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Do portable nursing stations within bays of hospital wards reduce the rate of inpatient falls? An interrupted time-series analysis

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Abstract

Background: falls can negatively affect patients, resulting in loss of independence and functional decline and have substantial healthcare costs. Hospitals are a high-risk falls environment and regularly introduce, but seldom evaluate, policies to reduce inpatient falls. This study evaluated whether introducing portable nursing stations in ward bays to maximise nurse–patient contact time reduced inpatient falls.
Methods: inpatient falls data from local hospital incident reporting software (Datix) were collected monthly (April 2014–December 2017) from 17 wards in Stoke Mandeville and Wycombe General Hospitals, the UK. Portable nursing stations were introduced in bays on these wards from April 2016. We used a natural experimental study design and interrupted time series analysis to evaluate changes in fall rates, measured by the monthly rate of falls per 1000 occupied bed days (OBDs).
Results: the wards reported 2875 falls (April 2014–December 2017). The fallers' mean age was 78 (SD = 13) and 58% (1624/2817) were men. Most falls, 99.41% (2858/2875), resulted in none, low or moderate harm, 0.45% (13/2875) in severe harm and 0.14% (4/2875) in death. The monthly falls rate increased by 0.119 per 1000 OBDs (95% CI: 0.045, 0.194; $P = 0.002$) before April 2016, then decreased by 0.222 per 1000 OBDs (95% CI: −0.350, −0.093; $P = 0.001$) until December 2017. At 12 months post-intervention, the absolute difference between the estimated post-intervention trend and pre-intervention projected estimate was 2.84 falls per 1000 OBDs, a relative reduction of 26.71%.
Conclusion: portable nursing stations were associated with lower monthly falls rates and could reduce inpatient falls across the NHS.

Keywords: *falls prevention, epidemiology, natural experiment, interrupted time series, older people*

Introduction

More than one in three people over 65 (~3.4 million people) fall in the UK every year [1]. The direct healthcare and associated social care costs of injurious falls in the UK are estimated at over £2 billion per year, mostly associated with hip fracture [2]. Hospitals are a high-risk environment for falls, as patients are often disorientated, unwell, navigating an unfamiliar environment and ~77% of inpatient falls occur in patients aged over 65. Hospitals' hard flooring and sharp-edged furniture increase the potential for serious injury [3]. Falls can have devastating consequences for

patients [4], with many suffering loss of independence and reduced confidence, and even non-injurious falls are associated with prolonged hospital stay [5].

Improving patient safety by reducing falls is a national priority [6], and several programmes have been developed and implemented to address this. However, they are often not conducted and evaluated in a scientifically rigorous manner [7]. The ageing population is a challenge for health systems across the world [8]. Two hospitals in our health region in the UK, Stoke Mandeville and Wycombe General, aimed to reduce inpatient falls by increasing nurse–patient contact time, using an intervention called Stay in the Bay (SITB). They introduced portable nursing stations in ward bays to allow nurses to do more of their routine work, and therefore spend more time, in the ward bays amongst patients, with the expectation of helping to reduce the inpatient fall rate.

This study aimed to evaluate whether the monthly inpatient falls rate changed after introducing SITB.

Methods

Study design

This study followed a natural experimental study design [9].

Data sources

Data were obtained from a patient safety and risk management reporting software system (Datix Limited, London, UK) that includes inpatient falls data. This dataset is routinely collected and reported to the National Reporting and Learning System, by over 98% of the UK healthcare trusts. It records the date and location of the fall, basic patient demographic data, a patient-hospital identifier number, and the level of harm (none, low, moderate, severe and death) sustained as a result of the fall.

All wards and departments of Buckinghamshire Healthcare Trust use Datix. Staff are trained and understand the importance of accurate reporting. All falls, whether avoidable or not, are reported and reviewed by a senior clinician and the patient safety team.

Bed occupancy rates for each participating ward between April 2014 and December 2017 were also obtained to enable standardised calculations of monthly fall rates. The data are recorded by the hospitals on a business intelligence platform (Qlikview, Pennsylvania, USA) and were provided in pseudonymised form, to maintain patient confidentiality.

Study population and setting

We evaluated the introduction of SITB from April 2016 in individual patient bays of 17 wards in Stoke Mandeville and Wycombe General Hospitals in Buckinghamshire, UK. The individual patient bays generally contained four or six beds. Some areas had more beds (e.g. observation and assessment areas have twelve beds to allow nursing staff to see more patients at a glance).

Clinicians and hospital management chose to implement SITB in wards with higher historical fall rates. They selected 12/17 wards in Stoke Mandeville and 5/8 wards in Wycombe General. The study included only wards that implemented SITB.

Intervention

SITB consisted of a portable nursing station on wheels with a computer system and a secure, attached drawer to store patient records. One portable station was placed within each bay on the ward, allowing nursing and other clinical staff to carry out their routine and administrative duties within the bay. In wards with single rooms, where possible and according to need, a station was positioned outside each room, with the door open to improve observation. The portable stations were relocated outside the bays, but within sight at night, to avoid disturbing sleeping patients. Before SITB, nursing and clinical duties were carried out from a traditional, large single nursing station, usually placed centrally on each ward and in view of one or two patient bed bays. The portable stations were not always occupied by a nurse. Instead, SITB was a means of encouraging and facilitating increased observation. Staff were encouraged to SITB—rather than by the main nursing stations wherever practicable.

Primary outcomes

The primary outcome was the monthly falls rate per 1000 occupied bed days (OBDs). OBDs were defined as the sum of the number of occupied beds for each day of the time period. OBD data were provided monthly and accounted for temporary closures.

Primary exposure

The exposure was the month that SITB was introduced, April 2016.

Statistical analyses

We used interrupted time series analysis to evaluate the effect of SITB on the monthly falls rate. Segmented linear regression models were used to estimate changes in falls immediately after the intervention period, while controlling for pre-intervention levels and trends.

We used the following segmented regression model to estimate effects of SITB:

$$Y_t = \beta_0 + \beta_1 Time_t + \beta_2 Intervention_t + \beta_3 Post\_Intervention\_Time_t + e_t,$$

where $\mathbf{Y_t}$ is the outcome, rate of falls per 1000 OBDs at time $\mathbf{t}$; $\boldsymbol{\beta_0}$ estimates the baseline level of the outcome at the beginning of the time series; $\boldsymbol{\beta_1}$ estimates the pre-intervention trend; $\boldsymbol{\beta_2}$ represents the change in level

immediately after the intervention; and β_3 represents the post-intervention trend.

Data covering 44 months (April 2014–December 2017) were available for analysis, with 24 pre-intervention data points (April 2014–March 2016) and 21 post-intervention data points (April 2016–December 2017). We report estimates of the trend before and after the intervention, and the rate of change.

To aid interpretation, we express regression coefficients for the level and slope as a single estimate of absolute change between the estimated post-intervention values and estimates for the same time points under the assumption that the trend observed in the pre-intervention period had continued. This is referred to as the counterfactual. Based on this value of absolute change, we also report the corresponding relative percentage change.

Data were prepared using R version 3.3.4 and analyses were performed using Stata IC version 15.1.

This study was reported using the STROBE guidelines for observational studies [10] and the TIDieR guidelines for interventions [11].

Results

We identified 2875 inpatient falls in the 17 participating wards between April 2014 and December 2017, summarised by ward in Table 1. Gender was not recorded for 2.02% (58/2875) of falls and age was not recorded for 8.28% (238/2875). Of the falls with known gender and age, men accounted for 58% (1624/2817) and the mean age of patients that fell was 78 years (SD = 13).

Table 2 shows the level of harm sustained as a direct result of each fall. Most falls (99.41%, 2858/2875) resulted in none, low, or moderate harm, 0.45% (13/2875) resulted in severe harm, and 0.14% (4/2875) resulted in death.

SITB significantly reduced the monthly falls rate (Figure 1). During the 24 months before April 2016, the estimated trend in the monthly falls rate increased by 0.119 per 1000 OBDs (95% CI: 0.045, 0.194; $P = 0.002$). After introducing SITB, it decreased by 0.222 per 1000 OBDs (95% CI: −0.350, −0.093; $P = 0.001$). The rate of change post-intervention was 0.341 falls per 1000 OBDs (95% CI: 0.159, 0.524; $P = 0.001$). One year post-intervention (April 2017), the absolute difference in the rate of falls between the estimated post-intervention trend and the projected pre-intervention estimate (i.e. the counterfactual) was 2.84 falls per 1000 OBDs, giving a relative reduction of 26.71% (95% CI: 25.10%, 28.33%).

Discussion

Main findings

The monthly falls rate decreased among hospital inpatients after introducing SITB. Previous studies have shown that most inpatient falls are unobserved, occurring when nurses are away from patients [12–14]. Nurses within bays may have reduced falls by identifying and intervening in high-risk situations and by reinforcing safety instructions, such as using walking aids and correct footwear. Increasing the nurse–patient contact time could also have reduced the risk of falls, as nurses would be more likely to see a fall and swiftly assist, minimising the patients' harm. As the stations

Table 1. Summary of demographics

			Age			Gender					
						Female		Male		Total	
Ward	Description	Beds	Mean	SD	*n*	*n*	%	*n*	%	n	%
Wycombe General											
2a	Coronary Care	22	78.79	12.52	153	54	32.73	111	67.27	165	100.00
8	Hyper Acute Stroke Unit	14	76.87	12.49	110	51	42.15	70	57.85	121	100.00
9	Acute Stroke Unit	27	77.95	11.91	189	72	35.64	130	64.36	202	100.00
12b	Elective Orthopaedic Surgery	27	72.10	13.80	69	37	47.44	41	52.56	78	100.00
12c	Elective and Emergency Urology	22	82.02	6.89	44	8	17.39	38	82.61	46	100.00
Stoke Mandeville											
FNH	Florence Nightingale Hospice (inpatient)	13	71.20	11.92	122	50	39.68	76	60.32	126	100.00
AOU	Assessment and Observation Unit	26	76.86	14.50	182	86	43.88	110	56.12	196	100.00
1	Trauma and Orthopaedic	22	79.97	14.83	156	90	52.94	80	47.06	170	100.00
2	Orthopaedic Trauma Rehab	20	81.31	10.86	147	96	61.54	60	38.46	156	100.00
4	Respiratory	23	73.80	11.54	88	35	39.33	54	60.67	89	100.00
5	Acute Haematology	18	73.70	15.44	174	72	39.13	112	60.87	184	100.00
6	Endocrine and General Medicine	24	77.69	13.36	166	82	48.24	88	51.76	170	100.00
7	Respiratory	19	75.98	11.54	81	22	26.83	60	73.17	82	100.00
8	Medicine for Older People	21	83.80	8.67	286	156	51.15	149	48.85	305	100.00
9	Medicine for Older People	22	85.45	7.59	222	84	35.29	154	64.71	238	100.00
10	Short Stay Ward	25	76.52	15.59	207	112	50.45	110	49.55	222	100.00
17	Gastroenterology	24	70.13	15.83	241	86	32.21	181	67.79	267	100.00
Missing data		N/A	N/A	N/A	238	N/A	N/A	N/A	N/A	58	N/A
Total	All 17 participating wards	369	77.73	13.49	2637	1193	42.35	1624	57.65	2817	100.00

Table 2. Summary of falls by harm category

		Falls by harm category											
		None		Low		Moderate		Severe		Death		Total falls	
Ward	Description	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Wycombe General													
2a	Coronary Care	133	75.57	41	23.30	2	1.14	0	0.00	0	0.00	176	6.00
8	Hyper Acute Stroke Unit	101	80.16	24	19.05	1	0.79	0	0.00	0	0.00	126	4.35
9	Acute Stroke Unit	157	74.41	50	23.70	4	1.90	0	0.00	0	0.00	211	7.57
12b	Elective Orthopaedic Surgery	53	67.95	24	30.77	1	1.28	0	0.00	0	0.00	78	2.85
12c	Elective and Emergency Urology	25	54.35	18	39.13	2	4.35	1	2.17	0	0.00	46	1.57
Stoke Mandeville													
FNH	Florence Nightingale Hospice (inpatient)	81	64.29	43	34.13	2	1.59	0	0.00	0	0.00	126	4.54
AOU	Assessment and Observation Unit	128	63.37	67	33.17	5	2.48	2	0.99	0	0.00	202	6.79
1	Trauma and Orthopaedic	105	61.05	61	35.47	4	2.33	1	0.58	1	0.58	172	6.11
2	Orthopaedic Trauma Rehab	102	63.75	50	31.25	6	3.75	1	0.63	1	0.63	160	5.74
4	Respiratory	54	58.06	37	39.78	1	1.08	0	0.00	1	1.08	93	3.11
5	Acute Haematology	121	65.41	62	33.51	1	0.54	1	0.54	0	0.00	185	6.45
6	Endocrine and General Medicine	111	63.79	61	35.06	1	0.57	1	0.57	0	0.00	174	6.15
7	Respiratory	53	63.10	30	35.71	0	0.00	1	1.19	0	0.00	84	2.85
8	Medicine for Older People	190	61.89	108	35.18	8	2.61	1	0.33	0	0.00	307	10.61
9	Medicine for Older People	150	61.73	81	33.33	9	3.70	2	0.82	1	0.41	243	8.44
10	Short Stay Ward	152	67.56	67	29.78	4	1.78	2	0.89	0	0.00	225	7.80
17	Gastroenterology	179	67.04	85	31.84	3	1.12	0	0.00	0	0.00	267	9.07
Missing data		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	All 17 participating wards	1,895	65.91	909	31.62	54	1.88	13	0.45	4	0.14	2875	100.00

were also accessible to consultants and doctors, SITB may also have increased the time that non-nurse healthcare professionals spent within bays.

Findings in context

Few studies have evaluated nurse-based interventions to reduce inpatient falls. Although several approaches and programmes have been developed and implemented, they are often not conducted and evaluated in a scientifically rigorous manner [7]. A systematic review of 59 fall-prevention intervention studies in acute care highlighted that outcomes and interventions were poorly reported [15]. Following their recommendations, we reported SITB using the TIDieR reporting guidelines [11].

Our findings agree with the published literature which suggests that strategies to increase patient observation reduce inpatient falls. Intentional rounding (IR) is a system of structured routine checking on patients at regular intervals determined by need [16]. IR reduced inpatient falls by 50% in a neurosciences ward in Oxford, UK [17]. However, that study followed one ward at one hospital for 12 months, so could not confirm that the reported changes were sustained. A systematic review of hourly IR found clear barriers limiting its long-term sustainability [18]. We followed 17 wards for 45 months, including 21 months after SITB was introduced, to ensure any observed changes were sustained to at least the medium-term.

A cluster randomised controlled trial (RCT) [19] conducted in six Australian hospitals evaluated the effect of a nurse-led programme to reduce falls and fall injuries. It incorporated a falls risk tool and the use of one or more of six interventions: a 'falls alert' sign, supervising patients in the bathroom, ensuring patients' walking aids were within reach, a toileting regimen, using a low-low bed and using a bed/chair alarm. Despite positive changes in falls prevention practice, no difference was seen in falls or falls injuries between groups. Although nurse-led, this programme did not move nursing stations into bays.

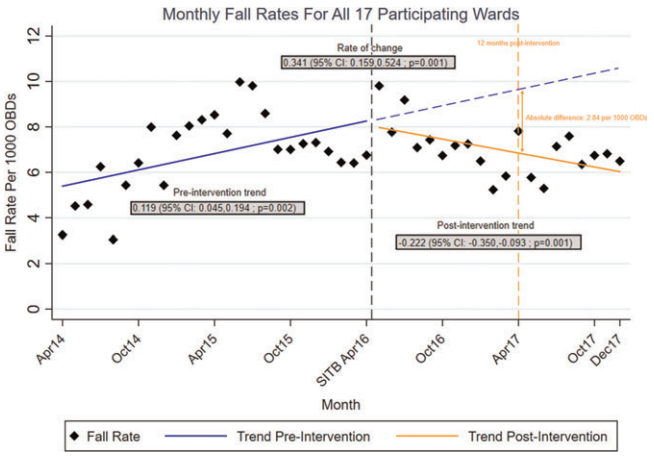

Figure 1. Interrupted time series analysis of monthly fall rates per 1000 occupied bed days (OBDs).

A stepped-wedge cluster RCT [20] found that individualised patient education programmes combined with training and feedback to all staff, including nurses, added to usual care reduced the rate of falls and injurious falls in older

patients. This study incorporated nurse training into a broader package of care, highlighting the importance of nurse-based interventions.

Patient sitters are sometimes used instead of nurses and other staff to observe patients at risk of falling. However, a review found conflicting evidence of their clinical and cost-effectiveness [21].

Despite the limited evidence available, there is some UK national guidance on falls prevention. The NICE guidelines [22] identify two major groups of inpatients at greatest risk of falling: all inpatients aged 65 and above, and inpatients aged 50–64 years who are judged by a clinician to be at greater risk of falling. NICE recommends multifactorial inpatient interventions, as the risk of falling appears to increase with the number of risk factors, and these interventions have been suggested as the most effective strategy to reduce functional declines and loss of independence [23]. However, there is little evidence to support NICE recommendations' clinical effectiveness. SITB offers a simpler alternative to complex multifactorial approaches.

The National Audit of Inpatient Falls identified five key recommendations for trust and local health boards [24]: having a falls steering group, a falls multidisciplinary working group, not using a fall risk prediction tool, conducting regular audits of bed rail use and reviewing multifactorial falls risks assessments. They also recommended that clinical staff should regularly review the falls numbers and reporting in their institution to identify under-reporting, critical incidents and areas for developing and sharing learning.

Limitations and strengths

A greater proportion of the patients who fell were male than female. The mean age of those who fell in our study agreed with previously published Hospital Episode Statistics data which found that in older age groups, more men tend to be admitted as inpatients than women [25]. Previous research has also shown that men above 50 years of age are more likely to fall than women of similar age, health condition, body composition and balance [26]. It is possible that men are more willing to take risks and less willing to call for assistance. Further research is needed to see if this gender discrepancy is found in other hospital settings.

There are some concerns around the reliability of using Datix reports. As the mechanism of completing Datix reports did not change over our study's duration, our findings are unlikely to be influenced by this factor. It is widely accepted that reporting via Datix is dependent on the reporting culture and falls rate, which is important in contextualising the observed falls rate. The participating healthcare trust has an open culture that supports learning from incidents. Staff are encouraged to report all incidents, including near-miss situations. SITB did not attempt to influence the reporting culture among nursing staff, which remained consistent before, during and after SITB was introduced.

We did not have access to detailed individual patient data for all patients admitted to the hospital wards, only for patients who fell. The time that the falls occurred could not be determined from the acquired data. Based on the experience of ward staff, there were no observed differences in the number of falls at night, as patients were usually observed from the entrance of the bay during this time.

Each ward acted as its own control within our interrupted time-series design, limiting the potential for confounding to factors that changed when SITB was introduced. However, the observed changes could still have been confounded by something other than SITB. The discourse around falls within the trust changed before and throughout our study, which could have contributed to the observed reduction in the monthly falls rates. For example, in the year before SITB the trust promoted IR and towards the end of 2016 it introduced extended visiting hours, allowing friends and relatives to stay for longer and therefore provide patients more help. However, our analysis took into account pre-existing secular trends. A culture of increased falls awareness and reporting would have continued after the intervention date, so is unlikely to explain the observed reduction in falls rates. Potential confounding will always be a limitation of observational studies. Although unlikely, it remains a possibility that the time trends observed are natural fluctuations in the falls rates. Whether the intervention fidelity can be maintained long-term also needs further study.

This study also has methodological strengths. We had more than the minimum eight time-points before and after the intervention to have sufficient power to estimate the regression coefficients [27]. We acquired detailed information about SITB from the clinical team who designed and introduced it into the hospital setting, which strengthened our study reporting. RCTs are widely regarded as the gold standard for evaluation [28] but can be costly, timely, and complicated to set up. Interrupted time-series studies are a strong quasi-experimental method for evaluating intervention effects when RCTs are infeasible [29]. Absolute and relative intervention effects, which compare the overall changes in outcome attributable to an intervention with counterfactual estimates of what would have happened without the intervention, provide an intuitive and informative summary of the results. Interrupted time series analysis allows us to control for secular trends in the data and to evaluate outcomes using population-level data [30]. It also produces results that can be presented in a clear and concise graphical format.

Further research

Adding an external group of wards that are not exposed to SITB, would allow us to compare trends in falls between the intervention and control groups, and separate the interventions' effect from other confounding events that may have occurred at the same time.

Understanding the barriers and facilitators to implementing and using SITB, requires qualitative research, including semi-structured interviews with nursing staff to identify potential advantages and disadvantages of SITB. This research would improve our understanding of SITB's effects and the potential

unintended consequences of implementing it in clinical practice. There is encouraging evidence and proof of concept to suggest that SITB could be tested in an RCT.

Conclusion

Introducing portable nursing stations in hospital ward bays was associated with a reduction in the monthly inpatient falls rate SITB has the potential to be applied across the NHS and may reduce inpatient falls.

Key points

- The Stay in the Bay (SITB) intervention, comprises of introducing portable nursing stations in ward bays to allow nurses to do more of their routine work, and therefore spend more time, in the ward bays amongst patients.
- Introducing portable nursing stations in hospital ward bays was associated with a reduction in the monthly inpatient falls rate.
- Nurses within bays may have reduced falls by identifying and intervening in high-risk situations and by reinforcing safety instructions.
- Increasing nurse-patient contact time could have reduced the risk of falls, as nurses would be more likely to see a fall and swiftly assist.
- SITB has the potential to be applied across the NHS and may reduce inpatient falls.
- We are currently seeking advice from the author.

Conflict of interest

None.

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Quality of primary palliative care for older people with mild and severe dementia: an international mortality follow-back study using quality indicators

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Abstract

Background: measuring the quality of primary palliative care for older people with dementia in different countries is important to identify areas where improvements can be made.
Objective: using quality indicators (QIs), we systematically investigated the overall quality of primary palliative care for older people with dementia in three different countries.
Design/setting: a mortality follow-back survey through nation- and region-wide representative Sentinel Networks of General Practitioners (GPs) in Belgium, Italy and Spain. GPs registered all patient deaths in their practice. We applied a set of nine QIs developed through literature review and expert consensus.
Subjects: patients aged 65 or older, who died non-suddenly with mild or severe dementia as judged by GPs (n = 874).
Results: findings showed significantly different QI scores between Belgium and Italy for regular pain measurement (mild dementia: BE = 44%, IT = 12%, SP = 50% | severe dementia: BE = 41%, IT = 9%, SP = 47%), acceptance of approaching death (mild: BE = 59%, IT = 48%, SP = 33% | severe: BE = 41%, IT = 21%, SP = 20%), patient–GP communication about illness (mild: BE = 42%, IT = 6%, SP = 20%) and involvement of specialised palliative services (mild: BE = 60%, IT = 20%, SP = 77%). The scores in Belgium differed from Italy and Spain for patient–GP communication about medical