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ORIGINAL ARTICLE

Preventive home visits to older people are cost-effective

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Abstract

Aims: There is ongoing debate over the effectiveness of preventive home visits (PHVs) for the elderly. A municipality in the north of Sweden carried out a controlled trial of such visits. Healthy seniors aged 75 years and over received two PHVs per year over 2 years. The aim of this study was to do a cost utility analysis of the intervention. *Methods:* The intervention group ($n=196$) was compared with a control group ($n=346$), and a cost utility analysis was performed. The analysis was carried out with three different time perspectives. Data were sourced from official documents and medical and social records. *Results:* From a societal perspective, using a time period of 4 years, the analysis of PHVs to healthy seniors showed net savings. When including estimated future costs for health and elderly care during gained life years, the result changed from a net saving to a cost of €200,000. A lifetime perspective also resulted in net savings if the costs of future health and elderly care were not included in the analysis. In this case, the total costs rose to approximately €900,000. The cost could also be expressed as €14,200 per quality-adjusted life year gained if future costs for elderly care and healthcare were included. ***Conclusions:* PHVs represent a cost-effective intervention in this setting. The costs are justified by the outcomes.**

Key Words: *Community intervention, cost utility analysis, economic evaluation, older people, preventive home visits*

Introduction

Is it possible to identify effective strategies for reducing ill-health among older people? This question is of great importance as the number of elderly individuals increases in Sweden and increases even more rapidly in other European countries. This anticipated change will demand an increase in healthcare spending of approximately 25% [1].

One strategy for reducing costs while achieving better health and living conditions for older people could be to offer preventive home visits (PHVs). In Denmark, legislation states that PHVs for the elderly are compulsory [2]. Some trials have reported results indicating that PHVs can postpone mortality and admissions to nursing homes, and/or prevent dysfunction [3,4]. Others have stated that PHVs do not have any effects [5]. Systematic reviews and meta-analyses have described the difficulties of comparing PHV trials, as a result of methods, target groups and contextual factors differing greatly [6–8].

In 1999, municipalities and county councils in Sweden were given the opportunity to apply for grants to introduce PHVs for older people. A more comprehensive description of the background to this can be found elsewhere [9,10]. Nordmaling was one of the municipalities that took advantage of this opportunity and initiated PHVs. Nordmaling is a sparsely populated rural area with 7,600 citizens (50% males and 50% females), and the average age of the population is higher than the average for the whole country.

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The purpose of the Nordmaling trial was to study whether and how PHVs can change the pattern of care utilization and whether the quality of life for older people can be improved. The aim of this study was to perform a cost utility analysis (CUA) of the Nordmaling trial and investigate whether the effects of PHVs can justify the costs.

The intervention can briefly be described as four home visits aimed at stimulating seniors (aged 75+ years) to adopt or maintain a healthy lifestyle and preserve functional ability as far as possible. The focus was on physical activity, fall prevention, diet, and common senior health problems. It was also important to inform the population about the supply of elderly care, primary healthcare, and social activities, and the fees related to these activities.

Methods

Identifying the effects

One intervention and one control group were randomly selected from the 595 inhabitants aged 75 years and over in Nordmaling, living independently without home help or home nursing services. One hundred and ninety-six seniors received PHVs, and 346 seniors formed the control group. The two groups were thus similar before the visits started, and any differences in outcomes between the groups can accordingly be explained by PHVs. A more detailed description of the methods used is available elsewhere [10]. Figure 1 shows that the PHVs were ongoing during 2000 and 2001 and the outcome period of interest is 2000–2003 or lifetime.

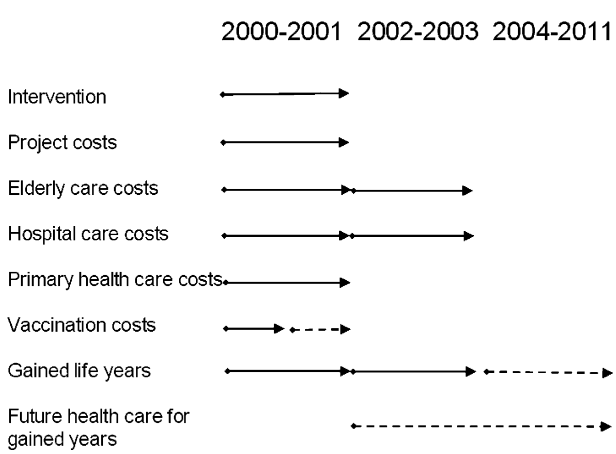

Figure 1. Description of time windows used to calculate costs. The arrows indicate the time periods used in the calculations. Unbroken lines are used for the periods when empirical data were collected, and broken lines are used for periods when effects and costs are predicted/modelled.

Information on utilization of elderly care (including institutional care and home help) and hospital care came from three sources. Medical records in the primary healthcare centre provided information regarding the use of primary healthcare, i.e. influenza vaccination and visits to general practitioners. Social records gave information on elderly care provided by the municipality. Knowledge about the use of hospital care came from the official registration documents in the county council. Differences in outcomes between the two groups were tested for significance (5% level). In all calculations, we assumed that effects developed linearly, with no effect at the beginning of the trial and the maximum effect being reached at the end of measured period.

Quantifying and valuing costs connected to the effects

A CUA with a societal perspective requires the identification of all relevant health effects but also the measurement of costs and savings caused by each effect. Quality-adjusted life years (QALYs) and gained life years were used as the outcome measures. Costs for the intervention occurred only during the first 2 years (Figure 1), and the costs were found in the municipality's records. Costs/savings for changed use of social services and healthcare were calculated as the consumption of physical units (days, visits, etc.) multiplied by a standard unit price. The standard unit price originated from official registers and documents. Estimations from informed insiders gave, for example, time used for emergency visits in primary healthcare. Costs for increased flu vaccinations were measured in the first year only, but we assume that this level of vaccination cost continued during the second year. The costs that seniors incurred for time spent in participating in the project and the value of senior production were not included in the model.

Deaths in both groups from 2000 to 2003 were obtained from the municipality and are part of the national registration. The Cohort software (developed by the Department of Public Health and Clinical Medicine, Umeå University and available as freeware from the author) was used to calculate the time at risk for each individual from the date when they entered the study. Incidence rate ratios, with the PHV group as reference group, were calculated with 95% confidence intervals (CIs).

Age- and sex-specific remaining life-year data were obtained from official statistics [11] and made it possible to calculate gained life years after the follow-up period, assuming that surviving seniors in Nordmaling are similar to average Swedish seniors in similar age groups.

In one version of the analysis we also assumed that gained life years are connected with additional elderly care and healthcare in the future. In Nordmaling, about 25% of seniors aged 80 years and over are living in nursing homes (institutional help) and 21% receive home help. Of seniors aged 75–80 years, 10% need elderly care. Using this information of provided care and the official average annual cost per person in Nordmaling for institutional care (411,000 SEK) and home help (114,000 SEK), we calculated the costs for elderly care during added life years. Information about the annual number of medical treatments for this age group and costs for each treatment were obtained from the county council, and the future healthcare costs for added life years were calculated.

A EuroQol 5 dimensions (EQ 5D) questionnaire [12] was sent to both the intervention group and the control group approximately 3 months after the end of the PHV activities. An EQ 5D questionnaire is based on the assumption that health-related quality of life consists of five dimensions (mobility, self-care, usual activity, pain/discomfort, and anxiety/depression). The mortality data in combination with the results from the EQ 5D questionnaires made it possible to calculate QALYs. The costs for the different years have been expressed in prices for 1999. A real discount rate of 3% is used in all calculations.

Ethics

Ethical aspects of the design were discussed with seniors from the local pensioners association, staff in the project, and local decision-makers. Permission from the Research Ethics Committee at Umeå University was obtained for this study (dnr 02-445).

Results

Mortality decreased during the intervention period, which is discussed further in an "on-treatment" analysis reported elsewhere [10]. The number of prevented deaths in the intervention group was estimated to be 11 out of 196. The utility scores after the intervention did not differ significantly between the intervention group and the control group. A utility score of 0.7 gives 63 QALYs, which corresponds to 91 gained life years when the lifetime perspective is adopted (Table I).

The cost of the project was €156,000 during the 2-year period of intervention. Eighty per cent of the cost (Table II) was for staff. About 90% of the costs came directly from financial records, while costs for premises and overheads were estimated.

All costs and savings incurred as a result of the intervention are presented in Table III. In the short-term window (2000–2001), the total cost is €152,000 if only significant costs and savings are considered. Costs of influenza vaccination increased, while the cost of emergency general practitioner visits decreased. The increase in influenza vaccination was significant (odds ratio (OR) 1.68, 95% CI 1.17–2.43). The cost for the first year is less than €10 per vaccinated individual, or €500 in total. For the 4-year period, the extra cost of vaccination is estimated to be approximately €1,500, which is a modest amount. If all costs and savings in this time perspective are included, the total cost drops to €8,000.

During the mid-term window (2000–2003), the visited seniors had utilized significantly less elderly care (OR 0.62, 95% CI 0.40–0.96). An estimation of this saving during the period equals a saving of €281,000 for the municipality. The number of hospital beds used is similar in both groups when studying the period 2002–2003. After addition of all costs and savings for the 2 years of intervention and the following 2 years, the result is a net saving of €213,000. The net saving is also substantial if savings based on significant results only are included. This means that PHVs with the chosen time window represent an example of a "win-win situation", since the savings are greater than the costs and the health consequences are positive. When estimated future costs for healthcare and elderly care during gained life years are included, the results change from a net saving to a cost of €117,000.

Table I. Gained years and quality-adjusted life years (QALYs) due to preventive home visits.

	Quality weight	2000–2001	2000–2003	2000–2011
Gained years		11	32	91
Gained QALYs	0.7	8	22	63

Table II. Costs for managing the project 2000–2001 (€).

Salaries for home visitors	120,000
Training of home visitors	6,000
Salaries for administrative staff	5,000
Material, services, travelling expenses	9,000
Overheads	6,000
Premises	7,000
Investments	3,000
Total	156,000

Table III. Municipalities' and county councils' costs and savings (€).

	Costs for which there is a significant difference[a] between the intervention group and the control group	All costs except for healthcare and elderly care during gained life years	All costs including healthcare and elderly care during gained life years
2000–2001, short-term window			
Municipality	81,000	21,000	
Total trial costs	81,000	81,000	
Assisted transportation costs		500	
Savings for home help		−60,000	
County council	72,000	−13,000	
Total trial costs	81,000	81,000	
Influenza vaccination costs	500	500	
Savings for emergency general practitioner visits	−9,000	−9,000	
Savings for hospital care		−85,000	
Total costs	152,000	8,000	
2000–2003, mid-term window			
Municipality	−200,000	−200,000	9,500
Total cost for trial	81,000	81,000	81,000
Assisted transportation		500	500
Home help	−281,000	−281,000	−281,000
Future elderly care			210,000
County council	72,000	–13,000	108,000
Cost of trial	81,000	81,000	81,000
Influenza vaccination	500	500	500
Emergency visits with general practitioner	−9,000	−9,000	−9,000
Hospital care		–85,000	–85,000
Future healthcare			120,000
Total costs	−129,000	−213,000	117,000
2000–2010, lifetime window			
Municipality	−200,000	−200,000	443,000
Cost of trial	81,000	81,000	81,000
Assisted transportation		500	500
Home help	−281,000	−281,000	−281,000
Future elderly care			643,000
County council	72,000	–13,000	448,000
Cost of trial	81,000	81,000	81,000
Influenza vaccination	500	500	500
Emergency visits with general practitioner	−9,000	−9,000	−9,000
Hospital care		−85,000	−85,000
Future healthcare			460,000
Total costs	−129,000	−213,000	891,000

In Sweden, there are two managing organizations for elderly care and healthcare, the county council and the municipality. In this table, costs for the intervention are divided equally between the municipality and the county council. The costs (or savings) resulting from the trial are assigned to the authority responsible. [a]The confidence intervals are calculated and in some cases presented in the text.

Finally, in the lifetime window, the total costs rise to approximately €900,000 if healthcare and elderly care costs are included. Future elderly care amounts to €640,000, while the corresponding amount for healthcare is €460,000 (Table III).

As shown in Table IV, assumptions relating to different time windows and decisions on what costs to include are important for the overall result. However, a longer time window also means that the health gains increase. In Table IV, the costs per QALY under different assumptions are calculated. The mid-term and long-term windows give the most favourable results if costs during added life years are ignored (net savings in combination with positive health gains). The inclusion of health and costs during added life years in a lifetime perspective increases the costs to about €14,000/QALY.

Discussion

The main conclusion from this CUA is that PHVs represent a cost-effective intervention in this setting. Both the time window and the costs

Table IV. Gained years/quality-adjusted life years (QALYs) related to three selections of costs (€) and shown with different time perspectives and discount rates.

	Costs based on significant difference between intervention group and control group	All costs except for future healthcare and elderly care during gained years	All costs including future healthcare and elderly care during gained years
2000–2001, short-term window			
Cost per year gained	13,800	700	
Cost per QALY gained	20,100	1,100	
2000–2003, mid-term window			
Cost per year gained	−4,000	6,600	3,700
Cost per QALY gained	−5 800	9,600	5,300
			4,000 (5%)
			6,000 (0%)
2000–2010, lifetime window			
Cost per year gained	−1,400	−2,300	9,800
Cost per QALY gained	−2,000	−3,400	14,200
	−2,600 (5%)	−4,000 (5%)	13,500 (5%)
	−1,600 (0%)	−2,800 (0%)	14,600 (0%)

Net savings are the result of the intervention if the time period of interest is expanded beyond the short-term window. Sensitivity analysis shows that the choice of discount rate is not important.

included were varied. The calculations have been done with different discount rates. The different cost-effectiveness ratios were constantly at an acceptable level, far below a common threshold level in Sweden (€50,000 per gained year). Some variants of the calculations even indicated a combination of health gains and savings. However, despite favourable results in the lifetime perspective, there is a greater degree of uncertainty.

The particular strengths of this study are that it is based on a controlled trial design, and data regarding health outcomes and resources use were collected alongside the trial. Every participant was followed up for 4 years. The inclusion criteria were very wide (all healthy 75+ seniors in the population), and this implied a natural selection process, where proportionally more of the healthiest elderly rejected PHVs. Thus, an on-treatment analysis is appropriate to understand what is within the range of possible outcomes. When this efficacy is transformed into effectiveness in ordinary healthcare and elderly care, an intention-to-treat approach might be more suitable.

A weakness of the study is that the use of EQ 5D questionnaires was not planned from the outset. A more optimal measurement procedure may have been to send the questionnaire at the beginning and at the end of the PHV trial. We only had the possibility of measuring health-related quality of life at the end of the trial period, assuming that there were no initial differences according to the random allocation and that any potential differences after the trial were caused by the intervention. Furthermore, the questionnaire was sent 3 months or more after the PHV programme was finished. This may explain the absence of improved health-related quality of life in the intervention group and strengthen the hypothesis that PHVs do not have any long-term effects on quality of life.

An effort was made to telephone the 46 persons who refused to participate and still lived in the community. We have no additional information from 21 of them. Thirteen seniors stated that they had no need for a visit, and four gave medical reasons for not participating. The remainder stressed different aspects of personal autonomy. In the dropout group, the proportion of youngest old (75–80 years) is higher than in the other groups. It was also less common in the dropout group to visit the hospital before the trial. This indicates that it is reasonable to expect a lower mortality rate in the dropout group. Therefore, there is no indication that the result in this study is affected by the dropout group in a way that overestimates the mortality incidence ratio between the intervention group and the control group. This is discussed in more detail elsewhere [10].

Since the aim of this article is to present this CUA in a societal perspective, a shortcoming is that the analysis has included neither the value of seniors' time nor the value of seniors' production. This is important when demanding comparability between interventions targeting different generations. Often, the value of seniors' time is disregarded, since they have left the formal labour market. On the other hand, one can argue that the value of time is a particularly important cost from the seniors' perspective. When the target group is older, there is naturally less lifetime remaining. In that sense, time is more limited the older the individuals are, and therefore time might be valued as very important by older people. Another factor to bear in mind is that many of the individuals included in the intervention expressed approval of the visits. Perhaps there is an "enjoyment" factor [13] compensating for the value of time used.

The value of seniors' production may be significant but it is not easy to measure. To our knowledge, little research has been carried out in this area, but there are indications that the value is substantial [14]. If seniors' production had been included, the outcome may have been even more positive. This means that the calculations performed, using a municipality and county council perspective, are useful indicators for the societal perspective.

A less important shortcoming in the costing is the incomplete information regarding the vaccination costs. In any case, uncertainty in this cost component cannot affect the overall results.

This trial shows different patterns when results during and after the trial are compared. Mortality was significantly postponed during the trial period (short-term window), but the effect did not last. Utilization of hospital care did not differ significantly either between the control and intervention groups or between the trial period and the two following years. The insignificant differences did, however, show the same pattern as observed for mortality (Figure 2). Use of elderly care provided by the municipality showed significant differences between the intervention group and the control group, both during and after the trial. Thus, PHVs do not seem to have any long-term effect on mortality and morbidity.The effects on the use of elderly care provided by the municipality lasted longer.

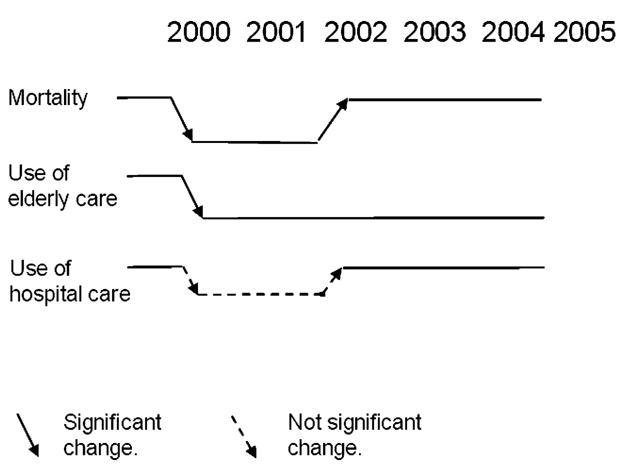

Figure 2. The direction of change, in mortality and utilization of healthcare and elderly care, caused by preventive home visits in the Nordmaling trial; an illustration of how changes differ over time when comparing the trial period with a more long-lasting perspective.

The cost components that should be included in this kind of analyses have been extensively debated in health economics. Some authors argue that it is important to adapt the analysis to the decided policy framework [15]. Economic analysis should have societal goals as the point of departure [16]. It is important that decision-makers pay attention to and use health economic evaluations. To achieve this, it is important that health economics are based on principles that relate to the public's views on fairness. For instance, the principal of human dignity is highly valued in Sweden. Another, although qualitatively different, argument that leads to the same conclusion of not including future costs for healthcare is that costs do not effect the prioritization ranking between different treatments [17]. There are, however, also arguments for including future healthcare costs in analyses. In fact, there are cost consequences of the intervention in question, and only if they are small and do not effect the cost-effectiveness ratios should they be omitted [18]. One option is to present cost per life year gained both with and without indirect costs [19]. All in all, our interpretation of policy and public debate in Sweden is that future costs for health and elderly care during added life years are a "red herring", i.e. not a reasonable cost component from a public decision-making perspective.

Conclusion

In a recent review [7], the authors' conclusion is consistent with the results from the Nordmaling trial: "The findings suggest that a diversity of home visiting interventions carried out by nurses can favorably affect health and functional status, mortality rates, use of hospitalization and nursing homes, and costs."

The additional knowledge gained from our study is that we now know the resource consequences of PHVs. This is important from a decision-maker's perspective. PHVs are cost-effective, meaning that costs are justified by the outcomes.

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