MAINTAINING GOOD HEALTH FOR OLDER PEOPLE WITH DEMENTIA WHO EXPERIENCE FRACTURED NECK OF FEMUR: REPORT FOR PHASE 2

Catherine Henderson, Juliette Malley and Martin Knapp[1]

Personal Social Services Research Unit

London School of Economics and Political Science

18 February 2007

[1] We are very grateful to the members of our expert panel who provided very valuable comments and suggestions on our model and its assumptions, and on the various scenarios. We are especially grateful to Dr John Holmes (Senior Lecturer in Liaison Psychiatry of Old Age, University of Leeds) who provided advice and further information on the Leeds hospitals study.

Table of Contents

List of Tables and Figures

1. Introduction

Hip fracture in the UK has been estimated to cost between £12000 per fracture (1998), and £25,424 (Parrott 2000), at a total cost to society estimated at almost £726 million a year in 2000 (ibid). The fracture of a hip may be the first contact an older person has with the hospital system. Hip fracture can have devastating consequences, with mortality rates estimated at 33% to 31% in the year following the fracture (Roberts and Goldacre 2003; Roche, Wenn et al. 2005); the institutionalisation rate was estimated in one study to be 13% in those previously dwelling in the community in the year following the fracture (Nurmi, Narinen et al. 2004).

Hip fracture has been studied as a 'tracer condition' for measuring health system responsiveness (Qureshi and Gwyn Seymour 2003). It is a relatively common condition, accounting for more than 20% of orthopaedic bed occupancy in the UK (Royal College of Physicians 1999). Hip fracture has been the subject of two Audit Commission studies (Audit Commission 1995; Audit Commission 2000), which identified persistent problems such as delays in admitting patients with hip fracture from the A&E department within an hour, delays in carrying out operations within 24 hours of admission, and (in the majority of hospitals) not implementing joint ward rounds between physicians and orthopaedic surgeons. The most recent Scottish Hip Fracture Audit Report (Scottish Hip Fracture Audit 2006) likewise has flagged up poor practice such as the lack of documentation of pain control in the emergency department and little evidence of assessment of the patient's mental status. A comparison of 1992 and 1997 hip fracture audits in East Anglia showed that at 3 months post admission, functional outcomes for patients remained poor and that overall mortality rates had not been reduced (Freeman, Todd et al. 2002).

Several guidelines of best practice in the management of hip fracture have been published in recent years. Early assessment and appropriate rehabilitation is one element of what is accepted as good practice (Scottish Intercollegiate Guidelines Network (SIGN) 2002).

Who Cares Wins (Working Group for Liaison Mental Health Services for Older People 2005), a recent report on the provision and organisation of mental health services in general hospitals in the UK, emphasised that older people are particularly likely to present with complex problems, greater sensitivity to adverse effects of medication, and to be more difficult to rehabilitate. The lack of specialist services in many general hospitals is therefore a concern, as is a trend in some areas towards the increasing separation of mental from physical health care. According to this report, the prevalence of depression in general hospitals has a range of 5% - 58%, while the prevalence of delirium is 7% - 61%, and for dementia is 5% - 45% (Working Group for Liaison Mental Health Services for Older People 2005).

It is therefore important to get a sense of the cost implications (a) of the current system for those older people with dementia who have fractured a hip, and (b) of any strategies to improve outcomes for this group.

In our feasibility (phase 1) report we described the results of a rapid literature review of the medical, nursing, allied health and social science databases. Briefly we found that there was sufficient information on most elements of 'standard care' for hip fracture patients with dementia; however the literature on intervention studies relating to best practice care for this group was quite limited. For instance, we found only one study with rehabilitation outcomes for cognitively impaired hip fracture patients (Huusko, Karppi et al. 2000).

Therefore we thought it infeasible to collect data in sufficient quantity and quality to construct a decision-analytic model to predict the costs of delayed discharge for this population. Given the short timescale and limitations in the evidence base, we have constructed a cell-based macro-simulation model to describe a base case of 'usual care' over the period from hospital admission through to one year after surgery, taking into account the numbers of people in England admitted for proximal femoral fractures, their typical length of stay in acute hospital, their discharge destinations, and their receipt of health and social care after discharge. Nationally applicable costs have been attached to each of those stages, with ranges of estimates based upon available evidence.

We then looked at the evidence base, primarily from the UK but drawing on international evidence where necessary, to get an understanding of whether cost reductions might be possible at each stage. For example, we looked for evidence on what can be done during the pre-operative, peri-operative and post-operative stages of admission to improve patient care quality and thus reduce the length of stay. We also examined what could be done during the post-discharge phase in terms of health and social care that could immediately or subsequently reduce the longer-term costs of support. The model takes into account the potential for such variations in costs and outcomes under various 'best practice' scenarios.

2. Model of a care pathway for older hip fracture patients

The phase 1 literature search yielded data for some elements of the base case model and scenarios. However, further searches of indexed and 'grey' literature were required for information on costs, as well as for more literature on the outcomes of inpatient and community rehabilitation of patients with hip fracture repair.

Wherever possible, we sought to build the model using data from research conducted in the UK. As noted in the phase 1 feasibility report, we identified a prospective study of the outcomes of psychiatric illness within an older hip fracture population (Holmes and House 2000) that contained most of the data required for the base case scenario of 'usual care'. Our model uses data from that study on the proportions of hip fracture patients in one of two psychiatric states – dementia and psychiatrically well – following a 'usual care' pathway from admission through to discharge. We obtained further information from the first author, Dr John Holmes, on the proportions of patients in each of these psychiatric 'states' going to a variety of discharge destinations. He also made available to us the corresponding average length of inpatient stay for each subgroup.

The model estimates are based on an amalgam of data from various sources and from various years. Clearly with some of the more recent changes to the NHS there is every chance that older data will not exactly reflect the current situation, and they should therefore be treated with some caution. We have made every attempt to be transparent and report the datasets used so that readers can judge for themselves the validity of the estimates, and we also include some sensitivity analysis to demonstrate the degree of uncertainty around the base case estimates.

What can be inferred with more confidence from this model is the effect of making changes to the system, since each change and its impacts can be clearly modelled. The analysis of the changes to the current system is the focus of this work and is reported in the section on scenario analysis.

Expert group

In order to test to what extent our base case and best-practice scenario assumptions were well founded, we assembled a group of experts (with whom we had one-to-one discussions by email or phone; the group did not ever convene as such), with backgrounds in geriatric psychiatry and psychiatric nursing, orthopaedic surgery and ortho-geriatrics. We were unable to recruit any experts with a background in rehabilitation within the limited time period. We asked them to help us to obtain ranges of estimates for what current best practice might achieve in terms of improvements in use of resources. We provided a summary of the project and presented our model's key assumptions, and the literature upon which these were based, to this group. For many of our assumptions there was general agreement between experts that these were reasonable. However, there were some areas where we received some responses indicating that the assumptions were not well founded:

- Delays to surgery from time of admission
- Location of patients between surgery and point of hospital discharge
- Benefits of psychiatric liaison nursing or psychiatric consultation

We addressed the issues within the base case and scenario sensitivity analyses, described below. Some comments are also addressed within the discussion section at the end of this paper. We received some additional references via the expert group to the literature, but in general these were either already known to us or not confined to the population under consideration (for instance we received some references to papers on the subject of infection control policies for patients undergoing elective surgery).

3. Description of the model

The model of pathways for fractured neck of femur is a cell-based (or macro-simulation model) and takes the form of an Excel spreadsheet. It consists of four main parts:

- Estimation of emergency admissions for fractured neck of femur per year for England
- Estimation of total bed days
- Estimation of volume of post-discharge care
- Estimation of expenditure.

Each part of model is based on a series of assumptions of current or standard practice drawn from the Phase 1 literature review. This represents the *base case* for the model. We then set out to vary these assumptions in scenarios designed to investigate the impact of different models of care. The model reflects several relevant outcomes of hip fracture in older people with dementia and in those with no psychiatric diagnosis, namely length of stays and discharge destination. There is no conclusive evidence that any of the interventions modelled in the scenarios have an effect on mortality, nor upon morbidity. Therefore, no measure of morbidity is included in the base case or scenarios, and the scenarios do not adjust the base case survival rates. Assumptions for the base case scenario are listed in Box 1.

BOX 1: ASSUMPTIONS OF THE BASE CASE

Phase: Preoperative
There is no causal relationship between days to surgery and discharge destination.
There is no relationship between psychiatric state and days to surgery.
The type of surgical management (e.g. fixation vs. total or partial hip replacement) is chosen on the basis of the location and type of fracture, rather than on pre-morbid mental status.

Phase: Postoperative
The typical location for a hip fracture patient post-surgery is on an orthopaedic ward.
A basic package of ward care includes: consultant surgeon/Senior House Officer/House Officers, Nursing staff, Physiotherapy, Occupational Therapy (OT).
Access to geriatricians and Social Workers is not consistently provided on orthopaedic wards to all patients with repair of hip fracture.

Phase: Post-Discharge
Patients with hip fracture repair are not routinely transferred to a rehabilitation ward within the acute hospital following initial orthopaedic ward stay.
A basic package of post-discharge care for patients with hip fracture repair includes:

- Outpatient hospital visits for the following specialties:
    - Orthopaedic
    - Radiography
    - Geriatric
    - Medical
- GP visits

For those at home the package includes: social and community health care package.
For those in residential homes/convalescence the package does not include additional community nursing.
Consumption of GP visits and outpatient visits does not vary by location of residence
Readmissions beyond 3 months are less likely to be primarily due to the hip fracture (for which the patient was originally admitted).

Estimation of emergency admissions

The first part of the model estimates the size of the population admitted per year in England for fractured neck of femur. Emergency admissions are estimated using data from hospital episode statistics (HES) for 2004/5. It is assumed that 100% of admissions for fractured neck of femur require surgical intervention[2].

Data from Holmes and House (Holmes 1999; Holmes and House 2000), based on two hospitals in Leeds, were used to break the population down by psychiatric status into the following categories:

- Psychiatrically well

[2] Data from Parker (1998) suggests that 97% of admissions require surgical intervention, so our assumption seems to be quite valid.

- Dementia
- Delirium
- Depression
- Other.

For the purpose of the pathways model, those with depression and other sub-groups of the population were not included. Due to the short timescale for this work, base case and scenarios reflecting the pathways of those with delirium were not modelled, although we are aware from our phase 1 literature review that delirium is both a risk factor for developing dementia later on (Working Group for Liaison Mental Health Services for Older People 2005) and contributes to poorer outcomes such as institutionalisation (Morrison, Chassin et al. 1998). Thus the totals presented are for the first two psychiatric groupings and should not be considered to represent the total spend on fractured neck of femur per year in England.

Estimation of total bed days

The Leeds hospital study (Holmes 1999; Holmes and House 2000) offers some evidence to suggest that length of stay is dependent on psychiatric status and that psychiatric status is also associated with discharge destination.[3] The second part of the model uses data from this study to estimate average length of stay for each sub-group of the population by discharge destination. The following discharge destinations were modelled:

- Home
- Residential home
- Nursing home
- Death[4].

The model therefore provides estimates of the total bed days per year for fractured neck of femur by psychiatric status and discharge destination.

Days to surgery has been found to have a significant impact on length of stay (Orosz, Magaziner et al. 2004). However, we did not estimate the average days to surgery in the model as these are captured within the data on length of stay. We do, however, investigate the potential impact of reductions to days to surgery in scenarios.

Estimation of the volume of post-discharge care

There is very little evidence available to estimate post-discharge packages of care for hip fracture patients with any degree of detail, especially for those people returning to a community setting. Data from Dolan and Torgerson (1998) were used to identify the standard package of care, and this was assumed to be invariant across psychiatric states but variable by discharge destination.

[3] Parker and Palmer (1995) find an association between cognitive impairment and mortality and institutionalisation at one year (but the authors find that in terms of return to community living, pre-fracture mobility is the most useful predictor); Holmes (1999) cites Parker and Palmer (1993, 1995), Withey et al (1995) and Magaziner (1990) as reporting effects of cognitive impairment on a number of outcomes such as physical dependency, mortality and institutionalisation).

[4] 4% of the sample was discharged to alternative destinations – other and convalescence. These were modelled as home (other) and residential home (convalescence) respectively.

The basic package of care for those in a community setting included:

- Outpatient visits for geriatric, orthopaedic, medical and radiological consultations (number of sessions per year)
- GP visits (number of visits per year)
- An unspecified yearly package of community health and social services (see table 1.)

Those in residential and nursing homes were assumed to require the equivalent number of outpatient and GP visits. Lack of data meant that it was impossible to ascertain any extra community nursing that may be required for patients in 'care-only'/residential homes. Therefore expenditure on residential services is likely to be an underestimate.

Data on readmissions were very patchy and were reported in various different formats depending on the source. We have included in the base case of the model the average number of readmission bed days per patient, based on data from Coast et al. (1998). However, due to differences in the way these data were reported it has not been possible to alter this variable in subsequent scenarios.

Expenditure

Data on volume of care provided at each stage, both in hospital and post-discharge, are multiplied by the unit cost for each care type to estimate expenditure for each fractured neck of femur patient by psychiatric status. For hospital care, the total number of bed days is multiplied by the cost of a bed day. For each element of the post-discharge care package, the total volume of care used per year per patient is multiplied by the unit cost of that element. These two totals are summed to provide an estimate of expenditure on fractured neck of femur, in England, covering the period of hospitalisation up to a year post-discharge.

Hospital expenditure

Care in hospital is assumed under the base case to consist of the following basic elements:

- Surgical team (consultant and more junior staff)
- Nursing staff
- Occupational therapist (OT)
- Physiotherapist (PT).

This care description is based on observational data provided by Tierney (1999) from four hospitals in Scotland treating older people with hip fractures. All of these elements are assumed to be included in the cost of a bed day on an orthopaedic ward, based on data from Herbert et al. (1998) [5] and uprated to 2005/06 prices using the hospital and community health services pay and prices index (Curtis and Netten 2006, 2005). No costs have been estimated for the surgical component of the patient's stay within the per diem rate for an orthopaedic bed. This is because we found no evidence that any of the interventions described would affect the costs of the

[5] The authors used data from a Health Technology Assessment (HTA) report by Fitzpatrick et al (1998). The data are based on the total cost of treating a patient over a 13-day stay, excluding costs of outpatient visits and of the prosthesis; a detailed account of calculations by Herbert et al (2000) can be found in Appendix 3 of their report. This assumption seems justifiable as there is no concrete evidence that type of fixation has any impact on patient outcomes (Parker and Handoll 2006). We also assume that the fixation type is a function of the type of fracture and so beyond the scope of this model.

surgical procedures. Thus the NHS reference costs for hip fracture (Department of Health 2006) were not suitable for use in the model.

Post-discharge expenditure

Data on unit costs for the elements of post-discharge care (outpatient visits, GP visits and the community health and social services package) were sourced from Dolan and Torgerson (1998) and uprated to 2005/6 prices using the hospital and community health services pay and prices index (Curtis and Netten 2006, 2005). Unit costs per week of stay in residential and nursing homes are based on data from Curtis and Netten (2005) and Department of Health PSS EX1 returns for 2004/05 and adjusted to reflect the balance of providers and differences in costs associated with provider type using data from the Department of Health SR1 returns for 2004/05.

4. Results

Base case estimates

There were, according to HES data, a total of 63,992 admissions for fractured neck of femur in England in 2004/05 (Hospital Episode Statistics 2007). Under base case assumptions, the model estimates that of these admissions, about 18,200 were psychiatrically well and 25,700 had dementia. The other roughly 20,000 people had either depression, delirium or another psychiatric illness on admission.

Under base case estimates the average length of stay for the group of patients with dementia was 43 days, and for those judged on admission to be psychiatrically well, the average length of stay was 26 days. The average combined length of stay was 36 bed days. These lengths of stay translate to a total of about 480,000 bed days for the psychiatrically well patients and 1,110,000 bed days for patients with dementia. The greater number of bed days for the group with dementia is driven both by the higher average length of stay and the greater numbers admitted from this group.

The total volume of post-discharge care for the year following discharge also varies by the two groups, as shown in Table 1. A larger volume of nursing home care and residential care is required for the group with dementia, driven partly by the larger proportion of this group discharged to these locations and the larger number of admissions for this group. Although there are fewer psychiatrically well people admitted for fractured neck of femur, the higher proportion discharged back home compared to the group with dementia means that a larger volume of community health and social care is required to support them in the community.

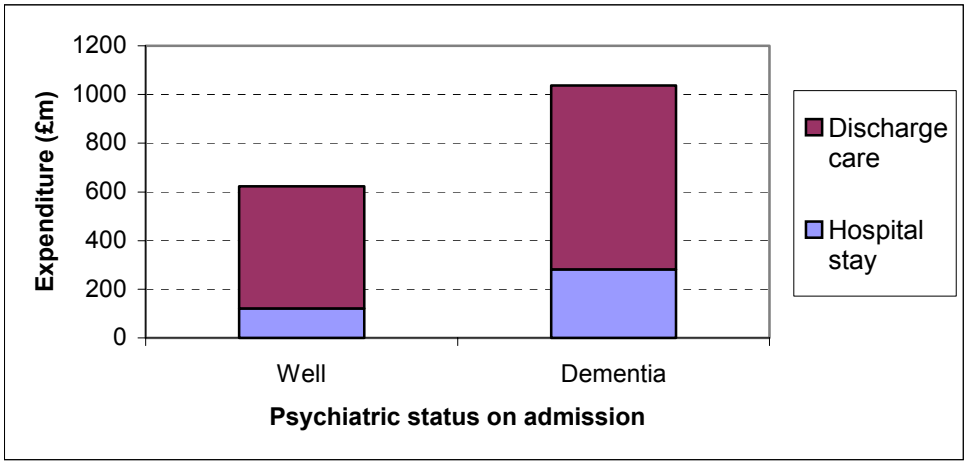
Table 1. Volume of post-discharge care in a year by psychiatric status on admission

	Psychiatrically well	With dementia
Community health and social care (packages)	16,400	15,400
Residential care (weeks)	22,800	36,200
Nursing home care (weeks)	9,500	264,300
Outpatients (visits)	1,011,400	1,261,000
General Practitioner (visits)	182,400	227,500

Readmissions were estimated for both the psychiatrically well and those with dementia. Under base case assumptions, the total number of bed days required for readmissions for the two groups are 81,500 and 101,600 respectively.

Expenditure on these two groups is shown in Figure 1, broken down by stage of recovery (pre- and post-operative hospital stay and post-discharge). Expenditure is much greater for the group with dementia, roughly £1bn per year in total compared to about £0.6bn for the psychiatrically well group. This is partly because more people are admitted with dementia, but it is also because the average expenditure per person is higher for the group with dementia compared to the psychiatrically well group, under base case assumptions.

Figure 1. Total expenditure on care for fractured neck of femur, England, by psychiatric status on admission and stage of recovery



5. Base Case Sensitivity analysis

As we have already stated, the estimates produced are only as good as the data that support the model. In some instances these data are quite old. However, in the absence of other more recent and detailed sources of data in the format required these sources remain the best options. Given these limitations and those introduced through the various assumptions we have made, in this section we examine the effects of changing the assumptions of some of the key variables. Here we look at the effects of

- Changing the rates of admission of psychiatrically well and dementia patients
- Increasing or reducing the mean length of stay
- Altering the location of stay in hospital from orthopaedic to rehabilitation ward
- Changing the balance of discharge destinations
- Decreasing the amount of outpatient follow-up
- Changing the unit cost of services

Where possible these analyses are informed by data from the literature, and in some instances they are informed by the opinions of the group of experts consulted as part of the validation of the model.

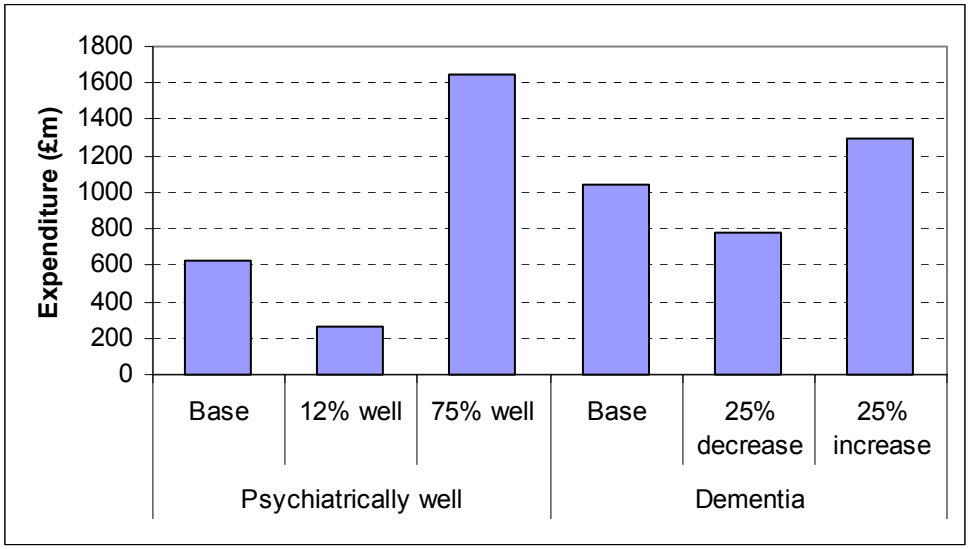
Psychiatric status

The base case estimates appear to be driven by the differences in numbers admitted by psychiatric status as well as the differences in cost per person by psychiatric status. In the model we rely on the information from the Leeds hospital study to split the population admitted for fractured neck of femur by psychiatric status. Although we have no reason to doubt the accuracy of these data, they have some limitations having been collected between 1995 and 1997 and from just two hospitals. Consequently, there could be problems generalising to both the English population as a whole and to 2007 using these data.

A review of the evidence on prevalence of cognitive impairment, rather than dementia, in older hip fracture patients suggests a range of figures, from 25% to 88% (Holmes and House 2000). Data from Dr John Holmes finds that 29% of the sample are psychiatrically well and 40% have dementia. Although our estimates for psychiatrically well fall inside the range reported by the review, they are at the lower end. It is not clear from the evidence whether the proportion with dementia is comparable with other studies. To reflect the variation in psychiatrically well, we explore two sensitivities based on the range reported by the review, where at the lower end 12% of the patients are psychiatrically well and at the higher end 75% of the patients are psychiatrically well. In the absence of any other sources to validate the dementia proportion, we can only explore this variation through a very general sensitivity analysis. Given the wide variation in the psychiatrically well population, we assume similarly that there is likely to be quite wide variation in the proportion of the fractured neck of femur population with dementia. We therefore explore two scenarios, where there is a 25% increase and 25% decrease in the proportion with dementia. The aim of these scenarios is to demonstrate the sensitivity of the estimates to different rates of admission for psychiatrically well and dementia patients.

Figure 2 presents the results of these four sensitivity analyses. As can be seen from this chart, the estimates are highly sensitive to variations in the rates of admission for both dementia patients and psychiatrically well patients. This is largely driven by the wide funnel of doubt associated with these rates of admission. The estimates for psychiatrically well patients vary from £260m to £1,640m; for patients with dementia the estimates vary from £780m to £1,300m.

Figure 2. Sensitivity of expenditure estimates to variations in rates of admissions for psychiatrically well and dementia patients



Lengths of stay

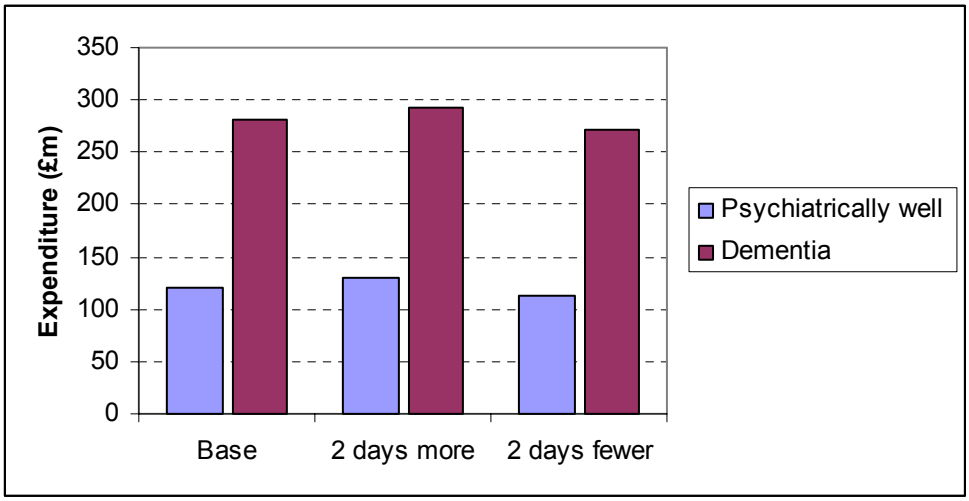
Lengths of stay have a significant impact on overall expenditure, as hospital stay represents a significant proportion of the overall expenditure for the care pathway. Information from the Leeds hospitals study is used to estimate length of stay (LOS) by psychiatric status and discharge destination. Consequently, as mentioned already, generalisability must be questioned. Data from the Scottish hip fracture audit (Scottish Hip Fracture Audit 2006) also reports an average length of stay of 36 days, and Roberts et al (2004) report a hospital average length of stay of 37.2, lending some support to our estimates. According to the HES data for England[6], the mean LOS for patients with hip fracture is 25.6 days. However, our estimates exclude several other psychiatrically unwell groups who might be expected to have longer LOS, so pushing up the average. The lengths of stay in the Leeds study ranged between 3 and 190 days, with a median of 23 days (Holmes and House 2000).

Given the degree of consensus around the average length of stay reported by these three sources, we can be quite confident in these figures. Any variation is likely to be small, of a magnitude of about plus or minus two bed days. Therefore, here we explore the sensitivity of the expenditure estimates to variations in average length of stay of about this magnitude. The following scenarios are explored:

- Length of stay is extended on average by 2 bed days[7]
- Length of stay is reduced on average by 2 bed days.

Figure 3 shows how the expenditure for each of the sub-groups of the hip fracture population varies under the two scenarios compared to the base case. The values shown are for hospital stay only, since length of stay has no impact on post-discharge expenditure. As can be seen, the impact of length of stay on expenditure is not particularly great for either group of patients, varying from £110m to £130m for the psychiatrically well and £270m to £290m for patients with dementia. The impact on overall expenditure is minimal.

Figure 3. Sensitivity of expenditure on hospital stay estimates only to variations in length of stay



Location of stay in hospital

[6] Associated with Diagnosis code S72 (Fracture of femur) for year 2004/05, mean length of stay per finished admission episode.

[7] Length of stay is reduced by two bed days for all sub groups except those who die whilst in hospital. The average length of stay for patients who die in hospital remains the same throughout these sensitivity scenarios.

In the base case we assume that all of the stay in hospital is on an orthopaedic ward. However, both the literature and expert feedback suggest that patients are often moved from orthopaedic wards to geriatric or rehabilitation wards before discharge. Parker, Todd et al (1998) found that 37% of patients with hip fracture were transferred from their initial ward of admission during their hospital stay. Furthermore, the authors observe that while the mean LOS of patients on an orthopaedic ward was 19 (sd 15) days[8], the total hospital mean length of stay was 29 (sd 24) days. There is, they suggest, a potential delay of discharge associated with ward transfers. It is possible that the decision to transfer to a rehabilitation ward, either within an acute trust or to a community facility, varies by psychiatric and functional status. The pre-morbidly fit and well may be less likely to require a further stay in hospital for additional rehabilitation as those patients who are frailer. However, in the case of transfers to community facilities, Herbert, Townsend et al. (2000) suggest that decisions over what services to use are

> more dependent on local supply and policy than on clinical, rehabilitation or care needs. Thus in considering rehabilitation pathways, it is necessary not only to identify the location in which patients may receive services, but also the actual rehabilitative inputs in those locations (p.121).

Unfortunately, although we can estimate the average length of stay before being moved to a rehabilitation ward, we lack information on exactly which patients are moved and so have not been able to model this complexity in the base case. To reflect this uncertainty we look here at the sensitivity of our estimates to variations in the location of care whilst in hospital.

Since movement from orthopaedic to rehabilitation wards is said to be standard practice we can assume that any effects of this on patient outcomes are already exhibited in the data on length of stay and discharge destination in the base case. Therefore, the only effect of this omission on the base case is its effect on the estimate of expenditure. Data from Curtis and Netten (2006) suggest that rehabilitation wards are cheaper than orthopaedic wards (£149 compared to £253, used as the value for the base case). Feedback from the expert group provided estimates of percentages of people moved to rehabilitation wards that varied between 30% and 70%. However, the experts were not able to provide a sense of the proportion of stay that is spent in rehabilitation as opposed to on the orthopaedic ward. Data from Parker, Todd et al (1998) find that 66% of hospital stay is spent on an orthopaedic ward. We therefore use these data to run the two scenarios described below:

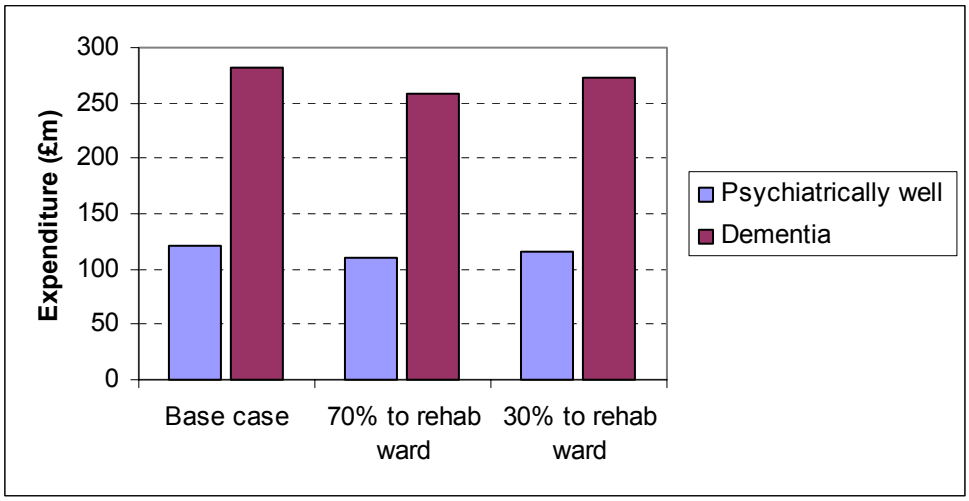
- 70% of patients move to rehabilitation wards: for each of these patients it is assumed that only 34% of the total bed days, excluding those who die, are spent on a rehabilitation ward.
- 30% of patients move to rehabilitation wards: for each of these patients it is assumed that only 34% of the total bed days, excluding those who die, are spent on a rehabilitation ward.

Figure 4 demonstrates the sensitivity of the estimate of expenditure for hospital stay to these alternative assumptions. Again we do not show the expenditure for post-discharge care as the alternative assumptions have no bearing on these costs. Both variants of the rehabilitation ward assumption decrease the expenditure estimate for hospital stay, by about 8% of the original estimate, from £120m to £110m for the psychiatrically well, and from £280m to £250m for patients with dementia, under the assumption that 70% of all patients are moved to a rehabilitation ward. If it is assumed that only 30% are moved, the impact is smaller, at about 5% of the original estimate. The magnitude of the effect is larger for patients with dementia, which

[8] Excluding those who died in the admission ward

is to be expected given the longer average length of stay associated for this group. The effect on overall expenditure for each group is however quite small.

Figure 4. Sensitivity of hospital stay expenditure estimate to alternative assumptions about location of stay in hospital



Discharge destinations

Data on discharge destinations are also drawn from the Leeds hospital study and so are sensitive to the same generalisability reservations mentioned already[9]. Other sources of data on discharge destinations are presented in a cross-sectional format, detailing proportions at each destination at, for example 3 or 6 months after surgery. These are obviously not the ideal data to use to provide comment on the accuracy of the proportions being discharged to each destination; however, in the absence of any other evidence it can provide some type of check.

Estimates vary of the numbers of people who die as a result of hip fracture in a year. Roche, Wenn et al (2005) found mortality within a population of hip fracture patients in a university teaching hospital at 30 days after hip fracture was 9.6%, and at one year was 33%; in a study of inpatient statistics from the hospitals of four southern English counties in 1984-1998, mortality rates were 9.8% at 30 days after admission, 18.3% at 90 days, and 30.7% at 1 year (Roberts and Goldacre 2003). The East Anglia audit of hip fracture in ten participating hospitals found an 18.9% mortality rate over the 3 months after admission (Freeman, Todd et al. 2002). The Scottish Hip Fracture Audit Report (2006) reported that of the 3043 hip fracture patients with recorded information on residence 120 days post admission, 19.3% were in long-term care and 23% had died.

A comparison of these data with the proportions used in the model implies that two proportions are potentially low. These are the rates for mortality and rates for institutionalisation, which were roughly 13% and 15% respectively in the model, but reported as being as high as 23% (for mortality) and 19% (for institutionalisation) in the literature. However, the figures reported in these studies are for all psychiatric groups whereas our model only includes psychiatrically well patients and patients with dementia. As rates of institutionalisation and mortality tend to be higher for those patients with psychiatric illness or delirium, it is possible that the model does

[9] It should be noted that we have not modelled mortality rates to one year post-fracture, only the mortality rates up to a maximum of six months post-fracture, as observed in the Holmes and House (2000) study.

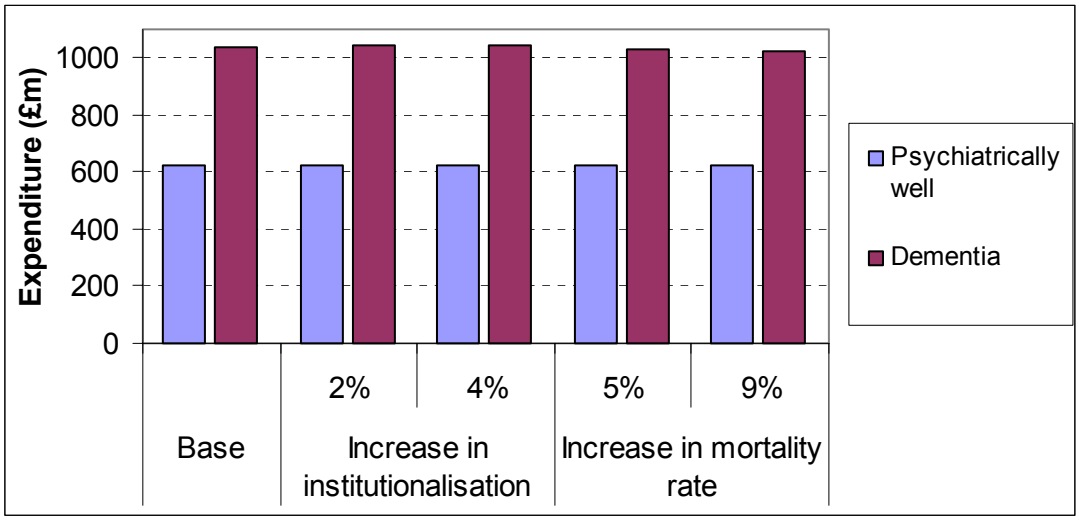
not significantly underestimate rates of institutionalisation and mortality. Indeed, overall mortality in the Leeds study at 6 months was 26.7%, with 13.1% of the sample dying in hospital, suggesting that the study is representative. Nevertheless, we do explore the possibility of lower and higher rates for institutionalisation and mortality in two different scenarios based on a high degree of difference and a low degree of difference. The scenarios are as follows:

- Increase mortality rates by 5%, with the 'extra' people taken pro rata from the other discharge destinations.
- Increase mortality rates by 9%, with the 'extra' people taken pro rata from the other discharge destinations.
- Increase rates of institutionalisation of 2%, with the 'extra' people coming from those discharged home.
- Increase rates of institutionalisation of 4%, with the 'extra' people coming from those discharged home.

These scenarios assume that those 'extra' people who are 'moved' to the alternative discharge destination, have the same average length of stay as those people identified as being discharged to that destination.

Figure 5 presents the total expenditure on both hospital stay and discharge care associated with each of the discharge destination scenarios. As the graph shows, the increased rates of institutionalisation have a negligible effect on the estimate of expenditure associated with the patients who are psychiatrically well on admission and only marginally increases the expenditure for those diagnosed with dementia: the difference for the 4% change scenario is about £10m more than the base case. Similarly for the increased mortality rate scenarios, the difference in cost compared to the base case is quite small for both the psychiatrically well and for patients with dementia. The difference is £7m for the psychiatrically well and £14m for patients with dementia under the 9% increase in mortality scenario.

Figure 5. Sensitivity of expenditure to variations in mortality and institutionalisation rates



Post-discharge packages of care

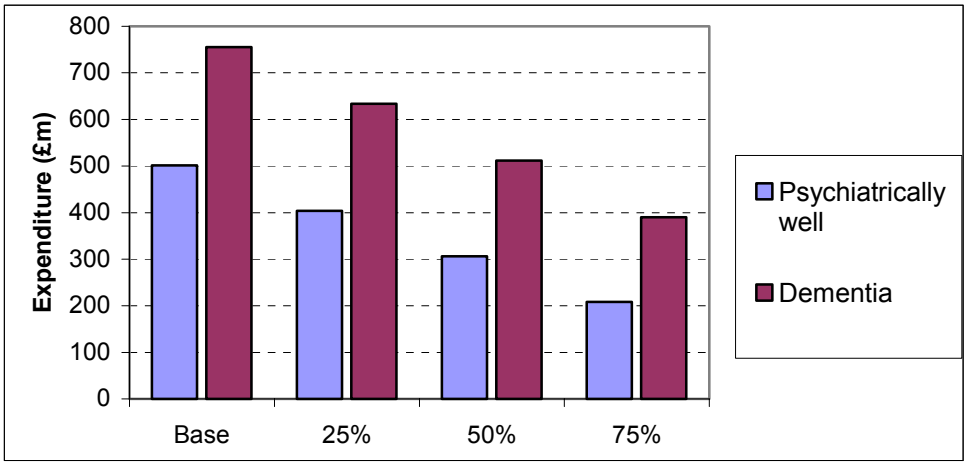
Post-discharge packages of care were determined using data from Dolan and Torgerson (1998) and, as we have already noted, this study is quite old. Since this study was conducted, there have been some quite significant changes in community health and social care services. On the one

hand, social care services have become increasingly targeted towards those judged as having critical needs, and on the other there have been efforts to increase provision of intermediate care services and new forms of home support such as telecare (Wanless 2006). New forms of rehabilitation/reablement are creating an intermediate 'tier' between hospital and home (Herbert and Lake 2004); other recent developments such as Payment by Results may now be creating pressures on acute hospitals to phase out their rehabilitation wards. However, we have neither sufficient information on the extent to which these trends have replaced the system that was in place in the late 90s to treat hip fracture patients in the community, nor is it clear how these changes to the service model will play out in this very specific population. In any case, at present none of the best practice guidelines for hip fracture patients that we have located recommends that patients be offered intermediate care per se. However, hospital at home (HAH)/early supported discharge (ESD) is one of several forms of extant intermediate care.

In summary, there is no published evidence to compare with the assumptions drawn from Dolan and Torgerson (1998), although this is a widely cited article. The expert group did, however, comment that the number of outpatient follow-ups seemed excessive and the findings of the Herbert, Townsend et al. (2000) study also suggest that outpatient visits may be less frequent in 'usual care': these authors found that 51% of hip fracture patients in their sample had *no* outpatient appointment following discharge home[10]. We have therefore modelled a few sensitivity scenarios based on this limited information.

The three scenarios we investigate here assume 25%, 50% and 75% reductions in the number of outpatient follow-up sessions, for all specialties. Figure 6 presents the results of these sensitivity analyses on the post-discharge portion of the expenditure.

Figure 6. Sensitivity of post discharge expenditure estimate to variations in assumptions about number of outpatient sessions



The graph demonstrates that the post-discharge expenditure estimates are really very sensitive to changes in assumptions about the number of outpatient sessions. A 25% reduction in the number of sessions leads to a 20% reduction in expenditure for the psychiatrically well group from £500m to £400m, and a 16% reduction in expenditure for patients with dementia from £760m to £630m. A 75% reduction in the number of outpatient sessions has, as expected, a more significant impact, reducing expenditure for the psychiatrically well group by nearly 60% and the group with dementia by nearly 50%. The impact on overall expenditure is also marked,

[10] Furthermore, they found that 53% had no contact with their GP and 49% had no contact with a district nurse in the 6 weeks following discharge from hospital.

demonstrating the significance of the contribution that outpatient visits make towards the overall cost of the care needed to support fracture patients post-discharge.[11]

Unit costs

Data on unit costs are derived from various sources. Although all of these are UK sources, in some instances these data can be quite old and although we have uprated all costs to the same price base, there is more uncertainty around older values. In particular, there is the most uncertainty around the figures used for hospital stay and for outpatient appointments. We have more confidence in the values for the cost of the community health and social care package as data (Romeo 2007) from a study investigating interventions to prevent or treat depression in patients with hip fracture, conducted in four orthopaedic units in Manchester (Burns, Banerjee et al. 2007), gave a very similar value to that derived from Coast, Richards et al. (1998).

Comparison between the unit cost used for each type of outpatient appointment, derived from Dolan and Torgerson (1999), and the value quoted in Curtis and Netten (2006) for the average outpatient follow-up appointment shows quite a large difference in the magnitude of the cost per visit. There are also wide variations in the unit costs reported by Dolan and Torgerson for each type of appointment. The costs for a geriatric consultation, an orthopaedic consultation, a medical consultation and a radiology session are £981, £253, £673 and £29 respectively. The cost quoted in Curtis and Netten (2006) is £113, which is on the lower side of the middle of the range.

Similarly, the unit cost of a bed day on an orthopaedic ward varies widely depending on the data source (see Table 2)

Table 2. Estimates of the unit cost of a bed day on an orthopaedic ward

Unit cost (2005/6 prices)	Source of estimate
£1,174	Shepperd, Harwood et al (1998)
£433	Lawrence, White et al. (2005)
£349	Dolan and Torgerson (1998)
£293	French et al. (French, Torgerson et al. 1995)
£253	Herbert, Townsend et al. (2000)
£188	Coast, Richards et al. (1998)

The base case uses the unit cost from Herbert, Townsend et al. (2000) primarily because these authors specify that the unit cost excludes the contribution of outpatient appointments and the prosthesis. This figure is also around the middle of the range of possible values, which makes it seem more plausible. The high unit cost from Shepperd, Harwood et al (1998) includes the cost of readmissions, which could explain why it is so much greater than all the other estimates. Leaving this estimate aside, the range is still very wide at about £245[12].

Consequently, given this quite wide range of potential error in the unit costs associated with hospital stay and outpatient appointments, we have modelled two different scenarios, representing the possible bounds of error. These are:

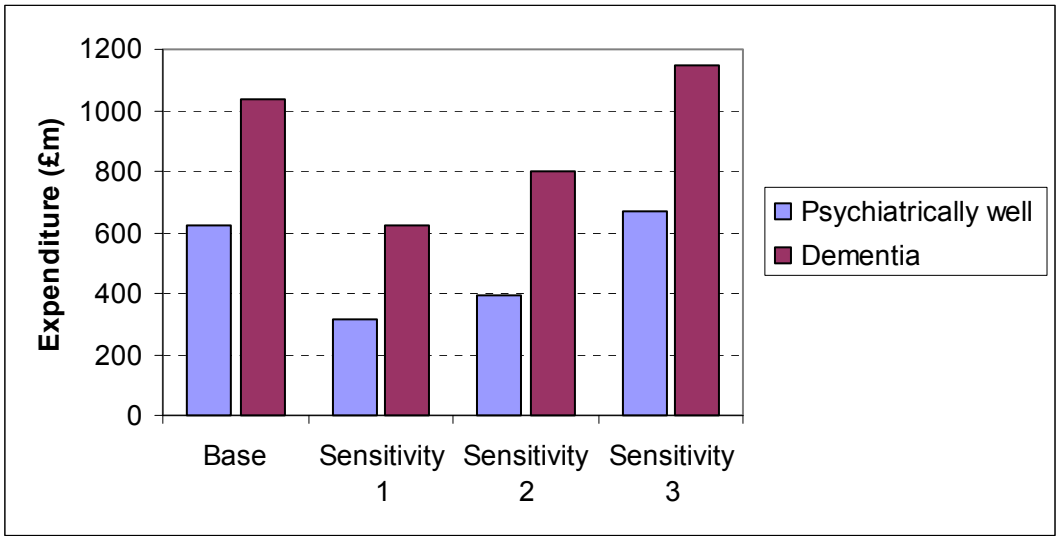
[11] We anticipate gaining access to further service use and cost data on the care of older people with hip fracture in 2-3 weeks, and could check and if necessary update the estimates at that time. It has not been possible to access the data (from what is still an unpublished study) in time for this report.

[12] We did not use the Lawrence, White et al. (2005) figures as we had concerns about the methodology employed to calculate the per diem cost.

- Sensitivity 1: Unit cost of an orthopaedic bed day is £188; outpatient costs for all appointments are £113.
- Sensitivity 2: Unit cost of an orthopaedic bed day is £349; outpatient costs for all appointments are £113
- Sensitivity 3: Unit cost of an orthopaedic bed day is £349; outpatient costs remain as for base case.

Figure 7 shows the total expenditure on both hospital stay and discharge care associated with these alternative assumptions about unit costs.

Figure 7. Sensitivity of base case expenditure estimates to variations in unit costs



As can be seen from the graph the expenditure estimates for both the psychiatrically well and dementia groups are particularly sensitive to assumptions in unit costs. This is driven in the most part by the wide uncertainty that exists around these unit costs. At the lowest bound of the estimate, given by sensitivity 1, expenditure on the psychiatrically well group is £315m and £620m on the group with dementia, around 50 and 60%, respectively, of the estimated expenditure under the base case. At the highest bound of the estimate, given by sensitivity 3, total expenditure is £670 for the psychiatrically well and £1140 for those with dementia, which represent increases over the base case of about 7 and 10%, respectively.

6. Scenario analysis

In the feasibility report we noted that some aspects of best practice for treating hip fracture appeared to have a strong evidence base, for instance:

- the use of adequate analgesia during initial investigation (Scottish Intercollegiate Guidelines Network (SIGN) 2002);
- the use of pressure-reducing mattresses (Beaupre, Jones et al. 2005);
- the benefits of surgery performed within 24 hours of admission (Scottish Intercollegiate Guidelines Network (SIGN) 2002; Beaupre, Jones et al. 2005);
- the benefits of implementing intermittent catheterisation rather than indwelling catheterisation perioperatively (March, Chamberlain et al. 1999; Chilov, Cameron et al. 2003; Beaupre, Jones et al. 2005); and

- the benefits of prophylaxis for DVT given postoperatively (Morrison, Chassin et al. 1998; March, Chamberlain et al. 1999; Scottish Intercollegiate Guidelines Network (SIGN) 2002; Beaupre, Jones et al. 2005).

However, we chose to focus principally on interventions that might particularly benefit those with dementia (although we have also modelled the impact of time from admission to surgery). This appeared to be reasonable given the original brief; also the evidence for some interventions, for instance pressure-reducing mattresses, reported outcomes that were not useable within our model (e.g. reduction of pressure sores, rather than impact on length of stay or discharge destination, even though it might well have an impact on these latter).

The interventions that we have modelled are based on the recommendations within recent evidence-based guidelines (March, Chamberlain et al. 1999; Scottish Intercollegiate Guidelines Network (SIGN) 2002; Beaupre, Jones et al. 2005; Working Group for Liaison Mental Health Services for Older People 2005; National Institute for Health and Clinical Excellence and Social Care Institute for Excellence 2006) and from recent systematic reviews of rehabilitation of older patients with fracture (Cameron, Crotty et al. 2000; Cameron, Handoll et al. 2001). These interventions are:

- Reduction in days to surgery to 24 hours
- Geriatric orthopaedic rehabilitation unit (GORU)
- Geriatric hip fracture programme (GHFP) on an orthopaedic ward
- Psychiatric liaison
- Hospital at home (HAH)
- Integrated care pathways (ICP).

We also sought evidence for the following, but were not able to locate reasonably recent published evidence for them that reported relevant outcomes (e.g. length of stay, mortality) for hip fracture or orthopaedic patients:

- Antibiotic prophylaxis at time of surgery
- Urinary intermittent catheterisation post-surgery
- Nutritional treatment post-surgery
- Geriatric rehabilitation on geriatric ward (GRGW)
- Psychiatric liaison nurse.

Feedback from the expert group did allow us to model the psychiatric liaison nurse scenario, and we present this as a variant of the psychiatric liaison scenario.

Here we present the results from these scenarios, identifying, where relevant, potential savings. We also present some sensitivity around the estimates, in response to feedback from the expert group and from available literature, where relevant. A summary of expenditure per scenario examined here is reported in Annex 1, with ranges derived from the variants. Assumptions for 'best practice' scenarios have been outlined in Table 2A in the annex.

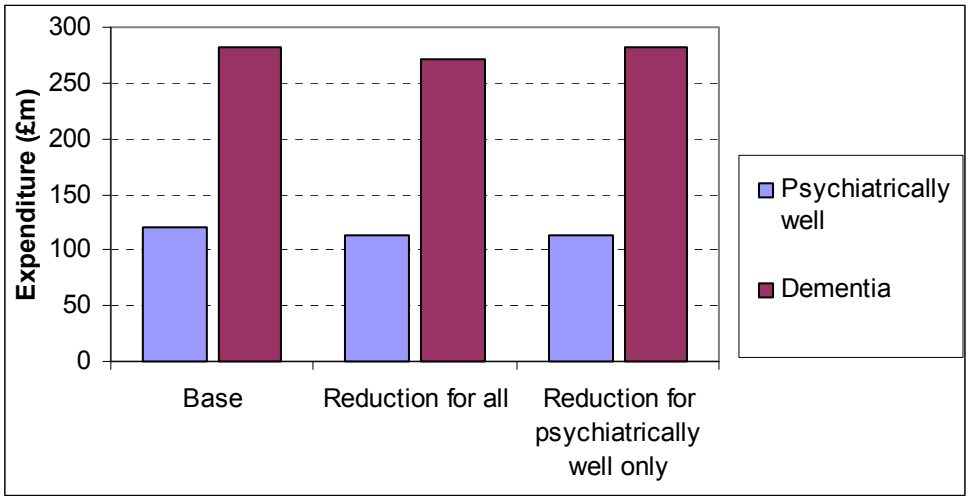
Reduction in days to surgery

According to the Audit Commission (2000), the Royal College of Physicians recommends that surgery for hip fracture should take place within 24 hours. There is evidence that reduction in days to surgery to 24 hours time from admission to surgery affects outcomes including length of

stay (Beaupre, Jones et al. 2005). This is based on a paper by Orosz, Magaziner et al. (2004), describing a prospective cohort study with analyses matching cases of surgery less than and more than 24 hours from admission. While this study was carried out in the United States, raising issues of generalisability to the UK, there was no UK paper of similar quality available. We are aware of a study by Herbert, Townsend et al (2000) that suggests that the reduction in length of stay associated with carrying out surgery within 24 hours is about 2.3 days on average, however the authors emphasise that they took a purposive sample that was not necessarily representative of the local hip fracture population. We therefore modelled a scenario based on the data from Orosz and colleagues where there is a 1.94 days reduction in length of stay for each person (except those who go on to die in hospital).

There are of course likely to be costs with such a scenario that we have not been able to model. It is not clear whether such a policy would require expansion of facilities/staff to achieve surgery within 24 hours for virtually all patients with fractured neck of femur. The expert group commented that there might be good reason to delay surgery for the psychiatrically unwell, for example, there may be problems attaining consent from the dementia group which could prolong days to surgery. We therefore try to address some of these concerns in a variant of the above scenario, assuming that the benefits are only attained by the psychiatrically well group. The results of these two variants of the days to surgery scenario are shown in Figure 8.

Figure 8. Variations in hospital stay expenditure resulting from a policy to ensure days to surgery are no greater than 24 hours



As might be expected, given the minimal influence of small variations in length of stay on hospital stay expenditure, the impact of this scenario is quite small, amounting to a saving of £8m for the psychiatrically well group and £10m for the group with dementia, although as we have discussed there are some reasons to doubt the extent to which this latter group would be able to realise any benefit from the introduction of such a policy. In terms of overall expenditure, the impact of the main scenario is not very significant, with roughly a 1% reduction in total expenditure for both the psychiatrically well group and the group with dementia.

Collaborative care models

Several guidelines recommend that geriatricians collaborate with orthopaedic surgeons to ensure the quality of care of hip fracture patients (Audit Commission 2000; Scottish Intercollegiate Guidelines Network (SIGN) 2002). The Audit Commission report suggested that hip fracture patients could benefit from closer working arrangements between physicians and orthopaedic

surgeons, for instance through joint ward rounds (however their audit found that only 23% of trusts carried these out)(Audit Commission 2000). We have based scenarios on two relatively well-established models of collaborative care (or 'co-care'), described below.

Geriatric orthopaedic rehabilitation unit (GORU)

Cameron, Crotty et al.(2000) define the geriatric orthopaedic rehabilitation unit (GORU) as a 'specialised inpatient rehabilitation supervised by a geriatrician with a multidisciplinary team. The geriatric orthopaedic rehabilitation unit (GORU) is dedicated to this patient group' (ibid, p.1). Treatment in a GORU may benefit frailer patients with co-morbid conditions and cognitive impairment (Scottish Intercollegiate Guidelines Network (SIGN) 2002).

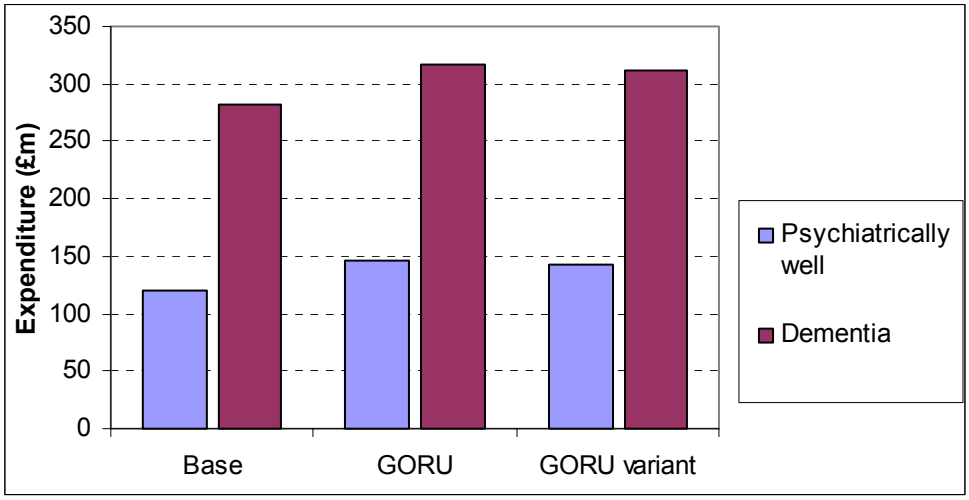
Data from the HTA review[13] suggests that the GORU intervention increases length of stay by 3.6 days on average. Extra inputs required above those already found on the average hospital ward are on average 1.5 hours per patient of physiotherapist time and 5 hours per patient of geriatrician's time. The literature does report various benefits associated with this scenario, such as an increased likelihood of patients returning to their own home reported in some papers, and also a reduction in readmission rates, by 9% (Galvard 1995, as reported in (Cameron, Crotty et al. 2000). However, the data on readmissions were not reported in a way that was compatible with the data in the base case, so we have not been able to include them in the model. We therefore model a scenario in which every patient receives the extra hours of input from geriatricians and physiotherapists, and there is a resulting increase in average length of stay of 3.6 days. The unit costs for each of these inputs are sourced from Curtis and Netten (2006).

The expert group raised some concerns over this scenario, in particular they suggested that the input is more likely in their experience to be the other way round, i.e. 1.5 hours per patient of geriatrician time and 5 hours per patient of physiotherapist time, and so we have modelled a variant of the scenario to examine the sensitivity to this suggestion. The expert group also raised some concerns over whether the scenario led to a reduction or prolongation of stay.

Figure 9 shows that the GORU scenario leads to a quite significant increase in expenditure on hospital stay from roughly £120m under the base case to about £145m for the psychiatrically well and from about £280m to £320m for those with dementia. The increase in lengths of stay associated with the scenario and the extra inputs both contribute to these extra costs, with the increase in length of stay being the more significant. The variant scenario shows that the extra costs can be marginally moderated by changes to the composition of the multidisciplinary team. In terms of overall expenditure, the GORU scenario has a small impact, raising expenditure on the psychiatrically well by 4% and those with dementia by 3%.

[13] One newer Canadian study (Naglie 2002, cited in Cameron, Handoll et al. (2001)), which was classified by Cochrane reviewers as a mixed assessment and rehabilitation unit (MARU) rather than a GORU, showed a lower length of stay for the control group and did not report readmission rates. A Spanish study published after the HTA review (Sanchez Ferrin 1999, cited in Cameron, Handoll et al. (2001)) found no difference in LOS or readmissions between groups.

Figure 9. Expenditure on hospital stay under GORU and variant-of-GORU scenario



Geriatric hip fracture programme (GHFP) on an orthopaedic ward

Cameron, Crotty et al. (2000) explain that in a geriatric hip fracture programme (GHFP) on an orthopaedic ward the

> involvement of the geriatric team begins in the orthopaedic surgical unit, early after admission. As part of this programme, frailer patients who were previously living in the community may be transferred to a rehabilitation unit, but those with less disability remain in the orthopaedic unit until able to return home (ibid, p.1).

Like the GORU model, the GHFP model entails an increase in inputs above those already present on the average ward. Data from Cameron, Lyle et al. (1993) as cited in Cameron, Crotty et al. (2000) suggest that there are increases in medical time of about 0.25 hours per patient and nurse/therapist time of about 0.5 hours per patient. Swanson, Day et al. (1998) as cited in Cameron, Crotty et al. (2000) also report a social worker as part of the team, but do not provide any detail of the extra time required. Given that under the base case we assume that social workers are not routinely available on the ward, we have included a social worker as an input. The amount of input was estimated at 2 hours per patient on the basis of experience, and this was judged as reasonable by some members of the expert group, although others suggested that it might be too high. Some members of the expert group also questioned the base case assumption that social workers are not routinely available on wards. We have therefore developed a variant of the GHFP scenario where the extra social worker input is excluded on the basis that it is already included in the cost of the base case.

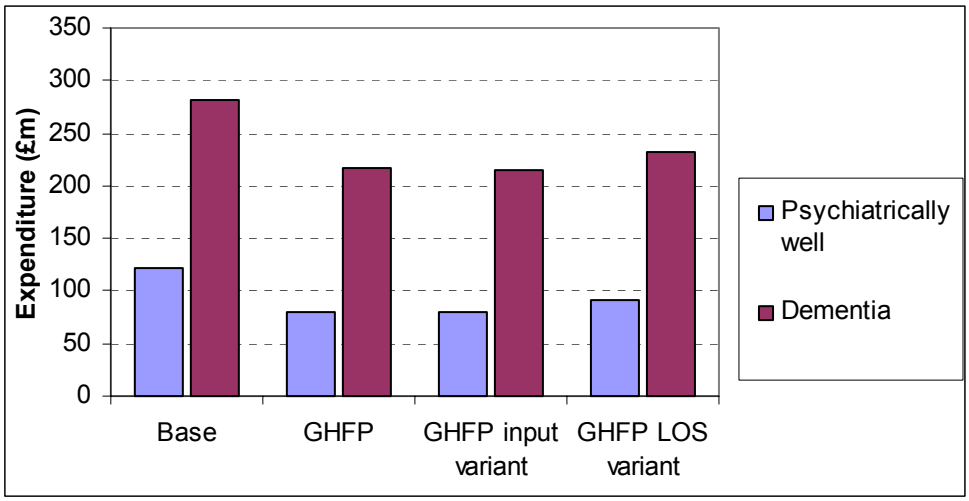
The GHFP model, as reported in Cameron, Crotty et al (2000), finds a decreased length of stay of 9 days on average per patient. Savings are also reported in the form of reductions in admissions to nursing homes, of 10.5% (ibid) and a greater likelihood of patients returning to their pre-fracture residence[14]. The expert group did question the magnitude of the reduction in length of stay, thinking that perhaps 9 days was too much. This value is based on the mean of the five GHFP studies included in the HTA review, so should be reasonably reliable. However, to respond to the concerns raised by the expert group we also include a variant of the GHFP

[14] Patients receiving this type of intervention were about twice as likely to return to their pre-fracture residence than those receiving standard orthopaedic care (pooled odds ratio from two RCTs was 2.06 (95% Confidence Intervals of 1.08-3.93)). See Cameron, Crotty et al. (2000).

scenario, where the reduction in length of stay is 25% lower than that found in Cameron, Crotty et al (2000).

The GHFP scenario, therefore, models a decreased length of stay of 9 days per patient, associated with a 10.5% reduction in admissions to nursing homes. These people are instead assumed to return home. The extra inputs are identified as nurse/therapist, social worker and medical time. The inputs were costed using the following assumptions: nurse/therapist was assumed to be the average of the cost of a nurse on a 24-hour ward and a physiotherapist and the medical time was assumed to be the cost of a specialist registrar. All unit costs were sourced from Curtis and Netten (2006). An input variant of the GHFP scenario assumes that social worker time is not an extra input, but the same savings and reduction in length of stay occurs. The impact on expenditure of the scenario and its variant is shown in Figure 10.

Figure 10. Expenditure on hospital stay under GHFP and GHFP input variant scenario



The GHFP scenario significantly decreases expenditure on hospital stay, whether calculated with or without social worker input. Under the basic GHFP scenario, expenditure totals £80m and £220m for the psychiatrically well and dementia patients, respectively. This is compared to £120m and £280m, respectively, under the base case. The majority of the reductions are found from the significant decrease in length of stay of, on average, 9 days per patient. When we examine the length of stay variant to this scenario, the savings are not as large: expenditure on hospital stay totals £90m and £230m for the psychiatrically well and dementia patients, respectively. The effect on overall expenditure is quite significant for both the group with dementia and those identified as being psychiatrically well on admission. Overall expenditure is decreased by about 8% for those with dementia and 7% for the psychiatrically well, under the main GHFP scenario.

Hospital at home (HAH)/Early supported discharge (ESD)

Early supported discharge (ESD) has been recommended for people who are pre-morbidly relatively fit and well (Scottish Intercollegiate Guidelines Network (SIGN) 2002). Cameron (2005) describes the ESD intervention as the

> transfer of selected patients to home after early identification in orthopaedic unit. May exist as a component of a GHFP … [The ESD] may not include significant geriatrician input, but requires skills in assessment, discharge planning, community resources and coordination (ibid, p.1084).

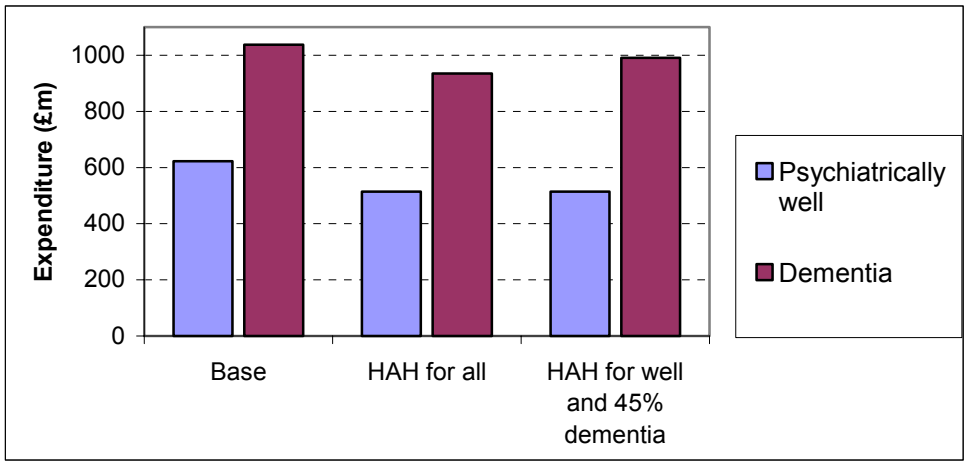
Staffing is generally multidisciplinary.

In modelling this scenario, we assume that the hospital at home (HAH) package leads to a reduction in length of stay of 6.9 days per patient (Cameron 2000). On discharge all patients participating in the HAH scheme are assigned a package of care to support them to live at home (the HAH package) and a package of community health and social care services for 3 months after discharge. The amount of care and unit cost of these packages are based on data from Coast, Richards et al. (1998). After 3 months it is assumed that patients revert to the base case package of community health and social services for the remaining 9 months of the year.

Only patients identified as being discharged home in the base case are included in this scenario, on the basis that only those who were pre-morbidly fit and well were included in the study intervention population. Given that we lack a variable to identify functional status, we use the discharge destination as a proxy for functional status and assume that those people who enter residential or nursing care have such a high degree of functional disability that they would not be offered the HAH package. There are, of course, likely to be some people who are discharged home who had a pre-morbidly high level of functional disability, but without additional information on pre-morbid functional status we are not able to test the sensitivity of the scenario to this possibility.

We also assume that psychiatric status has no impact on the benefit derived from the scheme. The expert group, however, suggested that patients with dementia may not benefit as much as psychiatrically well patients from this type of programme. While they were clear that patients with dementia would not be excluded outright, they mentioned that such a condition may delay the discharge onto the programme and that for others the programme may be unsuitable. In order to reflect the uncertainty of the scheme's applicability to the group with dementia, we have modelled a variant of the scenario where we assume that only 45% of the dementia population are offered the HAH package. This figure is based on the assumption that those who have 'mild' dementia are more likely to be offered a place in this service. We calculated the percentage of those with 'mild' dementia using data from a study of hip fracture patients analysed in terms of subgroups with dementia by Huusko, Karppi et al. (2000). The results of these scenarios, in terms of their impact on expenditure are shown in Figure 11.

Figure 11. Total expenditure for HAH scenario and variant including only 45% of patients with dementia



The HAH package leads to a reduction in overall expenditure on the psychiatrically well of over £100m, which is about 20% of the total expenditure on this group under the base case. The applicability of the intervention for people with dementia is questionable, but the graph shows that small reductions in expenditure can be gained even when the intervention is given to only

45% of the hip fracture population with dementia. Should all patients with dementia be suitable candidates for the intervention, then the savings are potentially significant at about £100m or 11% of total expenditure on this group under the base case. The saving is not as much for the group with dementia compared to the psychiatrically well group as fewer patients with dementia (60% compared to 90%) are discharged home under the base case.

Psychiatric liaison services to patients in orthopaedic wards

In the *Who Cares Wins* guidelines (Working Group for Liaison Mental Health Services for Older People 2005) it was recommended that acute hospital trusts consistently implement mental health liaison services within the general hospital. Furthermore, recent guidelines from the National Institute for Health and Clinical Excellence (2006) state that

> Acute trusts should ensure that *all* [our italics] people with suspected or known dementia using inpatient services are assessed by a liaison service that specialises in the treatment of dementia.

The most common approach to the provision of mental health care for older general hospital patients is the 'standard sector' model, providing a generalist service for older people in a geographical area or group of primary care practices. *Who Cares Wins* identifies a number of problems with this model, such as the reactive nature of the service and the low priority general hospitals may receive in the allocation of mental health services for older people. In contrast, the

> liaison approach is proactive and not limited to direct patient contact. It aims to integrate the assessment and treatment of mental disorder into routine general hospital practice. This requires a physical presence in the general hospital, close collaboration with general departments, shared care and the development of education and training programmes (ibid, p.23).

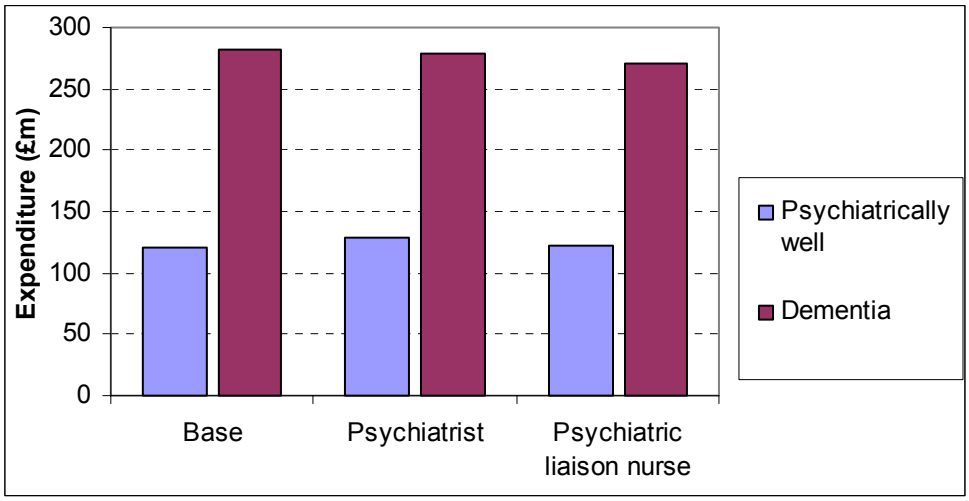
Evidence of the impact of psychiatric liaison services is limited to one article by Strain, Lyons et al. (1991), where it is reported that an input of 2.39 hours per patient on average of psychiatrist's time can lead to a reduction in average length of stay of 2.2 days. The scenario is modelled on the basis of this information, with the assumption that all patients require a psychiatric input, but the savings are only realised for those with dementia. The unit costs for a psychiatrist's time are derived from Curtis and Netten (2006).

The Strain et al. (1991) study is clearly quite old and one suggestion from the expert group was that the psychiatric liaison service could be more effectively provided by a team, comprising for instance a liaison nurse and occupational therapist. A further suggestion from the expert group was that members of the team, if well trained, in particular a psychiatric liaison nurse, would be just as effective as a psychiatrist. We had very limited information on the quantity of nursing input provided per patient, and none on the quantity of therapist input: we therefore model a variant of the scenario where instead of a psychiatrist we use a psychiatric liaison nurse, with the same savings in length of stay realised. Unit costs are sourced, as before, from Curtis and Netten (2006).

Figure 12 presents the expenditure on hospital stay for both variations of the psychiatric liaison scenario, where the input is either a psychiatrist or a psychiatric liaison nurse. As the graph shows, the scenario leads to a very marginal reduction in expenditure on the population with dementia, but an increase in expenditure on the population who are psychiatrically well. The extent to which expenditure is inflated for the psychiatrically well is moderated by using a psychiatric liaison nurse rather than a psychiatrist; this change in skill mix also leads to greater savings for those with dementia, of about £12m compared to £3m when using a psychiatrist.

The different skill mix has a significant impact on the overall balance, where the scenario inflates costs, by about £6m when using a psychiatrist; but leads to cost savings of about £10m when using a nurse. This saving is, however, only about 1% of the overall expenditure on both the psychiatrically well and those with dementia.

Figure 12. Expenditure on hospital stay, under psychiatric liaison and the input variant scenario



Integrated care pathways (ICP)

The National Service Framework for Older People (Department of Health 2001) defines a care pathway as

> an agreed and explicit route an individual takes through health and social cares services. Agreements between the various professional involved will typically cover the type of care and treatment, which professional will be involved and their levels of skills, and where treatment or care will take place (p.152).

The Healthcare Commission (2004) defines an Integrated Care Pathway (ICP) as

> a document that describes a process within health and social care, and that documents variances between planned and actual care. ICPs embed guidelines, protocols and locally agreed, evidence-based, patient-centred best practice, into everyday use for the individual patient. They form all or part of the clinical record for that particular episode of care. Uniquely, they record deviations from planned care in the form of variances (p.1).

This scenario is modelled using data from Roberts (2004). The ICP they use includes extra input from an occupational therapist (OT) above the level of input found on the average ward. They find that the introduction of an ICP leads to a prolongation of stay of, on average, 3.5 days per patient and a reduction in discharge to nursing homes of 6%. In modelling this scenario we therefore assume extra input from an OT of 0.42 contacts per patient (Roberts 2004). Data on unit costs is taken from Curtis and Netten (2006) and it is assumed that each contact is roughly an hour in duration.

The expert group challenged the data on length of stay; they thought the ICP should reduce length of stay. Indeed the literature is ambiguous in this area. An Australian study found a reduction in length of stay of 1.4 days, but did not find that this was associated with any reduction in discharge to a nursing home (Choong, Langford et al. 2000). It is difficult to determine the extent to which these variations may be a result of the differences in the health

systems. However, to reflect the uncertainty over the effect on length of stay we have also included a variant of the ICP scenario based on the findings of this study.[15]

Figure 13. Total expenditure for ICP scenario and variant where LOS is reduced by the scenario

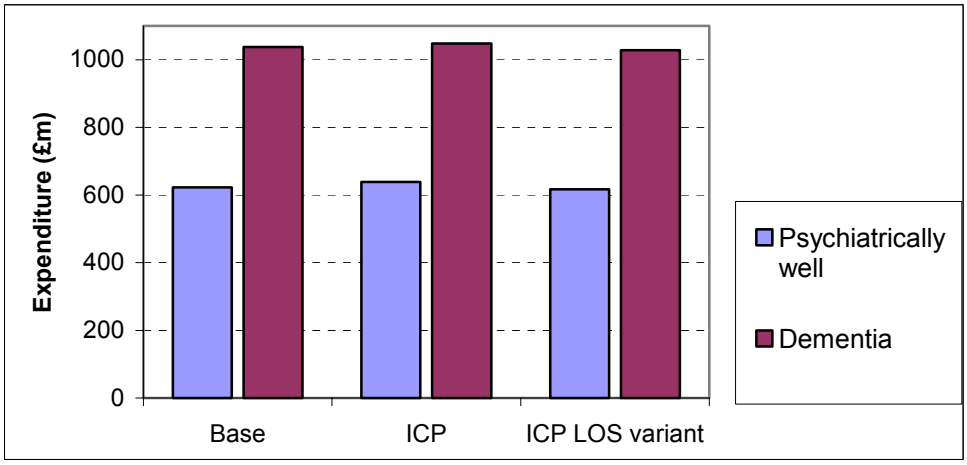


Figure 13 shows the effect on total expenditure from implementation of the ICP scenario. The results are equivocal, depending on the source of the evidence and more specifically whether the ICP is associated with a reduction in length of stay. Under the ICP scenario, where no length of stay reduction was detected, expenditure is £640m compared to £630 under the base case for the psychiatrically well. For people with dementia, expenditure is £1050m compared to £1040 under the base case. For the ICP scenario, where length of stay was detected to be reduced, the comparative figures are £615 for the psychiatrically well and £1030 for people with dementia. In both scenarios, the difference from the overall expenditure is quite minimal, between 1% and 2% of overall expenditure.

7. Discussion

The model we have built clearly shows that those people with hip fracture who have dementia impose greater costs on the health and social care system, and that some 'best practice' approaches in treating these patients may not reduce these costs. However, other approaches, such as the Geriatric Hip Fracture Programme and Early Supported Discharge appear to have the potential to decrease expenditure on people with dementia who fracture their hip (estimated as reductions of 6% and 4% respectively in the year following the fracture[16]). The results are summarised in Table 3.

In spite of obvious caveats in interpreting the evidence base (addressed in greater detail below), what emerges from the base case sensitivity analyses is that in most cases, within the boundaries of error presented, the estimates are in fact reasonably robust. Where we can be less sure of our results is in relation to unit costs, health and social care resource use post-discharge, and the proportions of patients admitted to hospital who have dementia.

[15] Furthermore a much greater reduction of length of stay of 5.3 days as a mean of three previous care pathway studies is given in the review by Cameron, Crotty et al. (2000). These were not used in preference to the two more up-to-date papers on care pathways presented here.

[16] Using the most conservative assumptions from the sensitivity analyses of these scenarios

We review our results first in terms of those interventions which appear to make modest impacts on expenditure on hip fracture patients in the year following the fracture, then in terms of those interventions with the potential to make a greater impact on expenditure.

Table 3. Summary of average expenditure by psychiatric state, £m

	Well (£m)	Dementia (£m)
Base Case		
Hospital stay	121	282
Discharge care	502	756
Total	623	1,037
Reduction in days to surgery to 24 hrs		
Hospital stay	113	271-282
Discharge care	502	756
Total	614	1027-1037
Geriatric orthopaedic rehabilitation unit (GORU)		
Hospital stay	142-145	312-317
Discharge care	502	756
Total	644-647	1068-1072
Geriatric hip fracture programme (GHFP) on an orthopaedic ward		
Hospital stay	79-91	216-231
Discharge care	501	742
Total	581-592	957-973
Psychiatric liaison		
Hospital stay	123-129	270-279
Discharge care	502	756
Total	624-631	1025-1035
Hospital at home (HAH)		
Hospital stay	93	255-270
Discharge care	421	680-721
Total	514	935-991
Integrated care pathways (ICP)		
Hospital stay	115-137	273-300
Discharge care	501-502	748-756
Total	616-638	1029-1048

Reduction in days to surgery

The model shows that reduction in days to surgery is unlikely to achieve major decreases in expenditure. There may also be additional costs inherent in achieving early surgery for almost all patients. There may be other benefits. For instance, the Orosz, Magaziner et al. (2004) study found that those having early surgery had significantly fewer medical complications and reduced days of preoperative pain prior to surgery. Further benefits may be difficult to evaluate: delays in recovery (i.e. due to unnecessarily prolonged periods of starvation and pain prior to surgery) cause patients more distress and may potentially, ultimately, increase admissions to long-term care. (This is not an outcome that appears to have been evaluated, going by the outcomes listed in a recent systematic review (Beaupre, Jones et al. 2005).)

Psychiatric liaison services to patients in orthopaedic wards

The impact on expenditure of a psychiatric liaison service to patients in orthopaedic wards is quite similar to that of reduction in days to surgery. There is a very modest decrease in

expenditure if employing a psychiatric liaison nurse, and a very modest increase if employing a psychiatrist. The expansion of psychiatric liaison to incorporate more team members would further push up expenditure. However, the approach may have other benefits outside the scope of our model, for instance in terms of identifying delirium in order to plan appropriate management. The expert group suggested that liaison may improve discharge planning and decrease unnecessary re-admissions to hospital.

Geriatric orthopaedic rehabilitation unit (GORU)

Results of the model suggest that a geriatric orthopaedic rehabilitation unit will raise expenditure by 3% and 4% for those with and without dementia respectively. The evidence on the GORU model suggests an increased length of stay and appears to slightly raise expenditure on those with and without dementia. It is interesting that, although recommended in the SIGN guidelines, one of the authors of the HTA review has questioned why SIGN felt there was sufficient evidence of effectiveness to recommend it (Cameron 2005).

Integrated care pathways (ICP)

The integrated care pathways intervention similarly appears to result in very modest increases or decreases in expenditure, depending on the choice of evidence. Our expert group expressed some scepticism about the effectiveness of care pathways; there was concern that initial enthusiasm for this intervention may dim over time and no longer be implemented consistently. However, Roberts, Pickering et al.(2004) stated that the ICP was still being used 21 months after their study's data collection ended.

Hospital at home (HAH)/Early supported discharge (ESD)

The ESD model has the potential to deliver large savings in expenditure for those psychiatrically well patients with hip fracture. Using our more conservative estimates, there would be a modest reduction in expenditure for those with dementia of about 4% of the base case estimate. If this model could be applied to all those with dementia, significant savings could be achieved, in the area of 10% lower expenditure on this group.

Geriatric Hip Fracture Programme (GHFP)

The Geriatric Hip Fracture Programme appears to have the greatest impact on expenditure, capable even under our most conservative assumptions of delivering savings of 5% and 6% for those hip fracture patients who are psychiatrically well and those with dementia, respectively.

The scenarios and accompanying sensitivity analyses are useful in that they tell us that the model estimates are not particularly sensitive to small variations in length of stay or discharge destination. Therefore, any best practice scenario that is going to deliver significant savings will have to significantly impact on these two variables, and indeed this is what we find. If the GHFP and the early supported discharge interventions do indeed deliver the degree of reduction in reduced bed days in both hospitals and institutions suggested by the literature and largely confirmed by the expert group, these deserve further funding for development and evaluation. However, if both these models exclude or limit access by those hip fracture patients with dementia, either explicitly or implicitly, then the potential total savings in expenditure will be proportionately reduced. In using data from the HTA review, we drew upon studies that did in some cases have exclusion criteria that limited the applicability to some groups of patients. For

instance, some of the GORU studies in the HTA review excluded those who were pre-morbidly fit and well, and others excluded those from nursing homes or hospital, while several GHFP studies excluded those with dementia or severe dementia. The little evidence that exists is mixed on the degree to which patients with dementia will benefit from the rehabilitation they receive (Huusko, Karppi et al. 2000; Naglie, Tansey et al. 2002; Vidan, Serra et al. 2005). As we noted in our earlier feasibility report:

> That little research has been carried out in this area has been raised as a concern by (Qureshi and Gwyn Seymour 2003) who argue that 'Despite evidence that those with mild to moderate dementia can benefit from specialised rehabilitation after a hip fracture [the authors cite Huusko et al 2000 and Beloosesky et al 2001] they continue to be excluded from trials, probably because of a combination of ethical and practical reasons'.

Further benefits and potential for savings

Further savings might come, as suggested by the expert group, from preventing re-admissions, either for reasons directly related to the fracture or more likely for 'social' reasons such as carer stress/breakdown and lack of appropriate management strategies. It was suggested by some of the expert group that this was likely to be the greatest impact of a liaison service. This could be of benefit in terms of identifying patients with dementia while they are still in the acute hospital setting. A psychiatric liaison nurse or team could enable mental health specialist workers – nurses and therapists – to share their skills with their colleagues on the orthopaedic wards. Examples of the potential benefits of this approach are outlined in *Who Cares Wins* (Working Group for Liaison Mental Health Services for Older People 2005). It must be said that community mental health team input might also be beneficial in preventing readmissions and that such services are not included within the post-discharge package for those patients with dementia. However, we had no information on how frequently patients might receive this care and whether it would be provided as a result of the hip fracture admission.

Within the literature on good practice, we did find evidence of some benefits that could not be accommodated within the scope of the model. For instance GHFP interventions may double the likelihood of patients returning to pre-fracture function (see the GHFP section above and footnote 11). Also one study found a reduction in caregiver burden at 12 months following hip fracture in the group having an early supported discharge (Crotty, Whitehead et al. 2003).

Limitations

As should be clear from the descriptions of the base case and best practice scenarios, the evidence base for many elements of the model is not particularly impressive. We received relatively few references to further literature from the expert group, so we have no reason to believe that we have missed key papers. As discussed above, research into the benefits of interventions with older hip fracture patients is reported in terms of heterogeneous outcome measures, making it difficult systematically to appraise these benefits. For each of the models of practice considered there were a fairly limited number of studies to draw upon (in the case of psychiatric liaison, only one relevant paper). Also, for some models of practice, the most recently reported studies were not from the UK: health services system variations create problems in generalising the benefits of complex, multifactoral interventions from one country to another.

What was apparent from the expert group feedback was the tremendous variation in service models. Whereas in our simulation we assume that our best practice scenarios are quite distinct

from ‘usual care’, in reality there will be shadings of practice, from poor to good, not only between regions but even within trusts.

The expert group responses also emphasised some weaknesses in the assumptions we had made. Comments centred on issues relating to the complex interactions between patient characteristics, interventions and outcomes, and the consequent pitfalls of assuming that those with dementia would get the full benefit of some best practice scenarios. For instance:

- those with dementia might have more comorbidities, the treatment of which could delay surgery;
- treating pre-surgical delirium may delay surgery;
- or consenting issues may cause delays (i.e. establishing capacity to give or refuse consent).

Therefore, improving timely access to surgical treatment may disproportionately benefit those who do not have dementia. Access to rehabilitation on an orthopaedic ward may likewise be denied or provided in less intensity to those with dementia, as a result of the person’s challenging behaviour or refusal to co-operate in therapy. Patients with dementia may thus experience poorer outcomes as a result of lower rehabilitation participation (cf. Lenze, Munin et al. 2004). However, expert group responses also suggest that those presenting with more complex problems are most likely to go into some form of rehabilitation, in which case this patient group may have a ‘second chance’ of receiving therapy.

The group also raised the possibility that the ESD/HAH type of service may exclude those with dementia from treatment. This could be because these patients are seen as not having ‘rehabilitation potential’, or because they are assessed as needing more support at home in terms of care/supervision than is available through the ESD service. It should be noted that the HAH service in the Richards (1998) study did not list dementia among the exclusion criteria. Given the much greater costs of placement in a care home, it does seem reasonable that people with mild/moderate dementia should be targeted by such services. Dedicated mental health intermediate care facilities could be a potentially helpful model of care for this group: although there is evidence of need for such services (Paton, Fahy et al. 2004), we found no literature on the subject, apart from service descriptions (cf. (Ackermann, Jane Burnand et al. 2003).

A further limitation might be that data for three scenarios were taken from a Health Technology Assessment review published in 2000 (Cameron, Crotty et al. 2000) and therefore the evidence is at least 7 years old. However there have been few relevant studies in the recent past, as noted in a relatively recent update of a Cochrane review of rehabilitation for older hip fracture patients (Cameron, Handoll et al. 2001; incorporating the most recent minor amendment from November 2003). Having used the pooled results from the Cameron, Crotty et al. (2000) review for the GORU and GHFP scenarios, we initially selected a specific study for the ESD/HAH model (Richards, Coast et al. 1998), primarily as it was recent and based in the UK. However, feedback received from the expert group led us to model the pooled data estimate of 6.9 days for ESD. The expert group response on the assumptions made for the integrated care pathways did not give us a clear steer as to how many hospital days this might save, although it was suggested that days might be saved. For this reason we used information from the other recent study on ICPs for hip fracture patients (Choong, Langford et al. 2000), which did demonstrate saved hospital days, although it was not a UK study. The days saved were quite moderate in comparison with the mean days saved from the HTA review, but the data were more recent and, in one case, were from this country.

Ideally a measure of functional ability would enable us to estimate in more detail the cost of community-based health and social care for this population from discharge to, say, one year later. Although functional outcomes are reported in the literature, studies of rehabilitation for older orthopaedic patients have used a variety of outcome measures (e.g. the Katz, Barthel and modified Barthel scales, and other measures such as attaining pre-fracture competence). This made it impossible for us to find a consistent measure that could be used across scenarios. Both Cameron, Crotty et al. (2000) and Cameron, Handoll et al. (2001) recommend that studies should employ agreed, standardised measures of outcome, particularly of function. While a measure of *function* is absent, dependency levels are proxied in the model by discharge destination.

We have limited the number of scenarios modelling best practice in terms of rehabilitation. Only the ESD model of 'intermediate care' has been presented. Rehabilitation in a nursing or 'care-only' care home setting is another form of intermediate care (Martin, Hewitt et al. 2007) that is somewhat common, but it could not be modelled as there is insufficient evidence for the effectiveness of this intervention. A 2003 Cochrane review found no papers on this subject that met all the reviewers' inclusion criteria, in particular their methodological inclusion criteria. Such services may impose exclusion restrictions on the basis of dementia assessed as likely to interfere rehabilitation (Fleming, Blake et al. 2004); there may also be a reluctance to take on service users who could exceed the 6-week period for which intermediate care funding may be available. Equally, community hospitals can be considered to provide intermediate care services (Martin, Hewitt et al. 2007), and there is some recent evidence that they can achieve outcomes such as increasing independence post-discharge (Green, Young et al. 2005); however this paper does not report what percentage, if any, of the patients seen had hip fractures or even orthopaedic conditions.

In conclusion, the results of the model show the higher expenditure required to treat hip fracture patients than their psychiatrically well counterparts; we have demonstrated some potential benefits in terms of cost savings arising from some models of good practice. However, it is clear from the information that we have been able to assemble that the evidence base on interventions within both hospital and community on how to improve outcomes for people with dementia after a hip fracture remains quite limited.

References

Ackermann, E., Jane Burnand, et al. (2003). "Two year outcomes of a multi-agency elderly mentally ill unit providing intermediate care." International Journal of Geriatric Psychiatry **18**(4): 359-360.

Audit Commission (1995). United They Stand: Co-ordinating Care for Elderly Patients with Hip Fracture.

Audit Commission (2000). United They Stand: Co-ordinating Care for Elderly Patients with Hip Fracture. Update.

Beaupre, L. A., C. A. Jones, et al. (2005). "Best practices for elderly hip fracture patients. A systematic overview of the evidence." J Gen Intern Med **20**(11): 1019-25.

Burns, A., S. Banerjee, et al. (2007). "Treatment and Prevention of Depression After Surgery for Hip Fracture in Older People: Randomized, Controlled Trials." Journal of the American Geriatrics Society **55**(1): 75-80.

Cameron, I., M. Crotty, et al. (2000). "Geriatric rehabilitation following fractures in older people: a systematic review." Health Technol Assess **4**(2): i-iv, 1-111.

Cameron, I. D. (2005). "Coordinated multidisciplinary rehabilitation after hip fracture." Disabil Rehabil **27**(18-19): 1081-90.

Cameron, I. D., H. H. G. Handoll, et al. (2001). "Co-ordinated multidisciplinary approaches for inpatient rehabilitation of older patients with proximal femoral fractures [Systematic Review]." Cochrane Database of Systematic Reviews **3**.

Chilov, M. N., I. D. Cameron, et al. (2003). "Evidence-based guidelines for fixing broken hips: an update." Med J Aust **179**(9): 489-93.

Choong, P. F., A. K. Langford, et al. (2000). "Clinical pathway for fractured neck of femur: a prospective, controlled study." Med J Aust **172**(9): 423-6.

Coast, J., S. H. Richards, et al. (1998). "Hospital at home or acute hospital care? A cost minimisation analysis." Bmj **316**(7147): 1802-6.

Crotty, M., C. Whitehead, et al. (2003). "Patient and caregiver outcomes 12 months after home-based therapy for hip fracture: a randomized controlled trial." Arch Phys Med Rehabil **84**(8): 1237-9.

Department of Health (2001). National Service Framework for Older People. London, Department of Health.

Department of Health. (2006, December 19,2006). "NHS reference costs 2005-06." from http://www.dh.gov.uk/assetRoot/04/14/14/30/04141430.xls.

Dolan, P. and D. J. Torgerson (1998). "The cost of treating osteoporotic fractures in the United Kingdom female population." Osteoporos Int **8**(6): 611-7.

Fleming, S. A., H. Blake, et al. (2004). "A randomised controlled trial of a care home rehabilitation service to reduce long-term institutionalisation for elderly people." Age Ageing **33**(4): 384-390.

Freeman, C., C. Todd, et al. (2002). "Quality improvement for patients with hip fracture: experience from a multi-site audit." Qual Saf Health Care **11**(3): 239-245.

French, F. H., D. J. Torgerson, et al. (1995). "Cost analysis of fracture of the neck of femur." Age Ageing **24**(3): 185-9.

Green, J., J. Young, et al. (2005). "Effects of locality based community hospital care on independence in older people needing rehabilitation: randomised controlled trial." Bmj **331**(7512): 317-22.

Herbert, G. and G. Lake (2004). Developing the Intermediate Tier: Sharing the Learning. Leeds, Nuffield Institute for Health, University of Leeds**:** 36.

Herbert, G., J. Townsend, et al. (2000). Rehabilitation Pathways for Older People after Fractured Neck of Femur. Leeds, Nuffield Institute for Health, University of Leeds and York Health Economics Consortium, University of York**:** 1-271.
Holmes, J. and A. House (2000). "Psychiatric illness predicts poor outcome after surgery for hip fracture: a prospective cohort study." Psychol Med **30**(4): 921-9.
Holmes, J. D. (1999). The detection of psychiatric factors predicting poor outcome in elderly hip fracture patients.
Research School of Medicine. Leeds, University of Leeds**:** 221.
Holmes, J. D. and A. O. House (2000). "Psychiatric illness in hip fracture." Age Ageing **29**(6): 537-46.
Hospital Episode Statistics. (2007, 3/1/07). "HESonline." from www.hesonline.nhs.uk.
Huusko, T. M., P. Karppi, et al. (2000). "Randomised, clinically controlled trial of intensive geriatric rehabilitation in patients with hip fracture: subgroup analysis of patients with dementia." Bmj **321**(7269): 1107-11.
Lawrence, T. M., C. T. White, et al. (2005). "The current hospital costs of treating hip fractures." Injury **36**(1): 88-91; discussion 92.
March, L. M., A. C. Chamberlain, et al. (1999). "How best to fix a broken hip. Fractured Neck of Femur Health Outcomes Project Team." Med J Aust **170**(10): 489-94.
Martin, G. P., G. J. Hewitt, et al. (2007). "The organisation, form and function of intermediate care services and systems in England: results from a national survey." Health Soc Care Community **15**(2): 146-54.
Morrison, R. S., M. R. Chassin, et al. (1998). "The Medical Consultant's Role in Caring for Patients with Hip Fracture." Ann Intern Med **128**(12_Part_1): 1010-a-1020.
Naglie, G., C. Tansey, et al. (2002). "Interdisciplinary inpatient care for elderly people with hip fracture: a randomized controlled trial." Cmaj **167**(1): 25-32.
National Institute for Health and Clinical Excellence and Social Care Institute for Excellence (2006). Dementia: supporting people with dementia and their carers in health and social care.
Nurmi, I., A. Narinen, et al. (2004). "Functional outcome and survival after hip fracture in elderly: a prospecive study of 106 consecutive patients." Journal of Orthopaedics and Traumatology **4**: 7-14.
Orosz, G. M., J. Magaziner, et al. (2004). "Association of timing of surgery for hip fracture and patient outcomes." Jama **291**(14): 1738-43.
Parker, M. J., C. J. Todd, et al. (1998). "Inter-hospital variations in length of hospital stay following hip fracture." Age Ageing **27**(3): 333-337.
Parrott, S. (2000). The economic cost of hip fracture in the UK. York, Centre for Health Economics, University of York**:** 1-11.
Paton, J. M., M. A. Fahy, et al. (2004). "Delayed discharge--a solvable problem? The place of intermediate care in mental health care of older people." Aging & Mental Health **8**(1): 34-39.
Qureshi, A. and D. Gwyn Seymour (2003). "Growing knowledge about hip fracture in older people." Age Ageing **32**(1): 8-9.
Richards, S. H., J. Coast, et al. (1998). "Randomised controlled trial comparing effectiveness and acceptability of an early discharge, hospital at home scheme with acute hospital care." BMJ **316**(7147): 1796-1801.
Roberts, H. C., R. M. Pickering, et al. (2004). "The effectiveness of implementing a care pathway for femoral neck fracture in older people: a prospective controlled before and after study." Age Ageing **33**(2): 178-84.
Roberts, S. E. and M. J. Goldacre (2003). "Time trends and demography of mortality after fractured neck of femur in an English population, 1968-98: database study." Bmj **327**(7418): 771-5.

Roche, J. J., R. T. Wenn, et al. (2005). "Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study." Bmj **331**(7529): 1374.

Romeo, R. (2007). Care packages for hip fracture patients t. C. Henderson**:** Email message.

Royal College of Physicians (1999). Osteoporosis. Clinical guidelines for prevention and treatment: summary sheet. London, Royal College of Physicians**:** 2.

Scottish Hip Fracture Audit (2006). Scottish Hip Fracture Audit Report 2006. Edinburgh, NHS National Services Scotland.

Scottish Intercollegiate Guidelines Network (SIGN) (2002). Prevention and Management of Hip Fracture in Older People.

Shepperd, S., D. Harwood, et al. (1998). "Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis." Bmj **316**(7147): 1791-6.

Strain, J. J., J. S. Lyons, et al. (1991). "Cost offset from a psychiatric consultation-liaison intervention with elderly hip fracture patients." Am J Psychiatry **148**(8): 1044-9.

Vidan, M., J. A. Serra, et al. (2005). "Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial." J Am Geriatr Soc **53**(9): 1476-82.

Wanless, D. (2006). Securing good care for older people: Taking a long-term view. London, King's Fund.

Working Group for Liaison Mental Health Services for Older People (2005). Who cares wins. Improving the outcome for older people admitted to the general hospital: Guidelines for the development of Liaison Mental Health Services for older people., Faculty of Old Age Psychiatry, Royal College of Psychiatrists**:** 1-60.

ANNEX A

Table 1A. Assumptions made under scenarios of 'best-practice care'

PHASE	NAME OF SCENARIO	ASSUMPTIONS
PREOPERATIVE		
	Days to surgery post-admission	Reduction in days to surgery to 24 hrs leads to a reduction in average length of stay (LOS) Reduction in days to surgery to 24 hrs leads to a reduction in LOS of 2.3 days
POSTOPERATIVE		
	Geriatric Orthopaedic Rehabilitation Unit (GORU)	GORU model leads to reduced admission to nursing homes but is associated with longer hospital LOS GORU model increases LOS in hospital by 3.6 days For the GORU scenario we assume that all patients going to residential or nursing homes AND all those living alone require a Social Work consult GORU model leads to reduced admission to nursing homes but is associated with longer hospital LOS GORU model has the following additional staffing hours per patient (per patient stay) Physiotherapist: 1.5 hours Geriatrician: 5 hours
	Geriatric Hip Fracture Programme (GHFP) on an orthopaedic ward	GHFP model has the following additional staffing hours per patient (per patient stay) Nurse/therapist time: 0.5 hours SW: 2 hours Medical time: 0.25 hours GHFP model leads to reduced admission to nursing homes of 10.5 admissions per 100 patients treated GHFP model decreases LOS in acute hospital by 9 days
	Psychiatric Liaison	Psychiatric screening and liaison by a psychiatrist decreases LOS in acute hospital by 2.2 days
	Hospital at home (HAH)	That discharge from hospital earlier to Hospital at home leads to a reduced LOS for patients who have had hip fracture repair applies equally to those patients with dementia HAH model decreases LOS in acute hospital by 9.4 days
	Integrated Care Pathways (ICP)	The ICP model has the following additional staffing inputs per patient (per patient stay) The ICP model increases LOS in hospital by 3.5 days OT: 0.42 contacts per patient per stay The ICP model results in decrease in readmissions to hospital of 6%

Table 2A. Further scenarios for which relevant outcomes not reported or the literature was unclear[17].

PERIOPERATIVE		
	Antibiotic Prophylaxis	Systemic antibiotic prophylaxis administered at the time of surgery decreases LOS in acute hospital Systemic antibiotic prophylaxis administered at the time of surgery decreases mortality at 3 months
	Urinary Intermittent Catheterisation	Intermittent catheterization to treat urinary retention after surgical repair of hip fracture decreases acute LOS Intermittent catheterization to treat urinary retention after surgical repair of hip fracture decreases mortality at 3 months
	Nutritional Treatment	Providing Oral Nutritional Supplements for patient who have had surgical repair of hip fracture decreases acute LOS Providing Oral Nutritional Supplements for patient who have had surgical repair of hip fracture decreases mortality at 3 months
PHASE: POSTOPERATIVE	Geriatric Rehabilitation on Geriatric Ward (GRGW) scenario	Treating patients who have had surgical repair of hip fracture via a Geriatric Rehabilitation team on a Geriatric ward decreases acute LOS Treating patients who have had surgical repair of hip fracture via a Geriatric Rehabilitation team on a Geriatric ward reduces admissions to nursing homes
	Psychiatric Liaison Nurse	Psychiatric screening and liaison by a psychiatric liaison nurse decreases LOS in acute hospital

Table 3A. Sources of data for resource use

Resource use	Source
Admissions	
Total number of admissions for hip fracture diagnosis (ICD 10 code S72) England	HES online data for 2004/05
Admissions for hip fracture, by psychiatric state	Holmes, 1999
Hospital stay	
Proportion of each psychiatric group by discharge destination	Holmes, 2000
Average Length of Stay by discharge destination	Holmes, 2000
Numbers by discharge destination	Holmes, 2000
Total LOS by psych state	Holmes, 2000

[17] Only psychiatric liaison nurse was included in the scenarios modelled as there were insufficient data to model the others.

Table 4A. **Sources of data for unit costs**

Costs	Resource item	Unit	Source
Hospital stay			
Basic package	Orthopaedic ward	bed day	Herbert et al. 1998
GORU scenario	Geriatric consult	per hour	UC 2006
	Physiotherapist	per hour	UC 2006
Psychiatric liaison scenario	Psychiatric consult	per hour	UC 2006
Psychiatric liaison nurse	per hour	UC 2006	
GHFP scenario	Nurse/therapist	per hour	UC 2006
	Medical	per hour	UC 2006
	Social worker	per hour	UC 2006
ICP	OT	per contact	UC 2006
Post discharge care			
Outpatient hospital treatment			
	Geriatric consult	session	Dolan & Torgerson, 1998
	Orthopaedic consult	session	Dolan & Torgerson, 1998
	Medical consult	session	Dolan & Torgerson, 1998
	Radiology consult	session	Dolan & Torgerson, 1998
Community package – primary care	GP	visit	Dolan & Torgerson, 1998
Community package for those at home – community health and social care	Package consisting of services such as: chiropody, physiotherapy, occupational therapy, social work, health visitor, district nursing, night attendant, laundry, bath attendant, meals, home care, day care, day hospital, respite care, GP home visits, GP surgery visits, outpatient care	package/year	Dolan & Torgerson, 1998
Residential Care Package	Residential home cost including community nursing	per year	PSSRU model
Nursing home	Nursing home cost	per year	PSSRU model
Readmission	General medical ward	bed day	Unit Costs 2006
community package	SC/HC inc day care	4 weeks post op to 1 year	R. Romeo personal communication
HAH scenario	HAH package	per intervention	Coast et al , 1998
	SC/CHC (extra)	package to 3months	Coast et al , 1998

ANNEX B

Table 1B. Expenditure on post-discharge care (£m)

	Psychiatrically well	With dementia
Community health and social care	37.4	35.2
Residential care	9.7	15.5
Nursing home care	5.2	144.6
Outpatients	390.8	487.3
General Practitioner	38.7	48.3
Readmission	19.8	24.7