**Appendix**

**Selected Comments and Responses from peer review processfor companion research article** [Bai A, et al. Mortality of Hospitalised Internal Medicine Patients Bedspaced to Non-Internal Medicine Inpatient Units: Retrospective Cohort Study]

*These selected commentsfrom the Editor, Authors and one Reviewer have been lightly edited for spelling, grammar, and colloquialisms. They are shown here to convey the lively debate over the result showing increased risk of mortality for bedspaced patients. The comments highlight some of the competing potential explanations for the results, as well as the need for other researchers and institutions to explore further the potential impacts of bedspacing on patient outcomes.*

**Editor**: This is an unusual situation. While you have done an excellent job with your analysis and revisions, the results still seem implausible. Let me make clear that we hope to publish your paper pending some minor revisions. But, it remains an unusual situation in so far as this is a well conducted study showing an implausibly large effect.

As a hospital-based internist, I share the concerns of many colleagues (and yourselves, presumably) that bedspaced patients receive poorer care. But, I don’t think I ever seriously thought bedspaced patients died in hospital as a result. Not having as frequent communication with nurses and allied health can certainly affect the care of elderly patients and others with complex comorbidities. But, these effects are usually seen in the form of prolonged LOS due to the greater difficulty in formulating good discharge plans. For elderly patients morbidity issues can also arise - they may experience a greater loss of function while cared for on a non-medical floor. And, occasionally any patient might experience harm from, say, missing some medications or causing pulmonary edema due to oversights resulting in intravenous fluids running for an extra day or two. But, none of these sorts of problems seem likely to cause a detectable short-term increase in mortality.

Even the weekend effect, which has a more plausible basis for an impact on mortality in the short term, has never shown this strong a signal of a 3-fold increased hazard of mortality.

This is a huge effect on mortality. Some or all of it must reflect unadjusted risk.

**Author**: We are of the same opinion that the magnitude of the effect of bedspacing on mortality in our single centre study was larger than we had anticipated, and is quite likely not representative of the ‘true’ impact of bedspacing on mortality that might be observed in a multicentre study involving many acute care hospitals with different patient flow policies. We agree that there is likely some element of unadjusted risk. Nonetheless, bedspacing was significantly associated with mortality in our study and the association was robust and consistent across a series of sensitivity analyses that address potential methodological limitations and residual confounding. Even if the true impact of bedspacing on mortality were half of what we found, it remains alarming and warrants careful attention. This is one of the first studies on the important topic of clinical outcomes relating to hospital bedspacing policies and shines a light on this area where there is likely little consistency across hospitals.

We agree that this manuscript must emphasize to readers that they should be careful not to generalize our findings to other institutions. We hope our concerning findings will provoke future studies of bedspacing in other institutions. If future studies corroborate our observation of a significant relationship between bedspacing and mortality, then it may be important to view bedspacing as a modifiable patient safety indicator.

**Editor** The reasons offered in the Discussion for the effect being real are not very convincing. I don’t think the frequency and duration of patient contacts and interactions would be lower – if anything teams make an extra effort to round on these patients. Plus, think about in community hospitals with the medicine patients are often seen just once a day. And, even if bedspaced patients are being seen less often, it’s just hard to imagine this playing out as an increased risk of death. (e.g., a classic study from Toronto after SARS showed that isolated patients were seen less often and also had more complications, but they didn’t die more often. [Stelfox HT, Bates DW, Redelmeier DA. Safety of patients isolated for infection control. JAMA. 2003 Oct 8;290(14):1899-905.])

**Authors** We agree that the underlying mechanisms for increased mortality remain unproven hypotheses. Probably multiple mechanisms interact in complex ways to mediate the relationship between bedspacing and mortality. The suggestion of less duration of patient contact was based on our anecdotal experience that the GIM ward patients were seen first based on hospital geography and convenience. The decision of which patients to see first is often based on the decisions of residents assigned to these patients, and they may fail to prioritize bedspaced patients (“out of sight, out of mind”).

In the study you mention by Stelfox et al., the isolated patients experienced a 17% mortality rate, which was higher than the 10% mortality rate in control patients (P=0.16). This numerically higher mortality among isolated patients may not have reached statistical significance due to the relatively small sample size (150 isolated patients vs. 300 control patients).

For nursing care of bedspaced patients, the off-service nurses may call more often, but they may not know which measures are most important to monitor. For example, a nurse on a neurology ward is often great at assessing for neurological decline, but they may not be attentive to a cirrhotic patient having black tarry stools, or a COPD patient who is sustained on regular nebulized bronchodilators for days with increasing oxygen requirements…

**Editor** So, we have an observation that suggests a much larger effect than we can really explain. The patients admitted to off-service locations must have higher acuity/severity of illness or there must be some other type of confounding. It seems very implausible that a patient will die as a result of admission to an off-service location. To be clear, it seems quite plausible that bedspaced patients will have less well coordinated discharges, may stay longer in hospital, may have inferior functional outcomes, and maybe even that they have some nosocomial complications. But, it’s hard to see this translating into a 3-fold increased risk of death in the short term.

Thus, we are left saying “We have always thought it was bad to have bedspaced patients. We have shown that it is associated with a 3-fold hazard for deaths. Some or all of this could be due to unadjusted risk. And, we have no idea to what extent this is a reflection of admission practices idiosyncratic to this institution.” I’m just not comfortable saying that there is such a high risk when so much (or all) of the risk might not be real.

**Authors** We wholeheartedly agree that our findings warrant further study using data from other institutions. The need for further research on this topic suggests that our current manuscript, once published, will likely be cited by future studies that will help to clarify the relationship between bedspacing and patient outcomes and the mechanisms that influence this relationship.

**Editor** Having thought about this awhile and discussed with a few colleagues, I think it’s fair to say that this is case where the usual comment about ‘this is a single site study’ is very, very important. This caveat is offered so often, that it won’t seem noteworthy to people. But, having worked in a number of different hospitals in the US and in Canada (and, again, discussing this with some colleagues), I think it is very plausible that idiosyncratic practices at any given hospital could have a major impact on the outcome of this study. E.g., one colleague with whom I discussed the situation pointed out that at his hospital, during times of high census (most of the time), patients who are stable and going to be discharged in next 1-2 days are preferentially sent off the ward (i.e., bedspaced) for their last day or two in hospital in order to make room for newer patients. So, this mortality effect would almost certainly not exist in a hospital like that.

I am not suggesting your hospital is the only one where this effect happens. In fact, maybe that’s the hook for your article. You have shown that there is no obvious explanation for this result, so it certainly requires further exploration. Any hospital where bedspacing occurs should probably conduct this sort of analysis. Some hospitals may turn out have the reverse situation (higher mortality on medical wards) and will want to know that and know why – maybe it has an implication on nurse staffing. Other hospitals may find no effect. And, others may find what you found.

**Authors** We agree that practices differ across hospitals, which may have affected our findings. We have emphasized the limitations of a single center study in the abstract and in the discussion… We have also changed the discussion to reflect a more sober presentation of the results. We have emphasized that the strength of the association was surprisingly large and may be due at least in part to residual confounding or other unforeseen factors.

**Reviewer** (FM – one of the authors of this editorial, replying to follow up questions by Editor and invitation to write an editorial):

I share your skepticism about the size of the exposure effect, and to be honest I thought the additional adjustments would reduce the hazard ratio (especially the one for over-capacity ratio as a time varying covariate as a proxy for system strain/team workload) but they didn't.  While the results make me think there must be some unmeasured confounder at play, logically I can't imagine GIM teams selectively sending their sickest pts to off-service wards?  I had wondered if there was a bias to send pts with malignancies to the one off-service ward that was an amalgam of oncology/palliative care and where the mortality was higher...but in one of the appendix tables they list the top 52 case mix groups in bedspaced vs. home wards and there really wasn't much of a difference, and that of course disappeared on the CMG-matched analyses.

Given that the Emergency Medicine Council in the UK published a guideline in 2014 advocating bedspacing pts to clear out ERs, I think the value of this paper lies in stimulating discussion about the topic as the UK guideline said there were no downsides to bedspacing.  That was the slant I would take with the editorial (and was going to specifically cite the Emerg Med Council guideline) - well done study, effects may be larger than "truth" but it raises an issue previously neglected, needs to be replicated, but in the meantime let's not assume bedspacing is a safe panacea for ER overcrowding.  And then end with a call for actual evidence-based decision making in the ER (or at least evaluating the myriad of natural experiments policy makers keep foisting on us).