately 30% of problems during hospitalization are related to medication error, and these errors account for up to 6.5% of disability and death (Kapadia et al., 2017). With the dangerous nature of high-alert medications and alarming rates of medication error, providers must be extra careful when handling these drugs to ensure patient safety.

The Institute for Safe Medication Practices established a list of high-alert medication, which includes drugs such as insulin, epinephrine, and KCl for injection concentrate (ISMP, 2018). When concentrated KCl is administered, cardiac conduction disorders such as complete heart block and arrhythmias may occur (Reeve & Allinson, 2005). While mild hyperkalemia is often asymptomatic, continuous monitoring of EKG and serum potassium level are necessary as

fatal arrhythmias may occur at any time in severely hyperkalemic patients (Reeve & Allinson, 2005).

The association between physician burnout and patient safety has been widely researched. The current guidelines under the Accreditation Council for Graduate Medical Education (ACGME) mandates that residents may work no more than 80 hours per week or 24 consecutive hours on duty (Agency for Healthcare Research and Quality, 2019). A meta-analysis of 47 studies involving 42,473 physicians concluded that burnout is related to two-fold increase of patient safety issues (Panagioti et al., 2018). A prolonged exposure to occupational stress correlates with negative experiences such as emotional exhaustion, decreased professionalism, and depersonalization (Panagioti et al., 2018).

In addition to physician burnout, a lack of safety culture was another human error identified in the root cause analysis. Safety culture is defined as "shared perceptions, beliefs, values, and attitudes that combine to create a commitment to safety" (Emergency Care Research Institute, 2019). Safe medication practices begin with prioritizing medication safety as a departmental objective. The American Society of Health-System Pharmacists (ASHP) published guidelines to address medication errors. Hospitals are advised to develop a program led by a medication safely leader responsible for promoting safety culture and arranging safe medication administration training (ASHP, 2017). Cultures of safety encourage healthcare workers to report breaches in safety without fear of penalization or blame. If these events occur, leaders must initiate a transparent process to evaluate the cause of the error (ASHP, 2017).

Other than human errors, faulty process was another contributing factor to this fatal event. A delayed rapid response is defined as at least one hour passing between the first documented abnormal vital sign and activation of the response team alert (Barwise et al., 2016).

In a study examining the correlation between delayed response team activation and patient outcomes, a total of 1,725 patients were recruited as participants in the research. Barwise et al. (2016) concludes that the delayed group had higher hospital mortality, 30-day mortality, and hospital length of stay compared to the no-delay group.

Corrective Care Plan

Problem Statement

The case of KCl IV injection during a code response at Santa Barbara Cottage Health is a multifaceted event. A combination of distractive ICU environment, delayed rapid response, human error, and lapses in communication resulted in patient death. In terms of human error, a series of false assumptions and a lack of safety culture are the most imminent problems; therefore, the corrective care plan highlighted in the following section will target the human errors of this sentinel event. The stakeholders involved in this plan include the management team, nurses, physicians, and pharmacists.

Goal and Objectives

The primary goal of the corrective action plan is to reduce the occurrence of medication errors, especially when high-alert medications are involved. A significant indicator of improvement is the number of days between major injury or death from medication errors (Graham et al., 2008). Therefore, the ultimate goal is to increase the number of days between medication events that caused preventable harm. This will be accomplished within a year by reaching three main objectives. The first objective is that all nurses will be able to identify the list of high-alert medications by December 2022. The second objective is to establish an interdisciplinary medication safety team that consists of a pharmacist, an information technology (IT) specialist, and a registered nurse. The medication safety team will be responsible for setting

up online modules to train for the usage of event-reporting system, hosting in-person training sessions, and keeping track of the incident reports. The third objective is to set up at least one staff meeting every month to promote better communication and safety culture.

Logic Model

Please refer to Appendix B for the logic model diagram. The logic model identifies the situation as high-alert medication error, specifically KCl given via IV push due to miscommunication, faulty process, and a series of false assumptions. The logic model defines patient safety as the priority. The model also includes the inputs, activities, participants, outcomes, and impact of the corrective action plan. The input includes staff time, planning time, funding, knowledge base, and materials. The implementation of the corrective plan involves establishment of education and training sessions. These training modules will cover topics such as safe medication administration process as well as recognition and proper handling of high-alert medications. The importance of safety culture and communication among staff members are also key components of these training modules. Additionally, the medication safety team will be responsible for teaching staff members about the event-reporting system with use of online modules. To reach the overall goal of this corrective plan, anticipated participants of this project include physicians, registered nurses, and pharmacists. While the short-term and medium-term results are detailed in the logic model, the ultimate impact is to increase the number of days between harmful medication events by December 2022. This will promote patient safety, improve patient outcomes, and overall quality of care.

Change Strategy

To successfully execute changes, Lewin's Three-Step Change Theory will be referenced during the implementation of the corrective action plan. Lewin proposed that individuals or

groups are under the influence of driving and restraining forces. While the driving force shifts the equilibrium toward change, the restraining force counters the push toward the desired outcome (Wojciechowski et al., 2016). The theory consists of three stages: unfreezing, change, and refreezing. During the unfreezing stage, leaders must create a sense of awareness that the existing way of thinking or doing is problematic. The second phase is the changing or moving stage, which involves implementation of change in thoughts and behaviors by demonstrating benefits of change and eliminating the counteractive forces (Wojciechowski et al., 2016). The last step is the refreezing stage. After change is established and becomes the new standard, leaders must reinforce the change and stabilize the equilibrium to prevent regression to the previous state (Wojciechowski et al., 2016). This model is ideal as a guidance for the corrective plan because it identifies strengths and weakness prior to implementing change, which facilitates a smoother transition from old to new practices.

Implementation Plan

Please see Appendix C for the work plan timeline that shows a chronological representation of the corrective plan. The work plan will be divided in three main stages over a year to fulfill the goal of reducing medication error rate with use of Lewin's change model.

Based on Lewin's theory, implementing organizational change begins with the unfreezing stage. In order to raise awareness about the current issue, the nurse leader will place posters or infographics about the importance of safety culture. The posters will emphasize on the value of learning from each other's mistakes, which will help with creating an environment where staff members may voice their concerns without fear or blame. The nurse leaders will also send weekly newsletter through email titled as "Friday Facts". The electronic newsletter will not only include updates of important events or news, but it may also include rates of medication

error and novel evidence-based findings that resolve these adverse events. This will effectively inform nurses about the alarming rates of adverse patient outcomes related to drug administration errors and the urgent need for change.

After the nurse leaders have successfully raised awareness among the nurses, the action plan will move on to the changing phase. The medication safety team consisting of a pharmacist, an information technology (IT) specialist, and a registered nurse will be responsible for setting up an online training module for medication error reporting. Virtual modules are ideal for nurses because they provide a self-paced learning system that is easily accessible on any electronic devices. The medication safety team will also be responsible for hosting in-person teaching sessions. Each session will be two-hours long and will be offered every three months. Topics covered in these training sessions will include but not limited to the five rights of medication administration process and identification of high-alert medications. A potential simulation scenario may include a code response situation similar to the sentinel event presented previously. Nurses will then have the opportunity to practice effective communication by verbalizing their actions, performing order read-back, and voicing concerns when safety breach arises. To ensure full compliance to these training opportunities, reminders of online modules due dates and in-person training availabilities will be included in the weekly newsletter sent through emails.

Lastly, once change has been implemented with use of consistent education and training, the action plan will enter the refreezing stage. In terms of medication safety, the nurse leaders will utilize shift huddles to reinforce the importance of safe drug administration, share strategies that have worked, and offer reminders of training opportunities. In terms of communication and safety culture, the nurse leaders will host monthly staff meetings so that nurses have the chance to discuss any issues that emerged in their work environment. This will help nurse leaders to

recognize resistant forces that are counteracting the shift toward change and develop solutions to the identified issues.

Evaluation

At the end of each training module, the nurse leaders will send out anonymous surveys to evaluate the effectiveness of the courses and receive valuable feedbacks. The surveys will ask the nurses if they feel more knowledgeable about safe medication administration and more well-informed about the event-reporting system. The attendance of in-person sessions and completion of online modules will also be closely monitored as these are good indicators of receptivity. Additionally, nurses will have the opportunity to voice their concerns during the monthly staff meetings held by the nurse leaders.

To monitor the rates of medication error, the medication safety team will be responsible for performing statistical analysis of the incident reports collected from the database throughout the year. The occurrence of medication error, especially events involving high-alert medications, are expected to decrease as nurses are educated about how to properly handle, recognize, and administer high-alert medications. With proper training on error-reporting process along with the presence of safety culture at the workplace, the nurses should be able to comfortably report any medication errors. This ensures that the reports collected will create an accurate depiction of medication error occurrences at the hospital. To further evaluate the effectiveness, it is important to compare the current rate of medication errors with the rate prior to implementation of the corrective plan.

Dissemination of Findings

The goal of dissemination is to share the evaluation results and spread knowledge of evidence-based practices. This may promote the access to information and motivate staff

members to integrate research findings into practice. To reach the intended recipients, the dissemination of findings will be shared using a combination of in-person and online approach. As mentioned previously, the nurse leader will host monthly staff meetings to discuss any difficulties with the new change. These staff meetings will also serve as an ideal opportunity to share evaluation results regarding medication and worthwhile lessons regarding effective communication and safety culture. The evaluation findings and reports on medication errors can also be integrated in the weekly newsletter through email. The data may be presented in graphics and bullet points to highlight major findings.

Budget Justification

Most of the expenditure will be devoted to hiring healthcare professionals for the medication safety team. The interdisciplinary team will be responsible for managing the online training module, hosting the in-person education sessions, and tracking the incident reports. The average annual salaries of the following positions are: IT specialist at $70,000; pharmacist at $150,000; and registered nurse at $90,000. Other than the cost of recruitment, the budget will also include the cost of implementing in-person training sessions. As detailed previously, the training session will be two-hours long and offered every three months. The expected attendance of each session will be forty employees at a time. Each participant will be paid $50 per hour and the total cost attending one session will cost $100 per person. With regards to the online training, the clinical eLearning program from Elsevier will be used. The estimated cost of access to the virtual program will be $200 per person. Training for a total of 1,100 nurses at Santa Barbara Cottage Health will cost $220,000.

In comparison to the proposed budget for this corrective action plan, the economic impact of medication error on hospitals is more expensive. According to Da Silva and Krishnamurthy

(2016), medication errors affect approximately 1.5 million people every year across the United States, totaling $3.5 billion per year. Because preventable medication errors pose serious injury and financial burden, healthcare professionals must be actively involved in the corrective plan to mitigate the issue.

Conclusion

Medication error continues to be a leading yet preventable cause of death in the United States. The sentinel event presented in this paper exemplifies how a combination of miscommunication, faulty process, and false assumptions can lead to detrimental patient outcome. In response to sentinel events, a root cause analysis should be performed to unveil the contributing factors. A thorough corrective plan should then be implemented to address the issue and prevent similar events from happening. By recognizing the occurrence of adverse events and learning from past mistakes, healthcare professionals may become one step closer to improving patient safety and overall quality of care.

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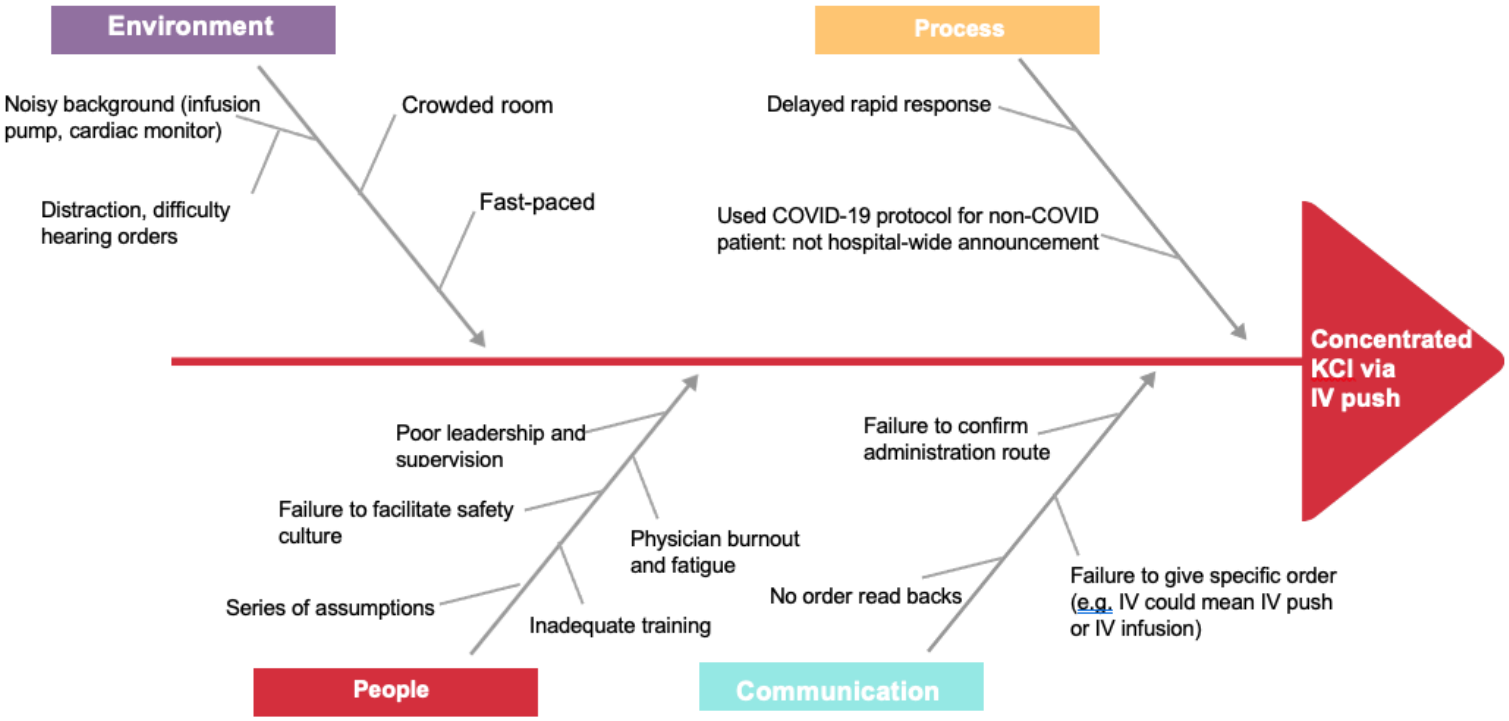
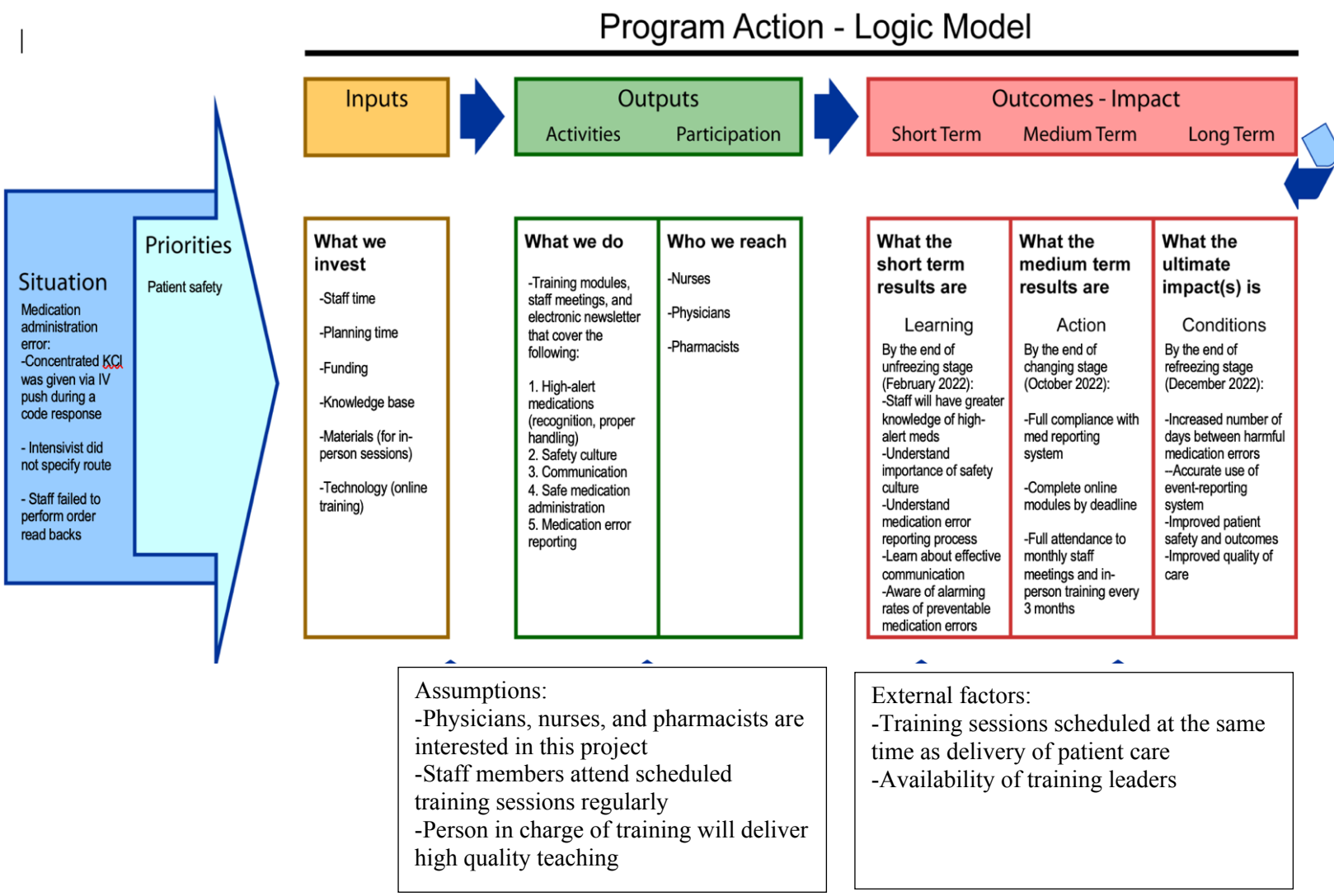
Appendix A: Fishbone Diagram



Appendix B: Logic Model



Assumptions:
-Physicians, nurses, and pharmacists are interested in this project
-Staff members attend scheduled training sessions regularly
-Person in charge of training will deliver high quality teaching

External factors:
-Training sessions scheduled at the same time as delivery of patient care
-Availability of training leaders

Appendix C: Work Plan