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Effectiveness of a reablement training program for homecare staff on older adults' sedentary behavior: A cluster randomized controlled trial

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Abstract

Background/Objectives: Homecare staff often take over activities instead of "doing activities with" clients, thereby hampering clients from remaining active in daily life. Training and supporting staff to integrate reablement into their working practices may reduce clients' sedentary behavior and improve their independence. This study evaluated the effectiveness of the "Stay Active at Home" (SAaH) reablement training program for homecare staff on older homecare clients' sedentary behavior.

Design: Cluster randomized controlled trial (c-RCT).

Setting: Dutch homecare (10 nursing teams comprising a total of 313 staff members).

Participants: 264 clients (aged ≥65 years).

Intervention: SAaH seeks to equip staff with knowledge, attitude, and skills on reablement, and to provide social and organizational support to implement reablement in homecare practice. SAaH consists of program meetings, practical assignments, and weekly newsletters over a 9-month period. The control group received no additional training and delivered care as usual.

Measurements: Sedentary behavior (primary outcome) was measured using tri-axial wrist-worn accelerometers. Secondary outcomes included daily functioning (GARS), physical functioning (SPPB), psychological functioning (PHQ-9), and falls. Data were collected at baseline and at 12 months; data on falls were also collected at 6 months. Intention-to-treat analyses using mixed-effects linear and logistic regression were performed.

Results: We found no statistically significant differences between the study groups for sedentary time expressed as daily minutes (adjusted mean difference: β 18.5 (95% confidence interval [CI] −22.4, 59.3), $p = 0.374$) and as

proportion of wake/wear time (β 0.6 [95% CI −1.5, 2.6], $p = 0.589$) or for most secondary outcomes.

Conclusion: Our c-RCT showed no evidence for the effectiveness of SAaH for all client outcomes. Refining SAaH, by adding components that intervene directly on homecare clients, may optimize the program and require further research. Additional research should explore the effectiveness of SAaH on behavioral determinants of clients and staff and cost-effectiveness.

KEYWORDS

accelerometry, home and community-based care services, independence, reablement training program, sedentary behavior

INTRODUCTION

The demographic transition toward an aging population increases demands for healthcare services.[1] Combined with an expected decline in financial resources and trained staff, this development challenges the sustainability of healthcare systems.[2] Hence, nowadays, there is increasing emphasis on homecare over residential care, which may achieve better outcomes at lower costs and is preferred by the majority of older adults.[3,4] In order to continue living at home, older adults need to remain physically active to diminish functional limitations, disability, and loss of independence.[5] Nevertheless, many older adults have a predominantly sedentary lifestyle; they spend approximately 65%–80% of their waking hours in sedentary activities.[6]

Long-term care staff providing community care at home, such as nurses, nurse assistants, nurse aides, and domestic workers, can play a pivotal role in supporting older adults to become more active throughout the day. They can engage older adults in personal care, nursing care, and domestic support activities, so that older adults can manage their everyday lives as independently as possible. Although staff generally aspire to promote independence, in daily practice, they often take over activities of older adults rather than supporting (e.g., giving instructions) or supervising (e.g., observing and only interfering if necessary) them in activities, as they are used to doing activities *for* rather than *with* older adults.[7–9] This conventional homecare approach may induce a more sedentary lifestyle.[10]

Previous research targeting sedentary behavior in older adults receiving care emphasized that, to successfully and sustainably decrease sedentary behavior and increase activity throughout the day, interventions need to be embedded in routine practice, and include staff and clients working together to find the best individualized approach.[11] This fits well with the holistic and person-centered approach of reablement (also known as restorative care). Reablement aims to enhance individuals'

Key Points

- This c-RCT evaluated the effectiveness of a reablement training program for homecare staff ("Stay Active at Home") on sedentary behavior in older homecare clients.
- Our study showed no evidence for the effectiveness of "Stay Active at Home" on sedentary behavior; daily, physical, and psychological functioning; and falls in older homecare clients.
- Adjustments to "Stay Active at Home," such as adding program components that intervene directly on older homecare clients, revising program materials offered to staff, and clarifying roles and responsibilities of staff involved in the implementation, may lead to an optimized program and require further research.

Why Does this Paper Matter?

Integrating reablement in homecare may support older adults to remain active and independent in daily life, but this requires staff training and ongoing support. "Stay Active at Home" is a systematically developed and comprehensive reablement training program for homecare staff to reduce older adults' sedentary behavior. This c-RCT showed no beneficial effects for "Stay Active at Home" compared to usual care. Refining the training program could benefit its effectiveness.

(physical) functioning, increase or maintain their independence in meaningful activities of daily living, and reduce their need for long-term services.[12] The effect of reablement interventions on sedentary behavior has not yet been investigated,[13] and research of varying methodological quality[14] has yielded inconsistent findings on other outcomes, such as daily,[15–17] physical,[18–20] and psychological functioning,[21,22] and falls.[23,24] This highlights the need for more methodologically robust trials to support or refute the effectiveness of reablement.

Working with reablement can be challenging, due to a lack of staff knowledge, willingness, and skills to adopt a "reabling" approach, or to resistance from clients or their social network.[25] Not surprisingly, previous research has emphasized that providing reablement services require staff training and ongoing supervision.[26,27] Currently, however, there is little information on staff training and on the effects of training programs on staff and client outcomes.[28] Evaluation of reablement training programs can provide valuable insights into their effectiveness and inform the development or optimization of other reablement training programs and interventions.

The Dutch reablement training program "Stay Active at Home" (SAaH) was designed to equip homecare staff with knowledge, attitude, and skills on reablement, and to provide social and organizational support to implement reablement in daily practice, thereby reducing clients' sedentary behavior and improving their independence.[29] A previous pilot study and an exploratory trial showed promising findings regarding the feasibility of SAaH in the Dutch homecare setting.[29,30] Furthermore, a process evaluation revealed that staff generally accepted the program, experienced positive changes in their knowledge, attitude, and skills about reablement, and perceived social and organizational support to implement reablement.[31] This cluster randomized controlled trial (c-RCT) aimed to evaluate the effectiveness of SAaH on older homecare clients' sedentary behavior (primary outcome), and daily functioning, physical functioning, psychological functioning, and falls (secondary outcomes).

METHODS

Study design

This c-RCT was conducted between September 2017 and July 2019 in a Dutch healthcare organization in the Netherlands. Ten nursing teams from five working areas (two teams per area) were pre-stratified based on area and randomized into the intervention or control group, together with their clients and, if applicable, clients' domestic workers. The study protocol was approved by the Dutch Medical Research Committee Zuyderland (METC #17N110) and is registered at ClinicalTrials.gov (Identifier NCT03293303). Details of the study design and sample size calculation were reported elsewhere.[32] The reporting follows the guidelines of the CONSORT extension for Cluster Trials statement.[33]

Setting

The healthcare organization has divided its region into seven working areas that are subdivided into small-scale self-directed nursing teams with on average 11 teams per area. Each team consists of about 10 staff members (i.e., baccalaureate-educated and vocationally-trained registered nurses, [certified] nurse assistants, and nurse aides) who provide personal and nursing care, often through short visits to clients several times a week. One of the nurses on the team, the district nurse, has a more supervising and coordinating role. Domestic support is provided by domestic workers; they usually visit clients once per week for multiple hours. In the Netherlands, physical and occupational therapists are not routinely involved in providing homecare.

Participants

Clients were eligible to participate in the study if they received homecare services from one of the selected nursing teams and were ≥65 years of age.[32] Clients who were terminally ill or bedbound, had serious cognitive or psychological problems, or were unable to communicate in Dutch were excluded. All participating clients provided written informed consent and were blinded to treatment assignment.

Intervention

SAaH is a systematically developed and comprehensive reablement training program to equip homecare staff with knowledge, attitude, and skills on reablement and to provide social and organizational support to integrate reablement in homecare practice. It consists of program meetings, practical assignments in-between meetings, and 20 weekly newsletters. Program meetings are divided into a kick-off meeting (120 min), (bi-)monthly team meetings over a 6-month period (60 min each), and a booster session at 9 months (120 min). The kick-off describes why a re-orientation of homecare is needed (*knowledge*). Each team meeting addresses a skill to facilitate the use of reablement in practice: (1) motivating

clients, (2) increasing clients' engagement in daily and physical activities, (3) implementing goal setting and action planning, (4) involving the social network of clients, and (5) assessing clients' capabilities. Each team meeting starts with discussing the practical assignment and stimulating staff to provide each other feedback (*social support*), followed by a presentation about the addressed skill (*knowledge*), and a skills training including interactive teaching methods (*skills*) and using continuous motivation, mentoring and Bandura's self-efficacy theory to improve staff's self-efficacy and strengthen positive outcome expectations on reablement (*attitude*). In the booster session, staff practice conversational skills in role-plays with professional actors (*skills*). Team managers are also invited to participate in program meetings and also receive the newsletters (*organizational support*). A full description of the program, its underlying assumptions, and the intended results for staff and clients have been published elsewhere.[29]

Implementation

The intervention group consisted of 169 staff members of whom 154 agreed to participate in the training program. On average, they attended 73.4% of the program meetings, conducted 56.7% of the practical assignments, and consulted 56.6% of the weekly newsletters; although, compliance differed across working areas (Table S1). Due to staff turnover, there were 14 dropouts (9.1%). Because SAaH was integrated into usual homecare, the district nurse set goals and action plans with the client, and as much as possible in consultation with the rest of the team. More information on the program's implementation can be found elsewhere.[31] Control group staff ($n = 159$) received no training and delivered care as usual.

Data collection

All outcomes were measured at baseline and at 12 months. To reduce the risk of recall bias, data on falls were also measured at 6 months. Data were collected through accelerometers, paper questionnaires, and physical performance tests by trained researchers or research assistants at the participants' homes following standardized protocols.

Baseline characteristics

The following baseline characteristics were collected: age, sex, body mass index, country of origin, educational level, marital status, and living situation. Furthermore, disability in (instrumental) activities of daily living ((I) ADLs) was measured with the Groningen Activity Restriction Scale (GARS).[34] Types of homecare received (i.e., personal care, nursing care and domestic support) and duration of homecare received (in years) were retrieved from client records.

Primary outcome measure

Sedentary time was assessed with tri-axial wrist-worn accelerometers (ActiGraph GT9X Link, ActiGraph Inc.). Participants were instructed to wear the accelerometer on the nondominant wrist for 24 h/day for seven consecutive days (excluding days on which the accelerometer was distributed and retrieved). Placement on the dominant wrist was allowed if nondominant placement would interfere with other monitoring equipment. Raw acceleration data were collected at 30 Hz and aggregated to 60-s epochs using ActiLife version 6.13.4. Activity counts per minute (counts/min) were derived for each axis and for the composite measure of the three axes, known as vector magnitude. Sequentially, we identified sleep time, nonwear time, and wake/wear time before calculating sedentary time. Sleep time and nonwear time were determined using the Cole-Kripke Sleep Scoring algorithm[35] and the Choi Wear Time algorithm, respectively.[36] Remaining minutes were labeled wake/wear time. Sedentary time during wake/wear time was determined using vector magnitude cut-points of Koster et al.[37]: <1853 counts/min for the nondominant wrist and <2303 counts/min for the dominant wrist. Sedentary time was defined in two ways: (1) average daily minutes and (2) average proportion of wake/wear time to ensure comparability across participants with different wake/wear times (in both cases averaging across days within each participant). Average vector magnitude counts/min were also obtained.

Secondary outcome measures

Daily functioning in (I)ADL was assessed using the GARS (score range 18–72).[34] Physical functioning was assessed using the short physical performance battery (SPPB) (score range 0–12), consisting of balance tests, a gait speed test, and a repeated chair stand test.[38] Psychological functioning was assessed using the Patient Health Questionnaire-9 (PHQ-9) (score range 0–27).[39] Falls were included to monitor for a potentially negative impact of increasing physical activity and were assessed using the following question: "How often did you fall during the past six months?"[40] Despite our intention,[32] the

LASA Sedentary Behavior Questionnaire was not used because many participants experienced difficulties answering its questions, which led us to question the reliability of the data.[41]

Statistical methods

Descriptive data are shown as means (standard deviations) or as frequencies (percentages). Data were analyzed according to the intention-to-treat principle on condition that participants had ≥1 valid accelerometer wear day of ≥10 h/day of wake/wear time. Missing values were imputed using mean imputation.[32] Mixed linear regression was applied for all outcomes to analyze the difference in changes between the study groups over time using restricted maximum likelihood estimation (except for falls, which, due to excessive zeros, was dichotomized as 1 (≥1 fall in the past 6 months) and 0 (no fall), and analyzed with logistic regression). By design, our data structure consists of three levels (repeated measures nested in clients nested in nursing teams). However, results are presented based on two-level models with adjustment for working area as the small sample size of the third level (only 10 nursing teams) led to instability of the random effect parameters. In all models, an unstructured residual variance–covariance matrix was assumed for the repeated outcome measures to allow change in outcome variance over time. Treatment, time, and treatment × time interaction together with working area and baseline covariates age, sex, educational level, disability, and duration of homecare were included in the models as fixed factors, irrespective of their statistical significance; participants were specified as random factors. To assess the robustness of results, we also ran the models with additional adjustment for the baseline status of the outcome variables.

Subgroup and sensitivity analyses

The three-way interactions of treatment, time, and the covariates that were included in the model were tested using a hierarchical approach to variables' selection. If a significant three-way interaction was detected, subgroup analyses were conducted with subgroups based on the covariate that interacted with treatment × time. Furthermore, we performed a sensitivity analysis for the primary outcome, including only participants with ≥5 valid accelerometer wear days.[42] Data were analyzed with SPSS version 25.0 (IBM Corp.) and SAS version 9.4 (SAS Institute Inc.). The significance threshold was set at 0.05 (two-tailed tests). For details on the model building strategy, see Appendix S1.

RESULTS

Participant flow and baseline characteristics

Of the 742 clients screened for eligibility, 290 were not eligible (main reason: serious cognitive/psychological problems), 156 declined to participate, and 32 dropped out before baseline measurements, resulting in 264 clients who agreed to participate and were measured at baseline (133 intervention and 131 control group participants) (Figure 1). Participants' mean age was 82.1 (SD 6.9) years, 67.8% were female, and 67.4% had a low educational level (Table 1). During the study, 63 participants (23.9%) dropped out. Dropouts were significantly less physically active, had worse daily, physical, and psychological functioning, and fell more often at baseline than study completers (Table S2). Dropouts' characteristics, dropout rates, and reasons for dropout were comparable between study groups.

Primary outcomes

Of the participants, 245 (92.8%) had ≥1 valid accelerometer wear day and were included in the primary data analysis (on average, participants had 7.0 ± 1.7 valid days). Between baseline and 12 months, there was no statistically significant difference between the study groups for sedentary time expressed as daily minutes (adjusted mean difference: β 18.5 (95% confidence intervals [CI] −22.4, 59.3), $p = 0.374$) and for sedentary time as proportion of wake/wear time (β 0.6 [95% CI −1.5, 2.6], $p = 0.589$) (Table 2). Re-running the analyses with additional adjustment for the baseline status of the outcome variables yielded comparable results (data not shown).

Secondary outcomes

We observed a statistically significant difference in favor of the control group in the overall SPPB score and in the gait speed subscale (β −0.6 (95% CI −1.1, −0.1), $p = 0.028$ and β −0.3 (95% CI −0.5, −0.0), $p = 0.030$, respectively) (Table 3). For the remaining secondary outcomes, no differences were observed. Tables S3 and S4 show the full models' results for the primary and secondary outcomes.

Subgroup and sensitivity analyses

For vector magnitude in counts/min, a three-way interaction between treatment, time, and disability was observed

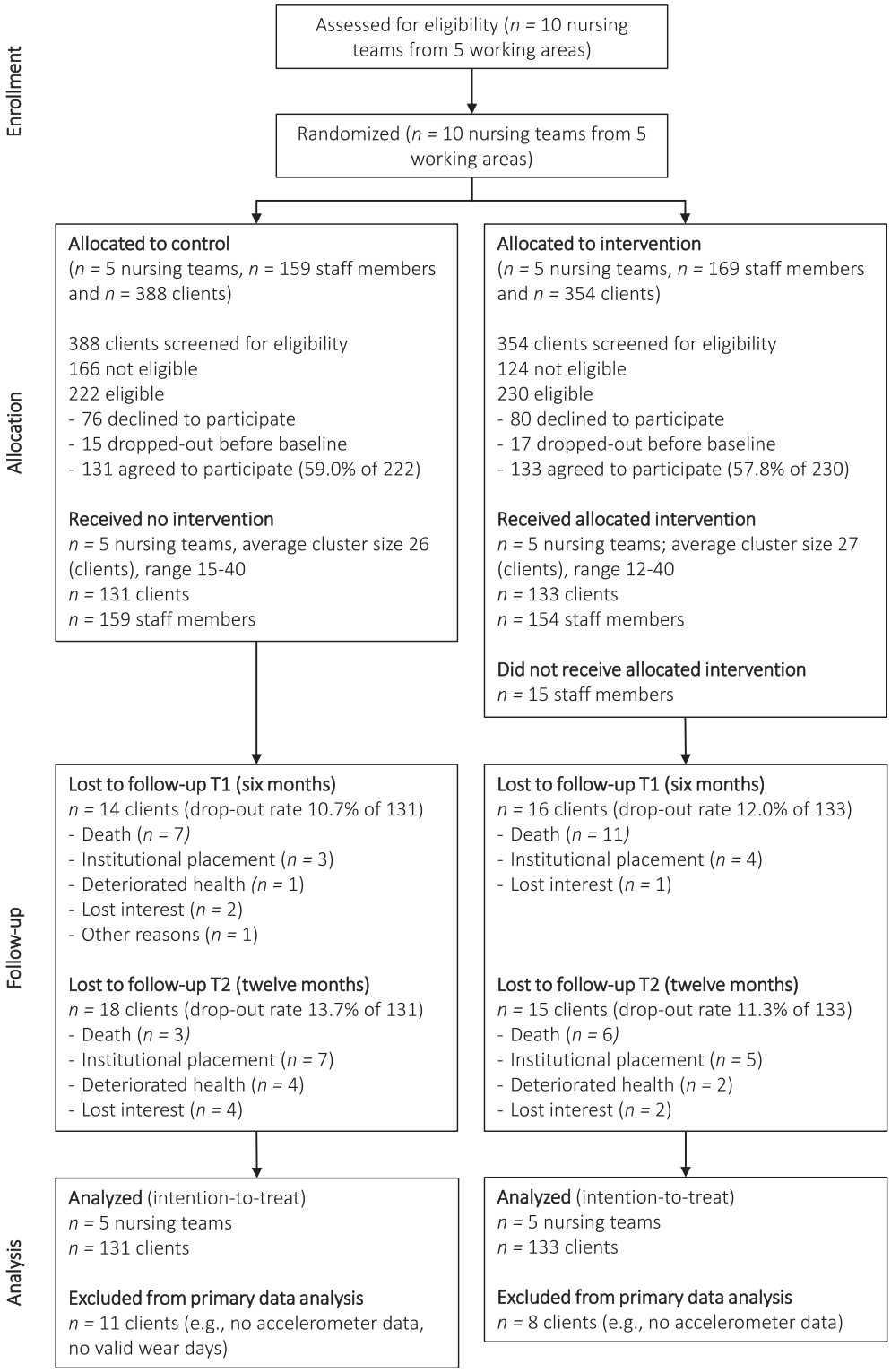

FIGURE 1 Flow diagram of participants of the "Stay Active at Home" intervention

($p = 0.025$) (Figure 2A). Subgroup analysis by median disability showed no statistically significant differences between the study groups. For daily functioning in IADL, a three-way interaction between treatment, time, and working area was observed ($p = 0.019$) (Figure 2B). Subgroup analysis by working area showed a statistically significant treatment effect in favor of the intervention group for working area 2 at 12 months (β 3.7 [95% CI 0.0, 7.4], $p = 0.050$). These are weak indications only, given multiple testing.

The results of the sensitivity analysis including only participants with ≥5 valid accelerometer wear days ($n = 236$, 89.4%) did not substantially differ from those of the intention-to-treat analysis for sedentary time

TABLE 1 Baseline characteristics of participants in the control and intervention groups ($N = 264$)

	Control group ($n = 131$)	Intervention group ($n = 133$)
Age (years), mean (SD)	81.5 (7.0)	82.7 (6.8)
Sex (male), *n* (%)	38 (29.0)	47 (35.3)
BMI (kg/m^2), mean (SD)[a]	28.6 (5.8)	29.2 (6.1)
Country of origin (The Netherlands), *n* (%)	128 (97.7)	128 (96.2)
Educational level, *n* (%)[b]		
Low	85 (64.9)	93 (69.9)
Intermediate	33 (25.2)	31 (23.3)
High	13 (9.9)	9 (6.8)
Marital status, *n* (%)		
Single	7 (5.3)	8 (6.0)
Married	41 (31.3)	29 (21.8)
Divorced	13 (9.9)	8 (6.0)
Widowed	70 (53.4)	88 (66.2)
Living situation (living alone), *n* (%)	86 (65.6)	97 (72.9)
Disability (18–72), mean (SD)[c]	41.6 (10.6)	41.7 (10.6)
Duration of homecare (years), mean (SD)	5.4 (5.4)	5.8 (5.4)
Types of homecare received, *n* (%)		
Personal care	114 (87.0)	118 (88.7)
Nursing care	69 (52.7)	66 (49.6)
Domestic support	73 (55.7)	78 (58.6)

Note. n: sample size; SD, standard deviation; BMI, body mass index; kg/m^2, kilogram per square meter.

[a]Control group $n = 126$, intervention group $n = 126$.

[b]Low: low vocational or advanced elementary education; Intermediate: intermediate vocational or higher secondary education; High: higher vocational education, university.

[c]Underlined score indicates the most favorable score.

expressed as daily minutes (β 21.4 [95% CI −20.0, 62.8], $p = 0.309$) and for sedentary time as proportion of wake/wear time (β 0.7 [95% CI −1.3, 2.8], $p = 0.482$).

DISCUSSION

This study evaluated the effectiveness of the reablement training program SAaH for homecare staff on older homecare clients' outcomes (i.e., sedentary behavior, daily, physical, and psychological functioning, and falls). Our c-RCT showed no evidence for differences between the study groups for any of these outcomes, except for a significant improvement in physical functioning (in the overall SPPB score and in the gait speed subscale) in the control compared to the intervention group.

To our knowledge, this is the first study that investigated the effect of a reablement training program on sedentary behavior. Encouragement by homecare staff was assumed to lead to increased activity throughout the day and reduced sedentariness among homecare clients. Nevertheless, despite slightly less sedentary behavior for the intervention group after 12 months, our trial showed no statistically significant between-group differences. According to several (systematic) reviews, other interventions, not primarily focused on reablement or embedded in homecare, have reduced sedentary behavior in (older) adults.[43–48] These interventions varied substantially regarding their components and delivery methods, but focused on improving physical activity or reducing sedentary time,[43–48] or on self-monitoring or digital technology to change behavior.[46–48] Noteworthy is that in all (systematic) reviews, a need for studies with higher methodological quality was emphasized, including larger trials with longer follow-up, with health outcomes relevant for older people, and with study populations representing the less healthy older people.[43–48] These needs were incorporated in our trial evaluating SAaH; however, where SAaH targeted older adults via the behavior of staff, previous research directly targeted (older) adults' behavior.[43–48] Therefore, supplementing SAaH with program components that directly intervene on homecare clients may increase its effectiveness.

Regarding the secondary outcomes, we observed no beneficial effects in favor of the intervention group in the current study. A systematic review on reablement interventions in older adults receiving homecare reported that about half of the studies showed improvements in daily and physical functioning, a few studies showed reductions in falls, and hardly any study showed improvements in psychological functioning.[28] Several reasons may explain the differences in findings between the current study and previous research. First, as a reablement training program integrated into usual homecare, staff were stimulated to incorporate the new philosophy of homecare delivery in their daily practice. SAaH provided practical examples, showing, for example, that while using a regular care plan, one can talk with a client about the importance of physical activity and what goals the client would be interested in setting. In contrast to other reablement programs that showed effective in physical functioning,[18,19] SAaH did not introduce new assessment forms or goalsetting instruments, specify staff roles and responsibilities regarding the practical application of reablement, and let clients set their own goals. Incorporating these elements in SAaH may lead to

TABLE 2 Estimated means with 95% confidence intervals per study group per time point, adjusted mean difference (β for treatment × time interaction) with 95% confidence intervals, and *p*-values for the primary outcomes

	Time, *T*	Control group, mean (95% CI)	Intervention group, mean (95% CI)	Adjusted mean difference, β (95% CI)	*p*-Value
Sedentary behavior					
Sedentary time (daily minutes)	T0	836.6 (800.2, 873.1)	799.1 (760.8, 837.4)		
	T2	827.6 (786.1, 869.2)	808.6 (764.8, 852.3)	18.5 (−22.4, 59.3)	0.374
Sedentary time (proportion of wake/wear time)	T0	76.1 (74.0, 78.2)	74.1 (71.9, 76.3)		
	T2	77.5 (75.1, 79.8)	76.0 (73.5, 78.5)	0.6 (−1.5, 2.6)	0.589
Vector magnitude (counts/min)	T0	1156.4 (1063.6, 1249.2)	1234.1 (1136.5, 1331.7)		
	T2	1138.6 (1022.2, 1254.9)	1154.1 (1031.9, 1276.3)	−62.1 (−186.2, 61.9)[a]	0.324

Note: The treatment × time effects of the multivariable two-level mixed linear regression models are adjusted for baseline age, sex, educational level, disability, and duration of homecare (covariance structure: unstructured). Treatment: control group is reference. Time: baseline is reference. T0 (baseline); T2 (12 months); 95% CI (95% confidence interval).

[a]Two-way interactions "time × disability" and "time × duration of homecare" were significant ($p = 0.042$ and $p = 0.016$, respectively).

better guiding and motivating staff and clients toward the new behavior. Second, SAaH involved homecare staff only (nurses, nurse assistants, nurse aides, and domestic workers), yet a multidisciplinary approach was applied in other reablement programs, involving for instance, occupational therapists, social workers, and physical therapists.[49] This may increase client exposure to reablement and foster cooperation and application of professional expertise and judgment.[50] Third, we made no distinction between newly referred clients and those who have been used to staff taking over care tasks for at least a time. As reablement seems to be most beneficial for newly referred clients,[26,51] clients receiving ongoing support may have been less inclined to change their behavior due to habituation. Fourth, the current study used objective and validated, but generic outcome measures, such as accelerometers, to be able to capture the full range of activities throughout the day and to detect small differences in client's activity level. In contrast, previous research sometimes used more tailored, subjective outcome measures focusing on clients' perceived difficulty and satisfaction in completing activities, and goal-setting interviews to identify and monitor outcomes prioritized by clients.[52] Lastly, the contrast between SAaH and usual homecare may have been too small to elicit substantial effects because healthcare delivery in the Netherlands is at a relatively high standard,[53] and independence has likely been encouraged in both study groups as the healthcare organization involved in the current study has a leadership position in this domain.

Changing care and the manifestation of its potential impact requires a major paradigm shift from both homecare staff and their clients. A 1-year time window may not suffice to bring about change at both levels. This is in line with findings of the earlier process evaluation that staff experienced positive changes in their knowledge, attitude, and skills about reablement, and perceived social and organizational support to implement reablement, but still considered it challenging to integrate reablement into their way of working.[31] More time and effort may be needed to change the behavior of both staff and clients to allow for a more adequate evaluation of how these changes impact health outcomes (both in terms of improving function and reducing the rate of decline in function). Adjustments to SAaH, such as adding components that directly intervene on clients, revising program materials, and clarifying roles and responsibilities of staff involved in the implementation, may optimize the program and require further research. In addition, since the potential of reablement is likely to be influenced by wider health and social care services, policy incentives to regain activity and self-care capabilities may warrant attention.

A strength of the study was that SAaH was embedded within a healthcare organization, reflecting a real-life setting. Additionally, to maximize the reliability of the data, a mix of performance-based and self-reported outcome measures with good psychometric properties was used. Clients were highly compliant with wearing the accelerometer. A limitation, however, is that the wrist may not have been the most suitable placement to measure sedentary time—this would require a thigh-worn accelerometer taped on the skin, which is more invasive, especially for older adults with fragile skin. The wrist-worn meter may have underestimated

TABLE 3 Estimated means with 95% confidence intervals per study group per time point, adjusted mean difference (β for treatment × time interaction) with 95% confidence intervals, and *p*-values for the secondary outcomes

	Time, *T*	Control group, mean (95% CI)	Intervention group, mean (95% CI)	Adjusted mean difference, β (95% CI)	*p*-Value
Daily functioning					
GARS (18–72)	T0	41.5 (39.4, 43.7)	40.8 (38.5, 43.0)		
	T2	42.8 (40.5, 45.0)	40.9 (38.6, 43.2)	−1.1 (−2.9, 0.8)	0.252
GARS ADL (11–44)	T0	21.4 (20.2, 22.6)	21.1 (19.8, 22.3)		
	T2	21.7 (20.4, 23.0)	20.8 (19.4, 22.1)	−0.6 (−1.7, 0.5)[a]	0.267
GARS IADL (7–28)	T0	19.0 (18.0, 20.1)	18.5 (17.4, 19.7)		
	T2	20.0 (18.9, 21.0)	19.0 (17.9, 20.1)	−0.4 (−1.4, 0.6)	0.406
Physical functioning					
SPPB (0–12)	T0	4.2 (3.7, 4.6)	4.3 (3.8, 4.8)		
	T2	4.4 (4.0, 4.9)	3.9 (3.4, 4.5)	−0.6 (−1.1, −0.1)[b]	0.028*
SPPB balance (0–4)	T0	2.0 (1.7, 2.2)	2.1 (1.9, 2.4)		
	T2	2.1 (1.9, 2.4)	2.0 (1.7, 2.2)	−0.3 (−0.6, 0.0)	0.076
SPPB gait speed (0–4)	T0	1.7 (1.5, 1.9)	1.7 (1.5, 1.9)		
	T2	1.8 (1.6, 2.0)	1.6 (1.3, 1.8)	−0.3 (−0.5, −0.0)[c]	0.030*
SPPB chair stand (0–4)	T0	0.5 (0.4, 0.7)	0.5 (0.3, 0.6)		
	T2	0.6 (0.4, 0.7)	0.4 (0.2, 0.6)	−0.1 (−0.3, 0.1)	0.370
Psychological functioning					
PHQ-9 (0–27)[e]	T0	1.8 (1.6, 1.9)	1.7 (1.6, 1.9)		
	T2	1.6 (1.4, 1.8)	1.5 (1.3, 1.7)	0.0 (−0.2, 0.2)	0.948
Falls					
≥1 fall in the past 6 months, *n* (%)	T0	50 (38.2)	57 (42. 9)		
	T1	37 (28.2)	42 (31.6)	−0.0 (−0.7, 0.6)	0.930
	T2	27 (20.6)	36 (27.1)	0.0 (−0.7, 0.7)[d]	0.951

Note: The treatment × time effects of the multivariable two-level mixed linear and logistic regression models are adjusted for baseline age, sex, educational level, disability, and duration of homecare (covariance structure: unstructured). Treatment: control group is reference. Time: baseline is reference. T0, baseline; T1, 6 months; T2, 12 months; 95% CI, 95% confidence interval; GARS, Groningen Activity Restriction Scale; ADL, activities of daily living; IADL, instrumental activities of daily living; PHQ-9, Patient Health Questionnaire-9; SPPB, short physical performance battery. Underlined score indicates the most favorable score.

[a]Two-way interaction "time × duration of homecare" was significant ($p = 0.040$).

[b]Two-way interaction "time × disability" was significant ($p = 0.043$).

[c]Two-way interaction "time × age" was significant ($p = 0.030$).

[d]Two-way interactions "time × duration of homecare" and "time × disability" were significant ($p = 0.030$, $p = 0.012$, respectively).

[e]Ln ($x + 1$).

*$p \leq 0.05$.

sedentary time by misclassifying sole movements of the upper body as nonsedentary. This was, however, not considered problematic for the scope of this research, as it affected both groups in the same way. Moreover, dropouts resulted in missing data. Because dropout rates were comparable across study groups, comparisons are likely not biased. However, as dropouts had more vulnerable health, a misrepresentation of the estimated means in both groups cannot be ruled out. Lastly, results cannot be generalized to other populations due to the use of two-level multivariable models in which working area was treated as fixed effect instead of nursing team as random effect.

To conclude, we observed no evidence for the effectiveness of the SAaH reablement training program for homecare staff on sedentary behavior; daily, physical, and psychological functioning; and falls in older homecare clients. Further research should examine the effectiveness of combined SAaH staff training and client intervention on staff and client outcomes (in terms of

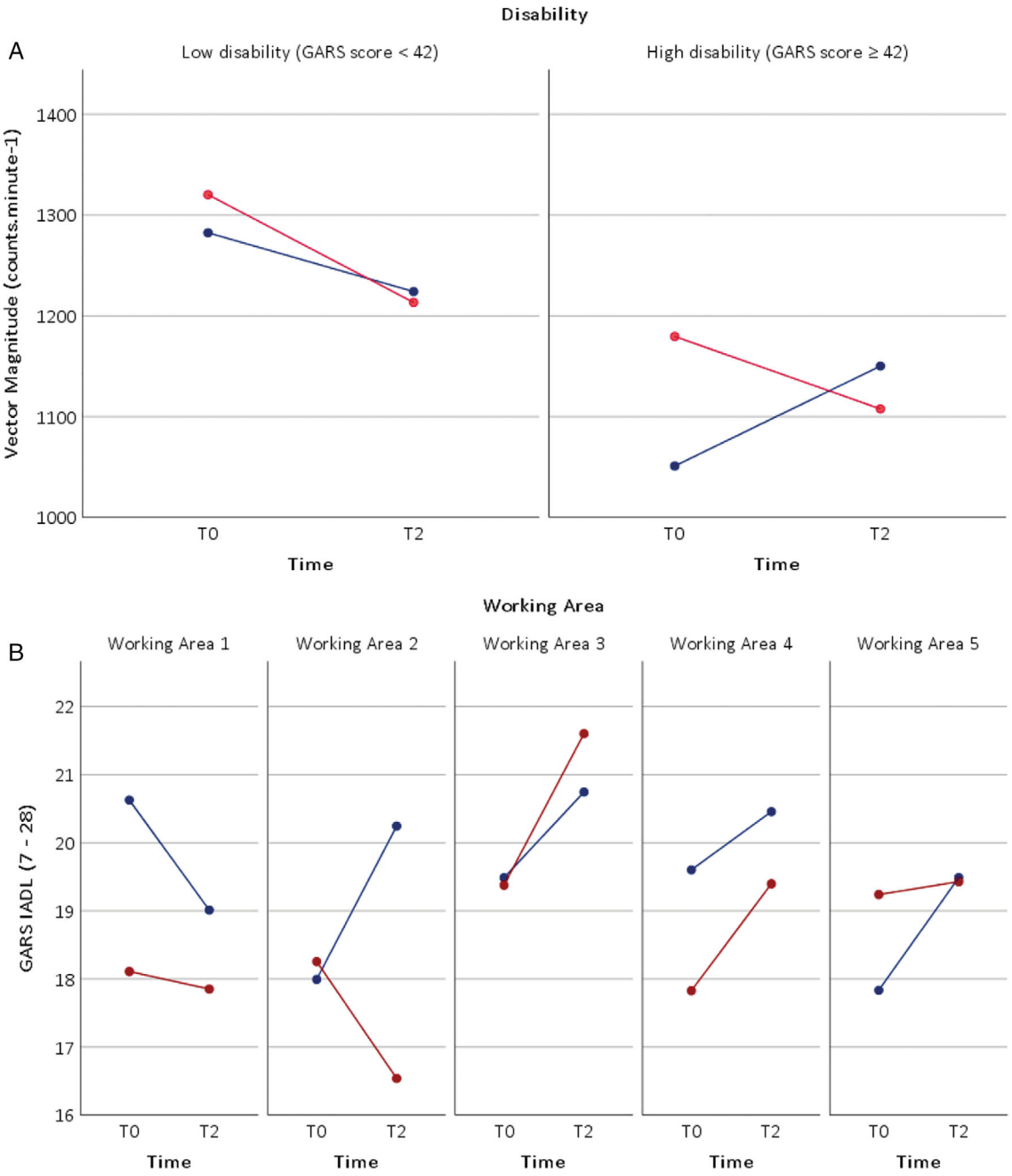

FIGURE 2 Graphs of three-way interaction effects. The red line represents the intervention group; the blue line represents the control group. (A) Three-way interaction of treatment, time, and disability predicting vector magnitude (counts/min) based on the multivariable two-level model. Analyses by median disability showed no statistically significant differences between the study groups. (B) Three-way interaction of treatment, time, and working area predicting daily functioning in instrumental activities of daily living (GARS IADL, scale ranges from 7 to 28, underlined score indicates the most favorable score). Subgroup analyses by working area showed a statistically significant treatment effect in favor of the intervention group for working area 2 at 12 months (T2) ($p = 0.050$)

behavior and behavioral determinants) and cost-effectiveness. Moreover, questions remain regarding client groups that are likely to benefit the most from reablement, and the most appropriate outcome measures and assessment tools to measure relevant outcomes for reablement.

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Conflict of Interest

The authors have no conflicts.

Author Contributions

Teuni H. Rooijackers: Methodology, Software, Formal Analysis, Investigation, Data Curation, Writing — Original Draft, Visualization, Project Administration. Gertrudis I. J. M. Kempen: Conceptualization, Methodology, Funding Acquisition. G. A. Rixt Zijlstra: Conceptualization, Methodology, Writing — Review & Editing, Supervision, Funding Acquisition. Erik van Rossum: Conceptualization, Methodology, Writing — Review & Editing, Supervision, Funding Acquisition. Annemarie Koster: Methodology, Software, Writing — Review & Editing. Valéria Lima Passos: Software, Formal Analysis, Data Curation, Writing — Review & Editing. Silke F. Metzelthin: Conceptualization, Methodology, Writing — Review & Editing, Supervision, Funding Acquisition. All authors have read and approved the manuscript.

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DATA AVAILABILITY STATEMENT

Individual participant data and data dictionaries that underlie the results reported in this article are available from the corresponding author on reasonable request after de-identification. Data will be available beginning 9 months and ending 36 months following article publication for researchers who provide a methodologically sound proposal to achieve aims in the approved proposal. Proposals should be directed to s.metzelthin@maastrichtuniversity.nl. To gain access, data requestors will need to sign a data access agreement.

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REFERENCES

1. United Nations, Department of Economic Social Affairs, Population Division. World population ageing 2019: highlights (St/Esa/Ser.A/430). 2019.
2. Organization for Economic Co-operation and Development. *Health at a Glance 2013: OECD Indicators*. Paris, France: OECD Publishing; 2013.
3. Rostgaard T, Glendinning C, Gori C, et al. *Livindhome: Living Independently at Home: Reforms in Home Care in 9 European Countries*. Copenhagen, Denmark: SFI-Danish National Centre for Social Research; 2011.
4. Wiles JL, Leibing A, Guberman N, Reeve J, Allen RES. The meaning of "aging in place" to older people. *Gerontologist*. 2012;52(3):357-366. https://doi.org/10.1093/geront/gnr098.
5. Paterson DH, Warburton DE. Physical activity and functional limitations in older adults: a systematic review related to Canada's physical activity guidelines. *Int J Behav Nutr Phys Act*. 2010;7(1):1-22. https://doi.org/10.1186/1479-5868-7-38.
6. Harvey JA, Chastin SF, Skelton DA. How sedentary are older people? A systematic review of the amount of sedentary behavior. *J Aging Phys Act*. 2015;23(3):471-487. https://doi.org/10.1123/japa.2014-0164.
7. Den Ouden M, Kuk NO, Zwakhalen SM, Bleijlevens MH, Meijers JM, Hamers JP. The role of nursing staff in the activities of daily living of nursing home residents. *Geriatr Nurs*. 2017;38(3):225-230. https://doi.org/10.1016/j.gerinurse.2016.11.002.
8. Oliver D, Foot C, Humphries R. *Making Our Health and Care Systems Fit for an Ageing Population*. London, England: King's Fund; 2014.
9. Resnick B, Boltz M, Galik E, Pretzer-Aboff I. *Restorative Care Nursing for Older Adults: A Guide for All Care Settings*. New York: Springer Publishing Company; 2012.
10. Chad KE, Reeder BA, Harrison EL, et al. Profile of physical activity levels in community-dwelling older adults. *Med Sci*

Sports Exerc. 2005;37(10):1774-1784. https://doi.org/10.1249/01.mss.0000181303.51937.9c.

11. Giné-Garriga M, Sandlund M, Dall PM, Chastin SF, Pérez S, Skelton DA. A novel approach to reduce sedentary behaviour in care home residents: the get ready study utilising service-learning and co-creation. *Int J Environ Res Public Health*. 2019;16(3):418. https://doi.org/10.3390/ijerph16030418.
12. Metzelthin SF, Rostgaard T, Parsons M, Burton E. Development of an internationally accepted definition of reablement: a Delphi study. *Ageing Soc*. 2020;1-16. https://doi.org/10.1017/S0144686X20000999.
13. Mjøsund HL, Moe CF, Burton E, Uhrenfeldt L. Integration of physical activity in reablement for community dwelling older adults: a systematic scoping review. *J Multidiscip Healthc*. 2020;13:1291-1315. https://doi.org/10.21203/rs.2.17945/v1.
14. Cochrane A, Furlong M, McGilloway S, Molloy DW, Stevenson M, Donnelly M. Time-limited home-care reablement services for maintaining and improving the functional independence of older adults. *Cochrane Database Syst Rev*. 2016;10(10):CD010825. https://doi.org/10.1002/14651858.CD010825.pub2.
15. Winkel A, Langberg H, Wæhrens EE. Reablement in a community setting. *Disabil Rehabil*. 2015;37(15):1347-1352. https://doi.org/10.3109/09638288.2014.963707.
16. Courtney MD, Edwards HE, Chang AM, et al. Improved functional ability and independence in activities of daily living for older adults at high risk of hospital readmission: a randomized controlled trial. *J Eval Clin Pract*. 2012;18(1):128-134. https://doi.org/10.1111/j.1365-2753.2010.01547.x.
17. Senior HE, Parsons M, Kerse N, et al. Promoting independence in frail older people: a randomised controlled trial of a restorative care service in New Zealand. *Age Ageing*. 2014;43(3):418-424. https://doi.org/10.1093/ageing/afu025.
18. Parsons JGM, Sheridan N, Rouse P, Robinson E, Connolly M. A randomized controlled trial to determine the effect of a model of restorative home care on physical function and social support among older people. *Arch Phys Med Rehabil*. 2013;94(6):1015-1022. https://doi.org/10.1016/j.apmr.2013.02.003.
19. Langeland E, Tuntland H, Folkestad B, Førland O, Jacobsen FF, Kjeken I. A multicenter investigation of reablement in Norway: a clinical controlled trial. *BMC Geriatr*. 2019;19(1):29. https://doi.org/10.1186/s12877-019-1038-x.
20. Burton E, Lewin G, Boldy D. Physical activity levels of older adults receiving a home care service. *J Aging Phys Act*. 2013;21(2):140-154. https://doi.org/10.1123/japa.21.2.140.
21. Melis RJ, van Eijken MI, Teerenstra S, et al. Multidimensional geriatric assessment: back to the future a randomized study of a multidisciplinary program to intervene on geriatric syndromes in vulnerable older people who live at home (Dutch Easycare study). *J Gerontol A Biol Sci Med Sci*. 2008;63(3):283-290. https://doi.org/10.1093/gerona/63.3.283.
22. Martin F, Oyewole A, Moloney A. A randomized controlled trial of a high support hospital discharge team for elderly people. *Age Ageing*. 1994;23(3):228-234. https://doi.org/10.1093/ageing/23.3.228.
23. Whitehead PJ, Walker MF, Parry RH, Latif Z, McGeorge ID, Drummond AE. Occupational therapy in homecare reablement services (others): results of a feasibility randomised controlled trial. *BMJ Open*. 2016;6(8):e011868. https://doi.org/10.1136/bmjopen-2016-011868.
24. Comans TA, Brauer SG, Haines TP. Randomized trial of domiciliary versus center-based rehabilitation: which is more effective in reducing falls and improving quality of life in older fallers? *J Gerontol A Biol Sci Med Sci*. 2010;65(6):672-679. https://doi.org/10.1093/gerona/glq054.
25. Beresford B, Mann R, Parker G, et al. Work package 2b: delivering reablement–practitioner views. Reablement services for people at risk of needing social care: the more mixed-methods evaluation. *NIHR Journals Library*. 2019;7(16):51-59. https://doi.org/10.3310/hsdr07160.
26. Social Care Institute For Excellence. *SCIE Guide 49: Maximising the Potential of Reablement*. London, England: Social Care Institute For Excellence; 2013.
27. Rabiee P, Glendinning C. Organisation and delivery of home care re-ablement: what makes a difference? *Health Soc Care Community*. 2011;19(5):495-503. https://doi.org/10.1111/j.1365-2524.2011.01010.x.
28. Sims-Gould J, Tong CE, Wallis-Mayer L, Ashe MC. Reablement, reactivation, rehabilitation and restorative interventions with older adults in receipt of home care: a systematic review. *J Am Med Dir Assoc*. 2017;18(8):653-663. https://doi.org/10.1016/j.jamda.2016.12.070.
29. Metzelthin SF, Zijlstra GAR, Van Rossum E, et al. "Doing with..." rather than "doing for..." older adults: rationale and content of the "stay active at home" programme. *Clin Rehabil*. 2017;31(11):1419-1430. https://doi.org/10.1177/0269215517698733.
30. Smeets RGM, Kempen GIJM, Zijlstra GAR, et al. Experiences of home-care workers with the "stay active at home" programme targeting reablement of community-living older adults: an exploratory study. *Health Soc Care Community*. 2020;28(1):291-299. https://doi.org/10.1111/hsc.12863.
31. Rooijackers TH, Zijlstra GAR, van Rossum E, et al. Process evaluation of a reablement training program for homecare staff to encourage independence in community-dwelling older adults. *BMC Geriatr*. 2020;21(1):1-15. https://doi.org/10.1186/s12877-020-01936-7.
32. Metzelthin SF, Rooijackers TH, Zijlstra GAR, et al. Effects, costs and feasibility of the "stay active at home" reablement training programme for home care professionals: study protocol of a cluster randomised controlled trial. *BMC Geriatr*. 2018;18(1):276. https://doi.org/10.1186/s12877-018-0968-z.
33. Campbell MK, Piaggio G, Elbourne DR, Altman DG. Consort 2010 statement: extension to cluster randomised trials. *BMJ*. 2012;345:e5661. https://doi.org/10.1136/bmj.e5661.
34. Kempen GI, Miedema I, Ormel J, Molenaar W. The assessment of disability with the Groningen activity restriction scale. Conceptual framework and psychometric properties. *Soc Sci Med*. 1996;43(11):1601-1610. https://doi.org/10.1016/s0277-9536(96)00057-3.
35. Cole RJ, Kripke DF, Gruen W, Mullaney DJ, Gillin JC. Automatic sleep/wake identification from wrist activity. *Sleep*. 1992;15(5):461-469. https://doi.org/10.1093/sleep/15.5.461.
36. Choi L, Liu Z, Matthews CE, Buchowski MS. Validation of accelerometer wear and nonwear time classification algorithm. *Med Sci Sports Exerc*. 2011;43(2):357. https://doi.org/10.1249/MSS.0b013e3181ed61a3.
37. Koster A, Shiroma EJ, Caserotti P, et al. Comparison of sedentary estimates between Activpal and hip-and wrist-worn

Actigraph. *Med Sci Sports Exerc*. 2016;48(8):1514. https://doi.org/10.1249/MSS.0000000000000924.
38. Guralnik J, Simonsick E, Ferrucci L, Glynn R, Berkman L, Blazer D. A short physical performance battery assessing lower extremity function: association with self reported disability and prediction of mortality and nursing home admission. *J Gerontol*. 1994;42(2):85-94. https://doi.org/10.1093/geronj/49.2.M85.
39. Spitzer RL, Kroenke K, Williams JB, Group PHQPCS. Validation and utility of a self-report version of prime-md: the Phq primary care study. *JAMA*. 1999;282(18):1737-1744. https://doi.org/10.1001/jama.282.18.1737.
40. Zijlstra GAR. *Managing Concerns About Falls: Fear of Falling and Avoidance of Activity in Older People*. Maastricht, The Netherlands: Maastricht University; 2007.
41. Visser M, Koster A. Development of a questionnaire to assess sedentary time in older persons—a comparative study using accelerometry. *BMC Geriatr*. 2013;13(1):80. https://doi.org/10.1186/1471-2318-13-80.
42. Sasaki JE, Júnior JH, Meneguci J, et al. Number of days required for reliably estimating physical activity and sedentary behaviour from accelerometer data in older adults. *J Sports Sci*. 2018;36(14):1572-1577. https://doi.org/10.1080/02640414.2017.1403527.
43. Aunger JA, Doody P, Greig CA. Interventions targeting sedentary behavior in non-working older adults: a systematic review. *Maturitas*. 2018;116:89-99. https://doi.org/10.1016/j.maturitas.2018.08.002.
44. Copeland JL, Ashe MC, Biddle SJH, et al. Sedentary time in older adults: a critical review of measurement, associations with health, and interventions. *Br J Sports Med*. 2017;51(21):1539. https://doi.org/10.1136/bjsports-2016-097210.
45. Shrestha N, Grgic J, Wiesner G, et al. Effectiveness of interventions for reducing non-occupational sedentary behaviour in adults and older adults: a systematic review and meta-analysis. *Br J Sports Med*. 2019;53(19):1206-1213. https://doi.org/10.1136/bjsports-2017-098270.
46. Elavsky S, Knapova L, Klocek A, Smahel D. Mobile health interventions for physical activity, sedentary behavior, and sleep in adults aged 50 years and older: a systematic literature review. *J Aging Phys Act*. 2019;27(4):565-593. https://doi.org/10.1123/japa.2017-0410.
47. Stockwell S, Schofield P, Fisher A, et al. Digital behavior change interventions to promote physical activity and/or reduce sedentary behavior in older adults: a systematic review and meta-analysis. *Exp Gerontol*. 2019;120:68-87. https://doi.org/10.1016/j.exger.2019.02.020.
48. Compernolle S, DeSmet A, Poppe L, et al. Effectiveness of interventions using self-monitoring to reduce sedentary behavior in adults: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. 2019;16(1):63. https://doi.org/10.1186/s12966-019-0824-3.
49. Ryburn B, Wells Y, Foreman P. Enabling independence: restorative approaches to home care provision for frail older adults. *Health Soc Care Community*. 2009;17(3):225-234. https://doi.org/10.1111/j.1365-2524.2008.00809.x.
50. Hjelle KM, Skutle O, Førland O, Alvsvåg H. The reablement team's voice: a qualitative study of how an integrated multidisciplinary team experiences participation in reablement. *J Multidiscip Healthc*. 2016;9:575. https://doi.org/10.2147/JMDH.S115588.
51. Tessier A, Beaulieu M-D, Mcginn CA, Latulippe R. Effectiveness of reablement: a systematic review. *Healthc Policy*. 2016;11(4):49. https://doi.org/10.12927/hcpol.2016.24594.
52. Beresford B, Mayhew E, Duarte A, et al. Outcomes of reablement and their measurement: findings from an evaluation of English reablement services. *Health Soc Care Community*. 2019;27(6):1438-1450. https://doi.org/10.1111/hsc.12814.
53. Kroneman M, Boerma W, van den Berg M, Groenewegen P, de Jong J, van Ginneken E. *The Netherlands: Health System Review. Health System in Transition*. Kopenhagen: WHO Regional Office for Europe; 2016.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

Appendix S1: Technical details of the model building strategy.

Table S1: Homecare staff's average compliance with the program components stratified by working area.

Table S2: Baseline characteristics of study completers and dropouts ($N = 264$).

Table S3: Estimated fixed effect parameters and residual variance–covariance matrices of the multivariable two-level models for the primary outcomes.

Table S4: Estimated fixed effect parameters and residual variance–covariance matrices of the multivariable two-level models for the secondary outcomes.

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