Measuring the Economic Impact of Falls Prevention Interventions

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Abstract

The objective of this paper is to assess the appropriateness of available health economic models and concepts in the development of a best practice model to assess community-based multifactorial falls prevention programs. To this end, a critical review and synthesis of contemporary published and unpublished methodological approaches to economic evaluation of health initiatives in general and falls prevention initiatives in particular, has been carried out. The review indicates that costs, time and utility all need to be taken into consideration when economically evaluating a falls prevention program.

A recommended approach that takes into account a full consideration of relevant costs and benefits associated with falls prevention programs is outlined. This approach can help demonstrate the true relative efficacy of preventing falls over the treatment of their consequences.

Measuring the Economic Impact of Falls Prevention

Introduction

Falls are a major health hazard, particularly for older people. In the USA, Tinetti, et al. (1994) have identified that "Approximately 30 percent of people over 65 years of age who live in a community fall each year" (p. 821). Some writers have also identified the major role that falls play in the health status of older people in Australia (for example Hahn, et al. 1996). In the North Coast of New South Wales, it has been estimated that two in every nine people over the age of 60 fall every year, with 50 percent of injuries to older people resulting from a fall. (Garner, Kempton and van Beurden, 1996; Kempton, et al. 1992).

Falls prevention programs can be used to reduce the levels of fall related accidents in a population. Such a program can address a range of issues such as education, structured exercise, home hazard review and reduction and public hazard review and reduction.

Since many falls lead to health service utilisation, fall related injuries consume a substantial proportion of health care expenditure prevention of falls is likely to produce major economic benefits for society. However, the effects of such falls and the potential benefits of falls prevention need to be fully assessed in economic terms. This means that it is important to assess the economic costs and benefits of different methods of falls prevention so as to identify the most suitable methods to be employed. With this end in view, this paper considers the manner in which economic benefits and costs of falls prevention can be assessed.

The Economic Assessment of Health Care Costs and Benefits

Drummond, (1990) identifies four methods that can be used to fully evaluate economic health care effects. These are cost-minimisation analysis, cost-effectiveness analysis, cost-benefit analysis and cost-utility analysis. He identifies a cost minimisation approach as "…a special case, where assessment of the competing technologies shows them to be identical" (p.78). Such an approach is therefore not suitable for exploring the consequences of falls prevention.

Two of these methods, cost-effectiveness and cost–benefit analysis, simply compare costs and benefits of a program. Cost-effectiveness analysis gives the cost per unit of effect while cost-benefit analysis determines the net benefit or cost for a treatment.

Cost effectiveness analysis is useful where the outcome can be expressed in terms of a single focus such as 'years of life gained'. It does not give a straightforward result when there are multiple outcomes that need to be assessed.

Cost-benefit analysis provides a useful method of assessing outcomes and for deciding on expenditure priorities when the benefits are evident and are easy to value in monetary terms. However, in cases such as falls prevention, there is likely to also be a major impact in terms of the future quality of life of the person who has fallen and been treated. This is especially true of older people where future mobility, feelings of insecurity and inability to easily manage simple requirements of life may have a major influence on an individual's quality of life. To attempt to consider such effects, economists have moved towards using cost-utility assessments where quality of life adjusted measures are used in order to reflect the benefits (or disadvantages) of treatments to patients. This would seem to be the ideal method of approach for an economic assessment of the consequences of falls prevention.

Studies involving the economic assessment of falls prevention

According to Salkeld, et al. (2000a), very few economic evaluations, of falls prevention strategies have been published and only the following five studies could be found in the literature.

In New Zealand, Robertson, et al. (2001a) carried out a study to assess the effectiveness of a trained district nurse in individually prescribing a home based exercise program to reduce falls and injuries in elderly people. A purely cost oriented approach was used and a cost was calculated per injury. A further study by Robertson, et al. (2001b) used an approach that was cost-effectiveness oriented. The study design consisted of a randomised-controlled trial with one-year follow up and suggested that an individually tailored exercise program would reduce the incidence of falls.

In Australia, Salkeld, et al. (2000a) also used a cost effectiveness approach to examine a single component of a home hazard reduction program. A randomised trial was conducted to evaluate the effectiveness of home modifications for falls prevention and the implications for costs. The effect of the intervention on the incidence of falls was assessed in terms of the relative risk of a fall for the subjects. The study found "...a cost saving for subjects who had fallen in the 12 months prior to randomisation."

Smith and Widiatmoko (1998) modelled the cost-effectiveness of introducing a home hazard assessment and modification program for Australians aged over 75 years. Due to a lack of direct clinical trial evidence, a decision analytic model was developed to simulate potential costs and outcomes of the intervention over one and ten years. This model reflected cost savings for falls prevented and for injuries prevented.

In the USA, Rizzo, et al. (1996) carried out a randomised control study to estimate the cost per fall prevented in a targeted multifactorial falls prevention program. Mean costs,

used to evaluate the results of the study, indicated that targeted group intervention was cost effective.

Kempton, et al. (2000) reported on the evaluation of the Australian Stay on Your Feet (SOYF) falls prevention program. This was a multi-factorial preventative program that was implemented along five strategic lines, on the North coast of NSW. The five approaches were as follows:

- Raising a public awareness that falls are preventable, was addressed by a media advertising initiative and the distribution of 24,000 copies of the SOYF booklet to the elderly
- Community education included the running of exercise classes to improve the gross motor skills of the elderly. Thirty-eight people were trained as Falls Prevention Advisers, Medication Workshop Leaders, and Home Safety Advisers, to provide face-to-face instruction.
- A falls-prevention program was developed which provided a seeding grant to four local councils, to identify and rectify falls hazards within local town centers.
- Home hazard reduction was addressed by compiling a home safety checklist, which included information on the range and availability of home safety products in local hardware stores. The hardware stores organized formal safety product promotion and demonstrations on their premises.
- A General Practitioner (GP) liaison officer was employed to ensure that GPs were aware of available falls prevention initiatives within the community. Focus groups identified lack of activity and poor sight as important risk factors, which the GPs could address.

An economic evaluation focussed on hospital admission reductions and based on an average cost per bed day showed a cost-effective reduction in admissions.

Most economic evaluations of falls prevention have used either a randomised control study or an estimate of cost using data derived from such a study. Quasi-experimental designs such as the SOYF programme have less validity than randomised control studies because of the potential for confounding factors to influence the observed relationship between the prevention program and a measured reduction in falls. However, in the SOYF other methodological strategies were employed to maximise validity within the limitations of the experimental design. These included a pre and post comparison using large cohorts in matched intervention and control regions.

The five studies that have been described, all focussed on a cost effectiveness approach although the Kempton, et al. (2000) paper did introduce benefits in the nature of hospital admission reductions. However, none of the studies used a formal cost-benefit assessment or considered a cost-utility based approach to program evaluation.

Falls Prevention Program Cost Evaluation

Direct costs of any falls prevention program can be obtained from costs for salaries, wages, goods and services that are used in the program. On the other hand, benefits of a falls prevention program may accrue from both falls prevention and falls postponement. Such benefits can be estimated from the reduction in "direct" and "indirect" costs that occur because of the injury. Direct costs refer to expenditure that is associated with the direct treatment of the injury. Five categories of direct costs can be identified.

- Hospital inpatients*:* Inpatient costs for public hospitals, repatriation hospitals, and private hospitals. Also included are private medical costs for private patients in public and private hospitals.
- Medical Services*:* Total costs of all private medical services excepting those to hospital inpatients. This includes general practitioner and specialist visits, pathology and diagnostic imaging.
- Pharmaceutical: The cost of prescription and non-prescription drugs.
- Nursing Homes: The cost of nursing home treatment.
- Allied Health Services: Costs of visits to allied health practitioners including dentists.

Assessments of indirect costs may include a valuation of time lost due to illness using the human capital approach. However, the decision to include indirect costs in the analysis is questionable. This approach could discriminate against those people whose time is not sufficiently valued by the labour market. Assuming that the greatest number of people who are affected by falls will be over 65, and will generally have retired from the workforce, an analysis should exclude any indirect costs associated with work hours lost due to injury. This exclusion will result in a marginally more conservative view of potential benefit values.

Drummond, et al. (1996) have listed the following four different approaches to direct cost estimation in descending order of accuracy.
1. Micro-costing: Each component of resource use is estimated and a unit cost derived for each.
2. Case-mix group: Gives the cost for each category of hospital patient and takes account of the length of stay. Precision is dependent on specifying the types of cases.
3. Disease-specific per diem: Average daily cost for treatments in each disease category.
4. Average per diem: Averages the per diem over all categories of patient.

While micro costing is an ideal approach, it requires an intensive use of resources to assess operating costs. In addition, the inclusion of the use of resources for treatments that occurred many years previously, may provide an incorrect result. Use of published current case-mix estimates are likely to provide a more practical approach to calculating savings in hospitalisation costs that have resulted from a falls prevention program.

Data usually exists to allow for the direct estimation of hospitalisation costs, for each patient, that can arise from injury due to falls. However, the data pertaining to the other four cost categories, medical services, pharmaceutical, nursing homes services, and allied health services are often not known. In addition, a certain percentage of falls related injuries would require ongoing treatment or service provision. This could take the form of visits to the general practitioner or an allied health professional such as a physiotherapist, or service provision such as meals on wheels, home help, district nursing. Some of the injuries will also result in readmission to the hospital system.

It is possible however to model some of these factors using a national estimate. In Australia, Mathers and Penn (1999) developed an estimate of the national cost of accidental falls, where they took into account hospitalisation, medical, pharmaceutical allied health, nursing home and other costs. Hospitalisation costs could be used as a base measure for treatment costs and could then be increased proportionately to allow for other associated costs as identified in the Mathers and Penn (1999) data. This would result in hospitalisation costs being increased by approximately 60 percent. The feasibility of including costs arising from ongoing chronic complaints and readmissions could also be explored and included in the analysis on a proportionate basis.

Often, clinical data on patients is recorded using the International Classification of Diseases (ICD). This system uses over 10,000 disease codes and hence the ICD classification can lead to an inordinately large number of patient classifications and, for the typical hospital, the number of patients contained within each classification is often too small to be statistically significant.

In response to these shortcomings, Yale University developed the Diagnosis Related Group (DRG). This was designed to create a mechanism that could describe the output of hospitals and was therefore, a system of patient classification designed to group inpatients into classes, which were both clinically meaningful and homogenous with regard to resource consumption. However, when using clinical databases to estimate the cost of treating falls related injuries it is necessary to create a DRG weighted average cost and ideally, this cost should be calculated using an average that is specific to the hospital in which each patient was treated.

The compression of morbidity theory, as articulated by Fries (1980), suggests that medical intervention may have caused morbidity to generally occur later in the human life cycle. This notion of "morbidity compression", has an important implication for the cost-benefit assessment of a preventative intervention. The benefit of the intervention may not be limited to a decrease in the incidence of the intervention. The occurrence of an injury or disease may be delayed and hence may result in postponement of costs. A thorough assessment of the benefits of a falls prevention program should therefore attempt to determine to what extent the process of assessment and risk reduction could postpone

falls. If the falls program were able to delay a fall that then required treatment, an important health benefit could be realised. Such postponement of a fall could be evaluated from an increase in the average age of hospital presentation. In monetary terms, a delay in injury would primarily manifest itself as savings in nursing home costs, since discharge to a nursing home is a possible sequel following admission for a fall, although this may be more likely to occur in older groups. A valuation of these years of healthy life cannot be realised by using a cost-benefit analysis and it would be necessary to consider a cost-utility analysis in order to be able to assess the value of this potential benefit.

A costing system that uses DRG data is one that is concerned with average cost. These costs are useful for reimbursement justification or for setting long-term policy but not so useful in making managerial decisions concerning resource allocation. However, costing systems can be designed to distinguish between average cost components such as fixed and variable costs. This distinction may be useful for assessing the marginal impact of an additional service on total hospital costs (Abernethy 1995, p.54.). The effect of a small change in output is likely to be less than the average cost, because as output is varied only the variable costs will yield a cost saving. Thus, while the distinction between marginal and average cost is important its significance will be specific to the cost flexibility of individual hospitals (Drummond et al. 1996).

The best estimates of average cost will include both direct and overhead costs. Cost savings resulting from a falls prevention program may not manifest themselves through a closure of beds but rather through an increased capacity to accept other patients. This impact will be immediate. However, the importance of restructuring the factors of production (fixed and variable or capital and labour costs) in response to a reduced need, will remain theoretical and cannot be easily estimated.

Since the opportunity cost of an elective orthopaedic procedure can be seen as a missed opportunity to treat another patient, one better way to quantify this impact might be to measure the length of hospital waiting lists. However, the length of waiting lists is dependent on a variety of other factors and this would need to be taken into account in any comparison. The impact may also be felt on non-elective admission opportunities.

The introduction of a community based falls reduction program could have a cumulative effect on the people within the community who are actively taking measures to reduce their risk of a fall. An economic assessment of a falls prevention program should therefore consider the dynamic effect of the programs and may need to consider temporal effects. A study by Smith and Widiatmoko (1998) was mindful of these considerations when they chose to calculate cost effectiveness after one year and after ten years. Their model based simulation suggested that once a home modification had been implemented, the incidence of a fall-related injury would be reduced for each of the ensuing years. Based on their calculations, it would seem that the longer the period of analysis the greater the

economic dividend that theoretically might be found to accrue and hence that any evaluation of a falls program should take temporal effects into account.

This section has identified a number of effect evaluations that would need to be included in a falls prevention program evaluation. These items mainly relate to assessable costs and savings, although mention has been made of a possible need to assess utility values in such an assessment. The evaluation of utility in falls prevention is of itself a complicated process and therefore the next section of the paper examines the possible use and assessment of utility in a falls prevention program evaluation.

Use and Assessment of Utility in Falls Prevention Evaluation

One widely used utility measure of health outcomes not directly measured as a cost related benefit, is the Quality of Life Years instrument (QALY) (Drummond, 1990). Glick (1990) suggests, "Such a standardized measure of outcome is essential if valid comparisons are to be made…" However, normal QALY measures do not take account of issues such as an older person's desire to remain mobile, continue active involvement in society or a host of other aspects that can be inhibited or prevented because of a fall. They may, therefore, not be suited to the evaluation of a utility outcome in the case of falls prevention and there is a need for different utility measures to be developed and used. Glick (1990) identifies four methods for measuring utility that might help to counter these problems: standard gambles, time-trade-off, category scaling and difference.

Standard gambles ask a subject to gamble between a good and bad outcome and is more easily utilised when one is asking a subject to weigh up the gamble between living for an extended number of years or dying very shortly. The system is probably not well suited to falls prevention utility measurement because of its focus on being dead as the zero utility level, an occurrence not likely to be a major consideration for falls victims. However, Salkeld, et al. (2000b) did use this form of evaluation when assessing the threat to quality of life from fear of falling and hip fractures amongst older women. They found that 80% of the older women surveyed would have preferred to be dead rather than to experience the effects of a bad hip fracture.

Time-trade-off techniques ask the subject to make choices between healthy states of shorter duration as against less healthy states of longer duration. Again, the method seems better suited to measuring life years than falls prevention consequences because the consequences of falls are unlikely to be seen to be a shortening of life.

The last two methods of category scaling and difference are similar in nature and ask the subject to either rate particular items or to rate the differences between different health states. These approaches may be more appropriate in the utility assessment of falls prevention as they allow the value of notions such as independence and mobility to be included. Both methods use a survey type instrument with the difference between the methods resulting from the manner in which the issues are posed. Saw and Ng (2001)

have explored the design of such instruments and stress the importance of reliability and validity. These considerations will be essential in development of a new and effective instrument to measure falls prevention utility.

Conclusions

This paper has identified key aspects that need to be considered when evaluating health promotion initiatives such as a falls prevention program. Assessments that have been carried out have focussed on cost effectiveness based on a limited range of assessable program aspects and have not taken into account the full range of potential costs or benefits. It is possible that such incomplete assessments may reflect prevention as being less cost effective than cure although, even when such a situation occurs, a prevention program may still be desirable from a social perspective once all the benefits have been taken into account. For these reasons, it is essential that any economic evaluation of a prevention program take into account the full range of appropriate costs and benefits as have been outlined in this paper.

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