

Meeting the challenge of falls prevention at the population level: a community-based intervention with older people in Australia

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SUMMARY

Older people form a large and growing segment of our population, experience disproportionately more illness and require more use of health services than any other group. This differential is largely due to falls, which are the leading cause of injury for those aged 65 plus. The North Coast 'Stay On Your Feet' programme is a 4-year multi-strategic, community-based intervention to address this problem among 80 000 older residents. This paper presents key results of the first 18 months of the programme. It demonstrates potential achievements of this type of intervention and examines some barriers. Programme effect was measured quasi-experimentally by monitoring indicators of awareness, knowledge, attitudes and risk factors via a telephone survey with random cohorts in intervention and control areas. After allowing for baseline covariates, the intervention was significantly associated with: raised awareness both of the problem of falling and its preventability; improved knowledge of the

risk factors for falling; and a higher self-rated risk of falling. As expected, there is as yet no population change in falls rate. Initial changes shown in risk factors for falling raise interesting challenges. A reduction in physical activity may indicate that older people, now more aware of risk, are being advised to restrict their activities. An increase in proportion of older people taking medications which may cause unsteadiness also presents a challenge. However, a concomitant decrease in reported dizziness may indicate that medications are now better managed. This evaluation shows that in 18 months, a well-funded and managed community-based falls prevention programme can achieve changes in awareness, knowledge and attitudes but that continued intervention is required to substantially change behavioural risk factor profiles and the likelihood of an older person falling.

Key words: aged; health promotion; injury; risk factors

INTRODUCTION

As with other developed nations, older people are a large and growing segment of the Australian population (Australian Institute of Health, 1988). They experience disproportionately more illness and use health services more often than younger people (Cadigan *et al.*, 1989). Falls are a major contributor to this differential. For those aged 65 or more, falling is the most common of all injury events (Baker and Harvey, 1985; Schelp and Svansson, 1987; Cwikel *et al.*, 1990; Lord, 1990). Within this group, one in three who live

in the community will fall in a given year (Campbell *et al.*, 1990; Lord *et al.*, 1993). Although a large proportion of all falls result in little or no injury, ~25% result in the faller restricting their usual activities because of injury or a fear of falling again and ~4% result in major injury (laceration, fracture or dislocation; Nevitt *et al.*, 1989). These observations about falling among older people appear to be relatively consistent across the developed world.

Generally accepted risk factors for falls among

older people include unsafe footwear, deterioration of vision, changes in balance and gait, medication use and mis-use, underlying chronic conditions, insufficient muscle strength and environmental hazards (Tideiksaar, 1989; Campbell *et al.*, 1989; Vaughan and Kempton, 1990; Kempton *et al.*, 1992; Lord *et al.*, 1993; Robertson and Campbell, 1993; Downton, 1993). The person who falls is also more likely to be female, living alone and to have fallen previously (Wild *et al.*, 1981).

The likelihood of a fall increases with the number of risk factors and this suggests the need for a multifactorial approach to the problem (Blake *et al.*, 1988; Tinetti *et al.*, 1988, 1994). Furthermore, because falls are predictable and preventable, the problem should be amenable to preventive intervention (Kellogg International Work Group on the Prevention of Falls by the Elderly, 1987). Awareness of those aspects in Europe and America has prompted a number of multifactorial controlled community trials and community-based interventions to address the problem and there is now mounting evidence that a community-based approach may significantly and efficiently reduce the rate of falls among older people (Bjaras, 1991; Tinetti *et al.*, 1994).

The rationale for such interventions applies equally well in Australia. With an ageing population and rapidly escalating health costs, falls among older people are estimated to be costing an alarming A\$3 200 000 000 nationally per year (Fildes, 1992).

On the North Coast of New South Wales (NSW) the problem of falls is of special concern because both the proportion and growth rate of the older component of our population is substantially greater than state and national figures (Sladden, 1993). The North Coast 'Stay On Your Feet' programme (SOYF) was launched in October 1992 in response to this concern. It is a 4-year regional health promotion initiative aimed at reducing the number of falls experienced among the 81 000 older North Coast residents (aged 60 plus) (Kempton *et al.*, 1992; Australian Bureau of Statistics, 1993).

Details of the intervention strategy have been described elsewhere (Kempton *et al.*, 1992). In brief, the intervention addresses a range of risk factors (identified in a baseline survey conducted pre-intervention in 1992) by applying multiple strategies consistent with the Ottawa Charter for health promotion (Van Beurden *et al.*, 1993;

World Health Organization, 1986). The risk factors addressed are insufficient physical activity, poor balance and gait, chronic illness, poor vision, unsafe footwear, medication use and misuse, and unsafe domestic and public environments. Strategies include awareness raising, information dissemination, community education, policy development and home safety measures.

This paper describes the achievements of the North Coast SOYF programme after 18 months of implementation and highlights some challenges for similar community-based falls interventions.

METHODS

Design

The research question for this evaluation was: 'Are there any changes in self reported awareness, knowledge, attitudes, risk factors and falls history that are associated with the SOYF intervention?' A prospective cohort design was chosen to measure changes from baseline to follow-up of falls-related indicators for awareness, knowledge, attitude, risk factors and falls history. This was done by a telephone risk factor survey of a cohort of people aged 60 plus in the intervention area and also in a control area. In order to minimise the limitations typical of pre/post designs our evaluation included partial remedies such as demographic matching of study groups, and adjustment for baseline differences through covariate analysis (Farquhar, 1978).

Sample

The risk factor survey was conducted in the NSW North Coast and in a control area in Queensland (an adjacent state). The control area was chosen because of its demographic and geographic similarity to the North Coast of NSW and because the local health authority could ensure that no falls prevention programme was planned for at least the next 18 months.

The survey targeted all community-dwelling people aged 60 years and over. At baseline survey, telephone numbers were randomly selected from an electronic telephone listing using postcodes of the intervention and control areas. Approximately five telephone numbers were needed to contact one person in the target age group. At 18 months those who had com-

pleted the baseline survey and agreed to be followed up were contacted again by telephone and invited to participate in the follow-up survey.

A baseline sample size of 2000 in each of the intervention and control groups allowed for anticipated loss to follow-up over the 4-year intervention leaving at least 1000 in each group. This enables a minimum difference of 7% in proportion to be detected with 80% power and 95% confidence.

Survey instrument

The questionnaire consisted of 44 questions designed to assess falls-related knowledge, attitudes, behaviour and risk factors and also 12-month history of falls and their impact on participants. Validated questions were used where available (i.e. one-third of questions). The remainder were rigorously pretested and the questionnaire was piloted in another district in Queensland ($n = 70$). The 18-month repeat survey instrument was identical except for four questions which were added to assess exposure to the programme strategies.

Survey procedures

Interviewers were recruited and trained in telephone interviewing techniques before contacting respondents. The protocol for making contact with someone over 60 and then requesting an interview was read by the interviewer from a standardised procedure printed on each survey form. Each randomly selected telephone number was called and the household was screened for a person aged 60 years or over. Up to three attempts were made to contact each number. If more than one person in the household met the age requirement, the person closest to the telephone at the time of the call was then asked to complete the survey. Telephone interviewers recorded answers given by respondents directly onto the printed survey forms.

Eighteen months after the baseline survey, the risk factor survey was repeated by following up consenting respondents from the baseline survey using the same procedures.

Statistical analysis

All responses were coded by one person, entered into a database and imported to 'SAS' version 6.04 statistical software (SAS Institute Inc., 1987). The data were checked for accuracy by entering 10% again and were found to have an

error of 0.08%. Respondents to the follow-up survey were matched to their baseline survey results by their identification number and analysis was performed on the matched pairs. To prepare data for logistic regression all indicator response variables were dichotomised as follows.

- 'Fell': yes or no in past 12 months.
- 'Falling a problem': yes or no.
- 'Falling preventable': yes or no.
- 'Knowledge': can or cannot list three known risk factors.
- 'Risk of falling': high/medium or low/non-existent.
- 'Physical activity': less than 7, or 7 plus hours per week.
- 'Balance': excellent/good or fair/poor.
- 'Chronic illnesses': none or at least one condition known to cause unsteadiness.
- 'Dizziness when rising': never/rarely or sometimes/always.
- 'Vision': checked or not in past year.
- 'Footwear': wear grip sole/safety important or never wear/safety unimportant.
- 'Medication': take or do not take sleeping, nerve, fluid or blood pressure tablets.
- 'Made changes': made or have not made falls-safe changes in home in 18 months.

Proportions were calculated and McNemar's test for paired proportions was used to test for univariate differences between the baseline and follow-up values in the two settings using a χ^2 approximation with one degree of freedom. The effect of the intervention on the outcome variables of interest was then tested by logistic regression which adjusted for potential confounders and effect modifiers. These included age, gender, setting, time and all indicators listed above. Odds ratios were calculated with 95% confidence intervals using the parameter estimates for independent variables and their standard error.

RESULTS

The baseline survey obtained data on 2002 respondents, 81.8% of 2448 people over 60 contacted on the North Coast and 1666, 72.1% of 2310 contacted in the control area. At the 18-month follow-up survey 1373 (68.6%) of the North Coast cohort and 1004 (60.3%) of the control cohort could be contacted and agreed to complete an interview (Table 1). Profiles of reasons for loss to follow-up were similar in the two

Table 1: Baseline and 18-month survey samples

	Baseline		18-month follow-up	
	North Coast	Control	North Coast	Control
Over 60s contacted (<i>n</i>)	2448	2310	1437	1154
Completed interviews (<i>n</i>)	2002 (81.8%)	1666 (72.1%)	1373 (95.5%)	1004 (87.3%)
Loss to follow-up			31.4%	39.7%
Male ^a	33.9 (32.0, 36.0)	34.9 (32.6, 37.2)	31.5 (29.0, 34.0)	35.0 (32.0, 37.9)
Age (years) ^a				
60–74	73.8 (71.0, 75.2)	77.2 (74.2, 78.6)	75.5 (72.7, 77.5)	79.0 (75.6, 81.0)
75–84	22.7 (21.5, 25.5)	17.8 (17.1, 21.3)	22.0 (19.9, 24.5)	17.8 (15.7, 20.8)
85+	3.2 (2.5, 4.2)	4.0 (3.0, 5.0)	2.6 (1.8, 3.6)	3.2 (2.2, 4.6)

^a Percentage and 95% confidence intervals for proportions.

groups and reasons included refusal, unable to be contacted, deceased or too ill to be interviewed.

There was no significant difference in the proportion of males and females, or the proportion in each age group in the intervention and control groups. Nor were there any significant differences in these proportions between baseline and follow-up. Furthermore, in most demographic aspects the respondents surveyed were not significantly different from the reference population of North Coast residents over 60. The main difference was in the proportion of males and females, the sample population having a higher proportion

of females than the reference population ($\chi^2 = 115.6, p < 0.001, 1 \text{ d.f.}$).

Programme reach

At follow-up, respondents were asked a series of questions about their exposure to falls prevention messages. The results showed that 18 months after the programme was launched respondents from the North Coast were four times more likely to recall being aware of falls prevention messages than control respondents ($\chi^2 = 255.1, p < 0.001, 1 \text{ d.f.}$; Figure 1). Significantly more had attended a meeting or class about preventing falls ($\chi^2 = 20.0, p < 0.001, 1 \text{ d.f.}$); and more had noticed changes in their surroundings that might reduce their chances of a fall ($\chi^2 = 53.5, p < 0.001, 1 \text{ d.f.}$). There was no significant difference in the proportion who reported having been advised on a one-to-one basis about preventing falls ($\chi^2 = 2.5, p = 0.12, 1 \text{ d.f.}$).

Univariate analysis

Pre-post univariate changes in dichotomised risk factor indicators are shown for both the North Coast and control cohorts in Table 2. For the North Coast there was a significant increase from baseline to follow-up of falls awareness and knowledge indicators. Specifically, this occurred in the proportion of people who thought that falling was a problem for older people (89.2 to 91.4%); thought that falling was preventable (45.9 to 52.8%); and could correctly name three falls risk factors (31.4 to 35.6%).

Significant positive changes in risk factor indicators included a reduction in the proportion who sometimes or always felt dizzy on rising (25.2 to 21.3%); an increase in those having their vision checked in the last 12 months (59.0 to 62.5%); and a reduction in those reporting one

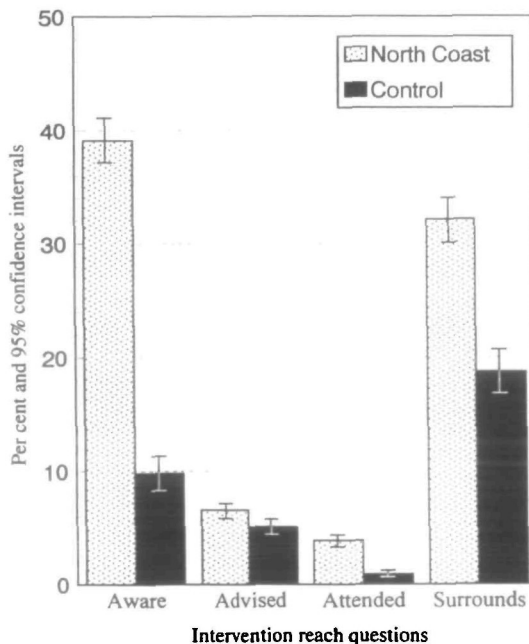


Fig. 1: Respondents' exposure to interventions.

Table 2: McNemar's tests for proportions for outcome variables—North Coast and control area

Variable	Category	North			Control area		
		Baseline (%)	18 months (%)	McNemar's ^a	Baseline (%)	18 months (%)	McNemar's ^a
Fell	yes	23.3	24.5	0.7	20.7	21.4	0.1
Falling a problem	yes	89.2	91.4	4.5 ^a	86.3	87.5	0.7
Falls preventable	yes	45.9	52.8	15.1 ^a	48.9	48.6	0.02
Knowledge score	score = 3	31.4	35.6	6.4 ^a	30.3	32.1	0.8
Risk of falling	high/medium	24.6	26.7	2.1	19.3	22.1	3.0
Physical activity	≥ 7h/week	49.5	43.4	13.7 ^a	58.0	52.4	8.4 ^a
Balance	excellent/good	76.6	75.8	0.4	78.9	76.4	3.2
Chronic illnesses	one or more	79.0	76.2	6.7 ^a	76.5	74.8	1.9
Dizziness	never/rarely	74.5	78.7	10.4 ^a	76.1	76.4	0.04
Vision	checked < 12 months	59.0	62.5	4.5 ^a	59.7	63.8	3.7
Footwear	safe shoes	70.0	70.6	0.1	61.2	66.3	8.6 ^a
Medication	one or more	49.2	51.6	5.4 ^a	43.3	45.8	4.0 ^a
Made changes	yes	15.2	11.0	15.1 ^a	14.8	9.5	16.8 ^a

^a McNemar's test: $p \leq 0.05$ where $\chi^2 \geq 3.84$ with 1 d.f.

Table 3: Logistic regression results for the effect of the intervention with covariates for each dependent variable

Dependent variable	Category	Odds ratio of the intervention	95% confidence interval
Fell	yes	1.11	0.95, 1.29
Falling a problem	yes	1.40 ^a	1.12, 1.75
Falling preventable	yes	1.27 ^a	1.11, 1.44
Knowledge score	score = 3	1.24 ^a	1.07, 1.43
Risk of falling	high/medium	1.27 ^a	1.07, 1.51
Physical activity	≥ 7h/week	0.79 ^a	0.67, 0.94
Balance	excellent/good	1.11	0.91, 1.34
Chronic illnesses	one or more	0.89	0.75, 1.04
Dizziness	never/rarely	1.29 ^a	1.10, 1.51
Vision	checked < 12 months	0.93	0.76, 1.13
Footwear	safe shoes	1.05	0.87, 1.27
Medication	one or more	1.20 ^a	1.04, 1.38
Made changes	yes	1.09	0.80, 1.48

^a The intervention is a significant predictor of the outcome variable ($p < 0.05$).

or more falls-related chronic illnesses (79.0 to 76.2%).

Significant negative changes included an increase in the proportion taking one or more falls-related medications (49.2 to 51.6%); a decrease in those doing seven or more hours of physical activity per week; and a decrease in those improving the falls-related safety of their homes (15.2 to 11.0%).

There was no change in the proportion who reported having fallen in the past 12 months; rated their risk of falling as medium to high; rated their balance as excellent or good; or wore safe footwear.

In the control cohort, significant changes from baseline to 18-month follow-up were: an increase in use of safe footwear; an increase in medication use; a decrease in physical activity and a decrease in those improving the falls-safety of their homes.

Multivariate logistic regression analysis

Logistic regression analysis was applied to the combined North Coast and control cohorts data to correct for potential confounders and explore the effect of the intervention alone on the changes reported in Table 2. A separate model was calculated for each of the indicators as the dependent variable. The variable for 'presence or absence of intervention' was included as a predictor variable in each model. All other variables were added one at a time and retained in the model if they were significant at the $p < 0.05$ level. Results are reported in Table 3 and give the odds ratio (OR) \pm 95% confidence intervals for the effect

of the intervention on each dependent outcome variable.

Some of the significant results found in the univariate analysis were found to be directly associated with the intervention after the logistic regression. These included a significant positive effect on the proportion of respondents who thought falls were a problem for older people (OR = 1.40); thought that falling was preventable (OR = 1.27); could name three or more risk factors (OR = 1.24); and rarely or never felt dizzy when getting up (OR = 1.29). Significant negative effects were observed including a decrease in proportion doing seven or more hours of activity per week (OR = 0.70) and an increase in proportion taking one or more medications (OR = 1.20).

Unlike the univariate analysis, the logistic regression analysis showed a significant effect of the intervention on the proportion of respondents rating their risk of falling as moderate or high (OR = 1.27). Significant univariate differences in chronic illnesses, vision and having made changes to the home to prevent a fall proved not to be associated with the intervention after logistic regression corrected for confounders.

DISCUSSION

The results clearly indicate that the North Coast Stay On Your Feet intervention is significantly influencing the target population, at least in the statistical sense. At this early stage the effect sizes

for the 18 months of intervention vary up to a maximum of 6% in the increase in beliefs that falls are preventable. How such changes will manifest in terms of real risk reduction and change in the number of falls will only become evident when the final programme evaluation is conducted.

The study design used for this evaluation was chosen to best detect the effect of the intervention with available resources. A prospective cohort design with a separate control site was chosen because it enabled a smaller difference in indicators to be detected than by other affordable designs. However, one limitation may be that the survey itself may have differentially heightened awareness of falls prevention issues among respondents in the intervention area when compared to the control. One other possible limitation is that respondents lost to follow-up may have included more older people who had had a serious fall since the baseline survey and were no longer living at home. However, demographic data suggest that any bias due to loss to follow-up was minimal and power calculations indicate that the retest sample was sufficiently large for measured changes to be representative of changes in the North Coast older population.

Responses to the intervention exposure questions indicate a dramatic increase in awareness of falls prevention messages among North Coast respondents. The difference in awareness at follow-up within intervention and control areas provides good evidence that the increase is due to the SOYF intervention. This result combined with significant increases in attitude and knowledge indicators show that strategies aimed at emphasising the preventability of falling and at disseminating information about the falls risk factors are having the desired effect. The increase in the proportion of older people who rate their own risk of falling as medium to high may also be attributable to effective awareness raising strategies. Unfortunately it was not possible in the context of this study to compare component strategies.

Whereas univariate analysis showed the size and direction of changes in the two groups, the true effect of the intervention was only ascertained after adjusting for possible confounders using logistic regression. Univariate changes observed in awareness, attitudes and knowledge were largely confirmed by multivariate analysis. The only exception was the change in self-assessed risk of falling which became significant only after multivariate analysis.

Of the changes in risk factor indicators, only three were shown to be directly associated with the intervention. These were: an increase in the proportion who never or rarely felt dizzy when rising; an increase in the proportion taking one or more medications known to cause unsteadiness; and a decrease in the proportion doing seven or more hours of physical activity per week.

Careful management of medications has been a key component of the community education and awareness raising activities of the SOYF intervention. The reduction in reported dizziness may well be attributable to raised community understanding. This may involve both older people and their prescribers becoming more aware of the need to manage medications safely, resulting in respondents experiencing fewer side effects such as postural hypotension. Paradoxically, the proportion of the sample taking medications increased. These two effects could conceivably co-exist if, for example, more of the sample were taking only one medication while those on multiple or problematic medications were better managed by themselves and/or their prescriber. Clearly, more information is needed to investigate this effect.

One negative effect observed to be associated with the intervention was a significant reduction in physical activity level. This is despite major promotion of gentle exercise through community education and provision of gentle exercise classes throughout the intervention area. There are at least two possible explanations for this effect. First, the follow-up was in the opposite season (baseline in October; 18-month follow-up in April). Seasonal differences may have affected older people's tendency to exercise and the fact that levels of activity decreased in both areas may reflect this. It was not possible in this evaluation to determine whether such seasonal effects differ between intervention and control areas.

A more likely explanation for the change is that older people in the intervention cohort, who are now rating their risk more highly, are being advised by family, friends and physicians to reduce activity in order to prevent a fall. This explanation is supported by the findings of a separate reach survey which indicated that the most common advice given by family and doctors when older people discuss falling is to 'take it easy' (Kempton and Garner, 1995).

This highlights the need to work more closely with family members and general practitioners to provide more appropriate falls preventive advice.

Regardless of which explanation is more likely, there is a need to continue and expand gentle exercise workshops across the North Coast. Self-assessed balance should also improve as a greater proportion of older people complete the 9-week exercise workshops (Aniansson *et al.*, 1984; Morey *et al.*, 1991).

Vision, footwear and home safety risk factors are now receiving more attention as the SOYF intervention moves from a primarily awareness-raising phase to focus more on community education, community action and policy development. Strategies now being implemented include a referral system for community health nurses which ensures that older and more frail clients receive specific attention for identified risk factors. This includes vision testing, podiatry, home maintenance and gentle exercise. Other new strategies include greater emphasis on improving home safety, such as promotion of falls-safe home improvement products and an improvement in falls-related policy for public places.

This evaluation demonstrates population changes which might reasonably be achieved in 18 months with a well-funded and well-managed community-based falls prevention programme. That is, changes in knowledge, attitudes and awareness and initial changes in behavioural risk factors. In view of the diversity of risk-abatement strategies implemented to date and the fact that programme evaluation seeks to detect changes in population level, this is clearly a long-term process and it is not surprising that there are, as yet, no significantly associated improvements in the majority of risk factors or the chance of an older person falling. The only studies that have shown improvements in the short term have involved intensive intervention with selected cohorts (Tinetti *et al.*, 1994). Although these provide a sound rationale for large community interventions, it remains for population-level evaluations such as that of the SOYF programme to show the efficacy of the community-based approach in redressing the broader problems of falls in the older population.

The SOYF risk factor survey will be repeated in October 1996 when the falls prevention programme will have been implemented for 4 years. The strategies of awareness raising, information dissemination and community education will continue, and new strategies will include promoting and advocating changes in public policy, modifying the home environment and enlisting the help of other groups such as general practi-

tioners. This latter set of strategies is expected to yield more concrete changes in behavioural and environmental risk factors and in the number of falls experienced by older people residing on the North Coast.

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