Doing more with less: Using Artificial Intelligence to help predict and prevent inpatient falls

CHI Health Lakeside Hospital

August 1st 2022

16909 Lakeside Hills Court

Omaha, Nebraska 68130

402-717-8335

Jennifer Baumert DNP, RN-BC, OCN

Jennifer.Baumert@commonspirit.org

Leadership/Planning

Despite incredible advancements made in the medical world, it remains a necessity to indulge in creativity and look 'outside the box' to develop solutions for a healthcare system that was strained even before a worldwide pandemic. Patient falls are such events that require creativity and out of the box thinking to help reduce their frequency and severity.

CHI Health Lakeside has long prided itself on patient centered care with a focus on safety, quality, and innovation, caring for the whole person: mind, body and spirit. Classified as a 'medium sized' hospital, Lakeside is the perfect size to trial various advances in the medical world from newer products, to even vendor changes. Staff have become accustomed to truly evaluating various aspects of care to ensure they are as advanced as possible, and giving honest feedback to the workflow of staff and satisfaction of patients.

Hospital Administration encourages autonomy, and encourages staff to enact positive change at the bedside. Staff are encouraged (through unit based councils) to bring forth ideas, and recommendations – often with plans to trial a process and make changes as necessary. Inpatient falls have always been a metric that was monitored and measured in each department on a quarterly and fiscal year basis. Celebrations and recognition were awarded to various departments able to achieve various goals regarding length of time since a previous fall and steady reductions in the severity of any fall. Various initiatives were implemented and supported by administration, including: proactive hourly rounding, stocking of chair alarms inside patient rooms, safety advocates as needed for confused patients etc. While all initiatives were helpful in reducing falls, none showed significant reduction and sustained consistency.

The decision was made during an inpatient staff meeting to seek out other options regarding fall reduction, especially as assigning nursing assistants to sit with confused patients was proving to be unsustainable not only financially, but was also taking valuable resources away from other patients and staff. Through various discussions, Lakeside Administration was made aware of new technology being tested using Artificial Intelligence (AI) to not only take out the human error component, but also perhaps use the concept of proactive care to prevent falls, and falls with injury from occurring.

This project encountered not only typical challenges, such as staff 'buy-in', various delays in implementation, but also extraordinary unforeseen challenges encompassed in the COVID-19 worldwide pandemic. Lakeside Administration remained steadfast in their commitment to this project, supporting the importance of fall reduction especially in those severally weakened by unknown complications of COVID-19. Lakeside Administration was clear in their commitment to patient safety and that this project had their full support, while delegating authority to key staff members.

Process of Identifying Need

Lakeside Hospital follows the National Database of Nursing Quality Indicator's (NDNQI) definition of a patient fall as an 'unplanned decent to the floor with or without injury'. As an NDNQI metric, patient falls has always been a measured and monitored for patient safety, often failing to achieve or maintain a score below the national mean. Despite various initiatives: new chair alarms, stocking chair alarm sensors in patient rooms, newer beds with improved bed

alarm technology, and proactive hourly rounding, a consistent and significant reduction in falls failed to materialize.

Falls from various units were reviewed and drilled down for trends and learning opportunities. Falls were categorized into those that were witnessed or unwitnessed, and assisted or unassisted. Witnessed and assisted falls were recognized as 'wins', as staff was eager to encourage and increase a patient's mobility, but yet remain cognoscente of protecting patients from falls. Falls that were unwitnessed were then reenacted in an attempt to determine what may have contributed to the situation for further learning. Despite all of these initiatives, care was always reactive- staff was reacting to what had already occurred. By the time a bed/chair alarm is activated, the patient has typically already left the chair or the bed. Staff questioned if there was anything 'new' in the world of fall prevention, leading to the discovery of using artificial intelligence.

Process Improvement Methods

Lakeside Hospital Administration met with a local technology company working on using AI to predict and prevent patient falls, and discussed how this might correlate with safety and quality goals and metrics. After many months of working to obtain approval from the research review board, Lakeside was given the green light to conduct a 12 month pilot study to review not only if AI was able to help reduce falls, but how it affected staff workflow.

Camera like sensors were installed in all 32 beds of the Medical/Surgical-Orthopedic floor, and all 28 beds of the Post Intensive Care Unit. These two units were chosen as they had previously had the highest inpatient fall numbers and highest number of falls with injury. Patients were consented to be part of the study prior to camera activation. For the first three months of the study, no alerts were issued to staff, as the camera sensors were only learning the

flow of the room/patient and building algorithms in an effort to help predict when it thought the patient was going to try and get out of bed.

After three months of building algorithms, staff were educated at a mandatory inpatient nursing skills day with how the sensors worked to predict bed exit, how alarms sounded, how staff could respond and answer alarms, and also the variety of alerts that were available for staff to use. All inpatient nurses were educated in the event of possibly working in various departments throughout this study. Staff were educated to carry a small smartphone with them that would allow them to view alerts from the sensors for intended bed exit, and also view the activity of the patient. Computer monitors that also showed all patients currently on camera were installed in each nursing station on the pilot units, allowing any staff member to have a view of patient activity and the ability to respond when an alert sounded. Camera sensor alerts were activated in November of 2020.

Patient cameras and room numbers were monitored frequently to help ensure accuracy, and confirm the consents matched with the patient currently being monitored. The number of alerts in each day were also monitored for accuracy. Rooms with multiple 'false alarms' were reported to the technology company to help tailor the algorithms to remain vigilant, but also remain as accurate as possible.

Staff were interviewed and observed at random to study how AI affected workflow, ease of use, and perceptions. These interviews and observations were conducted by a psychology work group in collaboration with the University of Nebraska at Omaha. Staff were given the opportunity to opt out of these interviews and observations.

After 12 months of study, Lakeside administration met with the local technology company to collaborate on results and how to further proceed. Lakeside agreed to another 12

months of using the AI technology to allow for further review in situations that were not as prevalent with COVID-19 as the previous 12 months had been. Lakeside also wished to review cost savings/sustainability, to see if using AI could help reduce not only potential bedside sitter usage, continued decrease in falls and falls with injury, and also any savings regarding unnecessary medical care from a fall that was observed with the AI cameras. Lakeside hypothesized that the review of any fall that did occur on camera, could help answer questions as to not only how the fall occurred, but also if the patient could have possibly incurred any injury-therefore helping the physician to determine if additional computerized tomography (CT) scans were necessary. Footage of these falls were then also reviewed with staff and department meetings. While this footage was uncomfortable for staff to watch, it was felt to be vital to help them understand what happens to a patient during a fall, and to put themselves in that situation in order to learn from it.

Results

Throughout the 12 months of this study, over 1500 patients were monitored via AI sensors, obtaining over 10,000 patient hours. On average over the 12 months of the study it was estimated that over 34% of patients on both pilot units at any given time were monitored by AI technology. The Medial/Surgical-Orthopedic pilot unit was able to achieve over 60 days on two separate occasions without ANY patient falls on their 32 bed unit. For the first time, this unit achieved an NDNQI fall score for two consecutive quarters, below the national mean. Falls from both pilot units where the patient originated from the bed dropped by 48%. All inpatient falls decreased by 24% (Appendix A). Patients who were monitored by AI technology were 55% less likely to have an unassisted fall originating from the bedside, and 32% less likely to sustain an injury from falling, compared to those not monitored by AI. Patients who were monitored by AI

technology, were shown to be a 1.97 times more likely to fall (due to their various risk factors)

than other patients due to their fall risk score, diagnosis, impulsivity etc., yet the significant

decrease in noted falls was achieved. Most importantly, staff was able to clearly understand that

data that they were using new and innovated tools to help keep their patients safe, noticing that

falls numbers significantly decreased (Appendix B).

Nurses rated the AI system/process four out of five stars for usefulness in fall prevention

for their patients. Data extrapolation estimated that over 13.4 falls were prevented during the

timeframe of this study and over $291,000 were saved in post fall cares as a result of this

prevention. Staff learned how to rethink about patient cares, and view falls as something they

could be proactive and not necessarily reactive about.

Lessons Learned, Replicability, Sustainability

Implementing a research study at any time can be daunting. Implementing it in the

middle of a worldwide pandemic was something unanticipated, however it did lead to interesting

learnings, pointing out challenges and also unforeseen successes. A data point that staff hoped to

measure throughout this study was monitoring the number of safety advocate/sitter hours that

were perhaps reduced as a result of these AI sensors. The thought process was that if AI could

reduce the staff that needed to sit with these confused patients, and put them to use on the

inpatient units, it would be a savings in sense of resources and cost. Unfortunately this data was

unable to be properly studied due to the significant increase in COVID-19 patients in the

fall/winter of 2020. During that time, several long term care facilities were shut down due to

COVID outbreaks, and all of their patients re-located to hospitals until a deep cleaning was

conducted, and patients and staff were out of quarantine. Many of these patients were residents

of memory support units. Due to the additional time restraints in applying personal protective

equipment, staff were rightly concerned about being unable to quickly get into these isolation rooms to help these high fall risk patients. Memory support patients often require additional complex safety measures, especially when they are confined to a room for 21 days, and unable to have the door open due to isolation restrictions. While this data continues to be monitored, it was unable to reflect an accurate picture of bedside sitter numbers at that time.

Obtaining staff 'buy in' was a critical yet, challenging component of this project. This project implementation required patience as there was a three month wait time while the sensors worked to build and adjust the algorithms that no alerts were available. Three months can be a long amount of time for staff to buy in to a product that they are not able to see in action immediately. Information had to be continually shared with staff to ensure that this was a priority for safety and Lakeside was on the correct path. Nursing leaders eventually collaborated with unit charge nurses to have conversations with staff members about which patients were being monitored or not and why and documenting to this in the medical record. Fall risk scores were discussed daily, as was those patients with impulsive behaviors to look for further study opportunities, and to encourage daily discussion of fall risks.
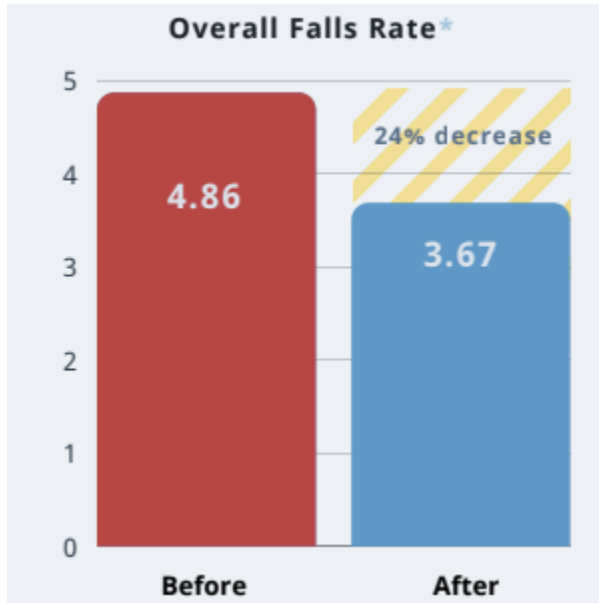
The 'go-live' time frame during the height of the 2020 wave of the pandemic was unfortunate, but unavoidable. Staff at times viewed this study as 'one more thing', something that could be potentially put off until hospitals were no longer in a survival type mindset. The pandemic however also led to some interesting learnings that had not been anticipated. Staff discovered they really liked being able to view patients on their handheld phones and sensors monitors on the nurses station, especially those in COVID isolation. While staff were frequently at the bedside of those patients, it was a sense of security for them to be able to quickly have eyes on those patients. Staff also appreciated the alerts that would sound on the pod and the hand

held phones. Staff were able to have 20-30 seconds of proactive response to a patient attempting to get out of bed, and if they were unable to answer the alert for whatever reason, their colleagues were alerted as well to the fall risk event in that room.

Lakeside was honored to be a small part of a replicating this study in other areas. Following the study, Lakeside implemented the sensors/monitors on the Med-Surg/Oncology 26 bed unit, and remains in discussion about possible eventual integration into the Emergency Department and Intensive Care Unit. Due in large part to the data that was gathered during Lakeside's study, Lakeside was able to be one of the first hospitals in the country to test out the implementation of chair exits. The same technology that was used to help build algorithms to predict and prevent bedside falls, were able to be added for patients who are in a chair/recliner in the room, and within camera/sensor view. This was a huge step forward for patients, and continued to encourage staff to keep patients mobile and allow for more freedom of movement.

The sustainment of this project lies in the transparency of data collection and collaboration with staff. It can be difficult to quantify events that didn't happen. It requires a lot of trust and patience to have the time to collaborate with our technology partners to work to review data and estimate falls and injuries that were prevented. There were times that staff members were able to witness and prevent falls with their own patients, however it was necessary to relay the estimated data throughout both inpatient pilot units to all staff members and build the trust in this new technology.

(APPENDIX A)

Overall Falls Rate*

- * Rate per 1,000 patient days

(APPENDIX B)

Fall Count Fiscal Year 21 (Entire Hospital)