Staying active, staying strong: pilot evaluation of a once-weekly, community-based strength training program for older adults

Amanda Bates, Alex Donaldson, Beverley Lloyd, Sally Castell, Patricia Krolik and Renee Coleman

Abstract

Issue addressed: Little is known about the effectiveness of once-weekly strength training programs for older adults based in community settings. This pilot study evaluated such a program to assess changes in the functional fitness of participants.

Methods: A pre-test/post-test within subjects study design was used with new participants in the 10-week Staying Active, Staying Strong (SASS) program (all aged 50+ years). The Seniors Fitness Test (SFT) and SF-36 were used to assess functional fitness and health-related quality of life respectively. Perception of physical ability was assessed using a study-specific questionnaire. Pre- and post-test SFT and SF-36 scores were compared using paired t-tests. Frequency of responses was used to describe participant perceptions.

Results: 110 evaluation participants (mean age 68.2 years; 85% female), 49% of those who completed the pre-test, also completed the post-test. Evaluation participants significantly improved their strength (assessed using arm curls and sit-to-stand); endurance (two-minute step test); flexibility (sit and reach, back scratch); and agility/dynamic balance (eight-foot up and go). SF-36 physical-functioning domain scores also significantly improved. Most participants reported improved strength, fitness, mobility, general well-being and confidence in performing daily activities.

Conclusion: Weekly, community-based strength training programs show promise in improving the functional capacity, including the strength, of older adults. More thorough evaluation is now required to confirm these findings.

Key words: older adults, strength training, community setting, functional fitness, falls prevention.

Health Promotion Journal of Australia 2009; 20:42-7

So what?

Once-weekly strength training programs have the potential to offer an effective, practical and more accessible way to improve older adult functional fitness. We recommend larger scale trials in community based settings.

Introduction

Falls among older adults are a significant and costly injury-related public health issue.[1-3] The risk of falling or sustaining a falls-related injury is associated with physiological and behavioural factors including muscle strength, balance, mobility and levels of physical activity.[1,2,4] While functional fitness and strength reductions are a normal part of ageing,[5] they have potentially negative effects on older adults' capacity to engage in the tasks of everyday living.[4,6,7] These changes are not inevitable and it is possible to increase muscle strength and improve functional capacity in older age.[6,7]

Strength training (also known as progressive resistance training) can improve older adults' muscle strength[7,8] and reduce the risk of falls.[2] Given adequate training, older men and women can experience strength gains comparable to younger individuals.[6] A two to threefold increase in strength can be achieved within three months of commencing training.[6] More than half the strength gained during a one-year strength training program occurs within the first 12 weeks.[9] Strength training participation has other health benefits including improved emotional well-being and vitality, and reduced depressive symptoms.[7,10] It can also result in increased physical activity participation.[11]

Implementing evidence-based strength training programs for older adults can be challenging for service providers. Many communities, including rural and remote communities, do not have commercial or clinical fitness facilities and such settings may be inappropriate for some older adults to participate in strength training due to expense, inaccessibility and availability.[7,12,13] Community-based strength training programs can enhance access to programs[12,13] and have been shown to safely and effectively improve older adults' strength and functional capacity.[7,13,14] Free weights, resistance bands and body weight can be used in community settings as an alternative to expensive equipment commonly used in commercial, academic and clinical fitness facilities.

The training frequency required for older adults to achieve significant strength gains has been subject to debate.[2] The American College of Sports Medicine and others recommend a training frequency of two or three times per week.[6,15] A recent systematic review of older adults' strength training concluded that participation two to three times per week can increase strength, muscle mass and functional capacity.[9] Three times per week low cost, community-based exercise programs can improve older adults' health and reduce falls risk.[8] However, community-based organisations may have limited capacity to provide programs that meet these recommendations due to associated costs. For the same reason older adults may be unwilling or unable to attend.

Weekly participation in strength training for older adults in formal settings and also with younger age groups have demonstrated promising results. Among older adults, once-weekly participation in academic medical fitness centre-based strength training resulted in strength and functional capacity gains, similar to those achieved by training two or three times per week.[16,17] Once-weekly resistance training has also been shown to be equally as effective as more frequent training (two or three times per week) in improving children's leg strength[18] and young adults' lumbar extensor strength.[19] However, there is a gap in the evidence about the effectiveness of once-weekly community-based training programs for older adults.

Given that community-based strength training programs may be more appropriate for older adults[7,12,13] and less frequent training can save time and potentially increase population reach,[18] this pilot evaluation was conducted to determine the effectiveness, under 'real world' conditions, of the once-weekly Staying Active, Staying Strong (SASS) community-based strength training and education program for older adults in the northern region of Sydney, Australia. The objective was to assess functional fitness and health-related quality of life changes among SASS participants using a pre-test/post-test within subjects design.

Table 1: Exercises performed in the SASS Program.

Lower Body	Upper Body	Other
Lower leg extension	Bicep curl	Abdominal brace
Hamstring curl	Triceps extension	Postural correction
Hip extension	Lateral arm raise	Pelvic floor
Hip abduction	Wall push	
Heel lift	Rotator cuff	
Wall sit		

Methods

The intervention program

SASS was developed for older adults in the general population of a metropolitan health service in Sydney, Australia as an alternative to fitness centre-based strength training programs. SASS was conducted once a week for 10 weeks in community settings including community centres, church halls, surf lifesaving clubs and hospital recreation halls. Classes were conducted by qualified and experienced fitness leaders who had undergone specific SASS-related training and been given a SASS Program Leaders Handbook.[24] SASS has four levels with all new participants commencing at Level 1 (Beginner). Participants advance through the levels as they progress in skill, strength and confidence.

SASS used hand weights, ankle cuffs and body weight. Each class included 60 minutes of strength training and 30 minutes of education about strength training (e.g. benefits, stretching, back care, posture, pelvic floor, etc) and falls prevention (e.g. osteoporosis, physical activity options, nutrition, medication monitoring, home modifications, footwear, eyesight etc). The Level 1 program included the upper and lower body exercises (see Table 1). In general, two sets of eight to 10 repetitions of each exercise were performed. The guideline for the size of the weights used at the start of SASS is listed in Table 2. Relatively light weights were used at the start so that participants could successfully perform the exercises with an initial focus on correct techniques, comfort, injury prevention and gradual progression.

Progression within Level 1 was individualised with participants advised to increase the weights they used when they could perform two sets of eight repetitions comfortably. Participants were encouraged to discuss concerns about the program and to report any exercise-related joint or muscle pain experienced to the program leader, so that appropriate adaptations could be made. Exercises were slightly adapted for people with specific chronic conditions (e.g. arthritis), to prevent their exacerbation. Participants were also encouraged to practise the SASS strength training exercises, particularly those where body weight provided resistance, at home in between weekly classes. All participants received a SASS Participant Handbook.[25]

Study participants

Evaluation participants were drawn from new SASS program

Table 2: Guidelines for commencement of use of weights.

Starting level	Weight per arm (kg)	Weight per leg (kg)
Beginner – no experience	1	2
Intermediate – basic fitness level	2	4
Advanced fitness level	3	5

enrolments between July 2003 and April 2005. SASS program participants were recruited through standard processes including: word of mouth; local media advertising; and distributing program promotional material to target settings (e.g. older adults' community programs, local government and other service providers, libraries, general practitioners etc). All new Level 1 SASS participants were invited to join the evaluation if they were enrolled in the SASS program for the first time and were over 50 years of age. Participants were excluded from the analysis if they did not complete at least eight of the 10 weekly classes. The Human Research Ethics Committee of Northern Sydney Central Coast Area Health Service approved the evaluation. All evaluation participants gave informed consent. All SASS program participants were required to obtain a medical clearance from a doctor.

Study instruments and measurements

Functional fitness

The nine-item Seniors Fitness Test (SFT)[20] was used to assess functional fitness measuring: strength (arm curls, sit to stand); endurance (two-minute step test); flexibility (sit and reach – right and left, back scratch – right and left); agility/dynamic balance (eight-foot up and go); and Body Mass Index (BMI). The SFT has good test-retest reliability and criterion validity.[21]

Health-related quality of life

The SF-36[22,23] was used to measure physical and psychological health-related quality of life. The SF-36 has eight domains – four that measure physical well-being (physical functioning, role-physical, bodily pain and general health) and four that measure psychological well-being (vitality, social functioning, role-emotional and mental health).

Perceptions of physical ability

Perceptions of the impact of SASS participation on functional capacity were obtained from participants using a study-specific questionnaire. Participants self-reported their perceptions on a five point Likert scale ("strongly agree" to "strongly disagree"). The parameters reported were: strength; fitness; mobility; balance; general well-being; confidence; and SASS 'worthwhileness'. Participants also reported how many SASS sessions they participated in and if, and for how long, they practiced the SASS strength training exercises at home.

The SFT, the SF-36 and a study-specific demographic characteristic (age, gender, existing medical conditions etc) questionnaire were completed at additional sessions before the start of, and a week after the end of, SASS. The SF-36 and demographic characteristic questionnaire were self-administered before performing the SFT. Participants completed the SFT under the supervision of trained members of the research team following a documented testing protocol based on the work of Rikli and Jones.[20] Participants were given feedback on their performance at the end of all SFT tests at post testing. The perceptions questionnaire was self-administered at post-testing.

Statistical analysis

The data were analysed using SPSS for Windows Version 15. Pre- and post-test SFT item and SF-36 domain scores were compared using paired t-tests. The significance level was adjusted to allow for multiple comparisons for each set of tests, using the Bonferroni method ($p=0.05/8=0.0063$), with p-values slightly larger than 0.006 considered marginally significant. The baseline demographic characteristics and pre-test SFT scores of participants who completed pre- and post-testing were compared with participants who completed pre-testing only, using independent sample t-tests. Response frequencies were used to describe the perceptions of the impact of SASS on functional capacity.

Results

Two hundred and twenty-five eligible participants completed pre-testing. Of these, 119 completed post-testing. However, nine of these did not attend the required minimum number of classes (i.e. eight of 10) and were excluded from the analysis. This left 110 participants (49% of those who completed pre-testing) eligible for inclusion in the study. The mean age of participants was 68.2 years (SD 7.67, range 51–88), and 85% were female. The demographic characteristics and pre-test SFT scores of the 110 SASS participants who completed pre- and post-testing were compared with the 115 participants who completed pre-testing only, to identify any significant differences between the groups at baseline. There was no significant difference in the gender distribution, mean age or pre-test SFT item scores between the two groups, indicating that the 110 participants included in the analysis were broadly representative of all SASS Level 1 participants.

Seventy-five per cent (75%) of evaluation participants reported practising the SASS strength training exercises at home, in between weekly SASS classes. Of those, 42% reported practising at home for <30 minutes per week and 58% for 30 minutes or more.

Table 3 shows the evaluation participants' pre- and post-test means and mean difference (post–pre) scores for the nine SFT items. A higher score indicates improvement with the exception of the BMI and 'eight-foot up and go' where a lower score indicates improvement. A statistically significant improvement was obtained for seven of the nine SFT items. Evaluation participants did an average of 4.07 more arm curls per 30 seconds at post-test than they did at pre-test ($p<0.0001$). The mean number of sit to stands completed increased by 2.38 per 30 seconds ($p<0.0001$). Sit and reach was measured for both right and left legs, with mean improvement of 3.24 cm ($p<0.0001$) and 2.75 cm ($p<0.0001$) respectively. The mean right-arm back scratch improved by 1.77 cm ($p<0.001$). Aerobic capacity, measured by the two-minute step test, improved by a mean of 17.68 steps per two minutes ($p<0.0001$). The mean time taken to complete the eight-foot up and go test, which measured agility/dynamic balance, decreased by 0.81 seconds ($p<0.0001$). There was a mean improvement of 4.04 cm for the left-arm back scratch but this was not significant due to considerable variability around the post-test mean. Pre- and post-test mean BMI did not differ significantly.

The pre- and post-test mean scores, mean differences and paired t-tests results for the eight SF-36 domains are shown in Table 4. The mean physical functioning domain score improved ($p=0.004$) and the mean role-physical, vitality and role-emotional domain scores all improved at least three points but did not reach statistical significance.

Seventy-three per cent (73%) of participants agreed or strongly agreed that they felt stronger after participating in SASS. Sixty-seven per cent (67%) agreed or strongly agreed that they felt fitter and 57% agreed or strongly agreed that they felt more mobile. Sixty-four per cent (64%) also agreed or strongly agreed that they felt their general well-being had improved and 53% agreed or strongly agreed that they felt more confident about doing everyday activities (e.g. gardening, housework, lifting and walking). Nearly half (47%) agreed or strongly agreed that their balance had improved. In addition, 98% of evaluation participants agreed or strongly agreed that participating in the SASS program was worthwhile.

Table 3: Mean and mean differences scores on eight measures of the seniors fitness test.

SFT Measure	N	Pre-Test Mean	Post-Test Mean	Mean difference (SD)	Paired sample t-test[a]
Body Mass Index (kg/cm²)	110	24.62	24.58	0.04 (0.57)	$t_{109}=0.79$ $p=0.43$
Arm Curl (curls/30 secs)	110	13.66	17.73	4.07 (3.32)	$t_{109}=12.88$ $p<0.0001$
Sit to Stand (stands/30 secs)	109	10.83	13.21	2.38 (3.12)	$t_{108}=7.94$ $p<0.0001$
Sit and Reach Right (cm)	110	-5.08	-1.84	3.24 (5.56)	$t_{109}=6.11$ $p<0.0001$
Sit and Reach Left (cm)	110	-5.46	-2.71	2.75 (6.23)	$t_{109}=4.62$ $p<0.0001$
Back Scratch Right (cm)	107	-6.07	-4.30	1.77 (5.16)	$t_{106}=3.55$ $p<0.001$
Back Scratch Left (cm)	107	-9.18	-5.14	4.04 (19.98)	$t_{106}=2.09$ $p=0.04$
Two-minute Step Test (steps/two mins)	109	94.70	112.38	17.68 (22.14)	$t_{108}=8.36$ $p<0.0001$
8-foot Up and Go (sec) (fastest of two trials)	108	5.95	5.14	-0.81 (0.89)	$t_{107}=9.41$ $p<0.0001$

Note: a) The significance level of p≤ 0.05 was adjusted to allow for multiple comparisons (i.e. eight paired sample t-tests were undertaken), using the Bonferroni method p=0.05/8=0.0063.

Table 4: Mean and mean differences scores on eight domains of the SF-36.

SF-36 Dimensions	N	Pre-Test Mean	Post-Test Mean	Mean Difference (SD)	Paired sample t-test[a]
Physical Functioning: the extent to which, on a typical day, a person is limited by their health in performing a range of physical activities including bathing and dressing.	104	76.6	81.0	4.4 (15.36)	$t_{103}=2.91$, $p=0.004$
Role-Physical: the effects of physical health on a person's performance of their work or other daily activities.	105	71.2	78.8	7.6 (41.77)	$t_{104}=1.87$, $p=0.06$
Bodily Pain: the severity of pain experienced and the extent to which it had interfered with normal activities.	109	69.0	69.3	0.3 (18.76)	$t_{108}=0.17$, $p=0.86$
General Health: combines self-assessed health status with indicators of current expectations and perceptions of health relative to the health of others.	100	69.8	71.3	1.5 (14.69)	$t_{99}=1.04$, $p=0.30$
Vitality: a person's energy level and level of fatigue.	107	62.9	66.4	3.5 (14.68)	$t_{106}=2.50$, $p=0.01$
Social Functioning: the impact of health or emotional problems on the quality and quantity of a person's activities with others.	106	88.2	89.7	1.5 (19.03)	$t_{105}=0.83$, $p=0.41$
Role-Emotional: the effects of emotional problems on a person's performance of their work and other daily activities.	107	85.3	90.0	4.7 (27.64)	$t_{106}=1.75$, $p=0.08$
Mental Health: the amount of time a person experienced feelings of anxiety, nervousness, depression and happiness.	105	78.9	80.8	1.9 (12.57)	$t_{104}=1.55$, $p=0.13$

Note: a) The significance level of p≤ 0.05 was adjusted to allow for multiple comparisons (i.e. eight paired sample t-tests were undertaken), using the Bonferroni method p=0.05/8=0.0063.

Discussion

The SASS evaluation participants showed significant improvements in functional fitness including strength, lower body flexibility, endurance, and agility and dynamic balance. They also reported that they felt stronger, fitter and more mobile and had improved general well-being and had more confidence in doing everyday activities. This is potentially good news for older adults who are unable or unwilling to attend more than one strength training session per week. It is also potentially good news for strength training providers who are unable to deliver programs that require the provision of more than one session per week. The fact that such outcomes have been achieved through participation in a community, rather than fitness or medical facility, based program is also encouraging as it suggests that older adults do not need access to specific facilities or expensive equipment to improve their functional fitness. Although improvement in the strength and functional capacity of older adults has been demonstrated in other strength training program evaluations, these involved either attending community-based programs two or more times per week[8,12,13] or were academic medical fitness facility-based.[16,17] Therefore SASS and other similar programs offer the potential to improve population reach of strength training through improved access and decreased time demands for participants and reduced resource demands for program providers.

The physical functioning component of health-related quality of life can also be improved through participation in once-weekly strength training. This improved physical functioning is consistent with the finding that many participants reported feeling fitter, stronger and more mobile after participating in SASS. A spin-off effect of SASS was that many participants also practised the SASS strength training exercises at home. This suggests that participants in one supervised strength training session per week may, if encouraged to do so, increase their participation in strength training more generally.

This was a pilot evaluation and the results are encouraging but conclusions are limited due to the study design. It is not possible to know if the evaluation participants were representative of all SASS Level 1 participants (sample selection bias). However, there was no difference between SASS participants who completed the evaluation and those who completed the pre-test only, on the basis of their pre-test SFT scores, their gender distribution or age. As there was no control group, it is not possible to state conclusively that the observed functional fitness improvements were due to participation in SASS and not, to some degree, due to background events (e.g. social marketing campaigns encouraging physical activity among older adults). It is unlikely that the observed improvement was due to previous exposure to the measurement instruments and procedures (testing effect) as these were only used on one previous occasion, at least 10 weeks before the post-test. However, it is difficult to untangle the impact of any additional strength training activity undertaken by the participants at home from the impact of participation in the once-weekly supervised sessions. More rigorous evaluation including a control group is required to determine which components of SASS contribute to the functional capacity improvements observed in this pilot study.

There was a significant drop-out rate in the evaluation – 51% of pre-test participants did not participate in the post-test. Therefore, the benefits of SASS have been shown to apply only to older adults who attended at least eight of the 10 classes and attended additional pre- and post-test sessions that were held a week before and a week after SASS program. Those who met the attendance requirements may have been more committed to undertaking strength training and to evaluation involvement than those who only participated in the pre-test or other SASS participants who did not participate in the evaluation. However, it should be noted that low evaluation participation does not necessarily reflect low program compliance as it is possible (and anecdotal reports from participants suggest) that many SASS participants completed the program but were unable to participate in the post-test data collection. Reasons given by some SASS participants for evaluation drop-out included being unable to attend the post-test session because the session fell within the school holidays when they had (grand) child minding responsibilities or were travelling to see families who lived elsewhere etc. In addition, the small pilot evaluation budget and the significant resource demands in collecting the data, did not allow for data collection times that exactly matched the times at which SASS participants had been attending classes. Also, participants self-selected for the study as participation was not compulsory for people enrolling in SASS. In hindsight, these issues could have been avoided by incorporating the testing into SASS itself during the study. Not withstanding the above, the evaluation participation rate (49%) needs to be considered along side the relatively high attendance requirement set for the study (i.e. participation in at least 80% of classes and attendance at pre- and post testing sessions) and compared to other similar studies with a 50% attendance rate and 16% non-adherence rate.[8]

Implications and conclusion

Once-weekly community-based strength training programs may be more accessible for, and acceptable to, older adults than similar programs that require more frequent attendance or are fitness or medical centre-based. In addition, service providers might be more motivated to offer programs if they are required to deliver only one session per week. Programs similar to the one evaluated in this study can potentially be successfully and sustainably implemented in community settings because they are easy for participants to access and the equipment required, such as free weights and ankle cuffs, can be easily transported and stored.

SASS has been shown to improve the functional fitness of people aged over 50 years living in the northern Sydney region, provided they complete at least eight of the 10 weekly classes. Once-weekly strength training programs in community settings may be able to make a practical contribution to the prevention of falls and falls-related injuries among older adults. Due to the significant study design limitations of this pilot evaluation, it is recommended further evaluation be conducted with particular attention paid to assessing program compliance and reducing evaluation participant drop-out. Subject to the findings of more comprehensive evaluation, we cautiously recommend that similar strength training programs be made more widely available to older adults in accessible community settings.

Acknowledgements

The researchers are indebted to the study participants and the staff of Northern Sydney Central Coast Health Promotion Healthy Lifestyle and Ryde Hospital Units. The comments of two anonymous reviewers are also gratefully acknowledged. There was no financial assistance for this project beyond internal institutional funding.

References

1. Gregg E, Pereira M, Caspersen C. Physical activity, falls and fractures among older adults: A review of the epidemiological evidence. *J Am Geriatr Soc.* 2000;48(98):883-93.
2. Kannus P, Sievunen H, Palvanen M, Jarvinen T, Parkkari J. Prevention of falls and consequent injuries in elderly people. *Lancet.* 2005;366:1885-93.
3. Sherrington C, Lord S, Finch C. Physical activity interventions to prevent falls among older people: update of the evidence. *J Sci Med Sport.* 2004;7(1): 43-51.
4. National Ageing Research Institute. *An Analysis of Research on Preventing Falls and Falls Injury in Older People: Community, Residential Care and Hospital Settings*. Canberra (AUST): Department of Health and Ageing, Commonwealth of Australia; 2004
5. Rikli R, Jones C. Development and evaluation of a functional fitness test for community-residing older adults. *J Aging Phys Act.* 1999;7:129-61.
6. Mazzeo R, Cavanagh P, Evans W, Fiatarone M, Hagberg J, McAuley E, et al. ACSM position stand: Exercise and physical activity for older adults. *Med Sci Sports Exerc.* 1998;30(6):992-1008.
7. Sequin R, Nelson M. The benefits of strength training for older adults. *Am J Prev Med.* 2003;25:141-9.
8. Di Brezzo R, Shadden B, Raybon B, Powers M. Exercise intervention designed to improve strength and dynamic balance among community-dwelling older adults. *J Aging Phys Act.* 2005;13:198-209.
9. Latham N, Bennett D, Stretton C, Anderson C. Systematic review of progressive resistance training in older adults. *J Gerontol A Biol Sci Med Sci.* 2004;59A(1):48-61.
10. Rejeski W, Mihalko S. Physical activity and quality of life in older adults. *J Gerontol A Biol Sci Med Sci.* 2001;56A (Special Issue II):23-35.
11. Fiatarone M, O'Neill E, Ryan N, Clements K, Solares G, Nelson M, et al. Exercise training and nutritional supplementation for physical frailty in very elderly people. *N Engl J Med.* 1994;330:1769-75.
12. Barrett C, Smerdely P. Progressive resistance training for seniors in a community setting: a process evaluation. *Health Promot J Aust.* 2003;14(1):32-6.
13. Brill P, Probst J, Greenhouse D, Schell B, Macera C. Clinical feasibility of a free-weight strength-training program for older adults. *J Am Board Fam Pract*. 1998;11(6):445-51.
14. Barrett C, Smerdely P. A comparison of community-based resistance exercise and flexibility exercises for seniors. *Aust J Physiother.* 2002;48:215-19.
15. Westcott W, Baechle R. *Strength Training Past 50*. Champaign (IL): Human Kinetics; 1998.
16. DiFrancisco-Donoghue J, Werner W, Douris P. Comparison of once and twice weekly strength training in older adults. *Br J Sports Med.* 2007;41:19-22.
17. Taaffe D, Duret C, Wheeler S, Marcus R. Once-weekly resistance exercise improves muscle strength and neuromuscular performance in older adults. *Journal of the American Geriatric Society*. 1999;47(10):1208-14.
18. Faigenbaum A, Milliken L, Loud R, Burak B, Doherty C, Westcott W. Comparison of 1 and 2 days per week of strength training in children. *Res Q Exerc Sport*. 2002;73(4):416-24.
19. Graves J, Pollock M, Foster D, Leggett S, Vuoso R, et al. Effect of training frequency and specificity on isometric lumbar extension strength. *Spine*. 1990;15(6):504-9.
20. Rikli R, Jones C. *Seniors Fitness Test Manual*. Champaign (IL): Human Kinetics; 2001.
21. Rikli R, Jones C. Functional fitness normative scores for community-residing older adults. *J Aging Phys Act*. 1999;7:162-81.
22. Ware J. *SF-36 Health Survey: Manual and Interpretation Guide*. Boston (MA): The Health Institute, New England Medical Centre; 2003
23. Ware J, Sherbourne C. The MOS 36-item Short Form Health Survey (SF-36), I. Conceptual framework and item selection. *Med Care*. 1992;30(6):473-83.
24. Northern Sydney Health Promotion. *Staying Active Staying Strong Exercise Leader's Manual*. Sydney (AUST): Northern Sydney Health Promotion; 2005.
25. Northern Sydney Health Promotion. *Staying Active Staying Strong Participant's Handbook*. Sydney (AUST): Northern Sydney Health Promotion; 2003.

Authors

Amanda Bates, formally at Northern Sydney Central Coast Health Promotion Unit, New South Wales

Alex Donaldson, formally at Northern Sydney Central Coast Health Promotion Unit and the School of Human Movement and Sport Sciences, University of Ballarat, Victoria

Beverley Lloyd, Northern Sydney Central Coast Health Promotion Unit and School of Public Health, Faculty of Medicine, University of Sydney, New South Wales

Sally Castell, Patricia Krolik, Northern Sydney Central Coast Health Promotion Unit, New South Wales

Renee Coleman, formally at Northern Sydney Central Coast Health Promotion Unit, New South Wales

Correspondence

Beverley Lloyd, Northern Sydney Central Coast Health Promotion, Macquarie Hospital, Locked Bag 2220, North Ryde, NSW, 1670, Australia. Fax: (02) 8877 5310; e-mail: blloyd@nsccahs.health.nsw.gov.au