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An economic evaluation of the SUNBEAM programme: a falls-prevention randomized controlled trial in residential aged care

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Abstract

Objective: To estimate the cost-effectiveness of a strength and balance exercise programme (SUNBEAM) which has been shown to be clinically effective in reducing the rate of falls in residents of aged care facilities.

Design: An economic evaluation was conducted alongside a pragmatic cluster randomized controlled trial that included 16 residential care facilities and 221 participants. Mean participant age was 86 years, 65% were female and 78% relied on a mobility aide. A cost-effectiveness analysis examined the costs of providing the exercise programme and costs of health service use arising from falls in each arm (intervention and usual care) over 12 months.

Main measures: Incremental cost-effectiveness ratios were calculated for the cost per fall avoided. Costs were bootstrapped to obtain adjusted confidence intervals for the incremental cost-effectiveness ratios.

Results: Of 63 facilities contacted, 16 met the eligibility criteria and were randomized to the intervention or usual care (1:1). There were 142 falls in the intervention group and 277 in the usual care group. 72 injurious falls occurred in the intervention group versus 157 with usual care. Delivery of the SUNBEAM programme cost $463 per participant. The mean total cost of each fall (regardless of group) was $400.09 and the mean cost of each injurious fall was $708.27. The incremental cost-effectiveness ratio was $22 per fall per person avoided with the mean bootstrapped incremental cost-effectiveness ratio $18 per fall avoided (95% CI: −$380.34 to $417.85).

Conclusion: The SUNBEAM programme can be considered cost-effective, relative to other fall-prevention interventions in older adults.

Keywords

Exercise, cost-effectiveness, long-term care, physiotherapy

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Introduction

A recent trial has demonstrated the clinical effectiveness of a strength and balance exercise programme for reducing the rate of falls in older people in residential care.[1] After 12 months of follow-up, there were 142 falls in the intervention group and 277 with usual care. The fall rates were 1.31 falls per person versus 2.91, respectively. This equated to a significant reduction in fall rate (incidence rate ratio: 0.45, 95% confidence interval (CI): 017–0.74) and improvement in physical performance ($P=0.02$).[1] Provision of the programme incurred an additional expense, and at present it is unknown if the expense was cost-effective. Healthcare economic analyses are becoming increasingly important as the cost-effectiveness of interventions are a major determinant of the types of rehabilitation programmes that patients receive, even if there is evidence of clinical efficacy.

There has been ambiguity in the literature regarding exercise for the prevention on falls in residential aged care[2–4] and little research has been conducted on the cost-effectiveness of such interventions. One study derived a model for evaluating costs per fall in this setting by retrospectively auditing both acute and long-term costs of 545 falls[5] however this was not associated with evaluating the cost-effectiveness of an intervention. Studies of the cost-effectiveness of fall-prevention interventions in other settings are emerging.[6,7] The aim of this study was to conduct an economic analysis of the SUNBEAM programme and report on the cost-effectiveness the intervention in a residential aged care setting.

Methods

An economic evaluation was conducted alongside a pragmatic cluster randomized controlled trial (RCT)[1] using cost and outcome data over a 12-month follow-up period. Ethics approval was granted by The University of Sydney Human Research Ethics Committee (Approved protocol: 14995). The published protocol can be found at: https://dx.doi.org/10.2147/CIA.S53931 and registration was with the Australia and New Zealand Clinical Trial Registry (Registration number: ACTRN12613000179730).

Clusters were residential aged care facilities in New South Wales and Queensland, Australia, that housed a mix of high care and low care residents. Residents were ineligible only if they had: a diagnosis of a terminal or unstable illness; participated in a similar exercise in the previous 12 months; or were deemed unable to participate safely in a group gym-based exercise programme.[8]

The intervention was conducted in two stages over a 12-month trial period. The first 25 weeks comprised of progressive resistance training (using HUR Health and Fitness Equipment), and high-level balance exercise. Sessions were one hour and conducted in small group settings, two days per week. The second stage was a maintenance programme conducted two days per week for 30 minutes. Participants in clusters allocated 'usual care' continued without the programme.

The primary outcome was fall rate (falls per person year). Secondary outcomes included functional mobility measured using the short physical performance battery,[9] and quality of life measured using the Short Form-36.[10] The primary economic measure was cost per fall avoided.

A stepped cost-effectiveness analysis was undertaken examining the costs of providing the exercise programme and costs of health service use arising from falls. Programme costs include the upfront capital cost of the exercise equipment, the cost of staff training, plus the physiotherapist and facility staff time required to deliver the intervention. Health service use was determined from audits of each clusters' records to extract data specific to fall incidents sustained throughout the trial period, including medical services received and injuries sustained. The total health service costs were estimated by multiplying the resource used by the relevant cost of care standard[11] or Australian-Related Diagnosis Resource Group schedule.[12] The analysis adapted a health service perspective and all costs were based on 2015 Australian prices ($AUD).

Delivery of the SUNBEAM programme incurred both equipment and personnel costs. The acquisition cost of the gym equipment was $60,000

Table 1. Unit costs of attending to or treating a fall.

	Cost	Unit	Source
PT – with on costs	$53.93	Per hour	Level 2, Year 1[12]
AO – with on costs	$28.52	Per hour	Aged Care Employee Level 3; Paid as equivalent to a Personal Care Worker Grade 2[10]
RN – with on costs	$37.23	Per hour	Residential Care Nurse 02RCN03[12]
MP	$40.35	Per 20-minute session	Item 35 for RACF, 20 minutes, assume seven patients[11]
Ambulance	$287	Per attendance	By road[13]
Ambulance travel	$1.77	Per kilometre	By road[13]
Acute Admitted patient without fracture	$4294	Per visit	Acute admitted patient per night[9]
Hospitalizations fractures	$2672 to $9096		Weighted average of I178A and I78B (neck of femur); I175A and I75B (neck of humerus and upper limb fracture); B79A and B79B (skull fracture and assumed same for spinal fracture); I77A and I77B (pelvis fracture); I74Z (lower limb fracture); I76A and I76B (rib fracture)[9]
Hospitalization for same-day visit	$1271		Z61B[9]

PT: physiotherapist; AO: activities officer; RN: registered nurse; MP: medical practitioner; RACF: residential aged care facility.
Base year 2015, $AUD.

with a projected life of 10 years, servicing of $600 per annum (p.a.) and capital loss at 3% p.a. The equipment cost for the intervention was $3729 per cluster or $264 per participant for the intervention. Staff training costs consisted of a two-hour session where the physiotherapist trained two activity officers per cluster in the use of the gym equipment, balance exercises, techniques to maximize safety and record keeping. Ongoing staff costs were for two staff for every 60-minute gym session. The trial comprised one researcher or facility-based physiotherapist and one activities officer from the facility. The configuration recommended for clinical application is for physiotherapist attendance once per fortnight and two trained activities officers for all other sessions. One activities officer would be running the gym session as part of usual duties; therefore, only one additional activities officer is costed.

Each time a fall occurred, there were costs incurred for residential aged care facility staff to attend to or treat the participant. Details regarding the location and type of injury sustained were collected for each fall so that specific costs could be calculated. Base costs of each resource (facility staff or visiting professional) are displayed in Table 1, and resource use is displayed in Table 2.

The time taken for the registered nurse at each cluster to assess, treat, refer, and record fall incidents was attained from one of the research team (J.H.) interviewing the registered nurse at three included clusters. A non-injurious fall was allocated 30 minutes for the initial consultation and 15 minutes for a follow-up visit. Injurious falls (defined as laceration, bruising, pain, or fracture) were allocated 50 minutes for the initial fall, and 20 minutes for follow-up visits (3.59 additional visits were allocated for lacerations, 3.26 additional visits for bruising and 3.08 additional visits for pain). For falls with multiple injuries, the maximum of 3.59 additional visits was used. The number of additional registered nurse visits by injury sustained was calculated using mean data from a detailed analysis of participant records for a subset from the first four clusters included in the trial. Costs attributed to registered nurse time were derived from the New South Wales State award for a middle grade registered nurse[13] with additional 40% on costs.

Table 2. Resource use for the treatment of falls over the study period comparing exercise and usual care groups.

	Exercise group			Mean no. of units per participant	Usual care group			Mean no. of units per participant
	No.	Units	Mean no. per fall		No.	Units	Mean no. per fall	
Overview of falls data								
Fall rate[a]	1.31				2.91			
Falls	142				277			
Injurious falls	72				157			
Participants	113				108			
Participants that had a fall	50				73			
Personnel								
RN								
Non-injurious fall visits	102	204	1.44	1.81	211	422	1.52	3.91
Injurious fall visits	40	80	0.56	0.71	66	132	0.48	1.22
Injurious fall – multiple injuries	45	162	1.14	1.43	131	470	1.70	4.35
Injurious fall – laceration	6	22	0.15	0.19	3	11	0.04	0.10
Injurious fall – bruising	1	3	0.02	0.03	4	13	0.05	0.12
Injurious fall – pain	20	62	0.43	0.55	19	59	0.21	0.54
PT								
Injurious fall – laceration	35	35	0.25	0.31	62	62	0.22	0.57
Injurious fall – pain (w/o laceration)	36	36	0.25	0.32	91	91	0.33	0.84
MP								
Injurious fall – laceration	35	35	0.25	0.31	62	62	0.22	0.57
Injurious fall – pain (w/o laceration)	36	36	0.25	0.32	91	91	0.33	0.84
Ambulance and hospital								
Ambulance attendance at RACF	8	8	0.06	0.07	22	22	0.08	0.20
Ambulance transport to ER	9	9	0.06	0.08	19	19	0.07	0.18
Ambulance and ER visit	3	3	0.02	0.03	14	14	0.05	0.13
Admitted patient – no fracture	3	3	0.02	0.03	6	6	0.02	0.06
Admitted patient – fracture	5	5	0.04	0.04	6	6	0.02	0.06

RN: registered nurse; PT: physiotherapist; MP: medical practitioner; RACF: residential aged care facility; ER: emergency room.
Multiple injuries defined as at least two of the following – laceration, bruising, and pain.
[a]Negative binomial regression, analysed at participant level and adjusted for clustering (falls per person year).

Falls incurring two or more injuries, not resulting in hospital admission, were assumed to be referred for a Physiotherapist and Medical Practitioner review at the visiting health professional's next scheduled visit, not as a new individual consultation. Medical Practitioner costs were derived from the Medical Benefit Scheme,[14] item code 35 for residential aged care facility. Physiotherapy costs were calculated for a 20-minute consultation using the New South Wales State award[15] for a Level 2, Year 1 therapist plus 40% on costs.

In some cases, falls resulted in the participant requiring assessment by ambulance services. A fixed fee for an ambulance attending a cluster after a fall were derived by adding the published call-out fee[16] to the per kilometre fee at a distance of 5.4 km (mean distance from each cluster to its local ambulance station). If the participant was transported to hospital, an additional per km fee for 6.33 km was added (the mean distance from each cluster to its local public hospital). Return from hospital to the aged care facility was calculated using the same data and applied to all incidents when the participant was transported to hospital.

Hospital costs were derived from the Australian-Related Diagnosis Resource Group schedule for same-day discharge and fracture type sustained. An acute admission cost was applied for falls that required hospital admission but were not related to a fracture.[12]

Incremental cost-effectiveness ratios were calculated relative to the usual care group for the incremental cost per fall avoided per person. In addition, incremental cost-effectiveness ratios were calculated for the incremental cost per person avoiding mobility decline (defined as an unaltered or improved Short Physical Performance Battery score[9]), and this method has been used previously when calculating the incremental cost-effectiveness ratios for fall-prevention exercise in community-dwelling older adults.[6,7] A within-trial time horizon forms the base case analysis. The CIs for the estimate for the mean total cost per fall per person were adjusted for clustering using STATA® 13 (StataCorp, College Station, TX, USA). Bootstrapping (1000 repetitions, adjusted for clustering) of the costs and outcomes was performed to obtain adjusted CIs and the incremental cost-effectiveness ratio for cost per fall per person. Sensitivity analyses explored the robustness and validity of cost-effectiveness data and tested any assumptions in the economic model.[17] A scenario analysis excluding the upfront capital equipment from the cost of the intervention was conducted to test the cost-effectiveness of the programme assuming the gym equipment had already been purchased and the programme implemented. Scenario analyses assuming the average cost of attending to, or treating, a fall regardless of group allocation, and the cost of attending to or treating an injurious fall or non-injurious fall (regardless of group) were also performed.

Our data collection extended only to the acute costs of falls. Long-term costs are an important reality, but collecting such records was beyond the resources available to this study. A model formulated by Haines et al.,[5] however, examined the combined acute and long-term costs of falls in residential aged care. Using this model, a scenario analysis that incorporated our outcomes into the model was also performed.

Results

Figure 1 displays the flow of participants through the trial. Of the 63 residential aged care facilities contacted, 16 facilities met the eligibility criteria and were randomized to the intervention (eight clusters) or usual care (eight clusters). In total, there were 1481 residents housed in the 16 residential aged care facilities. The major reasons for excluding residents were: cognitive ability ($n=296$); being permanently bed-bound/immobile ($n=265$); severe Parkinsonian symptoms that rendered them unable to use the gymnasium equipment ($n=8$); performed similar exercise in the previous 12 months ($n=4$); medical clearance declined ($n=9$); or legal representative declined signing consent ($n=1$). Of the 898 eligible residents, 268 declined to participate in the trial, a further 409 did not respond to their invitations, leaving a total of 221 residents who volunteered to participate.

Loss to follow-up for the falls and costs outcomes was 15 in the intervention group (13.3%) and 16 in the usual care group (14.8%). The predominant reason for loss to follow-up was death ($n=29$) or moved to other aged care facilities ($n=2$). A combined total loss to follow-up over the 12-month trial was 31 (14.0%).

The mean age of the participants was 86 years (SD 7: exercise group) and 87 (SD 7: usual care). The majority (65%) of participants were female and 78% relied on a mobility aide for walking. Baseline demographic data were similar between groups (Table 3).

Table 2 displays the resource use per fall, by group. After 12 months of follow-up, 142 falls were recorded in the exercise group and 277 in the usual care group, equating to an incidence of 1.31 falls per person years in the exercise group, compared to 2.91 in the usual care group: IRR = 0.45 (95% CI: 0.17–0.74). There were 72 injurious falls in the intervention group and 157 injurious falls in the usual care group, 11 fractures were sustained during the study period (5:6, intervention: usual

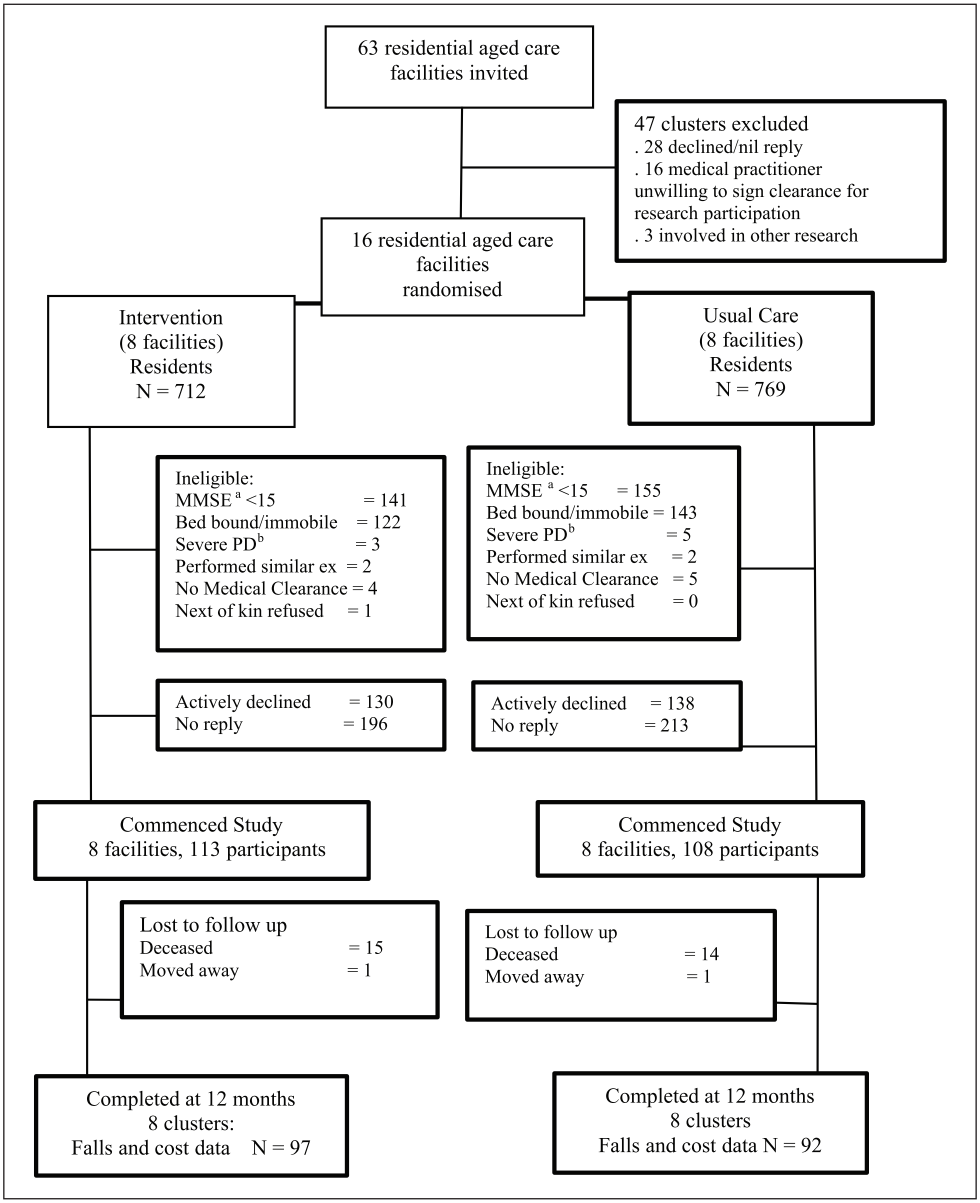

Figure 1. Flow of residential aged care facilities and participants through the trial.
[a]Mini-mental state examination.[18]
[b]PD: severe Parkinson's disease symptoms that precluded safe inclusion in group exercise.

care). The mean number of injurious falls per person was 0.64 in the exercise group and 1.45 in the usual care group, with an incremental difference of 0.81 fewer per person in the exercise group.[1]

With respect to physical performance measures (Short Physical Performance Battery),[9] 59% of participants in the exercise group had the same or improved scores compared to 44% of participants

Table 3. Participant characteristics at baseline.

	Intervention group ($n=113$)	Usual care group ($n=108$)
Age	Mean: 86 (65–100[a])	Mean: 86 (65–99[a])
Female	71 (62.8%)	73 (68.2%)
Male	42 (37.2%)	34 (31.8%)
Months in RACF	22.9 (7.6[b])	26.9 (24.6[b])
Falls in prior 12 months	189	114
Fallers	69 (61.0%)	54 (50.5%)
Uses mobility aide	86 (76.1%)	86 (80.3%)
Diagnosed co-morbid conditions associated with increased falls risk		
Anxiety and depression	56 (49.6%)	31 (28.7%)
Cardiac disease	54 (47.8%)	47 (43.5%)
Cerebrovascular disease/stroke	21 (18.6%)	21 (19.4%)
Cognitive impairment	63 (55.8%)	45 (41.7%)
Foot pain	35 (31.0%)	33 (31.0%)
Hypertension	69 (61.1%)	60 (55.6%)
Incontinence	30 (26.6%)	17 (15.9%)
Parkinson's disease	3 (2.7%)	0 (0.0%)
Visual impairment	38 (33.6%)	29 (27.1%)

RACF: residential aged care.
All other figures are descriptive statistics.
[a]Range.
[b]Standard deviation.

in the usual care group. A statistically significant between-group difference ($P=0.02$) was found for functional mobility at 12 months.[1] No significant between-group differences in quality-of-life measures were demonstrated.

The mean costs per fall are presented in Table 4. The cost of delivering the intervention was $463 per participant in the exercise group compared to usual care. The capital cost was applied per person in the exercise group. The healthcare cost of treating falls was an additional $52 in the exercise group. The key drivers for the cost of falls were visits to hospital and treatment of fractures. Specifically, treatment of a pelvic fracture for one of the exercise group participants (the most expensive fracture on the Australian-Related Diagnosis Resource Group schedule[12]) reflected a higher admitted hospital cost.

The total cost of treating falls per person in the exercise group was $1009 and the usual care group was $981, with an incremental cost of $28 (Table 5). The incremental cost-effectiveness ratio was estimated based on the incremental number of falls avoided per person over the intervention period between the groups. The incremental cost-effectiveness ratio was $22 per fall avoided ($28/1.31 fewer falls). The bootstrapped incremental cost-effectiveness ratio of 1000 repetitions provided a point estimate of $18 per fall avoided (95% CI: −$380 to $417 per fall avoided). With respect to injurious falls the incremental cost-effectiveness ratio was $35 per injurious fall avoided. The incremental cost-effectiveness ratio based on the Short Physical Performance Battery outcomes was $179 per avoided mobility deterioration.

Scenario analyses were conducted to better understand the clinical application and robustness of the data. The results presented related to incidents and costs during the 12-month follow-up period and therefore included the upfront purchase price of the gymnasium equipment. In reality, this would only occur in the first year of implementation of the programme so a scenario analysis was performed to examine the cost-effectiveness of the

Table 4. Mean total costs of falls in $AUD per fall per 25-week exercise intervention by cost category.[a]

	Exercise group (*n* = 113)	UC (*n* = 108)	Difference
Number of falls	142	277	−135
Intervention costs			
Capital	$264.00	NA	$264.00
Gym session – PT	$70.87	NA	$70.87
Gym session – AO	$112.43	NA	$112.43
Training – PT	$7.64	NA	$7.64
Training – AO	$8.08	NA	$8.08
Total intervention costs	$463.01	0	$463.01
Cost of attending to or treating a fall			
Personnel–RN (non-injurious and injurious)	$53.96	$56.38	−$2.42
Personnel – PT	$12.53	$13.76	−$1.23
Personnel – MP	$28.13	$30.88	−$2.75
Ambulance and ER costs	$39.65	$88.05	−$48.29
Admitted hospital cost	$300.30	$193.35	$193.35
Total cost of fall per fall in trial	$434.57 (±$1422.81)	$382.41 (±1157.42)	$52.16 (95% CI: −$202.14, 306.46)
Total cost of fall per fall			
Total cost of fall – intervention or UC same (*n* = 419)		$400.09 (±$1228.17)	
Total cost of fall – non-injurious (*n* = 190)		$28.66 (±$3.02)	
Total cost of fall – injurious (*n* = 229)		$708.27 (±$1391.56)	

AO: activities officer; Ex: exercise group; MP: medical practitioner; PT: physiotherapist; RN: registered nurse; CI: confidence interval; UC: usual care group.
Mean costs have been adjusted for clustering. Calculations based on personnel recommended for clinical application of SUNBEAM trial.
[a]Values are the mean ± SD costs per patient in 2015, $AUD.

intervention for subsequent years. This analysis returned a cost benefit resulting in an incremental cost saving of $333 per fall avoided with the SUNBEAM programme. A second scenario analysis assumed that the cost of falls would be the same in both the intervention and usual care groups. This was performed as one trial participant (in the intervention group) sustained a pelvic fracture which is the most expensive fracture on the AR-DRG and may have skewed the results as there was a small number of fractures sustained in the trial overall. This analysis led to an incremental cost saving of $46 per fall avoided in the intervention group. The third scenario was conducted as our data pertained to the acute costs of falls only, and it is possible that some falls may alter the care needs of the participants on a long-term basis. This analysis therefore included both acute and long-term costs of falls using previously published data from the Australian residential aged care setting[5] and returned an incremental cost saving of $670 per fall avoided for the intervention group.

Discussion

The SUNBEAM programme can be considered cost-effective in the context of other economic analyses performed alongside fall-prevention interventions.[6,7] The programme cost $463 per participant to implement including the cost of the gym equipment. The incremental cost-effectiveness ratio was $22 per fall avoided with the mean bootstrapped incremental cost-effectiveness ratio $18 per fall avoided (95% CI: −$380.34 to $417.85). Results indicate that the SUNBEAM trial was the dominant strategy compared to usual care when the gymnasium equipment had been purchased upfront (−$333 per fall avoided, indicating that it was more

Table 5. Incremental cost-effectiveness ratio (per person).

Exercise group	Usual care group	Incremental costs	Exercise group	Usual care group	Incremental falls	Incremental cost-effectiveness ratio
Base case						
Mean	Cost	Mean cost (95% CI)	Mean falls		Mean no. of falls (95% CI)	
$1009.11	$980.82	$28.29 (−$573.77, $630.35)	1.26	2.56	−1.31 (−2.28, −0.34)	$22 per fall avoided bootstrapped ICER ($19, 95% CI: −$380.34, $417.85) per fall avoided
Scenario analyses						
Scenario 1. Gym paid upfront						
$546.10	$980.82	−$434.72 (−$1036.78, $167.34)	1.26	2.56	−1.31 (−2.28, −0.34)	−$333 per fall avoided Exercise dominant
Scenario 2. Cost if injuries same in intervention and usual care groups						
$965.78	$1026.16	−$60.38 (−$447.87, $327.11)	1.26	2.56	−1.31 (−2.28, −0.34)	−$46 per fall avoided Exercise dominant
Scenario 3. Modelled costs including acute and long-term costs[5]						
$1749.81	$2626.37	−$876.56 (−$1868.31, $115.19)	1.26	2.56	−1.31 (−2.28, −0.34)	−$670 per fall avoided Exercise dominant
Injurious falls			Mean injurious falls			
$1009.11	$980.82	$28.29 (−$573.77, $630.35)	0.64	1.45	−0.82 (0.01, −1.63)	$35 per injurious fall avoided
SPPB[6]			Mean SPPB			
$1009.11	$980.82	$28.29 (−$573.77, $630.35)	0.59	0.44	0.16	$179 per avoided mobility deterioration

CI: confidence interval; ICER: incremental cost-effectiveness ratio; SPPB: Short Physical Performance Battery.
Incremental defined as exercise group minus usual care group.

expensive to continue usual care than to implement the programme, Table 5). When both the acute costs and long-term costs are modelled, there is a cost saving of $670 per fall avoided (Table 5).

Prior studies have used functional mobility measures to calculate incremental cost-effectiveness ratios.[6,7] Farag et al.[7] investigated fall interventions in community-dwelling Parkinson's disease patients and found that the average cost of the exercise intervention was $1010 per participant, the incremental cost-effectiveness ratio relative to usual care was $574 per fall avoided and $9570 per person avoiding mobility deterioration. Another study explored the cost-effectiveness of home exercise versus usual care post hospitalization for community-dwellers.[6] The average cost of the programme was $751 per participant, and the incremental cost-effectiveness ratio of the programme compared to usual care for mobility improvement was $22,958 per person. The strongly significant reduction in fall rates found in the SUNBEAM trial has driven the incremental cost-effectiveness ratio calculations and resulted in the programme returning improved cost-effectiveness outcomes.

Despite the care being taken to ensure the accuracy and robustness of this study, it is not without limitations. It is recognized that caution must be applied when using data from RCTs to calculate cost-effectiveness when the study was powered for falls.[19] The low recruitment rate (24% of aged care residents) was attributed to a combination of factors including residents declining involvement in clinical research and staff and residents' beliefs about exercise in the oldest-old. Educating staff and residents on the potential benefits of progressive resistance training (PRT) and balance training may have resulted in higher participation rates. It must be acknowledged however that generalizability of the findings may be limited. Also, no significant between-group differences in quality-of-life measures were demonstrated in the SUNBEAM trial, which rendered us unable to calculate quality-of-life-adjusted years, limiting the opportunity to compare policy makers' thresholds for willingness to pay for the programme. Similar outcomes for quality of life have been identified in other fall-prevention exercise trials.[19]

The key implication from this study is that the SUNBEAM programme can be considered cost-effective, it also significantly reduces falls in residents of long-term aged care facilities.[1] The work has important implications for the residential aged care sector as the intervention is scalable. The potential benefits to society are substantial, despite representing 7% of the older population, residents of aged care have been reported to account for >20% of fall-related hospital in-patient costs,[20] and these costs are projected to increase 60% by 2050.[21] The World Health Organization has highlighted the prevention of falls as an international priority.[17] The benefits of funding and implementing the SUNBEAM programme are likely to be reduced falls, fewer fall-related injuries, reduced load on ambulance and hospital systems, and reduced costs to society.

Clinical Messages

- The SUNBEAM strength and balance programme can be considered a cost-effective approach to preventing falls in the residential aged care setting.

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