FALL AUDIT IN A COMMUNITY HOSPITAL

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SUMMARY

Community hospitals in Singapore are staffed by family physicians and provide step-down, rehabilitative, respite and sub-acute healthcare. In 1999, a rising trend in fall rates within Ang Mo Kio Hospital (AMKH) triggered staff to audit past falls within the hospital and implement an inter-disciplinary multi-interventional fall prevention programme. AMKH's fall rate declined significantly from a peak of 2.9 falls/1000 patient-days in 1999 to 0.9 falls/1000 patient bed days in 2002 (c^2 = 3067.64, p<0.01 at 0.05 significance level). A comparison of patient characteristics between random samples of 1999 and 2002 cohort demonstrated no significant differences except that the 2002 cohort was older and more functionally dependent on admission. The paper will discuss the audit process and results.

Keywords: fall prevention, audit, multi-intervention, inter-disciplinary, community hospital

Introduction

Ang Mo Kio Hospital (AMKH) receives about 2000 patients a year, of which 96% are from acute hospitals and 86% are aged 60 years and above. Most patients admitted to AMKH have multiple illnesses and functional disabilities and hence are at risk of falls. However, their risk for falls must be balanced with their need for rehabilitation to become as independent in Activities of Daily Living (ADLs) and ambulation as possible.

Falls in AMKH have been monitored since 1996 and are documented through Incident Reporting Forms. The fall rate was noted to be steadily increasing since 1996 but in 1999 when the hospital extended its rehabilitative programme to all patients admitted, it reached a peak of 2.9 falls/1000 patient days. Previously, patients received rehabilitation only if they were referred by a doctor. In the extended rehabilitation programme, all admitted patients received rehabilitation by a physiotherapist and an occupational therapist without need for a doctor's referral.

To address the rise in fall rates, a fall committee was set up in early 2000 consisting of a doctor, nurses from each ward, a physiotherapist and an occupational therapist. The committee approached the problem by:

1. Defining falls and fall rate;
2. Reviewing previous fall data to identify common areas and reasons for falls;
3. Reviewing literature on evidence-based strategies to prevent falls in intermediate care/rehabilitation settings;
4. Reviewing the hospital environment for fall hazards.

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Definitions

A fall was defined as an incident resulting when a resident comes to rest on the ground secondary to an unplanned occurrence. The fall rate was defined as the number of falls per 1000 patient-days and is calculated by using the following formula:

$$\frac{\text{Number of Patient Falls}}{\text{Number of Patient-Days}} \times 1000$$

Review of Previous Falls

From the data on previous falls documented through incident reports, we were able to identify the common areas in the hospital where patients fell for the year 1999 (Table I). Most falls occurred at the patient's bedside, while ambulating and in the toilet. It was also noted that patients who should be on assistance during transfers at the bedside were three times more likely to fall without assistance than when it was available. This suggested that patients requiring assistance were not receiving adequate supervision and a better method for nurses to identify patients who needed assistance during ambulation was needed. Falls in toilets were mainly the result of inadequate supervision, wet floors, inappropriate height of toilet seats and showerheads, inadequate aids and a lack of call bells in the toilets. Fall prevention strategies focused on these common areas for falls.

Literature Review on Fall Prevention in Intermediate Care Settings

A literature review showed that while there was literature on fall prevention in acute hospitals, nursing homes and the community, there was a lack of published data on fall rates in community hospitals or other step-down care/intermediate care facilities. The term "community hospitals" in other parts

Table I: Frequency and Site of falls in 1999.

% of Falls in 1999	Site of Fall
2%	Transferring at bedside between chair and bed or to standing position without supervision
27%	During ambulation
14%	While in toilet
10%	Transferring at bedside between chair to bed with supervision
7%	Reaching out for things while seated on bedside chair
6%	While climbing out of bed with bed-rails up. (Such patients are usually cognitively impaired and have decreased safety awareness.)
4%	Ambulating on a wheelchair
1%	Mechanical fault of equipment

of the world refer to rural secondary-level hospital settings and they provide a different kind of service than those in Singapore. Moreover, differences in definitions of step-down care in different parts of the world make it difficult to compare fall rates meaningfully.

Published fall rates for rehabilitation hospitals were found in a book written by a nurse Janice Morse. In her book, fall rates in rehabilitation hospitals were reported by Mion et at al as 46 out of 143 patients while Vlahov et al reported a fall rate of 178 falls per 1000 patients[1]. In a paper written by Nyberg et al, the fall rate in a geriatric stroke rehabilitation unit was reported as 15.9 falls per 1000 bed-days[2]. Tutuarima et al reported that in a study of 720 stroke patients from 23 hospitals, the average incidence of falls was 8.9 falls per 1000 patients per day[3].

Evidence to support the use of an inter-disciplinary approach to fall prevention came from a study by Tinetti et al which showed that a multifactorial intervention reduced the risk of falling among elderly living in the community by 12%[4]. A study by Close et al demonstrated the efficacy of a structured inter-disciplinary approach to the management and prevention of falls in older persons in an emergency service setting[5].

The need for a multi-interventional approach to fall prevention was supported by a study by Feder et al who conducted a systematic review of data on falls in various healthcare settings and concluded that multifaceted interventions reduced falls in older people[6]. A later systematic review of falls in acute hospitals by Evans et al also concluded that single interventions for fall prevention failed to show any benefit, and that significant protection against falling was achieved by interventions which targeted multiple identified risk factors in non-hospital settings[7]. A paper by Louise Patrick et al (1999) described a standardised assessment and intervention protocol for managing risk of falls in a geriatric rehabilitation unit[8] which provided a comprehensive list of fall prevention strategies.

In Evan et al's paper (ibid), fall risk assessment tools were examined and it was found that such tools were limited in their usefulness and that there was very little evidence to support its use[7]. Most fall risk assessment tools used to predict the likelihood of a patient falling are either not validated, too lengthy or impractical to be of clinical use. For example, the Downton Index, which is used to predict persons prone to falls during stroke rehabilitation, had a sensitivity of 91% but its specificity was limited to 27%[9]. The Morse Fall Scale created by Janice Morse[10] is an easy fall risk predictor tool which had been validated and found to be reliable in community living patients, but it has significant ceiling effects on frail, functionally-impaired elderly. On scoring the Morse Fall Scale on AMKH patients, the majority scored at least 50 points out of a possible score of 125 points, which is classified as 'very high risk'. According to Morse, in a stroke rehabilitation unit where all patients may be at very high risk of falls, fall prevention strategies should be provided for all patients.

Hospital Environment Review

Our occupational therapist also performed a complete physical environment review of the hospital and formulated a plan to improve the environmental safety of our hospital with a focus on the common areas for falls.

Fall Prevention Strategies Implemented

Based on the literature review and fall audit, the following fall prevention strategies were agreed upon and implemented in 2000:

1. Fall prevention education of doctors, nurses and therapists.
2. A monitoring system to review all falls.
3. A coloured chart system by the bedside for easy identification of a patient's ambulation needs.
4. A clothing labelling system to identify patients who do not require a staff member for ambulation.
5. Institution of a footwear policy.
6. Environmental improvements to reduce the risk of falls.

1. Fall Prevention Education

   In-house staff education was conducted for all staff. They were taught fall prevention strategies such as proper patient transfer and ambulation techniques and safe toileting techniques by senior nursing officers and rehabilitation therapists. Non-nursing ward staff, like ward assistants and health attendants, had a special course targeted at their vocational level, conducted by our resident Nurse Educator.

2. Fall Monitoring System

   A fall monitoring system was formally set up. Each ward was assigned a Fall Team Leader from the Fall Committee and they acted as resource persons for falls in the ward. The Ward Fall Leader monitored falls in the ward and ensured that falls were identified, assessed and documented. Every fall required reviews by every member of the inter-disciplinary team and correctable fall risk factors were identified and followed up.

3. Coloured Bed Chart System

   All patients in our hospital have a chart at the head of their beds displaying patient details such as their names, language spoken, ambulatory status and diet. To facilitate easier identification of ambulatory needs of each patient at the bedside, the chart was in a colour that corresponded to the degree of assistance needed by each patient which could be seen easily from a distance. The colour-coding system used is shown in Table II.

Table II: Colour-Coding System for Patient's Bed-Charts

Colour of Chart	Ambulatory Status
White	Requires Assistance with Physical Effort
Orange	Requires Contact Guard/Standby Assistance
Yellow	Requires Supervision
Green	Independent

4. Clothing-Labelling System
   Patients out of bed also needed to be identified whether they needed assistance while they were ambulating. The patient's clothing was sewn with shoulder straps so that a coloured epaulet could be fastened. Only patients who were safe to ambulate independently wore a green epaulet so that any patient ambulating without one could be easily identified as requiring assistance.

5. Footwear Policy
   There was a lack of attention to the type of footwear patients were using during rehabilitation so a shoe-wearing policy was implemented. All staff was taught what was suitable footwear (eg. good fit, comfortable, flat or very low heel and non-slip). Family members were also informed to bring a pair of suitable footwear from home for the patient. Patients themselves were reminded to put on their footwear especially during ambulation and rehabilitation. Nurses and physiotherapists were responsible for ensuring footwear suitability and compliance.

6. Environmental Improvements
   Our occupational therapist performed an extensive review of the hospital and identified many areas requiring improvements to make it safer for patients. The environmental modifications that were implemented in 2000 included the following:

   Bedside
   - Patients were positioned on their chairs at the bedside such that call-bells and their side-table were within easy reach.
   - The height of hospital beds wee adjusted on admission according to the height of the patient so that it would not be too low for post-hemi-arthroplasty patients (who require that their operated hip does not flex beyond 90^{o}) or not too high such that patients have to "jump" off their beds.

   During Ambulation
   - Gait belts were purchased to increase patients' safety while ambulating with assistance.
   - A formal system for 3-monthly maintenance checks on wheelchairs, beds and physiotherapy equipment was implemented with cooperation of hospital maintenance department.

   Toilets
   - A fresh layer of non-slip coating was applied on all toilet floors.
   - Wall fans were installed in toilets to keep the toilet floors dry.
   - Ward shower cubicles which tended to trap water were modified to improve drainage.
   - Call bells were installed in every toilet.
   - Wall-mounted shower chairs that were too low were raised.
   - Wall-mounted showerheads that were too high were lowered so that patients could reach them more easily.
   - Handrails were installed in shower stalls that lacked them.

Close coordination and cooperation between hospital administration, maintenance, engineering and rehabilitation departments was the key to successful implementation of environmental modifications.

Results

The measures implemented to reduce the fall rate in our hospital appeared to show effect in a year with the reduction in our fall rate from 2.9 falls/1000 patient-days in 1999 to 1.7 falls/1000 patient-days in 2000. In the subsequent 2 years, the fall rate continued to remain low at 1.3 falls/1000 patient-days in 2001 and 1.5 falls/1000 patient-days in 2002 (Figure 1). Applying Chi-square analysis between the number of fallers before the Fall Prevention Programme (1999 cohort) and after (2002 cohort), the decline in number of fallers was significant ($c^2 = 19.82$, $p<0.001$).

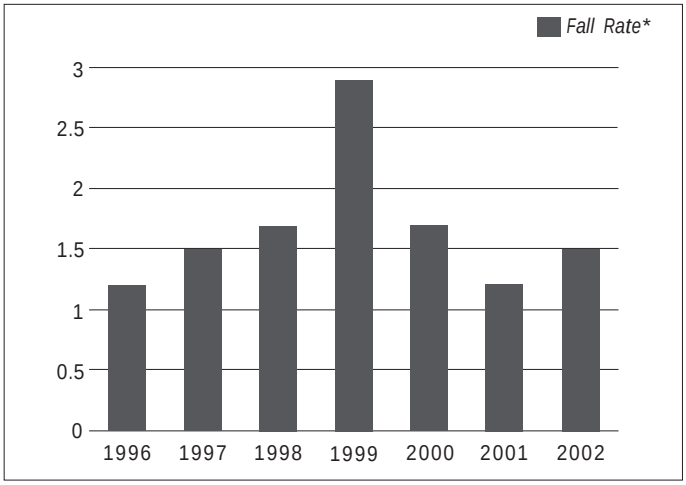

Figure 1: Fall Rates in AMKH from 1996 to 2002.
**Fall Rate = Number of falls per 1000 patient-days*

Discussion & Analysis

The decline in fall rates could have been the result of a Hawthorne effect: the heightened awareness of a study being conducted which caused changes in staff behaviour (instead of the new fall prevention measures implemented) could have led to the decrease in fall rates. Hence, we cannot confidently attribute the effectiveness of the fall prevention programme purely on strategies implemented.

Moreover, there was no control group to compare the effectiveness results of the implementation programme. As a result, the possible confounding factors for the decline in fall rates could have been that the 1999 cohort of patients were older, more dependent, 'had more co-morbidities or enjoyed a higher staff to patient ratio than the 2002 cohort, hence explaining the drop in fall rates. To analyse this, we selected 200 patients randomly from all admissions in 1999 and

compared them to another 200 randomly selected patients from all admissions in 2002. This represents an 11% and 10% sampling of the total number of patients admitted in 1999 and 2002 respectively. They were analysed for differences in age, gender, principal diagnosis for admission, co-morbidities (namely diabetes, hypertension and ischaemic heart disease) and Barthel Index scores on admission and discharge (Table III). On comparing the 2 cohorts, we found that there were no significant differences between both cohorts, with the exception that the post-intervention group (2002 cohort) was older and more functionally dependent on admission than the pre-intervention group (1999 cohort). This suggests that even though the post-intervention group had a higher prevalence of characteristics that are associated with a higher fall risk, the fall prevention strategies were still able to reduce the hospital fall rate. Comparing the Barthel Index score on discharge, we also found no significant difference between the two cohorts. This suggests that although the 2002 cohort were more functionally dependent upon admission, we were still able to rehabilitate them to a level similar to 1999 before discharge. We were also able to study the patient to staff (P:S) ratio of the hospital from 1997 to 2002 (Table IV). The P:S ratio in the hospital has remained steady from 1997 to 1999. However, it reached a low in 2000 because we recruited more nurses than needed in anticipation of expansion of the hospital, which was subsequently shelved. The increase in the patient to staff ratio in 2000 could explain the drop in falls in 2000. However, it does not explain why the fall rate continued to fall in 2001 when the patient to staff ratio was at its highest. Hence, the patient to staff ratio is unlikely to be a significant factor in explaining the sustained decrease in fall rate.

Table III: Statistical Comparison of Possible Confounding Variables between 1999 Cohort and 2002 Cohort. (All statistical analysis done on SPSS Version 10)

Possible Confounding Variable	1999 cohort	2002 cohort	Statistical Method Used	Statistical Value	Statistical Significance
Age (years)	Mean = 70.8	Mean = 74.5	Independent t-test	t = -2.88 ($p < 0.05$)	Significant
Gender (Number)	Female = 119 Male = 81	Female = 125 Male = 75	Chi-square analysis	X^2 = 0.38 ($p > 0.05$)	Not significant
Principal Diagnosis as Stroke	81	67	Chi-square analysis	X^2 = 2.10 ($p > 0.05$)	Not significant
Principal Diagnosis as Fracture	80	84	Chi-square analysis	X^2 = 0.16 ($p > 0.05$)	Not significant
Principal Diagnosis as Surgical Conditions Other than Fractures	5	7	Chi-square analysis	X^2 = 0.34 ($p > 0.05$)	Not significant
Principal Diagnosis as Medical Conditions Other than Strokes	34	42	Chi-square analysis	X^2 = 1.04 ($p > 0.05$)	Not significant
Diabetes Mellitus as Co-morbidity	59	61	Chi-square analysis	X^2 = 0.05 ($p > 0.05$)	Not significant
Hypertension as Co-morbidity	98	79	Chi-square analysis	X^2 = 3.60 ($p > 0.05$)	Not significant
Ischaemic Heart Disease as Co-morbidity	18	17	Chi-square analysis	X^2 = 0.03 ($p > 0.05$)	Not significant
Barthel Index Score on Admission	Mean = 49.44	Mean = 44.39	Independent t-test	t = 2.06 ($p < 0.05$)	Significant
Barthel Index Score on Discharge	Mean = 61.8	Mean = 58.9	Independent t-test	t = 1.10 ($p > 0.05$)	Not significant

** Level of significance = 0.05.*

Table IV: Staffing Ratio of hospital 1997 – 2002 (Data for 1996 is not available.)

Year	No. of Beds Available Rate	Average Occupancy Occupied Beds	Average No. of Patients who	Average No. of Staff	Patient : Staff Ratio bed-days)	Fall Rate (no. of falls per 1000
1997	156	80%	125	104	1.20:1	1.5
1998	180	79%	142	112	1.27:1	1.7
1999	178	82%	146	116	1.26:1	2.9
2000	178	80%	142	126*	1.13:1	1.7
2001	190	82%	156	112	1.39:1	1.3
2002	201	79%	159	120	1.32:1	1.5

** Additional nurses were recruited in 1999 in preparation for hospital bed expansion but plans were shelved in mid-2000.*

Conclusion

The fall audit process in AMKH involved an evidence-based, inter-disciplinary and multi-intervention approach and resulted in a decline in fall rates. However, there is insufficient evidence to attribute the decreased fall rates wholly to the fall prevention strategies implemented. Nevertheless, comparison of pre and post intervention cohorts suggests that differences in patient characteristics were unlikely to be significant confounding factors.

Acknowledgements

I thank Dr Lau Hong Choon, Dr David Yong and all staff at Ang Mo Kio Hospital for their support.

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