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Utility of Goal Attainment Scaling (GAS) in evaluating a multicomponent exercise programme for community-dwelling pre-frail older adults

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ABSTRACT

Objectives This study aimed to investigate the effectiveness of Goal Attainment Scaling (GAS) in assessing an intervention for pre-frail senior citizens. Additionally, the study aimed to explain how the GAS goals were established based on the International Classification of Functioning, Disability and Health (ICF) categories, including body function, activity and participation and environmental factors.

Methods In this study, 220 pre-frail older adults were randomly selected to participate in a controlled trial. The intervention group engaged in multicomponent exercise three times a week, once at a community health service location and twice at home. The control group received advice on physical activity but did not have supervised exercise. Participants in both groups selected individualised GAS goals from 23 goals developed based on ICF by focus group discussion. The study used generalised estimating equations to analyse the differences between the groups.

Results The study included 144 participants, 72 in the exercise group and 72 in the control group. The top three individualised goals for all participants were vestibular functions (53.5%), pain management (43.1%) and lifting and carrying objects (31.9%). Both groups saw a significant increase in GAS scores at week 8 and week 24 of the intervention ($p<0.05$), but the exercise group showed a more significant improvement ($p<0.05$). The participants living alone were associated with lower postintervention improvements in the GAS scores. In contrast, the participants who were using a smartphone were likely to get higher postintervention improvements in the GAS scores.

Conclusions GAS can be a valuable tool for setting and evaluating individualised and meaningful goals in body functions, activity and participation and environmental factors. The multicomponent exercise interventions can help pre-frail older adults achieve their expected goals as measured by the GAS.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Goal Attainment Scaling (GAS)people with cognitive impairment, dementia, Parkinson's disease and multiple disabilities to identify patient-centred goals, but no study has assessed the suitability of GAS in older adults with pre-frailty in the community, especially in the exercise intervention.

WHAT THIS STUDY ADDS

⇒ The combination of the GAS and the International Classification of Functioning, Disability and Health categories could facilitate the goal setting for older adults involved in exercise intervention. Multicomponent exercise programme may facilitate personalised goal attainment among older populations with pre-frailty in the community, which effectively measured by GAS.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ It might be feasible to implement GAS in the primary care of older adults with pre-frailty to facilitate patient-centred care.

INTRODUCTION

Frailty is a common clinical state in which there is a marked individual's vulnerability to developing an increased dependency and mortality when exposed to a stressor.[1]

Pre-frailty is a multidimensional risk state associated with one or more physical impairments, cognitive decline, nutritional deficiencies and socioeconomic disadvantages, predisposing to the development of frail.[2] Pre-frailty prevalence was approximately 50%, based on a recent systematic review and meta-analysis of population-level studies in 62 countries.[3] Older adults with pre-frailty have problems being actively involved in essential life activities that affect their health. Due to a decline in reserve and function across multiple physiologic systems, older adults with pre-frailty often present with complex problems and adverse outcomes, such as frailty, functioning decline, hospitalisation, institutionalisation and increased mortality.[4 5]

Multicomponent exercises are the most effective programme in improving the

physical condition and health status of older people with frailty among various physical interventions.[6] A Position Stand written for the American College of Sports Medicine pointed out that exercise prescription for frail people is more beneficial than any other intervention, and multicomponent exercise usually includes strength and balance exercises.[7] According to Marques *et al*,[8] multicomponent exercises combine endurance, strength, co-ordination, balance and flexibility exercises. Cadore *et al*[9] believed that multicomponent exercises comprise resistance, balance and gait exercises. Another study defined it as a physical intervention consisting of physical conditioning activities, such as strength, endurance, balance and flexibility training.[10] To improve physical performance in the older population, Sadjapong *et al*[11] conducted a multicomponent exercise programme including aerobic, resistance and balance training.

Multicomponent exercises intervention programme necessitates a multidimensional approach to assessment and the establishment of a range of individualised goals for each participant.[12] There are diverse benefits of goal setting for older adults, such as improved functional ability, life satisfaction, emotional status and self-efficacy.[13–15] Not all of these goals may be relevant for each older adult. Moreover, the same result, such as walking 100 m without assistance, may be considered a positive or a negative outcome, depending on the circumstances of a particular patient. Current outcome measures for pre-frailty do not incorporate personalised health goals, and individualised goal setting could help pre-frail older adults obtain what is essential to them and identify if the improvement is within their expectations.

Goal Attainment Scaling (GAS) is a personalised outcome measurement approach that accommodates multiple and individual goals, initially developed as a community mental health programme evaluation tool.[16] GAS is considered especially sensitive in assessing the achievement of individualised intervention or care goals over time.[17] Although GAS was first developed for use in the mental health field,[16] it was used in geriatric medicine,[18] rehabilitation,[19] surgery[20] and neurology.[21] The GAS process usually begins with an interview to identify areas of challenge and to set three or more goals, often weighted according to personal importance and difficulty. The baseline status for each goal is then established, and outcomes considered better and worse than the baseline are described to complete the 5-point GAS Scale, ranging from +2 (much better than expected) to − 2 (much worse than expected). The scale is then used to assess the degree of goal achievement over specified time intervals.

The administration of GAS has been seen as complicated.[22] Inconsistent goal terminology confuses patients and reduces the engagement of older adults.[23] A goal inventory was used to assist in goal setting in the clinical care of persons with dementia to make the administration more explicit.[24] Matérne *et al* conducted a study targeted at adults with profound intellectual and multiple disabilities, where GAS goals were mainly formulated according to International Classification of Functioning, Disability and Health (ICF).[25] Even small changes are probably meaningful for the aquatic activity group and could be measured by GAS.[25]

Few studies attempted to use GAS to facilitate individual goal setting on the pre-frail older adults in the community. Little is known about whether goals for persons with pre-frailty can be elicited and measured in clinical care, especially in exercise intervention. It is interesting to understand how the goals set within GAS are distributed from an interactional perspective described based on the model of the ICF if the goals can be classified as goals in terms of body functions, activity and participation and environmental factors. Therefore, this study aimed to explore the utility of GAS as a tool for facilitating individual goal setting and in the evaluation of individual goal attainment in pre-frail older adults involved in the multicomponent exercise intervention, as well as to describe how the GAS goals were set according to the ICF domains.

METHODS

Design

This study is part of a larger research project of an exercise intervention, a parallel group randomised controlled trial with repeated measures to determine the effect of a 24-week exercise programme on community-dwelling pre-frail older adults. The trial was conducted from 1 July 2022 to 31 December 2022 in four community health service sites of two community health service centres in China. GAS was applied as a measure of individual goal attainment along with other measurements in evaluating the potential impacts of exercise intervention. The present study focuses on the utility of GAS for the participants in the intervention. The GAS goals were set before the start of the intervention period for each participant and evaluated at week 8 and week 24.

Participants and setting

Two community health service centres were selected in Shangcheng District and Gongshu District of Hangzhou, respectively, using the typical sampling method, as the two centres selected are the first batch of demonstration community health service centres in Zhejiang. One community health service centre has four community health service sites and another has seven community health service sites. Then, one community health service site was randomly chosen from each community health service centre as the exercise group and one site as the control group. The randomisation was conducted by simple random sampling in SPSS V.22.0. Finally, the old adults who met the inclusion criteria at each site were chosen as the participants. A total of 144 pre-frail older adults were enrolled, 72 in each group.

The inclusion criteria were the following: (1) age of 60–85 years; (2) one or two frailty criteria described by Fried *et al*[26]; (3) without regular exercise habits (less than three times per week and 30 min every time) in the past

Table 1 Goals pool for exercise interventions on pre-frail older adults in the community

Domain	Area	Category
Body functions	1.1 Mental functions	1.1.1 Temperament and personality functions
		1.1.2 Energy and drive functions
		1.1.3 Sleep functions
		1.1.4 Emotional functions
	1.2 Sensory functions and pain	1.2.1 Vestibular functions (balance ability)
		1.2.2 Pain
	1.3 Exercise functions	1.3.1 Exercise tolerance functions
		1.3.2 Mobility of joint functions
		1.3.3 Muscle power functions
Activity and participation	2.1 Mobility	2.1.1 Changing basic body position
		2.1.2 Maintaining body position
		2.1.3 Lifting and carrying objects
		2.1.4 Walking
		2.1.5 Moving around
		2.1.6 Using transportation
	2.2 Domestic life	2.2.1 Acquiring goods or services
		2.2.2 Doing housework
	2.3 Community, social and civic life	2.3.1 Community life
		2.3.2 Recreation and leisure
Environmental factors	3.1 Support and relationships	3.1.1 Immediate family
		3.1.2 Friends, neighbours and community members
		3.1.3 Health professionals
	3.2 Services, systems and policies	3.2.1 Health services, systems and policies

6 months; (4) can generally communicate without auditory or visual impairment; (5) be able to walk without assistance; (6) community-dwelling for the next 6 months; and (7) volunteered to participate in this study.

The exclusion criteria were as follows: (1) severe psychiatric illness; (2) moderate or severe cognitive impairment, which will be assessed by Mini-Mental State Examination scores<18; and (3) unstable clinical condition to performing exercise, including but not limited to severe cardiac insufficiency, acute myocardial infarction, unstable angina, non-controlled hypertension, a history of stroke, Parkinson's disease and severe respiratory insufficiency disease. Condition (1) was previously diagnosed by a physician.

The sample size was calculated (http://powerandsamplesize.com/Calculators/) in the ratio of 1:1, considering α of 0.05, power of 80% and intergroup difference of 24% in the reversal rate of frailty, including a loss to follow-up rate of 20%. The intergroup difference was based on the effective size of exercise intervention in a previous study.[6] Finally, 126 qualified participants were divided into an exercise and a control group, 63 per group. A researcher blinded to assignment to interventions enrolled participants and another assigned participants to interventions. The participants were blinded from assignment to interventions.

Intervention group

The exercise group received 24 weeks of exercise intervention of traditional Chinese exercise and modern exercise. Exercise intervention was performed three times a week, once at a community health service location and twice at home. Each session was 47 min, including warm-up exercise for 5 min, aerobic exercise for 10 min, resistance exercise for 5 min, flexibility training for 5 min, balance training for 5 min, acupoint patting[27] for 5 min and Baduanjin for 12 min.

Control group

Participants in the control group received health education about exercise only once. After the trial, they were invited to participate in the physical activity programme if the results were positive, and they accepted the invitation.

Goal Attainment Scaling

Attainment of goals was assessed using the GAS. A pool of potential goals was developed by the research team based on the ICF to simplify the process and make it easier for the participants to identify relevant targets. Through focus group discussion with 4 relevant experts and Delphi consultations with 21 experts on the relevance, importance and applicability of the goals, a total of 23 goal indicators tailored to individual participants'

Table 2 Demographics and characteristics of participants

Variable	Exercise group (n=72)	Control group (n=72)	T/Z/χ^2	P value
Age (years, $\bar{x} \pm s$)	73.96±7.20	72.92±6.36	0.92	0.359
Gender				
Male (%)	27 (37.5)	23 (31.9)	0.49	0.484
Female (%)	45 (62.5)	49 (68.1)		
Educational level (%)			2.09	0.553
Primary school and below (%)	19 (26.4)	17 (23.6)		
Junior high school (%)	36 (50.0)	33 (45.8)		
Senior middle school (%)	7 (9.7)	13 (18.1)		
College and higher (%)	10 (13.9)	9 (12.5)		
Marital status			0.04	0.851
Married (%)	52 (72.2)	53 (73.6)		
Not married (unmarried, divorced, widowed) (%)	20 (27.8)	19 (26.4)		
Personal monthly income (¥)			0.29	0.865
≤3999 (%)	15 (20.8)	15 (20.8)		
4000–6999 (%)	50 (69.4)	48 (66.7)		
≥7000 (%)	7 (9.7)	9 (12.5)		
Job before retired				
Person in charge of enterprises and institutions/administrative personnel (%)	12 (16.7)	10 (13.9)	1.53	0.677
Professionals (%)	9 (12.5)	14 (19.4)		
Worker (%)	39 (54.2)	35 (48.6)		
Other (%)	12 (16.7)	13 (18.1)		
Living condition			0.05	0.820
Living alone (%)	11 (15.3)	12 (16.7)		
Not living alone (%)	61 (84.7)	60 (83.3)		
Smoking			0.93	0.335
Yes (%)	12 (16.7)	8 (11.1)		
No (%)	60 (83.3)	64 (88.9)		
Drinking			1.21	0.271
Yes (%)	15 (20.8)	10 (13.9)		
No (%)	57 (79.2)	62 (86.1)		
Using a smartphone			0.13	0.717
Yes (%)	51 (70.8)	49 (68.1)		
No (%)	21 (29.2)	23 (31.9)		
Number of chronic diseases			0.14	0.934
≤1 (%)	31 (43.1)	30 (41.7)		
2 (%)	20 (27.8)	22 (30.6)		
≥3 (%)	21 (29.2)	20 (27.8)		
BMI	23.69±2.86	23.28±3.32	0.81	0.418
Heart rate (bpm)	75.72±10.44	74.82±8.86	0.56	0.577
Systolic pressure (mm Hg)	133.36±17.06	133.42±12.82	−0.02	0.982
Diastolic pressure (mm Hg)	74.53±10.64	75.69±9.42	−0.70	0.487
GAS	17.56±7.59	17.75±8.40	−0.14	0.889

BMI, body mass index; GAS, Goal Attainment Scaling.

needs and preferences were established, which involved three problem areas (body functions, activities and participation and environmental factors) and covered eight aspects (mental functions, sensory functions and pain, exercise functions, mobility, domestic life, community, social and civic life, support and relationships and

services, systems and policies). All 23 individualised goals are presented in table 1.

Three GAS assessments were conducted at baseline, 8 weeks into the intervention and 24 weeks into the intervention. A general practitioner at each site was designated to guide participants in setting and evaluating goals throughout the study after unified training by the research team. All participants are required to set between three and six goals, selected from a list of 23 items developed. Participants were actively involved in the goal-setting and goal-rating process with the guidance of the general practitioner. Older adults also should weigh their goals by importance and difficulty at baseline. In most cases, GAS baseline status was anchored below '0'. GAS scores were calculated by the researcher using the following formula:

$$T = 50 + \frac{10\sum w_i x_i}{\sqrt{(1-\rho)\sum w_i^2 + \rho\left(\sum w_i\right)^2}}$$

An aggregated T score with a mean of 50 and an SD of 10 was obtained. T is the composite score, w_i is the weight assigned to the ith goal, x_i is the numerical value (− 2 to +2) of the attainment level of the ith goal and ρ is the estimated correlation between goal scores, assumed to be constant at 0.3.[24]

Procedure and data collection

Before starting the intervention, the research team member met the participant at the included community health service centre. With the assistance of the general practitioner, three to six desirable and expected individual goals that could be affected by the intervention were identified and set for each participant through discussion. To evaluate the study participant's individual goal achievement, the baseline level for the individualised GAS was also established simultaneously. At week 8, the mid-intervention GAS assessment was performed. Each participant graded their achievement of the individual goal. The final assessment was conducted similarly after the intervention at week 24.

Statistical analysis

SPSS V.22.0 was used for statistical analysis. The measurement data were described using mean and SD, median and interquartile distance according to distribution. Description of frequency and percentage were used for classified data. The baseline characteristics of the two groups were compared using the independent t-tests, Mann-Whitney U test or χ^2 test.

This is a repeated measurement study with intersubject factors (intervention and control) and intrasubject factors (time). The generalised estimation equations were used to evaluate the difference in the change of outcome indicators between the two groups. Moreover, the generalised linear mixed model is further used to analyse influencing factors of intervention effect. Bilateral p<0.05 was considered statistically significant.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Attendance

A total of 220 community-dwelling older adults were screened. Among them, 144 were enrolled in the trial and randomly allocated to the control group (n=72) or exercise group (n=72). Five participants in the control and six in the exercise group were lost to the follow-up. The reasons for the loss of follow-up were surgery (n=1), hospitalisation (n=3), removal from the community (n=2) and unwillingness to continue participation (n=5).

The participants' general characteristics are described according to groups in table 2. Participants were between 60 and 85 years, 94 (65.3%) were women and all were assessed with pre-frailty. In the exercise group, the mean age of participants was 73.96 (7.20) years; 45 (62.5%) were women and 27 (37.5%) were men. On average, the percentage of attendance in the exercise group was 86%, ranging from 60% to 100%.

Description of individual goal setting

All participants selected 617 goals in total. The top three individualised goals of all participants were vestibular functions (53.5%), pain (43.1%) and lifting and carrying objects (31.9%). Participants in the intervention group selected a total of 317 goals: the first was vestibular functions (40.3%), the second was the mobility of joint functions (36.1%) and the third was community life (34.7%). The participants in the control group selected 300 goals in total, and the top 3 choices were as follows: vestibular functions (66.7%), pain (55.6%), lifting and carrying objects (36.1%) and changing basic body position (36.1%) (table 3).

Changes in GAS scores from baseline to 8 weeks and 24 weeks

GAS scores measure the degree of attainment of individualised goals. The status of the participants was assessed against the goal attainment levels, and an overall goal attainment score was calculated using the standardised formula. A score of 50 represents an outcome at the expected level, and a higher score represents a higher level of achievement. At week 8 and week 24, participants in both groups had a significant increase in GAS scores (p<0.05), but the improvement was more significant in the exercise group (p<0.05). At week 8, the mean GAS Score of the two groups was below the successful level of 50, while at week 24, the mean score of the exercise group was over 50 points (table 4).

The multivariate linear regression model indicated that the participants who were not living alone (β=6.30,

Table 3 Goals selected by participants in two groups

Goals	Exercise group (%)	Ordering	Control group (%)	Ordering
Temperament and personality functions	6 (8.3)	18	2 (2.8)	22
Energy and drive functions	17 (23.6)	9	8 (11.1)	13
Sleep functions	14 (19.4)	12	21 (29.2)	5
Emotional functions	7 (9.7)	17	4 (5.6)	15
Vestibular functions (balance ability)	29 (40.3)	1	48 (66.7)	1
Pain	22 (30.6)	4	40 (55.6)	2
Exercise tolerance functions	9 (12.5)	15	3 (4.2)	20
Mobility of joint functions	26 (36.1)	2	16 (22.2)	7
Muscle power functions	13 (18.1)	13	9 (12.5)	11
Changing basic body position	15 (20.8)	10	26 (36.1)	3
Maintaining body position	6 (8.3)	18	12 (16.7)	10
Lifting and carrying objects	20 (27.8)	5	26 (36.1)	3
Walking	8 (11.1)	16	3 (4.2)	20
Moving around	5 (6.9)	20	4 (5.6)	15
Using transportation	2 (2.8)	23	1 (1.4)	23
Acquiring goods or services	4 (5.6)	22	4 (5.6)	15
Doing housework	18 (25.0)	8	9 (12.5)	11
Community life	25 (34.7)	3	4 (5.6)	15
Recreation and leisure	5 (6.9)	20	4 (5.6)	15
Immediate family	20 (27.8)	5	20 (27.8)	6
Friends, neighbours and community members	11 (15.3)	14	8 (11.1)	13
Health professionals	15 (20.8)	10	15 (20.8)	8
Health services, systems and policies	20 (27.8)	5	13 (18.1)	9

p=0.018) were associated with higher postintervention improvements in the GAS scores. In contrast, the older adults who were not using a smartphone (β=−4.16, p=0.015) were associated with lower postintervention improvements in the GAS scores (table 5).

DISCUSSION

The GAS instrument was called for to evaluate patient-reported healthcare outcomes, as it is advantageous in a healthcare environment that encourages highly individualised patient-centred care.[28] It is a great challenge to ask patients to set goals without a reference pool of targets.[28] A predefined pool of target indicators could make it easier for care providers to negotiate with their patients to set goals.[28] ICF was confirmed to be influential in the formation of the goals pool, where each older adult selected three to six various goals.

Of the 23 goals, the top choice was vestibular functions (balance exercise), selected by more than half of the older adults. Vestibular dysfunction is common in older adults, especially those aged 80 years and above, which may lead to vertigo, dizziness, poor postural stability, oscillopsia, decreased dynamic visual acuity and reduced postural stability.[29] For the older people, improving and maintaining balance is essential, as a lack of balance ability may contribute to falls and activity avoidance.[30] In the exercise intervention for older adults in the pre-frailty period, it is necessary to pay attention to the needs of the older adults to improve their balance ability or delay the deterioration

Table 4 Comparisons of GAS Score between exercise and control groups across time

Time	Exercise group (n=66)	Control group (n=67)	Linear mixed effects model (p)			Change from baseline (p)		Intergroup comparisons (p)
			Group	Time	Group×time	Exercise group	Control group	
Baseline	17.56±7.59	17.75±8.40	<0.001	<0.001	<0.001	–	–	0.889
Week 8	33.98±8.63	21.81±9.30				<0.001	<0.001	<0.001
Week 24	54.62±13.25	22.39±13.88				<0.001	0.002	<0.001

Table 5 Multivariate analysis of GAS Score between exercise and control groups across time (n=133)

Variable	β (95% CI)	T test	P value
Constant	12.24 (2.39 to 22.10)	2.44	0.015
Group (ref.=control)			
Exercise	−0.12 (−3.52 to 3.27)	−0.07	0.943
Time (ref.=baseline)			
Week 8	4.03 (1.63 to 6.43)	3.30	0.001
Week 24	4.42 (1.68 to 7.16)	3.17	0.002
Group×time (ref.=control and baseline of exercise group)			
(Exercise group)×(week 8)		7.00	<0.001
(Exercise group)×(week 24)	32.19 (28.31 to 36.08)	16.29	<0.001
Gender (ref.=male)			
Female	−2.52 (−5.92 to 0.87)	−1.46	0.145
Marital status (ref.=married)			
Not married	−1.94 (−6.20 to 2.32)	−0.90	0.371
Age (ref.=<75 years)			
≥75 years	−1.07 (−4.42 to 2.28)	−0.63	0.529
Educational level (ref.=primary school and below)			
Junior high school	−0.69 (−4.27 to 2.88)	−0.38	0.702
Senior middle school	−0.86 (−5.78 to 4.07)	−0.34	0.732
College and higher	−3.52 (−9.72 to 2.68)	−1.12	0.265
Personal monthly income (ref.=≤￥3999)			
￥4000–￥6999	−0.08 (−3.58 to 3.42)	−0.05	0.964
≥￥7000	−1.37 (−6.73 to 3.99)	−0.50	0.616
Job before retirement (ref.=person in charge of enterprises and institutions/administrative personnel)			
Professionals	2.86 (−2.67 to 8.40)	1.02	0.309
Worker	0.87 (−3.60 to 5.34)	0.38	0.703
Other	3.30 (−2.01 to 8.61)	1.22	0.222
Living condition (ref.=living alone)			
Not living alone		2.37	0.018
Smoking (ref.=yes)			
No	2.95 (−2.00 to 7.89)	1.17	0.242
Drinking (ref.=yes)			
No	2.13 (−2.10 to 6.35)	0.99	0.324
Using a smartphone (ref.=yes)			
No	−4.16 (−7.50 to −0.83)	−2.46	0.015
Number of chronic diseases (ref.=≤1)			
2	1.00 (−2.38 to 4.38)	0.58	0.561
≥3	1.29 (−2.25 to 4.83)	0.72	0.473
BMI (ref.=<24)			
≥24	−1.43 (−4.30 to 1.44)	−0.98	0.326
Heart rate (ref.=<70 bpm)			
70–79 bpm	−1.34 (−5.15 to 2.47)	−0.69	0.489
≥80 bpm	0.60 (−3.81 to 5.01)	0.27	0.788
Systolic pressure (ref.=<140 mm Hg)			
≥140 mm Hg	1.25 (−2.02 to 4.51)	0.75	0.452
Diastolic pressure (ref.=<80 mm Hg)			
≥80 mm Hg	−1.07 (−4.13 to 2.00)	−0.68	0.495

BMI, body mass index; GAS, Goal Attainment Scaling.

of balance ability and strengthen the balance training in the intervention programme.

Overall, 43.1% of participants would like to alleviate pain through the intervention. Indeed, it is reported that pain can be a barrier to exercise.[6] Chronic pain could predict the incidence of frailty.[31] Studies that use different pain management strategies to reduce physical frailty are called for. Future exercise programmes should consider whether the intervenor has pain, the location and the degree of pain to improve the degree of personalised intervention and the effect of the intervention.

The goal of 'lifting and carrying objects' was selected by nearly a third of the participants. Guidelines recommend assessing muscle strength by 'the degree of difficulty in lifting and carrying a 10-pound weight'.[32] Lifting and carrying objects is a daily requirement for the older adults. The older adults live alone in the community, and a large part of the older adults live apart from their children, and the older adults need to complete various tasks in life by themselves. The older adults' upper limb muscle strength training should be strengthened in the intervention programme to meet the goal of lifting and carrying objects.

The multicomponent exercise intervention programme evaluated in this study involves aerobic exercise, resistance exercise, flexibility training, balance training, acupoint patting and Baduanjin. This study shows that multicomponent exercise interventions in community health services can improve self-reported health outcomes measured by the GAS among pre-frail older adults. This result is consistent with previous studies.[11 27] A review also showed that traditional Chinese exercise may help alleviate frailty status and improve the quality of life and physical functions of frail and pre-frail older adults.[33]

Living condition was associated with the GAS scores in this study. In this study, participants living alone reported a lower level of achievement than those living with others. Older people living alone results in less companionship and care of family members, lack of social support and financial support, more difficulties in the accessibility of medical services and a series of problems in physical and psychological conditions.[34 35] Previous studies also demonstrated that living alone was associated with cognitive decline and increased mortality in older adults.[36 37] In addition, whether a participant used a smartphone or not was shown to be a predictor of the change in the GAS scores. Older adults who did not use smartphones were less likely to achieve individualised goals. Smartphones have become increasingly popular among the older population, through which they can obtain information, communicate, entertain and purchase goods, making the lives of older adults more abundant and convenient. Studies have shown that the internet can help older people improve family relations, increase intergenerational support levels and enhance well-being.[38] It can also improve self-rated physical health and mental health and reduce the impact of health problems on work and daily activities.[39]

Overall, the multicomponent exercise that integrated modern exercise and traditional Chinese exercise may be tailored to pre-frail older adults and could be implemented in the community, as it could facilitate participants' personalised goal attainment regarding three areas of ICF. Our results also demonstrated that GAS was beneficial for identifying subtle personal improvements and could be incorporated into the care of persons with pre-frailty. This individualised assessment could improve participants' self-efficacy and compliance with regular exercise.

Nevertheless, this study has several limitations. First, the study was conducted in Hangzhou, one of the cities with the highest concentration of quality healthcare resources in community health services. Attempts to extrapolate the findings to other regions need to be cautious. Second, the participants recruited are limited to community-dwelling pre-frail older adults, so the results cannot be extrapolated to the rest of the population. Third, the goals pool in this study was developed by focus group discussion and expert consultation, being lack of the investigation of the older people with pre-frailty. Future studies are warranted to compare GAS to other patient-reported outcome measures[24] and validate if GAS could be a rigorous outcome measure for other interventions among older adults with pre-frailty.

CONCLUSION

The GAS can be used as a viable way to optimise improvements in personal goal attainment for community-dwelling older adults with pre-frailty. The 24-week multicomponent exercise programme can help pre-frail older adults achieve their expected goals as measured by the GAS.

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