Effect of bedroom size on falls in hospital: Does one size fit all?

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Running head: Effect of bedroom size on falls in hospital
To the Editor: Hospital design has seen a trend moving from large open-plan wards, to multi-bed bays [1], and now single room design policies are being implemented in hospitals across a number of countries (including for example the UK, USA, and Australia [2-4]). The thinking behind this approach is commonly attributed to infection control, reduction of medical errors, increased privacy, provision of personalised spaces, and noise control [5-6]. Yet the evidence behind these beliefs has been highlighted as lacking, or conflicted [7]. Not disputing the importance of these issues, there is an opposing view, especially with respect to older individuals at higher risk of falls [8], and for those for whom the company of a fellow patient may actually be held in high regard [9].

Improving patient observation is a commonly utilised strategy for those at risk of falls and injury. In our experience of establishing a study on flooring for fall-related injury prevention, policies to place high risk patients in rooms with good line of sight from the nursing station appear widespread [10]. Yet there is a dearth of empirical evidence on room type for patient safety, particularly with respect to falls [7-8]. Serendipitously, the double-relocation of a local elderly care general rehabilitation ward provided an ideal opportunity to assess the influence of bedroom type on falls.

We retrospectively analysed fall-rates on an elderly care unit, which was decanted first from a facility arranged in four 4-bedded bays and eight single rooms (Period A: 12 months, 8760 patient bed-days; and Period B: 10 months, 6623 patient bed-days), to a second facility with a 15-bed open-plan ward and a single side-room (Period C: 13 months, 6755 patient bed-days), and then to a third facility, arranged in three 4-bedded bays and six single rooms (Period D: 12 months, 6387 patient bed-days). Routine operational processes, policies, and staff turnover did not change during the study period. There was one major staff change with the
appointment of a new consultant in Period B. Bed-to-nurse ratio was predominantly consistent across the study periods (Period A unknown; Period B = 1.45; Period C = 1.46; Period D = 1.48). Prior to each move the ward capacity was run down to 15 beds.

Patient falls data were retrieved from the standard incident-report monitoring system. The mean incidence rates of falls per 1000 patient bed-days over the four study periods (Periods A, B, C, and D) were 13.27 (SD = 6.13), 13.98 (SD = 8.03), 5.90 (SD = 3.77), and 15.80 (SD = 9.82) respectively. Following square root transformation, an ANOVA indicates a significant difference in fall-rates between Periods (F = 5.10, df = 3, p = 0.005). This effect is also apparent when the data are analysed using the Kruskal Wallis test (H = 12.32, df = 3, p = 0.006, adjusted for ties). Subsequent pair-wise comparisons suggest that the open plan ward (Period C) produced a significant reduction in fall rates compared to the wards with 4-bedded bays and single rooms (Period A, p = 0.002; Period B, p = 0.008; Period D, p = 0.014). Figure 1 demonstrates the trend in fall-rates over time.

This study is retrospective and based on standard audit data, and as such does not incorporate data on individual patient characteristics or recurrent fallers. The built and designed environment (e.g. room/ward size) is in a dynamic system with the social environment (e.g. staffing levels and skills) and patient characteristics (e.g. case mix). Changing one component will change the dynamic of the system and alter its outcomes.

With regard to hospital room size, there are a variety of qualitative studies on patient preferences [e.g. 9], along with a large volume of “expert” opinion cited [7], based on reasoning as opposed to clinical evidence, which has become engrained into policies and guidance. The observational data presented here only points to one outcome (patient falls) of
a multitude of trade-offs which should be considered in hospital design. Nonetheless, here stands a small contribution from which future research evidence can grow, and which may encourage guideline developers to think twice before deciding that one (room) size fits all.
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**Conflict of interest checklist**

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**Author contributions:** Ike Ugboma’s role included the study concept and acquisition of data. Bernard Higgins led the analysis and all authors contributed to the study design, interpretation of data and preparation of the manuscript. No other persons but the authors have been involved in conducting the study or in the writing of the paper.

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REFERENCES


FIGURE LEGENDS

Figure 1. Trend in fall rates (per 1000 patient bed-days). Period A: four 4-bedded bays and eight single rooms; Period B: same facility as Period A + new consultant; Period C: 15-bed open-plan ward and a single side-room; Period D: three 4-bedded bays and six single rooms.