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Web-based Hazard and Near Miss Reporting as Part of a Patient Safety Curriculum

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Abstract

As part of a patient safety curriculum, we developed a Web-based hazard and near miss reporting system for post-baccalaureate nursing students to use during their clinical experiences in the first year of their combined BS/MS Advanced Practice Nurse program. The 25-week clinical rotations included two days per week for five-weeks each in community, medical-surgical, obstetrics, pediatrics, and psychiatric settings. Over three years, 453 students made 21,263 reports. Of the 10,205 positive ('Yes') responses to a hazard or near-miss, a total of 6,005 hazards (59%) and 4,200 near misses (41%) were reported. The most common reports were related to infection, medication, environmental, fall and equipment issues. Of the near misses, 2,009 (48%) had planned interceptions and 2,176 (52%) had unplanned interceptions. Types of hazards and near misses varied by rotation. Incorporating hazard and near miss reporting into the patient safety curriculum was an innovative strategy to promote mindfulness amongst nursing students.

Keywords

near miss reporting; patient safety; nursing education; mindfulness

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Introduction

National efforts toward preventing medical errors and promoting patient safety have reached critical mass in recent years (Committee on Data Standards for Patient Safety, 2003; Committee on Quality of Health Care in America, 1999; Institute for Healthcare Improvement, 2006). As patient advocates, nurses act as the point of care surveillance system and seek to promote patient safety; however, it has become evident that patient safety needs to be approached from a systems perspective rather than an individual perspective. What this involves is moving from a 'culture of blame and shame' in which personal accountability is considered the pivotal aspect of any error, to a 'culture of safety,' in which one takes into account that a long chain of mishaps often lead to an adverse event (Reason, 2004). Several dimensions of safety culture have been identified including leadership commitment, professional salience, presence of a non-punitive environment, systems for error reporting, preoccupation with failure, and communication (Agency for Healthcare Research and Quality, 2006; Vogus & Sutcliffe, 2007). Taking the cue from industries that rely on high levels of safety (e.g., airlines or nuclear power), healthcare leaders are seeking to transform hospitals into high reliability organizations (HROs) in which very few errors occur (Dixon & Shofer, 2006; Sutcliffe, 2000; Vogus & Welbourne, 2003). HROs are notable in that they build safety aspects into the general workflow and have extensive systems for error reporting and effective communication (Weick & Sutcliffe, 2006). For example, rather than waiting for an accident to happen, HROs promote reporting potentially hazardous situations before an event occurs (Kaplan, 2005a; Langer & Moldoveanu, 2000). This 'preoccupation with failure' helps HROs have a deeper understanding of their processes, and is one of the factors to which low error rates may be attributed (Sutcliffe, 2000; Vogus & Sutcliffe, 2007).

An aspect of preoccupation with failure in HROs is promoting voluntary reporting of dangerous situations (or hazards) and near misses (Kaplan, 2005b; Langer & Moldoveanu, 2000). A hazard is defined as 'a setting or a technology that has the potential to cause harm' (Tweedy, 2005). Near misses (or close calls) are those events in which 'something almost happened, but was intercepted before it reached [the patient]' (van der Schaaf, 1992). Near miss interceptions can be *planned* or *unplanned*; Planned interceptions are those in which a process is in place for preventing an adverse event, e.g., two-person checking of labels for name and blood type before a blood transfusion, whereas, unplanned interceptions are those events that are prevented by a fortuitous occurrence that was not part of a planned procedure. Near misses are estimated to happen between 7 and 100 times more frequently than actual adverse events and ideally should be used to identify system flaws (Bates, Boyle, Vliet, Schneider, & Leape, 1995; Committee on Data Standards for Patient Safety, 2003).

Hazard and near miss reporting is very common in HROs, however, to date, it is not common in healthcare. One area of healthcare in which hazard and near miss reporting data are being collected is via the US Pharmacopeia MEDMARX® error reporting system. MEDMARX is an anonymous, Web-based standardized reporting system that, in addition to traditional error reporting, allows for documentation of 'circumstances or events that have the capacity to cause error (Category A)' and 'an error occurred, but the error did not reach the patient (Category B)' (Hicks, Santell, Cousins, & Williams, 2004). In a report prepared

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by MEDMARX, reporting on data from 1999-2003, 15.7% of reports were identified as Category A (hazards) and 38.4% of reports were identified as Category B (near misses). In a more recent study that examined more than 92,000 computer-based incident reports for all types of incidents, Milch and colleagues found that 13% of all incident reports were near misses and 14% were environmental problems (i.e., dangerous situations or hazards) (Milch et al., 2006). With increasing use of electronic error reporting (Rowin et al., 2008; Tuttle, Holloway, Baird, Sheehan, & Skelton, 2004) and computer systems in general, incorporating hazard and near miss reporting into clinical documentation may provide a method to identify potential adverse events before they happen.

Despite the focus on patient safety in general nursing education, key tenets of current patient safety efforts have not been part of nursing, medical, or other clinician training until recently (Bakken et al., 2004; Margareta & Susan, 2004; Sherwood & Drenkard, 2007). In the inpatient setting, patient safety training tends to occur on the fly (Elder, Brungs, Nagy, Kudel, & Render, 2008) and often in response to organizational requirements, such as an anticipated visit from the Joint Commission. Identifying the content and structure of formative patient safety education for student nurses has been an active area of work in recent years, but has not yet been fully defined.

In order to provide formal patient safety education, we developed a patient safety curriculum that was delivered to nursing students at multiple levels and across areas of practice. We modeled our patient safety curriculum around three major components of the systems approach to patient safety: modeling, monitoring and mindfulness (Committee on Data Standards for Patient Safety, 2003; Kaplan, 2002; van der Schaaf, 1992). Modeling involves a series of review activities that are targeted towards identifying real or potential flaws in an organization's processes (Tweedy, 2005; Weick & Sutcliffe, 2006). Tools such as root cause analysis (RCA), typically used after an adverse event, and failure modes effects analysis (FMEA), used to examine flaws in processes before an adverse event, are examples of modeling techniques (Tweedy, 2005; Weick & Sutcliffe, 2006). Monitoring involves tracking and reporting quality indicators for internal or external review, such as with a state reporting agency. Mindfulness has been defined as 'attention to moment-by-moment experience' (Kabat-Zinn, 2003), and as 'alertness to danger' (Kaplan, 2002). Much of the research about mindfulness in healthcare has focused on how best to teach patients to be mindful towards managing their illness (Kabat-Zinn, 2003; Langer & Moldoveanu, 2000), however a growing body of research seeks to identify best practices to increase mindful behavior of workers performing their work in organizations (Issel & Narasimha, 2007; Weick & Sutcliffe, 2006). In the context of healthcare providers, mindfulness requires both professional accountability and organizational commitment to providing safe care (Committee on Data Standards for Patient Safety, 2003; Kaplan, 2002; van der Schaaf, 1992). For this project we sought to encourage students to focus their attention on near misses and dangerous situations.

Our curriculum included didactic content and innovative use of information technologies. The students received four lectures, each with associated small group activities, on the following topics: i) overview of patient safety and promotion of mindfulness in health care settings, ii) hazard, near-miss, and error reporting, iii) methods to model events such as RCA

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and FMEA, and iv) disclosure of adverse events in the healthcare setting. Students also completed a 1-credit decision support course focused on the application of informatics tools to evidence-based practice and patient safety (e.g., medication safety, surveillance and monitoring, patient and family communication). In addition to the patient safety lectures and the decision support course, our patient safety curriculum consisted of using a Web-based system to report observations of hazards and near misses during their clinical experiences. The purpose of this paper is to describe the frequencies and types of hazard and near miss events reported across three cohorts of BS/MS students who used the Web-based system in the first year of their combined BS/MS Advanced Practice Nurse program.

Methods

We developed a Web-based hazard and near miss reporting system that was theoretically grounded using the three areas of patient safety described above: modeling, monitoring and mindfulness. Our goal was to incorporate patient safety concepts into daily clinical activities during formative nursing education to promote thinking about healthcare from a systems perspective. Hazard and near miss reporting was seen as a reasonable activity because it transects all three areas of patient safety: i) modeling is addressed in that documentation of hazards and near misses provides the foundation for organizational leadership to identify problems or poor processes and prevent errors from taking place, ii) monitoring is facilitated by providing a method to document the types of events that are identified as part of daily clinical activities, and iii) mindfulness is promoted by asking clinicians to reflect on activities, which may heighten their awareness to notice future problems.

The Web-based hazard and near miss reporting system was designed to be accessed via any computer with Internet access and to capture both hazards and near misses (Currie et al., 2007). The system incorporated event categories used in the electronic Medical Event Reporting System for Hospitals (MERS-TH), a system in use in multiple locations in the United States (Kaplan, Callum, Rabin Fastman, & Merkley, 2002). Table 1 lists the event categories with examples for each category. The categories *infection* and *food/nutrition* were not in the MERS-TH system, but were added because they were considered important based on the clinical expertise of the team. Hazards were captured via responses to the question, “On your shift today, were there any ‘dangerous situations’ that could cause a future event?” Near misses were captured via responses to the question, “On your shift today, were there any near misses (i.e., events that almost happened)?” For each of these questions the user was able to select ‘No’ or to pick one or many of the items listed in Table 1. For the near miss question, each item was further categorized as having a planned or unplanned interception resulting in 26 items to select from. In addition to the questions and items, a free text comment section was provided at the end of each question. We intentionally excluded actual event reporting from the reporting process and students were educated to use the appropriate event reporting process at their clinical site. Hazards and near miss data were not reported to clinical sites; however, students were instructed to discuss the data with their preceptors.

Post-baccalaureate nursing students in the first year of their combined BS/MS Advanced Practice Nurse program participated in the project (i.e., students have a degree in another

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field). Completion of a weekly entry into the hazard and near miss reporting system contributed to the grade for each clinical rotation. However, the students were not required to disclose hazards or near misses in their entry (i.e., they could answer 'No' to both questions, thus actual reporting was voluntary). The project was approved by the local institutional review board, which declared the protocol exempt under the federal regulations for Educational Practices (S46.101(b1)). The 25-week clinical rotations included two clinical days per week for five-week experiences in each of the following areas: community, medical-surgical, obstetrics, pediatrics, and psychiatry. The clinical experiences took place at multiple institutions and outpatient settings across a large ethnically diverse metropolitan area. Students could access the Web-based system via any computer with an Internet connection. Each week the students were sent a reminder email with a link to the website and the system was also available via the School of Nursing website. The students received training to use the Web-based system via a demonstration during the lecture about hazard and near miss reporting, and they received one-on-one or email support if necessary. For each year, data from the preceding year were presented to the students during the Masters portion of their education to illustrate potential use and usefulness of the aggregated data.

Quantitative data were available from three different academic years (i.e., three different 25-week clinical rotations). These data were analyzed using descriptive statistics for each of the question categories across the years and by rotation. Chi-square analyses were performed to examine differences between report types, and by rotations and year. Comments were analyzed using thematic analysis.

Results

During the 25-week periods a total of 500 students (year 1=158; year 2=178; and year 3=164) submitted 21,263 reports (year 1=6,512; year 2 = 8,853; and year 3=5,900), for a total of 42,553 responses (year 1=13,019; year 2=17,709; and year 3=11,815). Of these, 10,205 (24%) were 'Yes' responses and 32,348 (76%) were 'No' responses. A small proportion of students entered only 'No' responses (year 1 = 13 students, year 2 = 2 students, and year 3 = 32 students). The analyses reported here are based on 453 students who entered at least one 'Yes' answer (range=1-256). Table 2 displays the characteristics of the student participants. The students were predominantly female, were frequent computer users and had been using computers for more than two years. We only collected race/ethnicity data in year 3. During year 3, approximately 70% of the students were White followed by Asian (10.5%), Multi-racial (6.2%), and Black (2.5%). About four percent identified themselves as Hispanic.

Of the 'Yes' responses, 6,005 (59%) were hazards and 4,200 (41%) were near misses. Table 3 shows the frequency of reports overall and for hazards and near misses for each of the years. In years one and three there were almost twice as many reported hazards as near misses, but in year two, hazards and near misses were reported almost equally (chi-square=65.3, df=2, $p<0.01$).

A total of 6,005 hazards were reported, including 1,551 in year 1, 3,930 in year 2, and 524 in year 3. The most commonly reported hazard across all three years was infection, followed

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by medication-related situations, then equipment/device failures and environmental hazards. Very few transfusion or laboratory related hazards were reported. Proportionately more reports were entered for environment, equipment, and medication in years 1 and 2 as compared to year 3. And there were proportionately more reports for infections and falls during years 2 and 3 as compared to year 1 (chi-square=116, df=24, $p<0.01$) (see Table 4).

Of the total 4,200 near misses, 845 were reported in year 1, 3,067 in year 2, and 274 in year 3. In years 1 and 3, the most frequently reported near miss was medication-related and was rescued by an unplanned interception. These were proportionately much higher than reports from year 2. There were proportionately more reports for environment, fall, and infection with planned interceptions in year 2 as compared to years 1 and 3. Infection was reported more frequently during years 2 and 3 as compared to year 1 (chi-square=169, df=50, $p<0.01$). Again, transfusion and laboratory-related near miss reports were relatively infrequent (see Table 5). Of the near misses, 1,996 (47.7%) were noted to have a planned interception in place and 2,190 (52.3%) were intercepted by an unplanned act. However, when examined by year, there were almost twice as many unplanned interceptions identified in years 1 and 3 than in year 2 (year 1: planned = 352 (41.7%), unplanned = 493 (58.3%); year 2: planned = 1542 (50.3%), unplanned = 1525 (49.7%); and year 3: planned = 102(35.4%), unplanned = 186(64.6%) (chi-square=379, df=2, $p<0.01$).

The numbers of reports by rotations were: community = 2,096 (20.5%); medical-surgical = 2,304 (22.6%); obstetrics = 2,013 (19.7%); pediatrics = 2,023 (19.8%); and psychiatry = 1,770 (17.3%). There were statistically significant differences between rotations across categories (chi-square=272, df=152, $p<0.01$) with lower number of reports overall during psychiatry rotations and a higher number of reports overall during medical-surgical rotations. The highest numbers of hazard reports by rotation and category were: 1) community with 38% of laboratory reports; 2) medical-surgical with 29% of food/nutrition and 29% of restraint reports; 3) and pediatrics with 26% of transfusion reports. The highest number of near miss reports by rotation and category were: 1) community with 43% of planned laboratory event reports and 33% of unplanned laboratory event reports; 2) medical-surgical with 44% of unplanned restraint reports; and 3) obstetrics with 47% of planned transfusion reports. Reported unplanned interceptions for fall-related near misses were much higher in the medical-surgical setting as compared to pediatrics and laboratory reports were lower in psychiatry and obstetrics than in community or medical-surgical rotations.

Over the three years, a total of 3,739 qualitative comments were entered into the reporting system (year 1 = 1,145, year 2 = 2,136, and year 3 = 470). Of these, 2,455 were associated with hazards and 1,284 were associated with near misses (year 1: hazard=798, near miss=347; year 2: hazard=1,347, near miss=789; year 3: hazard = 310, near miss=148). Several students used the comment section to provide feedback about the project, or to indicate that they were absent from clinical. These items were not counted and were removed from the comments reported here. Based on the comments, several major themes arose including: 1) poor infection precautions related to poor hand washing, lack of soap or alcohol-based hand cleansing solution at site, 2) environmental hazards such as construction, wet floors, 3) medication-related issues such as a medication cart being left open and expired medication on a code blue cart, and 4) issues with documentation/patient

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identification. Common themes across the hazard comments for the 'Other' category included: 1) privacy issues with patient information being communicated in public spaces, patient charts being left in a public location or a computer screen with patient information on display; 2) patient identification bands either not being on patients' wrists (or ankles); 3) patient data concerns such as the wrong labels in a patient's chart, documenting on an incorrect patient and finding the wrong note in a patient's chart; 4) physician and nurse handwriting being illegible; and 5) safety issues in relation to violent patients and settings. Comments related to the 'Other' reports for the near miss question addressed a wide variety of near miss events including inaccurate allergy documentation, nearly placing baby in the wrong bassinette, and near misses related to a potential patient disappearance in the psychiatric setting.

Discussion

To our knowledge, this is the first report describing hazard and near miss reporting for nursing students during their formative education. As part of our patient safety curriculum, the Web-based hazard and near miss reporting system was used by three cohorts of baccalaureate nursing students during their 25-week clinical experiences. Overall, students reported more hazards than near misses (59% vs 41%), and in years 1 and 3 twice as many hazards were reported than near misses ($p<0.01$). This is inconsistent with the report by Milch in which hazards and near misses were reported almost equally (14% and 13% respectively) (Milch et al., 2006). In addition, the MEDMARX data identified 15.7% hazards and 38.4% near misses for medication-related reports (Hicks et al., 2004). Wolf and colleagues recently reported on a small study examining 27 nursing student medication errors (Wolf, Hicks, Altmiller, & Bicknell, 2009). Of the 27 errors, only two were near misses. There are several possible explanations for our reporting rates. It is possible that hazards may be more visible and therefore easier to report for entry-level students, who, at this stage of learning, might not notice the nuances of near miss type events. However, it is also possible that hazards occur more frequently than near misses, but that protocols that are closer to the patient prevent them from reaching the patient. Since voluntary reporting of hazards and near misses in not a common practice in healthcare, further research should explore reporting rates.

Our students reported 48% planned interceptions and 52% unplanned interceptions for the near misses observed. These results are inconsistent with the report by Kanse et al. in which 75% were planned interceptions and 25% were unplanned interceptions (Kanse, van der Schaaf, Vrijland, & van Mierlo, 2005). However the Kanse report was from the railroad industry, therefore it is unclear if the data are comparable. Since our hazard and near miss reporting system was not designed to capture actual events, it is unclear how common the near miss reports were in relation to actual events, i.e., we are unable to determine if our data support the claim that near misses occur between 7 and 100 times more frequently than actual errors.

Students were required as part of their clinical grade to enter reports for each clinical shift, but had the option to indicate 'No' (i.e., they were not required to disclose hazards and near misses). During year 3, 32 students reported 'No' for every shift resulting in the smaller

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overall numbers of hazards and near misses reported in this cohort. It is unclear if these students observed fewer events than other cohorts or simply chose not to report them. The reporting period was also slightly shorter for the year 3 cohort due to several technical issues. However, in spite of the smaller number of reports from the year 3 cohort, there was no pattern that indicated the group was consistently different. In addition, the narrative comments were remarkably similar across all three years.

Traditionally, adverse event reporting in the US has been a voluntary activity, primarily because of the fear of punishment or legal ramifications (Cohen, 2000; Committee on Data Standards for Patient Safety, 2003). However, it is well documented that voluntary reporting of actual events fails to capture all events and that chart review and automated surveillance methods (Resar, 2006) typically outperform voluntary reporting (Committee on Data Standards for Patient Safety, 2003). Despite this, voluntary versus mandatory reporting is still controversial.

We added infection as a reportable element in the reporting system and we found that infection control practices were one of the most common hazard reports across all years. Historically, lack of compliance with infection prevention and control practices are not considered reportable events; however, this is changing with the increased focus and attention in hospitals to prevent healthcare associated infections. The ability to examine such reports may improve infection control practices. Several comments related to infection control practices indicated that patients on isolation precautions were not frequently monitored by staff. This may help to understand a report by Stelfox and colleagues who identified higher rates of falls in patients on isolation precautions (Stelfox, Bates, & Redelmeier, 2003). We also added food/nutrition as a reportable element and found that these reports accounted for 5% of hazards and 3% of near miss events. Comments related to food included many events in which an NPO patient received food or in which a patient who was no longer on NPO did not receive food. Although these reports represent only a small portion of responses, hazard and near miss reporting may help to identify methods to improve care around nutrition.

Medication-related hazards were more commonly reported in the medical/surgical and obstetrics rotations. Comments about medication-related hazards included disorganized crash cart and medications left unattended at bedside. These comments indicate that students, because of or despite being novices, are aware of medication best practice. In regards to environmental and equipment hazards, problems included ongoing institutional construction and water on floors with a large time delay before clean up. Attention to these issues would benefit any institution.

The most common near miss reports were medication, infection and fall. For the medication near misses, unplanned interceptions were more common than planned interceptions. Although the proportion of medication near misses with unplanned interceptions was small (9% of all near miss reports), it would be important to identify the root causes of the events with unplanned interceptions. Both planned and unplanned activities intercepted infection and fall-related near misses. This indicates that some processes are in place, but that

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additional barriers would likely be beneficial for fall and infection prevention at the point of care.

For both hazards and near misses, a very small number of reports identified problems with blood product processes. Comments related to blood product reports indicated that the near misses were caught by processes in place in the organizations. Double checking blood immediately prior to blood administration is an example of a barrier that is in place very *near* to the patient and the rigor with which blood administration is monitored demonstrates best practice for promoting patient safety. Identification of best practices for other common activities may actually decrease errors.

Students reported documentation issues in both the procedure/treatment section as well as the 'other' section. Several comments related to documentation issues included illegible notes, documenting in the wrong paper or electronic chart, and lack of patient identification. This was a consistent theme across all years and in light of Joint Commission recommendations to both improve communication and to prevent computer mediated medication events (The Joint Commission, 2008), it may be useful to incorporate documentation related events into hazard and near miss reporting systems.

A small, but consistent portion of 'other' comments related to safety issues from the student perspective, in which the student felt unsafe in a neighborhood or in a unit, from the patient perspective in which the student remarked that a violent patient was acting out towards another patient, and from the clinician perspective in which the student commented about potential patient violence towards staff. These were interesting to note in relation to recent literature about violence in the workplace, including a study by Hinchberger in which 100% of student nurses surveyed had indicated that they had experienced violence in the workplace (Hinchberger, 2009). Indeed, from the perspective of reporting near misses in order to avert events, it would be useful to have documentation of potentially violent situations before an event occurs.

Several comments addressed unprofessional staff behavior that the student observed. For example, a student commented that: "The nurse became frustrated with a paranoid patient while trying to administer meds. This lack of patience ended up making the patient very agitated and almost combative." Students who are in the second-degree program typically have non-healthcare experience in their background. These comments demonstrated the perspective of a new nurse who has not yet been socialized to hospital culture, but accentuates behaviors which may promote moral distress in new nurses (Kelly, 1998).

Our overall goal was to increase mindfulness amongst nursing students. Langer posits that when one is mindful, one: i) will be more sensitive to the environment, ii) will be more open to new information, iii) can create new categories to structure perceptions, and iv) is able to see multiple perspectives (Langer & Moldoveanu, 2000). Although we did not directly measure mindfulness, we saw a large number of very thoughtful comments that appear to indicate that the students were sensitive to their environments. It is unclear if the other aspects of mindfulness as described by Langer (2000) were present in our students. Future work should consider measuring the concept of mindfulness amongst nursing students.

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In conclusion, our project was informative on many levels. Indeed, it would be very useful to incorporate hazard and near miss reporting into clinical documentation in order to provide a method to identify potential adverse events before they happen. Voluntary disclosure of hazards and near misses through a weekly requirement to enter a report into a web-based hazard and near miss system during clinical experiences may help to improve students' mindfulness regarding the proximity of barriers in relation to the patient. The wide variety of comments demonstrated that the students were indeed mindful of the clinical environment despite being novices. However, the system also functioned as a repository of notes about the process of being socialized to the healthcare environment. It is hopeful that integrating patient safety concepts and voluntary disclosure of hazards and near misses into the curriculum will instill safety culture concepts sufficiently early to ensure safe practice throughout one's career.

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Table 1

Dangerous Situation and Near Miss Event-Type Categories with Examples

Event Categories	Examples
Accident (non-fall)	Needle stick, electrical shock, burn, poisoning
Environmental Hazard/Safety	Body fluid exposure, chemical exposure, chemotherapy spill, hazardous material spill
Equipment/Device	Equipment malfunction, poor maintenance, inappropriate use, non-availability
Fall	Factors related to the individual or the environment
Food/Nutrition*	Diet and NPO orders
Infection*	Sterile precautions, hand washing
Laboratory	Laboratory orders or results
Medication	Prescribing, ordering/documenting, administering, monitoring
Patient Disappearance	Increase risk of patient disappearance
Procedure/Treatment	Consents, delays, wrong procedure/treatment, failure to perform
Restraint	Improper bedrail use and other types of restraint use
Transfusion	Sample collection or product administration
Other	Another type of risk

* Items added to extend voluntary reporting system categories

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Table 2

Characteristics of Students

	Year 1	Year 2	Year 3	Total
	n = 158	n = 178	n = 164	n = 500
	n(%)	n(%)	n(%)	n
Gender				
Female	102 (64.6)	156(87.6)	150(91.5)	408
Male	14 (8.9)	15(8.4)	13(7.9)	42
Missing Data	42 (26.6)	7(3.9)	1(0.6)	50
Frequency of Computer Use				
Several times /day	98 (62.0)	98(57.3)	161(98.2)	357
Once / day	16 (10.1)	9(5.2)	3(1.8)	28
Several times / week	1 (0.6)	1(0.5)	0(0)	2
Several times /months or never	1 (0.6)	1(0.5)	0(0)	2
Missing Data	42 (26.6)	69(38.7)	0(0)	111
Length of Computer Use				
6 months or less	2 (1.3)	0(0)	0(0)	2
More than 6 months to 2 years	1(0.6)	0(0)	1(0.6)	2
More than 2 years	113(71.5)	109(61.2)	163(99.4)	385
Missing Data	42(26.6)	69(38.7)	0(0)	111
Age				
20-29	90(57)	96(54)	142(87.2)	328
30-39	20(12.7)	11(6.2)	18(11.0)	49
40-49	4(2.5)	2(1)	2(1.2)	8
50-64	1(0.6)	0(0)	1(0.6)	2
Missing Data	43(27.2)	69(38.8)	1(0.6)	113

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Table 3

Overall Hazard and Near Miss Reports by Year

Year	Hazard Reports n(% Total)	Near Miss Reports n(% Total)	Total 'Yes' Reports
1	1,551(64.7)	845(35.3)	2,396
2	3,930(56.2)	3,067(43.8)	6,997
3	524(66.4)	274(33.6)	798
Total(%total)	6,005(58.8)	4,200(41.2)	10,205

Note: Totals represent multiple responses per report

Differences between frequencies of hazard reports and frequencies of near miss reports by year: chi-square=65.3, df=2, $p<0.01$

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Table 4

Reported Hazards by Category and by Year

	Year 1	Year 2	Year 3	Total
Category	**n(%)**	**n(%)**	**n(%)**	**n(%total)**
Accident (non-fall)	85 (5.5)	158(4)	27(5.2)	270(4.5)
Environmental Hazard/Safety	189(12.2)	501(12.7)	47(9)	737(12.3)
Equipment/Device	216(13.9)	473(12)	48(9.2)	737(12.3)
Fall	86(5.5)	364(9.3)	49(9.4)	499(8.3)
Food/Nutrition	124(8)	179(4.6)	24(4.6)	327(5.4)
Infection	283(18.2)	896(22.8)	131(25)	1,310(21.8)
Laboratory	28(1.8)	51(1.3)	8(1.5)	87(1.4)
Medication	220(14.2)	553(14.1)	57(10.9)	830(13.8)
Patient Disappearance	40(2.6)	130(3.3)	13(2.5)	183(3.0)
Procedure/Treatment	110(7.1)	293(7.5)	50(9.5)	453(7.5)
Restraint	27(1.7)	66(1.7)	14(2.7)	107(1.8)
Transfusion	6(0.4)	20(0.5)	9(2)	35(0.6)
Other	137(8.8)	246(6.3)	47(9)	430(7.2)
Total	1,551	3,930	524	6,005

Note: percentages do not total 100% due to rounding

Differences between report categories by year: chi-square=116, df=24, $p<0.01$

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Table 5

Reported Near Misses by Category and by Year

Category	Interception Type	Year 1	Year 2	Year 3	Total
		n(%)	n(%)	n(%)	n(%total)
Accident (non-fall)	Planned	52(2.2)	87(1.2)	4(0.5)†	143(3.4)
	Unplanned	35(1.5)	123(1.8)	12(1.5)	170(4)
Environmental Hazard / Safety	Planned	22(0.9)	150(2.1)	2(0.2)T	174(4)
	Unplanned	26(1.1)	167(2.4)	15(1.8)	208(4.9)
Equipment / Device	Planned	35(1.5)	153(2.2)	6(0.7)	194(4.6)
	Unplanned	47(2.0)	173(2.5)	15(1.8)	235(5.5)
Fall	Planned	27(1.1)	187(2.7)	11(14)	225(5.3)
	Unplanned	49(2.0)	169(2.4)	20(2.5)	238(5.7)
Food/ Nutrition	Planned	20(0.8)	99(1.4)	6(0.7)	125(2.9)
	Unplanned	34(1.4)	99(1.4)	5(0.6)	138(3.2)
Infection	Planned	44(1.8)	262(3.7)	18(2.2)	324(7.7)
	Unplanned	50(2.1)	224(3.2)	27(3.3)	301(7.2)
Laboratory	Planned	5(0.2)	37(0.5)	0(0.0)†	42(1)
	Unplanned	11(0.5)	22(0.3)	3(0.4)†	36(0.8)
Medication	Planned	68(2.8)	243(3.5)	26(3.2)	337(8)
	Unplanned	109(4.5)	210(3.0)	39(4.8)	358(8.5)
Patient Disappearance	Planned	22(0.9)	78(1.1)	3(0.4)†	103(2.4)
	Unplanned	19(0.8)	57(0.8)	6(0.7)	82(1.9)
Procedure/ Treatment	Planned	31(1.3)	107(1.5)	13(1.6)	151(3.6)
	Unplanned	40(1.7)	115(1.6)	17(2.1)	172(4)
Restraint	Planned	6(0.3)	26(0.4)	2(0.2)†	34(0.8)
	Unplanned	8(0.3)	29(0.4)	2(0.2)†	39(0.9)
Transfusion	Planned	4(0.2)†	10(0.1)	1(0.1)†	15(0.4)
	Unplanned	3(0.1)†	3(0.0)	0(0.0)†	6(0.1)
Other	Planned	16(0.7)	103(1.5)	10(1.2)	129(3)
	Unplanned	62(2.6)	134(1.9)	25(3.1)	221(5.2)
	Total	845	3,067	274	4,200

Note: percentages do not total 100% due to rounding

Differences between report categories by year: chi-square=169, df=50, p<0.01

Differences between planned versus unplanned reports by year: chi-square=379, df=2, p<0.01

†Cells with less than 5 were excluded from analysis