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# The increase in healthcare costs associated with frailty in older people discharged to a post-acute transition care program

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## Abstract

**Background:** older people are high users of healthcare resources. The frailty index can predict negative health outcomes; however, the amount of extra resources required has not been quantified.

**Objective:** to quantify the impact of frailty on healthcare expenditure and resource utilisation in a patient cohort who entered a community-based post-acute program and compare this to a cohort entering residential care.

**Methods:** the interRAI home care assessment was used to construct a frailty index in three frailty levels. Costs and resource use were collected alongside a prospective observational cohort study of patients. A generalized linear model was constructed to estimate the additional cost of frailty and the cost of alternative residential care for those with high frailty.

**Results:** participants ( $n = 272$ ) had an average age of 79, frailty levels were low in 20%, intermediate in 50% and high in 30% of the cohort. Having an intermediate or high level of frailty increased the likelihood of re-hospitalisation and was associated with 22 and 43% higher healthcare costs over 6 months compared with low frailty. It was less costly to remain living at home than enter residential care unless >62% of subsequent hospitalisations in 6 months could be prevented.

**Conclusions:** the frailty index can potentially be used as a tool to estimate the increase in healthcare resources required for different levels of frailty. This information may be useful for quantifying the amount to invest in programs to reduce frailty in the community.

**Keywords:** cost, frailty, community care, older people

## Background

The population is ageing in most developed countries and older people are high users of health care. In Australia, it is estimated that demand for aged care services for people aged 70 and over will more than treble in the next four decades [1]. Therefore, good healthcare system design should have the needs of older people as a central focus [2].

Age-related decline in physiological systems results in frailty. Quantifying the impact of frailty on costs for hospital and post hospital care spending would enable better decision-making for healthcare planning and the implementation of targeted interventions. Individual scores from the Frailty Index (FI), a measure of frailty based on the accumulation of deficits [3], are strongly associated with admission to hospital and institutions and predict mortality with greater accuracy than chronological age [4–8]. The FI has been directly correlated with length of stay in a geriatric rehabilitation ward [9], functional dependency in a post discharge transition care population [10], linked to higher surgery costs, and inversely correlated with discharge home after major surgery [11, 12].

The aim of this study was to model the impact of frailty on healthcare expenditure and resource utilisation in a population who entered a community-based post-acute transition care program. A secondary aim was to model the cost of admitting those with high levels of frailty to residential care rather than receiving supported community care.

## Methods

### Study design, setting and participants

Resource use was collected in a prospective observational cohort study of older people discharged from hospital to a community-based Transition Care Program (TCP) in two Australian states. The program provides a time-limited (18 weeks maximum) package of therapy and personal care and targets older people who would otherwise be eligible for residential care. Descriptive details of the study including a detailed breakdown of the healthcare costs of the cohort have previously been published [10, 13].

### Frailty index

The frailty index (FI) was calculated by coding accumulated symptoms, diseases and disabilities as deficits [14, 15]. All health deficits were derived from a comprehensive geriatric assessment using the interRAI Home Care (HC) instrument [16] administered by trained assessors at first contact with the TCP service. The interRAI HC measures a comprehensive set of items including patient demographics, cognition, communication, continence, health conditions and symptoms, medications, mood, functional status, nutritional status and social support. Recoding procedures were applied for categorical, ordinal and interval variables such that they could be mapped to the interval 0–1, where 0 = absence of a

deficit and 1 = full expression of the deficit [15], yielding a total of a possible 57 deficits (score range 0–57). The methodology for deriving an FI from an interRAI tool has been described in detail elsewhere [17].

To measure the clinical and economic significance of the level of frailty, the index was divided into low (0–0.25), intermediate (>0.25–0.4) and high (>0.4) groups. These scores represent clinically meaningful cut points and have been validated against increasing risk of adverse outcomes in community-dwelling and hospitalised older people [9, 18].

### Healthcare resource use

Pharmaceutical usage and health provider items (GP visits, allied health consultations) were collected from Australian government databases for 6 months after discharge from the initial hospitalisation which led to the episode of care. Hospital admissions or presentations to the Emergency Department over the 6 months were obtained from data matching services in State Health Departments and cross-matched with records from telephone follow-up of patients at 6 months post enrolment in the TCP. A cost was attributed to these, based on the Australian-Revised Diagnostic Related Groupings v5.2 (AR-DRG codes). Costs weights (hospitalisation, average lengths of stay and costs of pharmacy items) were obtained from the National Hospital Cost Data Collection [19] for the respective AR-DRG codes. Where DRG codes were not provided, an average cost per day of \$1131.27 was used based on the average of the four most frequent DRG codes in the sample.

The average TCP was priced at \$12,444 per episode. This figure was based on the national and state government expenditure on the program divided by the number of participants in 2011, reflecting the cost to the Australian government for providing the service [20]. The cost of residential care was based on the daily government subsidy rate for a person of medium level of dependency with complex healthcare needs of \$106.88 [21] (\$19,506 for 6-month period). All costs are reported in 2011 Australian dollars (AU\$1.00 ≈ US \$1.05 ≈ £0.64 ≈ €0.74).

### Analysis

A generalised linear model (GLM) with gamma family and ID link was constructed to predict the increase in healthcare costs for increased levels of frailty adjusted for age, gender and the presence of a co-resident carer.

A further analysis was conducted using the GLM by replacing the cost of TCP with the alternative cost of entering residential care for the subset of the cohort with high levels of frailty ( $n = 53$ ).

## Results

A total of 272 out of 351 participants had health resource use recorded and were included in the analysis. Participants

Table 1. Descriptive statistics by level of frailty

Frailty category	Low	Intermediate	High	Total
Number <sup>a</sup>	82 (30%)	137 (50%)	53 (20%)	272
Age	79.5 (8.1)	79.0 (8.2)	78.0 (9.3)	79.0 (8.4)
Gender (female)	54 (66%)	92 (67%)	32 (60%)	178 (65%)
Co-resident carer	30 (37%)	67 (49%)	30 (57%)	127 (47%)
Re-hospitalised	20 (24%)	53 (39%)	21 (40%)	94 (35%)
Follow-up health care costs (6 months)	\$19,905 (\$13,876)	\$24,192 (\$16,907)	\$28,906 (\$22,970)	\$23,818 (\$17,664)

Statistics presented as mean (SD) or *n* (%).

<sup>a</sup>% of row total; all others % within level.

had an average age of 79 and 2/3 of the cohort were female (Table 1). Half the participants were categorised in the intermediate level of frailty. With increasing frailty, the likelihood of having a co-resident carer increased.

Overall, healthcare costs were higher with increased levels of frailty with intermediate and high levels of frailty costing about AU\$4,000 and AU\$9,000 more than low frailty, respectively. Re-admissions to hospital within the 6-month follow-up period were lower if the participant had a low level of frailty; however, the propensity for re-admission to hospital did not differ between the intermediate and high frailty levels.

The GLM equation is as follows:

6-month healthcare cost

$$= \exp(9.983 + 0.196 \text{ intermediate frailty} + 0.356 \text{ high frailty} - 0.014 \text{ female} + 0.001 \text{ resident carer} - 0.001 \text{ age}).$$

Standard errors for these coefficients were 0.437, 0.102, 0.129, 0.094, 0.001 and 0.005. The GLM found that increasing levels of frailty were significantly associated ( $P < 0.05$ ) with increased healthcare costs within the first 6 months post-TCP admission. An intermediate level of frailty increased healthcare costs by 22% over low level and high frailty increased costs by a further 17% over intermediate. Other factors (gender, age and availability of a co-resident carer) were not significantly associated with increased costs.

The GLM was used to estimate what the cost to government would be if people with high frailty entered residential care by including residential care costs and testing three scenarios, preventing none, 50% and 100% of hospital re-admissions in this cohort. In addition, a break-even point was estimated of the proportion of hospital re-admission avoided needed to equal the cost of remaining in the community.

Table 2 presents the modelled healthcare costs per level of frailty and alternative residential care for those with the highest level of frailty. The modelled costs per frailty level are similar to the raw unadjusted means (Table 1) with a difference in costs per category of approximately \$4,000. For those with high frailty, if residential care prevented all (100%) future hospital admissions, then it would be cost saving. However, a more likely scenario is that residential care prevents some but not all admissions. The break-even point where costs to government are identical requires 62% of all admissions to be averted for admission to residential care to be cost-neutral.

Table 2. Modelled healthcare and residential care costs over 6 months per level of frailty

Level of frailty	Mean (SD)	Cost difference
Low	\$19,947 (\$878)	
Intermediate	\$24,270 (\$1,068)	\$4,323
High	\$28,471 (\$1,253)	\$4,201
Alternative residential care for people with high frailty <sup>a</sup>		
No hospitalisations prevented	\$35,914 (\$22,970)	\$7,443
50% of hospitalisations prevented	\$30,149 (\$12,440)	\$1,678
100% of hospitalisations prevented	\$24,384 (\$5,001)	-\$4,087
Break-even point where hospital admissions prevented = cost of care in the community	62%	\$0

<sup>a</sup>Includes residential care and medical and hospital costs but excludes transition care costs for *n* = 53 people with high frailty levels.

## Discussion

We found an increase of 22 and 43% in the costs of 6 months of health care for a cohort of older people with intermediate and high levels of frailty compared with those with low frailty following a hospital admission. In this cohort, there was no significant difference in readmission to hospital between the intermediate and high frailty groups. Frailty status takes no account of medical instability or of protective factors (such as a supportive environment and motivated care givers), and these may be more important determinants of hospital readmissions.

Programs such as community-based Transition Care, designed to help older people remain living in their own homes after a hospital admission rather than enter residential care prematurely, are likely to be cost saving to governments, even for those with high levels of frailty. Additionally, it has been shown that people are likely to maintain higher levels of functioning and have higher quality of life by remaining at home rather than entering residential care prematurely [22].

A limitation of the study is that the costs did not take into account other social and community care costs apart from TCP which may be accrued in the community setting. A further limitation is that the study was based on a selected population of older patients who entered a TCP post hospital. Because discharge to TCP indicates different underlying care needs, results may not be generalisable to all older people who have had a recent hospital admission.

## Conclusions

The FI can be a powerful prognostic tool. In this study, we have shown that it can also be useful for quantifying the additional resource use required to manage increasing frailty in a selected older population, which may be useful for care planning and health system efficiency.

## Key points

- Increasing frailty levels increase healthcare costs.
- The frailty index can be used to quantify additional costs.
- Living at home is likely to reduce overall health and social care costs.

## Conflicts of interest

None declared.

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