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Fall Prevention and Injury Reduction Utilizing Virtual Sitters in Hospitalized Patients

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Abstract

Falls and fall-related injuries occur far too often in hospitals every year. The goal of the quality improvement (QI) project reported here was to reduce the number of falls and fall injuries in hospitalized patients using virtual sitters and continuous video monitoring (CVM) cost effectively. Run charts portray data trends for fall rates and fall related injury rates at the inpatient care facility in two-week increments over a six-month period. Descriptive statistics were collected to characterize the sample and setting, and differentiate components of the falls, falls with injuries and related costs. The literature review noted positive outcomes regarding both cost savings and reduction in fall rates with the launch of virtual sitters. The QI project with the implementation of CVM with virtual sitters depicted a 14% decline in fall rates and a 6% decrease in fall-related injury rates with a cost savings to the hospital. Plans for expansion of the program were underway with integration into the electronic health record. As modalities such as CVM with virtual sitters are adopted by more institutions, additional at-risk patients will be monitored for fall prevention and additional uses continue to prevail. Fall prevention and injury reduction remain at the forefront of quality care, keeping patients safe.

Keywords

falls, fall related-injury, continuous video monitor, virtual sitter, QI project

Disciplines

Nursing

Fall Prevention and Injury Reduction Utilizing Virtual Sitters in Hospitalized Patients

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ABSTRACT

Falls and fall-related injuries occur far too often in hospitals every year. The goal of the quality improvement (QI) project reported here was to reduce the number of falls and fall injuries in hospitalized patients using virtual sitters and continuous video monitoring (CVM) cost effectively. Run charts portray data trends for fall rates and fall related injury rates at the inpatient care facility in two-week increments over a six-month period. Descriptive statistics were collected to characterize the sample and setting, and differentiate components of the falls, falls with injuries and related costs. The literature review noted positive outcomes regarding both cost savings and reduction in fall rates with the launch of virtual sitters. The QI project with the implementation of CVM with virtual sitters depicted a 14% decline in fall rates and a 6% decrease in fall-related injury rates with a cost savings to the hospital. Plans for expansion of the program were underway with integration into the electronic health record. As modalities such as CVM with virtual sitters are adopted by more institutions, additional at-risk patients will be monitored for fall prevention and additional uses continue to prevail. Fall prevention and injury reduction remain at the forefront of quality care, keeping patients safe.

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Falls and serious injuries related to falls remain a major concern in hospitals. The Agency for Healthcare Research and Quality (AHRQ) estimated between 700,000 and 1,000,000 hospitalized patients fell yearly, with 30 to 50% of patients sustaining significant injuries (AHRQ, 2015). Patient safety was highlighted as a risk as accidental falls were one of the most documented hospital incidents with 2.3-7 falls per 1,000 patient days (Gray-Micelli et al., 2012). The Joint Commission on Accreditation of Healthcare Organizations (JCAHO, 2015), described falls as sentinel events, and noted that almost 33% of falls were preventable in the United States. The Institute of Healthcare Improvement (IHI, 2008) identified the most prevalent fall associated injuries as head trauma, bleeding and fractures. Less than 1% of hospital falls result in fatalities, however this converts to nearly 11,000 deaths from an injury sustained in a hospital per year (IHI, 2008).

Additional Ramification of Falls and Fall Injuries

Falls resulted in additional hospital days and contributed to an increase in costs (AHRQ, 2015). The typical fall incident added 6-12 days to a hospitalization, and $30,000 per patient (Burns et al., 2016). Falls were determined to be hospital-acquired conditions by The Center for Medicare and Medicaid Services (CMS, 2008) which lowered the reimbursement for hospital-acquired falls. The decrease in reimbursement policies by CMS attempted to reduce falls and ultimately costs, however the cost for falls in 2015 remained over $31 billion (Burns et al., 2016).

Furthermore, falls can negatively impact quality of life (Resnick et al., 2019; Scheffer et al., 2008) including a detrimental psycho-social impact contributing to feelings of fear and powerlessness (Boltz et al., 2012; Wong et al., 2011). Once a person experienced a fall, the risk of another was significant and led to activity limitation (Boltz et al., 2012). Fear of falling initially

surfaced post-fall and impacted approximately one third of older adults; however, new findings depicted 50% of people who have never fallen also experience fear of falling (Schoene, 2019).

Rationale

Data indicators for falls and fall injuries in the National Database of Nursing Quality Indicators (NDNQI) for Penn Medicine Chester County Hospital (PMCCH), included performance data from the 1st quarter of 2017 through the 4th quarter of 2018 (PMCCH, 2018). During this period, average performing hospitals scored 0.435, worst performing hospitals scored more than 1.747, best performers registered no falls and the PMCCH score indicated 0.130 for every 1,000 patient days (PMCCH, 2018 & Leapfrog Group, 2019). Patient fall rates were the rate of total falls per 1000 patient days and fall injuries were the rate of injuries incurred from falls per 1000 patient days (Staggs et al., 2015). The Leapfrog Hospital Safety Group evaluated fall data and positioned PMCCH in the upper safety tier thus earning an "A" grade (Leapfrog Group, 2019).

Although falls and fall injury indicators granted PMCCH an "A" for safety, there remained work to be done to achieve best practice as a total of 93 inpatient falls occurred between January 1, 2020 through June 30, 2020. Several evidence-based interventions to decrease hospital-associated falls and fall-related injuries were used such as hourly rounding, non-slip socks, bracelets, signs, bed alarms, huddles, education and 1:1 sitters. A novel and promising approach which addressed inpatient falls was the CVM with virtual sitter QI project.

An integrated literature review identified evidence of a decrease in hospital-associated falls and fall-related injuries with CVM as an intervention. Nine observational studies and two quasi-experimental studies (N=11) focused on fall rates and cost savings. Although none of the 11 studies demonstrated an increase in fall rates, only four studies observed a statistically significant decline in falls or fall related injuries using CVM (Cournan et al., 2018; Jeffers et al., 2013;

Spano-Szekely et al., 2019; Votruba et al., 2016). All studies calculated falls per 1000 patient days. In addition, all 11 studies reported a decrease in overall costs transitioning from 1:1 sitters to virtual sitters using CVM (Burtson et al., 2015; Davis et al., 2017; Cournan et al., 2018; Goodlett et al, 2009; Harding et al., 2013; Jeffers et al., 2013; Purvis et al., 2018; Quigley et al., 2019; Sand-Jecklin et al., 2016; Spano-Szekely et al., 2019; Votruba et al., 2016).

Conduction of all studies were in sites with patients over 18 years of age. Ten sites were inpatient, acute care facilities and the 11th was an inpatient rehabilitation unit. Ten of the 11 studies incorporated patient consent into the standard admission process and one study obtained a separate consent for each monitored patient. Due to the additional consent, this study had a low rate (20.7%) of participation (Harding et al., 2013).

Although each study reported monetary savings and recouped initial investments for cameras, monitors, and training, there were important differences. Studies varied due to the number of patient observations and the protocol for patient selection. Multiple methods facilitated determination of patient assignment for CVM and virtual sitter surveillance. For example, some studies developed algorithms for inclusion per individual institution (Votruba et al., 2016; Purvis et al., 2018; Spano-Szekely et al., 2019) or unique patient populations (Votruba et al., 2016). Other studies chose to use nursing judgement rather than formulate specific guidelines (Burtson et al., 2015; Cournan et al., 2018). Yet another relied solely on a fall risk assessment tool to determine eligibility for CVM (Harding et al., 2013). Additionally, others used a combination of a fall risk tool and nursing judgement to determine eligibility (Sand-Jecklin et al., 2016; Goodlett et al, 2009). Across studies the ratio of patients to CVM ranged between eight to twelve patients to one CVM. The study that occurred in a rehabilitation unit reported patient to virtual sitter ratios

as high as a 15:1; with justification by study authors who noted the facility had a higher ratio of patients to virtual sitters due to lower patient acuity (Cournan et al., 2018).

Specific Aim

This quality improvement project at PMCCH aimed to implement virtual sitters utilizing CVM in hospitalized patients over 18 years of age. The aim was for fall rates and fall-related injury rates to decrease when comparing pre- and post-implementation of CVM. The secondary aim was the conduction of a cost analysis to determine cost effectiveness.

Nurses evaluated appropriate observation levels on admission, after a safety event and during nursing rounds to identify at-risk patients eligible for video monitoring with the guidance of an algorithm (Figure 1). This intervention allowed for simultaneous monitoring of patients and freed up 1:1 sitters for patient care on the unit (Bradley, 2016) and contributed to better patient outcomes and cost savings.

Methods

Setting and Context

This QI project was conducted at PMCCH. Located in the suburbs of Philadelphia, PMCCH has served the community for over 125 years and been a part of the Penn Medicine Health System since 2013. The hospital had 248 inpatient beds and over 700 registered nurses. PMCCH earned Magnet status (2014, 2019), a designation of excellent professional nursing care. Quality patient care and safety, including eradication of patient falls and fall injuries, remain high priorities within this institution. The fall definition in the National Database of Nursing Quality Indictors (NDNQI) in conjunction with the American Nurses Association (ANA) was an unintentional descent to the floor which may or may not incur an injury (NDNQI, 2012). A fall injury was 5 definitive categories starting with no injury, minor, moderate, major injury

and death (NDNQI, 2012). During hospitalization consideration for circumstances such as alteration in mental status, fluctuating glucose levels, side effects from medications, blood loss, incontinence, changes in strength and balance affecting mobility, vision changes and environmental hazards were addressed as all can contribute to falls or fall injuries. Hospitalized patients continue to be at risk for falls and fall injuries and warrant new prevention strategies.

Intervention

This QI project proposed the use of CVM technology with virtual sitters for supervision of hospitalized patients at risk for fall and fall injuries as an intervention to improve outcomes. Current "standard of care" safety practices such as: signs, wristbands, non-slip footwear, education, safety rounds and bed alarms continued in tandem with implementation of virtual sitters. Ten individual portable video monitor carts, each with 2-way audio and visual cameras, enabled the patient to see the virtual sitter and the sitter to monitor up to 10 patients. Designated patients were monitored from a central station continuously, in real time, with synchronous video/audio monitoring technology on a secure HIPPA telemedicine platform. Close communication between the nursing staff and the sitter was via encrypted phones.

Prior to operationalization of CVM using virtual sitters, our team ensured "buy in" and educated key stakeholders including nursing staff, managers and virtual sitters. Additionally, technicalities of the video monitoring system were addressed, the workflow process was managed, and CVM specific policies and job descriptions were developed. Qualifications for a virtual sitter included the ability to focus, multi-task and watch multiple patients at one time (Votruba et al., 2016). Individuals for the new CVM positions already worked at PMCCH and were familiar with institutional policies and safe practices.

CVM of at-risk patients required special training. Virtual sitters attended an initial two-hour introductory session in conjunction with a web-based training program. Additionally, multiple interactive hands-on sessions with equipment and documentation continued. Virtual sitters received additional education in communication including how to redirect patients and when to alert nursing staff to maintain safety and prevent falls and injuries. The nurse manager of the virtual sitter team was the lead project champion to guide the process and field questions. Educational modules were assigned to all nurses, certified nursing assistants and virtual sitters through Knowledge Link, an online learning management system. This was ongoing to ensure competency on technology and institutional policies in conjunction with unit-based demonstrations with initial implementation during a two-week period in January 2020.

A secluded station outside the nursing coordinator office was designated as the centralized monitoring station to provide patient privacy. The CVM equipment included a screen to monitor up to 10 patients at one time. Patient eligibility for CVM intervention was assessed using a PMCCH algorithm (Figure 1) to guide nursing judgement. The algorithm detailed the inclusion/exclusion criteria and the CVM policy. Once selection occurred, education was provided by the nurse to the patient and family regarding the role of the virtual sitters and the CVM equipment. Virtual sitter introductions included a demonstration on how to gain attention with a hand wave. If a patient attempted to get out of bed without assistance the virtual sitter verbally redirected the patient and reported the activity or patient needs to the nurse. If the verbal interaction did not deter the patient, a loud emergent audio alarm alerted the nurse that immediate attention was necessary. If more than three re-directs in a span of 30 minutes occurred, the patient was removed from CVM with reassignment to 1:1 in-person observation. Flowsheets for documentation were for virtual sitters to track communication with patients and staff.

Measures

The following measures were collected:

Fall. A fall was defined as a sudden unintentional descent to the floor. Collation of fall data three months prior to CVM implementation and three months post implementation was through the MIDAS Fall report**.** Generation of the hospital falls report was via a secure software system.

Fall-related injury. A fall-related injury was harm that occurred due to a fall. Total number of fall-related injuries were computed using the MDAS Fall report. The fall related injuries categorization was based on the level of injury as defined by National Database of Nursing Quality Indicators (NDNQI): *None*- no injury occurred and confirmation by an x-ray, CT scan or post-fall assessment; *Minor*- a simple intervention was necessary such as ice, elevation, topical medication, cleaning of a bruise or abrasion; *Moderate* - required sutures, steri-strips, splints or joint or muscle strain; *Major* – needed a cast, surgery, blood products or additional consults for neurological or internal injuries and *Death* -a result of fall injuries (AHRQ, 2013).

Bed Occupancy. Bed occupancy was the number of patient occupied beds in the hospital at a set time each day. The daily bed census for each unit at PMCCH factored into the calculation of fall rates.

Fall Rates. Fall rates per 1000 occupied bed days were calculated dividing fall numbers by bed occupancy and multiply by 1000.

Fall-related injury. Fall-related injury rates per 1000 occupied bed days were calculated dividing fall-related injury numbers by bed occupancy and multiply by 1000.

Demographics and Patient Characteristics. Data collected from the MIDAS Fall report included age, sex, marital status, language, day of fall occurrence, and the type of falls and injury (Table 1).

Costs Savings. The virtual sitter hours were calculated by nursing management and multiplied by the hourly rate plus benefit rate to determine the daily cost of the intervention. This intervention cost was subtracted from the cost of using 1:1 sitters for total overall cost.

Supplemental reports for falls data collection and support included the Virtual Sitter and Caregility© reports. The Virtual sitter report was collected daily with information on location of patient assignments, alerts, falls and discharges. The Caregility© data contained alerts and interactions between the virtual sitter and the patient. The data included falls and fall related injuries.

Patient identifiers were removed from all data collection. Every report received a code and each patient had a unique number. This system was created to recognize and decrease data duplication and eliminated use of patient identifiers. The only missing data was the shift a fall occurred, which was not significant for this project. For these patients, 999 was entered as a place holder for this variable and noted as unspecified in Table 1.

Study of Interventions

The bi-weekly data collection of fall rates and fall injuries over the six-month period assessed the trend and captured a more informative picture. The first three months did not use virtual sitters and the second three months of data included implementation of virtual sitters. Methods to ensure use of CVM with virtual sitters and fall reporting adherence comprised education at the onset, weekly review of tools and importance of thorough documentation including a revision of the virtual sitter tool. All virtual sitter reports were collected daily by the nurse manager.

Midas Fall, Virtual Sitter and Caregility© reports were reviewed, extraction of relevant data was entered for analysis on a spreadsheet and this information was double checked for accuracy.

Analysis

Descriptive statistics were used to characterize the sample and setting, as well as falls and falls with injuries from January 1, 2020 through June 30, 2020. Pre-intervention data collection for three months began in January with implementation of video monitoring in April and data collected through June. Frequencies and percentages described categorical variables, while continuous variables were described by means, medians, and ranges as appropriate. Analyses conduction used Excel and SPSS software (version 25.0, IBM).

Run charts graphically portrayed the data trends for fall rates and fall related injury rates over a six-month period in two-week increments. Run charts, a quality improvement specific analytical tool, were simple yet effective for assessing variations in the healthcare process. Run charts visually depicted the falls and fall related injuries pre and post virtual sitter intervention and assisted to determine if improvement occurred.

A cost analysis was performed and tallied the total hours paid for virtual sitters (2152 hours) and the total number of hours 1:1 sitters were replaced with CVM (7031.5 hours) for the months of April, May and June (2152 hours). The hours were multiplied by the hourly wage of $15.00 plus 33% benefits ($4.95).

Ethical Considerations

Patient consent for care bundled CVM into the admission process. Privacy considerations were acknowledged via information about the virtual sitter program, including the inability to record. Patients were viewed in real time and during patient care, the camera was turned towards

the door. Audio was off and turned on when signaled by someone in the room or when the virtual sitter interacted with the patient. HIPPA requirements were reviewed with virtual sitters and all staff to maintain confidentiality.

Results

Implementation of CVM in conjunction with standard fall precautions demonstrated a 14% reduction in median fall rates from 3.93 falls per 1000 patient days from January thru March of 2020 (pre-intervention period) to 3.37 falls per 1000 patient days from April thru June of 2020 (post-intervention) in hospitalized patients. Fall-related injuries decreased from 0.95 to 0.89 per 1000 patient days post-intervention – a 6% reduction. The run chart supported the data collection (Figure 2) and demonstrated a downward trend in both falls and fall-related injuries. Over the initial three months, one virtual sitter monitored up to 10 patients for a savings of 2,152 patient hours. Based on the average hourly rate and benefits paid to virtual sitters the total cost saving was equivalent to over $97,000.00 in 1:1 sitter expenditure that was eliminated with video monitoring.

A total of N=93 patients including n=47 females (51%) were included. Most patients were in the 65-84-year age group (57%), spoke English (98%), and were married (41%). Overall, falls occurred similarly throughout the week, with the lowest and highest frequency of falls observed on weekends (Saturday n=10; Sunday n=11) and on Wednesdays (n=16), respectively. Most patients were found on the floor (49%) as a as result of not asking for assistance to go to the bathroom or attempting to pick something up. Detailed demographics are presented in Table 1.

Discussion

Falls and fall-related injury prevention continue to be a priority in hospitals. This quality improvement project aimed to utilize CVM to prevent falls and fall-related injuries in hospitalized patients. The secondary aim was to determine if use of CVM impacted cost. A change occurred in reduction of both falls and fall-related injury rates over 3 months with a substantial cost savings with CVM beginning 24 hours a day in April 2020. Patient quality and safety was a strength of the project, as was the underlying cost reduction factor.

Interpretation

In this improvement project, CVM had a positive outcome regarding both safety and cost. Although we did not observe any of the 'signals' (i.e., trend, run, etc.) mentioned in the Perla et al (2011) paper that would indicate "signficant" changes in the outcome, there were substantial cost-savings and fall rates did not increase. Virtual sitters will continue as a fall prevention strategy as many hospitals experienced encouraging results in terms of fall reduction (Cournan et al., 2018; Jeffers et al., 2013; Spano-Szekely et al., 2019; Votruba et al., 2016). In addition, cost savings for all hospitals who introduced CVM was convincing (Burtson et al., 2015; Davis et al., 2017; Cournan et al., 2018; Goodlett et al, 2009; Harding et al., 2013; Jeffers et al., 2013; Purvis et al., 2018; Quigley et al., 2019; Sand-Jecklin et al., 2016; Spano-Szekely et al., 2019; Votruba et al., 2016).

Nursing was a proponent of virtual sitters as it applies to patient safety. Virtual sitter communication was a strength and appeared to delay patients getting out of bed without assistance, adding precious seconds to prevent falls. The intent was to roll out video monitoring one unit at a time however with the onslaught of COVID-19, video monitoring was rapidly expanded to the entire hospital. Positive outcomes of CVM included decreased patient falls and fall injuries

and isolation patients could communicate with virtual sitters who expedited needs prior to nurses donning personal protective equipment. Unforeseen benefits included decreased length of stay, reduced overtime and re-assignment of nursing assistants (CNA's) to 1:1 sitters decreased therefore CNA's remained on the unit in direct care potentially decreasing falls.

Limitations

The duration of the project was a limitation to the follow-up period post intervention, as ideally monthly fall rates to follow progression would be preferred. Lack of control of extraneous factors that possibly confounded the effect of CVM on fall rates and fall-related injury rates such as patient profiles potentially limited data collected. Another limitation was the cost analysis investigated savings on nursing hourly rates based on the total saved hours and not on purchase price of program expansion.

Initial plans for the project were deterred as COVID-19 precipitated the rapid release of CVM to the entire hospital rather than a targeted floor. The ability to monitor additional patients, including those in COVID isolation and the freeze on elective surgeries supported the decision. The decline in census challenged the bed occupancy rates and demographics. The patient population might look different as CVM continued and elective surgeries resume.

Expansion of CVM will entail investment in additional cameras. Based on the pilot nature of this QI project, only 10 cameras were available, limiting the number of patients assigned to monitoring. Due to this limitation, the falls prevention analysis could have been substantially more if patients who fell and did not receive CVM had the opportunity and could have potentially precluded a fall. Algorithms were utilized to adjust for the limited equipment and select the patients at high risk for falls.

Next Steps

Sustainability of CVM's was favorable with staff, patient, families, nurse champions and management support of the program. Fall and fall related injury rate reports were disseminated to each unit and signs were displayed on units with the number of days without falls listed for staff, patients and families to view. The vendor's next CVM version adoption was approved after the completion of this project. An important feature of the new version included documentation integration into the electronic health record.

Budget allocations for the purchase of additional cameras has stalled due to COVID budget constraints. Growth of the program with additional cameras and virtual sitters continued as a goal. The vision to spread to additional contexts include self-harm prevention and staff safety. These have implications for practice and research as does how the number of cameras impact falls, how response time is influenced, and the psychological impact of CVM on patient care from different perspectives including the patient, family and nursing.

Conclusion

The quality improvement project supported the use of CVM as an intervention in fall prevention and fall-related injuries. Long term goals for expansion of the program move forward with time investments and monetary projections. Sustainability of virtual sitters continued with nurse management and staff commitment championing this program supported by electronic health record integration and continuing education. As continuous video monitoring with virtual sitters evolves, patient safety and quality care remain a priority in terms of fall prevention and injury reduction.

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Conflicts of interest: None

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Table 1

Patient Demographics by Fall Intervention Group

Baseline Characteristic	Group 1 (n=53)		Group 2 (n=40)		All (n=93)	
	n	%	n	%	n	%
Gender						
Male	28	61	18	39	46	49
Female	25	53	22	47	47	51
Age Group						
18-64	13	48	14	52	27	29
65-84	35	66	18	34	53	57
≥85	5	38	8	62	13	14
Marital Status						
Single	10	53	9	47	19	20
Married/partner	22	54	19	46	41	44
Widowed	13	65	7	35	20	22
Divorced	7	64	4	36	11	12
Separated	1	50	1	50	2	2
Language						
English	52	57	8	35	91	98
Spanish	1	50	1	50	2	2
Other	0	0	0	0	0	0
Shift						
Night	15	65	8	35	23	25
Day	12	44	15	56	27	29
Evening	18	64	10	36	28	30
Unspecified	8	53	7	47	15	16
Day						
Sunday	8	73	3	27	11	12
Monday	5	36	9	64	14	15
Tuesday	9	56	7	44	16	17
Wednesday	11	79	3	21	14	15
Thursday	8	53	7	47	15	16
Friday	7	54	6	46	13	14
Saturday	5	50	5	50	10	11
Fall Type						
Floor	25	54	21	46	46	49
Bed/chair	2	25	6	75	8	9
Toilet	5	83	1	17	6	6
Transfer	1	100	0	0	1	1
Ambulate	2	25	6	75	8	9
Assist	10	77	3	23	13	14
Other/unknown	7	70	3	30	10	11

Note: Group 1 = pre-intervention and Group 2 = post-intervention using CVM.

Figure 1

Flowchart for Use of Continuous Video Monitor Intervention

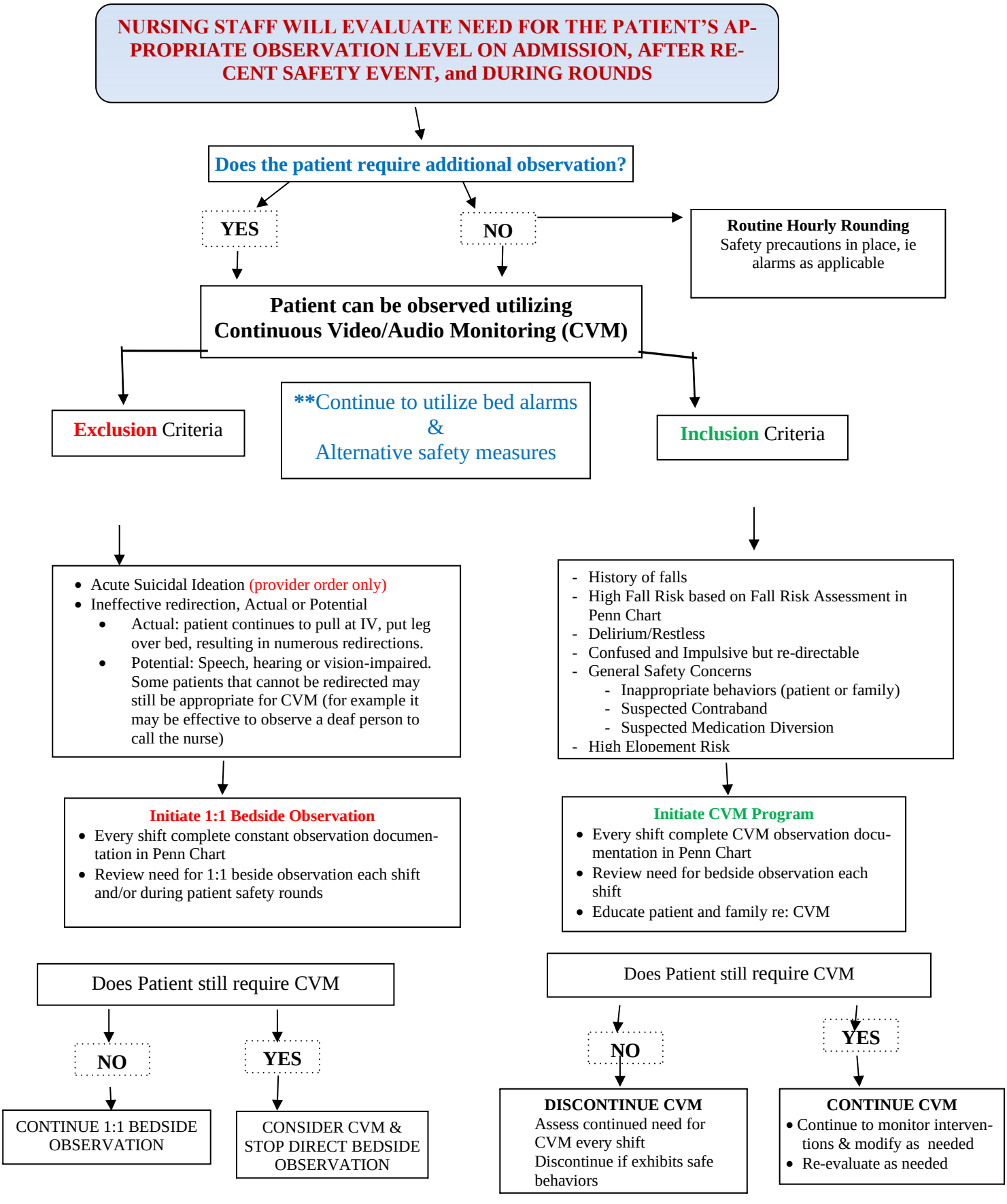
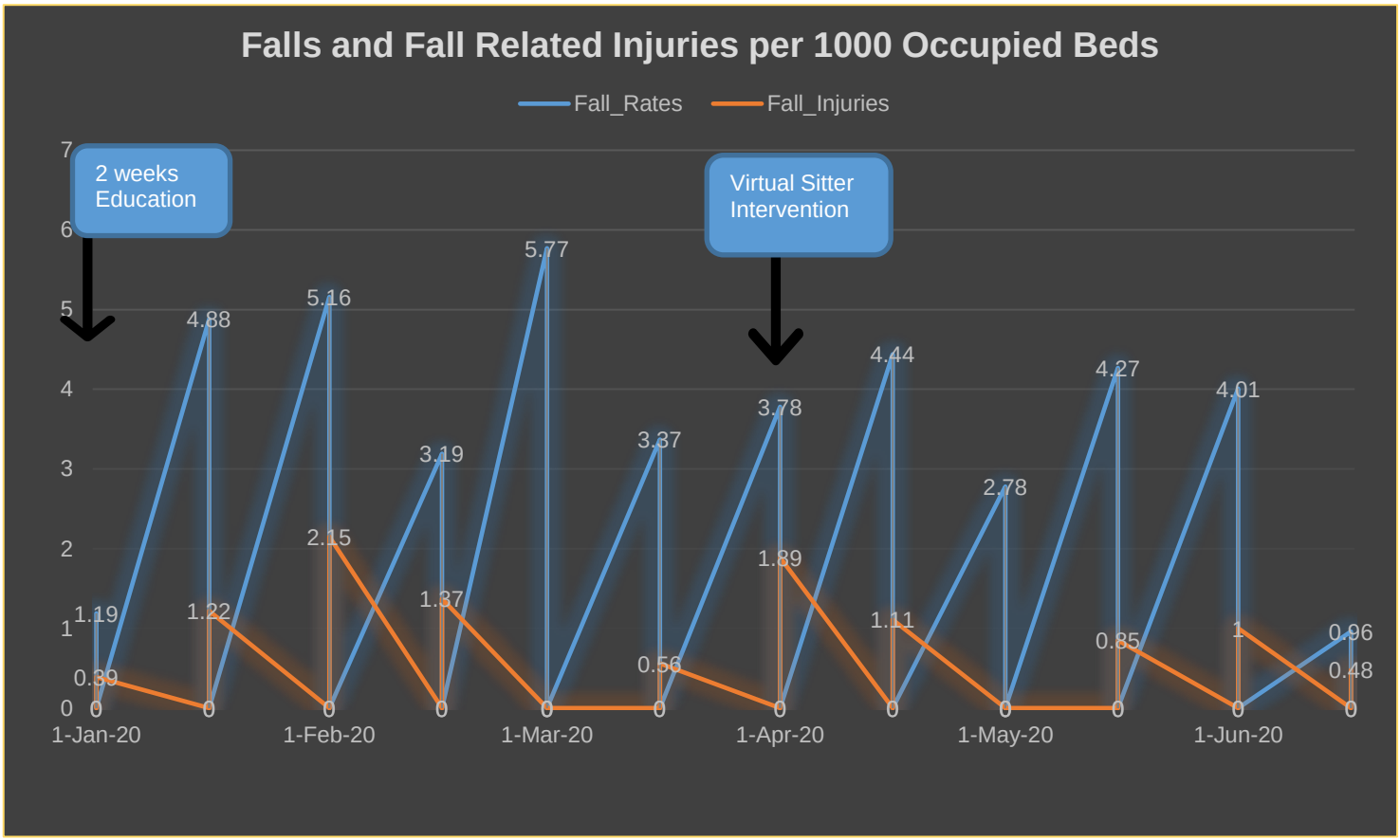


Figure 2

Run Chart: Fall and Fall-Related Injuries



Note: Rates determined using 1000 patient days