A comparison of the home-care and healthcare service use and costs of older Australians randomised to receive a restorative or a conventional home-care service

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What is known about this topic

- The evidence base for the effectiveness of restorative approaches to home care has been growing over recent years.
- A restorative approach has been found to be more effective than standard home care in terms of a number of different outcomes including reducing the length of the home-care episode and increasing functional independence and quality of life.
- A recent UK study found that there was no significant difference between the total 12-month health, social care and re-ablement service costs of individuals who received a re-ablement service compared with conventional home-care users.

What this paper adds

- This paper represents the first study to compare the use and costs of health and home care for individuals receiving restorative vs. conventional home care using a randomised controlled trial study design.
- Unlike the UK study, this Australian study found that the aggregated health and home-care costs of the restorative clients were lower than the costs of individuals who received conventional home care.

Abstract

Restorative home-care services, or re-ablement home-care services as they are now known in the UK, aim to assist older individuals who are experiencing difficulties in everyday living to optimise their functioning and reduce their need for ongoing home care. Until recently, the effectiveness of restorative home-care services had only been investigated in terms of singular outcomes such as length of home-care episode, admission to hospital and quality of life. This paper reports on a more complex and perhaps more significant measure – the use and cost of the home-care and healthcare services received over the 2-year period following service commencement. Seven hundred and fifty older individuals referred for government-funded home care were randomly assigned to a restorative or standard service between June 2005 and August 2007. Health and aged care service data were sourced and linked via the Western Australian Data Linkage System. Restorative clients used fewer home-care hours (mean [SD], 117.3 [129.4] vs. 191.2 [230.4]), had lower total home-care costs (AU$5570 vs. AU$8541) and were less likely to be approved for a higher level of aged care (N [%], 171 [55.2] vs. 249 [63.0]) during follow-up. They were also less likely to have presented at an emergency department (OR = 0.69, 95% CI = 0.50–0.94) or have had an unplanned hospital admission [OR (95% CI), 0.69 (0.50–0.95)]. Additionally, the aggregated health and home-care costs of the restorative clients were lower by a factor of 0.83 (95% CI 0.72–0.96) over the 2-year follow-up (AU$19,090 vs. AU$23,428). These results indicate that at a time when Australia is facing the challenges of population ageing and an expected increase in demand for health and aged care services, the provision of a restorative service when an older person is referred for home care is potentially a more cost-effective option than providing conventional home care.

Keywords: costs, home care, older people, restorative, service use

Introduction

Restorative home care focuses on restoring independent functioning rather than on simply doing things for people so that they can remain living at home, which has been the traditional way home care has been provided.

The seminal paper of Tinetti *et al.* (2002) demonstrated the effectiveness of a restorative home-care service as compared with standard home care in improving self-care, keeping older people at home and reducing the likelihood of emergency department (ED) presentation. Since then, the evidence base for a restorative approach to home care has been growing steadily. Until very recently, the research and evaluations providing this evidence have examined specific individual outcomes such as length of home-care episode (Tinetti *et al.* 2002), ongoing home-care use (Kent *et al.* 2000, Newbronner *et al.* 2007, McLeod & Mair 2009), hospital admissions (Tinetti *et al.* 2012), admission to residential care (Parsons *et al.* 2007), everyday functioning (Lewin & Vandermeulen 2010), self-rated health (Jones *et al.* 2009) and quality of life (Lewin & Vandermeulen 2010). Composite outcomes such as system-wide health and aged/social care service use and the associated cost have been reported by only one study as summarised below.

Over 12 months of follow-up, Glendinning *et al.* (2010) completed a prospective longitudinal UK study that examined multiple (individual and composite) outcomes including health-related quality of life, ongoing use of social care services, health and social care use and associated costs. They found that re-ablement (a restorative approach to home care) compared with conventional social (home) care resulted in greater improvements in health-related quality of life and social care outcomes. There were no differences between the groups in terms of healthcare costs or the total costs (health plus social care).

Similarly, the present study also examined multiple outcomes. This paper reports on the comparison of the health and aged care service use and costs of older home-care clients who were randomly assigned to receive either a restorative or conventional home-care service. An earlier paper reported on their ongoing home-care use and their functional and quality-of-life outcomes (Lewin *et al.* 2013). Our hypotheses for this study were that the clients who received restorative home care would (i) use fewer subsequent home-care services; (ii) be less likely to need residential aged care (RAC; or home-based equivalent); (iii) have fewer ED presentations; (iv) have fewer and shorter unplanned hospital admissions; and (v) cost the Western Australian aged and healthcare sectors less over time than if they had received standard home care.

Methods

Ethics approval for this study was granted by the Human Research Ethics Committees of both Silver Chain (the home-care provider) and the Western Australian Department of Health (WADoH).

Design and setting

This study was a randomised controlled trial (RCT) that has been described in great detail elsewhere (Lewin *et al.* 2013). Older individuals living in the Perth metropolitan area and referred to Silver Chain for a government-funded home and community care (HACC) service were randomised to receive a restorative or a conventional service. Silver Chain (hereafter called HACC service provider) is a not-for-profit organisation that provides a large range of community health and aged care services in remote, regional and metropolitan Western Australia.

The original power calculation for this RCT was based on having 1000 clients (500 in each group) with follow-up information, which gave 90% statistical power (alpha level = 0.05) to detect a 10% difference (40% vs. 50%) between the two groups in the proportion needing ongoing care at the end of follow-up. Due to a lower referral rate during the recruitment period (compared with previous years), the sample size was reduced to 750 clients, with 375 each in the intervention and control groups. The resultant power was 79%.

Participants

Eligibility criteria for this study included living in the metropolitan area (as the restorative service was not available in all rural areas), 65 years of age or older, assessed as eligible for HACC-funded personal care services due to ongoing (i.e. not post-acute) difficulty with activities of daily living (ADL), English speaking and no known diagnosis of dementia or a terminal illness. Clients with complex care needs requiring 15 hours or more of HACC per week were also excluded. Note that this paper refers to study participants as clients, consistent with the preferred Australian HACC nomenclature. The terms HACC service and home care are used interchangeably.

Clients referred to the HACC service provider and assessed as eligible for personal care were randomly allocated to receive a restorative (intervention) or conventional HACC service (control). Randomised group assignment was determined by a computer algorithm following completion of the RCT eligibility assessment. These telephone assessments were conducted by trained Customer Centre Representatives employed by the HACC service provider, who were instructed to comply with the computerised randomisation protocol. Following randomisation, the onward referral of assessed clients to the appropriate service complied

with the HACC service provider's normal business processes. Randomised recruitment occurred from June 2005 until August 2007.

Conducting a tightly controlled RCT within a 'real world' setting was a major challenge. Randomisation was found to have not been entirely effective as, in a small number of cases, there appeared to have been an attempt to manipulate the assignment to groups by Customer Centre Representatives at referral.

Intervention

This study modelled the intervention on the Home Independence Program (HIP), which has been described in great detail elsewhere (Silver Chain Nursing Association 2007, Lewin & Vandermeulen 2010). In summary, HIP is a short-term individualised service designed to promote independence and minimise the need for ongoing support services. It is goal-oriented and promotes active engagement in daily living activities using task analysis and redesign, work simplification and assistive technology. Depending on an individual's goals, it may also include strength, balance and endurance programmes for improving or maintaining mobility; chronic disease self-management; falls prevention strategies; medication, continence and nutrition management; and strategies to assist the individual to reconnect socially. The service usually has a 12-week time limit. It is funded by the WADoH as a HACC service.

Clients who needed ongoing assistance with either ADLs (e.g. bathing/showering) or instrumental ADLs (IADLs, e.g. laundry) at the end of the intervention period were referred internally to receive usual HACC services.

HACC usual care

Following telephone assessment of eligibility and group assignment, individuals received a face-to-face assessment from a Care Co-ordinator who completed a care plan and scheduled the care. The most common care plan included three personal care visits a week to assist with bathing/showering and fortnightly domestic assistance to clean and do the heavy laundry. Social support and in-home or centre-based respite were also available, although used less commonly.

Data sources

Demographic, ADL and IADL characteristics were collected using two mandatory HACC reporting requirements: the national HACC minimum data set (HACC MDS) and the WA HACC Needs Identification (HNI) instrument. These data are collected routinely at referral by staff in the Silver Chain Customer Centre and recorded electronically in Silver Chain's client information management system.

The following linked data were sourced via the Western Australian Data Linkage System: the Emergency Department Data Collection; the Hospital Morbidity Data System; the Mortality Register; the HACC database; and the Aged Care Assessment Program (ACAP) database (records whether an individual is approved for government-funded RAC or an equivalent community-based package). HACC, emergency and hospital data were extracted for a 3-year period commencing 1 year prior to the date the individual was randomly assigned to receive either HIP or conventional HACC, while the ACAP and mortality data were extracted for just the 2-year period following individuals' group assignment.

Service costs

For each individual, average costs were calculated in three settings (HACC, ED and Inpatient) using the following sources:

- HACC costs – Western Australian unit cost data supplied by the WADoH.
- ED costs – National Hospital Cost Data Collection Cost Report Round 12 (2007–2008) (Commonwealth of Australia 2009).
- Inpatient – Public Sector Estimated Round 12 (2007–2008) AR-DRG 5.1 Cost Report for Western Australia (Department of Health & Ageing 2008).

The total cost for each individual, as defined in this study, represented the sum of the costs of their care in each of these three settings.

Outcomes

The intervention and control groups were compared on three overarching outcomes over a maximum period of 2 years:

- Aged care usage (HACC services, RAC approval) and HACC costs;
- Healthcare usage (ED presentations and unplanned inpatient admissions) and costs; and
- Total health and home-care costs (sum of 1 and 2).

RAC costs could not be calculated because there was no certainty that RAC eligibility translated into an actual RAC admission.

Statistical analysis

All data analysis was performed using Stata Version 11 (StataCorp 2009). A significance level of 0.05 was

adopted for all tests. Analysis was performed on the basis of randomised allocation (i.e. intention-to-treat [ITT]), and then on the basis of the actual treatment received (as treated [AT]). 'AT HIP' comprised clients who received a minimum of three HIP visits. 'AT HACC' comprised clients who received a minimum of 3 hours of personal care. Analysis was conducted for all data sets based on a 2-year period for each individual from entry into the study, for the first and second years alone and for the overall study follow-up period. Given the compromised randomisation, the characteristics and prior service use of the groups were compared at baseline to ascertain the need for adjustment for potential confounders in later analyses.

The hours of home care for all clients were summed and the mean hours for each time period were tested between the two groups for all care hours, and separately for personal care using *t*-tests. Clients with no hours of care in the second year were assigned a total of zero hours of care to compare the distribution of hours used over the two groups. The use of ongoing or emergent personal care services was determined based on the accumulation of personal care hours in the last quarter of each analysis year. Chi-square tests were used to compare the proportion of clients with ongoing or emergent personal care services and RAC eligibility (or community equivalent).

For the ED data set, unplanned presentations (i.e. emergency presentations) were analysed using logistic regression and chi-squared tests for dichotomised outcomes (i.e. unplanned presentations vs. no unplanned presentations). Similarly, unplanned inpatient admissions (e.g. via an ED) were analysed using logistic regression and chi-squared tests for dichotomised outcomes (unplanned admissions vs. no unplanned admissions). Additionally, the average episode and the average cumulative length of stay (LOS) were compared between the groups using a *t*-test.

A generalised linear model (GLM) using a gamma distribution and log link function was used for regression of aggregated health and aged care costs. This choice was based on consideration of the distribution of cost and the relationship of variance to mean (Barber & Thompson 2004). The log link allows the intervention and covariates to have a multiplicative effect on the outcome. In all cases where regression modelling was performed (logistic, GLM), living arrangements, carer status, gender and dependency were included because these variables are likely to affect outcome and there were baseline differences in these variables between the groups due to the partly compromised randomisation. The reference groups

used in the analyses were usual HACC care (vs. HIP), lived alone (vs. lived with family or others), no carer (vs. has a carer), female (vs. male), low ADL dependency (vs. medium, vs. high) and low IADL dependency (vs. medium, vs. high).

Results

Samples

The ITT analysis comprised 375 individuals in each group. The AT analysis comprised 395 individuals in the usual HACC group and 310 in the HIP group. The 45 individuals who received fewer than 3 hours of either service were excluded from the AT analysis. The participant flow through the study is illustrated in our previous paper (Lewin *et al.* 2013). Individuals who died in the first year were removed from the second year analysis.

Client characteristics and prior service use

The groups can be seen in Table 1 to have been somewhat different demographically. Baseline data show the HIP group to have been less likely to be male or to have had a carer and to be more likely to live alone. There was also a small, but statistically significant, difference in their IADL and ADL scores.

Table 1 also shows that the groups were similar at baseline in terms of their previous use of health and home-care services. While a greater number of the HACC group were already receiving a personal care service at study commencement, they represented a very small proportion of the group as a whole.

Aged care use and home-care costs

Aged care services
The HIP group used considerably fewer hours of all HACC-funded services and personal care in all time periods (Table 2). Additionally, at 1- and 2-year follow-ups, the HIP group were less likely to use ongoing personal care services or to have a new (emergent) personal care service. These results were consistent in both AT and ITT analyses.

The ITT mean total cost per client of all HACC-funded services over the first year and the total 2-year period was AU$5270 and AU$8374 for the HACC group compared with AU$4096 and AU$5833 for the HIP group. The AT difference was bigger: AU$5449 and AU$8541 for the HACC group, and AU$3938 and AU$5570 for the HIP group. Per client, this represents a minimum average savings in the first

Table 1 Baseline client characteristics

	Intention-to-treat (ITT)			Actual treatment (AT)		
	HACC (*n* = 375)	HIP (*n* = 375)	*P*-value	HACC (*n* = 395)	HIP (*n* = 310)	*P*-value
Characteristic						
Female, *n* (%)*	242 (64.5)	263 (70.1)	0.102	254 (64.3)	224 (72.3)	0.025
Australian born, *n* (%)*	183 (48.8)	204 (54.4)	0.415	195 (49.4)	173 (55.8)	0.211
Had a carer, *n* (%)*	254 (67.7)	216 (57.6)	0.004	266 (67.3)	176 (56.8)	0.004
Co-resident carer, *n* (%)*	185 (72.8)	141 (65.6)	0.089	195 (73.3)	109 (62.3)	0.014
Lived alone, *n* (%)*	159 (42.4)	192 (51.2)	0.016	167 (42.3)	164 (52.9)	0.005
Government pension, *n* (%)*	350 (93.3)	333 (88.8)	0.097	367 (92.9)	276 (89.0)	0.207
Age, mean (SD)†	82.7 (7.7)	81.8 (7.2)	0.105	82.7 (7.6)	81.9 (7.4)	0.164
IADL Silver Chain score, mean (SD)†,‡	7.2 (3.6)	8.1 (3.2)	<0.001	7.2 (3.7)	8.2 (3.1)	<0.001
ADL Silver Chain score, mean (SD)†,‡	12.2 (3.2)	12.8 (2.8)	0.013	12.2 (3.1)	12.9 (2.7)	0.005
Services used previous year						
HACC hours all services, mean (SD)†	49.22 (45.43)	45.09 (47.35)	0.437	49.55 (47.17)	46.65 (45.50)	0.287
HACC hours personal care, mean (SD)†	33.37 (36.20)	24.94 (34.14)	0.486	39.40 (39.80)	17.27 (25.47)	0.108
Ongoing personal care, *n* (%)*	23 (6.13)	6 (1.60)	0.02	24 (6.07)	3 (0.97)	0.001
ED presentation, *n* (%)*	198 (52.80)	201 (53.60)	0.826	209 (52.91)	162 (52.26)	0.863
Hospital admission, *n* (%)*	224 (59.73)	215 (57.33)	0.505	232 (58.73)	176 (56.77)	0.601
Episodic LOS, mean (SD)†	9.21 (12.79)	9.80 (11.40)	0.493	9.14 (12.50)	10.08 (12.11)	0.302
Cumulative LOS, mean (SD)†	10.51 (19.00)	9.83 (17.09)	0.605	10.71 (19.04)	9.79 (17.60)	0.511

HIP = home independence program (intervention group); HACC = home and community care programme ('usual care' control group); intention-to-treat = subjects grouped as randomised; actual treatment, subjects grouped according to actual service received; LOS, length of stay.
*Chi-squared test.
†Unpaired *t*-test with equal variances.
‡The higher the IADL and ADL Silver Chain score the more independent the client.

12 months of 22% and 30% over the 2-year study period.

Aged Care Assessment Program

At study end, a significantly higher proportion of clients in the HACC group (ITT and AT) were approved for a higher level of aged care (residential care or equivalent home care) (Table 2). While there was also a significantly higher proportion of HACC clients approved in the first year in the ITT analysis, there were no significant differences in the AT analysis or either analysis in year 2.

Healthcare use and costs

Emergency presentations

A significantly greater proportion of clients presented to an ED from the usual HACC group (AT) in the first year, second year and overall 2-year follow-up compared with the HIP group (Table 2). The adjusted analysis showed that the HIP group (AT) had a 30% reduced risk of ED presentation at all time periods investigated (Table 3).

The mean total cost per client of all ED visits over the 24-month period was lower for HIP than usual HACC by AU$22 (ITT) to AU$67 (AT). Total ED costs for the HIP ITT group were AU$686 and AU

$659 for the HIP AT group compared with AU$708 (ITT) to AU$726 (AT) for the HACC group.

Hospital admissions

The adjusted analysis showed that the HIP group (AT) had a 34% reduced risk of unplanned hospital admission during the second year and 31% over the whole 24 months (Table 3). The mean LOS for each episode of care was not significantly different between the two groups (Table 2). The cumulative LOS was statistically higher in the HIP group compared with the HACC group in the second year (AT).

The mean total cost per client of all hospital admissions over the 24-month period was lower for HIP than usual HACC by AU$306 (ITT) to AU$1300 (AT). Total hospital costs for the HIP ITT group were AU$13,369 and for the HIP AT group AU$12,860, compared with AU$13,675 (ITT) to AU$14,160 (AT) for the HACC group.

The total cost per client of all hospital admissions over the 2-year period was AU$13,675 for the HACC group and AU$13,369 for the HIP group by ITT, and AU$14,160 for the HACC group and AU$12,861 for the HIP group by AT. This constitutes a AU$306 difference in hospital admission costs between the groups by ITT and AU$1299 by AT.

Table 2 Unadjusted outcomes of aged care and healthcare over 24 months from referral, by first and second years and overall

Outcome over time	Intention-to-treat (ITT) HACC n		HIP n		P-value	Actual treatment (AT) HACC n		HIP n		P-value
First year										
Hours all services, mean (SD)*	375	116.8 (125.4)	375	83.6 (81.9)	<0.001	395	119.6 (124.9)	310	79.5 (70.6)	<0.001
Hours personal care, mean (SD)*	375	45.6 (49.3)	375	19.1 (27.6)	<0.001	395	48.2 (49.1)	310	16.1 (22.2)	<0.001
Assessed and approved for higher level of care, n (%)†	375	190 (50.7)	375	163 (43.5)	0.048	395	196 (49.6)	310	134 (43.2)	0.091
Ongoing personal care, n (%)†	310	160 (51.6)	150	63 (25.2)	<0.001	336	175 (52.1)	216	45 (20.8)	<0.001
Emergent personal care, n (%)†	65	18 (27.7)	125	17 (13.6)	0.017	59	22 (37.3)	94	11 (11.7)	<0.001
ED presentation, n (%)†	375	208 (55.5)	375	188 (50.1)	0.143	395	224 (56.7)	310	146 (47.1)	0.011
Hospital admission, n (%)†	375	218 (58.1)	375	206 (54.9)	0.377	395	233 (59.0)	310	160 (51.6)	0.050
Episodic LOS, mean (SD)*	375	6.3 (9.9)	375	5.4 (9.2)	0.092	395	6.1 (9.5)	310	5.2 (9.1)	0.109
Cumulative LOS, mean (SD)*	375	18.6 (19.0)	375	18.4 (24.2)	0.926	395	18.3 (18.9)	310	19.11 (26.0)	0.708
Deaths, observed (expected)‡	375	77 (75.8)	375	74 (75.2)	0.840	395	84 (79.9)	310	59 (63.1)	0.489
Second year										
Hours all services, mean (SD)*	298	92.5 (137.9)	301	50.4 (90.7)	<0.001	311	90.8 (138.7)	251	46.7 (75.8)	<0.001
Hours personal care, mean (SD)*	298	36.2 (51.5)	301	13.4 (31.5)	<0.001	311	37.9 (52.9)	251	11.0 (26.2)	<0.001
Assessed and approved for higher level of care, n (%)†	298	104 (34.9)	301	92 (30.6)	0.258	311	110 (35.4)	251	73 (29.1)	0.114
Ongoing personal care, n (%)†	246	85 (34.5)	201	23 (11.4)	<0.001	266	85 (31.9)	174	20 (11.5)	<0.001
Emergent personal care, n (%)†	52	9 (17.3)	100	6 (6.0)	0.027	45	10 (22.2)	77	4 (5.2)	0.004
ED presentation, n (%)†	298	139 (46.6)	301	117 (38.9)	0.054	311	143 (46.0)	251	94 (37.4)	0.042
Hospital admission, n (%)†	298	132 (44.3)	301	110 (36.5)	0.053	311	139 (44.7)	251	87 (34.66)	0.016
Episodic LOS, mean (SD)*	298	4.4 (9.9)	301	3.9 (10.4)	0.301	311	4.5 (10.1)	251	3.9 (10.8)	0.235
Cumulative LOS, mean (SD)*	298	15.2 (15.4)	301	20.6 (27.6)	0.055	311	15.7 (16.2)	251	21.8 (29.1)	0.044
Deaths, observed (expected)‡	298	62 (51.2)	301	43 (53.8)	0.035	311	66 (53.7)	251	33 (45.3)	0.013
Overall 24 months										
Hours all services, mean (SD)*	375	190.3 (230.4)	375	124.0 (154.5)	<0.001	395	191.2 (230.4)	310	117.3 (129.4)	<0.001
Hours personal care, mean (SD)*	375	74.4 (86.6)	375	29.8 (52.6)	<0.001	395	78.0 (87.9)	310	25.0 (42.4)	<0.001
Assessed and approved for higher level of care, n (%)†	375	241 (64.3)	375	210 (56.0)	0.021	395	249 (63.0)	310	171 (55.2)	0.034
ED presentation, n (%)†	375	257 (68.5)	375	239 (63.7)	0.165	395	274 (69.4)	310	188 (60.6)	0.016
Hospital admission, n (%)†	375	265 (70.7)	375	248 (66.1)	0.182	395	283 (71.6)	310	194 (62.6)	0.011
Episodic LOS, mean (SD)*	375	7.6 (10.9)	375	6.8 (10.5)	0.161	395	7.5 (10.7)	310	6.6 (10.4)	0.120
Cumulative LOS, mean (SD)*	375	22.8 (22.8)	375	24.4 (36.4)	0.558	395	22.8 (23.3)	310	25.55 (39.5)	0.335
Deaths, observed (expected)‡	375	139 (127)	375	117 (129)	0.133	395	150 (133.6)	310	92 (108.4)	0.034

HIP = home independence program (intervention group); HACC = home and community care programme ('usual care' control group); intention-to-treat = subjects grouped as randomised; actual treatment, subjects grouped according to actual service received; LOS, length of stay.

*Unpaired t-test with equal variances.

†Chi-squared test.

‡Log-rank test for equality of survivor functions.

Table 3 Adjusted* odds of emergency department (ED) presentation and hospital admission, HIP vs. HACC

	Intention-to-treat (ITT)		Actual treatment (AT)	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
First year	*n* = 748		*n* = 704	
ED presentation	0.83 (0.62–1.11)	0.206	0.70 (0.52–0.95)	0.023
Hospital admission	0.93 (0.69–1.26)	0.650	0.79 (0.58–1.07)	0.130
Second year	*n* = 598		*n* = 562	
ED presentation	0.72 (0.52–1.01)	0.056	0.70 (0.49–0.99)	0.045
Hospital admission	0.74 (0.53–1.03)	0.073	0.66 (0.46–0.94)	0.020
Overall 24 months	*n* = 748		*n* = 704	
ED presentation	0.81 (0.60–1.10)	0.183	0.69 (0.50–0.94)	0.021
Hospital admission	0.85 (0.62–1.17)	0.316	0.69 (0.50–0.95)	0.025

HIP = home independence program (intervention group); HACC = home and community care programme ('usual care' control group); intention-to-treat = subjects grouped as randomised; actual treatment, subjects grouped according to actual service received.
*Adjusted for living arrangements, carer status, gender and dependency.

Aggregated home-care and healthcare costs

Aged care costs were restricted to home-care costs. The mean aggregated home-care and healthcare costs per client over the 24-month period were lower for HIP than usual HACC by AU$2869 (ITT) to AU$4338 (AT). The mean total health and aged care costs for the usual HACC care group over the 24-month study period were AU$22,757 (ITT) to AU$23,428 (AT) compared with AU$19,888 (ITT) to AU$19,090 (AT) for the HIP intervention group.

After adjustment for known confounders, the HIP AT group was significantly less costly than the HACC AT group in the first year by a factor of 0.82 and overall by a factor of 0.83 (Table 4). In the ITT analysis, the HIP group also had lower costs by a factor of 0.93 in the first year and 0.89 overall, but these did not reach statistical significance.

Discussion

The results of the study provide support for our original hypotheses that individuals who receive a restorative rather than a conventional service when referred for home care will use fewer health and aged care services, and cost the health and home-care sectors less in subsequent years. Statistical significance was achieved more often for AT analyses than for ITT analyses, which suggests that the success of the intervention depends heavily on participant compliance with the HIP restorative protocol. Identifying the characteristics that improve participant adherence to the restorative protocol warrants further research. This should include examination of social, cultural and health characteristics. An earlier related HIP paper identified the presence of a carer being associated with poorer restorative outcomes (Lewin *et al.* 2013).

We found that the impact of restorative care was greatest on subsequent use of home-care services, particularly personal care, noting that the need for personal care assistance was an eligibility criterion for the study. Individuals who received the restorative service were less likely to use personal care at either the first or second year of follow-up intervals, or to have had a new personal care service episode opened. When the effect was examined in terms of

Table 4 Generalised linear model regression of aggregated health and aged care costs over time

	Model variables	Intention-to-treat		Actual treatment	
		RR (95% CI)	*P*-value	RR (95% CI)	*P*-value
First year	Sample size	*n* = 748	0.276	*n* = 704	0.007
	Group	0.92 (0.80–1.06)		0.82 (0.70–0.95)	
Second year	Sample size	*n* = 598	0.155	*n* = 562	0.197
	Group	0.85 (0.68–1.06)		0.86 (0.68–1.08)	
Overall 24 months	Sample size	*n* = 748	0.083	*n* = 704	0.010
	Group	0.89 (0.78–1.02)		0.83 (0.72–0.96)	

RR = estimated relative reduction adjusted for living arrangements, carer status, gender and dependency; intention-to-treat = subjects grouped as randomised; actual treatment = subjects grouped according to actual service received; CI, confidence interval.

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the total cost of HACC services over the first 12 months and the total 2-year study period, average savings per client of 22% and 30% were found for the HIP group in the ITT analyses and 28% and 35% for HIP in the AT analyses.

As described in the Introduction, the Glendinning *et al.* UK study found no differences between the re-ablement and conventional social care groups in terms of healthcare costs or the costs overall, whereas there were differences in the use and costs of social care (Glendinning *et al.* 2010). Importantly, these social cost differences were relatively small: 13% (statistically insignificant) once the high up-front costs of re-ablement compared with conventional care had been taken into account. A similar result was found in an earlier non-RCT trial of HIP, which examined home-care costs associated with the recruiting agency only (Lewin & Vandermeulen 2010). This may be due to the less restrictive eligibility criteria used in the former studies compared with the RCT reported here. In our RCT, clients had to be referred as needing personal care, which is both costlier and provided more frequently than other home-care services (e.g. domestic assistance, respite, meal preparation, transport, shopping, etc.). This potentially explains why the current RCT was able to demonstrate cost savings; that is, by reducing relatively expensive personal care services, which also offset the restorative intervention costs.

Limitations

As described in the Methods section, randomisation of clients was sometimes compromised by Customer Centre Representatives seeking to direct particular clients to one or other of the services. This attempt at manipulation may have stemmed from underlying ageist attitudes to home-care provision or requests for ongoing home care by the referrer (e.g. doctors, nurses, family or care staff). The resulting differences between the groups in known confounders were controlled in the analysis.

Home and community care service and aged care assessment data were collected by predefined calendar quarters, which we then grouped into financial years. Hence, it was impossible to match the date of home-care referral exactly with the quarter/financial year date of aged care assessment or aged care service usage. Consequently, there may be some overestimation or underestimation of the number of hours of service(s) clients used or the results of aged care assessments in each year being investigated. This measurement bias was non-differential and, if present, would have weakened the measure of association towards the null.

Conclusions

The results of this study provide support for the hypothesis that recipients of a restorative home-care service cost the Western Australian aged and health-care sectors less over time than if they receive conventional home care. The majority of these savings occur in the aged care sector, although small savings are seen in the hospital sector in terms of reduced hospital admissions and emergency presentations.

Given the projected increase in numbers of older people in Australia over the next 40 years, the incorporation of intensive restorative services into the Gateway proposed for the reformed Australian aged care system (Commonwealth of Australia 2012) could result in very substantial savings at a whole of population level. Careful targeting of older people to maximise the cost-effectiveness of restorative interventions warrants further investigation.

Acknowledgements

References

Barber J. & Thompson S. (2004) Multiple regression of cost data: use of generalised linear models. *Journal of Health Services Research and Policy* 9, 197.

Commonwealth of Australia (2009) *National Hospital Cost Data Collection. Cost Report, Round 12 (2007–2008)*. Commonwealth Department of Health and Ageing, Canberra.

Commonwealth of Australia (2012) *Living longer. Living better*. Available at: http://www.health.gov.au/internet/publications/publishing.nsf/Content/CA2578620005D57ACA2579E2007B9DFC/$File/D0769%20Living%20Longer%20Living%20Better%20SCREEN%20070512.pdf (accessed on 4/12/2013).

Department of Health and Ageing (2008) *Data Collections. Round 12 (2007–08) Cost Report – Public version 5.1, Private Version 5.1 and Private Day Hospital Facilities (Standalone) Version 5.1*. Australian Government, Canberra.

Glendinning C., Jones K., Baxter K. et al. (2010) *Home Care Re-ablement Services: Investigating the Longer-term Impacts (Prospective Longitudinal Study)*. Social Policy Research Unit, University of York, York.

Jones K., Baxter K., Curtis L. *et al.* (2009) *Investigating the Longer Term Impact of Home Care Re-Ablement Services. The Short-Term Outcomes and Costs of Home Care Re-Ablement Services. Interim Report* (Working Paper Number DHR 2378). Department of Health, London.

Kent J., Payne C., Stewart M. & Unell J. (2000) *Leicestershire County Council: External Evaluation of the Home Care Reablement Pilot Project*. Centre for Group Care and Community Care Studies, De Montfort University, Leicester.

Lewin G. & Vandermeulen S. (2010) A non-randomised controlled trial of the Home Independence Program (HIP): an Australian restorative programme for older home-care clients. *Health and Social Care in the Community* 18, 91–99.

Lewin G., De San Miguel K., Knuiman M. *et al.* (2013) A randomised controlled trial of the Home Independence Program (HIP), an Australian restorative home care programme for older adults. *Health and Social Care in the Community* 21, 69–78.

McLeod B. & Mair M. (2009) *Evaluation of City of Edinburgh Council Home Care Reablement Service*. Scottish Government Social Research, Edinburgh.

Newbronner E., Baxter M., Chamberlain R., Maddison J., Arksey H. & Glendinning C. (2007) *Research into the Longer Term Impacts/Effects of Re-Ablement Services, Care Services Efficiency Delivery Program*. Department of Health Care Services Efficiency Delivery Program, London. Available at: http://www.york.ac.uk/inst/spru/pubs/pdf/reab.pdf (accessed 28/8/2013).

Parsons M., Anderson C., Senior H. *et al.* (2007) *ASPIRE: Assessment of Services Promoting Independence and Recovery in Elders*. The University of Auckland, Auckland.

StataCorp (2009) *Stata Statistical Software: Release 11*. StataCorp LP, College Station, TX.

Silver Chain Nursing Association (2007) *Home Independence Program (HIP) User Manual*. Silver Chain Nursing Association, Perth.

Tinetti M., Baker D., Gallo W., Nanda A., Charpentier P. & O'Leary J. (2002) Evaluation of restorative care vs usual care for older adults receiving an acute episode of home care. *Journal of the American Medical Association* 287, 2098–2105.

Tinetti M., Charpentier P., Gottschalk M. & Baker D. (2012) Effect of a restorative model of posthospital home care on hospital readmissions. *Journal of the American Geriatrics Society* 60, 1521–1526.