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**ORIGINAL ARTICLE**

# **A Randomized Controlled Trial to Determine the Effect of a Model of Restorative Home Care on Physical Function and Social Support Among Older People**

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**Abstract**

**Objective:** To determine the impact of a restorative model of home care on social support and physical function among community-dwelling older people.

**Design:** Cluster-randomized controlled trial.

**Setting:** Home care in an urban area.

**Participants:** Participants (N=205) were randomly assigned to an intervention group (n=108; mean age, 79.1y; 71.3% women; 81.5% New Zealand European [NZE]; 50.8% residing in areas of the highest levels of social deprivation) or a usual care group (n=97; mean age, 76.9y; 60.8% women; 73.2% NZE; 53.5% in the highest levels of social deprivation).

**Intervention:** Participants randomly assigned to the intervention group completed a goal facilitation tool with a needs assessor to determine their needs and to establish the aims for the episode of care. Services were structured according to the principles of restorative home care (independence focused with individually tailored activity programs). Usual care participants received a standard needs assessment that informed the delivery of home care services.

**Main Outcome Measures:** Short Physical Performance Battery (SPPB), Dukes Social Support Index (DSSI).

**Results:** There was greater change over time in physical function (measured by SPPB: F=8.30, P=.003) but no associated increase in social support (as determined by DSSI: F=2.58, P=.09).

**Conclusions:** Significant improvements in physical function were observed after a period of restorative home care services. The absence of an associated change in social support may have been the result of a combination of factors, including the threshold of physical function required for community ambulation, the low rate of allied health service provision, and the time required to reestablish social ties. The findings contribute to a greater understanding of factors necessary to refocus home-based services to emphasize improvements in physical function and independence. Archives of Physical Medicine and Rehabilitation 2013;94:1015-22

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For older people, physical function is integral to achieving and maintaining independence and is a major contributor to overall health status.<sup>1</sup> Functional capacity inside, and more importantly outside the home environment, is essential for independent living.<sup>2,3</sup>

Furthermore, mobility outside the home has been shown to have a strong association with greater emotional support from social networks,<sup>4,5</sup> including the maintenance of cultural connections.<sup>6</sup>

Up to half of older people lose some functional ability during hospitalization.<sup>7</sup> Three months after discharge from the hospital, two thirds of them still have reduced physical functioning.<sup>8</sup> Traditional models of home care often miss the opportunity to maximize an older person's physical function and independence. Evidence suggests that they often focus on completing tasks and activities that older persons are unable to complete or that they

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find difficult. This has been shown to lead to an increased level of dependency and a concomitant loss in function.<sup>9</sup> Various models of home care that concentrate on optimizing function and independence have been described previously, including “Reablement” (United Kingdom),<sup>10,11</sup> “Active Service Model” (Australia),<sup>12-14</sup> and “Restorative Home Support” (New Zealand and United States).<sup>15-22</sup>

Restorative home care focuses on the restoration and maintenance of older people’s physical function, so that the highest possible level of function is achieved. The model integrates principles from medicine, nursing, goal facilitation, and rehabilitation to improve functional outcomes for older people. Progressive restorative programs assist older people to identify life goals, and then home care aides engage with older people to help achieve the goals, often through engagement with relevant services. Several key components of restorative home care have been identified. One of these involves reorienting the focus of the home care team from treating disease and creating dependency to maximizing function and comfort. This has required individuals to work as an integrated interprofessional team with shared goals.<sup>16</sup> Other key features of restorative home care are functional and repetitive exercises incorporated into activities of daily living,<sup>23-26</sup> home care aide training and enhanced supervision,<sup>27-30</sup> health professional training,<sup>15-17</sup> comprehensive geriatric assessment,<sup>31-33</sup> and coordinated care management.<sup>34-41</sup>

This study sought to determine whether provision of restorative home care to a sample of community-dwelling older people in New Zealand would result in an improvement in physical function and social support when compared with a group receiving standard home care. More specifically, the study explored the impact of aligning service delivery through individually tailored activities to support the older person in attaining his/her goals.

## Methods

### Setting and participants

Community-dwelling people older than 65 years (55y if Māori or Pacific Islander) were eligible for entry into the study if they were new referrals for home care. The lower age criterion for Māori and Pacific people was in line with the recommendations from the New Zealand Guidelines Group for assessment of older people with complex needs.<sup>42</sup>

Ethical approval was gained on December 20, 2006, from the Northern Y Regional Ethics Committee (NTY/06/12/132), and the study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12608000027314).

The following criteria excluded those who were unlikely to complete the study intervention and follow-up: (1) severe cognitive impairment that may have compromised adherence to the intervention, defined as an Abbreviated Mental Test score<sup>43</sup> of less

than 7/10; and (2) referral for assessment for admission to a residential facility, carer support, or short-term services.

### Randomization and interventions

The study was a prospective, cluster-randomized controlled trial with 2 arms. Randomization occurred through a 5-step process. Step 1 involved collection of all referrals to the care coordination agency for home care from primary care physicians from February to June 2006. In step 2, the referrals were then separated into 4 geographic pods aligned to the care delivered by the needs assessment team. Step 3 involved the allocation of primary care practices to blocks within each pod. The number of blocks corresponded to the number and full-time equivalent of care coordination staff within each pod. The allocation was stratified in an attempt to ensure that there was parity across the blocks in relation to the number of referrals received. In step 4, the blocks within each pod were randomly assigned as either usual care or intervention. This activity was undertaken to ensure that equal numbers were allocated to each pod. Step 5 then involved the allocation of an individual needs assessor to each study group through the use of a numeric list randomly generated within Microsoft Excel.<sup>a</sup> The allocation of participants to each of the 2 study groups was undertaken by the administration staff within the needs assessment agency administration staff, and the allocation was not revealed to the research team until after consent had been obtained.

Within New Zealand, a nationally standardized comprehensive geriatric assessment, the Support Needs Assessment (SNA) tool,<sup>44-46</sup> has been used since 1992 by needs assessors to determine an older person’s level of need and to direct the required input of home care to meet that need. The SNA tool examines a number of areas including cognition, informal caregiver stress, safety, and nutrition.

The usual care process used the SNA tool undertaken by a needs assessor randomly assigned to the usual care group. After completion of the SNA tool, the needs assessor worked with the participant to identify the services that would be provided and how many hours were required. This information was passed to the home care provider contracted to deliver services. The home care organization then prepared a support plan to meet the identified needs of the older person.

The study intervention involved a needs assessor who had been randomly assigned to the intervention group. The assessor used a goal-setting tool (Towards Achieving Realistic Goals in Elders Tool [TARGET]) during the initial assessment process of the participant to establish the aims of the rehabilitation episode. The assessment phase incorporated 2 outcome tools, namely, the Nottingham Extended Activities of Daily Living Scale (NEADL)<sup>47</sup> and the EuroQoL 5D<sup>48</sup> (EQ-5D), into the SNA tool. The NEADL was used to quantify an individual’s level of functioning, and the EQ-5D is a descriptive tool, measuring health status, that features mental health and pain in the questionnaire. There were 3 scoring levels for each of the 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression). After assessment, a long-term goal was identified together with necessary short-term goals through a process of activity breakdown to form a goal ladder. This included addressing areas of deficit such as falls risk, decreased muscle strength, difficulty with showering, and other personal cares that may have prevented the older person from attaining his/her goal.

#### List of abbreviations:

DSSI	Dukes Social Support Index
EQ-5D	EuroQoL 5D
NEADL	Nottingham Extended Activities of Daily Living Scale
SNA	Support Needs Assessment
SPPB	Short Physical Performance Battery
TARGET	Towards Achieving Realistic Goals in Elders Tool

The goal ladder was then passed from the needs assessment agency to the home care organization. Based on the goal ladder, the home care coordinator developed concrete instructions for the home care aide in the form of a support plan. The support plan comprised a detailed list of the tasks to be undertaken. This may have included the use of allied health professionals (occupational therapist, physical therapist, speech-language pathologist, dietician) to provide expert guidance in the tasks required to attain a participant's goals. A description of the training provided to assessment staff and all home care coordinators using TARGET is presented elsewhere.<sup>20</sup>

Both groups were assessed by a needs assessor, and the assessment findings formed the basis for the quantity and content of the services to be delivered by the contracted home care organization. The use of TARGET as a strategy to identify the goals of the older person and the subsequent use of these goals to structure the services delivered to support the older person was the major difference between the usual care process and the intervention.

To avoid potential bias, the needs assessors randomly assigned to the usual care group were not trained in the use of TARGET and were not in contact with the assessors randomly assigned to the intervention group. However, the 5 contracted home care organizations all provided services to participants randomly assigned to both the usual care and the intervention groups, and this was recognized as a source of potential bias. The home care organizations were therefore only allowed to integrate activities into the support plan that were directly relevant to the issues identified in the needs assessor referral. Furthermore, home care aides were only paid for completing tasks outlined in the support plan. This was closely monitored by both the needs assessment agency (as a cost management strategy) and the research team who reviewed the content of every support plan.

## Outcomes and follow-up

Physical function was determined by the Short Physical Performance Battery (SPPB), a validated test comprising an assessment of standing balance, a timed 2.4-m walk test, and a timed test of 5 repetitions of rising from a chair and sitting down.<sup>49</sup> Social support was ascertained by the Duke Social Support Index (DSSI).<sup>50,51</sup> Measurements were taken at study entry (baseline) and at 6 months (follow-up). Assessments were completed by experienced researchers blinded to group allocation. Support plans were analyzed to determine the tasks implemented by home care aides.

The study was powered ( $N=205$ ) to detect a change over time in the primary outcome of health-related quality of life (determined by the Medical Outcomes Study 36-Item Short-Form Health Survey). The results of this are reported elsewhere.<sup>20</sup> Power calculations suggested that a total sample of 166 participants would provide a power of 90% with a 2-sided alpha level of .05 to detect a .75-point improvement in the SPPB (from 8.3 to 9.05) with an SD of 1.48. A .75-point difference in the total score was estimated to provide meaningful clinical difference and was based on findings from previous studies.<sup>52</sup> Given the frailty of the population under observation and anticipated attrition rates, a further 10% was added, yielding a total population of 183 participants.

The study sample size was also adequate to allow for consideration of a change in DSSI scores. It was determined that a total sample of 132 would provide a power of 90% with a 2-sided alpha level of .05 to detect a 2-point improvement in DSSI (26.1 to 28.1) with an SD of 3.5. This was informed by previous published

studies<sup>53,54</sup> exploring social isolation and support among community-dwelling older people.

## Statistical analysis

The study explored a change in participants' physical function over time, measured by a change in SPPB scores, and social support, measured by a change in DSSI scores. Generalized linear mixed models for repeated measures and clustered data were used to allow an estimation of the treatment effect on physical function and social support. To investigate whether changes over time differed for active and usual care groups, the interaction between treatment and time was also assessed in the model. Chi-square tests were undertaken to determine the significance of difference in the proportion of defined activities in the support plans developed for participants.

All statistical tests were 2-tailed, and a 5% significance level was maintained. Evaluations were undertaken on the "intention-to-treat" principle.

The  $P$  values presented are not corrected for multiple testing but come directly from the analyses. It was felt that it was better to do this and to interpret the results conservatively, looking for consistency across the outcomes. This strategy minimizes the risk of the increased opportunity for type I errors when multiple testing strategies are used.<sup>55,56</sup> To reduce the risk of type II errors, a more conservative level of significance ( $P=.01$ ) was used in the primary analysis.

## Results

Recruitment was from September 2007 to May 2008 (fig 1). Differences were observed between the 2 groups in terms of participant characteristics (mean age, sex, ethnicity, living situation) and physical function at baseline (table 1). The effect of these differences was controlled for by stepwise development of the generalized linear mixed model, so that only variables showing a significant effect were included as fixed effects in the final model.

### Physical function

The intervention group had a greater mean increase in physical function over time than the usual care group as determined by overall SPPB ( $F=8.30$ ,  $P=.003$ ) and in the gait speed component of the SPPB ( $F=3.74$ ,  $P=.002$ ) (table 2). There was no difference between the 2 groups in the change over time in the balance component ( $F=9.74$ ,  $P=.03$ ) or the Chair Stand Test component ( $F=2.10$ ,  $P=.25$ ).

### Social support

The model of analysis included living arrangement as a fixed effect factor. There was no difference over time between the 2 groups in terms of DSSI scores ( $F=2.58$ ,  $P=.09$ ) (table 3).

### Home care support plans

The services provided to participants as part of their home care were analyzed and categorized as domestic tasks (vacuuming), personal care (showering assistance), shopping (with and/or without the

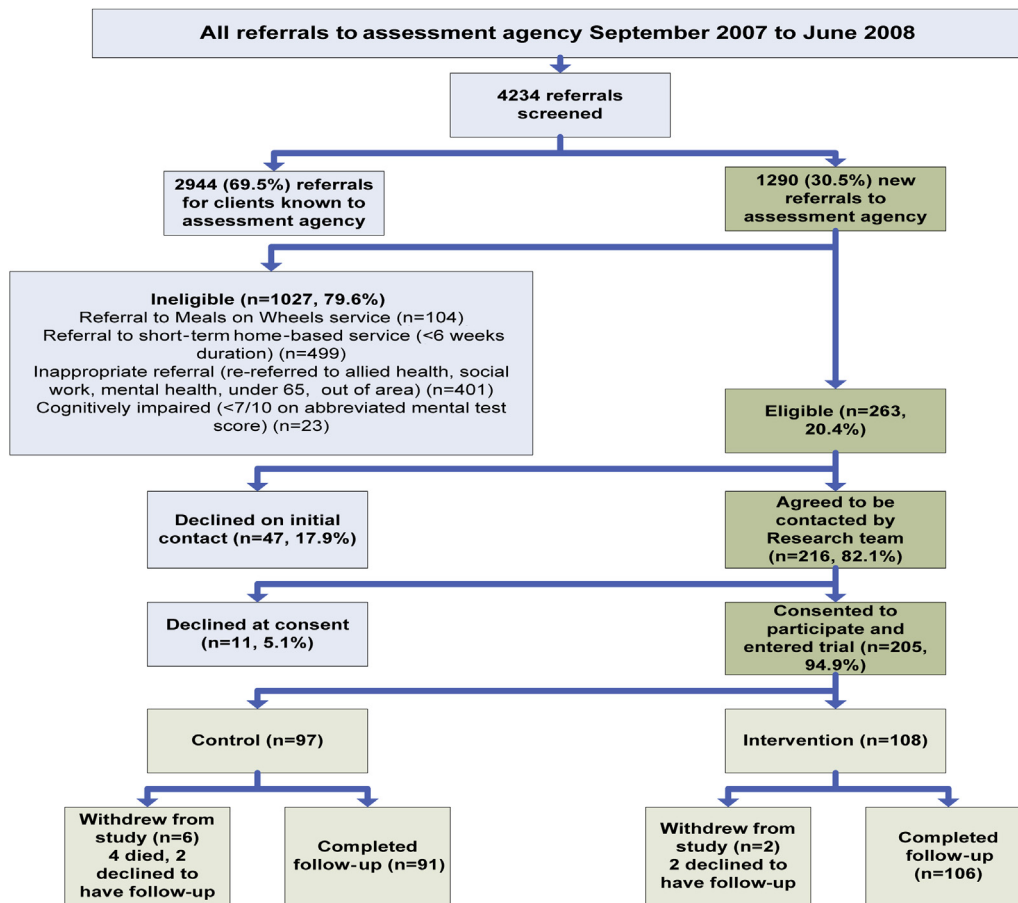


Fig 1 Recruitment details.

participant), and individualized activities (activities identified specifically for the individual participant). Individualized activities predominantly focused on assisting participants to access the community and were concerned with increasing function outside the home. There was no difference between groups in the percentage of services relating to domestic tasks, personal care, or shopping.

The main difference in services related to the proportion of individualized activities in participants' support plans across the 2 groups ( $\chi^2 [1, N=205]=56.4, P=.004$ ). These activities were individualized walking or exercise programs or other activities aimed at improving functional ability. In the intervention group, 61.7% ( $n=66$ ) of the support plans described such individualized activities as opposed to 15% ( $n=14$ ) in the usual care group. All activities described in the support plans were undertaken by home care aides employed by the home care organizations. These home

care aides were trained to a nationally accredited program (New Zealand Qualifications Authority Home and Community Support, Level 1 and 2).<sup>57</sup> Individualized training of the home care aide for specific cases (eg, mobilizing safely outdoors or strategies to improve meal preparation) was undertaken by the home care coordinators (who were registered nurses). It is acknowledged that in many cases, the use of allied health staff to provide this level of support may have been of greater benefit in terms of enhanced safety and the optimization of functional benefits.

### Other services

Referrals to allied health were made by needs assessors after initial assessment. These decisions were based on the clinical opinion of the assessor when either occupational therapy or physical therapy expertise was required to facilitate a participant's return to an optimal level of function. A total of 10 referrals were made to allied health from the intervention group ( $n=108$ ) and only 1 from the usual care group ( $n=97$ ).

This impact of low rates of referral to allied health was investigated. In the intervention group, there was no significant relationship between allied health referral and changes between the 2 groups in social support over time ( $t_{106}=-1.52, P=.13$ ). However, referral to allied health had a significant effect on change in physical function over time when the 2 study groups were compared ( $t_{72}=-2.12, P=.04$ ), although the negative  $t$  values show that those participants referred to allied health had

**Table 1** Baseline demographic characteristics for intervention and usual care groups

Characteristic	Control (n=97)	Intervention (n=108)
Age (y)	76.90±7.61	79.08±6.93
Women	59 (60.8)	77 (71.3)
White	71 (73.2)	88 (81.5)
Living alone	60 (61.9)	69 (63.9)

NOTE. Values are mean ± SD or n (%).

**Table 2** Results of adjusted linear mixed model examining the change in SPPB total scores and component scores at baseline and follow-up

Scale Measurement	Baseline	Follow-up	P
SPPB*			
Usual care	6.48±0.52 (5.45–7.18)	6.14±0.52 (5.60–7.33)	.003
Intervention	6.00±0.44 (5.26–6.29)	6.68±0.44 (6.36–7.69)	
SPPB Balance Test			
Usual care	2.06±0.37 (1.30–2.86)	1.82±0.37 (0.98–2.54)	.03
Intervention	2.05±0.40 (1.33–2.70)	2.22±0.40 (1.80–3.06)	
SPPB Gait Speed Test			
Usual care	2.42±0.13 (2.18–2.68)	2.35±0.13 (2.26–2.76)	.002
Intervention	2.18±0.12 (1.93–2.42)	2.52±0.12 (2.09–2.58)	
Time taken for gait speed test (s)			
Usual care	6.97±0.51 (5.97–7.97)	6.98±0.50 (5.98–7.99)	.04
Intervention	7.11±0.50 (6.13–8.11)	6.14±0.50 (5.16–7.13)	
SPPB Chair Stand Test			
Usual care	1.18±0.16 (0.78–1.35)	1.19±0.16 (0.94–1.50)	.25
Intervention	1.06±0.14 (0.88–1.49)	1.22±0.14 (0.85–1.46)	
Time to complete 5 sit-to-stand transfers (s)			
Usual care	23.78±1.26 (21.9–26.27)	21.18±1.26 (18.70–23.67)	.87
Intervention	25.23±1.17 (22.93–27.53)	22.46±1.17 (20.17–24.77)	

NOTE. Values are least squares mean ± SE, (95% confidence interval), or as otherwise indicated.

\* Modeling included ethnicity, perceived relationship between Needs Assessment Service Coordination and home care, Emotional Support–Seeking Scale (a component of the Proactive Coping Inventory), and the number of hours of home-based support allocated by Needs Assessment Service Coordination.

smaller positive changes in physical function. This counterintuitive finding, as it would be expected that allied health input would be associated with improvements in physical function, is explored further in the Discussion section.

## Discussion

We showed that physical function as determined by SPPB improved significantly over time in the group receiving restorative home care. However, there was not an associated increase in social support over time. Finally, there was a higher degree of individually tailored support plans generated by home care coordinators in the intervention group in response to the goals identified by TARGET.

The study used the key concepts of restorative home care, together with a philosophy of person-centered care. In relation to the changes observed in physical function over time, the functional ability of the participants at baseline appeared to have a major impact on the success of the intervention; if the participants had high levels of disability and a concomitant low level of

function, then 6 months of home care did not have sufficient impact to enable them to regain a clinically meaningful level of functional ability. This is particularly relevant when the issue of community ambulation and the level of function necessary to mobilize safely within the community are considered. The level of functional change observed over time in the intervention group was also not large enough to show an associated change in social support.

It is also important to consider the impact resulting from the low utilization of allied health professionals in the study. As described previously, there was no significant relationship observed between allied health referral and improvements in physical function over time ( $t_{72} = -2.12$ ,  $P = .04$ ). One possible explanation might be that participants referred to allied health professionals were more functionally disabled and thus less likely to show meaningful changes in functional ability. The small number of referrals to allied health within the current study precludes analysis to determine the efficacy of this explanation.

The potential effect of low rates of utilization of allied health is considerable. A core component of restorative home care is the optimization of physical activity and the integration of functionally based exercises into the provision of home care. Allied health professionals can teach and implement plans of treatment in cooperation with home care coordinators to enable individuals to maintain independence.<sup>15–17,58</sup> It was expected that allied health would be used in the intervention to advise on optimizing mobility, fitness, and endurance, reducing falls risk, and modifying tasks, as these are core skills for allied health working in the community.

The improvements observed in SPPB scores are of vital importance. A decline in functional mobility is associated with a loss of independence for community-dwelling older people<sup>59</sup> and is a predictor of residential care admission and mortality.<sup>60</sup> Evaluating the impact on older people's functional mobility of

**Table 3** Results of adjusted linear mixed model examining the change in DSSI scores at baseline and follow-up\*

Scale Measurement	Baseline	Follow-up	P
Usual care	36.64±1.10 (34.47–38.79)	36.05±1.10 (33.90–38.23)	.09
Intervention	36.93±1.14 (34.65–39.14)	37.35±1.14 (35.04–39.53)	

NOTE. Values are least squares mean ± SE, (95% confidence interval), or as otherwise indicated.

\* Adjusted for living arrangement, home care provider, and the Avoidance Coping Scale.

restorative home care is therefore clearly important. In the current study, the services provided to the intervention group included a far greater proportion of activities that concentrated on assisting participants to improve their mobility outside the home.

The absence of a statistically significant difference in the levels of change in DSSI across the 2 groups is surprising, given the findings relating physical function and the change in health-related quality of life described elsewhere.<sup>20</sup> Potential reasons for the lack of change in DSSI scores need to be explored so that this can be understood.

The level of physical function in the sample tested was very low (see table 2). Adults scoring 4 to 7 on the SPPB have been shown to have significantly higher levels of functional disability than those scoring higher on the SPPB.<sup>61</sup> In addition, a gait speed of 0.4m/s has been reported as the threshold for independent mobility in the home, whereas in the current study the mean gait speed was 0.3m/s.<sup>62,63</sup> It may be that to reestablish social networks and social support requires higher levels of physical function than those observed in this study, as the person requires sufficient functional capacity for community ambulation. Community ambulation has been broadly defined as locomotion outdoors to encompass activities such as visits to the supermarket, shopping mall, and bank; social outings; vacations; and pursuit of leisure activities.<sup>64</sup> This may include not only walking outside but also the use of public transport and the use of stairs and ramps. The reported threshold to independently function in the community is therefore important. Schmid et al<sup>63</sup> suggest that walking speed can be stratified into clinically meaningful functional ambulation classes, such as household ambulation (<0.4m/s), limited community ambulation (0.4–0.8m/s), and full community ambulation (>0.8m/s). The mean walking speed observed at follow-up assessment in the current study across both groups (.49 m/s) would suggest only limited community ambulation ability. Also, walking speed is only a small component of community ambulation. For an older person to mobilize in the community, it is also necessary to have the ability to perform concurrent cognitive and motor tasks, maintain a trajectory, and negotiate unpredictable terrain.<sup>62</sup>

The important consideration therefore is whether the statistically significant improvements observed over time in the SPPB scores for participants in the intervention group reached a level of clinical significance. The mean change over time in the intervention group for total SPPB scores was .68 points (from 6.00 to 6.68). This was not sufficient to move the mean values from the tertile range (scores of 4–7) for individuals at significant risk of developing further disability. There is evidence to suggest that a change of greater than .45 to .50 SPPB points indicates a small but clinically meaningful change in functional ability,<sup>52,65</sup> but other studies<sup>66,67</sup> have shown that a change of more than 1 point is necessary to show a clinically meaningful change. The low level of functional ability in the sample and the absence of a change in social support suggest that there is considerable ambiguity in determining whether a clinically meaningful change in physical function can be associated with the intervention.

An additional explanation for the absence of an improvement in DSSI scores may relate to the time it may take to reestablish social ties.<sup>68</sup> Even with an improvement in physical function, there may be a delay in improved physical function impacting positively on increased social activity. It is important to consider that physical function is only one of the risk factors that contributes to social isolation among older people. Others include

being older than 80 years, living alone, having a low income or educational level, living in poor or deprived areas (with high crime rates), and lacking access to appropriate and affordable transport.<sup>69</sup> A significant change in DSSI scores may take a longer length of time to achieve and also require an intervention that seeks to address other risk factors for social isolation.

## Study limitations

More than 93% (3971/4234) of individuals screened for inclusion into the study were ineligible to participate. However, 25% (1027/3971) of those excluded did not receive home care. Careful consideration of the generalizability of the study findings is therefore necessary. This is particularly relevant because the current study excluded those with moderate or severe cognitive impairment. Previous use of TARGET in planning community-based services for those with impaired cognition<sup>21</sup> showed the tool to be less effective in determining goals for people with moderate to severe cognitive impairment. Identification of a goal using TARGET through discussion with a proxy (carer or family member) is suggested as a practical method, and this is supported by other studies<sup>70,71</sup> exploring a person-centered approach to delivering health care to people with cognitive impairment. However, the current study did not focus on this, and additional training would be necessary if this strategy were to be implemented.

A further weakness of the current study was the short length of follow-up and inability to establish long-term sustainability of improvements in physical function.

## Conclusions

This study highlights that reorientation of home care toward a model that concentrates on maximizing independence can lead to significant improvements in physical function among frail older people living in the community. The findings contribute to a greater understanding of the factors necessary to refocus home-based services to emphasize such improvements. The study also suggests, however, that to have an associated impact on the older person's levels of social support, the activities undertaken to maximize independence need to be of sufficient intensity to raise the older person above the functional threshold required for community ambulation.

## Supplier

a. Microsoft Excel; Microsoft Corp, One Microsoft Way, Redmond, WA 98052-6399.

## Keywords

Aged, 80 and over; Home care services; Physical therapy; Rehabilitation; Social support

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