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**Prognostic tools for the care of older adults presenting with trauma**

**Editorial to accompany: Development and Validation of the Geriatric Trauma Frailty Index**

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**Keywords:** Frailty, Prognosis, Trauma, Older people.

**Keypoints:**

- Prognostic models are important in directing the acute trauma care of older people in helping identify high risk patients.
- Model impact studies are needed to prospectively evaluate how exposure to the clinical prognostic model impacts outcomes.
- Further steps are required before the Geriatric Trauma Frailty Index could be adopted as a prognostic tool in clinical care.

Risk of adverse outcomes following major trauma has traditionally been defined by the level and extent of injury, not the characteristics of the patient undergoing the trauma (1). This approach is insufficient – not least because of the growing vulnerability, complexity and advanced age of patients presenting to hospital with trauma, who are a heterogeneous population in need of care that takes account of this complexity.

Prognostic models typically combine multiple predictors to predict the risk of an individual with a particular condition or health state (the 'startpoint') experiencing a particular outcome event (the 'endpoint') (2). Zhao and colleagues report the development and validation of a new prognostic model – the Geriatric Trauma Frailty

Index (GTFI). The GTFI aims to predict the risk of an older person who presents to hospital with trauma (startpoint) dying in hospital, and length of hospital stay (endpoints) (3). Prognostic models may have a role in directing the acute trauma care of older people in helping clinicians identify patients who are at highest risk – and which patients may be candidates, for example, for: early transfer to a major trauma centre; escalation to critical care; geriatrician led or orthopaedic care.

There are a number of strengths in the development of the GTFI, which was developed and validated using US data with a large sample size, and externally validated in a Chinese dataset. The authors used routine electronic health record data and International Classification of Disease Version 10 (ICD-10) codes for the GTFI variables so that the GTFI they have developed can be widely replicated.

The key concern from a clinical perspective is whether this model should be adopted in routine clinical care (4). To determine this, we have four key questions:

1. **Is the GTFI a measure of frailty?**

Although the authors present the GTFI as a frailty measure there are some considerations regarding this. Frailty is a condition characterised by loss of biological reserves, failure of homeostatic mechanisms and vulnerability to adverse outcomes (5). However, the fact that people with frailty are at increased risk of adverse outcomes does not necessarily mean that frailty can be considered to be equivalent to the risk of experiencing a long hospital stay or dying after an admission with trauma. Although not feasible in this study, the construct validity of new frailty measures generated using routinely available data should be assessed as a key part of validation, for example by comparing with reference standard measures. Otherwise, there is the risk that the tool could be rejected by patients and clinicians as it may not actually be seen to be measuring the condition it is designed to measure once it is implemented. There is a particular consideration related to specialty-specific frailty tools, as it is plausible that different tools in operation in one hospital could identify different people with and without frailty, with potential for problems with their use in routine clinical care.

2. **When are the GTFI predictor variables collected?**

The GTFI predictor variables plausibly represent factors that currently inform decision making at the point of a trauma admission, including signs identifiable on a trauma survey (e.g. pressure ulcers); and basic tests available in the emergency department (e.g. acid-base imbalance). However, study methods did not appear to account for the fact that many of the variables included could have been recorded at any point during the admission. For example, a patient may develop an aspiration pneumonia during the acute admission, and new conditions such as myocardial infarction may be diagnosed. This concern potentially limits the utility of the GTFI at the point of admission where it is arguably most needed, as the reported measures of prognostic performance may not be valid at this timepoint. Furthermore, a score that may vary considerably with an acute illness developed in hospital does not align with a conventional view of frailty, which is ordinarily assessed outside of the context of an acute illness.

3. **How good is the GTFI at prediction?**

Two core measures of prognostic model performance are discrimination and calibration. The concordance or c-statistic reported for the GTFI is high (0.79 for length of stay and 0.90 for in-hospital mortality), indicating that the GTFI has good discrimination between individuals who do and do not have a long admission or die as an inpatient.

Calibration is a measure of how well the prediction of outcome events using the model matches the proportion actually observed in follow up data. Calibration for the GTFI is not reported. Prognostic models are often overly optimistic in the development data, and in the hands of the original investigators (6). Calibration is especially important if potential applications of a tool include supporting decisions on transfer to specialist care or escalation of care. If the tool is poorly calibrated it can both over and under-predict people at risk of the outcomes that are being used to support decision making, with potential adverse consequences for important clinical decisions.

4. **Will the GTFI improve care?**

A key, but often overlooked, aspect of prognostic model evaluation is studying impact on decision making and subsequent health outcomes (7). Model impact

studies are designed to prospectively evaluate how exposure to the clinical prognostic model impacts outcomes, ideally using methods of random assignment to use of the prognostic model (6). For example, GTFI informed care could be compared to non-GTFI informed care by randomisation to use (or not) of the prognostic model. These evaluations can be highly complex to design and implement, with considerable resource implications, and are not frequently done. To motivate this kind of investigation more routinely, the PROGnosis RESearch Strategy (PROGRESS) collaboration has recommended treating prognostic models as a health technology, subject to usual standards of health technology assessment (8).

**Summary**

The development and validation of the GTFI represents an interesting step forward in terms of prognostic tools for older people, that may have useful application in clinical care. However, there are a number of further steps required before the tool should be widely adopted as a prognostic tool. These include further understanding of prognostic performance, with a particular focus on model calibration and clarification on whether predictor variables are obtained at the point of admission or throughout the hospital stay. External validation in other international settings should be completed before wider adoption, and, ideally, prospective assessment of model impact using robust methods of evaluation.

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