What is a low bed and how effective are they at reducing risk?

Demographics

As the population continues to age, the number of the most elderly people aged 80+ in our society is expected to double from 3m to 6m by 2030. As people live longer, more elderly patients are being admitted to hospital, signalled by a 58.9% increase in admissions of those aged 85+ in England between 2006-16[1].

Falls

An ageing hospital population presents associated challenges in terms of patient safety. Inpatient falls are now the most commonly reported patient safety incident in hospitals in England. In 2015-16 there were 190,000 falls in the over 65s
in acute hospitals in England, of which 28.9% resulted in some form of harm. NHS England reports that the overall cost of
falls in acute settings is estimated to be £506m per annum
and those aged 65 and above are at a greater risk of harm
from a fall, accounting for 87% of the overall cost[2].

Patients aged over 65 are three times more likely to come to moderate or severe harm if they fall[2]. In addition, 10% of those who suffer a fractured neck of femur as a result of a fall are likely to die within one month, or one third may die within one year[3]. 22% of all falls occur from the bed4, meaning a preventative solution will ultimately reduce the amount of avoidable harm
and death.

Bed design

Low beds are a widely accepted tool in falls prevention and harm reduction due to the inherent shorter fall height and thus a lower impact force. Because of the growing emphasis on the cost of falls, the importance of selecting the most appropriate bed for vulnerable patients is paramount to tackling one of the main drivers of the forecasted increase in age-related pressures on healthcare.

So what is a low bed?

A low bed should have two benefits for patients:

01   **An optimal height to mobilise from the bed**

02   **A minimum height that is low enough to reduce the risk of fall-related injury**

There are many descriptions used by manufacturers such as 'Hi-Lo', 'Low Entry', 'Extra Low', 'Ultra Low' and 'Low', but how should we actually define 'low'?

How low is low enough?

To safely mobilise a patient from a bed the patient's feet should be firmly on the floor whilst they are sitting at the edge of the bed. The height at which the bed should be positioned to achieve this is equivalent to the patient's popliteal measurement. Therefore we can conclude that the distribution of popliteal heights of the population should dictate the minimum height required of a bed and mattress combination.
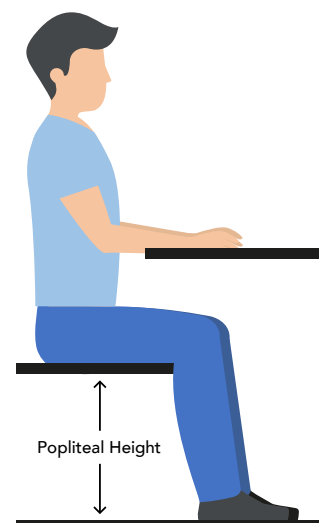
Popliteal Height

Analysis of popliteal heights to determine the ideal height of a low bed

Published popliteal height data6,7 has been analysed to determine the proportion of the population that would be able
to achieve a safe position (feet flat on floor) with beds of varying low heights. The bed heights were combined with a standard 14cm static mattress for the purposes of the analysis.

Based on the data set, a platform height of 21cm combined with a foam mattress of 14cm provides an optimal mobilisation height for:
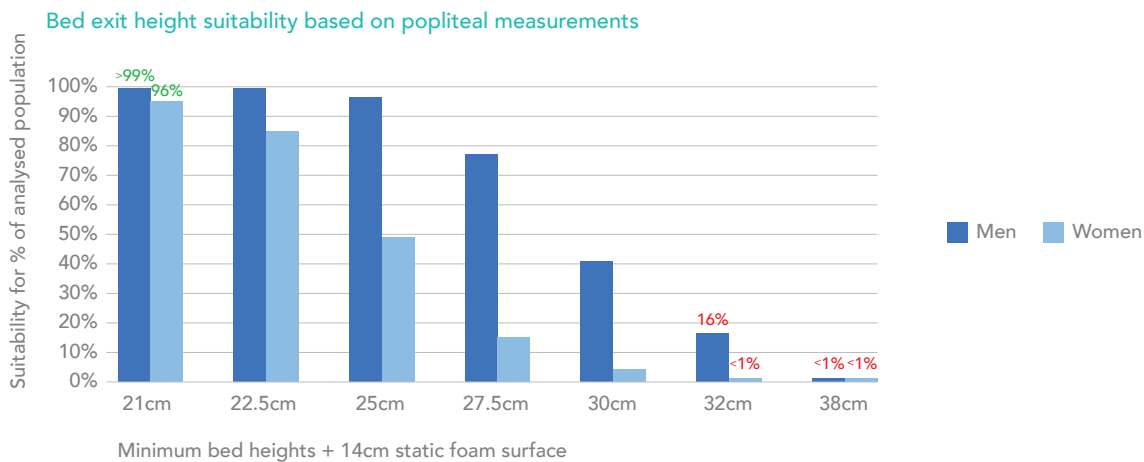• Over 99% of males
• 96% of females

A platform height of 32cm combined with a foam mattress of 14cm provides an optimal mobilisation height for:
• 16% of males
• Less than 1% of females

A platform height of 38cm combined with a foam mattress of 14cm provides an optimal mobilisation height for:
• Less than 1% of males
• Less than 1% of females

Bed exit height suitability based on popliteal measurements

Y-axis: Suitability for % of analysed population
X-axis: Minimum bed heights + 14cm static foam surface
Legend: Men, Women

Values: 21cm >99% / 96%, 32cm 16% / <1%, 38cm <1% <1%
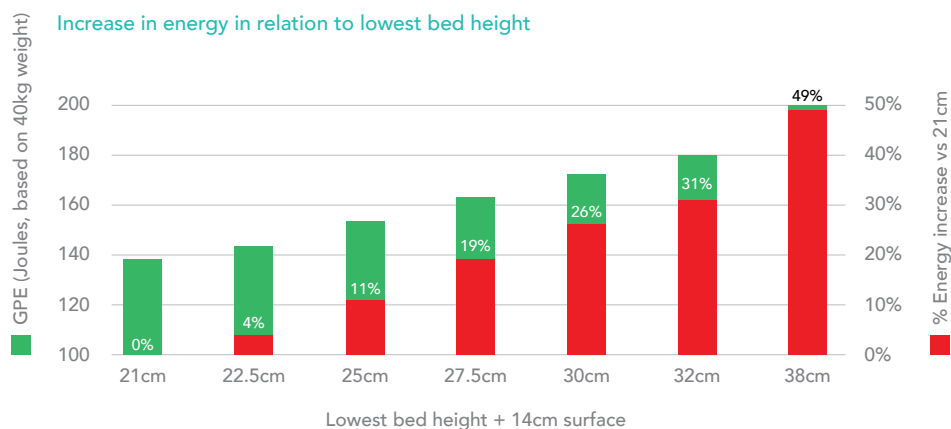
Reducing the impact force on falling

We can determine the relative risk of injury by using a simple physics equation to predict the relationship between bed height and harm from a fall.

Gravitational potential energy (GPE) is defined as the energy an object possesses due to its position in a gravitational field, and is directly proportionate to the height from which an object falls. The higher the height, the greater the GPE. Can we conclude that GPE can provide an indication of impact force which in
turn could be an influencer of the level of patient harm?

The relative increase in GPE based on bed height has

been calculated:
• A bed with a height of 32cm increases GPE by 31% versus a bed height of 21cm
• A bed with a height of 38cm would increase GPE by 49% versus a bed height of 21cm

Increase in energy in relation to lowest bed height

Y-axis (left): GPE (Joules, based on 40kg weight)
Y-axis (right): % Energy increase vs 21cm
X-axis: Lowest bed height + 14cm surface

Values: 21cm 0%, 22.5cm 4%, 25cm 11%, 27.5cm 19%, 30cm 26%, 32cm 31%, 38cm 49%

Discussion

A low bed height of 21cm or lower will provide the greatest protection for the ageing population:

- 21cm offers protection for more than 99% of males and 96% of females
- A bed height of 32cm can increase the impact force of a fall by up to 31% versus a bed of 21cm
- A bed height of 38cm can increase the impact force of a fall by up to 49% versus a bed of 21cm

Conclusions

With 40% of the acute patient population being 65 years and above – a percentage that is growing year on year – there is a strong argument for institutions to consider a bed fleet that comprises of an appropriate proportion of 'true' low beds in order to offer protection for those most at risk from falls. Additionally, there are further benefits in choosing to standardise on an ultra-low bed platform.

Key learnings

- An ultra-low bed of 21cm in height can protect 99% of males and 96% of females from falls when mobilising

- A bed height of 32cm protects just 16% of males and less than 1% of females and a bed height of 38cm protects less than 1% of males and females

- A bed height of 32cm creates 31% more impact force and a bed of 38cm creates 49% more impact force than a bed height of 21cm

References

1. Emergency Hospital Admissions in England: Which may be avoidable and how? Adam Steventon, Sarah Deeny, Rocco Friebel, Tim Gardner, Ruth Thorlby

2. NHS Improvement: The incidence and costs of inpatient falls in hospitals July 2017

3. NICE guidance CG 124: Hip Fracture: Management

4. National Patient Safety Agency: Using bedrails safely and effectively. 2007

5. Handling of Patients 4th Edition (revised) Lloyd et al (1998)

6. International Journal of Occupational Safety and Ergonomics: Anthropometry for Design for the Elderly, Kothiyal & Tettey (2001)

7. Anthropometric Survey of U.S. Personnel: Summary Statistics Interim Report. March 1989. Gordon, Claire C. et. al (1988)

medstrom⁺

Improved Patient Outcomes

UK
Tel: **0845 371 1717**
Email: **info@medstrom.co.uk**
www.medstrom.com

Ireland
Tel: **01 686 9487**
Email: **info@medstrom.ie**
www.medstrom.ie

2 Cygnus Court, Beverley Road, Pegasus Business Park, Castle Donington, DE74 2SA