USP<800> Hazardous Drug Safe-Handling in the Medical-Surgical Microsystem: A CNL Quality Improvement Project

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USP<800> Hazardous Drug Safe-Handling in the Medical-Surgical Microsystem: 

A CNL Quality Improvement Project

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NURS 653: Internship

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December 14, 2022
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Abstract

Problem: The USP General Chapter <800> guidelines protect healthcare workers from hazardous drugs (HD) and are enforceable by hospital regulatory organizations. Hospitals should increase their safe handling and administration of these drugs to be compliant and protect their workers. This quality improvement project aimed to improve nurse compliance with the safe handling of USP <800> drugs on the medical-surgical microsystem within 16 weeks.

Context: This clinical nurse leader (CNL) quality improvement project was implemented on two medical-surgical microsystems in a San Francisco Bay Area hospital system.

Interventions: The team conducted passive observational data collection and active observation in the form of a questionnaire for nursing staff within two weeks.

Measures: The tools focused on USP <800> signage, personal protective equipment (PPE), use of USP <800> PPE carts, nurse knowledge, comfortability, frequency of HD administration, and awareness of unit procedures.

Results: 24.8% of patients were on USP <800> medications. Twenty-seven nurses completed the questionnaire. Key findings included: 7.5% of door signages present, 44% of nurses surveyed reported always following PPE recommendations, and nurses self-reported high knowledge of HD. PPE was donned and doffed correctly 97% of the time.

Conclusion: Continued efforts are necessary to increase USP <800> compliance in the microsystem. Compliance with the safe handling and administration of HDs is essential to prevent adverse health outcomes in healthcare workers.
USP<800> Hazardous Drug Safe-Handling in the Medical-Surgical Microsystem: A CNL Quality Improvement Project

In the United States, more than eight million healthcare workers are at risk from exposure to hazardous drugs yearly (CDC, 2020). Exposure to hazardous drugs (HDs) can cause them to develop acute and chronic health conditions. Skin rashes, infertility, spontaneous abortions, congenital malformations, leukemia, and other cancers have been linked to HDs (CDC, 2020). Nurses can come into contact with these HDs in their daily routine, for example, during medication administration or when crushing pills that can aerosolize them. Common routes of exposure to HDs are inhalation, absorption through the skin, swallowing, or accidental injection (cdc.gov, 2020). In addition, bodily fluids such as blood, urine, and feces can expose the nurse to HDs. After 48 hours, most HDs are excreted from the body but some last for seven days (Polovich, 2017). There are precautions nurses and other healthcare workers can take to protect themselves. Proper use of personal protective equipment (PPE), routinely wiping surfaces, proper handling techniques, spill control, and proper disposal are ways healthcare workers can protect themselves from exposure to HDs (usp.org, 2020).

It is crucial that hospitals implement standards to protect their workers from developing preventable health conditions so they do not end up as patients themselves. In 2016, the National Institute for Occupational Safety and Health (NIOSH) created USP General Chapter <800> (GC USP <800>) to outline the responsibilities of healthcare facilities to protect their workers from HDs. These guidelines include HD handling, engineering controls, decontamination control methods, and documentation standards (usp.org, 2020). GC USP<800> is enforced by state agencies and regulatory organizations like The Joint Commission (TJC) (usp.org, 2020). In 2019, USP <800> temporarily became enforceable but was remanded until a revision of USP
Organizations like TJC recognized the scarcity of PPE and other resources during the Covid-19 pandemic and did not enforce USP <800> guidelines (jointcommission.org, 2020). Hospitals are working to increase their USP <800> compliance during this interim period. The location of this quality improvement project is one such hospital system located in the San Francisco Bay Area.

My project utilized the clinical nurse leader (CNL) role to improve the safe handling and administration of USP <800> HDs within the medical-surgical unit. The CNL is a nurse who utilizes skills in quality improvement to implement evidence-based practice in the healthcare microsystem (Harris et al., 2018).

**Problem Description**

The problem this quality improvement project addressed was to increase USP <800> compliance in the safe handling and administration of two medical-surgical units (med-surg) in a San Francisco Bay Area hospital system. Our team comprises master's nursing students and the USP <800> Committee from the hospital. While the oncology unit had the greatest incidence of administering USP <800> drugs, nurses on that unit had more training and resources in handling HDs. Therefore, the hospital committee chose the second-highest two units that administer HDs as target microsystems to increase HD protocol compliance. The hospital decided to study and improve the USP <800> compliance on non-oncology floors, where less HD training and resources were available. The two units selected were an endocrine-renal medical surgical unit (med-surg A) and a post-operative medical surgical unit (med-surg B). The quality improvement (QI) aim is to assess the units' current USP <800> safe handling and administration practices and increase PPE compliance. During this project, we conducted a literature review, assessed the
microsystem, implemented our intervention in a plan-do-study-act cycle, analyzed data, and
presented recommendations to the hospital's USP <800> committee.

Available Knowledge

**PICOT Question**

The PICOT question used to focus the literature review was: Among hospital staff who
administer USP <800> HDs (P), does active and passive observation (I) increase USP <800>
safe handling compliance (O) in one month (T), compared with only passive observation (C)?
The literature review was conducted using the Cumulative Index to Nursing and Allied Health
(CINAHL), PubMed, and Google Scholar. Keywords for the search included: USP<800>,
hazardous drug administration, hazardous drugs, and NIOSH. Ten articles were selected for
further review using the John Hopkins Literature Review Tool (see Appendix A). The studies
were grouped into three categories based on their themes related to HDs. The category themes
were factors influencing HD administration and exposure, the scope of the problem, and studies
that aimed to reduce HD exposure.

**Literature Review**

The majority literature focused on factors influencing HD administration and exposure.
Five studies were selected based on focusing on factors that apply to the setting, processes, and
equipment similar to our microsystem. All four studies found PPE availability, patient load, and
workplace safety climate significant factors contributing to nurses not wearing appropriate PPE
while administering HDs. Polovich and Clark 2012, in a cross-sectional mixed-method study,
found nurses' perception of risk to be a key factor. He et al., 2017, surveyed 250 oncology nurses
across the US and found that 90% of nurses only wore one pair of gloves during chemotherapy.
administration. Participation of nurses in nursing practice affairs increased compliance with PPE. Nurses were more compliant with HD safe handling when they demonstrated high knowledge and self-efficiency while being assigned fewer patients in one survey study by Callahan et al. (2016).

A non-experimental level three study was selected for its data on training. The study found that nurses better adhered to policy when the employer provided: engineering control, adequate PPE, training, and enough time to use PPE. It also stated that healthcare workers should be trained and consistently strive to follow safe handling procedures while reporting safety concerns (McDiarmid & Codon, 2005). Based on these studies, our project should consider the availability of PPE, the workload relating to time on the unit, and the education of the staff on the safe handling of PPE.

Three studies were selected that discussed exposure to HD knowledge. The studies were chosen because they discussed aspects of HD handling not looked at in other studies and filled a gap in knowledge. Colvin et al. compared nurses' perception of actions to observing their actual safe handling of HDs. The researchers found nurses under-reported double gloving, gowning, and properly discarding HDs. However, they overestimated gloving and protecting work surfaces from HD contamination (2016). In our project, we should consider nursing accuracy in survey reporting of actions and use a combination of observation and survey data. Hon et al., 2014, conducted a quasi-experimental study across six hospitals and swabbed worker hands for HDs. The results showed that the most significant HD load was not on workers who administered medication but on other staff: volunteers, oncologists, nurse aides, dieticians, and unit clerks. This indicates that our project should not be limited to nurses but include non-nursing staff. The last study in this section used a national survey to assess behaviors that expose healthcare
workers to HDs. Boiano et al. found that workers were exposed when 42% of workers failed to wear the proper gown PPE. The following caused 12% of those surveyed to be exposed: pharmacy contact, contaminated clothing, pill leak during medication administration, and failure to wear chemotherapy gloves. Only 4% of those surveyed reported not wearing gloves and being exposed, believing skin exposure to be minimal in HD administration (Boiano et al., 2014). This study shows that while most healthcare workers are knowledgeable about proper PPE, they do not always comply. Our project should consider barriers to different types of PPE.

The highest-level studies were conducted on interventions to reduce HD exposure. Three studies were selected based on their interventions and similarities to our microsystem. The first study is a randomized controlled study with a large sample size that compared nurses who received one hour of education in the safe handling of HD with quarterly email reminders to a group that received an additional three videos on PPE and spills. While the participants rated the training highly, the extra training yielded no significant difference in PPE usage or perceived barriers (Friese et al., 2019). This indicates that education alone is not enough to change HD compliance. The second study is a level I systematic review. It found measures that reduced HD drug exposure included: full PPE use, engineering controls, HD and environment monitoring, HD identification, and an education and training program for workers (Crickman & Finnell, 2016). This indicates that the microsystem should be set up to provide easy identification of HDs, PPE, education, and support staff to protect themselves. The final study is only a small-scale quality improvement project but was selected because it successfully increased PPE compliance in a microsystem similar to the one in this project. The Diana-Farber Cancer institute implemented a QI project to improve PPE compliance. Initial rates were 30% and by the end of the project were 90% in one year. The hospital conducted mandatory education initially, then
added monthly audits with staff feedback to increase staff participation in the change. They used observation tools and real-time feedback on PPE and included active demonstrations, skill days, and prizes for compliance (Hennessy & Dynan, 2014). This project shows that a successful QI initiative actively involves staff. Our microsystem should consider more hands-on approaches than only online education modules.

This literature review indicates that active and passive observation may increase safe handling compliance compared to passive observation. However, more than one month may be needed to see a change in compliance. The research shows that the microsystem's annual education modules are insufficient to increase compliance. The adequate PPE and active involvement of staff are essential to instigate change. Active observation involving staff would provide the needed push to increase the safe handling and administration of HDs if there is adequate time to implement safety measures.

Rationale

The framework for this project’s implementation combines the Eight Step Change Model and the Plan-Do-Study-Act Cycle (PDSA). This QI project fits into the larger hospital initiative to comply with the USP <800> standard. The Eight Step model mirrors the overarching hospital plan, while the PDSA cycle is this project's part that fits into that larger change initiative.

Kotter's Eight Step Change Model

This quality improvement project is based on Kotter's Eight Step Change Model. This change theory was developed in 1995 by John Kotter (Kotter International, 2022). The reason for using this change model is that the steps for change match more closely the needs of the hospital environment. The literature review showed that successful changes in HD compliance occurred over time, with staff participation, and had multiple steps. The first step of his change model is to
create urgency (Kotter International, 2022). The urgency is externally controlled by the deadline of future USP <800> accreditation inspections.

Steps two through five are this QI project's part in the hospital's overarching project to bring the hospital system fully into UPS <800> compliance. Step two is to form a powerful coalition (Kotter International, 2022). The hospital created the USP 800 committee of managers, unit leaders, and nurses. Our CNL team joined the committee during this project. In step three, create a vision for change, our team wrote a global AIM and specific AIM to focus our project. Step four is to communicate the vision (Kotter International, 2022). Our team presented our project proposal to the hospital committee during this step. Simultaneously, the committee worked with team leaders across their hospital system to set goals for increasing USP 800 compliance. Step five in Kotter's model is to remove obstacles (Kotter International, 2022). The primary intervention of this project was to identify and propose solutions to obstacles in USP <800> compliance.

Steps six through eight are fulfilled by the hospital USP <800> coalition in a broader expansion of this QI project. Step six is to create short-term wins (Kotter International, 2022). Short-term wins are when goals are met during the project. The first win was when the USP <800> carts were created as a system and implemented. The second was when the hospital updated and rolled out its updated USP <800> education training. The win during this QI project was the identification of system breakdowns in USP <800> on the units. The successive win after this project will be the hospital implementing the proposed changes from my project. Step seven is to build on change, and eight is to anchor the changes in the institution's culture (Kotter International, 2022). Building on this project, the hospital will expand the project to other units
in their hospital to continue change. Finally, once the hospital's compliance goal is achieved, they will incorporate the safety changes into their new safety standards.

**Plan-Do-Study-Act Cycle**

The plan-do-study-act (PDSA) cycle is a four-step QI process used to guide this project's stages. The PDSA cycle was originally the plan-do-check-act created by Shewhart in 1986 and modified by Deming, in 1993, to the PDSA cycle (Taylor et al., 2014). The change plan is created during the "plan" stage (Taylor et al., 2014). During this phase, the QI team was formed, the proposal was written, the aim statement was drafted, and the tentative schedule was written. The second phase of a PDSA cycle is "do" when the project is implemented (Taylor et al., 2014). During this stage, the intervention was carried out. The third stage is "study," when the results are examined (Taylor et al., 2014). During this phase, data were analyzed and compared to the aim. Changes are made in the final "act" stage, and the next steps are created (Taylor et al., 2014). Recommendations for future change were presented with project results to the hospital USP <800> Committee. Due to the short duration of our project, future actions to improve the microsystem will be carried out by the hospital's team. Refer to Appendix C for the project's PDSA cycle.

**Specific Project Aim**

The specific aim statement of this QI project is to stand as the goal for the length of the project. We aim to improve nurse compliance with the safe handling of Hazardous Drugs (USP <800>), on Medical-Surgical floors A and B, within 16 weeks. We expect a 50% increase in the use of USP <800> carts, PPE, and door and bathroom signs correctly filled out. This increase will be measured by passive and active observation and questionnaires. Refer to Appendix B for the entire global aim statement.
Methods

Context

Microsystem assessment and project organization are essential components of a successful QI project. This QI project was implemented using a PDSA cycle (Appendix C), and the project was organized using a Gantt chart (Appendix D). Weekly meetings were set up with our team of CNLs. Meetings between the hospital USP <800> team and our CNL team occurred at each new project stage. After defining the AIM statements (Appendix B), we assessed the microsystem using the five Ps Assessment, SWOT analysis, and case and effect diagram. A cost-benefit analysis was included to inform hospital stakeholders. Key stakeholders included: the USP <800> committee, unit managers, interdisciplinary hospital staff, and the patients.

Five Ps Assessment

Using a five Ps assessment tool, our team identified the microsystem's purpose, patients, professionals, processes, and patterns to understand the scope of the problem (Wasson et al., 2003). This was done through microsystem observation, interacting with staff, reviewing the hospital's current annual education, and meeting with the hospital USP <800> committee.

Purpose. The purpose of the hospital system that encompasses the microsystems our team assessed included: dedication to their patients and employees, continuous improvement, and acting as a highly reliable organization that promotes safety. This project improved safety in the microsystem and decreased health risks to the patients and employees. This mission and values demonstrate the organization's commitment to keeping its employees safe. This USP <800> QI project coincides with the organization's values.
**Patients.** The patient populations on the unit were mainly alert and oriented but unable to ambulate independently. Patients averaged older than 55 years of age. On Med-surg A, the patients had prescriptions for all routes of medications. However, Med-surg B patients were mainly on oral or injectable drugs. Intravenous HDs are rarely administered. Subcutaneous heparin injections were the most common USP <800> medication prescribed on both units. An average of one to two patients were on chemotherapy as outpatients and were admitted to the unit with USP <800> drugs still in their system, posing a risk to staff.

**Professionals.** The professionals on the units made up a diverse interdisciplinary team. Both units have a manager, nurse educator, social worker, nurses, certified nursing assistants, charge nurse, and unit secretary on the floor. Other healthcare workers that come daily to the units are respiratory therapists, physical therapists, phlebotomists, janitors, doctors, and nurse practitioners. Both units had travel nurses and break nurses, but more were seen on Med-surg B. The hospital employees receive annual online training on USP <800> precautions and PPE. However, while many know their role in HD handling, they are unaware of how their roles are connected; this causes a breakdown in communication. The travel nurses and individuals not generally on the units may be unaware of the USP <800> protocols and inadvertently cause HD contamination.

**Patterns.** The patterns in the two microsystems are different relative to the variation in layout and patient populations. Med-surg A is a rectangular layout with one nursing station on opposite sides; each nursing station has a medication room. The medication room has a USP <800> PPE designated cart. PPE not stocked in the cart can be found in the Covid-19 PPE supply room. Because this unit has a significant number of isolation and Covid-19 patients, there is adequate PPE available. On med-surg B, the unit comprises three connecting squares with a
long hallway running the length of the squares. The supply rooms and hallways are narrow, so there is less room for the USP <800> carts to fit. The carts on this unit were kept in the middle supply room and were not routinely fully stocked. The nurses on this unit rarely administered an HD that required more than double gloving. If they had a higher PPE need for the USP <800> drug, they obtained PPE from the Covid supply shelf rather than designated carts.

**Processes.** The processes in the microsystems are designed to follow the hospital USP <800> yearly training procedure, but actual processes deviate from the training. The electronic health record (EHR) has a banner identifying the USP <800> category of drug the patient is on. The banner is designed to populate if the patient answers a questionnaire that they take HDs at home or are on chemotherapy as an outpatient. This is because the patient may still have HDs in their system. When a patient is given a new order for a USP <800> drug, the nurse should pull a blank sign from the medication room, circle the category of PPE to wear, and place one sign each at the bathroom door and room doors. The sign will alert the janitor or other staff who may come into contact with bodily fluids of what PPE to wear. When PPE is needed, the hospital has USP <800> carts stocked with PPE and a laminated sheet to identify which PPE to don. The carts also contain wipes to decontaminate surfaces, a spill kit for pills less than 5 milliliters, and a pill crusher. The process taught in hospital training is to take the cart into the patient's room to crush and administer HDs, then immediately wipe the cart to decrease HD contamination across the unit. During our 5Ps assessment, nurses reported not taking carts into the rooms. They crushed medications in the medication rooms and acquired PPE from various locations across the units, not the dedicated carts.
**SWOT Analysis**

The SWOT analysis was used to assess the microsystem's strengths, weaknesses, opportunities, and threats for action (phf.org, 2017). The strengths of the microsystem were the tools provided on the unit. There were USP <800> HD carts with PPE on each unit, the computer system had warning banners for staff to identify HDs, and the staff received yearly HD online training. Weaknesses of the unit were based on a breakdown in ownership of processes and communication. Some staff did not use the carts, and one was designated to restock the USP <800> PPE. The computer HD warning banner PPE identification link was broken. Threats to the microsystem were the lack of maintenance and the replacement of carts and PPE.

Opportunities for improvement lay in incorporating USP <800> guidelines into existing processes. The person who stocks the unit PPE can be assigned to stock HD PPE. Door signages identifying patients on HDs can be incorporated into existing charge nurse rounding. The microsystem has the existing framework for a successful USP <800> implementation and needs to integrate HD safe administration into current practices. (See Appendix E).

**Cause and Effect Diagram**

Causes of unsafe HD administration were analyzed as part of the unit assessment. The root cause analysis of the microsystem was conducted using a cause-and-effect analysis with the fishbone diagram tool (see Appendix F). Key findings on the unit were in patient volume, environment, processes, and materials. The patient volume is roughly 36 per unit, with only one to three USP <800> carts for HD administration. The environment of unit B was large, but storage rooms and hallways were too narrow to store the PPE carts. This resulted in nurses preferring to obtain PPE from supply closets closer to their patient rooms which were viewed as faster and easier to access. In processes, there was no designated person in charge of the cart or
signage process, and a need for more communication on cart and signage requirements. Unclear processes contributed to the lack of adherence to HD protocol.

**Intervention**

The intervention was created based on evidence-based practice research, hospital policy and procedures, analysis of the microsystem assessment, and collaboration with the hospital USP <800> committee. The intervention was a combination of active and passive observation.

The passive observation was collected by CNLs on the unit using an observational data collection form created for this project (see Appendix G). The data collected focused on the electronic health record (EHR), patient room USP <800> signage, appropriate PPE usage, and USP <800> carts.

Active observation in the form of an anonymous formal questionnaire was administered to nursing staff by the CNLs. The questionnaire was administered "elbow-to-elbow" in person between the nurse and CNL. It covered the nurses' self-reported knowledge of USP <800> drugs, comfortability, and frequency of administering HDs, HD carts, HD waste containers, and HD signage (see Appendix H). These topics were chosen because they are the foundation of the hospital's yearly USP <800> training. Informal interviews of non-nursing staff were conducted with nursing assistants, janitorial staff, and pharmacy.

**Study of the Intervention**

The intervention was implemented over two weeks in person on the units by the CNLs. This QI project used quantitative and qualitative data collection, with both tools having open and closed-ended questions, to gain as much information as possible on the current status of USP <800> practices in the microsystem.
The observational data collection form tool covered 12 questions (see Appendix G). The first two questions covered unit metrics. The number of patients on USP <800> medications was to compare the actual number of HD administered to the nursing perceived number of HDs from the questionnaire. Questions three and four cover the functioning of the EHR HD banner. Question five asks if there is correct signage on bathrooms and patient doors. This was included because without this sign, the non-nursing staff and visitors do not have a way of knowing there is a risk of HD exposure. Questions six through eight cover correct PPE usage for HD. This was measured to compare nurses' reporting of PPE from the questionnaire to actual PPE usage. It also measures whether PPE is selected, donned, and doffed correctly to protect the wearer. Nine to eleven is an inventory of the unit's USP <800> carts and identification of PPE locations on the unit. The last question is an open-ended question where interviews with non-nursing staff were recorded.

The active observation questionnaires were kept short at seven questions to increase the number of nurses willing to take the questionnaire (see Appendix H). Questions one through six were qualitative. Most questions were on a Likert scale of zero (none) to ten (high), with a yes or no answer and a numeric answer. This was to keep it answerable in under two minutes because of management's concern of "survey fatigue" on the units. The last question was an open-ended question for improving unit USP <800> procedures.

**Measures**

The goal of the intervention period was to collect questionnaire data from 75% of dayshift nurses on the units and capture dayshift observational data. The observational tool for all categorical variables, except USP <800> carts, was analyzed and compared as percentages. The data on USP <800> carts was analyzed as averages of PPE. The questionnaire tool data was
analyzed as mean scores. All quantitative data were analyzed separately by unit, then combined and analyzed as a whole data set. Finally, qualitative open-ended answers were selected as representative of themes in answers and compiled as an anonymous staff comments chart.

**Ethical Considerations**

The American Nurses Association's *Code of Ethics* (COE) Provision 3 is the foundation of this QI project (ANA, 2015). The COE provision three states that "the nurse promotes, advocates for, and protects the rights, health, and safety of the patient" (ANA, 2015). This call to safety by the COE extends to provision 3.4; nurses are responsible for fostering a culture of safety (ANA, 2015). Nurses have an ethical obligation to uphold health and safety, which extends to themselves. Promoting USP <800> safe handling and administration of HD decreases the risk of adverse health outcomes and increases the safety of the nurses and other staff in the hospital.

This was a non-research quality improvement project and was not subject to IRB oversight. This was determined using the University of San Francisco's *Change Project Checklist* (see Appendix C). This QI project was conducted with the full approval of the hospital and med-surg units. There were no conflicts of interest in this QI initiative.

**Results**

This section describes the results of the project intervention tools used to improve nurse administration and safe handling of HDs. The data was collected using passive observation and active questionnaire tools (see Appendix I and J).
Passive Observation Results

The first step of data collection was to identify the number of patients on hazardous drugs to identify our patient population. The EHR was used to identify USP <800> patients on the units. 29.1% of Unit A patients were on a USP <800> medication, with only 20.7% on Unit B. A combined total of 24.8% of patients during the project were on a USP <800> drug (see Appendix K, Chart 1). A total of 155 patients on USP <800> medications during the QI project, divided by ten days of data collection, equates to an average of 16 patients per day on USP <800> medications.

The EHR banner nurses use to identify USP <800> patients malfunctioned 31% of the time. This malfunction was called a "misfire" and defined as the EHR not identifying a USP <800> medication. 100% of the time, the banner link did not load the PPE recommendation (see Appendix K, Chart 2).

The number of USP <800> door and bathroom signs were counted during each data collection day. A sign was considered correct if it was posted by the patient door or bathroom and filled out correctly. Across both units combined, only 1.7 % of patients had bathroom signage, and 7.5% had door signage (see Appendix K, Chart 3).

There were 37 incidents of staff utilizing PPE on the units combined. In addition, 97% of PPE observed across both units was correctly donned and doffed (see Appendix K, Chart 4). The majority of PPE required was a double glove for HD oral medication.

USP <800> cart inventory on units A and B was conducted and averaged by two carts on unit A and three carts on unit B. Data was analyzed in a line graph for trends in data. The USP <800> carts inventory increased on unit A (see Appendix K, Charts 5). On unit B, it initially
increased and then averaged the same (see Appendix K, Charts 6). The cart PPE combined average trends up across time (see Appendix K, Chart 7).

**Active Observation Results**

The in-person questionnaire data was administered to 27 nurses, 14 from unit A and 13 from unit B. The mean of each question was recorded by unit and as a combined mean (see Appendix K, Table 1). On a scale of 1-10, nurses rated their knowledge of HDs as 7.15 and comfortability handling HD as 8.45. They self-reported an estimation of 3.44 occurrences of administering HD per week. 56% reported knowing where USP <800> carts and waste receptacles were. On a scale of 1-10, nurses rated HD signage and PPE ease of identification as 8.39. 44% of nurses self-reported always following PPE recommendations, 37% reported sometimes, 15% most of the time, and 14% never (see Appendix K, Table 1). The staff’s written-in answers to the final open-ended question in the questionnaire were recorded in a figure (see Appendix K, Figure 1). Topics of these answers included feedback on PPE and signage.

Unintended consequences of our project were an increase in nurse survey fatigue and reduced time on work-related tasks to participate in our project. A secondary effect of our project was enhanced awareness of USP <800> procedures on the units. The impact of our QI project on the organization was to increase stakeholders' awareness of current unit processes and shortcomings related to USP <800> safe handling and administration and provide proposed solutions.
Discussion

Summary

This section will summarize the results from this QI project conducted on med-surg units A and B. I will discuss key findings, relevance to the specific aim, lessons learned, strengths of the project, and how the project contributed to increasing compliance and safe handling of USP <800> HDs.

The key findings of this QI project were that 24.8% of patients across the two microsystems were on USP <800> medications. The results of this project highlight the importance and need for compliance with policy and procedures to prevent the accidental exposure of healthcare workers. However, in the questionnaire data, the nurses estimated only administering HDs a mean of 3.44 times per week. The nurses may be unaware of which drugs are HDs, and additional training on identification in the EHR is an educational opportunity. The presence of door and bathroom signage identifying USP <800> patients and correct PPE was very low. This puts non-nursing employees at risk for HD exposure and adverse health outcomes. In the questionnaire portion of our data, we discovered that signage is the only way for janitorial staff to know what PPE to use to protect themselves. However, in the open-ended section of the questionnaire, nurses reported using methods other than door signages to identify HDs and PPE. Therefore, the nurses have a knowledge gap regarding why signage is necessary. We found no individual responsible for proper signage; nurses only posted signs if they had time. Most nurses did not know where to obtain blank signs.

Although nurses reported high ease of identifying correct PPE, less than half reported always using recommended PPE. Therefore, future studies should assess barriers to PPE
compliance in HD administration. The literature review found time and unit safety culture significant barriers in other studies. Nurses reported a high level of knowledge and comfortability with USP <800> medications. Future work in the microsystem should focus on implementing PPE, signage, and spill clean-up rather than knowledge.

The USP <800> carts were not observed to be utilized as intended during observational data collection. Unit A preferred collecting PPE and crushing HDs in the medication room using a closed transfer system rather than taking the cart to the room. Unit B did not utilize the carts for PPE or pill crushing and instead used the medication room for pill crushing and PPE from the "Covid Supply Closet" on the unit. We found that there was no individual in charge of stocking USP <800> supplies on both units. The QI project increased USP <800> awareness and increased cart inventory during the project.

The QI project's specific aim was to see a 50% increase in the use of USP <800> carts, PPE, and signage. This goal was not met during our project. PPE usage and signage remained the same throughout the project. While cart usage did not increase, the cart stocking did increase during the project. This was likely due to increased awareness of HD PPE.

Lessons from this project's methods were that the combination of active and passive observation yielded better data collection than either intervention individually. The questionnaire intervention would have been more effective if administered digitally to more participants. However, the unit managers were concerned about "survey fatigue" among their staff.

The main strength of this project was the collaboration between the USP <800> hospital committee and our CNL team. This teamwork led to a further-reaching project than what our QI team could accomplish alone. Our QI project was part of a larger hospital initiative by the
hospital USP <800> committee, which will utilize our data and recommendations to build upon this project's PDSA cycle to increase HD compliance.

Limitations

A significant limitation in implementing this project was the project's time constraint of fifteen weeks, which allowed only two weeks for data collection. The sample size for our passive and active observation was small, with 155 patients on HD and 27 nurses participating in our questionnaire. During questionnaire administration, nurses could select answers on the screen or provide answers orally. The oral reported answers may have been biased because of the proximity of colleagues and supervisors. There is a possibility of self-reporting bias in respondents indicating an unidentifiable knowledge gap. In addition, donning and doffing were not observed in hospital guests.

Future Recommendations

Based on our findings, recommendations to improve USP <800> compliance and safe handling can be broken down into two categories PPE and signage. A workflow diagram of each process illustrates the breakdowns and recommendation implementation (see Appendix L). In PPE workflow, barriers are when the EHR PPE banner malfunctions and carts are not stocked with PPE. Both barriers increase nurses' time to don appropriate PPE (see Appendix L, Diagram 1). Increased time poses a significant barrier to PPE compliance (He et al., 2017). The hospital IT department should repair the broken PPE banner identification link in the EHR. The Unit secretary, responsible for unit PPE inventory, can easily include inventorying and restocking USP <800> PPE on the unit. In Unit B, where there is insufficient room for the carts, the "Covid Supplies" closet can be designated to include USP <800> supplies since this is where most supplies are pulled from.
Lack of signage poses a threat to PPE compliance and safety for non-nursing staff. The charge nurse can incorporate these signs into the daily rounding by generating a list of patients on HDs, checking for signage when rounding, and providing the list generated to the janitorial staff (Appendix L, Diagram 2). A barrier to posting signage is finding the sign to fill out. USP <800> signs can be laminated and stored in the medication room where other isolation signs are kept. With correct signage, non-nursing staff and visitors can protect themselves from HD exposure.

Cost Benefit Analysis

The cost-saving benefits of the project pay for the cost of implementing the recommendations. During our project, there was an average of 16 patients per day on USP <800> medications and an average of ten nurses per day administering these medications. PPE costs per patient per day average $12.45 (Muoio, 2021). This comes to $72,708 per year in PPE. Staffing hours to cover recommendations total $24,729, and signage costs $84. The total yearly cost of implementing the project recommendations is $97,521 (see Appendix M, Table 1). However, cost-saving benefits include saved worker's compensation and indirect and direct costs of chemical exposure from OSHA 2022 data; the benefits total $587,422 (see Appendix M, Table 2). Therefore, implementing the recommendations would yield $489,901 in savings per year.

Clinical Nurse Leader Relevance

As CNLs in the microsystem, our team utilized CNL roles, professional values, and competencies. The CNL participates in QI projects to promote the professional values of quality, care, safety, and fiscal stewardship at the microsystem level (Harris et al., 2018). The CNL roles performed during this project were systems analyst, outcomes manager, information manager,
and advocate. Interprofessional communication, assessment, leadership, and quality improvement were the CNL competencies demonstrated in our project (Harris et al., 2018).

**Conclusion**

This CNL lead QI project aimed to increase USP <800> compliance and safe administration on the medical-surgical microsystem. While this QI project did not succeed in increasing USP <800> PPE, signage, and cart usage during the intervention, our data and recommendations will be incorporated by the hospital USP <800> committee to create the subsequent intervention on the units. The sustainability of this project will necessitate creating more robust unit communication and process ownership on the units. Our QI intervention has the potential as a valuable tool for data collection on other microsystems of the hospital. However, the questionnaire tool should be modified to include an assessment of nurse barriers to change. Application in different medical settings is possible by tailoring the tools to microsystem-specific USP <800> protocols. We hope this project encourages future QI projects to increase HD safety and compliance to protect nurses and other healthcare workers. As new drugs are developed each year, healthcare workers are exposed to even more USP <800> drugs, and the need for safe practices will continue to expand.
References


https://www.kotterinc.com/methodology/8-steps/


https://doi.org/10.1097/01.jom.0000165751.21088.46

Muoio, D. (2021). Hospitals have spent more than $3B on personal protective equipment since Covid-19 began. *Fiercehealthcare.com.* Retrieved from,
https://www.fiercehealthcare.com/hospitals/hospitals-have-spent-over-3b-personal-protective-equipment-since-covid-19-began-premier


Appendix A

Literature Review

**PICOT Question:** Among hospital staff who administer USP <800> Hazardous Drugs, does active and passive observation increase USP <800> safe handling compliance in one month?

<table>
<thead>
<tr>
<th>Level of Evidence (Type of Evidence)</th>
<th>Source</th>
<th>Synthesis of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I Randomized controlled study (larger sample size)</td>
<td>Friese, C., Yang, J., Mendelsohn-Victor, K., &amp; McCullagh, M. (2019). Randomized controlled trial of an intervention to improve nurses' hazardous drug handling. <em>Oncology Nursing Forum</em>, 46(2), 248-256. <a href="https://doi.org/10.1188/19.onf.248-256">https://doi.org/10.1188/19.onf.248-256</a></td>
<td>Control intervention: 1 hr education module on safe HD handling, NIOSH recommendations with quizzes, quarterly email reminders to reinforce education. Treatment intervention: 3 videos on PPE, requirement to report HD drug spills, quarterly email on spills. Results: no significant differences in PPE use, knowledge, perceived barriers. Participants reported high satisfaction with the study experience.</td>
</tr>
<tr>
<td>Study</td>
<td>Personal protective equipment uses and hazardous drug spills among ambulatory oncology nurses. <em>Oncology Nursing Forum</em>, 44(1), 60-65. <a href="https://doi.org/10.1188/17.ONF.60-65">https://doi.org/10.1188/17.ONF.60-65</a></td>
<td>Nurses report HD spill. 90% wore only one pair of chemo gloves. Inc PPE use associated with: inc nurse participation in practice affairs, non private ownership, inc nurse workloads, fewer barriers to PPE.</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Study</td>
<td>Description</td>
<td>Key Findings</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>Level IV</strong></td>
<td>National Survey</td>
<td>Boiano, J. Steege, A., &amp; Sweeney, M. (2014). Adherence to safe handling guidelines by Health Care workers who administer antineoplastic drugs. <em>Journal of Occupational and Environmental Hygiene</em>, 11(11),728-740. &lt;br&gt;<a href="https://doi.org/10.1080/15459624.2014.916809">https://doi.org/10.1080/15459624.2014.916809</a></td>
</tr>
<tr>
<td><strong>Level V</strong></td>
<td>Quality Improvement</td>
<td>Hennessy, K., &amp; Dynan, J. (2014). Improving compliance with personal protective equipment use through the model for improvement and staff champions. <em>Clinical Journal of Oncology Nursing</em>, 18(5), 497-500. &lt;br&gt;<a href="https://doi.org/10.1188/14.CJON.497-500">https://doi.org/10.1188/14.CJON.497-500</a></td>
</tr>
</tbody>
</table>
Appendix B

Student Project Approval: Statement of Determination

Title of Project:
Improving Safe Handling and Administration of USP <800> Hazardous Drugs within the Medical-Surgical Unit

Brief Description of Project:
We aim to improve nurse compliance with safe handling of USP 800 drugs as outlined on the hospital microsystem's "2022 HD Safe Handling and Management Updates Training. The process begins with the initial assessment of the microsystem, review of policy and procedures, investigation of current and relevant EBP. The process ends with the implementation of recommendations based on the assessment of the microsystem and data collected during the project through questionnaires, observational data, and feedback from the staff. We expect an increase in compliance of safe handling of HD including carts signage and PPE by 50%. This increase will be measured by a questionnaire administered in person to nursing staff and an observational data collection.

To qualify as an Evidence-based Change in Practice Project, rather than a Research Project, the criteria outlined in federal guidelines will be used: (http://answers.hhs.gov/ohrp/categories/1569)

This project meets the guidelines for an Evidence-based Change in Practice Project as outlined in the Project Checklist (attached). Students may proceed with implementation.

Comments:

Signature of Supervising Faculty ____________________________ (date) 

Signature of Student ____________________________ (date) 10/15/22
Appendix C

IRB Non-research Determination Form

EVIDENCE-BASED CHANGE OF PRACTICE PROJECT CHECKLIST *

STUDENT NAMES Ananda Lo
DATE 10/15/22

SUPERVISING FACULTY: Dr. Chukwu

Instructions: Answer YES or NO to each of the following statements:

<table>
<thead>
<tr>
<th>Project Title: Improving Safe Handling and Administration of USP &lt;800&gt; Hazardous Drugs within the Medical-Surgical Unit</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim of the project is to improve the process or delivery of care with established/accepted standards, or to implement evidence-based change. There is no intention of using the data for research purposes.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The specific aim is to improve performance on a specific service or program and is a part of usual care. ALL participants will receive standard of care.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The project is NOT designed to follow a research design, e.g., hypothesis testing or group comparison, randomization, control groups, prospective comparison groups, cross-sectional, case control). The project does NOT follow a protocol that overrides clinical decision-making.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The project involves implementation of established and tested quality standards and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does NOT develop paradigms or untested methods or new untested standards.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The project involves implementation of care practices and interventions that are consensus-based or evidence-based. The project does NOT seek to test an intervention that is beyond current science and experience.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The project is conducted by staff where the project will take place and involves staff who are working at an agency that has an agreement with USF SONHP.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The project has NO funding from federal agencies or research-focused organizations and is not receiving funding for implementation research.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The agency or clinical practice unit agrees that this is a project that will be implemented to improve the process or delivery of care, i.e., not a personal research project that is dependent upon the voluntary participation of colleagues, students and/or patients.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>If there is an intent to, or possibility of publishing your work, you and supervising faculty and agency oversight committee are comfortable with the following statement in your methods section.</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

**ANSWER KEY:** If the answer to ALL of these items is yes, the project can be considered an Evidence-based activity that does NOT meet the definition of research. IRB review is not required, except at Stanford Hospital. Keep a copy of this checklist in your files. If the answer to ANY of these questions is NO, you must submit for IRB approval.
Appendix D

Global Aim Statement

We aim to improve nurse compliance with the safe handling of Hazardous Drugs (USP <800>) as outlined in the 2022 Hazardous Drugs (HD) Safe Handling and management Updates Training on the Medical Surgical floors A and B.

The process begins with an initial assessment of the microsystem, a review of the hospital's Hazardous Drug (USP <800>) policy and procedures, and an investigation of current and relevant evidence-based nursing research.

The process ends with implementing recommendations based on the assessment of the microsystem, John Muir policy and procedures, data collected during the project through questionnaires and observational data, and feedback from the medical-surgical staff.

By working on this process, we expect increased compliance with safe handling of Hazardous Drugs (USP <800>), including increased use of USP <800> carts and PPE by 50% and an increased number of Hazardous Drug (USP <800>) signs correctly filled out. This increase will be measured by the questionnaires and observation data collection.

It is important to work on this now because:

1. Hazardous Drugs (USP <800>) medications pose a health risk to nurses. Therefore, nurses should be trained to understand the risks and proper techniques to fully protect themselves.

2. Not following or meeting current standards of safe handling of Hazardous Drugs (USP <800>) became an enforceable regulation in 2019.

3. Nurses who become ill from repeated exposure to Hazardous Drugs (USP <800>) will contribute to the nursing shortage.

4. Adequate PPE is now available following the PPE shortage during the COVID-19 pandemic removing this barrier to comply with Hazardous Drugs (USP <800>) recommendations.
Appendix E

PDSA Cycle

ACT
- Developed next steps based on what we learned
- Presented to hospital on 11/22/22

PLAN
- Developed global & Specific AIM
- Collaborated with John Muir
- Developed PICOT Question
- Created data collection forms
- Created data collection questionnaires

DO
- Analyzed microsystem 5Ps assessment
- Conducted root cause analysis
- Conducted SWOT analysis
- Conducted data gathering on 1 Med-Surg unit in each hospital
  - Passive & active observational data collection
  - Administered questionnaire

STUDY
- Analyzed data gathered from
  - Passive & active observation
  - Questionnaires
- Reviewed results of data
## Appendix F

### Gantt Chart

<table>
<thead>
<tr>
<th>WEEK</th>
<th>09/28 - 09/05</th>
<th>09/04 - 09/10</th>
<th>09/11 - 09/17</th>
<th>09/18 - 09/24</th>
<th>09/25 - 10/01</th>
<th>10/02 - 10/08</th>
<th>10/09 - 10/15</th>
<th>10/16 - 10/22</th>
<th>10/23 - 10/29</th>
<th>10/30 - 11/05</th>
<th>11/06 - 11/12</th>
<th>11/13 - 11/19</th>
<th>11/20 - 11/26</th>
<th>11/27 - 12/03</th>
<th>12/04 - 12/10</th>
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<tr>
<td>Identification of Problem</td>
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<tr>
<td>Development of PICOT and AIM Statements</td>
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<td>Literature review</td>
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<tr>
<td>Assessment of Microsystem</td>
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<tr>
<td>Data Collection</td>
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<td>Present proposal with future recommendations</td>
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</tbody>
</table>
## Appendix G

### SWOT Analysis

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hazardous carts available on the units</td>
<td>• Some staff not using the carts</td>
</tr>
<tr>
<td>• USP 800 training for staff</td>
<td>• Unit secretary not trained on USP 800</td>
</tr>
<tr>
<td>• Warning banners in each patient MAR</td>
<td>• No responsible person to fill the carts</td>
</tr>
<tr>
<td></td>
<td>• Warning banners misfiring occasionally</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Assign responsible person to check and refill the carts</td>
<td></td>
</tr>
<tr>
<td>• Daily door signage rounding</td>
<td>• Lack of sustainability</td>
</tr>
<tr>
<td>• Increased compliance with USP 800 Federal guidelines</td>
<td>• Training for new staff members</td>
</tr>
<tr>
<td></td>
<td>• Maintenance and replacement of carts</td>
</tr>
</tbody>
</table>
Appendix H

Fishbone Diagram
Appendix I

Observational Data Collection Form

1. Site / Number patients on Unit/ Date Collected
2. Number of Patients on USP <800> Drugs
3. Is there an EPIC banner and MAR USP <800> tab to notify staff of HDs?
4. Explain any discrepancy with EPIC banner or MAR USP <800> tab
5. Number of UPS <800> patients with CORRECT Room door signage
   a. Room door signage
   B. Bathroom door signage
6. Do the nurses wear the correct PPE for HD?

7. Please explain nurse wearing PPE correctly, incorrectly, or other

8. Are the nurses donning/doffing PPE correctly?

9. Location of UPS <800> carts?

10. Cart Inventory: RX crush, gowns, chemo gowns, gloves, goggles, face shield, bleach wipes, sani-wipes, spill kit, laminated HD drug PPE Chart

11. If missing items from USP <800> cart, please elaborate here:

12. Additional Observations or notable data collected
Appendix J

Questionnaire Form

1. On a scale of 0-10, how would you rate your knowledge of Hazardous Drugs (USP <800>) (0 indicating no knowledge, 10 indicating a high level of knowledge)?

   0  1  2  3  4  5  6  7  8  9  10

2. On a scale of 0-10, how comfortable do you feel with the handling of Hazardous Drugs (USP <800>) (0 indicating not comfortable at all, 10 indicating very comfortable)?

   0  1  2  3  4  5  6  7  8  9  10

3. How many times per week do you administer Hazardous Drugs (USP <800>?)? A numbered estimation is preferred.

4. Do you know where the Hazardous Drug (USP <800>) carts and waste receptacles are located?

5. On a scale of 0-10, how easy do you feel it is to identify Hazardous Drug (USP <800>) signage and recommended PPE for administration of the drugs?

   0  1  2  3  4  5  6  7  8  9  10

6. How often do you follow the Hazardous Drug (USP <800>) PPE recommendations?

   Never  Sometimes  Most of the time  Always

7. What are your recommendations for improvement?
Appendix K

Results

Chart 1

Patients on USP <800> Hazardous Medications

![Chart 1 showing patients on USP <800> hazardous medications]

Chart 2

EHR Banner Errors

![Chart 2 showing EHR banner errors]

Note:

53 Misfire incidences include:

- 31% of the time, the MAR Banner Did NOT List the Appropriate Medication
- 100% of the time banner did not load the PPE recommendation
Chart 3

USP <800> Signage

Chart 4

Donning & Doffing PPE
Chart 5

Unit A Average Number of PPE Per Cart

Chart 6

Unit B Average Number of PPE Per Cart

Chart 7

Combined Average Number of PPE Per Cart
**Table 1**

*Questionnaire Data Results*

<table>
<thead>
<tr>
<th>Questionnaire Question</th>
<th>Unit A ( n=14 )</th>
<th>Unit B ( n=13 )</th>
<th>Combined Data ( n=27 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>On a scale of 1-10, how would you rate your knowledge of hazardous drugs (USP &lt;800&gt;) ((1 = \text{no knowledge}, \ 10 = \text{high level of knowledge}))?</td>
<td>Mean 7.21</td>
<td>Mean 7.08</td>
<td>Mean 7.15</td>
</tr>
<tr>
<td>On a Scale of 1-10, how comfortable do you feel with the handling of hazardous drugs (USP &lt;800&gt;) ((1 = \text{not comfortable at all}, \ 10 = \text{very comfortable}))?</td>
<td>Mean 8.07</td>
<td>Mean 8.83</td>
<td>Mean 8.45</td>
</tr>
<tr>
<td>How many times per week do you administer Hazardous Drugs (USP &lt;800&gt;)?</td>
<td>Mean 1.79</td>
<td>Mean 5.096</td>
<td>Mean 3.44</td>
</tr>
<tr>
<td>Do you know where the hazardous drugs ((USP &lt;800&gt;)) carts and waste receptacles are located?</td>
<td>Yes: 10</td>
<td>Yes: 5</td>
<td>Yes: 15</td>
</tr>
<tr>
<td>No: 4</td>
<td>No: 8</td>
<td>No: 12</td>
<td></td>
</tr>
<tr>
<td>On a scale of 1-10, how easy do you feel it is to identify hazardous drugs (USP &lt;800&gt;) signage and recommended PPE for administering the drugs?</td>
<td>Mean 7.93</td>
<td>Mean 8.85</td>
<td>Mean 8.39</td>
</tr>
<tr>
<td>How often do you follow the hazardous drugs (USP &lt;800&gt;) PPE recommendations?</td>
<td>Always: 6</td>
<td>Always: 6</td>
<td>Always: 12</td>
</tr>
<tr>
<td>Sometimes: 7</td>
<td>Sometimes: 3</td>
<td>Sometimes: 10</td>
<td></td>
</tr>
<tr>
<td>Most of the time: 1</td>
<td>Most of the time: 3</td>
<td>Most of the time: 4</td>
<td></td>
</tr>
<tr>
<td>Never: 0</td>
<td>Never: 1</td>
<td>Never: 1</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1**

*Questionnaire Open-Ended Answers*

- “Non-nursing staff rely on signage for knowing what PPE to wear. Nurses sometimes do not put up the sign and janitorial or CNA staff finds out after cleaning or being with the patient that they should have worn PPE.”
- “It is rare to see appropriate signage because nurses like me rely on the MAR for when to use PPE.”
- “The hospital changes what meds are considered HDs frequently, but the package itself is labeled, which helps with identification.”
- “I am not familiar with many HDs since I do not consistently give them. A kit with signs or a checklist that is easy to grab and go and describes what I would need could help.”
- “Everything is spread all over the place. I would suggest keeping signs in one place since we don’t know where they are.”
Appendix L

Process Maps

Diagram 1

PPE Workflow

Diagram 2

Signage Workflow
Appendix M

Cost Benefit Analysis

Table 1

Project Costs

<table>
<thead>
<tr>
<th>Project Recommendations Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PPE cost per year</strong></td>
<td>$72,708/yr</td>
</tr>
<tr>
<td>Average 16 patients per day on USP &lt;800&gt; medication</td>
<td></td>
</tr>
<tr>
<td>x $12.45 cost of PPE per patient per day = $199.20 PPE per day</td>
<td></td>
</tr>
<tr>
<td>x 365 days/yr</td>
<td></td>
</tr>
<tr>
<td><strong>Staffing USP &lt;800&gt; Project Costs</strong></td>
<td>$24,729/yr</td>
</tr>
<tr>
<td>Unit Secretary</td>
<td></td>
</tr>
<tr>
<td>$25 per hour x 2 hours per week x 52 weeks per year = $2,600</td>
<td></td>
</tr>
<tr>
<td>Charge Nurse</td>
<td></td>
</tr>
<tr>
<td>$80 per hour x 5 hours per week x 52 weeks per year = $20,800</td>
<td></td>
</tr>
<tr>
<td>IT Analyst Epic EHR</td>
<td></td>
</tr>
<tr>
<td>$ 55 per hour x 24 hours x 1 week = $1,320</td>
<td></td>
</tr>
<tr>
<td><strong>USP &lt;800&gt; Signage</strong></td>
<td>$84</td>
</tr>
<tr>
<td>25 signs printed and laminated at the local office store = $84</td>
<td></td>
</tr>
<tr>
<td><strong>Total Yearly Cost</strong></td>
<td>$97,521</td>
</tr>
</tbody>
</table>

Table 2

Project Benefits

<table>
<thead>
<tr>
<th>Project Benefits</th>
<th>Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Costs: Worker’s Compensation</strong></td>
<td>$572,920/yr</td>
</tr>
<tr>
<td>Osha.gov estimated average WC chemical exposure cost $27,282 x</td>
<td></td>
</tr>
<tr>
<td>Average 10 nurses exposed to USP &lt;800&gt; drugs</td>
<td></td>
</tr>
<tr>
<td>= $272,820/year</td>
<td></td>
</tr>
<tr>
<td><strong>Indirect Costs: training replacement employees, PTO,</strong></td>
<td></td>
</tr>
<tr>
<td><strong>investigation</strong></td>
<td></td>
</tr>
<tr>
<td>Osha.gov estimated average chemical exposure indirect costs $30,010 x average 10 nurses exposed to USP &lt;800&gt; drugs</td>
<td></td>
</tr>
<tr>
<td>= $300,100/year</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of being out of compliance</strong></td>
<td>$14,502/yr</td>
</tr>
<tr>
<td>OSHA Penalty $14,502 per violation</td>
<td></td>
</tr>
<tr>
<td><strong>Unmeasurable costs: business disruptions, erosion of trust, damaged reputation, poor patient care</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total Yearly Saved</strong></td>
<td>$587,422</td>
</tr>
</tbody>
</table>
Table 3

Project Total Saved

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>$587,422</td>
</tr>
<tr>
<td>Cost</td>
<td>$97,521</td>
</tr>
</tbody>
</table>

**Total Yearly Saved**  
$489,901