Health-Promoting Interventions for Persons Aged 80 and Older Are Successful in the Short Term—Results from the Randomized and Three-Armed Elderly Persons in the Risk Zone Study

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OBJECTIVES: To examine the outcomes of the Elderly Persons in the Risk Zone study, which was designed to evaluate whether it is possible to delay deterioration if a health-promoting intervention is made when an older adult (≥ 80) is at risk of becoming frail and whether a multiprofessional group intervention is more effective in delaying deterioration than a single preventive home visit with regard to frailty, self-rated health, and activities of daily living (ADLs) at 3-month follow-up.

DESIGN: Randomized, three-armed, single-blind, controlled trial performed between November 2007 and May 2011.

SETTING: Two urban districts of Gothenburg, Sweden.

PARTICIPANTS: Four hundred fifty-nine community-living adults aged 80 and older not dependent on the municipal home help service.

INTERVENTION: A preventive home visit or four weekly multiprofessional senior group meetings with one follow-up home visit.

MEASUREMENTS: Change in frailty, self-rated health, and ADLs between baseline and 3-month follow-up.

RESULTS: Both interventions delayed deterioration of self-rated health (odds ratio (OR) = 1.99, 95% confidence interval (CI) = 1.12–3.54). Senior meetings were the most beneficial intervention for postponing dependence in ADLs (OR = 1.95, 95% CI = 1.14–3.33). No effect on frailty could be demonstrated.

CONCLUSION: Health-promoting interventions made when older adults are at risk of becoming frail can delay deterioration in self-rated health and ADLs in the short term. A multiprofessional group intervention such as the senior meetings described seems to have a greater effect on delaying deterioration in ADLs than a single preventive home visit. Further research is needed to examine the outcome in the long term and in different contexts. **J Am Geriatr Soc 60:447–454, 2012.**

Key words: aged; frail elderly; intervention studies; ADL; intention-to-treat analysis

Many older adults (≥ 80) in Sweden and other Western countries live in the community and have good health and quality of life. Nevertheless, these persons are often described as a vulnerable group particularly exposed to diseases and disability and at risk of becoming frail.[1–3] A frequently used conceptual definition of frailty is a state of decreased reserve and resistance to stressors as a result of cumulative decline across multiple physiological systems, causing vulnerability to different outcomes.[4] The concept is related to activity limitations, participation restrictions, and comorbidity and describes a dynamic progressive process from healthiness to functional decline, ultimately leading to death. One way to operationalize frailty is through the sum of a number of frailty criteria. Fried and coworkers[5] recommend that three or more of the following five criteria should be used to identify and

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measure frailty in clinical practice: weakness, poor endurance, weight loss, low physical activity, and slow gait speed. Directing healthcare efforts toward preventing the progression of frailty in older adults can lead to great gains, health-wise and economically, for the individual and society at large.[2] Thus, in the area of public health research, priority should be given to randomized studies evaluating the outcome of such interventions to be able to meet the challenges posed by the growing proportion of older adults in the general population and the increasing need for health care this could generate. A health-promoting intervention study, Elderly Persons in the Risk Zone,[6] was designed to compare the effect of a preventive home visit with that of multiprofessional senior group meetings with one follow-up home visit. The study addressed older adults who were at risk of developing frailty.

Several literature reviews[7–9] have shown that interventions based on preventive home visits have led to varying results. Home visits were found to achieve their goals more effectively if they were multidimensional (involving several components), included several follow-up visits, and addressed "younger elderly" whose health had not yet been markedly affected, although the repetition of home visits has been questioned,[10] and there is little evidence that a multiprofessional group intervention is beneficial. A review of health-promoting programs focusing specifically on frail older persons[11] concluded that an intervention targeting frail older persons needs personnel from different professions if it is to succeed. The authors concluded that different professionals most likely had their own ways of "framing the problem," which implies that an interdisciplinary team is desirable when addressing the complexity of frailty.

The ability to manage personal and instrumental activities of daily living (ADLs) deteriorates with age, and the need for assistance from someone else to manage daily activities often follows early signs such as experienced difficulties, insecurity, and fatigue performing everyday tasks.[2,12,13] Furthermore, self-rated health has proven to be an important part of quality of life and a central outcome in prevention research.[14] A health-promoting intervention, customized for community-dwelling older adults, could delay the development of disability and deterioration in self-rated health. Accordingly, the aim of the present paper was to evaluate Elderly Persons in the Risk Zone with regard to frailty, self-rated health, and ADLs at 3-month follow-up.

METHOD

Study Design

Elderly Persons in the Risk Zone was a randomized, single-blind, three-armed trial with two intervention groups and one control group with a follow-up of 2 years.[6] Its overarching aim was to delay the progression of frailty in older adults, preserve their health and quality of life, and minimize their need for health care. The hypothesis of the study was twofold: it is possible to delay deterioration (i.e., progression of frailty, greater dependence in ADLs, and deterioration of self-rated health) if an intervention is made when older adults (≥ 80) are at risk of becoming frail, and a multiprofessional group intervention is more effective at delaying deterioration than a single preventive home visit. The study was performed between November 2007 and May 2011. This article concerns the 3-month evaluation completed in August 2009. The Regional Ethical Review Board in Gothenburg approved the study, and written informed consent was obtained from participants.

Participants and Setting

Eligible persons for the study, adults aged 80 and older, were drawn from official registers in two urban districts in Gothenburg, Sweden. Equal numbers of persons were drawn from the two registers and listed in random order. Registration continued until the intended sample size was reached. Criteria for inclusion were that the participants should be community dwelling, not be dependent on the municipal home help service or care, be independent from another person in ADLs, and be cognitively intact (Mini Mental State Examination score ≥ 25).[15]

The two urban districts were situated outside the city center but within the city limits, with a mix of self-owned houses and apartment blocks. The general educational level and income level of residents were slightly better and the sickness rate somewhat lower than in the population of Gothenburg as a whole.

Interventions

Preventive Home Visit

Each participant received one home visit from a specially trained professional in the intervention team: an occupational therapist (OT), a physiotherapist (PT), a registered nurse (RN), or a qualified social worker (SW). The intervention included oral and written information and advice about what the municipality could provide in the form of local meeting places, activities run by local associations, physical training for seniors, and other services. Information was also provided about the various kinds of help and support offered by volunteers or municipal professionals and availability of assistive devices and housing modifications. Environmental fall risks in the home were identified, and advice on how to prevent them was included. A protocol was used to guide the preventive home visit (Table 1), which included an opportunity for individuals to elaborate further on certain elements and lasted between 1.5 and 2 hours. If a participant raised a question outside the expertise of the attending professional, he or she was informed where to go to receive comprehensive information.

Multiprofessional Senior Group Meetings with One Follow-Up Home Visit

The intervention comprised four weekly, 2-hour group meetings focused on information and discussion about the aging process and possible health consequences and providing strategies for solving the various problems that may arise in the home environment (senior meetings). A collaborative multiprofessional intervention team—an OT, a RN, a PT, and a qualified SW, each responsible for one

Table 1. Elements in the Protocol Used in the Preventive Home Visits in the Elderly Persons in the Risk Zone Intervention Study

Protocol Elements
Information and advice about and, when appropriate, instructions in a basic home exercise program including balance exercises
Assessment of the fall prevention checklist, information and advice on how to prevent identified fall risks and continue be active, and when requested a "safety walk" in the home
Information and advice about technical aids and housing modifications and, if necessary, where and whom to turn to for purchase or application
Information and advice about smoke alarms and, if necessary, an offer to check the smoke alarm
Information about the range of help and support available in Gothenburg and in the municipality (e.g., volunteers, churches, mission fellow human, health centers), and where to turn to for help with health problems and illness, opening hours, telephone times, and telephone numbers
Information on the possibility of an appointment with a pharmacist at the local pharmacy for review of and counselling on medicines
Information and advice about incontinence
Brochure with information on the Swedish legislation and possibilities for advice on and assessment of driving capacity by professionals
Information and advice about what the municipality can provide in the form of local meeting places, activities run by local associations, physical training for seniors, walking groups for seniors, and possibility of receiving or providing volunteer interventions
Offer to register for "tryout" activities, an additional group visit to local meeting places, a short introduction to computer sciences, petanque clubs for seniors, gyms for seniors, Nordic walking groups, and more
Information about public transportation, including buses adapted for older adults, and mobility service for the disabled
Information on the Social Services Act and on where and whom to contact in the municipality to apply for home care services

Table 2. Themes from the Booklet[16] Used in the Senior Meetings in the Elderly Persons in the Risk Zone Intervention Study

Themes From the Booklet	Principal Professional
Aging	PT
Physical activity helps keep you physically fit	PT
Food is a prerequisite for health	PT
You can take care of problems with your health	RN
How to use medicines	RN
To cope with everyday life	OT
You do not need to feel insecure	OT
Technology in everyday life	OT
Will I lose my memory?	OT
Life events and quality of life during aging	SW
Anyone who needs help can get help	SW

PT = physiotherapist; RN = registered nurse; OT = occupational therapist; SW = social worker.

occasion—led the group meetings. A principal professional attended all four meetings in each round of the intervention to provide continuity. Predetermined themes (Table 2), outlined in a booklet written in a popular style by researchers in the field and especially designed for the intervention formed the basis for the meetings.[16] The senior meetings provided an arena for the exchange of knowledge, and the content of the group discussions varied according to the attending participants' individual experiences and needs. Before the intervention, the professionals were instructed how to lead groups and in group process theory. The role of the leader was to encourage participant involvement in the discussions and guide participants in the learning process. A follow-up home visit, conducted by any of the professionals in the intervention team and fully governed by individual needs, took place 2 to 3 weeks after the meetings.

Control Group

The members of the control group had access to the ordinary range of community services offered by the municipal agency for care for the aged, which they accessed on their own initiative when they felt the need. The aim of these services is to ensure that older persons are able to live as independently as possible in their own homes. In Sweden, when older adults are no longer able to manage daily life independently, they can apply for assistance from the municipal home help service. The extent of such support is subject to an assessment of needs and may include meals on wheels, help with cleaning and shopping, assistance with personal care, safety alarms, transportation services, and health care. If the investigator discovered that a person in the control group had an urgent need of community or healthcare service, he or she informed the person where to go for help. After the end of the study, participants were asked whether they wished to take part in either of the two interventions that, at that time, had been implemented in the common routines of the urban districts.

Outcome Measures

Research assistants (OT, PT, or RN) collected data in participants' homes. They were trained in how to administer the assessments, and interrater reliability was tested. To ensure as much standardization of the assessments as possible, study protocol meetings were held regularly. Data on the municipal home help service and mortality were collected from municipal records. The outcome measures for this study were change in frailty, self-rated health, and ADL at 3-month follow-up.[6]

Frailty

According to the study protocol,[6] frailty was measured as a sum of six core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed. Cutoffs for weakness as grip strength of less than 13 kg for women and 21 kg for men for the dominant hand and 10 kg for women and 18 kg for men for the nondominant hand measured using a hand dynamometer.[17] An answer of yes to the question: "Have you suffered any general fatigue or tiredness over the last three months?"[18] indicated fatigue, and of yes to the question: "Have you suffered from any weight loss over the last three months?"[18] indicated weight loss. Low physical

activity was defined as one to two walks per week or less. Low balance was a score of 47 or lower on the Berg balance scale.[19] Low gait speed was walking 4 m at a speed of 6.7 seconds or slower.[20] The sum of frailty indicators counted the number of indicators exceeding the cut off for frailty (0–6).

Self-Rated Health

Self-rated health was measured according to the question: "In general, would you say your health is excellent, very good, good, fair or poor?"[21] The response alternatives were dichotomized into good (excellent, very good, or good) and bad (fair or poor).

Activities of Daily Living

Independence of another person in ADLs was assessed according to a cumulative scale of well-defined personal and instrumental activities, the ADL staircase.[22,23] Nine of the ten original activities were used: cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transferring, and feeding. Dependence was defined as another person being involved in the activity by giving personal or directive assistance. People living with another person were assessed as independent if they performed the activity when alone. The number of activities managed independently has been summarized (0–9).

Sample Size, Randomization, and Blinding

The power calculation was based on the expected difference in change in functional abilities over time between the study arms, an alpha of 0.05, and a power of 80% in a two-sided test. Thus, at least 112 persons were required in each intervention group to be able to detect a difference of at least 15% between the groups. A comparison between the control group and the intervention groups would require 72 persons in the control group, assuming a difference of at least 20%. Accordingly, it was found that at least 300 persons were needed, so 459 persons were included, to allow for dropouts. An independent researcher, not involved in the enrolling of participants or in the interventions, organized the allocation system used. A research assistant consecutively and randomly assigned the study participants to one of the three study arms using opaque sealed envelopes. Those assessing the outcomes were blind to group assignment.

Statistical Analyses

The analyses were made on the basis of the intention-to-treat principle. The basic assumption for imputing data was that older adults (≥ 80) are expected to deteriorate over time in the natural course of the aging process. Therefore, the imputation method chosen was to replace missing values with a value based on the median change of deterioration (MCD) between baseline and follow-up of all who participated at follow-up. Consequently, the MCD for an outcome measure was added to the individual value registered at baseline and imputed, substituting missing data at follow-up. Sensitivity analyses were performed but are not presented. To rationalize the choice of the imputation method, the results of the MCD analyses were compared with complete cases analyses (CC)[24] and analyses with the imputation of the worst change of deterioration (WCD), a variant of the worst rank.[25] All analyses showed aligned trends, but the stated basic assumption guided the final preference of the method used in the analyses presented.

Baseline and dropout characteristics of the three groups were compared using chi-square or Fisher exact tests for dichotomous variables, *t*-tests for continuous variables, and Mann–Whitney *U*-tests for ordinal data. The purpose of the interventions in this study was to delay deterioration, not to improve the status of the participants. Thus, in the final analyses, the outcome measures were dichotomized (nondeteriorated vs deteriorated), analyzed using an overall chi-square test, and thereafter compared group-wise by calculating the odds ratio (OR). Two-sided significance tests were used throughout. $P \leq .05$ was considered statistically significant, and a 95% confidence interval (CI) is provided for each analysis presented in a table. Statistical analyses were performed using PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL).

RESULTS

The flow of participants through the study is shown in Figure 1. Of the 546 persons who were assessed for eligibility, 459 met the inclusion criteria, consented to participate, and were included in the study: 114 in the control group, 174 in the preventive home visit group, and 171 in the senior meetings group.

The baseline characteristics of participants are shown in Table 3. There were no statistically significant differences between the intervention groups and the control group in terms of demographic data, self-rated health, or frailty.

The interventions were largely implemented according to plan. All participants assigned to a preventive home visit received the intervention. Ninety-seven percent of the participants in the senior meetings (n = 165) attended all four meetings, 2% (n = 4) attended three meetings, and 1% (n = 2) attended two meetings. No adverse events were reported, and no known organized co-intervention took place during the period in question.

The dropout rate at 3 months was 9% (n = 42), with dropouts in all groups but with a significantly larger proportion in the control group (17%, $P = .006$), than in the preventive home visit (7%) and senior meetings (6%) groups. "Not interested" was the main reason for declining participation in the preventive home visit and control groups, whereas the main reasons for declining participation in the senior meetings were more varied (Figure 1). No significant differences were found between participants and dropouts in age, sex, marital status, education, or living conditions, although at baseline, dropouts had significantly lower self-rated health; 31% reported bad self-rated health ($P = .04$), compared with 18% of participants. Seventeen percent of the dropouts also reported weight loss, compared with 5% ($P = .004$) of participants. Dropouts had higher consumption of municipal home help service at 3 months (19%, vs 6% for participants; $P = .001$). Five persons (1%) died.

Seventy-one percent of participants in the control group showed no progression of frailty between baseline

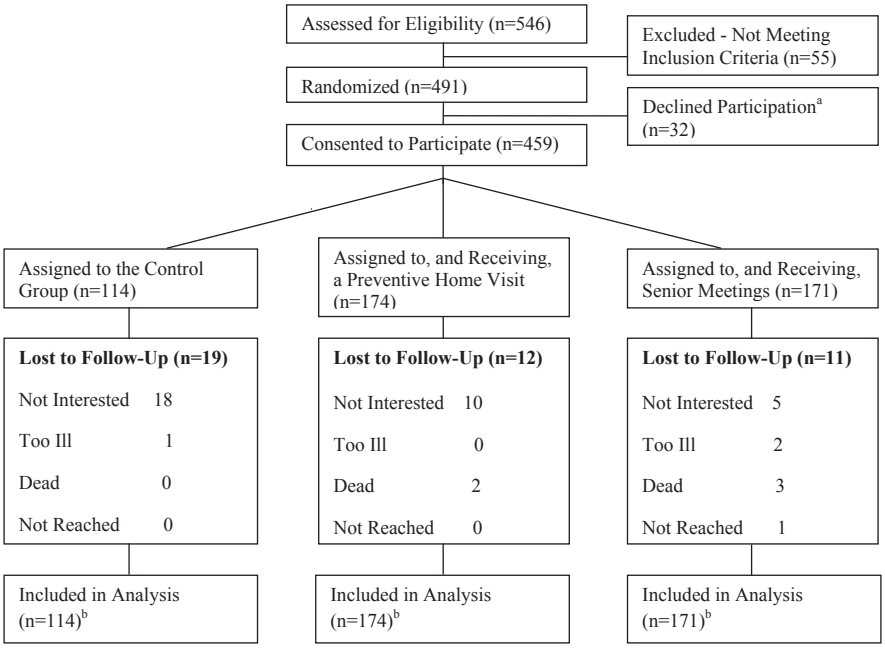

Figure 1. Flow of participants through the Elderly Persons in the Risk Zone study and reasons for declining participation at follow-up. [a]Reasons for declining participation, please see study protocol.[6] [b]Data for dropouts have been included in the analysis by imputation.

Table 3. Baseline Characteristics of Differences Between Study Arms in the Elderly Persons in the Risk Zone Study

Characteristic	Control, n = 114	Preventive Home Visit, n = 174	Senior Meetings, n = 171	*P*-Value
Age, mean (range)	86 (80–97)	86 (80–94)	85 (80–94)	.24
Female, n (%)	70 (61)	111 (64)	113 (66)	.63
Living alone, n (%)	55 (48)	99 (57)	103 (60)	.10
Tertiary education, n (%)	25 (22)	40 (23)	32 (19)	.69
Self-rated health good or very good, n (%)	90 (79)	139 (80)	142 (83)	.63
Sum of frailty indicators, median (range)	1 (0–5)	1 (0–5)	1 (0–5)	.89

Table 4. No Deterioration in Frailty, Self-Rated Health, or Activities of Daily Living (ADLs) Between Baseline and 3-Month Follow-Up of Participants in the Elderly Persons in the Risk Zone Study

	n (%)			
Outcome Measure	Control, n = 114	Preventive Home Visit, n = 174	Senior Meetings, n = 171	All Participants, n = 459
Frailty*	81 (71)	121 (70)	110 (64)	312 (68)
Self-rated health†	92 (81)	157 (90)	151 (88)	400 (87)
ADLs‡	75 (66)	115 (66)	135 (79)	325 (71)

* Sum of six core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed.[6]

† "In general would you say your health is: excellent, very good, good, fair or poor?"[20]

‡ Sum of nine activities in the ADL staircase: cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transferring, and feeding.[21]

and follow-up, compared with 70% in the preventive home visit group and 64% in the senior meetings group (Table 4). There was no significant difference in frailty between any of the groups (Table 5).

Eighty-one percent of participants in the control group had not deteriorated in self-rated health at follow-up, compared with 90% in the preventive home visit group and 88% in the senior meetings group (Table 4). There was a significant difference between both interventions and the control group, the OR for no deterioration in self-rated health in the intervention groups being double that of the control group (1.99, 95% CI = 1.12–3.54; preventive home visit group OR = 2.21, 95% CI = 1.12–4.37; senior meetings group OR = 1.81, 95% CI = 0.93–3.49). There was no significant difference in self-rated health between the two interventions (Table 5).

Sixty-six percent of the participants in the control group had no deterioration in ADLs and were still independent at 3-month follow-up, compared with 66% in the preventive home visit group and 79% in the senior meetings group (Table 4). The participants whose ADL scores decreased had become dependent in any of the four instrumental activities: cleaning, shopping, transportation, or cooking. Partaking in senior meetings resulted in an almost

Table 5. Likelihood of No Deterioration of Outcome Measures Between Baseline and 3 Months of Participants in the Elderly Persons in the Risk Zone Study

Group	Odds Ratio (95% Confidence Interval) *P*-Value		
	Frailty[a]	Self-Rated Health[b]	ADL[c]
Interventions vs control	0.83 (0.52–1.31) .42	1.99 (1.12–3.54) .02	1.37 (0.87–2.15) .18
Preventive home visit vs control	0.93 (0.55–1.56) .78	2.21 (1.12–4.37) .02	1.01 (0.62–1.67) .96
Senior meetings vs control	0.73 (0.44–1.23) .24	1.81 (0.93–3.49) .08	1.95 (1.14–3.33) .01
Senior meetings vs preventive home visit	0.79 (0.50–1.24) .30	0.82 (0.41–1.62) .56	1.92 (1.19–3.12) .01

[a]Sum of six core frailty indicators: weakness, fatigue, weight loss, low physical activity, poor balance, and gait speed.[6]
[b]"In general, would you say your health is excellent, very good, good, fair, or poor?"[20]
[c]Sum of nine activities in the activity of daily living (ADL) staircase; cleaning, shopping, transportation, cooking, bathing, dressing, going to the toilet, transferring, and feeding.[21]

doubled OR (1.95, 95% CI = 1.14–3.33) for no deterioration in ADLs in comparison with the control group. In addition, the OR for continued independence in ADLs in the senior meetings group was significantly higher than that in the preventive home visit group (1.92, 95% CI = 1.19–3.12) (Table 5).

DISCUSSION

This study demonstrates that both interventions in Elderly Persons in the Risk Zone delayed deterioration in self-rated health at 3-month follow-up. It was also found that participating in senior meetings significantly postponed dependency in ADLs, although it was not demonstrated that the interventions delayed the progression of frailty. In the short term, the result supports the two hypotheses of Elderly Persons in the Risk Zone: It is possible to delay deterioration if an intervention is made when an older adult (≥ 80) is at risk of becoming frail, and a multiprofessional group intervention such as senior meetings is more effective at delaying deterioration than a single preventive home visit.

The results are encouraging but must be interpreted with caution because most participants had neither become frailer nor deteriorated in self-rated health and were still independent in ADLs at 3-month follow-up. Also, analysis of self-rated health showed that the senior meetings group had similar results to preventive home visits but did not attain a statistically significant OR on its own compared with the control group. This might be a consequence of the use of MCD as an imputation method, which could have underestimated the results. The effects might have been higher than what was found. Nevertheless, there is an indisputable trend in favor of both interventions, which calls for an evaluation of long-term outcomes.

The positive result that both interventions had on self-rated health, a doubled OR compared with the control group, is inspiring, especially because a review from 2009 showed that 13 of 14 health-promoting interventions for frail older adults failed to achieve similar results for general well-being (including self-rated health).[11] This could indicate that targeting self-rated health in an older population is particularly difficult and raises the question of success factors in the interventions. It is possible that the multidimensionality of each intervention had a positive effect on the outcome. Several interacting components and approaches are at play in multidimensional or complex interventions.[26] Both interventions in the current study contained these elements. Others have supported the positive influence of multidimensionality, finding the sum of the parts in an intervention program to be greater than the value of each separate part.[27,28] The positive results of the current study also indicate that the interventions were correctly timed, as other studies have found that early intervention, before the older person is too frail, yields favorable results.[3,8,28] Furthermore, self-rated health is a factor in the overarching concept of quality of life, another important outcome of utmost importance in interventions for older adults. Hence, future articles will focus on the long-term outcome of the study, and priority will be given to quality of life and economic concerns (e.g., healthcare utilization).

Particularly interesting was the advantage that senior meetings had over a preventive home visit in postponing dependence in ADLs. Maintaining independence can have an important effect on the older person's quality of life[29] and on society in terms of lower healthcare costs.[30] The results of others who have found that complex interventions[28] and group interventions for independently living older persons[31] are successful in maintaining independent living support these positive results. The fact that the senior meetings in the current study were multiprofessional and had a participatory and client-centered approach (i.e., the discussions focused on individual needs) might be part of the explanation. This is described in two reviews of interventions for frail older adults that point to these factors as promising features in health promotion for older adults.[11,32] The positive outcome of the current study might also be because the senior meetings were group based, which could be a favorable pedagogical form for this population and for targeting ADLs.[33] Discussions with others in the same situation and sharing experiences of successful strategies in daily life, elements included in the senior meetings, might be important factors. A qualitative study of the senior meetings in Elderly Persons in the Risk Zone, in which the group discussions were seen as a "key to action" in the older person's life (unpublished observations), also support this. That the preventive home visit did not prove beneficial in delaying dependence in ADLs might be explained in several ways. One reason might be that a single home visit is inadequate. It was concluded in one study[8] that several visits or follow-ups may be

required to achieve a result, but others have recently contradicted this view.[28]

The fact that no delaying effect on the progression of frailty could be verified should not instantly be interpreted as an intervention failure. Instead, as proposed in the criteria for evaluating public health interventions,[34] other explanations should be considered. First, the study might have failed to show existing effects (all of the actual effects of intervention if any of the selected outcome measure was not sensitive enough). Even though most frailty indicators have been tested for validity and reliability, the sum of the six frailty indicators has not. Nor has weighting of indicators been considered. Second, and perhaps the most plausible explanation, the 3-month follow-up after the interventions is short, considering natural physical decline with advancing age in healthy older adults. The meta-analysis referred to earlier found that 14 trials offering complex interventions for older adults had an overall beneficial effect on general physical function.[31] Hence, the follow-up in the included studies was at least 6 months after the interventions. Therefore, it could not be expected that a positive result concerning frailty would be demonstrated at 3 months.

Finally, in discussing the interventions, the number of dropouts in the control group was significantly larger than in either intervention. One plausible explanation for this is that the interventions were perceived as being useful and positive, which might have motivated participants to remain in the study.

Special attention was paid to managing missing data. The data missing were predominantly wave nonresponses[35] and were classified as data missing not at random[36] because the dropouts had significantly worse self-rated health and weight loss at baseline and greater consumption of municipal home help service at 3 months than did participants. The total dropout rate was low (9%). Nevertheless, using only data obtained from persons who were evaluated, a complete cases analysis (CC),[24] was not a concern in this study because there is substantial evidence that dropouts in longitudinal studies tend to have worse outcomes than participants.[35] This was confirmed in the current study. An alternative approach for data imputation could have been last observation carried forward,[24] but this option was rejected because older adults, according to the basic assumption, are expected to deteriorate over time. Another method considered was the hot deck,[37] which was discarded because it performed less well than other imputation methods in a recent study.[38] Instead, the analysis of the dropouts supported the preference of MCD. Finally, even though it has been said that the only true solution to the missing data problem is to not have any[39] and that it is unlikely that data analysis can ever completely adjust for the effect of missing data,[35] this article shows a possible way to address missing data in a longitudinal study of adults aged 80 and older.

As a final point, this study was implemented in two city urban districts with inhabitants with a higher general educational level and income level and a lower sickness rate than in Gothenburg as a whole. It is likely that these characteristics affected the outcome because community demographics affect public health interventions,[34] positive and negative.[40] For instance, the participants might have had a higher awareness of health-related issues and consequently have been more motivated and susceptible to the interventions than older adults in areas with other social conditions. Conversely, the participants might already have been well aware and have had presuppositions concerning good health and well-being that could have led to the interventions having a smaller effect than expected. Subsequently, the results of this study do not address older adults in areas with a low educational and income level, nor can they be extrapolated to older adults in general. Future research should be devoted to evaluating the interventions in different contexts, for instance, in rural and culturally mixed areas and in other countries with different healthcare organizations.

SUMMARY AND CONCLUSIONS

Health-promoting interventions made when older adults are at risk of becoming frail can delay deterioration in self-rated health and ADLs in the short term. Also, a multiprofessional group intervention such as the senior meetings described seems to have a greater effect on delaying deterioration in ADLs than a single preventive home visit, although further research is needed to examine the outcome in the long term and in different contexts.

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