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Walk, Talk and Listen: a pilot randomised controlled trial targeting functional fitness and loneliness in older adults with hearing loss

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ABSTRACT

Background Age-related hearing loss (HL) is a prevalent disability associated with loneliness, isolation, declines in cognitive and physical function and premature mortality. Group audiological rehabilitation (GAR) and hearing technologies address communication and cognitive decline. However, the relationship between loneliness, physical function and GAR among older adults with HL has not been studied.

Objectives Explore the impact of a group exercise and socialisation/health education intervention and GAR on physical function and loneliness among older adults with HL.

Trial design A Young Men's Christian Association (YMCA)-based, 10-week, single-blind, pilot randomised controlled trial (RCT).

Participants Ambulatory adults aged 65 years or older with self-reported HL.

Interventions Seventy-one participants were screened. Thirty-five were randomised to intervention (strength and resistance exercise, socialisation/health education) and GAR (hearing education, communication strategies, psychosocial support) or control (n=31): GAR only.

Outcomes Ninety-five per cent of eligible participants were randomised. GAR and exercise adherence rates were 80% and 85%, respectively. 88% of participants completed the study. Intervention group functional fitness improved significantly (gait speed: effect size: 0.57, 30 s Sit to Stand Test: effect size: 0.53). Significant improvements in emotional and social loneliness (effect size: 1.16) and hearing-related quality of life (effect size: 0.76) were related to GAR attendance and poorer baseline hearing-related quality of life. Forty-two per cent of participants increased social contacts outside the study.

Discussion Walk, Talk and Listen was feasible and acceptable. Exercise and socialisation/health education improved loneliness and key fitness measures but provided no additional benefit to GAR only for loneliness. This is the first preliminary evidence about the benefits of exercise on fitness and GAR on loneliness among older adults with HL.

Implications This pilot trial provides key information on the sample size required for a larger, longer term RCT to determine the enduring effects of this holistic intervention addressing the negative psychosocial and musculoskeletal downstream effects of HL among older adults.

Strengths and limitations of this study

► First study to examine the effects of exercise intervention and auditory rehabilitation on functional fitness and loneliness among older adults with hearing loss.
► Fifty-seven per cent of participants are male: unusual for a community exercise programme.
► This is an exploratory single-blind pilot randomised controlled trial
► There is not a control group with no intervention.

BACKGROUND

Hearing loss (HL) is a prevalent and under-recognised disability that is associated with significant psychosocial and physical challenges. Large surveys[1][2] indicate that between 65% and 77% of North American adults aged 60–79 have audiometrically measured HL.

Untreated HL is associated with increased rates of loneliness, social isolation,[3][4] depression, accelerated cognitive decline, declines in physical function, gait speed, balance, frailty, increased falls, hospitalisations and premature mortality.[5]

These downstream effects of HL are inter-related. Numerous theories exist regarding the mechanism of these associations. One theory suggests that increased cognitive energy is used to comprehend sound/language, leaving less cognitive reserve for complicated tasks such as memory, social interaction and walking.[5] Work is ongoing in this area.[6][7] Another theory posits that HL–related social isolation and loneliness are linked to the cognitive decline, depression, impaired physical function, falls and mortality among older adults.[4][8][9]

Social isolation is an objective measure of lack of contact/interactions with others,[10] while loneliness is a subjective feeling of the

lack of meaningful social connections.[11] Linked to HL-related decreases in social participation, loneliness has also been independently associated with depression, cognitive decline, reduced physical functioning and mortality (reviewed in refs [12 13]).

Hearing technologies (hearing aids, assistive technologies and cochlear implants) and communication programmes (one on one or group auditory rehabilitation [GAR]) are the current approaches to treating HL. GAR programmes include education about hearing, hearing devices/technologies, enhancing communication skills and psychosocial support.[14] Hearing technologies improve auditory function, cognitive decline, depression and loneliness.[15–17] GAR improves objective measures of social participation (social isolation)[18] and hearing-related quality of life; however, to our knowledge, no studies explore how GAR programmes impact loneliness or physical function among older adults with HL.

Group programmes for lonely/socially isolated older adults involving interactive shared activities (eg, social/cultural, educational or physical activities), as opposed to independent activities (eg, reading or watching TV), improve quality of life, loneliness[19–22] and in those that included exercise interventions, physical function and premature mortality.[22 23]

Since HL, loneliness and physical inactivity are inter-related and associated with multiple comorbidities, it is of interest to explore interventions that improve loneliness and physical function among older adults with HL. In this pilot randomised controlled trial (RCT), Walk, Talk and Listen (WTL), we begin to explore the impact of GAR on loneliness and physical function, and importantly, whether addition of an interactive/social group educational and physical strengthening intervention is of any additional benefit to older adults with HL.

Objective

Examine the feasibility and impact of a group exercise and socialisation/health education (SHE) intervention added to GAR on physical function, hearing-related quality of life and loneliness among older adults with HL.

DESIGN AND METHODS
Patient and public involvement

Twenty-eight older adults with HL participated in the design of the intervention for this clinical trial.[24] WTL participants helped, by word of mouth, to recruit several other participants. WTL participants provided ongoing and end-of-study feedback and helped disseminate the trial results. One participant and the principle investigator continue to deliver GAR sessions twice a year in the local community.

Trial protocol

Detailed WTL methodology is reported elsewhere.[25] Briefly, in partnership with the Young Men's Christian Association (YMCA) Okanagan, WTL was a 10-week

prospective single-blind randomised controlled pilot trial of interactive GAR (control) versus GAR plus interactive SHE and strengthening exercises in community-dwelling, ambulatory older adults (age 65 or above) with self-reported[26] HL (ClinicalTrials.gov NCT02662192. Pre-results. Registered 14 January 2016). Participants were recruited over the two time periods preceding the trial (January to February 2016 and July to August 2016) through local newspaper ads, strategically placed posters and word of mouth. Potential participants contacting the trial centre underwent preliminary telephone eligibility assessment after the study was briefly described and verbal consent obtained. At the YMCA, eligible[25] participants signed informed consent and underwent baseline (week 0) and follow-up (week 11) assessments completed by trained students and research team members. All procedures included groups of 10–20 participants and took place in a small, acoustically favourable meeting room and/or a small gym at the same YMCA site over a period of 10 weeks. One-hour control group GAR-only sessions occurred once a week. Intervention group 1-hour GAR sessions were followed by 60 min of exercise (strength, resistance and coordination training: 45 min) and walking (outside or on indoor track: 15 min). On their second weekly visit, intervention participants attended a 1-hour interactive SHE session[25] followed by 60 min of exercise and walking. A certified YMCA trainer facilitated the exercise sessions. Participants were encouraged to walk between sessions and were provided a pedometer and tracking sheets to motivate them. At study end, control participants were offered the exercise programme and provided a pedometer. Trained students helped the principle investigator facilitate the GAR and SHE sessions. Interactive GAR sessions were guided by a modification of the The Group Rehabilitation Online Utility Pack (GROUP) programme[27] and provided hearing education, goal setting and psychosocial and behaviour change exercises including mindfulness, acceptance of HL, assertiveness training, communication strategies, problem-solving, anticipatory and repair strategies. Participants were encouraged to review class handouts with their communication partners (spouse, significant other or friend). One 3-hour large-group communication partner session was held near the end of the study. The trial was conducted over two separate 10-week time periods (with different participants) to accommodate YMCA scheduling and allow for smaller participant groups.

Feasibility and acceptability

Feasibility, including recruitment strategies and rates, acceptability/willingness to be randomised, adverse events, GAR attendance rates, overall retention rates, and acceptability of the GAR and exercise components, was assessed at follow-up (end of study). A priori, it was decided that a definitive RCT would be feasible if at least 120 individuals contacted the pilot trial centre, ≥90% of eligible participants were randomised and 70% of those completed the study. The WTL intervention was

acceptable if at least 85% of participants found the GAR, exercise and SHE sessions highly acceptable or acceptable.

Participant-specific outcomes
Demographic data were collected at baseline (week 0), and the remaining measures at baseline and follow-up (week 11).

Standard functional fitness outcomes included 30 s Chair Sit to Stand Test,[28] gait speed: 6 min Walk Test,[29] Timed Up and Go Test,[29] One-Foot Balance Test,[30] Grip Strength,[31] Chair Sit and Reach Test[32] and the Back Scratch.[33]

Psychosocial measures included self-reported hearing-related quality of life or hearing handicap (Hearing Handicap Inventory for the Elderly [HHIE-25])[26] and the Rand SF-36[34] (Short Form [general] quality of life measure) respectively, de Jong loneliness,[35] social support (the Medical Outcomes Trial-Social Support Survey[36]) and depression (Geriatric Depression Scale[37]).

GAR evaluation
The international outcomes inventory-alternative interventions (IOI-AI)[38] and the modified Client Oriented Scale of Improvement (COSI) questionnaires[39] were completed by all participants at follow-up. A follow-up evaluation questionnaire assessed the acceptability of the exercise and GAR sessions, acceptance and attitude about their HL, HL-related problem-solving, stress management and self-confidence in social situations.

Sample size
At least 23 people per group were needed to show a clinically meaningful increase in Sit to Stand of 2 or more[40]: the primary fitness outcome. This was inflated by 20% to account for dropouts and ensured generation of a reliable SE, SD and 95% CIs on the sample size required for a large RCT with this measure as the primary outcome.[41]

Statistical methods
Categorical data were expressed as frequency and percentage (eg, recruitment, adherence, overall retention rates). Continuous data were expressed as mean+SD or median and IQR (for non-normal data). Baseline data were compared between groups using a Fisher's exact test or independent samples t-test (Mann-Whitney U test where appropriate). Intention-to-treat analyses were conducted to examine change over time in functional fitness and psychosocial measures. Effect sizes (ES)[42] and 95% CIs for within-group changes and between-group differences are reported. Confounding and effect modification were examined using linear regression modelling with the change score as the dependent variable. GAR attendance was determined a priori as a potential confounding factor and HHIE-25 was included post hoc to account for the unanticipated baseline differences. All results are presented as intention to treat using the baseline observation carried forward to produce the most conservative results. Analyses were conducted in Stata S/E

V.15 (Stata [StataCorp. Stata Statistical Software: Release 15, College Station, TX, USA: StataCorp]) and p<0.05 was considered statistically significant.

RESULTS
Feasibility
The WTL Consolidated Standards of Reporting Trials diagram is shown in figure 1. One hundred and thirty-seven individuals contacted the study centre, 119 completed the initial phone screen and 71 completed full eligibility screening. Ninety-six per cent of eligible participants (n=69) were randomised (n=66) and 88% of participants (n=58) completed the study. GAR and exercise attendance rates were 80% and 85%, respectively. There was one adverse event (fall with hip fracture) within the trial during an exercise session and two outside the study in control group participants (one fall with hip fracture, one foot infection). Primary reasons for ineligibility included too young (33%) and no self-reported HL (67%). Newspaper ads were the most successful recruitment strategy (74%), followed by word of mouth (18%) and community posters or social media (8%) (data not tabled). The main reasons for withdrawal during enrolment (n=42) were time commitment (50%) and inconvenient location (24%).

Baseline measures
Among the 66 participants in the study, the mean age was 74.5 years, 57% were male, 94% Caucasian, 67% married/common law, 64% had completed some college/university or above, 54% reported an annual household income above $C50 000.00 and 88% were retired. Ten participants used mobility or balance aids, just over half used hearing aids and 11 reported one or more falls in the previous 3 months. Groups did not differ on any functional fitness or psychosocial measure with the exception of the total HHIE-25 score (control median=56; intervention median=38; p=0.045). (table 1)

Change in functional fitness and psychosocial measures
After adjusting for baseline HHIE-25 imbalance, gait speed improved more in the intervention group compared with the control group by an average of 0.05 m/s (95% CI 0.0 to 0.09; p=0.046; ES=0.57). Compared with the control group, intervention group Sit to Stand measures improved significantly more by an average of 1.0 Sit to Stand (95% CI 0.1 to 2.0; p=0.037; ES=0.53). Back Scratch improved by an average of 4 cm more in the intervention group compared with the control group (95% CI 0.2 to 7.7; p=0.039; ES=0.54). The de Jong emotional loneliness subscale showed greater improvement in the control group: average difference in change of 0.6 (95% CI 0.1 to 1.2; p=0.043; ES=−0.54). There were no significant differences for depression, social support or SF-36 measures (all p>0.05) (online supplementary file 1). (table 2)
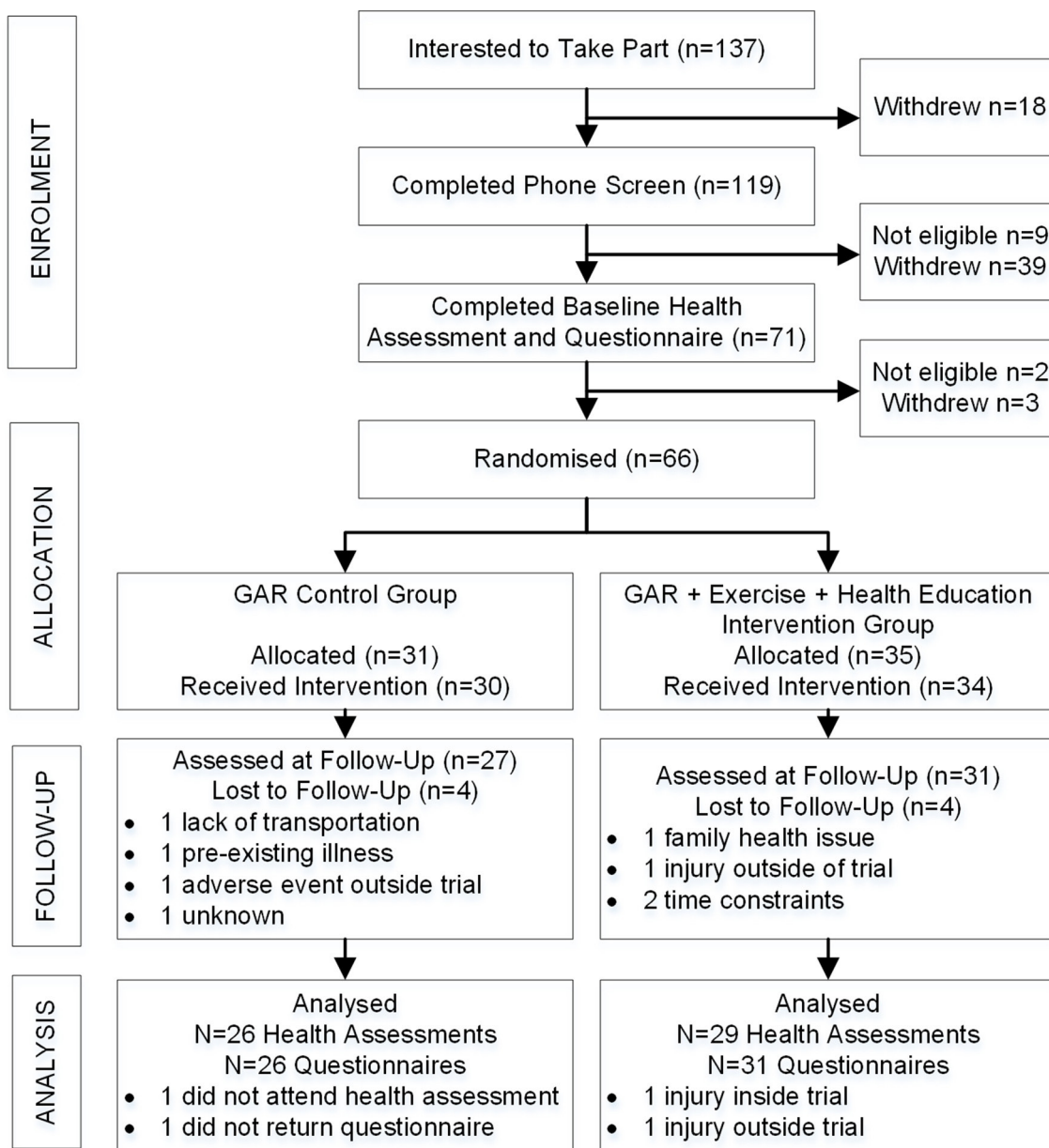
Figure 1 Participant time line: Consolidated Standards of Reporting Trials (CONSORT)-style flow chart. GAR, group auditory rehabilitation.

Improvements in HHIE-25 and de Jong loneliness were influenced by GAR attendance (table 3). Total, emotional and social HHIE-25 subscales showed significant improvement for those who attended ≥80% of GAR sessions: total: 95% CI −19.7 to −2.6; p=0.012; ES=0.76, emotional: 95% CI −11.0 to −1.1; p=0.018; ES=0.71, social: 95% CI −9.5 to −0.8; p=0.022; ES=0.69, regardless of group assignment. Similarly, those with ≥80% GAR attendance had a greater decrease in de Jong total (95% CI −2.7 to −0.9; p≤0.001; ES=1.16) and emotional loneliness (95% CI −1.7 to −0.4; p=0.002; ES=0.96).

GAR evaluation

At study end, participant responses to the seven IOI-AI questions (table 4) revealed that 67% of participants

were using GAR communication strategies on a daily basis for at least 1 hour. The majority reported moderate or greater benefit from using GAR strategies, satisfaction with the GAR programme, improvement in participation restrictions (visiting friends/relatives less than desired) and improvement in activity limitations (difficulty hearing TV or speech). COSI results were favourable overall (online supplementary file 2). Participants reported slightly better or greater progress in their goals of improving 'conversations with one or two or a group of people in a quiet environment' (67%) or 'noisy' environment (53%), half (51%) felt less embarrassed or stupid and 42% increased the amount of their social contact (such as attending more social events, social situations or going out in public).

Table 1 Baseline demographics, functional fitness and psychosocial measures, by group (control n=31; intervention n=35) and for the overall sample (n=66)

Demographics	Control n (%)	Intervention n (%)	Overall n (%)
Age (years), mean (SD)	74.8 (6.1)	74.3 (6.3)	74.5 (6.2)
Male gender	17 (54.8)	21 (60.0)	38 (57.6)
Caucasian ethnicity	30 (96.8)	32 (91.4)	62 (93.9)
Married/common law	22 (71.0)	22 (62.9)	44 (66.7)
College/university/graduate studies	19 (61.3)	23 (65.7)	42 (63.6)
Annual income >$50 000	18 (60.0)	17 (48.6)	35 (53.9)
Retired	29 (93.6)	29 (82.9)	58 (87.9)
Living alone	10 (32.3)	9 (25.7)	19 (28.8)
Uses mobility or balance aids	6 (19.4)	4 (11.4)	10 (15.2)
Wears hearing aids	18 (58.1)	17 (48.6)	35 (53.0)
Any falls in the past 3 months	7 (22.6)	4 (11.4)	11 (16.7)
Functional fitness measures	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Gait speed (m/s)	1.25 (0.20)	1.28 (0.25)	1.26 (0.23)
Sit to Stand (30 s)	12.7 (3.2)	12.9 (2.7)	12.8 (2.9)
Grip Strength (kg)	68.0 (19.4)	71.5 (21.6)	69.8 (20.5)
8-Foot Get Up and Go (s)	6.4 (1.9)	6.1 (1.5)	6.3 (1.7)
Sit and Reach (cm)	−4.6 (20.8)	−1.9 (20.9)	−3.2 (20.8)
Back Scratch (cm)	−38.8 (21.0)	−39.7 (25.5)	−39.2 (23.3)
Balance (s)	49.3 (33.3)	45.9 (34.2)	47.5 (33.5)
Psychosocial measures	**Median (IQR)**	**Median (IQR)**	**Median (IQR)**
HHIE-25 total	56 (28, 68)	38 (24, 56)	46 (26, 64)
Emotional subscale	30 (14 , 40)	18 (14 , 30)	20 (14 , 32)
Social subscale	26 (16 , 32)	18 (12 , 30)	24 (14 , 30)
de Jong loneliness total	7 (3, 10)	6 (2, 9)	7 (3, 9)
Emotional loneliness	3 (1, 5)	3 (0, 5)	3 (0, 5)
Social loneliness	3 (2, 5)	4 (1, 5)	3 (2, 5)

HHIE, Hearing Handicap Inventory for the Elderly.

Programme evaluation

Online supplementary file 3 questionnaires were filled out by 24 control group and 33 intervention group participants. The data revealed that a large proportion of both groups agreed or strongly agreed that GAR helped them: better recognise and accept their HL (93%); be more confident to speak out about their HL in social situations (98%); and to have a better attitude towards HL (95%). The majority (89%) felt that GAR helped them improve their problem-solving abilities. Intervention group participants reported that they were satisfied with the exercise (100%) and reported it was fun (100%). The majority (75%) indicated they increased their physical activity level outside the programme, and 88% were confident they would continue with regular exercise after the programme ended. When asked what could improve the programme, participants favoured a larger GAR session room, more emphasis on hearing assistive technologies (eg, telephones) with presentations by commercial

companies producing these items, better acoustics in the gym (eg, no fan noise in the background) with an improved sound system and instructors who could speak more slowly and clearly (data not tabled).

DISCUSSION

In this pilot trial, the feasibility, acceptability and preliminary evidence for the efficacy of a GAR, SHE and exercise intervention for older adults with HL was evaluated. Recruitment and retention rates suggested the study was well received. WTL was found to be feasible and highly acceptable. Strengthening, resistance and coordination exercises coupled with GAR and SHE improved lower extremity strength, gait speed and upper body flexibility. While exercise improved these key functional fitness measures, it provided no additional benefit beyond GAR alone for measures of hearing-related quality of life (HHIE-25) and loneliness. Significant improvements in

Table 2 Mean change and difference between control and intervention groups for functional fitness and loneliness, adjusted for baseline HHIE-25 score

Functional fitness	Controlgroup Mean Δ (95% CI)	Intervention group Mean Δ (95% CI)	Difference between groups Mean Δ (95% CI)	Effect size
Gait speed (m/s)	0.07 (0.04 to 0.11)	0.12 (0.09 to 0.15)	0.05 (0.0 to 0.09)*	0.57
Sit to Stand (30 s)	0.6 (−0.1 to 1.3)	1.6 (1.0 to 2.3)	1.0 (0.1 to 2.0)*	0.53
8-Foot Get Up and Go (s)	−0.5 (−0.9 to 0.2)	−0.8 (−1.1 to 0.5)	−0.3 (−0.8 to 0.2)	0.32
Grip Strength (kg)	1.3 (−0.8 to 3.5)	2.8 (0.8 to 4.8)	1.5 (−1.5 to 4.5)	0.26
Sit and Reach (cm)	0.8 (−3.6 to 5.2)	3.6 (−0.5 to 7.8)	2.8 (−3.3 to 9.0)	0.23
Back Scratch (cm)	0.0 (−2.7 to 2.7)	4.0 (1.4 to 6.5)	4.0 (0.2 to 7.7)*	0.54
Balance (s)	6.0 (0.1 to 11.9)	6.8 (1.2 to 12.3)	0.8 (−7.4 to 9.1)	0.05
de Jong loneliness total	−1.5 (−2.1 to 0.9)	−0.9 (−1.4 to 0.3)	0.6 (−0.2 to 1.5)	−0.35
Emotional subscale	−0.9 (−1.3 to 0.5)	−0.3 (−0.7 to 0.1)	0.6 (0.1 to 1.2)*	−0.54
Social subscale	−0.6 (−1.2 to 0.1)	−0.5 (−1.0 to 0.1)	0.1 (−0.6 to 0.8)	−0.07

*P<0.05.
HHIE, Hearing Handicap Inventory for the Elderly; Mean Δ, mean change.

hearing-related quality of life and total and emotional loneliness were found for those attending ≥80% of the GAR sessions and in those with the poorest baseline self-reported hearing-related quality of life. Delivery of GAR by a non-audiologist health provider appeared to be of similar benefit to participants as seen in the literature. To our knowledge, this is the first study to provide an approach to the treatment of HL in older adults that addresses HL-related activity limitations, participation restrictions in addition to physical function (impaired musculoskeletal function) and that showed an improvement in total and emotional loneliness.

Feasibility and acceptability
Implementation of the WTL proved to be feasible and acceptable to participants. Recruitment strategies, randomisation, study implementation and study completion

rates (88%) reached the a priori required feasibility goals and more than 95% of participants found the programme acceptable/highly acceptable.

Functional physical fitness changes
Preliminary evidence for efficacy of the exercise intervention on physical function was determined using ES in order to help decide on future sample size considerations. ES were calculated on a small sample, therefore need to be interpreted with that in mind.[43] They suggest that the physical activity and GAR interventions were of some benefit and deserve further investigation in a larger sample.

The WTL exercise intervention was associated with significant improvements in two major functional fitness measures (gait speed; ES 0.57 and 30 s Sit to Stand; ES 0.53) which have been associated with reduced risk for falls

Table 3 Impact of group and GAR attendance on mean change and difference in change for the HHIE-25 and de Jong loneliness scales (n=57)

GAR attendance	Hearing handicap for the elderly			de Jong loneliness and isolation		
	Total score Mean Δ 95% CI	Emotional subscale Mean Δ 95% CI	Social subscale Mean Δ 95% CI	Total score Mean Δ 95% CI	Emotion subscale Mean Δ 95% CI	Social subscale Mean Δ 95% CI
<80% attendance	1.3	−0.1	1.4	0.2	0.2	0.0
	−6.0 to 8.6	−4.3 to 4.1	−2.3 to 5.1	−0.6 to 1.0	−0.4 to 0.8	−0.7 to 0.7
≥80% attendance	−9.8	−6.1	−3.7	−1.6	−0.8	−0.8
	−14.0 to 5.6	−8.5 to 3.7	−5.9 to 1.6	−2.1 to 1.2	−1.1 to 0.5	−1.2 to 0.4
Group difference	−11.1	−6.0	−5.1	−1.8	−1.0	−0.8
	−19.7 to 2.6	−11.0 to 1.1	−9.5 to 0.8	−2.7 to 0.9	−1.7 to 0.4	−1.6 to 0.1
P value	0.012	0.018	0.022	<0.001	0.002	0.061
Effect size	0.76	0.71	0.69	1.16	0.96	0.58

GAR, group auditory rehabilitation; HHIE, Hearing Handicap Inventory for the Elderly.

Table 4 Per cent distribution of participant responses for each item on the IOI-AI at follow-up (n=57)

Item	Per cent (%) reported				
	None	<1 hour/day	1–4 hours/day	4–8 hours/day	>8 hours/day
Use (%)	3.5	29.8	49.1	12.3	5.3
	Not at all	Slightly	Moderately	Quite a lot	Very much
Benefit (%)*	0	35.1	29.8	31.6	3.5
Sat (%)	0	8.8	19.3	28.1	43.8
	Very much	Quite a lot	Moderately	Slightly	None
RAL (%)	3.5	3.5	49.1	38.6	5.3
RPR (%)	0	17.6	31.6	36.8	14.0
Ioth (%)	0	3.5	17.2	48.3	31.0
	Worse	No change	Slightly	Quite a lot	Very much
QOL (%)	0	10.3	44.8	38.0	6.9

*Statistically significant difference between control and intervention groups (control: not at all=0%, slightly=26.9%, moderately=19.2%, quite a lot=46.2%, very much=7.7%; intervention: not at all=0%, slightly=41.9%, moderately=38.7%, quite a lot=19.4%, very much=0%; p=0.040).
IOI-AI, international outcomes inventory-alternative interventions; Ioth, impact on others; QOL, quality of life; RAL, residual activity limitations; RPR, residual participating restrictions; Sat, satisfaction.

and improved maintenance of physical independence.[33] Adherence to the exercise intervention was excellent and end-of-study evaluations indicated that participants were satisfied with the exercise sessions. Lower body muscle strengthening and improved gait speed are expected to provide long-term benefit as shown in a prospective analysis of longitudinal data from National Health and Nutrition Examination Survey (2003–2006) where adults with at least moderate HL who undertook 2+ sessions/week of muscle strengthening exercises were at a 71% reduced risk of 7-year all-cause mortality.[44] However, static (One-Foot Stand) or dynamic (Timed Up and Go) balance was not improved. Furthermore, there was one fall during a fast-paced 'tag'-like exercise where a participant tripped on another participant's foot. While published rates of falls during fall prevention programmes range from 5% to 25% (depending on baseline risk for falls),[45] these findings have important implications for the design of future exercise interventions. Rather than rapid agility/coordination exercises, exercises should include more balance training such as the in-home or facility-based Otago falls prevention exercise programme or tai chi[46] which have been shown to reduce falls in the general population of older adults. Incorporation of these focused exercises may be more effective in improving balance in those with HL. The improvement in gait speed and lower extremity muscle strength seen in this pilot trial are encouraging and suggest that such an intervention, if carried on longer term, and which includes more aggressive balance training might be of survival benefit in older adults with HL.

Hearing and health-related quality of life, loneliness and social network

Improvements in loneliness, participation restrictions and activity limitations were related to higher (worse)

baseline HHIE-25 (hearing-related quality of life) and higher GAR attendance. Hearing-related quality of life has been found to be an effect modifier in other studies. Using a similar assessment of hearing-related quality of life (Hearing Attitudes to Rehabilitation Questionnaire)[39] found that higher baseline scores in this measure were also associated with greater benefit from a GAR programme for participation restrictions and activity limitations. The addition of exercise to GAR was of no added benefit for any of the psychosocial outcomes. This was an unexpected finding given the proven benefits of exercise in many of these realms.[47] It is unknown as to whether poorer hearing-related quality of life supersedes the psychosocial benefits of exercise. Further research is needed in order to understand this interaction.

That GAR attendance had a strong influence on psychosocial outcomes and is consistent with the findings of others who have found that GAR attendance is imperative for optimising the outcomes of GAR.[48] Our adherence rates of 87% were comparable to other group-based communication programmes where rates ranged from 56%–68%[18] to 96%.[49]

The association between untreated HL and loneliness is well known.[35] Treatment with cochlear implantation[17] and provision of hearing aids[16] has been shown to reduce loneliness in older adults with audiometrically measured mild to severe HL. To the authors' knowledge, only one other study has looked at the effect of audiological rehabilitation on loneliness. In this study,[50] participants were provided with an assistive hearing device (not a hearing aid) and with their communication partners undertook a one-time 1.6–2 hours' GAR session delivered by a trained clinician. Participants were given auditory rehabilitation manuals and workbooks to complete at home. Despite a significant decrease in HHIE scores

(meaning an improvement in hearing-related quality of life) at 3 months, loneliness (as measured by the University of California Los Angeles Loneliness Scale) increased. In the current study, hearing-related quality of life (HHIE-25) and loneliness (de Jong Loneliness Scale) significantly improved in those with higher GAR attendance, compared with poor attenders, who saw no benefit.

Furthermore, while social isolation was not formally assessed, the COSI results indicate that 42% of participants increased the amount of their social contact (such as attending more social events, social situations or going out in public) which might be expected to decrease social isolation if maintained over time.

While group or home auditory rehabilitation improves hearing-related quality of life, it appears that GAR may be more conducive than home-based auditory rehabilitation to addressing loneliness.

Health-related quality of life

Health-related quality of life, as assessed using the SF-36, did not show change by group assignment, GAR attendance or baseline HHIE-25 score. This finding is in agreement with others who also used generic health-related quality of life tools (WHO Disability Assessment Schedule II[49 51]: SF-36[39]) as a communication programme outcome measure. This was not unexpected given that the content of this questionnaire has little to do with communication and supports our finding that added exercise and health education did affect generic quality of life measures.

GAR evaluation

Together, the GAR evaluation tools (IOI-AI, COSI and qualitative feedback) suggested that the GAR programme was highly appreciated, benefited and improved self-efficacy of participants. When compared with other studies where communication strategies and psychosocial counselling were key features of GAR, improvement in HHIE-25 (ES=0.69–0.76) was similar to that in one study (ES 0.67–0.78)[49] and slightly greater than that in another (ES=0.25).[39] Furthermore, outcomes in all domains of the IOI-AI and relevant COSI outcomes compared favourably with these same established communication programmes.[38 39 49] Inclusion of communication strategies and facilitating behaviour change was associated with enhanced self-efficacy, a consistent finding in the literature.[52 53] As participants gain confidence in managing their HL and achieving their communication and social goals, their hearing-related quality of life improves.[49 51] These findings are encouraging and add to the emerging evidence, suggesting that with adequate training and resources, a non-audiologist may help build capacity for increased access to effective community-based GAR programming.[54–56]

Strengths and limitations

This study had several strengths: 57% of our participants were male. While not uncommon for GAR interventions, it is uncommon to see >30% of males participating in community-based exercise programmes.[57 58] This may simply reflect the higher prevalence of HL in men, or some other factor: qualitative work is underway to examine this.

In this pilot trial, a control group receiving no intervention was not included. This would have made for a more accurate determination the effects of GAR. However, one potential interpretation is that GAR can be effective when given alone or part of a more holistic health behaviour intervention. Second, participants were self-selected which may have introduced a bias favouring positive outcomes.[59] However, recruitment occurred in the 'real world' community setting and is representative of the population of hearing impaired older adults who have reached the stage of hearing help-seeking. Third, the baseline difference between groups in the baseline HHIE-25 scores is likely due to the small sample size. Although comparisons were reported in terms of relative improvements and not strict comparisons, this should be noted as a potential bias. This study provided only immediate postprogramme results and may have been underpowered to detect changes in the other fitness measures. There is a need for more longitudinal follow-up in a larger sample to determine if the positive changes can be sustained.

Finally, this is the first study to obtain preliminary information on the effectiveness of an exercise intervention to improve functional fitness, and GAR to improve total and emotional loneliness and social support in older adults with self-reported HL. GAR led by non-audiologist shows potential as a way to improve the accessibility of GAR programmes.

Age-related HL is a prevalent, under-recognised and significant disability that when untreated is associated with profound negative downstream effects. This study contributes to emerging evidence of the benefit of providing accessible community-based communication programmes delivered outside the traditional audiology clinical setting. Addition of an exercise component shows at least short-term functional fitness benefits. Further research is needed to determine the long-term benefits of combining communication and exercise programmes on the biopsychosocial domains among older adults with HL.

Implications

A larger, long-term study is needed to determine the enduring effects of this novel, community-based, holistic intervention in addressing both the negative psychosocial and functional physical effects of HL among older adults. Use of the home or facility-based Otago falls prevention exercise programme (muscle strengthening and a more focused approach to balance training) may be necessary to improve balance in older adults with HL. Face-to-face GAR sessions may be necessary in order to provide additional benefits on loneliness and social support. Provision

of GAR by students and non-audiologists may improve accessibility of audiological rehabilitation programmes.

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