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Enhancing safety in the ischaemic and haemorrhagic stroke population: exploring the efficacy of self-releasing chair alarm belts

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ABSTRACT

Introduction A quality improvement study evaluated the effectiveness of implementing self-releasing chair alarm belts in an inpatient rehabilitation facility (IRF) for patients who had a stroke. The objective of this study is to assess the effectiveness of self-releasing chair alarms as a chair-level fall preventive tool in patients who had a stroke in the IRF setting.

Methods A preintervention and postintervention quality improvement study was conducted in an IRF to address the high rate of falls in the stroke population. Falls from wheelchairs were identified as a significant concern, leading to the implementation of self-releasing safety belts (Posey HeadStart Notification Sensor Belts) with alarm systems as an intervention. In the preintervention phase (July 2021 to January 2022) falls from chairs while on standard fall precautions were recorded to establish a baseline. In the intervention phase, the self-releasing chair alarm belts were introduced along with standard fall precautions. The postintervention phase spanned from February 2022 to July 2022.

Results In the preintervention phase, 20 out of 86 stroke subjects experienced a total of 30 falls from chairs. However, in the postintervention phase, only one subject experienced a fall from a chair out of 104 stroke subjects. The mean percentage of subjects involved in falls decreased from 24±11.4% to 1±0.4% ($p<0.00001$), and the mean fall rate per 1000 patient days declined from 4.6±2 to 0.2±0.1 ($p<0.0001$).

Conclusions The implementation of self-releasing chair alarm belts significantly reduced falls from chairs among patients who had a stroke in the IRF setting. These findings highlight the effectiveness of this intervention in improving patient safety and fall prevention in IRFs.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Prior to this study, scientific literature lacked insights into the efficacy of self-releasing chair alarm belts in mitigating falls among patients who had a stroke within an inpatient rehabilitation facility (IRF) setting. The increasing trend of falls observed over 2 years in an academic medical centre's IRF prompted the need for an investigation into effective fall prevention strategies for this specific population.

WHAT THIS STUDY ADDS

⇒ This study fills a significant gap in the existing knowledge by demonstrating the effectiveness of self-releasing chair alarm belts in reducing falls from chairs among patients who had a stroke in an IRF. The introduction of these alarm belts resulted in a substantial decrease in both the number of falls and the fall rate per 1000 patient days. Additionally, the study showcases the practicality and patient-centred approach of the self-releasing feature.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study's findings hold implications for research, practice and policy within IRFs and other healthcare settings. It emphasises the tangible impact of self-releasing chair alarm belts on patient safety and highlights their potential to minimise falls. These results advocate for the adoption of such preventive measures in fall prevention strategies, thereby contributing to improved patient outcomes and fostering a safer care environment.

INTRODUCTION

After experiencing a stroke, patients face a heightened risk of falls.[1 2] The incidence of falls among stroke survivors is nearly double compared with the annual incidence observed in the elderly population in the community.[3 4] Moreover, advanced age, a widely acknowledged risk factor for falls further amplifies the heightened risk among individuals affected by stroke.[5 6] Several studies examining patients undergoing stroke rehabilitation have reported fall frequency rates ranging from 25% to 39%.[7] Falls that transpire during inpatient stroke rehabilitation have various adverse outcomes that can result in physical harm including soft tissue injuries and fractures, diminished mobility, and impaired function.[8–12] Additionally, falls can also lead to psychosocial difficulties, disruption of the inpatient rehabilitation process and increased financial burden on the healthcare system.[13 14] Injury rates linked to falls during inpatient rehabilitation vary between 13% and 29%. Fortunately,

the occurrence of severe injuries is rare, with fractures and intracranial haemorrhages accounting for only 4% of all fall-related injuries.[15] Inpatient rehabilitation programmes, which prioritise mobility, may pose an even greater risk compared with general medical wards.[12 16] Self-releasing chair alarm belts are intended to serve as a preventive measure against falls from chairs, particularly for individuals at risk, such as patients who had a stroke. These belts are equipped with an alarm system that alerts healthcare providers when a patient attempts to rise from the chair without assistance. Importantly, these belts are designed to be easily removable by the patient, granting them the freedom to move and reposition themselves as needed.

Self-releasing chair alarm belts should not be considered as restraints due to their unique design and purpose.[17] Unlike traditional physical restraints, which restrict a patient's movement and autonomy, self-releasing chair alarm belts are specifically designed to promote safety while allowing patients to maintain their independence and mobility. Restraints, on the other hand, are devices or measures that physically limit a patient's movement and freedom of mobility. They are typically used as a means of controlling or confining patients to prevent harm to themselves or others. Restraints may include wrist or ankle restraints, vest restraints, or bedrails that prevent a patient from getting out of bed. Self-releasing chair alarm belts, however, do not restrict a patient's movement or confine them to the chair. Instead, they provide a timely alert system to healthcare providers, ensuring that appropriate assistance is provided when a patient attempts to stand or move from the chair independently.

It is crucial to differentiate self-releasing chair alarm belts from restraints to avoid misconceptions and concerns regarding patient autonomy and ethical considerations. According to Centers for Medicare & Medicaid Services guidance on restraints, the classification of a device as a restraint depends on the patient's ability to remove it easily. If a patient can intentionally remove a manual method, device, material or equipment in the same manner it was applied by the staff, considering their physical condition and capability, it would not be considered a restraint. The term 'easily remove' implies that the patient can accomplish the objective without significant difficulty or assistance. This guidance emphasises the importance of assessing the patient's physical abilities and ensuring that restraints are only used when necessary, respecting the patient's autonomy and safety.[18] These alarm belts represent a patient-centred approach to fall prevention, striking a balance between safety and the preservation of patient independence.

The self-releasing chair alarm belts incorporate several key features for enhanced safety. When the first yellow strap on the belt is unfastened, the alarm activates instantly, alerting staff to the patient's attempt to exit the chair. Additionally, a secondary release mechanism provides an extra layer of protection by delaying the patient's ability to fully exit the chair. The inclusion of a dual-loop feature enables faster notification than sensor pads. These belts are designed using soft and comfortable foam material, ensuring patient comfort during use. They are intended for single-patient use to maintain hygiene standards. The fully disposable design of these belts further reduces the risk of contamination, promoting infection control practices within healthcare settings.

In 2021, a significant rise in the rate of falls from chairs in the stroke population was observed in an academic medical centre's standalone inpatient rehabilitation facility (IRF). This number has been steadily increasing over the previous 2 years. To address this concerning trend, a quality improvement study was conducted to investigate the potential efficacy of implementing self-releasing chair alarm belts within the IRF environment. The aim was to evaluate whether the utilisation of these alarm belts could contribute to mitigating falls in patients who had a stroke and enhance patient safety in an IRF setting. The study's objective was to assess the effects of self-releasing chair alarm belts on fall rates from the chair level. This quality improvement project is marked by its innovative approach, as it addresses the lack of existing literature on the effectiveness of self-releasing chair alarm belts in mitigating falls among patients who had a stroke within an IRF setting, thereby contributing novel insights to patient safety enhancement.

METHODS

After considering multiple options to address the concerning rate of falls in the stroke population within the IRF, specific measures were taken based on the unit population and the types of falls observed. On identifying an increase in falls specifically from the wheelchair, it was determined that implementing the use of self-releasing safety belts would be an appropriate intervention. These Posey HeadStart Notification Sensor Belts were equipped with an alarm system, triggering an alert when released (figure 1). This additional layer of alarm served to prompt a rapid staff response to the patient's room before a fall could occur.

A preintervention and postintervention quality improvement study was designed. This study conforms to

Figure 1 Posey HeadStart Notification Sensor Belts.

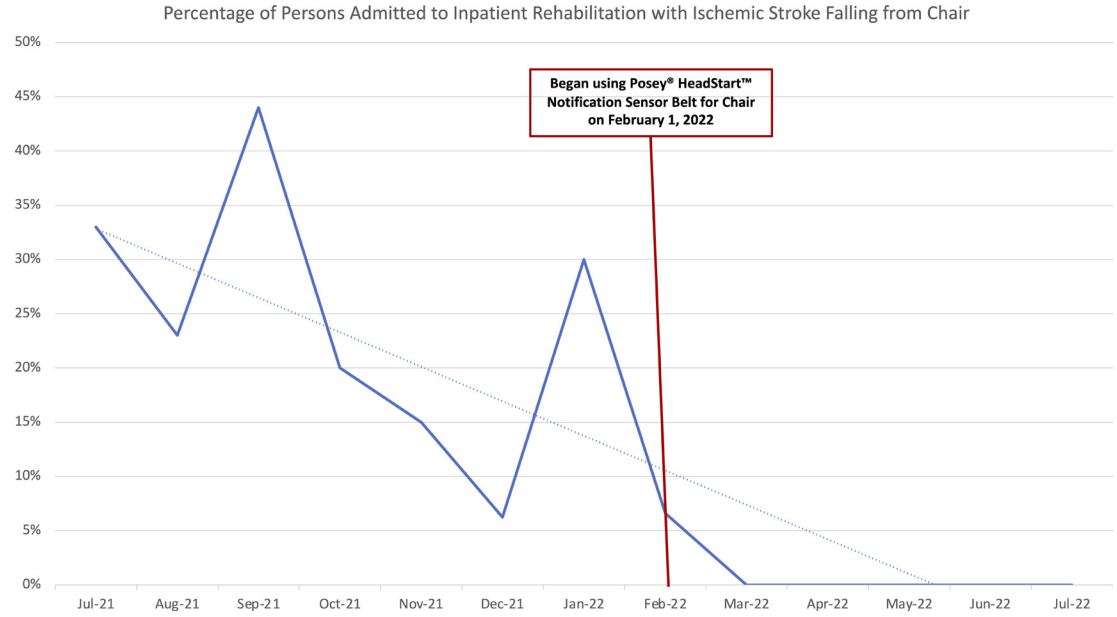

Figure 2 Effect of intervention on fall incidence from chairs: the figure presents the mean percentage of subjects involved in falls from chairs before and after the intervention. In the preintervention phase, the mean percentage was 24±11.4%, while in the postintervention phase, it decreased significantly to 1±0.4%. The decrease in fall incidence was statistically significant ($p<0.00001$) based on the analysis.

all SQUIRE 2.0 guidelines and reports the required information accordingly (seeonline supplemental checklist). During the initial phase, which served as the preintervention period, standard fall precautions were used for patients who had a stroke in the IRF. Falls that occurred while individuals were seated in chairs were recorded from July 2021 to January 2022. This allowed for the establishment of a baseline measure of falls from chairs in the stroke population.

Following this preintervention phase, patients were enrolled in the intervention phase of the study. Participants were enrolled based on the following inclusion criteria: (1) admission to the IRF for ischaemic or haemorrhagic stroke, (2) Morse Fall Scale ≥24, (3) demonstrate ability to independently remove chair alarm. After enrolling in the study, the Posey HeadStart Notification Sensor was introduced in the form of self-releasing chair alarm belts, which were implemented in addition to the standard fall precautions. The alarm belts used in our facility were designed to prioritise patient comfort and safety without needing a restraint. These belts were securely fastened around the patient using Velcro fasteners, allowing for easy release when needed. Prior to patient admission, we used data analysis to identify individuals who would benefit from the use of these self-releasing alarm belts and by implementing the belts from the beginning of their stay, patients were less likely to perceive them as a form of punishment. To ensure proper implementation, nursing and therapy staff received comprehensive education on the utilisation of these self-releasing belts when assisting patients from the bed to the chair. The postintervention phase started in February 2022 and continued through the study's conclusion in July 2022. Patients were involved as research partners in all aspects of the study including identifying the original research question, identifying the need for the original systematic review, and identifying the need for consensus.

The effectiveness of self-releasing chair alarm belts in reducing falls from chairs among patients who had a stroke was assessed by using several statistical measures. The percentage of subjects involved in falls from chairs was calculated for both the preintervention and postintervention phases using mean percentages and SD. A t-test was used to determine the significance of the difference between the two phases. Additionally, the fall rate per 1000 patient days was calculated for each phase, with mean fall rates and SD computed. The significance of the difference between the preintervention and postintervention phases for these rates were analysed using a t-test as well. The resulting p values were reported to indicate the statistical significance of the findings, employing a significance level (alpha) of 0.05. All statistical analyses were performed using IBM SPSS V.26.0 (IBM Corp).

RESULTS

A total of 86 stroke subjects were included in the preintervention phase, while the postintervention phase consisted of 104 stroke subjects. During the preintervention phase, 20 subjects experienced a total of 30 falls from chairs. However, in the postintervention phase, only one subject experienced a fall from a chair. These results indicate a significant reduction in falls from chairs following the implementation of self-releasing chair alarm belts.

The mean percentage of subjects involved in falls from chairs decreased significantly from 24±11.4% in the

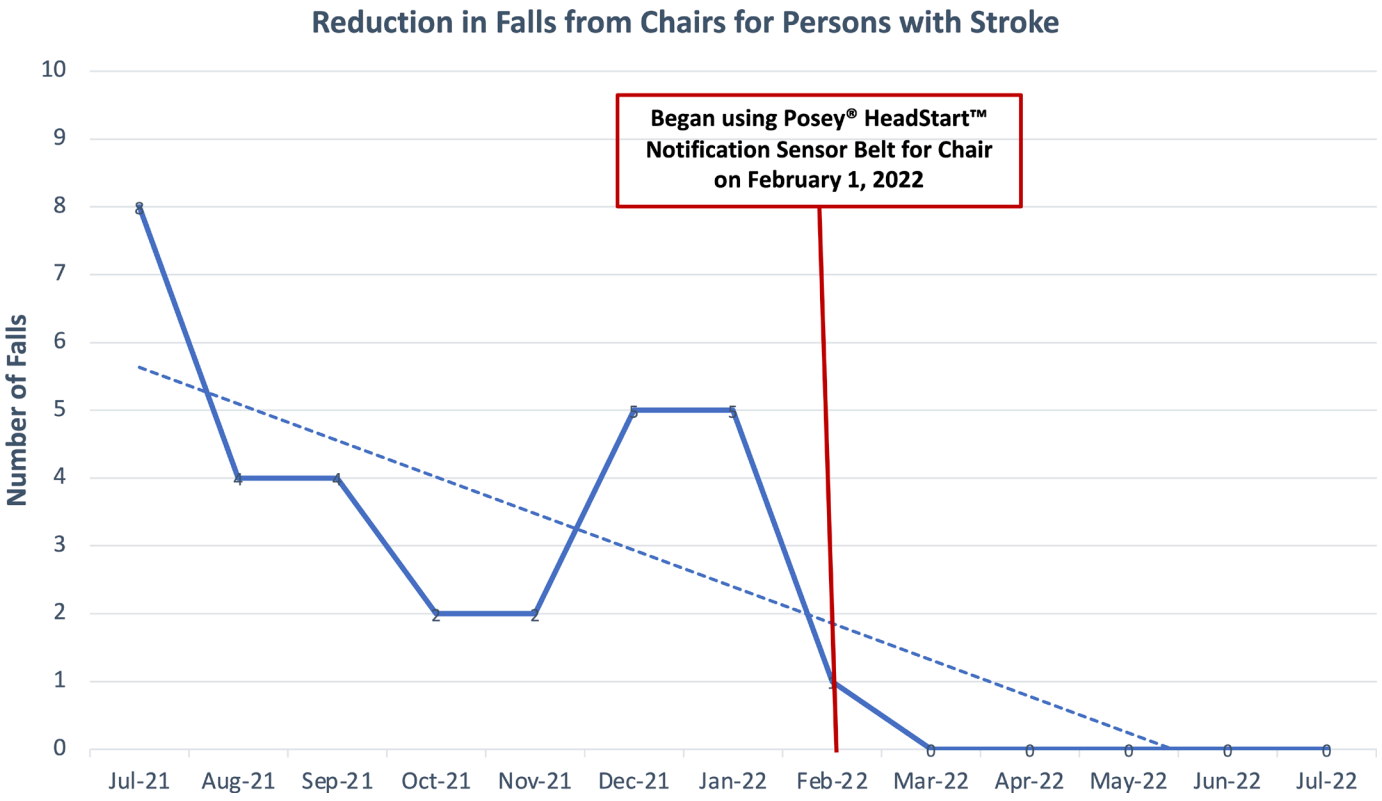

Figure 3 Impact of intervention on fall rate per 1000 patient days: the figure displays the mean fall rate per 1000 patient days before and after the intervention. In the preintervention phase, the mean fall rate was 4.6±2, whereas in the postintervention phase, it exhibited a substantial decline to 0.2±0.1. The decrease in fall rate was significant (p<0.0001) based on statistical analysis. These findings indicate that the intervention effectively reduced the occurrence of falls, resulting in a significantly lower fall rate per 1000 patient days. The results highlight the importance of the intervention in improving patient safety and reducing fall-related incidents.

preintervention phase to 1±0.4% in the postintervention phase (p<0.00001) (figure 2). Furthermore, the mean fall rate per 1000 patient days exhibited a substantial decline, decreasing from 4.6±2 in the preintervention phase to 0.2±0.1 in the postintervention phase (p<0.0001) (figure 3). These statistical findings highlight the efficacy of self-releasing chair alarm belts in mitigating falls from chairs among patients who had a stroke.

DISCUSSION

The results of this study demonstrate the effectiveness of self-releasing chair alarm belts in reducing falls from chairs among patients who had a stroke in an IRF. The implementation of these alarm belts led to a significant decrease in both the number of falls and the fall rate per 1000 patient days. These findings have important implications for patient safety and the overall quality of care provided in IRFs.

One of the key findings of this study was the substantial reduction in the percentage of subjects involved in falls from chairs. Prior to the intervention, approximately one-quarter of patients who had a stroke experienced falls from chairs. However, following the introduction of self-releasing chair alarm belts, this percentage decreased significantly to less than 1%. This indicates that the use of these alarm belts can effectively prevent falls and promote a safer environment for patients.

Furthermore, the mean fall rate per 1000 patient days significantly decreased from 4.6 to 0.2. This considerable reduction demonstrates the impact of the intervention on the overall fall risk within the study population. The findings suggest that the implementation of self-releasing chair alarm belts, in addition to standard fall precautions, can result in a substantial decrease in fall rates and contribute to the improvement of patient outcomes.

The results of this study align with previous research highlighting the importance of using preventive measures to reduce falls in healthcare settings.[19–23] Chair alarms have been recognised as a valuable tool in fall prevention strategies, particularly for individuals at risk of falls.[24] The self-releasing feature of the chair alarm belts used in this study allows patients to maintain their autonomy while ensuring their safety. The ability for patients to remove the alarm independently provides a practical and patient-centred approach to fall prevention.

The findings of this study have significant implications for IRFs and their efforts to enhance patient safety. Falls from chairs can lead to serious injuries and complications, and reducing their occurrence is of utmost importance. By implementing self-releasing chair alarm belts,

IRFs can effectively mitigate the risk of falls and improve the overall quality of care provided to patients who had a stroke. The positive outcomes of this study underscore the cost-effectiveness of implementing self-releasing chair alarm belts, as evidenced by the substantial reduction in fall rates and related healthcare expenditures. The integration of these alarm belts into fall prevention strategies holds potential to yield significant cost savings alongside the evident improvements in patient safety and care quality.

It is worth noting that this study focused exclusively on patients who had a stroke within an IRF, and further research is needed to evaluate the effectiveness of self-releasing chair alarm belts in other patient populations and healthcare settings. Additionally, future studies should consider evaluating the long-term effects of these alarm belts on fall rates and patient outcomes.

The results of this study provide compelling evidence that the implementation of self-releasing chair alarm belts significantly reduces falls from chairs among patients who had a stroke in an IRF, underscoring its potential to enhance patient safety and quality of care. Despite the promising results, some limitations should be acknowledged. The study design, a prospective before and after design, has inherent limitations such as the lack of randomisation and potential confounding factors. Due to limitations imposed by available data, our analysis did not extend to examining the comparative efficacy of self-releasing vs non-self-releasing seatbelts in preventing falls. This highlights a prospect for subsequent research endeavours aimed at better comprehending the influence of self-releasing chair alarm belts on fall prevention outcomes. The inclusion of a control group could also provide a more robust evaluation of the intervention's effectiveness. Additionally, the study was conducted within a single IRF, which limits the generalisability of the findings to other settings.

CONCLUSIONS

Falls from chairs represent a critical quality metric for IRFs that care for patients who had a stroke. The findings of this study demonstrate that the implementation of self-releasing chair alarm belts leads to a significant reduction in the number of falls from chairs within the stroke population. The findings of this study support the use of self-releasing chair alarm belts as an effective intervention to reduce falls from chairs among patients who had a stroke in an IRF. The significant decrease in the number of falls and the fall rate per 1000 patient days demonstrates the positive impact of this intervention on patient safety. Implementing self-releasing chair alarm belts, in combination with standard fall precautions, can contribute to a safer environment and improve the quality of care provided in IRFs. Further research is warranted to validate these findings in diverse patient populations and healthcare settings and to evaluate the long-term effects of this intervention. Furthermore, efforts will be directed towards evaluating comparable approaches to effectively minimise falls from the chair, with the ultimate goal of achieving a zero falls per month rate. After the study concluded, the IRF maintained the implementation of self-releasing chair alarms, emphasising the enduring sustainability of the fall prevention strategy and validating the continued effectiveness of these precautionary measures. This ongoing assessment and improvement process will contribute to enhancing patient safety and continuously striving for excellence in fall prevention.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants. The CC 20-334 Institutional Review Board (IRB) meticulously assessed the nature of the application and determined it to fall under the category of quality improvement, thus qualifying for an exemption. However, it is important to note that patient-informed consent was meticulously obtained as an essential component of the study's ethical considerations.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The dataset generated and analysed during the current study is not publicly available. However, it is available from the corresponding author on reasonable request.

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