Home visits to prevent nursing home admission and functional decline in elderly people: systematic review and meta-regression analysis

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Authors' objectives
To evaluate the effect of preventive home visits on functional status, nursing home admission, and mortality.

Searching
MEDLINE, PsycINFO and EMBASE were searched from January 1985 to November 2001, using the keywords 'aged', 'home' or 'in-home', 'prevention' and 'geriatric assessment'. The authors also searched the Cochrane Controlled Trials Register, checked reference lists of earlier reviews and book chapters, searched conference proceedings and specialty journals, and contacted experts. Studies were limited to reported in English, French, German, Italian or Spanish.

Study selection

Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for inclusion. Articles where attempts to obtain unpublished data from the authors were unsuccessful, were excluded from the review.

Specific interventions included in the review
Studies of preventive home visits were included in the review. The home visits were conducted by a nurse, home visitor (nurse or physician), health visitor, physician, social worker, volunteer, lay community worker, public health nurse, nurse practitioner, physical therapist or geriatrician.

Participants included in the review
Studies of older people (mean age over 70 years) living in the community were included. All the participants were aged 65 years and older, with the mean age of the study participants at baseline ranging from 72.7 to 81.6 years. The participants in the included studies included individuals living alone; not receiving home care; with no terminal illness or dementia; who were not severely impaired; at risk of falls; or at risk of functional decline.

Outcomes assessed in the review
The outcomes assessed in the review were nursing home admissions, mortality and functional status. For nursing home admissions, the number of participants admitted to nursing homes and the number of persons for whom information about nursing home admissions was available were recorded. For mortality, the number of deaths from all causes and participants with known vital status were recorded. The definition of function status was based on activities of daily living, or lower or upper extremity function. The number of persons with functional status decline were recorded.

Assessment of study quality
The quality of the primary studies was assessed by examining the method of randomisation, blinding of the caregivers and research staff ascertaining the outcomes, and the proportion of patients included in the analyses of the three end points. One reviewer assessed trial quality.

Data extraction
Two reviewers extracted the data. Data were extracted on the source of the study population, population inclusion criteria, mean age at baseline, intervention personnel, whether a multidimensional geriatric assessment and follow-up was performed, the number of follow-up visits, and outcomes. If published data on study populations and interventions
were incomplete, or if there were no published data relating to any of the three outcomes of interest, the original investigators were contacted. Additional unpublished information was obtained from 9 studies.

Methods of synthesis

How were the studies combined?
The results of the studies were combined on the risk ratio scale using fixed-effect and random-effects models. A random-effects model was used to calculate a typical risk difference, which was then converted to the number-needed-to-visit (NNV) to prevent one adverse outcome. In a sensitivity analysis, the authors excluded one trial whose results had been influential when formulating the study hypothesis. Publication bias was assessed using a funnel plot.

How were differences between studies investigated?
Heterogeneity was estimated with an iterative restricted maximum likelihood method. Standard tests of homogeneity of risk ratios were also calculated, and meta-regression models were used to examine the extent to which one or more variables explained heterogeneity in the treatment effects. The following variables were considered: the mean age of the study population and the mortality rate in the control groups (indicators of baseline risk), the duration of the intervention, the number of home visits, and whether the intervention was based on multidimensional geriatric assessment with follow-up. The authors also considered variables relating to the quality of the studies, geographic location of the study and groups of authors.

Results of the review

Seventeen reports of 18 RCTs, with a total of 13,447 participants, were included.

Twelve of the 18 studies were classified as not based on multidimensional geriatric assessment and follow-up because they did not include a medical, functional and psychosocial assessment, or because these assessments were not combined with a follow-up intervention. The number of follow-up visits ranged from 0 to 12.

Effects on nursing home admission (13 trials): overall, the reduction in the risk of admission was modest and non significant. However, in the meta-regression analysis, there was evidence of an association of treatment effect with the number of follow-up visits (P=0.05). The pooled relative risk (RR) was 0.66 (95% confidence interval, CI: 0.48, 0.92) for trials with more than 9 visits, with an NNV of 43, but was 1.05 (95% CI: 0.85, 1.30) for trials with 0 to 4 visits.

Functional decline (16 trials): overall, preventive home visits appeared to have little effect on functional status, but the results were heterogeneous (P=0.03). In the meta-regression analysis, beneficial effects were associated with multidimensional geriatric assessment with follow-up (P=0.01) and inversely correlated with control-group mortality (P=0.04). The pooled RR was 0.76 (95% CI: 0.64, 0.91) in trials with multidimensional assessment and follow-up, with an NNV of 15, and 1.01 (95% CI: 0.92, 1.11) in trials without. Functional decline was reduced (RR 0.78, 95% CI: 0.64, 0.95) in trials with a control-group mortality rate in the lower tertile (3.4 to 5.8%), but not (RR 0.98, 95% CI: 0.84, 1.13) in those with a control-group mortality rate in the upper tertile (8.3 to 10.7%).

Mortality (18 trials): preventive home visits appeared to reduce mortality, but the results were heterogeneous (P=0.04). In the meta-regression analysis, there was strong evidence (P=0.004) that the mean age of the participants was negatively associated with effects on mortality. The pooled RR was 0.76 (95% CI: 0.65, 0.88) for ages 72.7 to 77.5 years, with an NNV of 24, and 1.09 (95% CI: 0.92, 1.28) for ages 80.2 to 81.6 years.

There was little evidence (P>0.10) that the aspects of methodological quality assessed influenced the results, or that the results differed significantly according to the geographical region or groups of investigators (P>0.10). In a sensitivity analysis, the exclusion of the trial whose results had been influential when formulating the study hypothesis did not change the results. There was also little evidence of publication bias (P>0.10).

Cost information
The authors stated that the results can be used to approximate the cost implications of preventive home visits. The lifetime costs for a person admitted to long-term care in a UK nursing home have been estimated as $65,000 (£42,250).

The NNV to prevent one admission in programmes with frequent follow-up visits was about 40. Therefore,
programmes with expenditures of less than $1,500 (£1,000) per participant should reduce the costs. Furthermore, the costs are approximate and probably not linear over time. The authors stated that they found preventive home visits required an initial investment of $433 per person for the first year to produce net savings of $1,403 per person annually in the third year.

**Authors' conclusions**
Preventive home visitation programmes appear to be effective, provided the interventions are based on multidimensional geriatric assessment and include multiple follow-up home visits and target persons at lower risk of death. Benefits in survival were seen in young-old rather than old-old populations.

**CRD commentary**
The review question was well-defined and the inclusion criteria were appropriate. The search strategy was adequate, comprising a search of four suitable electronic databases, handsearches and contact with experts. Articles published in five languages were considered. Two reviewers screened abstracts for inclusion and extracted the data, thus minimising the possibility of bias and errors. There was no significant publication bias, as assessed using a funnel plot. Whilst a validated quality scale does not appear to have been used, the quality items assessed were suitable. The included studies were described in sufficient detail and the data synthesis was appropriate. Heterogeneity was assessed and meta-regression models were used to examine the extent to which one or more variables explained heterogeneity in the treatment effects. A sensitivity analysis was also performed.

This was a well-conducted systematic review and meta-analysis. The authors' conclusions appear to have been appropriate.

**Implications of the review for practice and research**
Practice: The authors stated that, in countries with existing national programmes of preventive home visits, the process and organisation of these visits should be reconsidered according to the criteria identified in this meta-analysis. In the USA, a system for functional impairment risk identification and appropriate intervention to prevent or delay functional impairment should be considered. Grafting the key concepts of home-based preventive care programmes into existing health maintenance organisation programmes for elderly patients and chronic-disease management programmes should be feasible as they continue to evolve, and should be cost-effective. Research: The authors did not state any implications for further research.

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