Fall prevention interventions in primary care to reduce fractures and falls in people aged 70 years and over: the PreFIT three-arm cluster RCT

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Declared competing interests of authors: Julie Bruce is chief investigator or co-investigator on multiple current research grants from the UK National Institute for Health Research (NIHR). Julie Bruce reports consultancy fees from Medtronic plc (Medtronic plc, Dublin, Ireland). Julie Bruce has received travel expenses for speaking at conferences from the professional organisations hosting the conferences. Julie Bruce is supported by NIHR Research Capability Funding via University Hospitals Coventry and Warwickshire. Martin Underwood was chairperson of the National Institute for Health and Care Excellence Accreditation Advisory Committee until March 2017, for which he received a fee. He is chief investigator or co-investigator on multiple previous and current research grants from NIHR and Arthritis Research UK and is a co-investigator on grants funded by the Australian National Health and Medical Research Council. He is a NIHR senior investigator. He has received travel expenses for speaking at conferences from the professional organisations hosting the conferences. He is a director and shareholder of Clinvivo Ltd (Kent, UK), which provides electronic data collection for health services research. He is part of an academic partnership with Serco Ltd (Hart, UK), which is related to return-to-work initiatives. He is a co-investigator on a study receiving support in kind from Orthospace Ltd (Caesarea, Israel). He has accepted an honorarium from Carta (Palo Alto, CA, USA). He is co-investigator on two NIHR-funded research projects receiving additional support from Stryker Ltd (Kalamazoo, MI, USA). He has accepted an honorarium from the Confederation for Advanced Research Training in Africa (CARTA). He is an editor of the NIHR journal series and a member of the NIHR Journals Library Editorial Group (2016–20), for which he receives a fee. Chris Bojke was a member of the NIHR Health Services and Delivery Research (HSDR) Board (2018–present). Roberto Longo was a NIHR HSDR Associate Member (2017–18). Claire Hulme reports being a member of the Health Technology Assessment (HTA) Commissioning Board (2013–17). Dawn A Skelton reports personal fees from Later Life Training Ltd (Killin, UK) during the conduct of the study. She is currently co-investigator on a NIHR HTA grant [ELECTRIC (ELECtric Tibial nerve stimulation to Reduce Incontinence in Care Homes), ongoing]. She has received grants from the NIHR Collaborations for Leadership in Applied Health Research and Care [PhISICAL (PHysical activity Implementation Study In Community-dwelling AduLts)], grants from the NIHR Public Health Research programme [REACT (REtirement into ACTION), ongoing; VIOLET (Visually Impaired OLder people's Exercise programme for falls prevenTion), finished] and grants from the Medical Research Council/ NIHR Methodology programme (finished) during the conduct of this study. Sarah E Lamb reports grants from the NIHR HTA programme during the conduct of the study, and was a member of the following: HTA Additional Capacity Funding Board (2012–15), HTA Clinical Trials Board (2010–15), HTA End of Life Care and Add-on Studies Board (2015), HTA Funding Boards Policy Group (formerly the Clinical Studies Group) (2010–15), HTA Post-Board Funding Teleconference (2010–15), HTA Maternal, Neonatal and Child Health Methods Group (2013–15), HTA Primary Care Themed Call Board (2013–14), HTA Prioritisation Group (2012–15) and the NIHR Clinical Trials Unit Standing Advisory Committee (2012–16).

Published May 2021
DOI: 10.3310/hta25340

Scientific summary

The PreFIT three-arm cluster RCT

Health Technology Assessment 2021; Vol. 25: No. 34
DOI: 10.3310/hta25340

NIHR Journals Library www.journalslibrary.nihr.ac.uk

Scientific summary

Background

Falls are the leading cause of accident-related mortality in older adults and are a major public health problem. Falls can lead to serious injury, with fractures necessitating hospitalisation occurring in 5% of community-dwelling adults with a history of falling. The evidence base for exercise interventions or multifactorial falls prevention programmes reducing fractures in the general population is lacking. Here, we report a cluster randomised trial testing the hypothesis that a 'screen-and-treat' approach to providing these interventions to older adults living in the community is clinically effective and cost-effective.

Objectives

To undertake a cluster randomised controlled trial to determine comparative clinical effectiveness and cost-effectiveness of three primary care falls prevention interventions: advice leaflet (Age UK. *Staying Steady*. London: Age UK; 2009) only or advice leaflet plus postal screening for falls risk, followed by either exercise or a multifactorial falls prevention for people aged ≥ 70 years, on outcomes of fractures, falls, quality of life and mortality. Secondary objectives were to estimate the relative clinical effectiveness of interventions in people by age, sex and falls history, to measure the uptake of the active interventions (i.e. exercise and multifactorial falls prevention) and to assess the relative costs of each intervention and determine the most cost-effective approach.

Methods

Study design and setting

This was a three-arm, pragmatic, cluster randomised controlled trial, with a parallel economic analysis. The unit of randomisation was the general practice. The setting for the trial was primary care in England.

Participants

People aged ≥ 70 years living in the community and identified from general practice registers took part.

Interventions

After completing recruitment we randomised practices. All practices provided a postal falls prevention advice leaflet to each participant. In addition, the practices randomised to the active intervention arms (exercise and multifactorial falls prevention) screened for falls risk using a postal questionnaire. For those participants identified as being at higher risk of falling, treatments were arranged and delivered in accordance with a standardised protocol.

Outcomes

Our primary outcome was fracture rate over 18 months. Secondary outcomes included the proportion of people with at least one fracture, falls, health-related quality of life, mortality, frailty and health service resource use over 18 months. Health-related quality of life was measured using the EuroQol-5 Dimensions, three-level version, and Short-Form questionnaire-12 items. Frailty was measured using

the Strawbridge questionnaire. We captured patient-reported outcomes using participant questionnaires and falls diaries. Fractures were captured from Hospital Episode Statistics, general practice records and participant self-reporting.

Randomisation and allocation sequence generation

The unit of cluster randomisation was the general practice. Participants aged ≥ 70 years were randomly selected from each practice and were recruited prior to practice randomisation. We aimed to recruit 9000 people to show a 2% absolute reduction in the proportion of older people sustaining a fracture over 1 year. Hence, we aimed to recruit approximately 150 participants each from at least 60 general practices. To ensure that local services could cope with the additional demand placed on them by the trial, we randomised practices in blocks of three from the same service area. We used a computer-generated algorithm held and controlled centrally in the Warwick Clinical Trials Unit by an independent programming team. Blocks of practices were randomised at the same time.

Blinding

The interventions were allocated at practice level and, therefore, although participants had agreed to participate in a research study about older people and falls, they were blind to the treatment allocation of their practice on recruitment. Practices were aware of their allocation. Practices randomised to the active interventions posted the falls risk screening questionnaire, and responding participants deemed at higher risk of falling were invited for treatment, either exercise or multifactorial falls prevention. Exercise therapists were aware that participants had been referred to exercise, but did not know which arm of the trial the participants had been allocated to. Other clinicians involved in multifactorial falls prevention were aware of the allocation. Follow-up was by postal questionnaire and routine data. Personnel involved in collection, data entry and analysis of outcomes were blind to the treatment allocation of the practice and participant. Allocation of treatment was coded but unavailable to the trial management team. Treatment codes were accessed only after data lockdown occurred for analysis. Fracture adjudication took place blind to treatment allocation.

Statistical analysis

The primary statistical analysis was intention to treat. A nested intention-to-treat analysis was undertaken in those participants identified as being at higher risk and complier-average causal effect analysis conducted. Fracture and falls rates were assessed over the 18 months, and for each time interval (from baseline to 4 months, 4 to 8 months, 8 to 12 months and 12 to 18 months). Fracture rates were expressed as per person per 100 years. Negative binomial models were used using a random- or fixed-effects model, whichever model better fitted the data. All models were adjusted for baseline variables: general practice deprivation score, participant falls history, age and sex. A Cox proportional hazards model was fitted to the data to compare time to first fracture across treatment arms. The total number of fracture episodes and rate of fracture per episode were summarised by treatment arm. Frequency and proportion of hip and wrist fractures were compared by treatment arms using the chi-squared test. The Short-Form questionnaire-12 items score was analysed using random-effect linear regression models. Frailty status was fitted using the random-effect logistic regression model, with the odds of being frail compared with non-frail modelled by treatment arm (exercise vs. advice; multifactorial falls prevention vs. advice). The cognition test was summarised as higher compared with lower cognitive functioning.

Health economic analysis

A within-trial evaluation comparing the incremental costs and quality-adjusted life-year captured over the 18 months of the trial was conducted. The EuroQol-5 Dimensions, three-level version, was used to measure health-related quality of life over time and quality-adjusted life-years were constructed by using the area under the curve approach. The cost perspective was that of the UK NHS and Personal Social Services. Multilevel linear modelling was used to account for the multiple observations over time of the health-related quality of life and costs per patient, clustered within practices. We discounted costs and outcomes at 3.5% per annum and we conducted a probabilistic sensitivity analysis using Monte Carlo simulation methods, with simulations of expected costs and quality-adjusted life-years drawn from the variance–covariance matrices from the health-related quality of life and cost regressions. To account for the possibility that the within-trial cost-effectiveness argument might be artificially censored at the 18-month trial period, a decision-analytic model was planned to extrapolate the economic argument over a lifetime horizon. This may be necessary if the trends of costs, outcomes or the mechanisms (rate of falls/fractures) that drive costs and outcomes are differentially changing over time for different treatment groups such that a longer time perspective is required to understand the full health economic picture.

Results

We randomised 63 general practices from six English localities: (1) Birmingham and the Black Country, (2) Cambridgeshire, (3) Devon, (4) Herefordshire and Warwickshire, (5) Newcastle upon Tyne and (6) Worcestershire. We randomised 21 practices to each intervention. We initially recruited 9819 participants; nine withdrew and seven died before randomisation. Our randomised population was therefore 9803 people aged 70–101 years. Among these, 3223 (32.9%) were randomised to receive an advice leaflet and 6580 were allocated to receive an advice leaflet supplemented with risk screening and referral to either exercise (3279/9803, 33.4%) or multifactorial falls prevention (3301/9803, 33.7%). The mean age of participants was 78 years (standard deviation 5.7 years), 5150 out of 9803 (52.5%) were female, and most participants had scored highly on a cognition screener test (8751/9803, 89.3%). One-third of participants had fallen in the year prior to recruitment (3854/9803, 39.3%). Postal questionnaires and core outcome data were obtained for 9064 out of 9803 (92.5%) participants at 4 months, 8578 out of 9803 (87.5%) at 8 months, 8136 out of 9803 (83.0%) at 12 months and 7490 out of 9803 (76.4%) at 18 months after randomisation. Following postal screening, 88% of falls risk screeners were returned to practices randomised to exercise or multifactorial falls prevention (5779/6580). The postal falls risk screener performed moderately well at predicting falls over 12 months (area under the curve 0.66, 95% confidence interval 0.64 to 0.68). Among the 5579 participants screened, 2153 (37.3%) were identified as being at higher risk of falling and were referred to treatment, either to exercise ($n = 1079$) or multifactorial falls prevention ($n = 1074$). In the exercise arm, 697 out of 1079 (64.6%) participants attended exercise and, among these, 454 (65.1%) completed the prescribed 6-month exercise programme. Among the 1074 participants referred to the multifactorial falls prevention, 762 (70.9%) attended falls assessment. Over half of those assessed were referred for a detailed general practice-led medication review and over one-third of participants were referred to exercise because of balance and/or gait problems (299/762, 39.2%). Among these 762 participants, 203 (26.6%) attended multifactorial falls prevention exercise and 124 (16.3%) completed the prescribed 6-month exercise programme.

Primary outcome

Fracture data were available from Hospital Episode Statistics for 9802 out of 9803 participants (99.99%) and from 62 out of 63 (98.4%) general practices. A total of 379 out of 9803 (3.9%) participants sustained a fracture over 18 months. Although there was a trend towards an increased fracture rate in both intervention arms (exercise compared with advice: rate ratio 1.20, 95% confidence interval 0.91 to 1.59; multifactorial falls prevention compared with advice: rate ratio 1.30, 95% confidence interval 0.99 to 1.71), neither difference achieved statistical significance. There were no differences in the number of hip or

wrist fractures by treatment group, nor in time to first fracture. Time to first fracture was approximately 2 months longer in the exercise group and 1 month longer in the multifactorial falls prevention group than in the advice group, although these differences were not statistically significant.

Secondary outcomes

Participants reported a total of 13,428 falls over 18 months. There was no difference in falls rate over the entire 18 months: rate ratio 0.99 (95% confidence interval 0.86 to 1.14) and rate ratio 1.13 (95% confidence interval 0.98 to 1.30) for exercise and multifactorial falls prevention, respectively. There was a lower falls rate over months 4–8 among those randomised to exercise than among those receiving advice only (rate ratio 0.78, 95% confidence interval 0.64 to 0.96). However, this was not sustained over time. A total of 289 (2.9%) participants died, with no differences by treatment arm. There were no differences in quality-of-life scores between groups over time, although interim improvements in subdomains (mobility, pain) were noted in the exercise group compared with the advice group. There were no differences in the rate of fractures and falls over 18 months in the stratum of people who were at higher risk of falling, among those who complied with the intervention or in the prespecified subgroups. The prevalence of frailty increased slightly over time, but there were no differences in odds of being frail by treatment comparison.

Economic analysis

The within-trial analysis found that, after allowing for clustering, a participant allocated to exercise would expect to enjoy 1.120 quality-adjusted life-years over 18 months and generate costs of £3720 to the NHS. These figures discount the costs and quality-adjusted life-years from months 12–18 by 3.5%. For the same participant allocated to advice, the net present value quality-adjusted life-years and costs are 1.114 and £3737, respectively. For multifactorial falls prevention, these figures are 1.106 quality-adjusted life-years and costs of £3941. Inspection of the data shows that the majority of the costs occur in secondary care and are largely unrelated to falls (e.g. cancer treatment). From an economic perspective, because exercise delivers the highest expected quality-adjusted life-years at the lowest expected costs, it dominates both advice and multifactorial falls prevention. Similarly, as multifactorial falls prevention delivers the lowest quality-adjusted life-year expectation at the highest cost, it is dominated by both advice and exercise. The incremental differences are rather modest, particularly between advice and exercise. Advice is expected to add roughly £1 per month over exercise to the expected costs, and the incremental quality-adjusted life-year difference amounts to approximately an additional 2 days in perfect health over the 18 months. Nevertheless, the large sample size, balance across cohorts and small numbers of missing data mean that the results are largely robust to probabilistic sensitivity analyses.

The within-trial analysis showed a consistent picture of cost-effectiveness over time, with exercise being the most cost-effective treatment at all time points and with an increasing dominance over time. Furthermore, the trial analysis showed no significant impact on the trends of fractures and falls and, therefore, there is no mechanism for a more structured model to alter the trends observed in the trial. It is therefore clear that extending the perspective of the model from 18 months to lifetime would offer little additional insight and could not change the substantive conclusions that exercise dominates advice, which in turn dominates multifactorial falls prevention.

Harms

No serious adverse events directly related to the interventions were reported. One participant sustained a fractured neck of femur during a trial procedure not related to the intervention: a fall sustained when returning from posting a follow-up questionnaire.

Limitations

The incidence of fractures was lower than anticipated in the original sample size calculation, although we used more efficient statistical methods than originally planned.

Conclusions

This large, high-quality cluster randomised controlled trial recruited almost 10,000 older people aged 70–101 years from across England; we found that a primary care-led screen and referral to falls prevention treatment did not reduce fractures. Exercise reduced falls in the time period around the end of intervention, but this benefit was not sustained over time. Screening for higher risk and provision of multifactorial falls prevention from primary care is not a worthwhile investment. Of the three treatments, exercise was both marginally cheaper and delivered the best health-related quality of life, and was therefore a dominant cost-effective treatment relative to both advice and multifactorial falls prevention. The multifactorial falls prevention intervention was found to be the least cost-effective, with the lowest quality-adjusted life-years and high costs (a result robust to probabilistic and other sensitivity analysis).

Future work

Falls and fracture prevention remains an important target of preventative health care. Improving uptake and adherence to strength and balance programmes in primary care is an important focus for future research, and should be tested as part of a framework or family of interventions to target geriatric syndromes.

Trial registration

This trial is registered as ISRCTN71002650.

Funding

This project was funded by the National Institute for Health Research (NIHR) Health Technology Assessment programme and will be published in full in *Health Technology Assessment*; Vol. 25, No. 34. See the NIHR Journals Library website for further project information.

Health Technology Assessment

ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

Impact factor: 3.370

Health Technology Assessment is indexed in MEDLINE, CINAHL, EMBASE, the Cochrane Library and Clarivate Analytics Science Citation Index.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: journals.library@nihr.ac.uk

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This report

The research reported in this issue of the journal was funded by the HTA programme as project number 08/14/41. The contractual start date was in September 2010. The draft report began editorial review in June 2019 and was accepted for publication in January 2020. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health and Social Care. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health and Social Care.

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