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A trial based economic evaluation of occupational therapy discharge planning for older adults: the HOME randomized trial

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Abstract

Objective: To compare the cost effectiveness of two occupational therapy–led discharge planning interventions from the HOME trial.

Design: An economic evaluation was conducted within the superiority randomized HOME trial to assess the difference in costs and health-related outcomes associated with the enhanced program and the in-hospital consultation. Total costs of health and community service utilization were used to calculate incremental cost-effectiveness ratios, activities of daily living and quality-adjusted life years.

Setting: Medical and acute care wards of Australian hospitals (n=5).

Subjects: A total of 400 people ≥ 70 years of age.

Interventions: Participants were randomized to either (1) an enhanced program (HOME), involving pre/post discharge visits and two follow-up phone calls, or (2) an in-hospital consultation using the home and community environment assessment and the Lawton Instrumental Activities of Daily Living assessment.

Main measures: Nottingham Extended Activities of Daily Living (global measure of activities of daily living) and SF-12V2, transformed into SF-6D (quality-adjusted life year) measured at baseline and three months post discharge.

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Results: The cost of the enhanced program was higher than that of the in-hospital consultation. However, a higher proportion of patients showed improvement in activities of daily living in the enhanced program with an incremental cost-effectiveness ratio of $61,906.00 per person with clinically meaningful improvement.
Conclusion: Health services would not save money by implementing the enhanced program as a routine intervention in medical and acute care wards. Future research should incorporate longer time horizons and consider which patient groups would benefit from home visits.

Keywords
Older adults, occupational therapy, economic evaluation

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Introduction

With an increased focus on discharge planning interventions to help older adults transition from hospital to home,[1] there is a need to assess the full health and economic implications for patients and the healthcare sector before any expansion of such services. HOME was a superiority randomized trial[2] which compared the cost and effectiveness of an enhanced occupational therapy discharge planning program to an in-hospital only consultation for older adults hospitalized with an acute condition. Embedding a cost-effectiveness analysis within the HOME trial aimed to reduce the gap in information on the cost of discharge planning interventions[2] and do so in the context of a trial-based study comparing patient health outcomes.

Occupational therapists are integral to the discharge planning process and carry out such assessments either in-hospital or through home visiting practices.[3,4] In the absence of rigorous data on the clinical efficacy and health service efficiency of discharge planning approaches, occupational therapists must assess a patient's ability to care for him or herself and engage in everyday activities in his or her own environmental context.[4,5] No matter the level of consistency of discharge planning approaches, there is a need for economic evaluations to guide clinical decision making.[1]

Rogers and colleagues completed a health economic review of hospital service spending and found that increased spending in occupational therapy led to lower readmission rates for patients with heart failure, pneumonia and myocardial infarction.[6] Further research is now required on which occupational therapy services are most cost efficient in supporting the transition from hospital to home.

The aim of this study was to compare the cost effectiveness (using a valuation of outcomes to include quality of life, typically expressed as a quality-adjusted life year (QALY)) of two occupational therapy-led discharge planning interventions from the HOME trial. The interventions included an enhanced occupational therapy discharge planning program that involved home visiting (pre/post discharge) and follow-up phone calls post discharge, to an in-hospital consultation focused on planning for discharge from the acute setting.[2] Both programs were manualized and administered by trained occupational therapists and were administered as part of a superiority-design parallel randomized controlled trial (RCT).[2]

From the results of the main study,[2] it was found that the enhanced program did not differ from the in-hospital consultation alone in global measures of activities of daily living (ADL), with both groups maintaining prehospital functional status. Even though there was no difference in functional ability in the enhanced program compared to an in-hospital consultation, there was a chance that either intervention may have resulted in greater cost saving compared to the other.

Methods

Participants were drawn from the HOME study, a multisite superiority-design RCT conducted in New South Wales and Victoria, Australia[2] (clinical trial registration no. ACTRN12611000615987). Methods related to the trial are published elsewhere.[7] Briefly, participants in acute and medical care wards were recruited if they were 70 years or older, expected to return to a community dwelling at discharge, had no significant cognitive impairment (score of <5 adjusted errors on the Short Portable Mental Status Questionnaire[8]) and were conversant in English. Participants were excluded if they scored <5 on the locomotion subscale of the Functional Independence Measure™,[9] anticipated that wheelchair prescription at discharge would be required, received a comprehensive occupational therapy assessment in the last six months or had significant comorbidities (age-adjusted Charlson Comorbodity Index (CCI) ≥8).[2,10] Following randomization, they were referred to occupational therapy to receive their allocated intervention. All participants provided informed consent in keeping with the Declaration of Helsinki.

All patients received discharge planning therapies that were based on maintaining or improving the functional ability for community living. The key difference between the two interventions was that the HOME program included pre- and postdischarge home visits. The inpatient phase of the HOME program differed from the in-hospital consultation in terms of information gathering in relation to the person's functional abilities and home environment to prepare for the predischarge home visit. During the predischarge home visit, the participant's home was assessed for hazards and everyday activities were practiced by the participant under occupational therapist supervision.[2] Up to one week after discharge from hospital, a post discharge home visit was conducted, with a focus on in-home training and any unmet needs. Two follow-up telephone calls were provided at two and four weeks post discharge that encouraged further goal attainment and problem solving related to functional abilities.[2]

In light of varied approaches when providing hospital-based discharge planning, a standardized in-hospital consultation was provided in the study (although seven participants (0.03% of the group) received a predischarge home visit to prescribe home modifications). The focus of the in-hospital consultation was an assessment of participants' previous and current functional ability and discussion of their home environment.[2] The in-hospital consultation varied from the enhanced program as it did not include information gathering for home visits, instead structuring home environment discussions and interventions using aspects of Home and Community Environment (HACE) Assessment.[11] Understanding of participants' engagement in everyday activities was established using the Lawton Instrumental Activities of Daily Living (IADL) assessment.[12] All occupational therapy discharge planning treatments for the in-hospital consultation group were provided during participants' hospital stay.

To illustrate the difference in interventions, Supplementary data 1 provides an outline of the occupational therapy discharge planning recommendations received by participants. This was summarized in the trial paper.[2] Briefly, the participants receiving the enhanced program had more recommendations related to environmental modifications, referrals to other services, education, health safety and well-being, task modification and strategies to improve function. Participants receiving the in-hospital consultation received more recommendations related to equipment prescription.

The primary outcome was a change in functional ability as measured on the Nottingham Extended Activities of Daily Living (NEADL) Scale[13] with a change of 1.73 points considered clinically important.[14] The Short Form Health Survey (SF-12V2) was administered at baseline and at the three-month follow-up interview to assess participants' health-related quality of life; the results of this assessment were then transformed into the SF-6D utility measure.[15] Additional information was collected to obtain subscale measures from the SF-36 (SF-36 Physical Functioning and SF-36 Role Physical);[16] however, it was the SF-12V2 that was transformed into the SF-6D.

Table 1. Resources Consumed and Method for Costing Described.

Resource consumed	Data collected	Cost
Occupational therapy time	Time spent with patient	Occupational therapy hourly rate and 18.9% on-costs[20,21]
Travel	Distance to travel to the patient location	Cost per kilometer, $0.77 cents[22]
Community follow-up	Self-report and health diary	Cost of medical appointments[23] Cost of allied health appointments[23,24] Cost of home help services (such as personal care or domestic assistance)[25] Cost of equipment and home modifications was based on market rate
Hospital readmission	Self-report and linked data	Cost per emergency department presentation (triage category).[24] Note emergency presentation was not costed if the client was then admitted to hospital[19] Cost per bed day using Australian Refined Diagnostic Groups (AR-DRG)[24]

A QALY is a multidimensional measure of health outcome which captures change in both survival and quality of life (on a scale where 0 represents death and 1 represents full health.[17] One QALY represents one year of survival in full health.

The economic evaluation was conducted from a health system perspective, including costs and outcomes, as they occurred in the hospital, home and community sectors. The base year for costs was set at 2014, any costing that was occurring at a rate other than 2014 was inflated using Health Price Indexes from the Australian Institute of Health and Welfare.[18] No discounting occurred as all costs were incurred within 12 months.

The main costs of treatment (per patient) included the time spent by occupational therapist providing the enhanced program (including travel) or the in-hospital consultation, in addition to community services (equipment, home modifications, support services and health services) used up to three months post discharge. Emergency presentations were costed per triage category[19] and hospital readmission stays priced via casemix group costing using bed day costs.[17] Although the number of unplanned readmissions was shown to be similar across groups in the main study, this economic analysis included both planned and unplanned readmissions. Furthermore, this study costed each readmission using the diagnostic category and length of stay, meaning that follow-up hospital costs were not based on the number of readmissions alone.

Data related to occupational therapy time and travel were gathered from study therapist's time recorded during the participants' indexed hospital admission. Community service use was recorded through the use of patient health dairies and questionnaires, with information collected via either fortnightly or monthly research assistant phone calls until three months post discharge. Hospital emergency department presentations and hospital readmissions, both planned and unplanned, were extracted via record linkage services (the use of linked data was not available for the previously published effectiveness trial.) When these data were not available, self-report information was taken from health diaries and questionnaires collected at three months post discharge. Further information related to resources consumed and method for costing is described in Table 1.

Costs for equipment and home modifications were estimated over the working life of the equipment using standard methods and reference material for costing capital expenditure.[19,21] When a replacement schedule was not obtainable, a judgment was made by a clinical expert (K.W.). For home modification costs, we consulted an architect who provided estimates. Total costs were

calculated for each participant from recruitment to the study until three months after discharge.

Statistical analysis

Health outcome analysis was conducted using SPSS version 19 (SPSS Inc., Chicago, IL). Analysis of functional ability was re-assessed for cases with total cost data. A priori predictors of functioning were included in multiple regression analysis to determine the mean difference in primary outcomes.[2] Predictors that were considered to most likely influence the function and readmission of older adults included gender, comorbidities (CCI), living alone/with someone, age <80 or >80, perceived physical fitness (SF-36 Physical Functioning subscale) or perceived roles associated with physical functioning (SF-36 Role Physical subscale).[2] Mean difference and 95% confidence interval (CI) values were reported. The intervention employed goal setting and an individually tailored approach to achieve transfer from hospital to home resulting in a broad range of occupational therapy recommendations. Individual participant changes were also explored to determine if individual clients achieved a clinically meaningful change in functional ability.

Economic evaluation analysis

The economic evaluation used a complete case analysis and estimated the incremental costs and incremental health outcomes of the enhanced program compared with the in-hospital consultation. The total costs of health and community service utilization (including enhanced program delivery costs) were used to calculate incremental cost-effectiveness ratios (ICERs). ICERs were calculated as the incremental cost per additional patient experiencing any improvement in the NEADL, the incremental cost per additional patient experiencing a clinically meaningful improvement in the NEADL and the incremental cost per QALY gained. The probability that the discharge planning therapy was cost effective given a decision maker's willingness to pay for each additional unit of health outcome achieved was estimated using bootstrapping of costs and health outcomes. Given that the underlying willingness to pay is unknown, the probability of the discharge planning therapy being cost effective (vertical axis) is presented as a function of a varying willingness to pay (horizontal axis) in cost-effectiveness acceptability curves. Cost-effectiveness analyses were conducted using STATA 14.2.

Results

A total of 400 people were randomized to this study (see related paper for participant flow).[2] The mean age of participants was similar across groups, that is, 80.1 years (SD 6.4) in enhanced occupational therapy discharge planning program and 80.7 years (SD 5.7) in in-hospital consultation. The groups were similar on all baseline characteristics apart from the enhanced program having fewer comorbidities than the in-hospital consultation group, 5.2 (SD 1.6) vs. 5.6 (SD 1.4), respectively.

There were 158 participants who received in-hospital consultation and 167 who received the enhanced program cases with complete cost and QALY data; 170 participants in each arm had complete data for the NEADL measure. These participants were included in the economic evaluation.

Health outcomes

Results from the main study demonstrated that there were no significant differences in functional ability between the enhanced and in-hospital consultation groups three months post discharge. This was confirmed by reviewing the difference for cases with complete data; there were no significant differences in functional ability (mean difference: –0.02, 95% CI: –0.87 to 0.83) or QALY (mean difference: 0.002, 95% CI: –0.01 to 0.02) between the in-hospital consultation and enhanced program. However, over three months, there were more patients in the enhanced group who experienced any improvement and a clinically significant improvement in the NEADL, as illustrated in Table 2.

Costs

Mean costs, by health service use category, are presented in Table 3. Total cost, which included all

Table 2. Summary of Incremental Costs and Benefits.

	Intervention				Control				Increment	ICER
	Mean	*n*	LCL	UCL	Mean	*n*	LCL	UCL		
Total cost	$8532	167	$6256	$10,807	$4980	158	$3603	$6356	$3552	
Improvement in NEADL—any	0.54	167	0.46	0.61	0.49	158	0.41	0.57	0.05	$68,866
Improvement in NEADL—clinically significant	0.44	167	0.36	0.51	0.38	158	0.30	0.46	0.06	$61,906
Quality-adjusted life years	0.15	167	0.15	0.15	0.15	157	0.15	0.15	0.00	–

LCL: lower control limit; UCL: upper control limit; ICER: incremental cost-effectiveness ratio; NEADL: Nottingham Extended Activities of Daily Living.
Figures in the table have been rounded to the nearest two decimal places.

Table 3. Driver of Costs Three Months Post Discharge.

Cost driver	Cost (enhanced program), mean (SD) [95% CI] *n* = 167	Cost (in-hospital consultation), mean (SD) [95% CI] *n* = 158
Total cost	$8532.33 ($15,003.93) [$6240.02–$10,824.63]	$4980.23 ($8827.03) [$3593.17–$6367.29]
Occupational therapist time and travel cost	$290.88 ($134.01) [$270.40–$311.35]	$82.98 ($95.73) [$67.94–$98.02]
Community follow-up cost	$1061.93 ($1072.20) [$898.14–$1225.74]	$1169.27 ($1703.14) [$901.64–$1436.90]
Hospital readmission cost	$7179.52 ($15,022.29) [$4884.41–$9474.63]	$3727.98 ($8562.77) [$2382.45–$5073.51]
	Number of days (enhanced group), mean (SD) [95% CI] *n* = 167	Number of days (in-hospital consultation), mean (SD) [95% CI] *n* = 158
Hospital length of stay	4.7 (10.0) [3.2–6.2]	2.6 (6.5) [1.6–3.7]

CI: confidence interval.

resources listed in Table 1, for the enhanced program was nearly twice as high as that for the in-hospital consultation. The spread of costs was also more dispersed in the enhanced group.

It was expected that the enhanced program would have higher costs of occupational therapy staff time and travel as this group received more time-intensive discharge planning package. Community follow-up costs were similar which indicates that the consumption of services such as general practitioners, allied health therapies and personal/domestic assistance was similar post discharge. Hospital readmission costs were higher in the enhanced group.

The reasons for readmission were grouped by major diagnostic category (see Supplementary data 2). The enhanced program had twice as many readmissions as the in-hospital consultation under the category for diseases and disorders of the circulatory system, digestive system and musculoskeletal and corrective tissue. The in-hospital consultation group had twice as many readmissions as the enhanced program under the categories for disorders of the kidney, urinary tract and respiratory

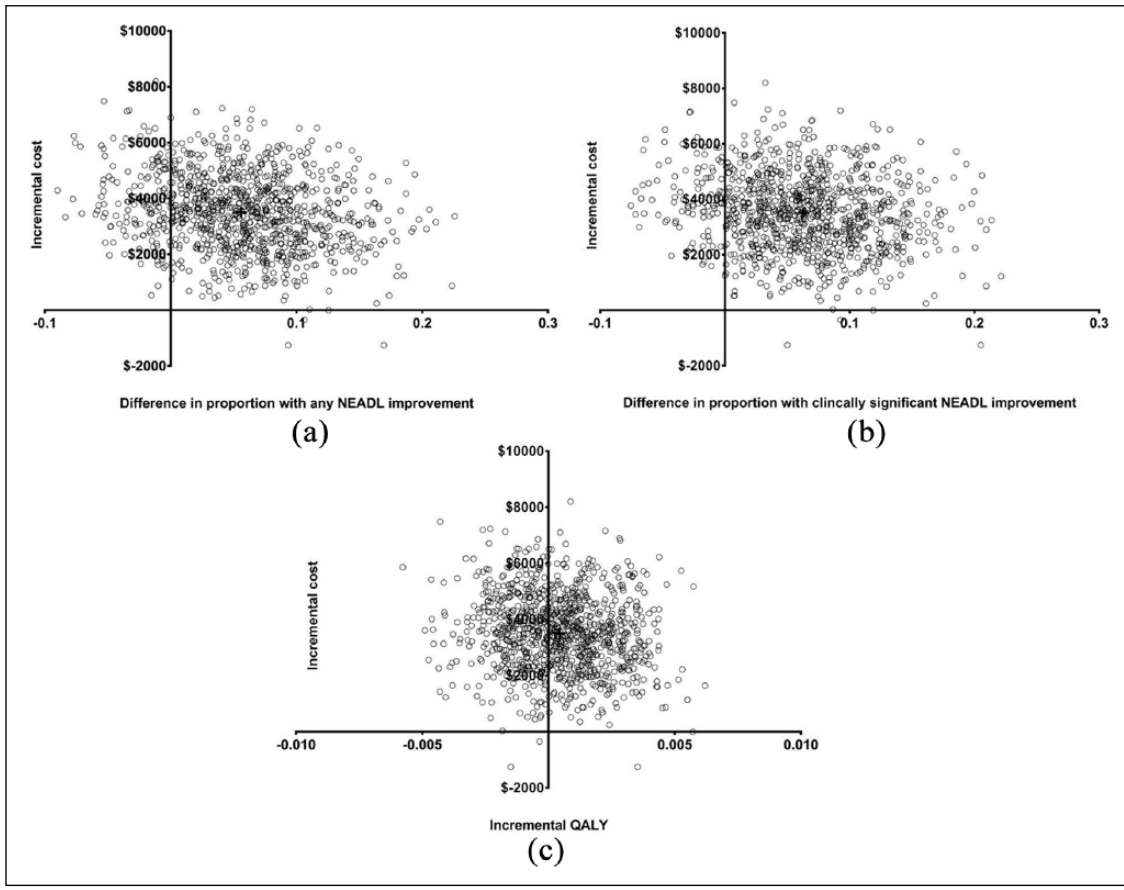

Figure 1. Incremental cost-effectiveness plane for proportion showing (a) any improvement in NEADL, (b) clinically significant improvement in NEADL and (c) quality-adjusted life years. Open circles are the results of 1000 bootstrap replicates and cross is the average of the replicates.

system, and factors influencing health status (such as rehabilitation stays).

Cost-effectiveness analysis

The results of the economic evaluation indicate an ICER of $68,866.00 per extra person with any NEADL improvement in the enhanced program compared to in-hospital consultation (see Table 2). The ICER improved to $61,906.00 per extra person with clinically meaningful improvement in the NEADL. It was not possible to calculate an incremental cost per QALY gained, as the denominator of the ICER was zero.

Figure 1(a)–(c) shows the cost-effectiveness scatter plots for the NEADL and QALY outcomes; Supplementary data 3 presents the cost-effectiveness acceptability curves for the NEADL outcomes. At a willingness to pay threshold of $50,000.00 per additional patient with clinically significant improvement in the NEADL, there is a 40% probability that the enhanced program is cost effective (Supplementary data 3)

Discussion

An economic evaluation was undertaken and it was found that the cost of the enhanced

occupational therapy discharge planning program was higher than that of the in-hospital only consultation. The enhanced program offered similar outcomes in terms of QALYs and the ability to perform ADL measured by the NEADL. However, when exploring the individual participant changes in performance of daily living activities, a higher proportion of patients experienced any improvement and a clinically significant improvement in the NEADL with the enhanced program compared to in-hospital consultation, with ICERs in the order of $60,000.00 per additional patient improvement. It is unclear whether an ICER of $60,000.00 per additional patient improvement in the NEADL would be considered good value for money by decision makers as we do not know a decision maker's willingness to pay for clinically significant improvement in the NEADL. A longer follow-up period may see a more meaningful improvement in longer term outcomes and translate it into reducing institutionalization and as such future research should incorporate a longer time horizon.

We found that community follow-up costs were similar between groups. Occupational therapy staff and travel costs occurred during the study period were higher in the enhanced discharge planning program, as was expected, as this intervention was more time intensive and required travel to participants' homes. The major differences in cost were related to hospital readmission costs which were also higher in the enhanced program with longer length of stay compared to the in-hospital consultation.

In reviewing reasons for readmission, no explicable pattern or explanation was identified. In order to explore potential reasons for increased costs, we compared the reason for admission to national data.[26] This demonstrated that the trial participants had lower incidence of readmissions for disease, disorders of the kidney and urinary tract (17.9% difference), neoplastic disorders (2.8%), disease, disorders of the skin, subcutaneous tissue and breast (2.7%) and disease and disorders of the nervous system (2.2%). There were higher incidences of disease and disorders of the respiratory system (3.8%), and disease and disorders of the circulatory system (3.5%). Other categories were similar (<2.0% difference). We acknowledge that there is a lack of statistical power when comparing the diagnostic categories; however, we believe it provides some valuable descriptive information. A limitation of the aforementioned data is that the reason for readmission does not provide information about comorbidities. It is difficult, therefore, to discern why this group had higher readmissions and may be an incidental finding. Another possible explanation is that the enhanced program participants were under greater scrutiny due to the higher numbers of referrals to other health professionals and/or services or community programs. However, the community service referrals which would be more expected as an outcome of this type of intervention did not differ statistically. As readmissions were initiated for medical reasons, it is also difficult to interpret how a discharge planning intervention, which is aimed at the practical aspects of going home and resuming life activities and roles as reflected in the range of occupational therapy recommendations, would directly influence readmission rates and therefore the subsequent costs. Nonetheless, this was included as this is usual practice to incorporate all health-related costs. Future research should explore which groups of people would benefit most from in-hospital and enhanced discharge planning packages rather than looking at routine blanket referrals.

Only one similar study in occupational therapy discharge planning was identified. The HOVIS study was a pilot randomized trial where participants in the intervention group were provided with a predischarge home visit and the control participants received an in-hospital interview.[27] A third arm was also included for participants who were deemed to require a home visit by occupational therapists. Follow-up occurred within one month of discharge from the index hospital admission. While the cost estimations (around £20,000.00–£30,000.00 per QALY gained ($33,151.00–$49,750.00 AUD)) were within the acceptable range in terms of cost effectiveness, the authors stressed that the results were inconclusive due to limited cost calculations, which did not include readmission or community service costs, and small sample size.[27]

A study of nurse practitioner and pharmacist management compared to usual care investigated the impact on length of stay and readmission for older adults.[28] There was a shorter hospital length of stay for the index hospital admission and the cost analysis showed that there was on average a difference of US$412.00 (approximately $545.00 AUD) per person in the intervention group indicating a saving of approximately 33.0%.[28] This study focused on the events occurring one month post discharge. A comprehensive nursing and physiotherapy assessment tailored program with 10 follow-up phone calls over 24 weeks found a mean cost saving of $333.00 AUD with a net monetary benefit of $7907.00 AUD per individual when compared to usual care.[29] Both studies found a cost saving (US$412.00 and $333.00 AUD, respectively) in the delivery of comprehensive discharge planning. These studies have varying follow-up periods, dosage and differences in cost data collected, which makes it difficult to compare the outcomes. Determining the most suitable follow-up period and dosage of intervention is essential in determining the most effective and efficient delivery of discharge planning services. It may be that the enhanced program did not provide sufficient dosage post hospital admission.[2]

This economic evaluation was not without its limitations. We did not consider the cost of unpaid caregivers, such as family members. A patient's family may provide support post discharge and may be used instead of paid services. As a result, there may be a case to cost unpaid hours of care in terms of replacement cost (with a paid service) and loss of employment opportunities. A further limitation was the use of patient health diaries and questionnaires to collect information about the use of community-based services. The accuracy of such records is limited by patient recall;[30] access to community health data via linkage services was not available. Thus, patient health diaries were the highest quality collection means available at the time of undertaking this study. Further discussion of the limitations of the main trial can be found in Clemson et al.[2]

Our study provides evidence related to the cost-effectiveness of occupational therapy-led discharge planning. This builds upon the work of Rogers et al.,[6] who determined that the inclusion of occupational therapy services prior to discharge led to reduced healthcare spending post discharge. We conclude that health services would not save money by implementing an enhanced occupational therapy discharge planning program as a routine intervention in medical and acute care wards. It is unclear whether decision makers would consider an ICER of $60,000.00 for clinically significant change in the NEADL to be value for money. Furthermore, we cannot overlook the in-hospital consultation which has lower costs to implement and achieved similar functional outcomes to the enhanced program. We emphasize that while the in-hospital consultation provided a greater amount of occupational therapy input than many hospitals' current usual practice, it appears to be an efficient method for discharge planning. Our study was not able to establish cost effectiveness compared to a control group as usual care for these patients does not routinely include an occupational therapy consultation or home visit. The lack of a control group who did not receive discharge planning should be considered by decision makers when using this information.

Previous research has identified that discharge planning may lead to increased satisfaction with healthcare for patients and professionals.[1] One qualitative review, specific to occupational therapy predischarge home visit, established that older adults found these visits could be at times challenging when they could not achieve previous function but they did value the time they were able to spend in their home. Carers reported that the visit was useful and reduced anxieties around the patients' return to home.[31] Indeed, in our study the broad range of recommendations indicated that change in ADL function was not always the goal of the intervention, and if so not the only goal. Further exploration of satisfaction with the types of discharge planning approaches should be built upon and determine how satisfaction relates to efficacy and efficiency.

This study focused on the transition from hospital to home for an older adult population admitted to acute and medical care wards. Our sample

included vulnerable older adults and as such the findings of this study should be considered within our sample context. We did exclude older adults with comorbidities ≥ 8 on the CCI,[10] those attending rehabilitation and those with significant cognitive impairment, undiagnosed or otherwise. It is strongly recommended that future research should consider reviewing the criteria for those receiving discharge home visits.

Intensive occupational therapy discharge packages which cross jurisdictions between hospital and community, such as the enhanced program tested in this study, are likely to incur higher costs than in-hospital only consultations at three months post discharge. In this study, there was a marked difference in the type of recommendations provided between the groups with the in-hospital consultation having more short-term recommendations in comparison to the enhanced group. We acknowledge the complexity of interpreting health outcomes and costs in terms of the health system perspective of individual functional outcomes, but our study supports that blanket referrals for one type of intervention are not considered value for money.

Clinical messages

- The additional cost of achieving an additional patient with a clinically significant improvement in the NEADL in the enhanced group when provided routinely to medical and acute care patients is around $60,000.
- Recommendations provided in the in-hospital group were more short-term, whereas the enhanced group was focused on long-term strategies.

Author note

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Supplement material

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