Bedrails, falls and injury: evidence or opinion? A review of their use and effects

Exploring the evidence from a systematic review on the use of bedrails and their effect on the incidence of falls and injury, plus ethical considerations

Bedrails used in health and social care settings, with reported prevalence in UK hospitals of 8%-39%, and in nursing homes internationally of 9%-71% (Healey et al, 2008). The most common reason given by staff for bedrail use is falls prevention (NPSA, 2007c).

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However, there is a difference between a safety measure and physical restraint or deprivation of liberty.

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Bedrails used to prevent an accidental fall from bed would be unlikely to be considered as restraint using these definitions, while using bedrails to keep a patient in bed against their will would be restraint.

OPINIONS IN THE LITERATURE

It is impossible to read even part of the body of published literature on bedrails without being struck by the overwhelmingly negative emphasis. Examples include:

- ‘A seemingly innocuous bed feature… has turned into a killer’ (Marcy-Edwards, 2005);
- ‘Bedrails… deprive older patients of their dignity and autonomy’ (Hanger et al, 1999);
- ‘… evidence suggests their use is dangerous and possibly unethical’ (Jehan, 1999);
- ‘… inherent dangers as well as the humiliation for a patient’ (Millar, 1989);
- ‘… not only unethical but… a type of physical abuse’ (van Leeuwen et al, 2001).

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2. That their use is morally impermissible – they are ‘unethical’
3. That they are ineffective in preventing falls or injuries.

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1. That they are ineffective in preventing falls
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3. That they are ineffective in preventing falls or injuries.
That they are inherently dangerous, either through causing direct injury or through increasing the risk of falls and injury.

Once strong assertions have been made in the literature they can easily be accepted uncritically, and clinical decisions can be influenced by culture, organisational values, regulatory frameworks, beliefs, values and role models as well as by research evidence.

Therefore, it is vital to examine the evidence used to support such assertions as well as considering the ethical arguments more closely.

**EVIDENCE IN THE LITERATURE**

A recent systematic review has made the task of understanding the evidence on bedrails easier (Healey et al, 2008). This review scrutinised 472 abstracts and identified 24 relevant studies including five before-and-after studies of bedrail reduction, one case-control study, and two cohort studies.

**Before-and-after studies**

Brown’s (1997) study in a nursing home tracked 94 residents for six months before a bedrail reduction policy and education was introduced, and for six months after.

After bedrail reduction, falls in bedrooms at night increased significantly from 16 to 35, and the increase was particularly significant in a subset of visually impaired residents.

Capezuti et al’s (2007) study on falls in bedrooms in nursing homes tracked 251 residents for 12 months before and after a bedrail reduction policy and education had been introduced.

A nurse specialist selected (not randomised) 49% of residents to have their bedrails removed and replaced with a range of equipment (including bed alarms, floor mats and low beds).

The selection meant the two groups with and without bedrails were different in several ways; the patients selected to have their bedrails removed were significantly more mobile, more independent, more likely to be taking antipsychotic medication and more likely to fall before bedrail reduction.

The rate of night-time falls in bedrooms decreased non-significantly by 38% in the group retaining their bedrails, and significantly by 46% in the group selected for bedrail reduction. Selection meant, however, that the intervention group was significantly more likely to fall than the control group before the intervention, and this group remained significantly more likely to fall after it. Injury rates are not described, but serious injury fell non-significantly in both groups.

Hanger et al’s (1999) study in a rehabilitation hospital examined falls rates before and after the introduction of a policy and education intended to reduce bedrail use. The proportion of beds with bedrails attached decreased from around 30% to 11%. Falls in bed areas rose from 186 in the six months before the study to 232 in the six months after it. Possibly because they applied a statistical test designed for whole numbers to a rate, the authors concluded this increase was not statistically significant. However, a later meta-analysis concluded it was significant (Oliver et al, 2007).

Overall injuries were 76 before the policy was introduced and 78 afterwards. The increases in injury were not statistically significant.

This study is often cited as showing serious injuries were reduced significantly, but serious injuries as conventionally defined did not decrease – hip fracture, immobilising hip pain, and lacerations needing suturing increased from six to seven. The only reduction appeared to be in the number of occasions nurses decided to take neurological observations; it appears that injuries were counted as ‘minor’ if nurses did not take neurological observations, but ‘serious’ if they did.

Hoffman et al’s (2003) before-and-after study in three care homes included seeking alternatives to bedrail use such as body pillows and crash mats. The use of bilateral bedrails was reduced from 31% of beds to 18%.

Falls from bed decreased slightly from 142 to 126, patients injured decreased slightly from 42 to 35, and hip fractures increased from one to two. However, none of these changes were statistically significant and occupied bed days had also reduced between the study’s before and after periods.

Si et al (1999) compared falls in bedrooms in the rehabilitation wing of a nursing home before and after a bedrail reduction programme, which involved policy, education and introducing bed alarms.

Bedrails were used only if patients fell from bed more than three times, or were injured in a fall from bed. Bedrail use reduced dramatically from almost all patients to around 13%. Falls rose from 19 before to 31 afterwards; the increase in multiple fallers was significant, and the increase in falls for a subset of patients with stroke was significant. There were two minor injuries before, and one minor injury and one serious head injury after.

**Case-control and cohort studies**

Capezuti et al’s (2002) retrospective cohort study looked at 318 reports of falls from bed in nursing homes. Three patients had serious injuries in falls from beds with bilateral bedrails, and two had serious injuries from falls from beds with partial or no bedrails. The actual number of falls with or without bedrails is not given, but patients with bilateral bedrails were no more or less likely to fall once corrections were made for dependency and confusion.

Krauss et al’s (2005) case-control study on all types of falls compared 98 patients who fell in a large urban hospital with 318 non-fallers matched for length of stay. Having one or more bedrails raised was associated with a significantly reduced risk of falling.

Kron et al’s (2003) prospective cohort study of 472 residents in nursing homes found the odds ratio of falls and of multiple falls was lower in patients with bedrails raised, but the difference did not reach statistical significance.

**Retrospective surveys, case reports and case series**

The remaining studies in the literature review (Healey et al, 2008) described individual accidents associated with bedrails or analysed...
series of accident reports in individual hospitals, within regions, or made to national safety agencies. These retrospective surveys, case series and case studies are likely to be affected by under-reporting and reporting bias (Sari et al, 2007) but they may still provide useful circumstantial information.

Five of these studies compared injury rates in falls from bed with and without bedrails in general hospitals. Of these five studies, four showed a lower rate of injury in falls from beds with bedrails (NPSA, 2007a; van Leeuwen et al, 2001; Govier and Kingdom, 2000; Everitt and Bridel-Nixon, 1997).

However, statistical significance was reached only in the larger multi-hospital study (NPSA, 2007a), which also found a significantly lower rate of head injury in falls from bed with bedrails.

One study in a large teaching hospital (Tan et al, 2005) found a higher rate of injury in falls from bed without bedrails. However, with only 12 falls from beds with bedrails over 12 months, this did not reach statistical significance.

One retrospective survey of legal claims after falls from bed (Oliver et al, 2008) found that bedrails were raised in only 2.6% of cases of bedrail entrapment. Five of these studies compared injury rates in falls from beds with and without bedrails in general hospitals. Of these five studies, four showed a lower rate of injury in falls from beds with bedrails (NPSA, 2007a; van Leeuwen et al, 2001; Govier and Kingdom, 2000; Everitt and Bridel-Nixon, 1997).

The literature review (Healey et al, 2008) also summarised nine of their relatives (Gallinagh et al, 2001b) found that most of them were positive or indifferent about them, but identified one patient that patients' and carers' views

**Patients’ and carers’ views**

The review identified only three studies including patients’ views, two including relatives’ views and one including staff views. A small qualitative study of 17 patients with bedrails raised (Gallinagh et al, 2001a) found that most of them were positive or indifferent about them, but identified one patient that patients' and carers' views

Most of these studies are based on incidents in patients’ own homes, nursing homes and hospitals in the US, and several are overlapping studies drawing on different years of the same data collection. Most studies only described the numbers of reports of different injuries. Additional analysis in Hignett and Griffiths (2005) indicated that ‘half rails’ (an outmoded inverted triangle design) were significantly more likely to be associated with death, full rails with non-fatal injury, and spilt rails with near misses (where a patient was entrapped but released without injury).

The real tragedy of these case reports seems to be that, although the message that bedrail entrapment can kill has been well disseminated, the detail they provide on how this could be avoided appears much less well known (NPSA, 2007c).

Good maintenance, correct assembly and eliminating incompatible or outmoded equipment can prevent fatal bedrail entrapment (Medicines and Healthcare products Regulatory Agency, 2006).

The MHRA has received reports of 18 deaths related to bedrail entrapment or bedrail failure in nursing or residential homes or patients’ own homes and three bedrail entrapment deaths in hospitals from 2000–2006.

The literature review (Healey et al, 2008) included only published papers. No articles on bedrail entrapment deaths in UK settings have been published.

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The bedrail-related entrapment deaths often involved poorly designed equipment (for example not complying with the MHRA’s requirements on maximum spaces between bedrail bars), poorly maintained equipment or ‘hybrid assembly’. Hybrid assembly occurs
where beds, bedrails and mattresses that are not designed to go together are used together, for example combining a divan-type bed in a care home with bedrails or mattresses designed for a hospital-style bed.

Since the dates covered by the literature review, two further studies related to bedrails have been published. Fonad et al (2008) combined an annual one-day survey of nursing home residents in Sweden with reported falls over four years; there was no correlation between falls and injuries and the use of bedrails. Wagner et al (2007) examined the cost of equipment provided as alternatives to bedrail use and found this averaged $135 per resident.

EVIDENCE OR OPINION?

Despite the weak methodological quality of many of the studies, the evidence presented above provides no support for the strong opinions in the literature that bedrails increase the likelihood of falls and injury or that they result in an inherent risk of fatal entrapment.

The evidence tends to suggest that the before-and-after studies that showed an evangelical commitment to bedrail reduction or elimination as a desirable goal at the design stage (Hanger et al, 1999; Si et al, 1999; Brown, 1997) found that bedrail reduction could lead to significant increases in falls, particularly in patients with stroke or visual impairment.

So why the strongly negative opinions? One cause appears to be the logical assumption that, if bedrails are used, patients will climb over them and fall from a greater height, inevitably leading to greater risk of injury. Some patients may do so (NPSA, 2007a; van Leeuwen et al, 2001).

However, the largest study (NPSA, 2007a) found injury, particularly head injury, appeared significantly less likely in falls from bed using bedrails, with most falls from beds with rails raised appearing to be feet first towards the bed end rather than through climbing over the rails.

Bedrails are undoubtedly inappropriate for patients who are both confused enough and mobile enough to be at risk of climbing over them but, at least in hospital settings, nursing staff appear to usually avoid using them for such patients (NPSA, 2007c).

Where bedrails have been described as causing incontinence, confusion or reduced mobility, this appears to have arisen from mistakes in correlation for causation; older, frailer patients are much more likely to be given bedrails than younger, fitter ones, and older, frailer patients are more likely to have continence, mobility or cognitive problems than younger, fitter people.

Restraint devices used outside the UK include ‘…wrist and ankle restraints, full-sheet restraints, soft belts or vests,rotch/pelvic ties, suit/harnesses…’ (Mott et al, 2005). Perhaps as a result of papers that group bedrails with these devices, they became ‘guilty by association’ with the considerable distress and harm caused by such devices (Evans et al, 2003).

Negative opinion may relate to an assumption that patients dislike bedrails. A wish to act as an advocate for patients’ views is always admirable, but the studies discussed earlier suggest staff can assume they know patients’ views on bedrails without actually asking them.

Perhaps the negative opinions arise simply because the evidence presents challenges in interpretation to anyone not confident in statistical methodology.

For example, Capezuti et al’s (2007) study used a multistep statistical analysis whose description covers several columns of text. Si et al’s (1999) study presents the results in a table which leaves the near doubling of falls after bedrail removal unclear without additional calculations.

Perhaps because of the relative paucity of the evidence base and difficulty in accessing some papers, citations of citations are common, with content or context lost in repetition, which may have influenced the view that bedrail use increases the risk of falls and injury.

For example, ’90% of falls occur with the bedrails raised’ continues to be cited, although this is based on 10 reported falls in a US hospital in the late 1980s (Bates et al, 1995), in an era when almost 100% of older patients would have been likely to have beds with fully raised bedrails.

In addition, a misprint in the abstract of van Leeuwen et al (2001) is frequently cited rather than the correct figure in the main paper.

Furthermore, there can be little doubt that, in the past, routine and inappropriate bedrail use did occur (Brush and Capezuti, 2002).

It may be that challenging the traditional – and often harmful – use of bedrails has resulted in the adoption of an opposing view. That is, if routine bedrail use is ‘institutional’ and ‘bad practice’, then not using bedrails at all represents up-to-date and enlightened practice.

CONCLUSION

Overall, while the evidence base is of limited quantity and quality, it suggests wholesale bedrail reduction may increase the risk of falls. Practical and ethical considerations mean that bedrails are not usually appropriate for patients who could be independently mobile without them, nor for those with capacity who do not want them, nor for those with severe confusion who are mobile enough to climb over them.

Bedrails should never be used routinely or unthinkingly, nor as a substitute for adequate practice on falls prevention. These include posters to educate nurses about safe bedrail use (see Fig 1 for an example).

Resources:
- NPSA (2007c) Resources for Reviewing or Developing a Bedrail Policy. London: NPSA. tinyurl.com/resources-bedrails (see resources document under Background material)
nursing care and observation or medical management, nor as a stand-alone method of falls prevention (Oliver et al, 2007).

However, where patients request bedrails or are incapable of leaving their bed without help, bedrails are unlikely to act as restraint or restrict independence. For those without decision-making capacity, staff have a duty of care to act in their best interests (Mental Capacity Act 2005), underpinned by realistic assessment and regular review of the individual risks of bedrail use or non-use (NPSA, 2007b).

Crash mats, movement alarms and ultra-low beds are often suggested as alternatives to bedrails, but their effects on reducing injury are unknown.

Systematic reviews (Coussment et al, 2008; Oliver et al, 2007) and other studies published (Stenvall et al, 2007; von Renteln-Kruse and Krause, 2007; Zermansky et al, 2006) tell us that recognising and treating delirium, comprehensive geriatric assessment, medication review and multifaceted falls prevention interventions can reduce falls rates in hospitals or care homes.

Nurses need to appreciate that fatal bedrail entrapment is neither random nor inevitable but can be prevented by: removing outdated equipment; ensuring that all bed, mattress and bedrail combinations are compatible; maintaining equipment; and training staff to fit and use bedrails safely and appropriately (NPSA, 2007b; MHR A, 2007; 2006).

In conclusion, nurses should not aim for the universal reduction of bedrail use, but focus on eliminating outdated equipment and reducing inappropriate bedrail use on a case-by-case basis. Boxes 1 and 2 outline resources to help them do this.

REFERENCES