

Reducing inpatient falls: Human Factors & Ergonomics offers a novel solution by designing safety from the patients' perspective

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Introduction

Patients feel safe in the hospital and perceive they are less likely to fall whereas the opposite can be true if weakness, confusion and/or altered elimination issues are experienced as a result of symptoms, medication and/or procedures. A previous editorial from Grealish and Chaboyer (2015) outlined the scale and scope of this problem with an excellent argument for improving nursing care by valuing essential needs including ambulation, hydration, nutrition and elimination. However, despite many interventions (and models of nursing care) to improve assessment, monitoring and communication (Hignett, 2010), there has been little evidence of sustained reductions in either the number of falls or severity of injuries over the last 60 years (Oliver et al, 2007). So perhaps falls really are a *'seemingly intractable cause of harm'* (Donaldson et al, 2014).

The most recent Cochrane review (Cameron et al, 2014) confirmed a lack of robust evidence for any one intervention with a recommendation for more trials to confirm the effectiveness of multifactorial interventions in the hospital setting. In response to this, Barker et al (2016) carried out a cluster RCT to evaluate a 6-Pack intervention (signage, supervision, walking aids within reach, toileting regimen, low-low bed and bed/chair alarms) with over 45,000 patient stays. They found no difference in falls or fall injuries between the intervention and control groups and concluded that *'novel solutions are urgently needed'* with *'system level interventions, environmental interventions, or both ..[as]..the focus of further investigation'*.

As professional and academic Human Factors & Ergonomics Specialists (Certified (USA), Chartered (UK) Professional Ergonomists) we commend Grealish and Chaboyer for their consideration of the caregiver role but disagree with their thesis; that a different model of nursing care would produce a sustained reduction in the number and severity of falls events. We believe that it's now time to take

a Human Factors & Ergonomics systems approach and understand patients' behaviours in relation to individual capabilities and limitations with respect to falls. The discipline and profession of Human Factors & Ergonomics (the terms are used interchangeably) integrates knowledge from design, psychology, organisational management, human sciences and engineering related to optimise human wellbeing and overall system performance (Dul et al, 2012).

Falls are usually the result of slips (e.g. fluid, or dry/dusty floor contamination) and trips (e.g. obstructions or uneven surfaces); the key factor in a fall event is movement. As Doherty-King and Bowers (2013) discuss, movement is important with 15-59% loss in independent ambulation during a hospital stay. In many care settings a risk-averse culture (e.g. inappropriate use of bed rails, Hignett et al, 2013) may contribute to reduced mobility and functional decline. As there are benefits from retaining mobility associated with continence, cognitive function and pressure care (Lahman et al, 2015), our thesis is that falls interventions should be designed to both reduce risks and support mobility using patients' perspectives of risks and safety (interactions and interfaces).

Patients are often overwhelmed with information about the new disease, treatment options and decisions. They need time to process what is happening while often feeling very ill, so the risk of falling may not be their highest priority and may be compounded by misunderstanding and denying risks (Wolf and Hignett, 2015). For example, Sonnad et al (2014) found that patients' perceptions of falls risk may not match their clinical risk or actual experience and they may overestimate the ability of the care team to prevent falls. Haines et al (2014) found that 25-34% of elderly adults (70 years and older) thought a falls prevention strategy was fine for someone else but not needed for themselves.

People-Centred and People-Driven

One of the key Human Factors & Ergonomics systems challenges in healthcare is the dual human interface; both people-centred (patient) and people-driven (caregivers). This is found in other sectors e.g. public transportation where at least two people must cooperate to achieve a common goal (for example a short bus journey) where the length of engagement is variable and the

passengers are in a temporary, unfamiliar environment. There is a partnership (goal confluence) between passengers' cooperation to stay seated and the driver's awareness to proceed after all passengers are safely seated.

In healthcare the patients and caregivers may have conflicting goals with respect to mobility and independence which could counteract or even sabotage falls interventions. In the transportation industry, people waiting in a queue line and finding their seat will behave in a way that is congruent with cultural norms and therefore (relatively) predictable to achieve their goal. In the care setting intimate activities, such as toileting, may enhance the wish to be independent and limit the tendency to call for help. It has been suggested that only about 50% of the patients may participate with falls prevention initiatives by calling for help (Nyman and Victor, 2001).

Designing the system from the patients' perspective

Many of the falls initiatives over the last 60 years have taken the fundamental premise that decreasing unwitnessed incidents holds the key to reducing total falls and injuries. This has resulted in prevention initiatives to increase monitoring (bed alarms, CCTV, clustering high risk patients etc.) which may have latent systems limitations due to ward/room layout and sight lines, and staffing numbers and competencies (Simon et al, 2016).

In the trajectory of a fall event for a very common activity (going to the toilet/bathroom) there are some challenges which are both foreseeable and generic. A Human Factors & Ergonomics method (Hierarchical Task Analysis) was used to describe the activity of going to the toilet from the patients' perspective (Hignett, 2012). The first two higher level tasks (of 5) will be further considered to understand human behaviour (capabilities and limitations); (1) decide to go to the toilet and (2) get out of bed without help (mobility assistance).

Decide to go to the toilet: request assistance or not... (call bell)

How long will patients wait for a response to the call bell before mobilising independently?

Two examples from other industrial sectors can provide insights for waiting behaviour. Firstly, when waiting for a response to a business call 60% of callers will hang up within 60 seconds, which reduces to 40 seconds if an automatic message tells the caller that they are being placed on hold (OnHold, 2015). Secondly, to manage public incursions onto railway tracks after automatic barriers are lowered over the road/track intersection, trains are scheduled to arrive within 27-75 seconds and the barrier lifts 4–10 seconds after the train has passed (Office of Rail Regulation, 2011).

An acceptable response time will vary depending on the person and situation, but typically some type of response or feedback is expected within 1- 5 seconds and a delay can be detected in less than 1 second (OnHold, 2015). A 3 minute response for a call bell could be perceived as very long depending on the urgency of the request so some patients may decide to 'get up and go'.

Get out of bed without assistance: mobilise independently at the bedside

The safe design of a bedside microsystem is a generic challenge across all care settings. There are predictable and foreseeable interfaces and interactions with the bed rails, bedside table and walking aids. If designed using a patient's perspective there will be preferred options, for example the bed rails should both support mobility both in bed (turning and repositioning) and transferring in/out of the bed (Hignett et al, 2013) and the environment should support 'furniture walking' to replicate behaviour in the home. When sitting in a bedside chair, the table should be located at the side of the chair rather than in front (blocking egress) as '*the biggest danger of current bed/table design is catching your feet on the bed/table feet*' (Hignett et al, 2015).

So designing from the patients' perspectives might include 3 items to improve bedside safety and support independent mobility. These are; firstly a bed with split bed rails (2 on each side) as a mobility aid by keeping the head-end rails raised to support turning, repositioning and transferring in/out of the bed; this design and configuration is used very commonly in the USA. Secondly, the provision of a table for use at the chairside (walker/table used in home care); and thirdly, a table for use in bed as a table combined with locker (used on Germany and The Netherlands; see one

example at <http://ilcaustralia.org.au/products/20216> ; this is not endorsed and other products are available).

After many years of good intentioned by ineffective interventions, we suggest that falls risk management should radically change by using a Human Factors & Ergonomics systems approach for this complex, multifaceted problem. This requires a bold step to challenge the established and increasing complex packages for falls interventions by understanding human behaviour (physical, cognitive and social). There needs to be a balance between safe (improved) organisational processes, environment and equipment design, and task behaviours from staff and patients. Although the use of Human Factors & Ergonomics in patient healthcare has been successful in some fields and situations, the practice is still rare and the inclusion of the patient perspective is infrequent (Pronovost and Bo-Linn, 2012). Designing for patients' using a Human Factors & Ergonomics systems approach will integrate risks for mobility and falls and offers a novel solution for an embedded improvement.

REFERENCES

- Barker, A.L., Morello, R.T., Wolfe, R., Brand, C.A., Haines, T.P., Hill, K.D., Brauer, S.G., Cumming, R.G., Livingston, P.M., Sherrington, C., Zavarsek, S. Lindley, R.I., Karmar, J. 2016. 6-Pack programme to decrease fall injuries in acute hospitals: cluster randomised controlled trial. *BMJ*. 352:h6781 <http://dx.doi.org/10.1136/bmj.h6781>
- Cameron, I.D., Gillespie, L.D., Robertson, M.C., Murray, G.R., Hill, K.D., Cumming, R.G., Kerse, N. 2014. Interventions for preventing falls in older people in care facilities and hospitals (Review). *Cochrane Database of Systematic Reviews*, Issue 12 (edited; no change to conclusions). Art. No.: CD005465. DOI: 10.1002/14651858.CD005465.pub3
- Doherty-King, B., Bowers, B. 2013. Attributing the responsibility for ambulating patients: a qualitative study. *International Journal of Nursing Studies*. 50, 1240-1246.
- Donaldson, L.J., Panesar, S.S., Darzi, A. 2014. Patient-Safety-Related Hospital Deaths in England: Thematic Analysis of Incidents Reported to a National Database, 2010–2012. *PLOS Med*. 11, 6, e1001667.

- Dul, J., Bruder, R., Buckle, P., Carayon, P., Falzon, P., Marras, W.S., Wilson, J.R., van der Doelen, B. 2012. A strategy for Human Factors/Ergonomics: Developing the Discipline and Profession. *Ergonomics*. 55, 4, 377-395.
- Grealish, L., Chaboyer, W. 2015. Older in hospital and confused – The value of nursing care in preventing falls in older people with cognitive impairment. *International Journal of Nursing Studies*. 52, 1285-1287.
- Haines, T.P., Day, L., Hill, K.D., Clemson, L., Finch, C. 2014. Better for others than for me: a belief that should shape our efforts to promote participation in falls prevention strategies. *Archives Gerontology Geriatrics*. 59, 136-44.
- Hignett, S. 2010. Technology and Building Design initiatives in interventions to reduce the incidence and injuries of Elderly In-Patient Falls. *Healthcare Environments Research and Design Journal*. 3, 4, 62-84.
- Hignett, S. 2012. Environmental audit of hospitals in the UK to design safer facilities for frail and confused older people. In: *Proceedings of the 2nd International Conference on Human Factors and Ergonomics in Healthcare / 4th International Conference on Applied Human Factors and Ergonomics*. San Francisco, pp 2587-2595.
- Hignett, S. 2015. Healthcare Ergonomics: Reaching out into all areas of Clinical Practice or ‘Touching and Analysing the Elephant’. *Proceedings of the 19th Triennial Conference of the International Ergonomics Association*. Melbourne, Australia, 11-15 August.
- Hignett, S., Sands, G., Fray, M., Xanthopoulou, D., Healey, F., Griffiths, P. 2013. Which bed designs and patient characteristics increase bed rail use? *Age & Ageing*. 42, 531-535.
- Hignett, S., Wolf, L., Taylor, E., Griffiths, P. 2015. Firefighting to Innovation: Using Human Factors & Ergonomics to tackle Slip, Trip and Fall Risks in Hospitals. *Human Factors*. 57, 7, 1195-1207
- Lahman, N.A., Tannen, A., Kuntz, S., Raeder, K., Schmitz, G., Dassen, T., Kottner, J. 2015. Mobility is the key! Trends and associations of common care problems in German long-term care facilities from 2008 to 2012. *International Journal of Nursing Studies*. 52, 167–174.
- Nyman, S.R., Victor, C.R. 2001. Older people's recruitment, sustained participation, and adherence to falls prevention interventions in institutional settings: a supplement to the Cochrane systematic review. *Age & Ageing*. 40, 4, 430-436.
- Office of Rail Regulation. 2011. *Level Crossings: A guide for managers, designers and operators*. http://orr.gov.uk/data/assets/pdf_file/0016/2158/level_crossings_guidance.pdf (accessed 17th Jan 2016)

- Oliver, D., Connelley, J.B., Victor, C.R., Shaw, F.E., Whitehead, A., Genc, Y., Vanoli, A., Martin, F. C., Gosney, M.A. 2007. Strategies to prevent falls and fractures in hospitals and care homes and effect of cognitive impairment: systematic review and meta-analyses. *BMJ*. 334, 82-7.
- OnHold, C. 2015. *On Hold Telephone Messages Are Effective Communication Tools*
<http://www.onholdcompany.com/benefits/just-the-facts/>. accessed 17th Jan 2016.
- Pronovost, P.J., Bo-Linn, G.W. 2012. Preventing patient harms through systems of care. *JAMA*. 308, 769-70.
- Simon, M., Maben, J., Murrells, T., Griffiths, P. 2016. Is single room hospital accommodation associated with differences in healthcare-associated infection, falls, pressure ulcers or medication errors? A natural experiment with non-equivalent controls. *J Health Serv Res Policy*. doi:10.1177/1355819615625700
- Sonnad, S.S., Mascioli, S., Cunningham, J., Goldsack, J. 2014. Do patients accurately perceive their fall risk? *Nursing*. 44, 58-62.
- Wolf, L., Hignett, S. 2015. Are patients at risk of falling? Not if you ask them!. Proceedings of the 19th Triennial Conference of the International Ergonomics Association. Melbourne, Australia, 11-15 August.