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Original Research

Age Self Care-Resilience, a medical group visit program targeting pre-frailty: A mixed methods pilot clinical trial

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ABSTRACT

Background: Pre-frailty is highly prevalent and multimodal lifestyle interventions are effective for preventing transition to frailty. However, little is known about the potential for medical group visits (MGV) to prevent frailty progression.
Objectives: To assess the feasibility and acceptability of the MGV Age Self Care-Resilience.
Design: Single-arm mixed methods pilot clinical trial.
Setting: Virtual MGV delivered in an ambulatory setting at a U.S. academic medical center.
Participants: Community-dwelling older adults (n = 11; age 65+) with pre- to mild frailty.
Intervention: Age Self Care-Resilience, an 8-week virtual MGV (90-minute sessions once per week) with sessions focused on physical activity, nutrition, social engagement, mind-body practice, and home environment modification.
Measurements: Primary outcomes were feasibility of recruitment, attendance, satisfaction, and feasibility of study measurements, collected via quantitative and qualitative approaches. Exploratory outcomes included frailty, psychosocial health, and physical function.
Results: A priori feasibility criteria were met for recruitment, with 15 (48 %) of those screened (31) meeting eligibility criteria, 11 (35 %) enrolling (mean age 74.5 yrs), and recruitment completed in less than one month. The nine participants who completed the study attended a mean of 7.2 of 8 sessions and completed 100 % of baseline and follow-up study measures; participants completed 58 % of the home practice log. Themes from participant interviews included: (1) mixed reactions to the recruitment term "pre-frailty;" (2) finding group participation as meaningful and empowering; and (3) perception that the program positively changed attitudes and lifestyle behaviors.
Conclusions: Age Self Care-Resilience is feasible and acceptable to pre- to mildly frail older adults. Next steps include evaluating the efficacy of Age Self Care-Resilience for preventing frailty progression with a fully powered randomized controlled trial.

1. Introduction

Pre-frailty, a clinically silent prodromal state that may lead to frailty, is estimated to have a global pooled prevalence of 46 to 49 % [1,2]. It represents a window of opportunity to prevent transition to frailty: in a meta-analysis of community-dwelling older adults, 23 % of those with pre-frailty transitioned to robust whereas only 3 % of those with frailty returned to a robust state [3]. Evidence-based interventions for community-dwelling older adults living with pre-frailty or frailty include physical activity programs, protein and micronutrient supplementation, health behavior education, and home environment modification [4,5]. Multimodal interventions that combine multiple approaches, in

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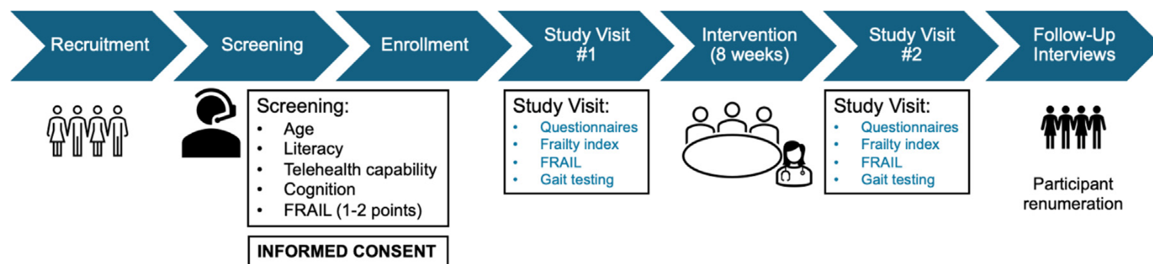

Fig. 1. Timeline of study procedures for Age Self Care-Resilience (n = 11), with recruitment occurring September to October 2023 and study completion occurring in March 2024.

particular physical activity and protein supplementation, are most effective and likely easiest to implement in a primary care setting [6,7].

Medical group visits (MGVs), or shared medical appointments, are appointments attended by multiple patients facilitated by a single clinician. MGVs can improve clinical outcomes for chronic diseases such as hypertension and diabetes [8]. For older adults, there is evidence that a group outpatient visit model reduces hospital admissions by 20 % and emergency room visits by 30 % [9]. In addition, participants report higher satisfaction with their care team, improved quality of life, and greater self-efficacy [10]. MGVs in aging populations have primarily focused on chronic disease management, care transitions, and advance care planning [10–13]. Since MGVs also increase time for health education and enhance social connection, we hypothesized that they may be an promising approach for the management of pre- to mild frailty. In this study, we assessed the feasibility and acceptability of an adapted MGV model "Age Self Care-Resilience."

2. Methods

2.1. Study design

We conducted a single-arm pilot clinical trial of an eight-week virtual MGV program, Age Self Care-Resilience, using a mixed methods design (quantitative and qualitative approaches) to investigate the feasibility and acceptability from multiple viewpoints. This design was well suited to our study since our program is new and the application of a medical group visit program in the context of pre-frailty is innovative [14]. We report results according to the CONSORT 2010 extension [15,16].

2.2. Ethics

This research was approved by the Mass General Brigham (MGB) Institutional Review Board (protocol 2023P001407) and written informed consent, including permission to review relevant portions of the EHR when necessary, was obtained from all participants prior to enrollment.

2.3. Trial registration

The study was prospectively registered at ClinicalTrials.gov as NCT06079762.

2.4. Participants

Eligible participants were community-dwelling older adults (age 65+) who met criteria for pre-frailty, defined as 1 or 2 points on the 5-point FRAIL screen (Supplement) [17]. Participants had to be able to consent to study procedures, be proficient in English, have access to broadband internet or cellular service, and be able to use a computer, tablet, and/or smartphone. Exclusion criteria included robust health status (0 points on FRAIL), frail health status (3+ points on FRAIL), clinical diagnosis of dementia, untreated psychiatric symptoms affecting group participation, and/or hearing or visual impairment affecting participation in the virtual program.

2.5. Procedure

Recruitment was conducted from September to October 2023 (Fig. 1). Study advertisements were posted on an approved research recruitment website (https://rally.massgeneralbrigham.org/). In addition, an electronic flyer was distributed to Brigham and Women's Hospital (BWH) ambulatory clinics, including 17 primary care clinics and the Osher Clinical Center for Integrative Health (OCC). Physical flyers were placed in the OCC waiting room and patients on the OCC e-mail listserv received an electronic flyer. An electronic flyer was also distributed to seven geriatricians; patients identified by geriatricians were contacted via a secure patient messaging portal embedded in the electronic health record (EHR).

Interested participants contacted a study research assistant (RA) by telephone or e-mail; a member of the study team then contacted the participant to screen for eligibility. If a participant was eligible, they were offered an in-person study visit at OCC, located at an ambulatory clinic site in the BWH system. At the study visit participants completed questionnaires, cognitive testing, and gait and balance testing with a member of the study team. The RA then scheduled the patient into the virtual program and a second in-person study visit after the program ended. The second study visit included the same outcome measures as the first, with the addition of a semi-structured interview. Enrolled participants also received a handbook and home practice log by mail. Participants were enrolled for a duration of eight to 12 weeks and the study was conducted between September 2023 to March 2024.

2.6. Intervention

Age Self Care-Resilience is an adaptation of a MGV program called Age Self Care, designed by a collaboration among the University of California, San Francisco, Division of Geriatrics (UCSF) and At Home With Growing Older [18]. Age Self Care is intended to be modifiable for distinct older adult populations. Sessions focus on healthy lifestyle education, including physical activity, nutrition, and socialization; home adaptation to optimize the home environment for usability and safety with aging; and psychosocial health. To develop Age Self Care-Resilience, sessions were modified and targeted toward frailty prevention according to existing data and published guidelines; a group of geriatrician clinicians and researchers selected the final program. For example, the nutrition sessions focused on protein intake and the Mediterranean diet [4,19]. Physical activity focused on resistance training to simulate daily activities, balance exercise, and mind-body movement [20–22]. The program consists of eight weekly 90-minute virtual medical group visits. Educational materials include a handbook and prerecorded videos from interdisciplinary team members. The group applies learning to their own lives, develops personal goals, and reports back about brief home activities or practices (details in Supplement).

All sessions were delivered virtually via secure Zoom offered through MGB [23]. Participants could call the study RA for technical support if they had difficulty accessing the Zoom platform. Sessions were 90 minutes in duration with one five-minute break. Sessions were structured as

follows: 30 minutes for report of the prior week's home activity to foster accountability and reflection, 15 minutes didactic education from the facilitator on the topic of the week, 30 minutes facilitated discussion, and 15 minutes for conclusion and review of the new home activity. Sessions were facilitated by the study PI/geriatrician J.V.L. To ensure treatment fidelity, all sessions were attended by a member of the study team (W.B.).

2.7. Baseline variables

Age, sex, ethnicity, race, relationship status, highest education level, employment status, estimated annual household income, living situation, FRAIL score, number of comorbidities, and presence of an emergency contact were assessed in baseline questionnaires.

2.8. Outcomes

Feasibility and acceptability. Where possible, feasibility and acceptability endpoints were assessed with both quantitative and qualitative approaches. The study team tracked recruitment, retention, attendance, adherence, and assessment completion. Participants were asked questions in post-program interviews about each of these items. Satisfaction was assessed post-program by asking participants to rate program satisfaction from one to four and by asking participants to describe their experience with the program (interview guide, Supplement). A priori feasibility and acceptability endpoints included:

1) Recruitment of 12 older adults who are pre-frail within six months.
2) At least 70 % of participants will attend ≥ 6 of 8 group visit sessions.
3) At least 70 % will report satisfaction with the group.
4) At least 70 % of participants will complete all elements of a frailty index in ≤ 60 minutes.

Participants who were absent were contacted to determine reasons for missing sessions. Participants were instructed to notify the PI about potential adverse events and the EHR was reviewed when necessary.

The following outcomes were measured at baseline and immediately post-program (eight weeks):

Loneliness. Participants completed the UCLA Loneliness Scale, scored from 3 to 9 with a score ≥6 indicating loneliness [24].

Self-reported health. Self-reported health was assessed with a single item from the 12-Item Short-Form Health Survey (SF-12;"In general would you say your health is excellent, very good, good, fair, or poor?"), which has high sensitivity and specificity in identifying frailty and likelihood of functional impairment in older adults [25,26]. Each response was assigned a number from one to five, with five indicating excellent health.

Physical activity. The Godin Leisure-Time Exercise questionnaire was used to assess physical activity at baseline and post-program. Scores ≥24 are considered active, 14-23 moderately active, and <14 sedentary [27].

Self-efficacy. Participants were asked to rate their agreement (strongly disagree, disagree, neutral, agree, or strongly agree) with the statement, "I will be able to achieve most of the goals that I set for myself," adapted from the New General Self-Efficacy Scale [28]. Responses were assigned a number from one to five, with higher scores indicating higher self-efficacy.

Mood. Depression was measured with the Patient Health Questionnaire 2 (PHQ-2), which contains two items and is sensitive to change [29]. Scores range from 0 to 6 and scores of 3 or greater indicate positive screen for depression. Anxiety was measured with the two-item generalized anxiety disorder (GAD-2) screener. Scores range from 0 to 6, with scores of 3 or greater suggesting possible anxiety disorder [30].

Sleep. Participants were asked to rate their sleep quality (very good, good, fair, poor, very poor) over the past seven days at baseline and post-program, adapted from the Pittsburgh Sleep Quality Index [31]. Responses were assigned a number from one to five with higher scores indicating better sleep quality.

Cognition. Participants completed a Mini-Cog test which assesses clock drawing and three-word recall. The clock and each word recalled are scored, with possible scores ranging zero to five. Scores of ≤2 indicate higher likelihood of clinically important cognitive impairment [32].

Physical function tests. The Short Physical Performance Battery (SPPB) assesses balance, gait speed, and chair stands. Scores range 0 to 12 with higher scores indicating better physical function [33]. Clinically meaningful improvements are considered to be 0.5 (small) to 1 (substantial) [34].

Gait testing. Participants were asked to ambulate four meters at their usual gait speed for two consecutive trials on an instrumented Zeno^{TM} Walkway (Protokinetics).

Frailty index. Methods to identify frailty include the Fried physical phenotype [35] and Rockwood cumulative deficit models [36]. We used a deficit-accumulation frailty index to measure frailty at baseline and post-program [37]. The comprehensive geriatric assessment frailty index (CGA-FI) includes 46 items and predicts mortality and activities of daily living (ADL) disability in community-dwelling older adults [37–39]. The CGA-FI includes comorbidities, ADLs and instrumental ADLs (iADLs), physical performance (Nagi and Rosow-Breslau Functional Health Scales [40,41]), body mass index (BMI), unintentional weight loss ≥10 lbs, Mini-Cog, gait speed, and chair stand assessments. The proportion of deficits to the number of domains assessed was determined; scores of 0 to 0.10 are considered nonfrail, 0.10 to 0.20 pre-frail, and >0.20 frail. Community-dwelling adults tend to accumulate deficits at a rate of 3 % per year with clinically meaningful annual increases ranging from 0.019 to 0.057, though an annual increase as low as 0.005 has been reported to be meaningful in a trial setting [36,42,43].

2.9. Sample size

A sample size of 12 participants was selected to facilitate group dynamics [44] and based on practical considerations including personnel and budgetary constraints.

2.10. Data analysis

Quantitative analysis. To evaluate feasibility and acceptability we calculated descriptive statistics of recruitment, retention, acceptability, post-program satisfaction, adverse events, and completion of pre- and post-program outcome measures, including time to complete and testing burden (verbal scale 0-100). Home practice logs were evaluated to determine program adherence.

To explore outcome measures, we initially used an intent-to-treat analysis but excluded post-program measurements for the two participants who withdrew due to small sample size. We calculated mean change scores and standardized effect sizes (Cohen d) to determine magnitude of change using the thresholds: trivial (0-0.2), small (>0.2), moderate (>0.5), and large (>0.8). Statistical analyses were performed using R.

Qualitative analysis. In-person one-on-one semi-structured interviews were conducted by a member of the study team (W.B.) during the post-program study visit. Interviews lasted from 30 to 60 minutes. Audio recordings were performed via Microsoft Teams with an external microphone connected to a laptop, deidentified, and transcribed using an IRB-approved professional transcription service.

Transcripts were analyzed independently by two members of the research team (J.V.L. and W.B.). Thematic analysis was utilized, which includes identifying, analyzing, and reporting repeated patterns [45]. First, a deductive approach was employed to evaluate feasibility and acceptability according to the pre-specified domains recruitment, acceptability, expectations, satisfaction, outcome measures, testing burden, and study materials. Then, through an inductive approach, partic-

ipant responses were analyzed to answer the following research questions: 1) How do participants perceive the term "pre-frailty" in recruitment materials and 2) what were key takeaways from the program? After reviewing an initial set of transcripts, J.V.L. and W.B. developed a codebook, which was then reviewed with all members of the study team, finalized, and applied to all transcripts.

3. Results

3.1. Feasibility and acceptability

Recruitment and retention. A total of 61 people expressed interest in the study, primarily from the research recruitment website and clinician referral. Of 31 screened for eligibility, 15 were eligible (48 %); the primary reason for exclusion was robust health status (FRAIL score 0). Twelve participants indicated interest in the study, eleven provided informed consent, and two withdrew during the study due to schedule changes. See Fig. 2 for CONSORT diagram.

In the enrolled participants (n = 11), mean age was 74.5 (range 64-83) with mean FRAIL score 1.45 and an average of 6.2 comorbidities. Participants were 72.7 % female, 81.8 % White, 9.1 % Hispanic, 45.4 % married, and mostly college graduates (81.8 %). All but one participant had an annual household income of <$100,000. Most lived alone (72.7 %) in the community (Table 1). Two participants withdrew during the study, and the remaining nine participants are designated "completers."

For recruitment, participants suggested using a variety of outreach strategies, such as text messages and social media ads. In addition, they highlighted a trusted clinician's referral as a major reason to enroll. Feasibility and acceptability data are summarized in Table 2.

Adherence and acceptability. Mean session attendance of those enrolled (n = 11) was 5.9 of 8 sessions, though attendance for completers (n = 9) was 7.2 sessions. 100 % of completers attended ≥6 sessions, meeting the pre-specified benchmark. In interviews participants described reasons for missing sessions including surgery (2), hospitalization (1), death in the family (1), travel (1), and forgot (1).

Participants completed 58.8 % of weekly activities in the home practice log (see details in Supplement). Almost all participants reported preferring a computer-based log rather than a paper version. Takeaways from using the log were mixed: some participants had important insights about their lifestyle, while others did not see a need for it or did not complete due to frustrations with their health limitations.

Satisfaction and expectations. Participants had varying expectations about the program: no expectations/open-minded, learn more about aging, work on self-care, avoid falls, and increase physical activity. After the program 100 % of completers were mostly or very satisfied, with mean satisfaction 3.89 (SD 0.33), meeting the pre-specified benchmark. Key takeaways are summarized in Table 2.

Outcome measures. At baseline, 100 % of assessments, including the 46 items of the CGA-FI, were completed for those enrolled (n = 11) in 30 minutes or less. At post-program, 82 % of assessments were completed for those enrolled (n = 11) and 100 % for completers (n = 9), all in 30 minutes or less. One participant was missing one item from the post-program CGA-FI, so 89 % of completers (n = 9) were assessed on 46 items of the CGA-FI, meeting our pre-specified benchmark. Testing burden, rated 0-100, was 0.78 (SD 0.71), or very low burden.

Participants suggested adding in more comprehensive study assessments, such as more detailed review of medical conditions, detailed medication review, tests of concentration, more complex tests of coordination and balance, and a detailed sleep assessment. However, one participant remarked that gait mat testing was challenging.

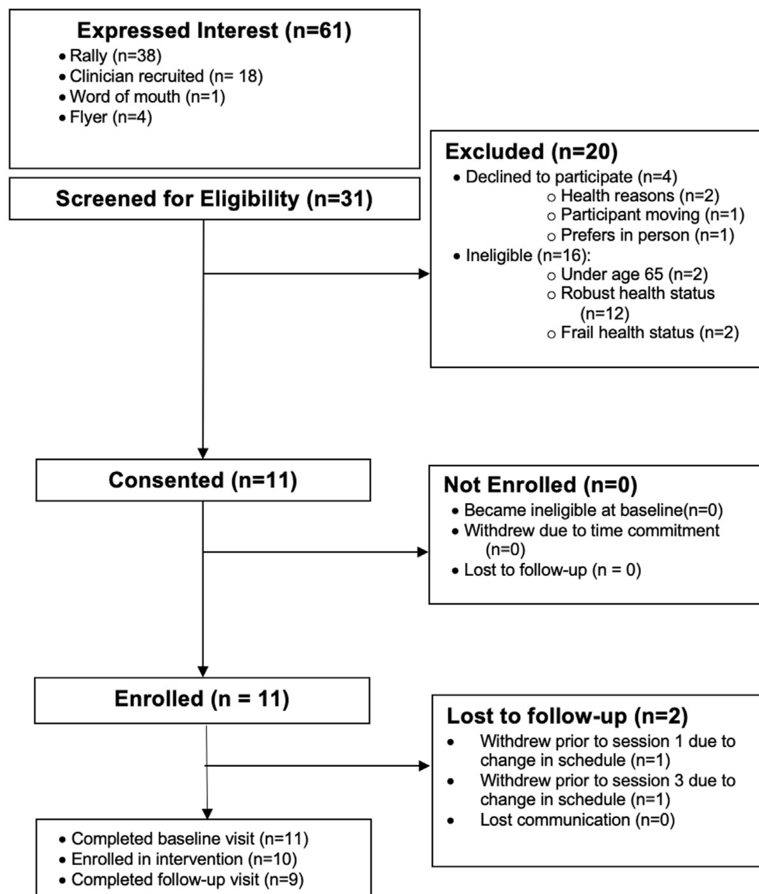

Fig. 2. CONSORT diagram of single-arm pilot study of Age Self Care-Resilience, a medical group visit intervention for pre-frailty (n = 11).

Table 1
Baseline demographics of participants who enrolled in (n = 11) and completed (n = 9) a single-arm pilot study of Age Self Care-Resilience, a medical group visit program intervention for pre-frailty.

Characteristic	Enrolled (n = 11)	Completed (n = 9)
Age (mean [range], yr)	74.5 (64 – 83)[#]	74.7 (65-82)
Sex		
Female	8 (72.7 %)	7 (77.8 %)
Male	3 (27.3 %)	2 (22.2 %)
Ethnicity		
Hispanic	1 (9.1 %)	1 (11.1 %)
Non-Hispanic	10 (90.9 %)	8 (88.9 %)
Race		
Black or African American	2 (18.2 %)	2 (22.2 %)
White	9 (81.8 %)	7 (77.8 %)
Relationship status		
Single	4 (36.4 %)	3 (33.3 %)
Long-term relationship	1 (9.1 %)	1 (11.1 %)
Married	5 (45.4 %)	4 (44.4 %)
Other	1 (9.1 %)	1 (11.1 %)
Highest education level		
High school or GED	1 (9.1 %)	0
Some college	1 (9.1 %)	1 (11.1 %)
College degree	3 (27.3 %)	2 (22.2 %)
Graduate degree	6 (54.5 %)	6 (66.7 %)
Employment status		
Retired	10 (90.9 %)	8 (88.9 %)
Full- or part-time	0	0
Disability	1 (9.1 %)	1 (11.1 %)
Estimated annual household income		
Under $15,000	1 (9.1 %)	0
$15,000-24,999	2 (18.2 %)	2 (22.2 %)
$25,000-49,999	2 (18.2 %)	1 (11.1 %)
$50,000-99,999	5 (45.4 %)	5 (55.6 %)
$100,000-149,999	1 (9.1 %)	1 (11.1 %)
Living situation		
Alone	8 (72.7 %)	7 (77.8 %)
With another person	3 (27.3 %)	2 (22.2 %)
Type of housing		
Community (house or apartment)	11 (100 %)	9 (100 %)
Independent or assisted living	0	0
Do you have someone to call in a crisis?		
Yes	10 (90.9 %)	8 (88.9 %)
No	1 (9.1 %)	1 (11.1 %)
FRAIL score (range 0-5)	1.45	1.33
Comorbidities (No.)	6.2	6.3

[#] participant's 65th birthday occurred during study period.

Adverse events. Four adverse events were reported during the study, all of which were unrelated to the intervention. Three participants had hospitalizations for the following indications: asthma exacerbation, complicated urinary tract infection, and hernia revision surgery. One participant had an Emergency Room visit for a headache, unrelated to the intervention.

3.2. Health outcomes

Since paired outcome data were not available for the two withdrawn participants, we present per-protocol analyses in Table 3 and gait data in the Supplement. The three participants who were hospitalized during the program were removed in exploratory analyses (Supplement).

3.3. Participant interviews

As described above, we used an inductive approach to identify themes that related to the following two study questions: 1) How do participants perceive the term "pre-frailty" in recruitment materials and 2) what were key takeaways from the program? We identified three major themes from participant narratives:

3.4. Mixed reactions to the term "pre-frailty"

When participants were asked about the term "pre-frailty" in recruitment materials, they ascribed a negative connotation to the term. One older adult said, "it's not a desirable condition to be part of…[it's] scary" (Interview 6) and another shared that "when you think of frail, you think of someone who needs a walker or a cane…that's what I was thinking of when I first saw it" (Interview 4). However, even when identifying the term negatively, several described that it motivated them to engage in behavior change:

I don't love thinking of myself as frail or pre-frail, but it fits. I certainly do fit those categories, I believe. As my COPD is getting worse, I do feel that if I don't really exert myself to be, for example, as physically active as possible, that I'm gonna be in for some unpleasant experiences. I think it's a motivation to avoid frailty (Interview 3).

Participants suggested using terms such as "healthy aging" or "self-care" in advertisements and study language in the future.

3.5. Group participation is meaningful and empowering

Participants shared that group participation and engagement was one of the most meaningful and empowering aspects of the program. However, they faced barriers in participating in the virtual group. A major barrier was social determinants of health: "Neighborhood determines quality of home—unfortunately, in this particular neighborhood I live, it's really poor…shops are very cheap. Food is the same" (Interview 5). In addition, several participants experienced grief and loss prior to or during the program, which affected their participation: "I think with grieving, I think I have a lot of avoidance and that's why it becomes complicated…I think that's affected my ability to move in the manner that I want to move" (Interview 9).

Participants found the group itself to be a rich source of knowledge and community: "Talking to other people and seeing the problems with other people makes me feel like I'm not isolated, that I'm not a strange person, that I can do something to help myself to do that" (Interview 8). In particular, they felt empowered being in the company of other older adults: "I can do this. There's hope. I'm not alone. Other people are dealing with this. I can do this" (Interview 1). Many participants commented on the diversity of the group and how this enriched their experience:

> I really enjoyed all the people I got to see. Different kinds of people, and the way they interacted, they all seem very courteous and understanding. You know their attitudes were, I thought were really, really positive. So many of them were really knowledgeable on how to take care of themselves. (Interview 4).

3.6. Age Self Care-Resilience changes attitudes and behavior

Through the program, participants described gaining self-care tips to "put in the toolbox to use at some time" (Interview 9). This allowed them to better prepare for the future by finding "the link between self-care and independence, [which] allows you to keep control of the life you want to have" (Interview 1). Most participants gained knowledge about lifestyle approaches for healthy aging: "I have to stay on top of the self-care, watching food, exercise, meditation, social connection. I could see by the exercises that we did that my social one-on-one connections with friends was lacking" (Interview 2). Many participants described substantial behavior and attitudinal changes because of the program:

> I think I feel a lot more optimistic. I feel like I'm capable of helping myself and getting in the habit of asking for help and figuring out how to find the resources I need…I feel more confident about the fact that it's okay to be in a group like that. To listen to what other people are doing and to participate. (Interview 4)

Several participants discussed how mind-body practice facilitated improvements in attitude: "I understand more of the mind-body con-

Table 2
Mixed methods feasibility and acceptability results from a single-arm pilot study of Age Self Care-Resilience, a medical group visit program intervention for pre-frailty (n = 11).

Feasibility/ Acceptability Endpoint	Results	Participant Feedback
Recruitment	• 31 of 61 (51 %) participants who expressed interest were screened for eligibility. • 15 of 31 (81 %) of participants who were screened were eligible. • Recruitment completed within 4 weeks.	• Term "pre-frail" has negative connotations. • Liked terms "self care" and "healthy aging." • Recommended via multiple strategies (flyers, text messages, e-mails, social media). • Trusted their referring clinicians.
Retention	• 2 of 11 participants withdrew (1 prior to session 1; 1 prior to session 3; both due to change in schedule)	N/A
Acceptability	• Mean attendance (n = 11) = 5.9 of 8 sessions • Mean attendance of completers (n = 9) = 7.2 • 100 % of completers (n = 9) attended ≥7 sessions	Participants reasons for missing sessions: • Death in the family (1) • Surgery (2) • Hospitalization (1) • Travel (1) • Forgot (1)
Expectations	N/A	• Increase physical activity (1) • Work on self-care (2) • Learn more about aging (2) • Avoid falls (1) • No expectations (3)
Satisfaction	• 100 % of completers (n = 9) were mostly or very satisfied • Satisfaction (mean ± SD; 1-4) = 3.89 ± 0.33	Key takeaways: • Interaction with others experiencing aging and pre-frailty (4) • Importance of self-care (2) • More capable and optimistic (1) • Importance of lifestyle change (2)
Outcome measures	Baseline: • 100 % of assessments completed (n = 11). • Time = 30 minutes • 100 % of participants assessed on 46 frailty index items Follow-Up: • 82 % of assessments completed for those enrolled (n = 11) and 100 % for completers (n = 9) • Time = 60 minutes • 89 % of completers assessed on 46 frailty index items (1 participant missing 1 item)	Participants suggested adding assessments: • More detailed review of medical conditions (1) • More detailed medication review and polypharmacy assessment (1) • Concentration (1) • More tests of coordination and balance (1) • Detailed sleep assessment
Testing burden (mean ± SD; 0-100)	0.78 ± 1.71	1 participant commented that walking tests were challenging
Adherence to home practice log	59 % of home activities documented	• All participants preferred a computer-based version • Did not see need for it (2) • Did not complete due to frustration with their own health limitations (1) • Realized something important about lifestyle based on data from the log (4)
Adverse events	4 adverse events unrelated to intervention: • 3 hospitalizations (asthma exacerbation, complicated urinary tract infection, hernia revision) • 1 ER visit (headache)	N/A

nection. Your mind listens to what you're thinking and acts accordingly…that is paying off in terms of how I'm physically feeling" (Interview 1).

4. Discussion

Our study results indicate that Age Self Care-Resilience was both feasible and acceptable to pre- and mildly frail older adults. Recruitment goals were met, with approximately half of those who were screened meeting eligibility criteria; of note, target enrollment was reached in less than a month. While two participants withdrew from the study, those who completed it attended almost all sessions. In addition, all participants reported being mostly or very satisfied. Testing burden was rated as very low. Finally, there were no adverse events related to the intervention.

Participant suggestions to enhance recruitment feasibility included using more positive terms such as "healthy aging" or "self-care" in advertisements, rather than the negatively perceived term of pre-frailty. In addition, they suggested having more variety of advertising methods and making efforts to reach non-clinical populations (e.g., senior centers). Home practice log adherence was lower than expected (58 %), with potential improvements including a computer-based version and more explanation and review of the log at each weekly visit. Two participants withdrew during the study, both due to a change in their schedule. Older adults face a high burden of medical appointments, which may limit their engagement in programs like this [46]. Running several programs at different times may improve adherence. While virtual groups may permit participation of homebound elders and reduce transportation burden, technology use may be a barrier, and there is likely lower social interaction and motivation building as compared to in-person groups.

While we collected health outcomes, these analyses were purely exploratory given the small sample size of the study. The mean frailty index of participants at baseline was 0.29 (SD 0.09) and 0.27 (SD 0.07) post-program. While some measures of function improved (ADLs, iADLs, Rosow-Breslau), others worsened (Nagi, total SPPB). Some measures may have improved due to practice effect (e.g., cognition, gait testing).

Studies of multimodal interventions for frailty have used a range of techniques to support behavior change [43]. Some effective interventions have included fairly minimal support: in a 2023 trial by Traves et al., primary care providers (PCPs) provided their patients with a leaflet with home-based exercises and protein content of various foods,

Table 3
Pre- and post-intervention results of exploratory clinical outcomes for participants who completed the Age Self Care-Resilience pilot (n = 9), a medical group visit program for pre-frailty.

Outcome		Baseline		8-week		Change		Effect Size		Interpretation	
		Mean	SD	Mean	SD	Mean	SD	d	95 % CI	Range	Direction
	General Health	2.78	0.83	2.89	1.27	0.11	0.93	0.10	-1.10 to 0.90	1-5	↑ = better self-reported health
Function	ADLs	0.33	0.71	0.11	0.33	-0.22	0.44	0.40	-0.61 to 1.41	0-1	↑ = greater ADL disability
	iADLs	0.89	0.60	0.56	0.88	-0.33	1.00	0.44	-0.57 to 1.45	0-1	↑ = greater iADL disability
	Nagi	2.00	1.22	2.33	1.22	0.33	1.32	0.27	-1.28 to 0.73	0-5	↑ = greater impairment
	Rosow-Breslau	1.89	0.78	1.56	1.01	-0.33	0.71	0.37	-0.64 to 1.38	0-3	↑ = greater impairment
	Physical Activity	26.8	22.4	26.9	18.7	0.11	18.50	0.01	-1.00 to 0.99	0-24+	↑ = more physically active
Psychosocial/ Cognitive	Self-Efficacy	4.00	0.71	4.11	0.78	0.11	0.33	0.15	-1.15 to 0.85	1-5	↑ = better self-efficacy
	Depression	1.11	2.03	1.44	2.13	0.33	3.20	0.16	-1.16 to 0.84	0-6	≥3 = positive depression screen
	Anxiety	1.11	1.17	1.56	1.67	0.44	1.59	0.31	-1.31 to 0.70	0-6	≥3 = positive anxiety screen
	Sleep	3.78	0.97	4.22	0.97	0.44	0.73	0.46	-1.47 to 0.56	1-5	↑ = better sleep quality
	Loneliness	5.00	2.60	4.89	2.26	-0.11	1.27	0.05	-0.95 to 1.05	3-9	≥6 = loneliness
	Cognition	4.33	0.71	4.67	0.50	0.33	0.87	0.54	-1.56 to 0.47	0-5	≤2 ↑ likelihood of cognitive impairment
SPPB	Balance Score	3.44	1.13	3.00	0.87	-0.44	1.13	0.44	-0.57 to 1.45	0-4	↑ = better balance
	Gait Score	3.11	1.05	3.22	0.67	-0.11	1.10	0.13	-1.13 to 0.87	0-4	↑ = faster gait speed
	Gait Speed (m/s)	0.78	0.20	0.79	0.13	0.02	0.17	0.11	-1.10 to 0.90	0-1.5+ m/s	↑ = faster gait speed
	Chair Score	1.78	1.56	1.89	1.62	0.11	0.78	0.07	-1.07 to 0.93	0-4	↑ = better chair stand
	Total Score	8.33	2.74	8.22	2.33	-0.11	1.83	0.04	-0.96 to 1.04	0-12	↑ = better physical function
	Frailty Index	0.285	0.085	0.273	0.067	-0.012	0.079	0.16	-0.84 to 1.16	0-1	↑ = more frail

Mean and standard deviation reported at baseline and post-program (8 weeks).
Pre/post change scores reported as mean change and standard deviation and Cohen's d effect size with 95 % confidence interval.
Abbreviations: ADL = Activities of Daily Living, iADL = Instrumental Activity of Daily Living, SPPB = Short Physical Performance Battery, SD = Standard Deviation, CI = confidence interval.

explaining exercises for five minutes or less. At three-month follow-up (n = 168), the odds of frailty between intervention and control was 0.23 (95 % CI: 0.07-0.72; p = 0.011), and both grip strength and bone mass significantly improved [47]. Others have studied home-based exercises with telephone-based support (n = 43), which reduced sedentary time by 30 minutes per day (p = 0.048) [48]. A New Zealand trial studied a multi-domain facilitator-led program that transitioned to a peer-led program for pre-frail older adults (n = 468), finding that group-based nutrition intervention and physical activity intervention, delivered separately, improved physical frailty at six months, though was not sustained at two-year follow-up [49]. In the Lifestyle Interventions and Independence for Elders pilot (LIFE-P), a highly supervised 12-month physical activity intervention, as compared to a successful aging education group, significantly reduced the prevalence of frailty (10.0 % vs. 19.1 %, p = 0.01) [50]. Effective behavioral change strategies include focusing on self-efficacy, intrinsic motivation, specific goal-setting, and peer support; intentionally integrating these approaches can meaningfully improve compliance and maintain long-term physical benefits [51].

While we have not yet tested the efficacy of Age Self-Care Resilience, alterations such as more frequent sessions, a longer duration program, or "booster" follow-up sessions may be more effective for pre- to mildly frail participants; the intervention could be finalized via an expert panel or formal consensus-building process (e.g., Delphi method). Enhanced peer support, such as an online inter-visit discussion board or app, may be beneficial. A certified health coach could facilitate sessions with the clinician, incorporating evidence-based strategies for behavior change and providing more touchpoints for follow-up. In this study, the facilitator was a geriatrician and was trained to facilitate groups. Given the geriatrician shortage, a facilitator training will need to be developed; this may be a novel strategy to help ameliorate existing gaps in geriatrics training in the U.S. health care system, benefitting both patients and generalist clinicians.

Age Self-Care Resilience was piloted in a U.S. fee-for-service academic health care system. While several payment models for MGVs exist, including capitation and self-pay, in the fee-for-service model the billing clinician (physician or advance practice provider) can submit traditional ambulatory billing codes for individual patients, which are reimbursed by the Centers for Medicare and Medicaid Services and private insurers [52]. Since Age Self-Care Resilience includes evidence-based interventions for multiple conditions that commonly affect older adults, including frailty, billing clinicians can conduct groups as part of routine clinical practice. Two factors that may limit scalability is the need to orient administrative staff to the model for scheduling purposes, and patient education to ensure they are aware of the differences between a group and a standard 1:1 medical appointment. Overall, the financial model permits billing clinicians to see higher volumes of patients, which may be especially beneficial for geriatricians who traditionally see fewer patients per day. However, rather than placing additional strain on clinicians, the model permits more face-to-face and educational time with patients than in a traditional ambulatory clinic schedule.

Our study has several limitations. First, this study excluded older adults who could not use or access telehealth technology, which may exacerbate socioeconomic disparities. However, our study sample was relatively diverse, including a range of income levels, for its small size, which was discussed as a major theme in qualitative interviews. Second, this study was not randomized, though this was intentional given its purpose as a feasibility and acceptability study, and constraints such as cost. Third, in addition to its non-randomized nature, the small sample size limits interpretation of the secondary health outcomes collected. Fourth, the two participants who withdrew during the study due to schedule change may have found the program less acceptable given constraints on their time, skewing our results toward being feasible and acceptable. Fifth, the study was conducted at a single academic medical center and may not be feasible or acceptable in a different environment.

Based on this pilot study, Age Self Care-Resilience appears to be feasible and acceptable to pre- to mildly frail older adults. To our knowledge, this is the first study of a MGV model for frailty management, a novel approach that is potentially scalable in a fee-for-service payment environment. Next steps include evaluating the efficacy of Age Self Care-Resilience for preventing frailty progression with a larger randomized controlled trial. In addition, future studies should evaluate cost-effectiveness as well as educational outcomes and professional fulfillment of generalist clinicians trained to facilitate the program.

Contributions

J.V.L., A.R.O., and L.A. obtained funding for and designed the study. J.V.L., W.B., S.K., and S.R. contributed to data analysis. J.V.L. and W.B. drafted tables and figures. J.V.L. drafted the manuscript. All authors read, edited, and approved the submitted manuscript.

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None.

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Declaration of competing interest

The authors declare that they do not have any relevant conflicts of interest.

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Supplementary materials

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References

[1] Dent E, Morley JE, AJ Cruz-Jentoft, et al. Physical frailty: ICFSR international clinical practice guidelines for identification and management. J Nutr Health Aging 2019;23(9):771–87. doi:10.1007/s12603-019-1273-z.
[2] O'Caoimh R, Sezgin D, O'Donovan MR, et al. Prevalence of frailty in 62 countries across the world: a systematic review and meta-analysis of population-level studies. Age Ageing 2021;50(1):96–104. doi:10.1093/ageing/afaa219.
[3] Kojima G, Taniguchi Y, Iliffe S, Jivraj S, Walters K. Transitions between frailty states among community-dwelling older people: A systematic review and meta-analysis. Ageing Res Rev 2019;50:81–8. doi:10.1016/j.arr.2019.01.010.
[4] Dent E, Martin FC, Bergman H, Woo J, Romero-Ortuno R, Walston JD. Management of frailty: opportunities, challenges, and future directions. Lancet 2019;394(10206):1376–86. doi:10.1016/S0140-6736(19)31785-4.
[5] Lorbergs AL, Prorok JC, Holroyd-Leduc J, et al. Nutrition and physical activity clinical practice guidelines for older adults living with frailty. J Frailty Aging 2022;11(1):3–11. doi:10.14283/jfa.2021.51.
[6] Dent E, Hanlon P, Sim M, et al. Recent developments in frailty identification, management, risk factors and prevention: A narrative review of leading journals in geriatrics and gerontology. Ageing Res Rev 2023;91(102082):102082. doi:10.1016/j.arr.2023.102082.
[7] Travers J, Romero-Ortuno R, Bailey J, Cooney MT. Delaying and reversing frailty: a systematic review of primary care interventions. Br J Gen Pract 2019;69(678):e61–9. doi:10.3399/bjgp18x700241.
[8] Parikh M, Rajendran I, D'Amico S, Luo M, Gardiner P. Characteristics and Components of Medical Group Visits for Chronic Health Conditions: A Systematic Scoping Review. J Altern Complement Med 2019;25(7):683–98. doi:10.1089/acm.2018.0524.
[9] Scott JC, Conner DA, Venohr I, et al. Effectiveness of a group outpatient visit model for chronically ill older health maintenance organization members: a 2-year randomized trial of the cooperative health care clinic. J Am Geriatr Soc 2004;52(9):1463–70. doi:10.1111/j.1532-5415.2004.52408.x.
[10] Levine MD, Ross TR, Balderson BHK, Phelan EA. Implementing group medical visits for older adults at group health cooperative. J Am Geriatr Soc 2010;58(1):168–72. doi:10.1111/j.1532-5415.2009.02628.x.
[11] Lum HD, Dukes J, Daddato AE, et al. Effectiveness of advance care planning group visits among older adults in primary care. J Am Geriatr Soc 2020;68(10):2382–9. doi:10.1111/jgs.16694.
[12] May SG, Cheng PH, Tietbohl CK, et al. Shared medical appointments to screen for geriatric syndromes: preliminary data from a quality improvement initiative. J Am Geriatr Soc 2014;62(12):2415–19. doi:10.1111/jgs.13142.
[13] Cherniack EP. The use of shared medical appointments in the care of the elderly. J Ambul Care Manage 2014;37(1):32–7. doi:10.1097/JAC.0000000000000003.
[14] Leon AC, Davis LL, Kraemer HC. The role and interpretation of pilot studies in clinical research. J Psychiatr Res 2011;45(5):626–9. doi:10.1016/j.jpsychires.2010.10.008.
[15] Eldridge SM, Chan CL, Campbell MJ, et al. CONSORT 2010 statement: extension to randomised pilot and feasibility trials. BMJ 2016;355. doi:10.1136/bmj.i5239.
[16] Lancaster GA, Thabane L. Guidelines for reporting non-randomised pilot and feasibility studies. Pilot Feasibility Stud 2019;5:114. doi:10.1186/s40814-019-0499-1.
[17] Morley JE, Malmstrom TK, Miller DK. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. J Nutr Health Aging 2012;16(7):601–8. doi:10.1007/s12603-012-0084-2.
[18] Nguyen T, Tang B, Harrison K, et al. Age Self Care, a program to improve aging in place through group learning and incremental behavior change: Preliminary data. Under Review.
[19] Kojima G, Avgerinou C, Iliffe S, Walters K. Adherence to Mediterranean diet reduces incident frailty risk: Systematic review and meta-analysis. J Am Geriatr Soc 2018;66(4):783–8. doi:10.1111/jgs.15251.
[20] Izquierdo M, Duque G, Morley JE. Physical activity guidelines for older people: knowledge gaps and future directions. Lancet Healthy Longev 2021;2(6):e380–3. doi:10.1016/S2666-7568(21)00079-9.
[21] HJ Coelho-Júnior, Uchida MC, Picca A, et al. Evidence-based recommendations for resistance and power training to prevent frailty in community-dwellers. Aging Clin Exp Res 2021;33(8):2069–86. doi:10.1007/s40520-021-01802-5.
[22] Loewenthal J, Innes KE, Mitzner M, Mita C, Orkaby AR. Effect of yoga on frailty in older adults: a systematic review. Ann Intern Med 2023;176(4):524–35. doi:10.7326/M22-2553.
[23] Zoom. zoom video communications, Inc. Accessed April 26, 2024. https://zoom.us/
[24] Russell DW. UCLA Loneliness Scale (Version 3): reliability, validity, and factor structure. J Pers Assess 1996;66(1):20–40. doi:10.1207/s15327752jpa6601_2.
[25] Jakobsson U. Using the 12-item Short Form health survey (SF-12) to measure quality of life among older people. Aging Clin Exp Res 2007;19(6):457–64. doi:10.1007/BF03324731.
[26] Giri S, Mir N, Al-Obaidi M, et al. Use of single-item self-rated health measure to identify frailty and geriatric assessment-identified impairments among older adults with cancer. Oncologist 2022;27(1):e45–52. doi:10.1093/oncolo/oyab020.
[27] Godin G. The godin-shephard leisure-time physical activity questionnaire. Health Fit J Can 2011;4(1):18–22. doi:10.14288/hfjc.v4i1.82.
[28] Chen G, Gully SM, Eden D. General self-efficacy and self-esteem: toward theoretical and empirical distinction between correlated self-evaluations. J Organ Behav 2004;25(3):375–95. doi:10.1002/job.251.
[29] Kroenke K, Stump TE, Chen CX, et al. Responsiveness of PROMIS and patient health questionnaire (PHQ) depression scales in three clinical trials. Health Qual Life Outcomes 2021;19(1):41. doi:10.1186/s12955-021-01674-3.
[30] Kroenke K, Spitzer RL, Williams JBW, Löwe B. The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. Gen Hosp Psychiatry 2010;32(4):345–59. doi:10.1016/j.genhosppsych.2010.03.006.
[31] Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The pittsburgh sleep quality index: a new instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193–213. doi:10.1016/0165-1781(89)90047-4.
[32] Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-Cog as a screen for dementia: validation in a population-based sample. J Am Geriatr Soc 2003;51(10):1451–4. doi:10.1046/j.1532-5415.2003.51465.x.
[33] Guralnik Simonsick, Ferrucci. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home …. J At Mol Phys 1994. Published online https://academic.oup.com/geronj/article-abstract/49/2/M85/595537 .
[34] Perera S, Mody SH, Woodman RC, Studenski SA. Meaningful change and responsiveness in common physical performance measures in older adults. J Am Geriatr Soc 2006;54(5):743–9. doi:10.1111/j.1532-5415.2006.00701.x.
[35] Fried LP, Tangen CM, Walston J, et al. Frailty in Older Adults: Evidence for a Phenotype. J Gerontol A Biol Sci Med Sci 2001;56A(3):12.
[36] Rockwood K, Mitnitski A. Frailty in relation to the accumulation of deficits. J Gerontol A Biol Sci Med Sci 2007;62(7):722–7. doi:10.1093/gerona/62.7.722.
[37] Searle SD, Mitnitski A, Gahbauer EA, Gill TM, Rockwood K. A standard procedure for creating a frailty index. BMC Geriatr 2008;8(1):24. doi:10.1186/1471-2318-8-24.

[38] Shi SM, McCarthy EP, Mitchell SL, Kim DH. Predicting mortality and adverse outcomes: comparing the frailty index to general prognostic indices. J Gen Intern Med 2020;35(5):1516–22. doi:10.1007/s11606-020-05700-w.

[39] Kim DH. For providers: online tool to calculate frailty index (FI). Beth Israel Lahey Health: Senior Health Calculator. https://www.bidmc.org/research/research-by-department/medicine/gerontology/calculator

[40] Dawber TR, Kannel WB, Lyell LP. An approach to longitudinal studies in a community: the framingham study. Ann N Y Acad Sci 1963;107:539–56. doi:10.1111/j.1749-6632.1963.tb13299.x.

[41] Dawber TR, Meadors GF, Moore FE Jr. Epidemiological approaches to heart disease: the framingham study. Am J Public Health Nations Health 1951;41(3):279–81. doi:10.2105/ajph.41.3.279.

[42] Jang IY, Jung HW, Lee HY, Park H, Lee E, Kim DH. Evaluation of clinically meaningful changes in measures of frailty. J Gerontol A Biol Sci Med Sci 2020;75(6):1143–7. doi:10.1093/gerona/glaa003.

[43] Simpson FR, Justice JN, Pilla SJ, et al. An examination of whether diabetes control and treatments are associated with change in frailty index across 8 years: An ancillary exploratory study from the Action for Health in diabetes (Look AHEAD) trial. Diabetes Care 2023;46(3):519–25. doi:10.2337/dc22-1728.

[44] The consumer assessment of healthcare providers and systems (CAHPS) ambulatory care improvement guide. strategy 6M: group visits. AHRQ: agency for healthcare research and quality. October 2017. Accessed July 15, 2024. https://www.ahrq.gov/cahps/quality-improvement/improvement-guide/6-strategies-for-improving/access/strategy6m-group-visits.html.

[45] Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol 2006;3(2):77–101. doi:10.1191/1478088706qp063oa.

[46] Ganguli I, Chant ED, Orav EJ, Mehrotra A, Ritchie CS. Health care contact days among older adults in traditional medicare : a cross-sectional study. Ann Intern Med 2024;177(2):125–33. doi:10.7326/M23-2331.

[47] Travers J, Romero-Ortuno R, Langan J, et al. Building resilience and reversing frailty: a randomised controlled trial of a primary care intervention for older adults. Age Ageing 2023;52(2). doi:10.1093/ageing/afad012.

[48] Tosi FC, Lin SM, Gomes GC, et al. A multidimensional program including standing exercises, health education, and telephone support to reduce sedentary behavior in frail older adults: Randomized clinical trial. Exp Gerontol 2021;153(111472):111472. doi:10.1016/j.exger.2021.111472.

[49] Teh R, Barnett D, Edlin R, et al. Effectiveness of a complex intervention of group-based nutrition and physical activity to prevent frailty in pre-frail older adults (SUPER): a randomised controlled trial. Lancet Healthy Longev 2022;3(8):e519–30. doi:10.1016/S2666-7568(22)00124-6.

[50] Cesari M, Vellas B, Hsu FC, et al. A physical activity intervention to treat the frailty syndrome in older persons-results from the LIFE-P study. J Gerontol A Biol Sci Med Sci 2015;70(2):216–22. doi:10.1093/gerona/glu099.

[51] Delaire L, Courtay A, Humblot J, et al. Implementation and core components of a multimodal program including exercise and nutrition in prevention and treatment of frailty in community-dwelling older adults: a narrative review. Nutrients 2023;15(19). doi:10.3390/nu15194100.

[52] Frates EP, Morris EC, Sannidhi D, Dysinger WS. The art and science of group visits in lifestyle medicine. Am J Lifestyle Med 2017;11(5):408–13. doi:10.1177/1559827617698091.