

Better outcomes, lower costs

Implications for health and social care budgets of investment in housing adaptations, improvements and equipment: a review of the evidence

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A report of research carried out by the School for Policy Studies, University of Bristol on behalf of the Office for Disability Issues, Department for Work and Pensions

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Glossary

A&E	Accident and Emergency Department of Hospital
ADL	Activities of Daily Living (washing, dressing, cooking, eating, going to bed, etc.)
DCLG	Department for Communities and Local Government (formerly, in part, ODPM)
DTI	Department for Trade and Industry
HASS	The Home Accident Surveillance System, with Leisure Accident Surveillance System (LASS), kept by DTI
ODI	Office for Disability Issues, located within the Department of Work and Pensions
ODPM	(Until May 2006) Office of the Deputy Prime Minister
RCT	Randomised Controlled Trial
RRAP	Rapid Response Adaptations Programme run by Care and Repair Cymru
RPI	Retail Price Index (one way of establishing current equivalent of past monetary values)

Summary

With the current demographic changes in society, any policy with the power to reduce the costs of health and social care for older and disabled people and enable resources to serve more people must be of interest to Government. If the policy also produces improved quality of life outcomes, it will be all the more welcome.

The Audit Commission and other bodies have asserted that increased investment in housing adaptations and equipment would bring significant savings to the National Health Service and to social services budgets, but funding and structures, compounded by the lack of clear evidence, have created barriers to such investment.

To tackle one part of this problem, this report has gathered the evidence together through a search of the international literature, in the disciplines of medicine, housing studies, ageing studies, economics, health-economics and occupational therapy, and through use of case studies from the grey literature.

The evidence is not complete, and more work is needed to disaggregate the 'multi-factorial interventions' that are known to be effective but not fully understood. Despite this, there are already findings that the provision of housing adaptations and equipment for disabled people produce savings to health and social care budgets in four major ways.

1 Saving by reducing or removing completely an existing outlay.

The two key savings under this heading are the cost of residential care and the cost of intensive home-care, both major expenses to social services budgets.

Saving the cost of residential care

For a seriously disabled wheelchair user, the cost of residential care is £700-£800 a week - £400,000 in 10 years. The provision of adaptation and equipment that enables someone to move out of a residential placement produces direct savings, normally within the first year. Home modifications can also help to prevent or defer entry into residential care for older people. In this case, one year's delay will save £26,000 per person, less the cost of the adaptation (average £6,000).

Examples from the review include the following:

- In a London borough, two wheelchair users (both the victims of accidents) were able, after the adaptation of suitable properties, to leave residential care that had been costing the local authority a total of £72,800 per year. This will achieve savings of over £30,000 per year for each of them after the first year. 1-2 similar cases per housing authority would produce savings in England of £10 million a year, growing incrementally each year.
- For a 30 year old man in an Italian study, savings in residential care costs of £1.6 million over an assumed life-expectancy of 20 years were projected as the result of investment in home modifications.
- A social services authority, by spending £37,000 on equipment, was able to achieve savings of £4,900 per week in respect of residential care for ten people.¹ The outlay was recouped in less than 8 weeks.

¹ The expenditure was for 183 people, but the residential care issue related to only ten. It was not possible to disaggregate the information.

Reducing the cost of home-care

An hour's home care per day costs £5,000 a year. At a national level, because of the large numbers and burden of revenue payments, the potential for savings is again in £millions:

- Adaptations that remove or reduce the need for daily visits pay for themselves in a time-span ranging from a few months to three years and then produce annual savings. In the cases reviewed, annual savings varied from £1,200 to £29,000 a year.
- Significant savings in home care cost are mainly found in relation to younger (including younger old) disabled people. Adaptations for older people will not routinely produce savings in home-care costs, because 83 per cent of those waiting for adaptations receive no homecare, whilst others are so frail that adaptations will not remove the need for care. In these cases, savings are still to be found but through the prevention of accidents or deferring admission to residential care, and in improved quality of life.

2 Saving through prevention of an outlay that would otherwise have been incurred.

Savings under this heading include the prevention of accidents with their associated costs, prevention of admission to hospital or to residential care and prevention of the need for other medical treatment. There was evidence of savings of all these kinds.

Prevention of hip-fractures

- Falls leading to hip fracture are a major problem internationally. In the UK in 2000 they cost £726 million. Housing adaptations, including better lighting, reduce the number of falls.
- There is a 30% increased risk of fracture of the hip for older women if they are suffering from depression. There is evidence that the most consistent health outcome of housing interventions is improved mental health. Findings on the impact of adaptations include 70% increased feelings of safety and an increase of 6.2 points in SF 36 scores for mental health.
- Visual impairment leads directly to 90,000 falls per year in England

and Wales at a cost of £130 million. The chances of hip-fracture for those with poor depth perception is 6 times the norm. Poor quality lighting in the homes of older people puts them at greatly increased risk. Swedish research indicates large savings to be made through improvements to housing and suitable equipment for people with visual impairment.

- People fall whilst waiting for adaptations, which are frequently delayed by lack of funding. The average cost to the State of a fractured hip is £28,665. This is 4.7 times the average cost of a major housing adaptation (£6,000) and 100 times the cost of fitting hand and grab rails to prevent falls.

Prevention of other health costs

- The lack of timely provision of equipment and adaptations for disabled people leads to costly physical health problems. Effects of non-provision include contractures, pressure sores, ulcers, infections, burns and pain. Interventions of adaptation and equipment are highly effective in preventing these physical health problems. Measured effects in international studies include 50% reduction in pain and 100% reduction in burns.
- The provision of adaptations and equipment can save money by speeding hospital discharge. It can also prevent admission to hospital by preventing accident and illness. The estimated saving from the Welsh Care and Repair agencies' Rapid Response Programme is between £4million and £40million.
- The Audit Commission in three successive reports has stressed the effectiveness and value of investment in equipment and adaptation to prevent unnecessary and wasteful health costs.

Prevention of health care costs for carers

- For parent care-givers without adaptations and equipment there is a 90% chance of musculoskeletal damage; falls leading to hospitalisation, and stress caused through inadequate space. When suitable adaptation/equipment is supplied there is improvement to physical and mental health of the carers.

Prevention of admission to residential care

- Adaptations give support to carers. By preventing back injuries and reducing stress, they lessen the costs to the health service. Carers in turn, if they are well supported, will save the costs of residential care.

3 Saving through prevention of waste

Waste is money spent with no useful outcome. There is evidence that much of the waste in regard to adaptations comes from under-funding that causes delay, or the supply of inadequate solutions that are ineffective or psychologically unacceptable.

- Delay was leading to more costly options. One person received 4.5 additional home-care hours a week for 32 weeks, at a total cost of £1,440, when a door-widening adaptation costing £300 was delayed for 7 months for lack of funding.
- Where there is delay in supplying equipment or adaptations, the assessment may be out of date and the item too small or no longer suitable. People of all ages develop habits of dependency when they have no choice, which are then hard to break.
- One local authority spent £89,000 in one year on adaptations for applicants who, because of long delays, died before they could obtain any real benefit from them.
- The waste is also a waste of human potential. Both housing adaptations and assistive technology have helped people into employment who would otherwise not have achieved this.
- The Audit Commission pointed out that funding levels for disabled facilities grants in 1998 were sufficient for just one in 26 eligible households.² As with the later reports on equipment, there is a clear message that increased investment would save waste and be better value for money.

² Audit Commission (1998).

4 Saving through achieving better outcomes for the same expenditure

- Adaptations produce improved quality of life for 90 per cent of recipients and also improve the quality of life of carers and of other family members.
- If, for the same money, a disabled person may have a carer come every day in to lift them on and off a commode and help them to wash, or may choose an automatic toilet and level access shower to use whenever they please, they will normally choose the solution that offers more dignity and autonomy.
- The average cost of a disabled facilities grant (£6000) pays for a stair-lift and level-access shower, a common package for older applicants. These items will last at least 5 years. The same expenditure would be enough to purchase the average home care package (6.5 hours per week) for just one year and three months.
- There is substantial evidence that for the average older applicant, an adaptation package will pay for itself within the life-expectancy of the person concerned and will produce better value for money in terms of improved outcomes for the applicant.

Conclusion

The Audit Commission in its report 'Fully Equipped' wrote of the clinical effectiveness of equipment in achieving good outcomes,

'If a drug was discovered with a similar cost-profile, it would be hailed as the wonder-drug of the age'³

The evidence concerning adaptations and improvements is not dissimilar. Not all adaptations save money. But where they are an alternative to residential care, or prevent hip fractures or speed hospital discharge; where they relieve the burden of carers or improve the mental health of a whole household, they will save money, sometimes on a massive scale.

³ Audit Commission 2000, p64.

1 Introduction

Professionals working in the field of housing for disabled and older people have long been convinced that housing adaptations and related improvements and equipment have the power to transform lives. Outcomes that have been repeatedly observed include improved mental health, improved quality of life, reduced fear of accidents, and the prevention or deferral of admission to residential care.

These benefits are experienced by individuals but they also have serious implications for the good use of public money. The Audit Commission in its report, 'Fully Equipped', speaking of the clinical effectiveness of equipment, wrote: 'If a drug was discovered with a similar cost-profile, it would be hailed as the wonder-drug of the age' (Audit Commission, 2000:64). Adaptations advocates similarly believe that capital investment in adaptations will lead to significant savings in health and social care revenue budgets. There is considerable frustration at seeing what appears to be needless waste incurred each year, as money is spent on apparently more expensive and less satisfactory solutions simply because it is available for those and not available for investment in adaptations.

It is in these circumstances that the ODI has commissioned a review, to bring together what international research evidence there is concerning the cost benefits of housing adaptations, improvement and equipment. From the outset it was expected that there would be gaps in the evidence and this has proved to be the case. Some aspects of the topic have much better evidence than others. In some areas, not enough work of the right type and quality has yet been done and researchers are still developing methodologies appropriate to the subject. This review will show what is already demonstrated and what is not. This having been said, there is some evidence already that is compelling, and will be of direct concern to those charged with the wise and efficient use of public money.

To understand why investing in adaptations and equipment makes sound

economic sense requires precision of thought and a rigorous attention to the details of the evidence. Sometimes cause and effect are not directly connected but there is a chain reaction of events. Sometimes (as in the case of preventing falls), different pieces of evidence have to be assembled and joined together, to understand how installing a shower in the bathroom may prevent a fall in the living room.

But before making the economic case for investment, we need to be very clear what the case is not, and also clear that there are aspects of this question where evidence has not been adequately collected. Truthfulness in these matters is necessary so that the powerful evidence of savings in other areas is not undermined. This is particularly important in relation to saving the cost of domiciliary care, as discussed in Chapter 5. There are savings to be made, but for many cases the route is through support to informal carers so that residential care is avoided, not because of direct cuts in the cost of home care. The cost of home care (on-costs apart) may be paid by the service user and not be a direct charge to the public purse. Also some older people, faced with the charges made, choose simply to struggle on without help, so providing adaptations in these cases will not produce a cash saving.

Bathing adaptations are the most commonly sought items by older people, and it is necessary to recognise that with the minimal home care most older people receive, the cost of a shower will take a long time to recover. This is not the full story. Bathing adaptations may prevent accidents or infections and save money that way. But the argument that the cost of quite expensive adaptations for older people will be offset by reduced outlay on home-care is one that often does not add up. This equation looks quite different when seriously disabled people, receiving many hours of home care are considered. It is also different once residential care or hospital admission are the alternative options. It is important to be clear about the difference.

Scale of problem

In England in 2003-4, the English Survey of Housing revealed that, of the total of 1.4 million people in England with 'a serious medical condition or disability', there are some 315,000 whose accommodation is not suitable for them. This includes nearly one on five of those wheelchair users who need adapted accommodation (ODPM 2006). These figures reflect, in part, the dramatic changes in policy which have led to the closure of long stay hospitals and residential establishments in favour of people being supported in their homes. This is a policy which has wide support, but it also has implications about how resources ought to have shifted.

For all these people, living in unsuitable housing without the adaptations or equipment they need, life is less than it could be. Independent Living means having the same choices and opportunities as all other citizens, but this is not possible if the circumstances of home present constant barriers and discomfort, or excessive dependence on other people, whether family members or professional carers. In many cases these problems could be solved by a greater investment in adaptations and equipment. The right adaptations, given in thorough consultation with the recipients, will transform the quality of life of those concerned. Good equipment and technology can have the same effect. But the problem goes beyond the individuals, because failure to provide what is needed at home may lead to greater costs to the community, in terms of provision of health and social care.

In the 2005 report, 'Improving the Life Chances of Disabled People', it was stated: 'There are many examples where expenditure by one government or local authority department means less expenditure for another department, yet this is not recognised. This results in insufficient incentive to spend money from one budget in order to decrease expenditure from another' (Cabinet Office 2005, p73).

The literature review here presented addresses the question of evidence. What savings to health and social care budgets and what better outcomes for the same expenditure follow from investment in adaptations and equipment? And if the evidence seems good, what actions should responsibly follow?

2 Methodology and definitions

Methodology

Two approaches to discovering evidence were used in this research.

- 1 A thorough search of appropriate databases including ISI Web of Knowledge, ASSIA, Sociological Abstracts, Medline, Dissertation Abstracts and SIGLE

(this search of databases was the principal method)

Details of the search strategy are given in Annex 1.

- 2 As a supplement, a request to Principal Occupational Therapists in English, Welsh and Northern Ireland social services authorities for any local gathering of evidence on this topic that they may have undertaken, material that would not necessarily be picked up by a literature search.

Although there are other professionals who may have gathered this kind of evidence, and other sources of unpublished literature, Occupational Therapy departments were the most likely to have sought such evidence. Information was sought through a request in Occupational Therapy News and a letter sent by post and e-mail to principal occupational therapists via Directors of Social Services.

This produced not only some important reports and case-studies but also suggestions of other sources from occupational therapists.

Definitions: please read this!

Definitions are important in this field because the same terms may be used so differently by different researchers that the results can be very misleading if the reader is not aware of the pitfalls.

Assistive technology

An international literature search produces problems of language and definitions. The most important as far as this search is concerned is the varied use of the term, 'Assistive technology'. In the UK this term tends to be limited to the new wave of electronic technology. In the United States, however, and consequently in much of the international English-language literature, the definition is much broader. It is:

'any item, piece of equipment or product system, whether acquired commercially off the shelf, modified or customised, that is used to increase the functional capabilities of individuals with disabilities.'

(Technology Related Assistance for Individuals with Disabilities Act, 1988, Public Laws 103-218)

This definition includes wheelchairs, computer equipment and vehicle modifications as well as home modifications (adaptations) and all kinds of electronic devices. Some British researchers (notably Tinker, Lansley and McCreadie) have adopted this broad definition in their work, but it is not yet widespread. We will therefore use 'assistive technology' to refer specifically to electronic devices, and will refer separately to 'adaptations' (fixed alterations to the home) and 'equipment' (portable items).

Cost benefits

The concept of cost-benefit is an idea from the discipline of economics, and is not limited to cash transactions. The definitions below from HM Treasury's Green Book have been borne in mind in compiling this review, although each individual research article is likely to take a slightly different stance on precise definitions.

- Cost-Effectiveness Analysis: Analysis that compares the costs of alternative ways of producing the same or similar outputs.
- Cost Benefit Analysis: Analysis which quantifies in monetary terms as many of the costs and benefits of a proposal as feasible, including items for which the market does not provide a satisfactory measure of economic value (HM Treasury, 2003, glossary).

Saving

In looking for evidence of savings to health and social care budgets, we are conscious that there are different kinds of saving relevant in different circumstances.

- An existing outlay is no longer needed or is reduced.
- An outlay that would otherwise have been incurred is prevented.
- Waste (money spent with no useful outcome) is prevented.
- Better outcomes are achieved for the same expenditure.

A summary of the savings under these four headings is given at the front of the report, and a shorter one at the end.

How the evidence in the literature is presented in this report

Chapters 3-9 of this report will present the evidence we have discovered in the literature, under the following headings:

- Savings through falls prevention (Chapter 3).
- Other health-care cost savings (Chapter 4).
- Savings in home-care (Chapter 5).
- Saving the costs of residential care (Chapter 6).
- Better Quality of Life for same expenditure (Chapter 7).
- Saving the health of carers (Chapter 8).
- Preventing waste (Chapter 9).

Where it is justified by the volume or complexity of evidence, there will be subdivisions reflecting aspects of the evidence. Under each sub-heading the sources of evidence are presented alphabetically by author, with any case-study evidence submitted specifically for this review at the end. Assessment of research quality will be briefly summarised but in each case will have taken into account:

- Transparency of methodology.
- Quality of sampling.
- Objectivity of approach.
- Reasonableness of assumptions.
- Reliability of findings and
- Financial soundness and accuracy and
- Wherever the study is from another country, the transferability of the findings.

3 Savings through falls prevention

Fractured hips (and, to a lesser extent, other fractures) cause pain and misery to those who suffer them, death to some and, according to a report for the Department of Trade and Industry (see Parrott below) cost £726 million a year in the United Kingdom. Falls in the home are a common cause of these fractures and falls prevention an issue of concern to the State. What is not so simple is to know the causes of these harmful falls, or what interventions are actually effective. The literature did not contain single articles that covered every aspect. Instead there is a trail to follow of separate pieces of evidence under the following main headings:

- Problems of evidence on falls prevention.
- The costs of falls to health and social care services.
- The causes of falls leading to hip fractures.
- Effectiveness and cost/benefits of interventions to reduce falls.

Under some of these headings, moreover, are additional sub-headings. Thus within the section on the causes of falls is evidence that both depression and anti-depressant drugs may cause falls. But there is also evidence that lack of adaptations or badly adapted housing may themselves cause depression in someone who is disabled. It is therefore possible that adaptations that reduce depression, even when not directly aimed at preventing falls, may nevertheless reduce the risk of falling. The evidence suggests a chain reaction of one cause leading to another that is more complex than just someone tripping on a loose rug or someone else doing exercises and improving their balance. It is only by putting the pieces of evidence together (even though some pieces are missing) that it is possible to see what role adaptations and equipment can play

in preventing falls and so reducing costs.

The problems of evidence on falls prevention

Allen, T (2003)

Positive action on falls: a peer education approach. Evaluation report. Bradford, Department of Social Sciences and Humanities.

An evaluation of a programme to reduce falls by peer education (which was designed to lead to other actions including installation of rails etc where desired).

Key points:

- Need to define a fall (not so easy when investigated).
- Evidence that 90% of falls not requiring medical treatment are not reported or recorded. Evidence from older people of fear of consequences if fall admitted. Fear of being forced into residential care or otherwise losing independence.

Quality of evidence: Peer-reviewed journal. Good, qualitative evaluation with input from older people that is crucial to understanding any of the large studies that depend at least in part on self-reported falls.

Swift, C. (2001)

'Falls in late life and their consequences – implementing effective services'
' British Medical Journal volume 322, 7 April, 855-857.

Not primary research but refers to evidence of Keene et al (1993) BMJ and Calder et al (1996) BMJ concerning 'widespread failure to certify femoral fracture as a cause of death).

Quality of evidence: Peer-reviewed journal. Good quality and again important as raising queries about the foundations on which some larger studies rest.

Heaton, J. and Bamford, C. (2001)

'Assessing the outcomes of equipment and adaptations: issues and ap-

proaches.' British Journal of Occupational Therapy. Jul; 64(7): 346-56.

Raises a number of important issues about outcome measures, including point that interventions where there are progressive conditions may not achieve improvements but perhaps only a slower rate of deterioration.

Emphasises the importance of judging user involvement and satisfaction when measuring outcomes.

Quality of evidence: Peer-reviewed journal. Is a review of the issues and approaches used in assessing outcomes. Useful collecting together of other studies.

[Tinetti, M., and Speechley, M \(1989\)](#)

'Prevention of falls among the elderly'. New England Journal of Medicine vol. 320 No. 16 pp1055-1059. United States

Stresses importance of involving older people in the assessment and the need for great sensitivity in finding solutions. Point here is that an 'on paper' solution included in a large trial may not be appropriately prescribed and may therefore be ineffective.

Quality of evidence: Peer-reviewed journal, Good.

The costs of falls to health and social care services

Autier, P., Haentjens, P et al. (2000)

'Costs Induced by Hip Fractures: a Prospective Controlled Study in Belgium.' *Osteoporosis International* 11(5): 373-380. Belgium

This study assessed the direct medical costs induced by hip fractures during and after hospitalization. Hospital costs of 170 consecutive Belgian women with hip fracture were gathered. During the year following discharge, all medical costs were collected for the 159 women who survived the acute hospitalization stay. A similar collection of data was performed on a comparison group of 159 age- and residence-matched women without a history of hip fracture. The mean cost of the acute hospital stay was €8,667, and the mean 1-year hip-fracture-related extra costs after hospitalization was €6,636. During the year following the acute hospital stay, 19% of the hip fracture women and 4% of the comparison women were newly admitted to nursing homes. Although health care costs in general increased with age, hip-fracture-related extra costs after hospitalization seemed similar in those below or above 81 years old. These extra costs amounted to €7,710 in women not living in nursing homes at the time of fracture, and to €3,479 in women who lived in nursing homes. Health or mental status before hip fracture seemed not to affect extra costs. In conclusion, taking into account both the cost of acute hospital stays and subsequent medical care, the extra medical costs that resulted from hip fracture during one year from the time of the fracture amounted to a mean €15,151 (£10,210) (from Journal abstract).

Quality of evidence: Careful study in specialist peer-reviewed journal.

Audit Commission (2000)

Fully equipped: the provision of equipment to older or disabled people by the NHS and social services in England and Wales. London, Audit Commission.

In 1999 there were 190,000 A&E attendances resulting from falls by people with a visual impairment. The associated costs to hospitals was £270 million. 89% of the falls and the majority of costs related to people aged 75 and over. Nearly one half (90,000) happened as direct result of visual impairment (cost £130 million).

Quality of evidence: This is not systematic research, but is based on front-line information and contributes an powerful overview of the general lack of investment in prevention of unnecessary ill-health as well as informative examples.

Chang, J., Morton, S., Rubenstein, L., Mojica, W., Maglione, M., Suttorp, M., Roth, E. and Shekelle, P. (2004)

'Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials.' *British Medical Journal*. 328(7441):680, Mar 20. United States

In the United States in 1994 the total cost of fall injuries was around \$20.2bn and is projected to reach \$32.4bn (in 1994 US dollars) by 2020.

Quality of evidence: Peer-reviewed journal: Good quality systematic review.

Pasco, J., Sanders, M. et al. (2005)

'The Human Cost of Fracture.' *Osteoporosis International* 16(12): 2046-2052. Australia

This study documented the personal burden of fracture, and the use of community and health services during the 12-month period following a fracture. Participants were 598 women (aged 35-92 years) with incident fracture in the years 1994-1996 who were enrolled in the Geelong Osteoporosis Study. Almost all hip fracture cases and 27% of non-hip fracture cases were hospitalized. Adaptations to homes were carried out in 14% of cases, and 32% of the women purchased or hired equipment to assist with activities of daily living. Three-quarters of women with hip, pelvis, or lower limb fractures were confined to the home, had to walk with a walking aid, or could walk only short distances for several weeks. After a year, nearly one-half had not regained pre-fracture mobility. One-seventh of women with upper-limb fractures did not venture outside the home for at least 6 weeks. Nearly half of all fracture cases needed help with personal care and housework during the first 6 weeks. After 6 months, 3.4% of all patients and 19.6% of hip, 12.8% of humeral, and 4.7% of spine fracture patients required assistance with bathing and showering. After a year, more than half of the hip fracture cases remained restricted, regarding housework, gardening, and transport. A fracture, regardless of site, had a major impact on a woman's lifestyle and well-being. Most women were restricted in their activities of daily living and suffered loss of confidence and independence. Short-term morbidity was common for all fractures, with varying degrees of prolonged morbidity often extending

to at least a year post-fracture (from Journal abstract).

Quality of evidence: Peer-reviewed journal. High quality, large scale observational study and detailed collection of evidence to enable a fuller costing of fractures.

[Parrott, S. \(2000\)](#)

The Economic Cost of Hip Fracture in the UK. York, University of York.

The paper was commissioned by Health Promotion England on behalf of the Department of Trade and Industry from Steve Parrott, Research Fellow, Centre for Health Economics, University of York.

The author takes into account hospital costs, ambulance costs, social care-costs, GP costs, outpatient costs and travel costs to outpatients. The total estimated cost to UK society as calculated in 2000 was £726 million, of which £236 million was health-care related and £490 million social care.

The average cost of a single hip-fracture was £25,424 at year 2000 prices (£28,665 in 2005 using RPI).

Quality of evidence: Assumptions and methods are transparent. Totals are based on average hospital stay of 20 days and a figure of 30,856 patients (a figure which excludes those who die as the result of the fracture).

[Plautz, B, Beck, D, Selmar, C. and Radetsky, M \(1996\)](#)

'Modifying the environment: a community-based injury-reduction programme for elderly residents' American Journal of Preventative Medicine. Research Linkages Between Academia and Public Health Practice, 1996 is a supplement to American Journal of Preventative Medicine, 12 (4) pp 33-38. United States_

Fall related trauma accounts for over 5% of hospitalisations and hospital charges amongst people aged 65 and over (reference for this is Rice, D, et al (1989) 'Cost of injury to the United States: a Report to Congress'). The aggregate lifetime cost of fall-related injuries among elderly people occurring annually in the US has been estimated at 9.8 billion dollars (source Rice et al. 1989).

\$9.8 IN 1989 would be \$15.4 (RPI) in 2005, but it is not clear whether Plautz had already updated the figure to a 1996 figure: if so, the increase from 1996 to 2005 would be to \$12.2 billion dollars rather than \$15.4billion.

Quality of evidence: Peer-reviewed journal. This particular part of the evidence is sourced directly from Rice et al. (1989). Quality of primary evidence in study high. See details below under 'Effectiveness of interventions to reduce falls.'

Rice, D, MacKenzie, E et al (1989)

Cost of injury to the United States: a Report to Congress. San Francisco. Institute for Health and Aging, University of California and Injury Prevention Centre, The Johns Hopkins University. United States

Summary indicates that falls cause second biggest lifetime economic losses in US (\$37.3 billion) The biggest losses are from accidents involving motor vehicles (\$48.7 bn). Productivity losses greater from injury than from other leading eventual causes of death. Injury causes 36 life years lost per death compared with 12 years from heart disease and stroke and 16 years from cancer. The lifetime economic costs reflect direct cost of treatment and rehabilitation of patients injured in 1985 and indirect costs from loss of earnings and premature death.

Quality of evidence: Cited in Plautz et al 1989. Summary only seen. Likely to be high quality because of provenance, but not possible to judge directly as full text not seen.

Scuffham, P., Chaplin, S. and Legood, R. (2003)

'Incidence and costs of unintentional falls in older people in the United Kingdom.' *Journal of Epidemiology and Community Health* 57 740-744.

In 1999 in the UK there were 647,721 A&E attendances and 204,424 admissions to hospital for fall-related injuries to people aged 60 years and over. The total cost to the UK government from falls in those aged 60 and over was £981 million. 59% of this cost was incurred by the NHS and the remainder by the Personal Social Services, for long term care. Figures in this report are based on a combination of use of epidemiological data from databases- The Home Accident Surveillance System (HASS) and Leisure Accident Surveillance system (LASS) (kept by DTI), which record mode of arrival at A&E, cause of the accident, injury sustained and 'deployment' (eg 'referred to GP for follow up'); and also use of the Hospital Episodes Statistics. Findings were based on database of 10,000 records of falls cases selected from the HASS/LASS database and scaled up from the 18 sentinel A&E departments to achieve the UK figures.

Quality of evidence: Peer-reviewed journal. Good, but with certain weaknesses that are inherent in this kind of research. Dependent on quality of evidence behind it and on assumptions made. Authors point out that the quality of evidence on the causes of falls in HASS is limited.

Assumptions made include decision to choose 6 months as duration of long term institutional care following a fall, and estimate of numbers of follow up visits to GPs – no data on these points being available. But sensitivity analysis is given for these items, (Table 8, p743).

Swift, C. (2001)

'Falls in late life and their consequences – implementing effective services' British Medical Journal volume 322, 7 April, 855-857. Last in a series of 4 articles, series editor, Ian Philp.

'Patients over 75 admitted after an accident (most often a fall) occupy a bed for an average of 18 days (DTI 1999). In the community, serious handicap or disability often lasts for several months or longer after a fall (Campbell et al 1990). If the rate of increase in the annual incidence of hip fractures in England and Wales seen in the early 1990s (then accounting for a quarter of all orthopaedic bed-occupancy) continues, the annual incidence would rise by 60% to 96,000 by 2031. (Armstrong and Wallace, 1994) In economic terms this translates to 1.6 million extra bed days and £507 m in direct hospital costs (Hollingworth et al, 1995).

Particularly useful point in this article is perhaps author pointing out unreliability of death certificates to capture full toll of deaths from fractures.

Quality of evidence: Peer-reviewed journal. Not primary research. Useful summary of some evidence, but 3 out of the 4 pieces cited in support of his proposals about falls in the UK (refs2-5) relate to the United States.

Tsuji, I., Kuwahara, A. Nishino, Y., Ohkubo, T., Sasaki, A. and Hisamichi, S. (1999)

'Medical Cost for Disability: a Longitudinal Observation of National Health Insurance Beneficiaries in Japan.' Journal of the American Geriatrics Society 47(4): 470-476. Japan

Solid cost evidence from Japan, not specifically of costs of falls but showing that there is a direct link between levels of disability (not being able to care for self) and high health costs. Link is that falls causing fracture lead to disability, which leads to high health-care costs. Medical costs for those with limitations in performing self care increased by 4 times in men and 3 times in women compared to those who were not limited in this way.

Quality of evidence: Peer-reviewed journal. Authors point out that sources of information for this kind of costing are particularly reliable in Japan, as all costs come from the records of the insurance companies and are

based on invoices they pay. Not immediately transferable but still useful as an indicator.

The causes of falls leading to hip fractures

Audit Commission (2002)

Fully equipped: assisting independence Audit commission update , June 2002. London, Audit Commission

Chances of hip-fracture are between 1.5 and 2.4 times greater for those with reduced visual acuity. The chance of hip fracture for those with poor depth perception is 6.0 times greater than the norm (citing Ivers, R, Norton, R., Cumming, R. Butler M and Campbell, A (2000) 'Visual impairment and the risk of hip fracture' American Journal of Epidemiology 152, 633-639).

Quality of evidence: This is not systematic research, but is based on front-line information from external auditors and contributes a powerful overview of the general lack of investment in prevention of unnecessary ill-health.

Cornillon, E., Blanchon, M., Ramboatsisetraina, P., Braize, C. et al (2002)

'Effectiveness of falls prevention strategies for elderly subjects who live in the community with performance assessment of physical activities (before and after)' Annales de Readaptation et de Medecine Physique 45.9: 493-504 (November).

Suggests that improved balance achieved as the result of exercise programmes does not reduce the number of falls.

(This is interesting evidence as so many of the studies imply that exercise is effective without giving very convincing evidence).

Quality of evidence: Original not seen. Peer-reviewed journal, cited in Allen 2003.

Cullinan, T, Silver, J, Gould, E and Irvine, D (1979)

'Visual disability and home lighting' The Lancet ,March pp642-644.

Discovered by home visits that standard of lighting in homes of people (average age 76) attending a low-vision clinic was 1/10 the lighting level in hospital. Passages and stairs were even more poorly lit. People were effectively rendered 'blind' by this level of lighting.

Quality of evidence: Peer-reviewed journal, Based on study of 56 people. Outside the search time parameters of 10 years but important and does not seem to have been replaced. Is important when linked to the Audit Commission (2002) information above.

Health and Safety Rating System ODPM (now DCLG) (2003)

Statistical Evidence to Support the Housing Health and Safety Rating System: Volume I – Project Report. London, ODPM.

Contains guidance on the probability of harm associated with particular housing design features, taken in conjunction with type of user. Enables an estimate of risk and therefore enables cost benefit of interventions to prevent risk.

Quality: based on as much information about the incidence and outcomes of accidents as it is currently possible to obtain through HASS and HES and other databases such as those kept by the Fire Service.

Quality of evidence: Very important. Thorough, long term gathering of information on risks. Is limited at present, as authors explain, by incomplete and insufficiently detailed record keeping of the databases it has to rely on concerning location, causes and outcomes of accidents in the home. Not strong on psychological or mental health contributions to risk.

Ruchinkas, R. (2003)

'Clinical prediction of falls in the elderly' American Journal of Physical Medicine and Rehabilitation 82.4: 273-8 (April) Concludes prediction of falls based on clinical assessment very uncertain. Major predictors were presence of a neurological condition (eg depression) and a previous history of falls.

Quality of evidence: Peer-reviewed journal, cited in Allen 2003; Original not seen.

Tinetti, and Speechley, M. (1989)

'Prevention of falls among the elderly'. New England Journal of Medicine vol. 320 No. 16 pp1055-1059 United States

Gives facts and incidence of falls in US and thoughtful review of causes.

Quality of evidence: Peer-reviewed journal, high quality albeit with strong medical focus.

Wanless, D (2004)

Securing good health for the whole population: Final report London HM Treasury/HMSO

'...it is recognised that poor housing conditions can increase the risk of falls'

(Chapter 4, paragraph 4.108)

Quality of evidence: The report is a review and assembly of wide range of available evidence, although the sources for this statement on housing conditions and falls are not explicit. The report is a follow-up to the 2002 Wanless report to Government on long term public health planning. This second report is focused on prevention and cost effectiveness in the use of health resources. It is significant that he speaks of the continuing 'very poor information base' for public health and preventative interventions and the need for better information. Recommends the use for public health of an approach closely akin to that of the National Institute for Clinical Excellence (NICE) (see under 'Effectiveness of Interventions..', below)

Whooley, M., Kip, K., Cauley, J., Ensrud, K., Nevitt, M, and Browner, W. (1999)

'Depression, falls and risk of fracture in older women.' Arch Intern Med 159 Mar 8 pp484-490. United States

Concludes that after adjustment for potential confounding variables, there is a 30% increased risk of fracture of the rib, hip, foot and ankle (but not wrist, humerus or other) in older people with depression, especially those suffering from sense of worthlessness, rather than just those lacking energy. Concludes that effective treatment for depression could reduce falls (but not drug therapies that themselves increase the risk of falling).

Quality of evidence: Peer-reviewed journal. Research is based on a large (7414 participants) long term (6 year) RCT study of white women aged over 65 in the United States.

Effectiveness and costs of interventions to reduce falls

Brandis, S. and Tuite, A. (2001)

'Falls prevention: partnering occupational therapy and general practitioners.' *Australian Health Review*. 24(1):37-42. Australia

'The Falls STOP project was a partnership between general practitioners (GPs) and occupational therapists with the common goal to reduce accidental falls in the elderly. A home visiting service was implemented that included the organisation of home modifications, education on falls prevention strategies and referral to other community services. The pilot demonstrated some valuable benefits to sixty-eight clients referred to the program by twenty GPs. A number of resources were developed such as a falls risk questionnaire completed by patients while waiting to see the doctor, and a falls prevention educational booklet. A significant challenge for future preventative programs is rousing the interest of a larger group of referring doctors, and promoting the benefits of shared care arrangements with occupational therapists that target specific health issues such as falls in the elderly.'

Outcome was a reduction in falls from 47% (23 out of 49) in 6 months before the intervention to 8% (4 out of 49) in same period after intervention.

Quality of evidence: Peer-reviewed journal. Good but numbers too small to be statistically reliable.

[Chang, J., Morton, S., Rubenstein, L., Mojica, W., Maglione, M., Suttorp, M., Roth, E. and Shekelle, P. \(2004\)](#)

'Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials.' *British Medical Journal*. 328(7441):680, Mar 20.

Shows multi-factorial and exercise interventions most effective.

Quality of evidence: Peer-reviewed journal. Is a systematic review and meta-analysis of 40 RCTs, but still may rest on shaky foundations in regard to the basic issues about measuring falls raised by Allen (2003).

[Healthy Communities Collaborative Pilot \(c 2003\)](#)

Reducing falls in older people_Brief report on website of National Institute for Clinical Excellence (NICE). www.nice.org.uk

Programme originally in remit of Health Development Agency (HDA),

now incorporated, with National Primary Care Development Team, into Improvement Foundation under the aegis of NICE. This website account reports a 32% reduction in falls for people over 65 achieved in one year in 3 PCT pilot areas: Easington, Gateshead and Northampton. Wanless (2004) - see below- cites these findings and gives details of the housing adaptations that (along with exercises, foot-care and eye tests) were part of the programme.

Quality of evidence: This one page report does not offer any chance to judge the quality of the evidence. Nor have I been able to track down a more substantive report. A press release from the HDA dated 24.09.2003 describes the same programme but gives a figure of a 60% reduction in falls after 9 months of the pilots. It also gives more details of the housing part of the interventions, including the fitting in one pilot area of a light plugged into a socket in the home that automatically lights up at dusk. A search on the title 'Reducing Falls in Older People' produces a 'Signpost' paper from the Healthcare Commission dated 2006. This describes the National Falls Collaborative that arose from large number of bids for the Healthy Communities Collaborative Pilot and says 20 sites are now collaborating on successful interventions to reduce falls. The National Collaborating Centre for Nursing and Supportive care (NCC-NSC) were commissioned by NICE to develop guidelines for prevention of falls. The recommendations, based on evidence up to 2003, are given below under NICE (2004). They stress the value of multi-factorial interventions, including home hazard assessment and intervention.

[Mann, W. C., K. J. Ottenbacher, et al. \(1999\)](#)

'Effectiveness of Assistive Technology and Environmental Interventions in Maintaining Independence and Reducing Home Care Costs for the Frail Elderly - a Randomized Controlled Trial.' *Archives of Family Medicine* 8(3): 210-217. United States

Concluded that for an average intervention of \$2,620 spent on adaptations and equipment for the treatment group, compared with \$443 for the control group, the spending on institutional care for the control group was \$21,846 versus \$5630 for the treatment group. Serious falls accounted for 4 hospitalisations in the treatment group and 11 in the control group.

Quality of evidence: Peer-reviewed journal. This study was based on 104 people divided into control and intervention groups. The statistical analysis for such small numbers is therefore a little open to question as to reliability. The reviewer contacted Professor Mann with a query about the evidence (because the control and intervention groups seem not well matched), but the answer did not quite address the problem.

Darzins and Smith published a critique of this work in a later edition of the same journal saying that its findings were not very reliable because blinding of outcome assessment was not maintained.

National Institute for Clinical Excellence (NICE) (2004)

Falls: The assessment and prevention of falls in older people. London, NICE

(Summarised in the NICE Clinical Guideline 21(2004) of same title)

The evidence-based approaches most emphasised in this report are multi-factorial falls risk assessment (including assessment of home hazards, visual impairment, and fear of falling) and multi-factorial interventions, including action to tackle home hazards and reduce fear of falling.

The multi-factorial interventions recommended include as four common key elements:

- strength and balance training;
- home hazard assessment and intervention;
- vision assessment and referral;
- medication review with modification/ withdrawal.

The evidence on things found not to be effective in specifically preventing falls include group (rather than personally tailored) exercise programmes and the use of hip-protectors. The report says 'home hazard assessment is shown to be effective only in conjunction with follow-up and intervention, not in isolation' (p10). (In other words, advice is not much use without action) and that referral for correction of visual impairment is similarly not effective as a single intervention.

Quality of evidence: There will have been a rigorous consideration of evidence, albeit from a medical perspective that may have overlooked some other kinds of evidence.

Nikolaus, T and Bach, M (2003)

'Preventing falls in community-dwelling frail older people using a home intervention team', *Journal of the American Geriatric Society*, 51: 300-305. Germany

The study concerned 360 older people (mean age 81.5), all with some functional decline, especially in mobility, who had been temporarily in-patients in hospital. At the point of discharge a random division into two groups was made. The control group were provided with comprehensive geriatric assessment (CGA) and recommendations in the hospital, followed by usual care at home. This included the provision of rollators (wheeled walking frames) to those who needed them. The intervention group also had a CGA, but in addition received a diagnostic home visit from a specialist Home Intervention Team. The HIT workers assessed the home for environmental hazards and gave advice about possible changes, help in obtaining home modifications and training in the use of technical and mobility aids. Both groups were phoned monthly and asked to report any falls they had had.

Results: After one year the intervention group had had 31% fewer falls than the control group although 23.4% had two or more falls in this year compared with 20.2% of the control group and the number of falls resulting in fracture was 3 in the control group, 4 in the intervention group. The effect of intervention was most evident for those 108 people who had reported two or more falls in the year before the study began. In these cases 65.5% of the 55 in the control group had two or more falls after discharge, compared with 39.6% of the 53 in the intervention group. The conclusion was that the interventions were effective in reducing the number of falls for those who were already most at risk. The study measured how many people used the modifications with which they were supplied, and found that the use of shower seats, grab rails and emergency call systems were all over 78% whilst use of walking frames and raised toilet seats was around 55%.

Quality of evidence: Peer-reviewed journal. Extremely thorough but evidence is quite equivocal. There is a problem in that the control group are (for ethical reasons) not left wholly without equipment and also reliance

on self-reporting of falls.

Plautz, B, Beck, D, Selmar, C. and Radetsky, M (1996)

'Modifying the environment: a community-based injury-reduction programme for elderly residents' American Journal of Preventative Medicine. Research Linkages Between Academia and Public Health Practice, 1996 is a supplement to American Journal of Preventative Medicine. 12 (4) pp 33-38. United States

Small but really important study because focused entirely on home modification and its effect in preventing falls and other accidents, especially burns and scalds. (There was also intervention by a pharmacist to modify drug use for 30 of the sample but this was controlled for in the analysis re the home modifications).

Final sample of 141 in San Francisco, aged 60+ if had had one fall but including all over 75 whether had fallen or not. Fall defined as ending up on floor.

Did 6 month data collection before intervention, then intervention including installing adaptations (costs included) then 6 month data collection afterwards.

Conclusion was that the modest home modification interventions had significant effect in reducing accidents when all other factors were controlled for.

59 falls (25%) pre intervention; 26 falls (9%) after intervention.

16 burns/scalds pre-intervention; none afterwards.

Quality of evidence: Peer-reviewed journal. Used standardized instruments to measure wide range of demographic and other characteristics; (ADL, IADL, Geriatric Depression Scale, Modified Mini-mental State Examination). Medication histories were established. All instruments were translated for use with Spanish speaking participants. Weaknesses as described by authors. Not a randomized clinical trial because this was not acceptable to the representatives of senior citizens' centres who were co-operating in the project; therefore no control group. Recruitment

dependent on judgment of outreach workers. Intervention limited to what could be carried out by crews from training programme for youth: (grab bars made up 50% of the interventions). No major adaptations. Not a blind intervention (this would not be possible); only self recorded falls (may have been desire to please and bias against reporting); no data about circumstances or medical consequences or costs of falls.

Note Fear of falls pre-intervention 66%; very fearful of falls, 45%. No post intervention figure for fear of falling.

Commission for Social Care Inspection (2006)

Supporting people –promoting independence: Lessons from inspections. London, CSI

A report concerned with the whole range of Supporting People services and with only a small part devoted to needs of older people, despite the fact that, as the report says, they constitute the largest group of Supporting People service users. Gives one example relevant to hospital discharge. Describes how Derby City Council was tackling delayed hospital discharges by arranging a community alarm installation and a support package for older people on the day of their discharge. The provision of community alarms had been extended to all tenures. There was an effective multi-agency partnership between housing, social services, a registered social landlord and local NHS services that resulted in the development of an intensive rehabilitation service operating in a sheltered housing scheme. These measures had helped the council to reduce the incidence of falls and hypothermia amongst people over the age of 75 years and had resulted in fewer people being admitted inappropriately to residential or nursing home care.

Quality of evidence: This case example is not quantified and as with most reports of inspections, it is not possible to weigh the evidence independently. It is reasonable to assume that, to the best of their abilities, the inspectors have checked the validity of the information.

Gillespie, L., Gillespie, W., Gillespie L, Gillespie W, Robertson M, Lamb S, Cumming R, Rowe B. (2003)

'Interventions for preventing falls in elderly people' (Cochrane Review). The Cochrane Database of Systematic Reviews 2003, Issue 4. Art. No.: CD000340. DOI:10.1002/14651858.CD000340

'Interventions to prevent falls in elderly people can be effective. Approximately 30 per cent of people over 65 years and living in the community fall each year; the number is higher in institutions.

A fifth of incidents require medical attention. Multidisciplinary interventions targeting multiple risk factors are effective in reducing the incidence of falls, as is muscle strengthening combined with balance retraining, individually prescribed at home by a trained health professional. Tai Chi may also be effective. Home hazard assessment and modification by a health professional may reduce falls, especially in those with a history of falling. Cardiac pacing for fallers with cardio-inhibitory carotid sinus hypersensitivity is likely to be beneficial, as is withdrawal of psychotropic medication. Individually tailored interventions delivered by a health professional are more effective than standard or group delivered programmes.

Quality of evidence: It is difficult to argue with a Cochrane Review, except for the possibility of an over-medicalised and over physical approach in the studies reviewed, that therefore may miss some additional evidence. It is also interesting that a Randomised Control Trial by Wolf et al, published in the Journal of the American Geriatrics Society in 2003 found that Tai Chi did not reduce the risk of falling in older people' (from abstract).

Wanless, D (2004)

Securing good health for the whole population: Final report London HM Treasury/HMSO.

Cites a case study example of an effective intervention: The Healthy Communities Collaborative pilot (HCCP) piloted in three PCTs from September 2002. Neighbourhood teams were made up predominantly of local people, supported by professionals. The actions they took included installation of grab-rails and stair rails, improved lighting and non-slip mats as well as exercise classes, better foot care and domiciliary eye-tests. Evaluation after 6 months demonstrated a 32 per cent reduction in

falls in older people across the 3 PCT sites. See also entry under Healthy Communities Collaborative pilot.

Quality of evidence: This is a review and assembly of a wide range of available evidence, although the sources for this statement are not explicit. The report is a follow-up to the 2002 Wanless report to Government on long term public health planning. This second report is focused on prevention and cost effectiveness in the use of health resources. It is significant that he speaks of the continuing 'very poor information base' for public health and preventative interventions and the need for better information. Recommends the use for public health of an approach closely akin to that of the National Institute for Clinical Excellence (NICE).

Summary of Chapter 3

- The annual cost of hip-fractures in the UK in 2000 was £726 million (six times the central Government expenditure in England on all Disabled Facilities Grants).
- Evidence concerning the exact location and causal circumstances of individual falls in the home is still rudimentary. Numbers of falls and of deaths caused by falls are likely to be underestimated.
- The prediction of falls through clinical assessment is uncertain. Better predictors are the presence of a neurological condition such as depression, and a previous history of falling. Falls prevention

interventions for older people are most effective where falls have already occurred, but there is evidence from older people that most falls are not reported, for fear of the consequences.

- There is a 30% increased risk of fracture of the hip for older women if they are suffering from depression.
- Older people who are unable to take a bath or shower or are confined and lacking in autonomy through lack of housing adaptations report that this causes depression. After adaptations they record improved mental well being and quality of life.
- Visual Impairment leads directly to 90,000 falls per year in England and Wales, mostly in people over 75, at a cost of £130 million. The chances of hip-fracture for those with poor depth perception is 6 times the norm. The very poor quality of lighting in the homes of older people puts them at greatly increased risk.
- The current consensus on interventions to prevent the falls that lead to fractures is that individually-tailored, multi-factorial approaches are the most effective. The four key factors are individualised strength and balance training; home hazard assessment and intervention; vision assessment and intervention and a medication review with resultant modification/withdrawal. A trial of such a multi-disciplinary intervention across three PCTs from 2002 produced a 32% reduction in falls in 6 months.
- The NICE and Cochrane reviews that reached these conclusions considered adaptations only as a means of reducing hazards. They did not include evidence on the ability of 'enabling' adaptations to reduce depression. This evidence therefore needs to be added.
- The average cost to the State of a fractured hip is £28,665. This is 4.7 times the average cost of a major housing adaptation (£6,000) and 100 times the cost of fitting hand and grab rails to prevent falls.

4 Other health-care cost savings

Important as falls prevention is, there are other extremely significant areas of health care affected by adaptations. These include the mental health of large numbers of older and disabled people and their families; the reduction of pain and the physical health of carers. This section contains evidence that unsuitable housing causes mental and physical ill health and that adaptations and equipment play both a preventative and a therapeutic role. The cost implications of this have not yet been as well researched as other aspects.

Evidence that unadapted housing causes mental and physical ill-health

Ayyangar, R.(2002)

'Health maintenance and management in childhood disability.' *Physical Medicine and Rehabilitation Clinics of North America*. Nov; 13(4): 793-821. United States

Although focused on children and young people, this article is relevant to disabled people of all ages because it gives a comprehensive summary of the health consequences of unsuitable equipment and spells out the risks of contractures, pressure sores, ulcers and infection that follow from lack of timely provision of correctly prescribed equipment. The article again also emphasises the serious and long-term effects on mental health when disabled people are left without control or autonomy in their environment.

Quality of evidence: Is a valuable, comprehensive overview, written

by a paediatrician, of the factors affecting the health and well-being of disabled children and young people. Draws on extensive knowledge of the literature. Peer reviewed journal.

[Bonney, X et al \(22 names from 9 EU countries\) \(2004\)](#)

Review of evidence on housing and health: Background document prepared for fourth Ministerial Conference on Environment and Health, Budapest, WHO, Europe.

Found that research on housing accessibility and official statistics on such issues are scarce, but that there is evidence that most older people are affected by access problems in their homes and that the magnitude of the problem increases with age.

Review found that poor accessibility in the home is related to dependence in activities of daily living; low subjective well being (Iwarsson and Isaacsson 1998); poor perceived health, and poor psychological well being. (Oswald et al 2004; Tomson et al 2004) Evidence from Sweden, Germany and Latvia respectively.

Quality of evidence: This broad-ranging housing-health review was carried out through the LARES project (Large Analysis and Review of European housing and health Statistics) of the World Health Organisation, Europe. It was based on a review of the literature and surveys in eight European cities. It was made specifically because of an awareness of limitations of evidence, particularly evidence relating to the impact of poor housing conditions on mental health.

Evidence of the preventative and a therapeutic role of adaptations and related services in mental and physical health

[Adams, S. \(2006\)](#)

Small things matter: the key role of handyperson services. Nottingham, Care and Repair England.

Key point of this study is evidence that as far as older people are concerned, the existence of a reliable handyperson service willing to undertake a range of small jobs in the home when and if they are needed may be of great importance to their mental well-being - possibly more important even than having major works carried out. The evidence concerns peace of mind and relief of stress experienced, as serious concerns about how they would get a small job done at all, whether they could afford it and whether they could trust the person doing it are removed by the presence of a trustworthy service.

Author warns of the danger, in the absence of adequate funding for Home Improvement Agencies; of them losing sight of this core function under pressure to enter into service level agreements concerning hospital discharge or falls.

Quality of evidence: An important think piece based on in-depth qualitative evidence from agencies and older people.

[Adams, J & Grisbrooke, J \(1998\)](#)

'The use of level access showers 12 months after installation' British Journal of Therapy and Rehabilitation, 5 (10): 504-10

Study found that benefits to health included generally greater safety following installation of grab rails, less breathlessness, temporary relief from arthritic pain and a lightening of mood, the effect of 'freshening up'. But found some respondents felt less safe in shower from dangers of slipping.

Quality of evidence: Peer reviewed journal. Qualitative retrospective study, small-scale (11 cases) but meticulous.

[Allen, T \(2005b\)](#)

'Private sector housing improvement in the UK and the chronically ill: implications for collaborative working' Housing Studies 20 [1]: 63-80.

This was an evaluation of a project to address the housing problems of people (60 per cent under 65) with chronic heart conditions, through a programme of improvement and disabled facilities grants, with the focus on improving heating and security and adapting bathrooms. The outcome was a significant improvement in the mental health of the residents (average increase of 6.2 points on the SF36 scale).

Quality of evidence: Peer reviewed journal. Good. The sample size was small (32), as dictated by the size of the improvement programme, but the researcher used the accredited tools SF36 and the HADS anxiety and depression scale to measure changes, so that the findings are robust.

Audit Commission (2002)

Fully equipped: assisting independence Audit Commission update, June 2002. London, Audit Commission

This was an update of the Audit Commission's 2000 study of equipment where they investigated the supply of five services, including specialist seating and community equipment. After this study, many reports from external auditors of local NHS and social service providers of equipment were received, and the Audit Commission used them, together with other new research, to create the new report.

The theme of the report is that investment in equipment would indeed reduce health costs besides producing better outcomes for many patients, but that under-investment or a lack of imaginative thinking was preventing these benefits. Of the prevention of the need for amputation following diabetes, they said:

'Auditors found no evidence of commissioners considering how investment in therapy or equipment could reduce the long-term incidence of surgery' (p14)

Auditor found a trust where £100,000 was needed to buy pressure-relieving equipment to remove backlog (ten week waiting list), while in the previous year 456 bed days had been lost because of patients waiting for this equipment. This investment would have paid for itself and saved further money on treating pressure sores (p15)

Discusses reduced provision of services, including adaptations, as eligibility criteria have become tighter and tighter. 70 per cent of those surveyed

reported reductions in help provided with bathing and toileting. Authors point out how this will have health cost consequences as hygiene is vital to controlling infection and pressure sores. States that such short term thinking in cutting prevention strategies is likely to lead to far higher costs elsewhere (p21).

'Equipment services could play a vital part in strategies to optimise capacity, prevent unnecessary admission to hospital and facilitate prompt discharge of patients. However, a real leap of faith is needed to spend hard cash now in anticipation of these future benefits' (p15)

Quality of evidence: This is not systematic research, but is based on front-line information and contributes an powerful overview of the general lack of investment in prevention of unnecessary ill-health as well as informative examples.

[Ayyangar, R.\(2002\)](#)

'Health maintenance and management in childhood disability.' *Physical Medicine and Rehabilitation Clinics of North America*. Nov; 13(4): 793-821.

Describes prevention of sores, ulcers and the complications that follow, and greatly improved mental state following the provision of empowering equipment and technology.

Quality of evidence: Peer reviewed journal. Is a powerful pulling together of evidence from an extensive review of the literature.

[Baldwin M \(2003\)](#)

Learning from experience: occupational therapy service housing adaptations: survey report. London, Royal Borough of Kingston-upon-Thames Social Services (cited in Awang 2004, not viewed directly).

38 out of 54 (70%) respondents reported that adaptations made them feel safer from risk of accidents.

Quality of evidence: Small-scale but sound. Retrospective postal questionnaire survey of recipients of major adaptations in one local authority: 63% response rate.

[Care and Repair Cymru \(2006\)](#)

Rapid response adaptations report 2006. (October 2002 – March 2005) www.careandrepair.org.uk/dld/1278

This is a report concerned with Care and Repair Cymru's Rapid Response Adaptations Programme (RRAP). The Welsh home improvement agencies have a unified policy, and £2,381,222 funding from the Welsh Assembly to carry out work costing not more than £350 pounds per person to enable someone to be discharged from hospital or to make them safer and so prevent admissions. Published statistics⁴ show that the average time that an older person stays in hospital, where there has been a fall or a critical incident is more than 14 days. Where this is through a need for repairs or adaptation, the average stay can be reduced dramatically through the use of the RRAP. The average number of days in which a RRAP job can be undertaken, based on the reporting period is 6.2 days. The author then goes on to calculate that if for every client (16,580) one week in hospital is being saved, either through prevention or quicker discharge, the savings to the Health Service amount to £41,316,856. (number of clients, times seven bed days each, minus the cost of the work).

Quality of evidence: In terms of data about the agencies, the jobs they do and their costs this is excellent. The rationale behind the cost savings claim is that this is not about just ordinary jobs but is a rapid response programme that is supposed to be always about prevention or discharge. Where people would be discharged anyway, even though work needs doing, the agencies honourably record the work as preventative rather than as aiding discharge.

As for the calculation on costs, the author provides their own critique:

'Clearly, it could be argued that our figures are highly simplistic; however, even if 10 per cent of cases resulted in facilitating quicker Hospital Discharge, this would be £4 million. Health professionals would argue that housing/adaptation intervention is not the priority determinant in Delayed Transfer of Care; also that the link between housing and health has not been proved. We have always taken the latter point as (a) 'common sense' given, in terms of falls prevention and the ability to go home. The "£41 million figure" is a headline illustration to draw attention to the health and housing connection and the benefits of the RRAP.'

Clemson L and Martin, R. (1996)

Usage and effectiveness of rails, bathing and toilet aids. *Occupational Therapy in Health Care* 10 (1) 41-51. Australia

⁴ A Statistical Focus on Older People in Wales 2004 edition, National Office of Statistics.

Research was a detailed evaluation of all aspects of minor adaptations. Found that the installation of rails led to reduced pain in 50 per cent of cases.

Quality of evidence: High quality research in peer-reviewed journal. Study based on 144 responses (response rate of 63% of which 49% usable) to a postal questionnaire sent to random stratified sample. Found high internal consistency in responses.

[Hakim, E., Bakheit, A. \(1998\)](#)

'A study of the factors which influence the length of hospital stay of stroke patients', *Clinical Rehabilitation*. 12(2):151-6, April.

On a study of 38 stroke patients in two hospitals in Southampton, researchers found that the two factors that best predicted an unnecessarily long stay in hospital were delay in provision of equipment and adaptations for patients to return home or difficulty in finding suitable residential places. The average length of stay for those where provision of equipment and adaptations was adequate was 60.2 days whilst where it was not adequate the average stay was 89.5 days. This suggests lack of adaptations were costing an extra 29 days of hospital care. (£6,409 at 2005 unit costs for a stroke patient bed-day of £221).

Quality of evidence: Peer reviewed journal and sound, but there is a problem in using the study because in 2006 the average length of stay in hospital for stroke patients is already down to 28 days. (Curtis, L. and Netten, A. (2005) *Unit Costs of Health and Social Care*).

[Heywood, F \(2001\)](#)

Money well spent: the effectiveness and value of housing adaptations. Bristol, Policy Press

In a retrospective postal questionnaire survey of randomly selected recipients of minor adaptations in 6 local authorities in England and Wales, 77 per cent of the 162 respondents said that the minor adaptations had had a good effect on their health, one person recorded a bad effect and the remaining 22 per cent that there had been 'no effect'. 62 per cent said additionally that one consequence of the adaptation was that of 'feeling safer from the risk of accidents'. In the same publication, qualitative interviews with 104 recipients of major adaptations revealed health improvements related especially to increased warmth, reduced pain and restored independence. There was widespread improvement in mental health and well-being expressed (except where adaptations had not met needs).

Quality of evidence: Random stratified sample, with response rate of 54%, for the postal questionnaire. Accepting the limitations of a postal questionnaire, and of self-reported health status, in both the postal questionnaire and the interviews on major adaptations this is valid evidence.

Plautz, B, Beck, D, Selmar, C. and Radetsky, M (1996)

'Modifying the environment: a community-based injury-reduction programme for elderly residents' American Journal of Preventative Medicine. Research Linkages Between Academia and Public Health Practice, 1996 is a supplement to American Journal of Preventative Medicine, 12 (4) pp 33-38. United States

Small but really important study because focused entirely on home modification and its effect in preventing falls and other accidents, especially burns and scalds. Final sample of 141 in San Francisco, aged 60+ if had had one fall but including all over 75 whether had fallen or not. Did 6 month data collection before intervention, then intervention including installing adaptations (costs included) then 6 month data collection afterwards.

Found 16 burns/scalds pre-intervention; none afterwards.

Quality of evidence: Peer Reviewed Journal: transparent methodology. For ethical reasons not an RCT. See more detail above under 'Effectiveness of interventions to reduce falls.'

The Sustainable Procurement Task Force (c.2005)

National Action Plan: Procuring the Future (publication details hard to establish: extracts below from web-site but not well labelled).

The Sustainable Procurement Task Force was established in May 2005,

charged with drawing up an action plan to bring about a step-change in sustainable public procurement so that the UK is among the leaders in the EU by 2009. The recommendations it makes include the following:

'There are other dimensions to this issue which are less straightforward:

- discretionary investment in non-departmental priority areas, which nonetheless are good value for money and offer the department a reasonable payback
- commodity purchasing where the benefits lie in delivering wider government benefits, not necessarily directly benefiting the purchasing department
- capital projects which need to be managed in ways that improve risk management, open up opportunities for innovation and maximise the potential benefit of the spend.

One example is where a local authority spends money to keep people out of hospital, saving money for the local primary care trust. Again, Treasury rules allow budgetary transfer but it does not happen in practice, so the renewed Green Book guidance must focus on what actually happens in practice and interpretation of the rules, rather than the rules themselves.'

(Chapter 2, p 32)

Quality of evidence: This is not a research document, but is based in the thinking and experience of those people from business and industry charged with thinking about sensible procurement by publicly funded bodies.

Thomson, H., Petticrew, M. and Morrison, D. (2002)

Housing improvement and health gain: a summary and systematic review
Glasgow, MRC Social and Public Health Sciences Unit.

Systematic review of published evidence on housing health links over

previous 100 years. Although the authors generally conclude that housing improvements can improve residents' health, their most solid findings relate to mental health. Eight out of the nine studies that met their criteria showed a gain in mental health after housing improvements. It should be borne in mind that in some of the old studies covered (eg from the 1930s), improvements led to a doubling of rent levels and consequent anxiety, hunger and ill-health.⁵

Quality of evidence: Although this is a systematic review, it excludes much evidence by restricting itself to randomised controlled trials, whilst its inclusion of the studies from a different era mean the conclusions must be used with caution in the modern context.

Evidence of cost savings to health and social care from adaptations that improve mental and physical health.

These many areas of health gain have not received the attention in terms of costing that has been given to the costing of falls prevention. There is a common sense assumption that where health is improved and ill health prevented, demands on primary care and hospital health care will reduce, but it has not been systematically measured and costed in relation to the different aspects.

[Audit Commission \(2002\)](#)

Fully equipped: assisting independence: Audit Commission update, June 2002. London, Audit Commission:

'Auditor found a trust where £100,000 was needed to buy pres-

⁵ Heywood's (2001) study into the effectiveness of major adaptations specifically asked service users whether the adaptations had increased their costs (consumption of electricity; service charges for lifts). The cost of lift servicing was a serious issue for some people, and one had stopped the contract but was faced with the anxiety of what they would do when the lift broke down. Just one person spoke of 'huge electricity bills since heater put in bathroom'. But in general there were either no increased costs or they were considered negligible.

sure-relieving equipment [for use in the community] to remove backlog (ten week waiting list), while in the previous year 456 bed days had been lost because of patients waiting for this equipment. This investment would have paid for itself and saved further money on treating pressure sores' (p15).

Quality of evidence: Not systematic research, but is based on front-line information from external auditors of equipment services.

Care and Repair Cymru (2006)

Rapid response adaptations report 2006. (October 2002 – March 2005)
www.careandrepair.org.uk/dld/1278

Evidence on savings to hospital costs through prevention or swifter discharge relate to all critical incidents, not just falls. Estimate is that maximum of £350 spent on adaptations for a single client saves an average 6.5 days of hospital care.

Quality of evidence: See above in first section of this chapter for detailed discussion. Figure for costs of intervention is actual maximum; number of days saved is more a hypothesis, deliberately designed as a challenge for policy makers to consider.

Hakim, E., Bakheit, A. (1998)

'A study of the factors which influence the length of hospital stay of stroke patients', *Clinical Rehabilitation*. 12(2):151-6, April.

This suggests lack of adaptations were costing an extra 29 days of hospital care (£6,409 at 2005 unit costs for a stroke patient bed-day of £221).

Quality of evidence: Peer reviewed journal and sound, but there is a problem in using the study because in 2006 the average length of stay in hospital for stroke patients is already down to 28 days. (Curtis, L. and Netten A. (2005) *Unit Costs of Health and Social Care*).

Summary of Chapter 4

- The lack of timely provision of equipment and adaptations leads to costly long-term physical health problems for disabled people. Effects of non-provision include contractures, pressure sores, ulcers,

infections, burns and pain.

- Interventions of adaptation and equipment are highly effective in preventing these physical health problems. Measured effects include 50% reduction in pain and 100% reduction in burns.
- Poor accessibility in the home leads consistently to a growth in mental ill- health (LARES project of the World Health Organisation in Europe).
- Conversely, the most consistent health outcome of housing interventions in small studies and in systematic reviews is improved mental health. Findings include 70% increased feelings of safety and an increase of 6.2 points in SF 36 scores for mental health.
- The very existence of a handyperson service can relieve anxiety in older householders and help maintain them in their homes.
- Figures on non-fall health and social care savings from equipment have not been systematically collected, and this needs to be done.
- Rapid response adaptation/ equipment supplies of £350 that prevent a hospital stay of one week produce savings of £2,490 per person. In Wales, where this service has over 16,000 clients a year, the total savings produced are estimated to be between £4 million and £40 million.
- The Audit Commission has stressed the urgency and value of investment in equipment and adaptation to prevent unnecessary and wasteful health costs.

5 Savings in home-care

This section of the review considers the extent to which adaptations and equipment reduce the need for domiciliary social care paid from public funds. There is some powerful evidence about this, relating especially to younger people receiving intensive support packages, but such evidence will not be heard if the clutter of unsubstantiated claims is not first removed. For it is not the case that every adaptation for an older person immediately reduces the social services home-care bill. Most applicants for adaptations are not receiving home care (Audit Commission 1998), or are receiving so little that savings would take a long time to accrue. Those that are may be so frail that adaptations may improve quality of life or ease the task of the professional carers, but will probably not remove the need for a visit. And indeed, when loneliness is such a common problem, writers are questioning the desirability of removing this human contact. There are key savings to be made in respect of the majority of older clients but they are chiefly to do with supporting carers and so preventing or postponing residential care. This evidence will be covered in Chapter 6.

The first section of this chapter will therefore present the evidence about the limitations of direct savings of this kind, and include the very careful work of Lansley et al. which suggests break-even as more common in respect of older people's adaptations than 'savings'. This evidence becomes important in Chapter 7 which brings into the equation the factor of improved outcomes for expenditure.

The second section of this chapter contains evidence of the kinds of case where large savings in home care costs are indeed achieved.

Evidence that every-day adaptations will not necessar-

ily produce direct savings in home care

Adams, J & Grisbrooke, J (1998)

'The use of level access showers 12 months after installation' *British Journal of Therapy and Rehabilitation*, 5 (10): 504-10.

'While this study suggests that informal carers benefited from the showers, no firm conclusion can be drawn as to whether level access showers prove cost effective in reducing the need for formal care' (p509).

Quality of evidence: Qualitative retrospective study, small-scale (11 cases) but meticulous. No claims made for generalisability of findings.

Brownsell, S., Bradley, D., Bragg, R. Catling, P. and Carlier, J. (2001)

'An attributable cost model for a telecare system using advanced community alarms.' *Journal of Telemedicine & Telecare*. 7(2):63-72.

These researchers compare the costs of advanced community alarms (£500-£1000 each) with conventional alarms costing £175. They conclude that it would take 10 years to recoup an investment in these advance AT items. They still argue that the investment would eventually be worthwhile especially in reducing need for hospitalisation. Cite evidence from Roush et al (1988) about how ordinary community alarms reduce the length of hospital stays.

Quality of evidence: Careful and thorough research. Cost modelling using data from Birmingham City Council.

Agree, E., Freedman, V., Cornman, J., Wolf, D. and Marcotte, J. (2005)

Reconsidering substitution in long-term care: when does assistive

technology take the place of personal care? *Journals of Gerontology Series B-Psychological Sciences & Social Sciences*. 60(5):S272-80. United States

An analysis of 1994-95 Supplement on Disability to the United States National Health Intervention Survey. Found that the impact of home modifications/assistive technology shown in this survey was more to reduce the burden on carers (both professional and informal) than to reduce directly the costs of care for older disabled people.

Quality of evidence: Conscientious secondary analysis of large database in peer-reviewed journal. Value of findings are limited, as authors point out, by problems of definitions and no means of judging quality of the technology supplied. Validity also reduced by reliance on 10 year old database in a rapidly developing field and by different funding systems in the United States. But a useful reminder of the need to consider that cost savings in regard to social care for older people specifically may be more about making care sustainable (and so preventing residential care costs) than about reducing direct social care costs.

Evidence of a break-even position

Lansley, P., McCreadie, C. and Tinker, A. (2004)

'Can adapting the homes of older people and providing assistive technology pay its way?' *Age and Ageing* 33(6) 571-576.

This EPSRC funded study relating to social rented housing was carried out by a multidisciplinary team including surveyors, builders, rehabilitation engineers, economists and an occupational therapist. It was a modelling exercise, but based on the most accurate information possible. An audit of 82 different dwellings enabled the team to model costs for typical adaptations that took into account both building types and levels of impairment and their progression over time, and to model the social care costs for a range of likely tenants with and without the adaptation. Costs were discounted using Treasury investment appraisal guidelines adjusted to take account of both normal life expectancy and reduced life expectancy that might result from the user's impairment. The model was realistic about numbers of older people receiving informal care or formal care. In-depth interviews with older people added information about preferences and quality of life issues. Its findings include important information about how much the cost of adaptation varies according to the design of the original property. Sheltered bungalows, for example

were expensive to adapt because of their very small space standards.

The key finding of the research is that in most cases the initial investment in adaptations and equipment, including AT, is recouped through subsequently lower care costs within the average life expectancy of a user, including reduced life expectancy where relevant. When a package of best practice (and more expensive) adaptations and equipment are supplied, costs will still be recouped within normal life expectancy but only about half the best practice adaptation packages will recoup their costs within the reduced life expectancy likely for recipients whose impairments are caused by conditions likely to shorten their lives. Conclusion: Appropriately selected adaptations and AT can make a significant contribution to the provision of living environments which facilitate independence. They can both substitute for traditional formal care services and supplement these services in a cost-effective way.

Quality of evidence: High, but sensitive, as the authors point out, to a number of assumptions. The assumptions about levels of social care provision actually being made may be optimistic. Peer-reviewed journal.

[Watson, S. and Crowther, L. \(2005\)](#)

Was it worth it? Study into the effectiveness of major adaptations. Nottingham, Nottingham City Council.

This survey carried out with recipients of major adaptations in Nottingham showed how those who had received adaptations felt the work had increased their independence, including in some cases the ability to manage their home without any or with considerably less help.

Quality of evidence: reputable research by local authority professionals but not costed and not clear whether the help is formal (and so money saving) or informal (and so part of an economic cost-saving but of a more complex kind).

Evidence of direct savings in home-care achieved through adaptation

[Andrich, R., Ferrario, M. and Moi, M. \(1998\)](#)

'A Model of Cost-Outcome Analysis for Assistive Technology.' *Disability and Rehabilitation* 20(1): 1-24. Italy

This is one of the most important of the studies found. It was carried out in 1994-96, in Italy, as part of the CERTAIN⁶ research within the European Union programme 'Technology Initiative for Disabled and Elderly' (TIDE).

It was a retrospective study on cost, effectiveness and utility resulting from the implementation of a programme of adaptations, equipment and assistive technology with a sample of persons who had adopted the use of these items before the start of the research. Seven intensely detailed case-studies were carried out. The sample was selected to include different pathologies (stable or progressive), impairments, ages, types of adaptation and equipment and social environment. Contains an acute analysis of the problem of measuring the cost-benefit or cost-effectiveness of adaptations/equipment/AT because outcomes are so much to do with improved quality of life. Also points out the need to measure impacts and cost consequences, not just on disabled individual but on whole household.

Results: Study found that intensive investment in adaptations and equipment/technology led to both improvements in quality of life and substantial savings, due to the reduction in assistance needed.

Case study one: Man with cerebral palsy, wholly dependent on his family. Received, over a three year period, step-lifts, power-adjusted seating systems, adapted bathroom, hoists for personal transfer, computer-based writing and environmental control system.

⁶ CERTAIN: Cost Effective Rehabilitation Technology through Appropriate Indicators. A European project based in Linköping University, Sweden from 1994-96 'to develop a methodology for evaluation of cost-effectiveness and cost-utility of rehabilitation technologies and to evaluate the methodology'.

'The cost analysis performed over a 10-year time span found that savings of €157,142 (c£106,000) were achieved, mainly through reducing the need for personal assistance.'

For a man with Multiple Sclerosis (different from case-study one because it is a deteriorating condition where items supplied became obsolete more quickly), savings over ten years, again mainly due to reduced burden of assistance, were €169,866.

For a woman of 78 in a residential home, whereas a prosthesis that was supplied after leg amputation was not successful and was abandoned, investment in bathroom adaptations produced a saving in the cost of assistance of €8,816 even though she died within three years.

This study was based on real costs, including, where relevant, the labour of unpaid family members. 'Real costs yield the real interest for this study, being the basis for any efficiency analysis.' The SIVA cost analysis instrument was used.

Social care costs whether by family members or professionals were rated at three different levels depending on the level of skill required. Records were also kept of expenditure, reflecting the observed flow of money. The method of cost-outcome analysis suitable for application to the provision of 'assistive technology' (adaptations, equipment and AT) was developed under the auspices by the Italian Ministry of Health.

The authors of the study raise crucial methodological issues, not just about measuring economic costs and looking beyond the individual to the family, but also about the unsuitability of health-based ability assessment tools that make no distinction between a person who cannot walk and is immobile and a person who cannot walk but has been supplied with an electric wheelchair and accessible housing and can go where they want. They introduce new tools that are appropriate for disabled people.

Quality of evidence: Very high quality paper in peer-reviewed journal, based on intensive detailed case studies and suitably varied sample to cover range of circumstances. Is an economic analysis (looking at costs) rather than simply financial (looking only at expenditure).

[Audit Commission \(1998\)](#)

Home Alone: the role of housing in community care. London, Audit Commission.

The Audit Commission found that a year's delay in providing adaptations

cost as much as £4000 (£4584 at 2004 prices) in domiciliary care costs that would be unnecessary if the adaptations were installed. (17 per cent of applicants in the fieldwork were receiving care at home).

Quality of evidence: Report based on fieldwork by Audit Commission staff in 19 local authorities in England and Wales. Research methods included questionnaire surveys of local authorities and supported housing providers, interviews, document reviews, sampling of case files and focus groups. Mainly qualitative, but some quantified evidence is produced - for example on delay and on the costed examples. (see also entry in Chapter 9: Preventing waste 'waste through delay'). The lack of detailed quantification makes it not possible to judge how many clients waiting for adaptations received care that would be reduced by adaptations. The fact that 83 per cent of those waiting were not receiving any professional care is important information in considering the nature of savings to be made in respect of older people.

Carton, H., Loos, R., Pacolet, J., Versieck, K. and Vlietinck, R. (1998)

'Utilisation and cost of professional care and assistance according to disability of patients with multiple sclerosis in Flanders (Belgium)' *Journal of Neurology, Neurosurgery & Psychiatry*. 64(4):444-50, Apr. Belgium

Based on detailed data-collection in respect of 184 patients with multiple sclerosis, divided into four levels of severity of the illness using the Kurtzke scale, adapted. The research recorded the patients' utilisation of services and calculated the direct health and social care costs to society. Found that patients with multiple sclerosis account for about 0.1 of the total population in Flanders and use approximately 1% of the total healthcare budget. Gives specific evidence on the different costs to society in respect of social care depending on where the individual is living.

- For patients at level 3 of impairment, the cost of social care for those living in sheltered housing was six times higher than the costs for those living in their own home with care from their family. (€126 per month compared with €746 (that is £84 compared with £497) at 1998 prices [table 3, exchange rate included in table].
- For patients at level 4 of impairment, the costs of sheltered housing care were 20 times higher than costs for those living at home.

€108 compared with €1,910 (£72 compared with £1,273 - 1998 prices).

Annual costs for the most severely impaired patients (Level 4) depending on where they lived were €20,991 at home; €25,760 in a nursing home; €42,777 in sheltered housing and €47,961 in an SPN (rehabilitation) institute. These costs include, for those living at home, the annual costs of housing adaptations, which were €324 for the level 4 patients and €678 for those at level 3.

Costs of equipment, including wheelchairs were also included. For level 4, these were €743 at home and €441 in sheltered housing. For level 3 the figures were €356 at home and €497 in sheltered housing.

Thus, for an annual outlay of €1,034 (£689) on equipment and adaptations for patients at level three of impairment in 1998, the state was saving €4,769 (£3,179) per year compared with the cheapest form of residential care and €26,970 (£17,980) per year compared with the cost of a specialist rehabilitation institute.

The study clearly demonstrates the financial savings to the State when a person remains at home and care comes from unpaid family members.

Quality of evidence: A high quality study in peer-reviewed journal based on real evidence collected through diary-keeping and the evidence of charges, invoices and bills, rather than modelling. Not dependant on participants' ability to recall. Sample was good with combined refusal and drop-out figure of only 14 from original sample of 198.

Major difficulty for the UK context is the need to pay close attention to differences of structures of provision and any problems of translation of terms between countries.

[Eklund, K., Sonn, U. et al \[\(2005\)\]](#)

'A cost-effectiveness analysis of a health education programme for elderly persons with age-related macular degeneration: a longitudinal study.' *Disability and Rehabilitation*. 27(20): 1203-12. Sweden

Research in Sweden concerning a health education programme for older people with age-related macular degeneration. Participation in

the programme led to the supply of significantly more Assistive Devices (equipment) than were supplied to the control group. Cost per head was 4596 Swedish kroner for the programme group compared with 3593 for the control group (£438 v £342). But what followed from this provision were large savings in the amount of home care, informal care and residential care needed. The researchers conclude that the annual saving to the Swedish government of investment in the programme for one year's cohort of people with macular degeneration would be somewhere between 6.8 and 17 million Swedish kroner (£650,000 - £1.6 million for a population of people over 75 of 66,900).

Savings would to some extent be cumulative year on year.

Quality of evidence: Thorough research in peer-reviewed journal. Size of sample (131 at end of 28 months) not large enough, as authors point out, for statistically significant findings but reasonable in terms of taking findings seriously.

Pasco, J. A., K. M. Sanders, et al. (2005).

'The Human Cost of Fracture.' *Osteoporosis International* 16(12) 2046-2052. Australia (see also Chapter 3 under 'The costs of falls').

Gives factual information on the increased need for home help that results from fracture. Nearly half of all fracture cases needed help with personal care and housework during the first 6 weeks. After 6 months, 3.4% of all patients and 19.6% of hip, 12.8% of humeral, and 4.7% of spine fracture patients required assistance with bathing and showering. Detail on whether help was professional or unpaid is not given, but reasonable to assume that for most people living alone it would probably have to be professional.

Quality of evidence: Peer-reviewed journal. High quality, large scale (n =598) observational study and detailed collection of evidence to enable a fuller costing of fractures.

Material supplied by Occupational Therapists and managers of occupational therapy services in response to request for information relevant to this review.

Northern authority

Written report of case study, supplied with full involvement of client. Adult client with cerebral palsy in northern authority wanted to stay in parental home where parents give much physical and emotional support,

but wanted more privacy and separation. Currently walking with help and going to work with 10-12 hours support from enabling team. Ultimately will be wheelchair user. Needed wheelchair- accessible extension.

Adaptations costing £27,500 were carried out (DFG of £18,500).

This enables the person to stay where they want with care package of £30,368 per year to supplement care from parents. If adaptations were not available, the person would have to move and would need 24 hour paid care. Cost of this in one year would be £59,332. Saving of public funding in first year £10,454 (£59,332 minus £18,500 +£30,368). On-going savings whilst arrangements last: £28,954 per year. Savings to public purse in 3 years: £68,362. Client also stresses great improvement in quality of life the adaptation will provide.

Quality of evidence: Current Case-study. Very thorough, detailed information.

Midlands County A

Man unable to bathe independently. Wife had found she could no longer assist him without putting herself at risk. A care package of 4 care-visits a week to enable him to bathe was put in place at cost of £26.64 per week (£1,385 per year). A level-access shower and seat were supplied at net cost of £4,659 so the man was able to bathe every day with no assistance or with minimal assistance from his wife. Care package is no longer needed and has been withdrawn. Capital outlay will be recouped in 3.4 years. Whilst shower is in use after that, savings will be £1,385 per year.

Quality of evidence: Current Case-study. It is not known whether the cost of care given here includes on-costs. As a detail, the man had been assessed as needing 7 visits a week but shortage of carers made this impossible.

Midlands County B

Small savings add up when daily care is needed. A reconditioned hoist costing £600 was supplied to a client. This meant that for one of the three daily calls necessary, the person needed only one rather than two carers. This saved half-an hour carer per day (£5 a day, £35 per week not allowing for on-costs). In one year, this saved £1,820 in care-costs; a net saving in the first year of £1,220.

In three years the savings would be £4860.

Quality of evidence: Current Case-study

South Eastern County

Double amputee client in wheelchair, is receiving level-access shower and equipment (£4,500 estimate) .This will remove need for 1 hour's care, 7 days a week, estimated cost £74 per week, or £3848 per year (not including on-costs).

In two years, this adaptation will have saved £3,196. In three years £7,044.

Quality of evidence: Current Case-study.

Other relevant material

Gatward, J. (2004)

'Electronic assistive technology: benefits for all?' Housing, Care and Support. Dec; 7(4): 13-7.

Sensible reminder of the dangers in human terms of inappropriately substituting Assistive Technology for visits to lonely older people.

Quality of evidence: Useful thought piece from very experienced professional.

Jones, K (2005)

The cost of providing home care.

www.psru.ac.uk/uc/uc2005contents.htm-16k

An up-to date piece of evidence that is especially useful in providing mark-up costs on top of charges made for home-care, so that total costs may be calculated. It showed that the average total cost per client (including overheads) of home-care provided by independent providers in 2005 was £4,800 (for 6.5 hours per week).⁷

Quality of evidence: Research is published on the website of the well-respected Personal Social Services Research Unit. Evidence comes from 28 independent providers of social care. Sample not wholly satisfactory as 25 of the providers were from a single local authority, so evidence not reliable as indicator of national average costs. Researcher was also not able to obtain adequate information on local authority social care provision so was obliged to exclude this.

Summary of Chapter 5

- The average total cost per client (including overheads) of home-care provided by independent providers in 2005 was £4,800. In cases where the provision of a stair-lift and level access shower would remove the need for this package, savings would begin after a year and three months.
- Significant savings in home care cost are mainly found in relation to younger (including younger old) disabled people. Adaptations that remove the need for a daily visit, or reduce the number of such visits,

⁷ In cases where the provision of a stair-lift and level access shower would remove the need for this package, savings would begin after a year and three months. (source for costs: ODPM/DH/DfES 2005)

pay for themselves in a time-span ranging from a few months to three years and then produce annual savings ranging in the cases reviewed from £1, 200 to £29,000 a year.

- The very large savings are found where informal carers are enabled by the adaptations/equipment to manage without the need for night-time professional carers.
- Adaptations for older people will not normally produce direct savings in home care costs. This is because the majority of older applicants are not receiving home care whilst others are so frail they will continue to need home-care visits.
- The benefits that adaptations and equipment provide in relation to home care costs for older people are therefore often indirect. They include the prevention of accidents that lead to a need for home-care (see Chapter 3); help to unpaid carers, so preventing residential costs (see Chapter 6); and improved quality of life for both older person and carer (see Chapter 7).

6 Saving the costs of residential care

This section of the review takes into account both evidence on the reduced need for residential care that follows when adaptations and equipment mean less help is needed, and evidence on the cost savings of people living at home compared with the cost of residential care.

Andrich, R., Ferrario, M. and Moi, M. (1998)

'A Model of Cost-Outcome Analysis for Assistive Technology.' *Disability and Rehabilitation* 20(1): 1-24. Italy

Full details of this research are described above in Chapter 5.

In the case study of 30 year old 'Robert', investment was made in step-lifts, power-adjusted seating systems, adapted bathroom, hoists for personal transfer, computer-based writing and environmental control system. If this had not happened, the research report states that, when 'Robert's' mother died three years after the investment, he would have had to enter residential care for the rest of his life. This was not just because of the physical help he had needed but because, before the adaptations he had had no autonomy and had become used to a life of complete dependency. The adaptations not only relieved the physical burden, they changed the man's life and abilities.

Assuming a life expectancy of 50, and weekly residential care costs of £800, the authors calculate the cost of the residential care would have been £41,600 per year at 2006 prices: £2million over twenty years. If this is compared with perhaps three sets of adaptations/equipment at £30,000 each over the period of 20 years and housing costs of £104,000, the saving is still of the order of £1.9 million. If in living independently he still needed some support, a £200 per week care package over 20

years would still result in a saving (compared with residential care) of £1.6 million.

Quality of evidence: Very high quality paper in peer-reviewed journal, based on intensive detailed case studies. A substantial element of the costing is based on evidence of what has already happened, although there is projection forward about potential future savings which is of necessity speculative.

[Audit Commission \(2002\)](#)

Fully equipped: assisting independence: Audit Commission update, June 2002. London, Audit Commission

Quotes Northamptonshire 'Safe at Home' project where investment in Assistive Technology (fall monitors, detectors and alarm systems) in the homes of 18 people with dementia led to savings of £68,000 over 12 months (average £3,780), through reduction in demand for residential, nursing and hospital care (research was done by comparison with a control group) p45.

Quality of evidence: The report is an assembling of information rather than systematic research, and it has not been possible to examine the details of this case study for this review.

[Elkan R, Kendrick D, Dewey M, Hewitt M, Robinson J, Blair M, Williams D, Brummell K \(2001\)](#)

'Effectiveness of home based support for older people: systematic review and meta-analysis' British Medical Journal 323 (7315): 719-724B SEP 29

Study is from Health Visiting viewpoint and is a response to findings of Stuck (1993) that Home Visiting reduced mortality and admission to residential care and/or hospital, and to the contradictory evidence of Van Hanstregt et al (2000) who did a systematic review (but not meta analysis, because of heterogeneity) and found no significant outcomes.

This study concludes that home visiting by health professionals assists with reduced mortality and reduced admission to residential care but not reduced admission to hospital. Indeed, it suggests on p.6 caution in using reduced hospital visits as automatically beneficial because a home visitor may have sent people to hospital who would otherwise have died. None of studies give enough detail on what the home visitors actually did to judge whether the interventions included recommendations regard-

ing adaptations or home improvement, although the provision of some equipment is mentioned.

Quality of evidence: Peer-reviewed journal. Systematic Review & Meta Analysis, not confined solely to RCTs. Quality constrained by limitations of the studies themselves.

Essex Learning and Social care (2005)

Independent Living: equipment cost savings

In this report, Essex County Council gave evidence concerning a package of £37,000 spent on equipment for a total of 183 people during a three-week period in January- February 2005.

Without the equipment provided, residential costs of £635 per week would have been necessary for three people, and residential nursing care (£757 per week) for seven others: total weekly cost for these ten people £7,202. Even assuming that with the equipment provided each of these people still needed a high support package (cost £230 per week), the savings in care costs per week of providing the equipment to the ten amounted to £4,902. (£25,490 each per year) The document does not provide the breakdown of the cost of equipment to these specific ten people, but at this level of saving, the outlay on all 183 people was recouped by the savings for just these ten in less than eight weeks.

Quality of evidence: Figures and assumptions very reliable. Main difficulty the lack of breakdown in regard to costs of equipment for these specific cases and lack of information as to what care packages they still needed. Worst (most expensive) scenario in terms of continuing care package has been assumed.

Heywood, F (2001)

Money well spent: the effectiveness and value of housing adaptations.

Bristol, Policy Press.

Study of overall effectiveness of adaptations. In qualitative interviews relating to the 70 adult recipients of major adaptations in seven local authority areas in England and Wales, six respondents (8.5%) said that without the adaptations residential care would have been inevitable. In one case the adaptations had enabled a person who had already been in residential care to move out to live with a relative. Costs not spelt out here, but at average residential care costs of £500 per week and average adaptation costs of £6,000, savings in residential care costs in these cases would begin after 12 weeks. For adaptations costing £20,000, the period before savings began would be 40 weeks.

Quality of evidence: Sound qualitative research with random stratified sample. In the matter of the risk of residential care, of course, it relies on evidence from interviewees and may not reflect in all cases what would have happened in practice.

[Sergeant, E. and Brown, G. \(2004\)](#)

'Housing people with complex needs: finding an alternative to traditional service models.' *Housing, Care and Support.*; 7(1): 25-30.

Article described how a project in Aberdeen incorporated assistive technology to enable people with physical and learning impairments, including those with challenging behaviour, to live independently.

Quality of evidence: Peer -reviewed journal. Costs of the assistive technology not given.

[Steverink, N. \(2001\)](#)

'When and why frail elderly people give up independent living: the

Netherlands as an example.' *Ageing and Society*, 21(1), Jan, pp 45-69.
Netherlands

Finding is that it is not the level of impairment that leads people to choose residential care – but loss of comfort, loss of affection and above all pressure from others. Loss of affection especially problematic and can't be bought. Found that having an adapted home made no difference to people's 'orientation towards living in an old age home' but author concludes this may be because having an adapted home is rather common in the Netherlands.

Quality of evidence: Peer-reviewed journal. Research based on longitudinal study. Difficulty is definition of comfort. The ability to perform certain acts of ADL are used within the research as a proxy for the definition given of 'satisfaction of basic needs and absence of need or pain'.

(Authors explain that they can assume that basic needs are met) Another problem is concept of 'orientation towards living in an old age home and the way in which this measured. It's not unreasonable, but is still a projection forward.

[Taylor, S., Ashton, V. and Gray, J \(2002\)](#)

Evaluation of Sedgefield Home Assessment Rehabilitation Partnership. Middlesborough, Postgraduate Institute of Health and Social care.

This is an independent evaluation of a project set up in partnership between a PCT, Borough Council and social services authority to provide a multi-disciplinary assessment service that would provide equipment and other services in a timely manner so as to prevent need for more costly outcomes. There was a one off sum of c. £12,000 at the start to buy a pool of equipment but apart from that they are simply using the normal resources of the local equipment service.

The evaluation, carried out after two years of the project stated that 'the interviewed referral agents (8/8) and multidisciplinary team (8/8) emphatically agreed that , in the absence of SHARP I and SHARP II many clients would be inappropriately referred and /or readmitted to hospitals and residential homes' (Taylor, Ashton and Gray 2002, p7).

Quality of evidence: Competent but clearly would have liked to have carried out thorough cost benefit analysis if resources had permitted.

[Material supplied by Occupational Therapists and managers of occu-](#)

pational therapy services in response to request for material relevant to this review (2006)

London borough

Case studies of two wheelchair users (aged in their 30s and 40s) who were in residential placements that between them cost £1,400 per week (£72,800 per year) One had lived there for ten years; the other for two. In both cases these costs came fully from local authority funds. By a special initiative that both sought out suitable properties for adaptation, and adapted to a particularly high wheelchair standard (the Greenwich standard), savings amounting to £18,080 within the first year and £61,360 per year thereafter have been achieved. This takes account of housing benefit of £90 pw for each person and a care package of £80 per week for one.

These savings will amount to £263,520 in a period of five years.

Officers report that both service users also consider there has been a dramatic improvement in their quality of life.

Quality of evidence: Costs given reliable but the evidence did not claim to be a full cost-benefit analysis. University of Bristol has added the deduction for housing benefit costs but other costs such as a difference in benefit levels received may need to be added.

North-Western authority

Person with Down's syndrome and early stages of dementia, at risk of entering residential care @£400 per week (£20,800 per annum) when parents entered nursing care. Adaptations costing £28,000 were supplied to home of relative who offered to give care. Break even point for this example: 70 weeks. Savings after 2 years: £13,600; after 3 years £34,400.

Quality of evidence: Just one study. Sound basis but not yet implemented so that actual savings can be measured.

South-Western authority

80 year old woman disabled by severe arthritis, heart problems and swollen legs. Great difficulty getting upright from chair and reaching toilet

down one step. Independence threatened and residential care likely to be necessary.

Supply of a riser chair overcame several of these problems: no longer needs nursing care and likely to be able to remain living at home longer than would have been possible without this equipment.

Quality of evidence: Case study, not costed by person submitting it. But cost of riser recliner chair is about £600. Reviewer therefore calculates this would pay for itself if residential care were deferred by even two weeks, and this is not taking account of the actual savings in nursing care visits.

Summary of Chapter 6

- Adaptations and equipment that allow people to leave residential care, or prevent admission to such care, produce very large savings to public bodies, especially where the State is bearing the full cost of residential care.
- Research and case studies show that investment in a suitably adapted and equipped home where this makes independent living possible, usually pays for itself in 12 months or less and produces savings to social care budgets thereafter ranging from £25,000 to £80,000 per year.

7 Better quality of life for same expenditure

This is another aspect of the research where to get an answer it may be necessary to join together separate pieces of research information. In this case the pieces of discrete research are:

- the effect of adaptations/equipment on quality of life;
- the costs of the adaptations and equipment;
- the amount of alternative services that could be supplied for an equivalent sum of money;
- the effect of those alternative services on quality of life.

Only some of the pieces of this particular jigsaw exist at present.

One important point is the concept that if there are better outcomes for the same expenditure, then an option is better value even if the cost of it is the same as that of an alternative option with less good outcomes. The examples in this chapter, however, mostly relate to options which are cheaper as well as giving a better outcome. The comparison of outcomes for similar levels of expenditure is an area where more evidence is needed.

The effect of adaptations/equipment on quality of life

Andrich, R., Ferrario, M. and Moi, M. (1998)

'A Model of Cost-Outcome Analysis for Assistive Technology.' *Disability and Rehabilitation* 20(1): 1-24. Italy

This detailed longitudinal study of 7 cases of differently disabled people as part of the CERTAIN⁸ research within the European Union programme 'Technology Initiative for Disabled and Elderly' (TIDE) has already been described above in Chapters 5 and 6 in respect of the savings in residential care and home care. One of the main points these authors make is that the outcomes of adaptations and assistive technology are so much to do with improved quality of life, and not just for the disabled individual but for the whole household. In the case study of 'Robert' described more fully above in Chapter 6, the provisions of adaptation and equipment led to dramatic improvement in quality of life, as over time he moved from complete dependency to considerable autonomy.

Quality of evidence: Numbers small but very high quality, in-depth evidence: especially valuable in judging improved quality of life because of longitudinal nature of the study. Peer-reviewed journal.

Audit Commission (2002)

Fully equipped: assisting independence Audit commission update, June 2002. London, Audit Commission

'Equipment services have the potential to make or break the quality of life for many older or disabled people.'

Quality of evidence: This general conclusion not the result of systematic research but based on a thorough gathering over two years of information sent in by external auditors of NHS trusts and social services departments.

⁸ CERTAIN: Cost Effective Rehabilitation Technology through Appropriate Indicators. A European project based in Linköping University, Sweden from 1994-96 'to develop a methodology for evaluation of cost-effectiveness and cost-utility of rehabilitation technologies and to evaluate the methodology'.

Awang, D (2004)

Building in Evidence: Reviewing Housing and Occupational Therapy, London, College of Occupational Therapists.

'Adaptations appeared to have positive effects on health (physical or mental), productivity, leisure, play and social aspects of individuals.'

Quality of evidence: Thorough review of the literature.

Brewis, C. (1994)

Targeting the resources of housing adaptations for people with disabilities. Dissertation. University of Newcastle-upon-Tyne, Department of Medicine. MSc in Rehabilitation Management.

11 out of the 12 respondents to this research (92%) said that their quality of life had improved as a result of the adaptations. Some of the details of what they were experiencing before the work was done are given in Chapter 9: 'Preventing Waste'. Problems included, falling, fear of falling, being unable to bathe, pain and fear in moving, being obliged to move out of home, increased dependency and seriously increased stress in relationships because of the dependency. These were the problems that were alleviated by the adaptations.

Quality of evidence: Research for master's dissertation: small but sound. See entry in Chapter 9 for more details.

Bushnik, T. (2002)

'Access to equipment, participation, and quality of life in aging individuals with high tetraplegia (C1-C4).' Topics in Spinal Cord Injury Rehabilitation. Winter; 7(3):17-27. United States

Finding was that age was the major factor in determining how much the subjects of the research, all with tetraplegia, participated in activities in the home or in the community. Access to equipment did not correlate so closely with participation, although individuals with access to a modified van gave higher Quality of Life ratings. Possession of a modified van was often related to family income.

Quality of evidence: Peer-reviewed journal. This was a longitudinal study carried out in 3 phases: 1984-85; 1992-94; 1997-99. By the third phase, 58 people (49 males and 9 females) of the original 91 met the criteria for continued inclusion in the study. The research seems flawed by the failure to allow for age as a basic premise of the research (with a comparison with norms for non-disabled people of the same age).

Harmer, J. and Bakheit, A.(1999)

'The benefits of environmental control systems as perceived by disabled users and their carers.' British Journal of Occupational Therapy. Sep; 62(9): 394-8.

Shows gains and effectiveness of Environmental Control Systems.

Quality of evidence: Peer -reviewed journal. Small scale but thorough (16 users 13 carers) Authors clear about limitations – not longitudinal.

Higham, E. (1999)

Changing rooms: a survey of the adaptations service in six Welsh authorities and the outcomes for service users with disabilities. Cardiff, Wales Office of Research and Development for Health and Social Care. Wales

Found 76% of respondents satisfied or very satisfied that the adaptations had met their needs, and 95% felt that the adaptations had made living easier in their homes.

Quality of evidence: Very broad-ranging research project and some methodological details not as clear as others. Postal surveys in 6 local authorities with very varied response rates (total response 246). 26 Telephone interviews and 10 face to face interviews.

Watson, S and Crowther, L. (2005)

Was it worth it? Study into the effectiveness of major adaptations. Nottingham, Nottingham City Council.

Found that 98.5% of people who have had adaptations reported an improved quality of life, 89% greatly improved.

Quality of evidence: Straight forward research carried out by local authority. Possibility of some slight bias by respondents towards pleasing the service providers.

West Sussex County Council Social and Caring Services Select Committee (2005)

Occupational Therapy/Disabled Facilities Grant scrutiny task force consultation with service users

Questionnaire survey of 145 people who had received adaptations through disabled facilities grants in the seven housing authorities within West Sussex. 40% response rate from original random sample of 362.

90% of respondents were 'satisfied' (23%) or 'very satisfied' (67%) with the work carried out. 76% felt the adaptation 'completely' met their needs, 17% 'mostly' and 7% 'partially'.

The open comments indicate the level of improved quality of life as some people speak of the work being life changing or life transforming. Specific aspects of quality of life mentioned included improved confidence and feelings of safety in the home; happiness at being able to keep clean; greatly improved independence, and not having to move home.

Quality of evidence: A thorough and competent questionnaire survey by a local authority. As with nearly all surveys of this kind, there is no way of knowing whether the views of non-responders would have been significantly different. Even without knowing that, however, the evidence of gain in quality of life for many respondents is valid in regard at least to those who responded.

Material supplied by Occupational Therapists and managers of occupational therapy services in response to request for information relevant to this review

South Western Authority

Case study described in Chapter 6 of 80 year old woman disabled by severe arthritis, heart problems and swollen legs. Great difficulty getting upright from chair and reaching toilet down one step.

Supply of a riser chair reduced the pain, reduced the swelling and enabled her to reach the toilet. Oedema in legs is reduced and no longer needs nursing care. Likely to be able to remain living at home longer than would have been possible without this equipment, and with less pain, more dignity and more independence.

Quality of evidence: Case study from occupational therapy professional.

London borough

The case studies from a London borough given in Chapter 6 stress the improved quality of life felt by people who had been living in residential care were enabled to live independently.

The costs of adaptations

ODPM (2004)

Paper submitted to the Disabled Facilities Grant Review Group, November 2004. London, ODPM.

States that average cost of a disabled facilities grant then was £6,000.

Quality of evidence: source is the government department that holds the statistics on disabled facilities grants.

ODPM/DH/DfES (2005)

Reviewing the disabled facilities grant programme. London ODPM.

Local authorities were asked for the costs of supplying and installing certain common adaptations. The mean costs were as follows:

Straight stair-lift	£1,965 (range £1,500-£3000)
Downstairs wc	£4,068 (range £947-£12,500)
Level access shower	£4,143 (range £2,401-£7,000)
Double bed extension with tracking hoists and en-suite	£31,855 (£20,000-£50,000)

Quality of evidence: Research carried out by University of Bristol. Information based on questionnaire returns from stratified sample of local housing authorities (39 in total). Part of wide-ranging questionnaire, so costings question fairly simplistic. Respondents were asked to include professional fees but not local authority costs.

Costs of equipment

There are numerous sources of information on the cost of supplying and fitting equipment but it has not been possible within the time frame of this review to assemble the information in a useful way.

The amount of alternative services that could be supplied for an equivalent sum of money

Heywood, F (2001)

Money well spent: the effectiveness and value of housing adaptations. Bristol, Policy Press.

In 39 cases out of 104 interviews relating to major adaptations, respondents said that one effect of the adaptation had been to reduce the burden of care (time spent and risks involved) on unpaid family carers. The average cost of adaptations in these cases was £10,569 and the average length of time they had already been in place at the time of the research was 3.57 years. This amount of money in 3.57 years would have bought £4.74 a week's worth of alternative support to the carer – about half an hour a week.

Quality of evidence: Research report of project in 7 local authority areas to discover the effectiveness of major adaptations through qualitative interviews with 104 households, backed up with database information. The evidence on costs and times comes from local authority databases.

Within the same research project, a postal questionnaire about minor adaptations was sent to 162 people in 6 local authority areas. Minor adaptations were defined as costing less than £500 and being simple to install. The most common minor adaptations were grab-rails, which were received by 60% of the respondents. The answers produced evidence of various aspects of improved quality of life. These included improved health (77% of respondents); an improved sense of safety (62%); ability to take a bath or shower (49%) and people feeling they needed less help from others (36%), besides other benefits.

There were almost no negative side effects, no waste and the majority of users considered that the money had been well spent. In some cases more than one person benefited from the installation. It was concluded that

'it would be difficult to match the value for money of these modest one-off interventions with comparable interventions of drugs, surgery or therapy.'

Quality of evidence: Good within the limitations of a postal questionnaire with an average 50% response rate. Improvements in health are self-reported, but this is appropriate in considering quality of life.

Quality of life from alternatives to the provision of ad-

aptations

Aronson, J.(2002)

"Frail and Disabled Users of Home Care: Confident Consumers or Disentitled Citizens?" Canadian Journal on Aging/La Revue Canadienne du Vieillessement, 21, 1, spring, 11-25. Canada

Is a report of an ongoing qualitative study with frail older and disabled women who are receiving home care in Ontario. Finds that far from feeling like consumers free to exercise choice, they experience their position as insecure, and the supply of care as unpredictable and meagre. The implications of these findings for fashioning secure & equitable public responses to elderly & disabled citizens who need assistance at home over the long term are discussed.

Quality of evidence: Peer reviewed article but not possible to judge further as full article not obtained.

Summary of Chapter 7

- Adaptations commonly produce improved quality of life for around 90 per cent of recipients.
- Factors contributing to this improved quality of life include reduced pain, reduced anxiety and fear, being able to bathe, being less dependent on others (with consequently less strained relationships) and not having to leave home.
- Adaptations also improve the quality of life of carers and of other family members.
- There is some evidence that older people receiving home-care experience the provision as meagre and unpredictable, leaving them with little sense of control. Adaptations that restore autonomy offer a better quality of life.
- The average cost of a disabled facilities grant (£6000) would pay for a straight stair-lift and level-access shower, a common package for older applicants. These items will last at least 5 years. The same expenditure would be enough to purchase the average home care package (6.5 hours per week) for just one year and three months.
- A bedroom extension with en-suite costs an average £32,000. This compares with the average cost of residential care of from £26,000 to £100,000 per year. Research shows the adaptations in many cases also offer better quality of life in terms of independence and autonomy compared with residential care.

8 Saving the health of carers

No-one knows the full extent of care given by family and household members to disabled people of all ages. Studies focusing primarily on the link between adaptations and equipment and the health and well-being of carers are not common, but even such evidence as there is, is fairly powerful because it is easy to see that it is structurally determined. Caring for a disabled person in unsuitable housing and without the equipment that is needed will bring people to physical or mental breakdown and when informal care breaks down, the cost to health and social services is very high. No specific costed studies were found, but the evidence in this chapter should be taken in conjunction with the saving of residential care and domiciliary care costs in Chapters 5 and 6.

[Adams, J. & Grisbrooke, J. \(1998\)](#)

'The use of level access showers 12 months after installation' *British Journal of Therapy and Rehabilitation*, 5 (10): 504-10.

Found reduced strain on family carers because less assistance required, and reduced back strain once a level access shower was installed.

Quality of evidence: Peer-reviewed article: small-scale but sound.

[Agree, E., Freedman, V., Cornman, J., Wolf, D. and Marcotte, J.](#)

(2005)

Reconsidering substitution in long-term care: when does assistive technology take the place of personal care? *Journals of Gerontology Series B-Psychological Sciences & Social Sciences*. 60(5):S272-80. United States

An analysis of 1994-95 Supplement on Disability to the National Health Intervention Survey. Suggests that more significant outcome than reducing direct care costs is that AT and formal care together reduce burden on informal carers.

Quality of evidence: Conscientious secondary analysis of large database in peer -reviewed journal. See Chapter 5 for more detail.

Beresford, B and Oldman, C. (2002)

Housing matters: national evidence relating to disabled children and their housing. Bristol, Policy Press.

This large-scale national questionnaire survey of families with a seriously disabled child showed that in one in five cases (21 per cent) carers (mainly parents) were experiencing problems themselves because of inadequate facilities for lifting, toileting and bathing their children. In addition, 55 per cent of respondents were experiencing difficulties because of insufficient family space, compared with 33 per cent of low-income families with non-disabled children. [This is relevant because of the stress that is caused by insufficient space]

Quality of evidence: High quality research based on a sample of just under 5,000 families from the Family Fund Trust database of families with a seriously disabled child. Part of a body of research by these authors, supported by the Joseph Rowntree Foundation (see also Oldman and Beresford below).

Brewis, C. (1994)

Targeting the resources of housing adaptations for people with disabilities. Dissertation. University of Newcastle-upon-Tyne, Department of Medicine. MSc in Rehabilitation Management.

Within a research project about the consequences of a change in council prioritising policy, in households where adaptations were delayed for between ten months and three years, the researcher included a specific question about impact on other family members of living without the adaptations. From 12 questionnaires, 5 carers responded with descriptions of the burdens they carried without the adaptation. Two described how, as they were themselves elderly and with health problems, the work of supporting their partner was a considerable strain. Another said how he felt the council were delaying the supply of a stair-lift, waiting for his partner to die, and that as his wife's physical dependence increased, their relationship deteriorated. Another (who was caring day and night for a partner with double incontinence and no shower) said he was so bitter he went to the press. Once the adaptations were finally supplied 11 out of the 12 questionnaires indicated improved quality of life. In the case of the 12th family, the adaptation was too late and was no longer any use.

Quality of evidence: Qualitative questionnaire with 12 respondents. Small-scale but sound. This study is outside the 1996 limit of our search, but is included because of the rarity of this detailed evidence about carers.

Heywood, F (2004)

'The health outcomes of housing adaptations' *Disability and Society*, 19 [2], 129-143.

This article based on the research fully described in Heywood (2001) includes a section of evidence on the health problems of those who care for a disabled family member, including back injury or falls leading to hospitalization whilst waiting for adaptations, besides extreme mental stress on those caring for a disabled person in unsuitable housing.

Quality of evidence: Peer-reviewed article. Findings based on wide-ranging research not primarily looking at health, so is not quantified, but case studies are valid.

Nicholson, J (1999)

'Management strategies for musculoskeletal stress in parents of children

with restricted mobility' *British Journal of Occupational Therapy*, 62 (5) pp 206-212.

This study focused on parents with children who had to be lifted or carried most of the time found that 91 per cent of respondents caring for children who had to be constantly lifted or carried had musculoskeletal problems, including back pain (experienced by 88 per cent). The help that was most desired to deal with this included stair-lifts, downstairs toilets and bathrooms and ramps, and adaptations to cars.

Quality of evidence: Peer reviewed journal. 81 % response rate to postal survey. Sample established through paediatricians.

[Oldman, C. and Beresford, B. \(1998\)](#)

Homes Unfit for children. Bristol, Policy Press.

Research based on qualitative interviews with 40 families with a severely disabled child. Contains detailed descriptions of the physical and mental problems experienced by parent carers as the result of living in unsuitable housing and without the right equipment for their child, or without space to use that equipment. Bad backs and damaged knees were common. Respite care was needed more often because of the unsuitable housing and strain on carers.

[Evidence received from occupational therapists](#)

South-western authority

Woman caring for husband with stroke. She (the carer) suffering from rheumatoid arthritis. Process of supporting husband in and out of bath caused pain and damage to her shoulders and required course of physiotherapy.

Level access shower enabled husband to bathe independently and improved her well being. She reported that she was less stressed, less tired and needed less physiotherapy. No figures, but risks of the breakdown of care through damage to wife's health might have led either to need for high level of social care or to residential care admission for the husband.

Quality of evidence: A case study from an occupational therapy professional.

Summary of Chapter 8

- Those caring for adults without the adaptations they need report physical and mental misery, deterioration in their own health and increased strain in their relationship with the person cared for.
- For parent care-givers without adaptations and equipment there is a 90% chance of musculoskeletal damage. Other problems reported include damage to knees, falls leading to hospitalisation and stress caused through inadequate space.
- The combination of adaptations and equipment with some formal care support can reduce burdens on carers and make it possible for them to continue their role. Savings will come even when some formal care continues, from the prevention of residential care through giving adequate support to informal carers.
- When suitable adaptation/equipment is supplied there is improvement to physical and mental health of the carers.

9 Preventing waste

This final chapter is focused specifically on the waste that results from the under-funding of adaptations. This waste includes adaptations that are delayed so long they are no use by the time they are finished; the costs of social care given whilst waiting outstripping the cost of the adaptation and the waste of employment opportunities for lack of adaptation. There is also brief reference to the evidence given in other chapters of the waste represented by illness and injuries unnecessarily caused by lack of equipment.

The evidence given here by the Audit Commission about the waste caused by delay linked to under-funding of adaptations is of particular note, since this is research from the national body charged specifically with 'promoting the best use of public money.'

Audit Commission for Local Authorities and the National Health Serv-

ice, (1998)

Home Alone: the role of housing in community care. London, Audit Commission for Local Authorities and the National Health Service, (1998)

A considerable part of this audit of the role of housing in community care is devoted to the subject of adaptations, which are, as it says, necessary to sustain independent living. The repeated message is that adaptations are under-funded at national and local level and that this under-funding is leading to waste on a large scale. It suggests that a proper allowance for the housing implications of sustaining those with long-term limiting conditions was not made when policies of community care were devised. The report highlights the issue of delay and, most significantly, the cost of delay. It states that delay is used as a form of rationing in the light of inadequate resources and that this in turn leads to waste and money badly spent. It also states that the 'cost-shunting' between social services and housing authorities that goes on when there is inadequate funding for adaptations ignores overall value for money.

Specific details given are:

- Funding levels were sufficient for just 25,000 DFGs a year while the DETR estimated 650,000 eligible households in the private sector alone.⁹
- 17% of the applicants for adaptations in the fieldwork sites were receiving care at home.
- The average time taken for a routine adaptation from application to completion was 14 months. Most of the delay was within local authority processes and caused by funding constraints as well as by sometimes inefficient systems.
- Delay was leading to more costly options. A year's delay in providing the adaptation could cost up to £4000 in additional care¹⁰. Case-

⁹ The number of grants per year has since risen to 30,000 but the number of people eligible to apply has also grown, not least because of the large scale transfer of properties from local authorities (not eligible for dfg subsidy) to housing associations (eligible).

study examples given: Person received 4.5 additional home-care hours a week for 32 weeks at total cost of £1,440, when a door-widening adaptation costing £300 was delayed for 7 months. Older woman at grave risk of fall on stairs and fracture, assessed for stairlift, but facing two year wait for installation.

- Delay meant serious waste. One local authority had spent £89,000 in one year on adaptations for applicants who died before they could obtain any real benefit from them.
- Examples of waste in terms of human life were also given, like that of the wheelchair user confined to his living room for over a year for lack of a ramp to his front door and stairlift to his bedroom.

Quality of evidence: An in-depth, reflective overview of housing and community care. The report is based on fieldwork by Audit Commission staff in 19 local authorities in England and Wales. Research methods included questionnaire surveys of local authorities and supported housing providers, interviews, document reviews, sampling of case files and focus groups. Mainly qualitative, but some quantified evidence is produced - for example on delay and on the costed examples.

Audit Commission (2002)

Fully equipped: assisting independence Audit Commission update, June 2002. London, Audit Commission (see Chapter 4 for full details).

Discusses reduced provision of services, including adaptations, as eligibility criteria have become tighter and tighter. 70 per cent of those surveyed reported reductions in help provided with bathing and toileting. Authors point out how this will have health cost consequences as hygiene is vital to controlling infection and pressure sores. States that such short term thinking in cutting prevention strategies is likely to lead to far higher costs elsewhere (p21).

‘Equipment services could play a vital part in strategies to optimise capacity, prevent unnecessary admission to hospital and facilitate prompt discharge of patients. However, a real leap of faith is needed to spend hard cash now in anticipation of these future benefits’ (p15)

Brewis, C. (1994)

Targeting the resources of housing adaptations for people with dis-
¹⁰ £4,584 at 2004 prices, using RPI.

abilities. Dissertation. University of Newcastle-upon-Tyne, Department of Medicine. MSc in Rehabilitation Management.

Researcher was looking at the implications of a system of prioritising adaptations introduced by Easington Borough Council to cope with limited funding and in response to Griffiths (1988) report on community care. Overall finding was that the priority system did not take sufficient individual factors into account and that some non-priority cases were more urgent than the priority ones.

Contains detailed evidence of the consequences of delay in supplying adaptations.

Of 12 people who had waited from 10 months to 2 years for the adaptation they required, 9 had experienced deterioration in their mental and physical health during the wait and the evidence shows in which cases this was caused by the delay, or exacerbated by it. Examples were:

- a person waiting for a stair lift who had repeated falls on the stairs;
- a person waiting for a stair-lift who became increasingly nervous of tackling the stairs at all (relying on partner's support) and therefore less mobile and more dependent. She had increased hospital admissions and there was growing tension in the relationship;
- a carer waiting for a shower for his confused partner, coping with day and night double incontinence without this facility and reaching 'a crisis point in caring';
- a person with Parkinson's disease waiting for an external stair-rail. By the time it was at last fitted they had deteriorated too far for it to be any use;
- several people describing the stress and distress caused by the dependency forced upon them by this waiting;
- a person waiting for heating who said the wait was 'very worrying' and added to their nerve problems;
- another person waiting for heating who spoke of their extreme worry as winter approached.

Besides harm to health and costs to the NHS, there were costs to social care budgets. One person waiting for heating adaptations required the daily services of a fire-lighter from social services.

Quality of evidence: Qualitative questionnaire with 12 respondents. Small scale but sound. Reports limitations of cross-checking evidence caused by incomplete or mislaid records (a commonplace with adaptations research). This study is outside the 1996 limit of our search, but is included because the detailed and quantified, albeit on small scale, information about the consequences of delay is illuminating and there are not many other studies on this subject.

Heywood, F (2001)

Money well spent: the effectiveness and value of housing adaptations. Bristol, Policy Press.

Contains example of service user sent on rehabilitation course after major accident and hospital admission. Long delay in delivering adaptations meant she was unable to practice the techniques she had been shown, so cost of rehabilitation was wasted. This report also records the waste caused by inadequate adaptations which because they are too small, or not heated, or reduce the family living space, fail to meet the needs of the household and may be completely wasted because they are literally unusable.

Quality of evidence: Research report of project supported by the Joseph Rowntree Foundation to discover the effectiveness of major adaptations through qualitative interviews in 7 local authority areas with 104 households, backed up with database information.

Higham, E. (1999)

Changing rooms: a survey of the adaptations service in six Welsh authorities and the outcomes for service users with disabilities. Cardiff, Wales Office of Research and Development for Health and Social Care.

Gives statistics of time waited for adaptations in Wales. 26% waited 7-12 months, 26% 13-18 months and 27% for more than 18 months. Gives an example of the resultant waste. Woman had deteriorated so much while waiting she was neither able to use the access to go out nor to use the shower that was installed.

Quality of evidence: Basically sound but very broad-ranging, so some methodological details not clear. Postal surveys in 6 LAs, with very varied response rates (total response 246). 26 telephone and 10 face-to-face interviews.

ODPM/ DH/ DfES/ (2005)

Reviewing the disabled facilities grants programme. London, ODPM

This has a section on the costs of not adapting, based on evidence sub-

mitted to the review.

Box 2.2 describes the situation of a couple in middle life who are both disabled. Because they cannot afford their assessed contribution for DFG they receive the services of four carers a day. The waste recorded here is not just in the cost of carers, (when, with adaptation, one a day would be sufficient), but the loss of opportunity to the couple to experience independence. (0.6 hours for four carers, 7 days a week at real cost of £12 an hour, adds up to £10,483 per year).

Quality of evidence: Research carried out by University of Bristol on behalf of three Government departments. This evidence given directly to the researchers in an interview for the review.

West Sussex County Council Social and Caring Services Select Committee (2005)

Occupational therapy/Disabled Facilities Grant scrutiny task force consultation with service users

Within a larger study of service users view of adaptations, 65 questionnaires were sent to people who had begun the process of application for adaptations but then withdrawn from the process and a 42% response rate was achieved. The most common reason for withdrawal was the means test and inability to afford the contribution. 64% (17) of these 27 people had not had their needs met since withdrawing, and the problems they were experiencing as a result included continued risk of injury whilst trying to use the bath; being unable to bathe and having to consider giving up work and strongly considering residential care because of the struggle.

Within the bigger study (of those who had continued and had received adaptations) there was also some evidence of problems caused by delay, including one person dying before the shower adaptation they needed was installed.

Quality of evidence: A thorough and competent questionnaire survey by a local authority, including a separate questionnaire specifically designed for those who had withdrawn. Information about outcomes for people who need adaptations but withdraw is rare, so although the numbers

are not large, the information is precious. In this case the evidence that there were high risks of costs to society (fall and fracture, loss of employment, residential care) because of the lack of resources for adaptations is the relevant point.

Avoiding the waste of unemployment

Bain, B., Block, L. et al.

'Survey report on the assessment of individuals with spinal cord injuries for assistive technology.' *Technology & Disability*. Vol. 5(3-4)(pp 289-294), 1996.

This was a survey to find out how assessment was being done. States that 'through the use of technology, many individuals with spinal cord injury have been able to reach higher levels of independent functioning than ever before possible, including independent living and employment.'

Quality of evidence: Peer-reviewed journal

Baldwin M (2003)

Learning from experience: occupational therapy service housing adaptations: survey report. London, Royal Borough of Kingston-upon-Thames Social Services. 54 respondents: 21 of them under 65. 3 had found adaptations helpful in returning to work.

Quality of evidence: Questionnaire postal survey of recipients of major adaptations in one local authority). 63% response rate.

Report cited in Awang (2004), not viewed directly.

Summary of Chapter 9

- The Audit Commission in their reports on adaptations and equipment repeatedly stress the waste of public money that is the consequence

of under-investment in these items. They compare the figure of 25,000 (now 30,000) dfgs a year with estimated 650,000 eligible households. They show high costs of delay, in providing more expensive services that would otherwise be unnecessary and the waste as items are provided so long after they are needed that they can no longer be used.

- Other research shows how delay leads to costly falls, hospitalisation, stress and the waste of rehabilitation.
- There is also waste where budget limitations lead to adaptations that, though costly, are too small or too cold or too poorly designed to be usable.
- In other cases, the means-testing that is intended to save public money is leading to greater expenditure as those who cannot afford assessed contributions receive costly care-packages instead. In one study, in 64 per cent of cases where people withdrew because of the assessed contribution, needs remained unmet, with consequent health and social care costs elsewhere.
- The waste is also a waste of human potential. Both housing adaptations and assistive technology have helped people into employment who would otherwise not have achieved this.
- The Audit Commission is very clear that there is a need to cross funding boundaries to find more money for equipment and adaptations if public resources are to be put to most effective use.

10 Conclusion

The review of evidence has shown that there are some serious methodological problems in gathering evidence that shows the cost effectiveness of adaptations, equipment and assistive technology. Some are as basic as defining a fall or knowing whether one has taken place, or knowing whether death certificates can be relied on. But there are also problems of isolating single factors in multi-factorial approaches, and developing Activities of Daily Living measures that are sensitive to the difference between being unable to walk and immobile and unable to walk but equipped with electric mobility. For a really good piece of research, all these things have to be taken into account.

Certain points emerge, despite everything, showing that there are savings to be made under each of the four headings listed in Chapter 2.

- An existing outlay is no longer needed or is reduced.

This applies to all the instances where an adaptation removes or reduces the need, either for intensive home care or for the costs of a residential placement. Within the evidence are to be found perfectly ordinary examples where the savings brought about by supplying suitably adapted and equipped housing to seriously disabled people, so that they are able to live independently will save the State money even in the case of a very old person with limited life expectancy. If the person is young, the sum may run into £millions.

- An outlay that would otherwise have been incurred is prevented.

This is reflected in the preventative aspect of adaptations. Keep people safe so they can see well and do not fall and break a hip; keep them warm so they do not fall ill; help the care-giver so the person for whom they are caring does not have to go into residential care.

- Waste (money spent with no useful outcome) is prevented.

Much of the waste in adaptations comes from under-funding: supplying things that do not work or are psychologically unacceptable. When under-funding causes delay in the provision of equipment or adaptation, there is often waste. Incurring annual revenue costs of £20,000 for lack of a single payment of £6,000 or £600 is not a good use of resources. Where there is delay, too, the assessment may be out of date and the item too small or no longer suitable. People of all ages may develop habits of dependency when they have no choice, habits which are then very hard to break.

- Better outcomes are achieved for the same expenditure.

If, for the same money, a disabled person may have a carer come once a day to help them use the toilet and wash, or can have an automatic toilet and level access shower to use whenever they please, the latter will, for most people, be a better outcome. This is borne out by the improved quality of life reported by 90% of recipients of adaptations as the result of the work. So even when costs of home-care or costs of home modifications are similar, the modifications are usually better value for money.

For older and disabled people, the choice between adaptations/equipment and other options is a choice between independence and dependence. For Government, the choice is a one-off capital outlay or ongoing revenue costs. The evidence from this review is that, unless the cost of the adaptation is very high compared with the life expectancy of the person concerned, adaptation (and independence) will nearly always be the better value option. This is where the frustration expressed by the Audit Commission author comes into mind:

‘Equipment services could play a vital part in strategies to optimise capacity, prevent unnecessary admission to hospital and facilitate prompt discharge of patients. However, a real leap of faith is needed to spend hard cash now in anticipation of these future benefits’

Annex 1: Search strategy

Search strategy for ODI project: Implications for Health and social care budgets of investment in housing adaptations (and associated equipment) and housing improvements

Re (1): In carrying out the literature search we were able to draw on advice and support from the Cochrane Developmental Psychosocial and Learning Problems Group based in the School for Policy Studies. The search was not systematic in the technical academic sense, as this was not possible within the time constraints and with the broad field of search terms that had to be used for a topic that touches so many disciplines. It was, however, thorough and systematically organised. The specific parameters were that the search was:

- international;
- cover all service user groups (including research relating to a limited number of key specific health conditions);
- cover all ages, although material exclusively about children under 16 has been excluded;
- cover research completed in the last 10 years.

The final list of search terms, including a decision on which specific health conditions to include, were agreed with the ODI consultant, Jenny Morris, before the search commenced.

From titles and/or abstracts of all hits found under the search terms,

the researchers selected those that had the possibility of being relevant, with priority given to obtaining full versions of those that best meet our agreed criteria of relevance.

The chosen publications were obtained through downloading or inter-library loan. There were some constraints on what was covered because of the short time-scale of the project.

Electronic databases

The following Databases were searched electronically:

- Medline.
- CINAHL.
- Embase.
- Web of Science.
- ASSIA.
- Cochrane library (all).
- Social Services Abstracts.
- Sociological Abstracts.
- SIGLE (System for Information on Grey Literature in Europe).

Two occupational therapy databases: CATS (Critically Appraised Topics)

and OT Seeker.

Medline was searched using the following terms:

1. (home adj1 (improvement\$ or adaptation\$ or alteration or modification\$)).tw. [tw = title and abstract]
2. (hous\$ adj1 (improvement\$ or adaptation\$ or alteration or modification\$)).tw.
3. repairs.tw.
4. (disab\$ adj1 (adaptation\$ or alteration\$ or facility\$)).tw.
5. environmental modification\$.tw.
6. lifetime home.tw.
7. assisted living.tw.
8. independent living.tw.
9. heating improvement\$.tw.
10. major adaptation\$.tw.
11. minor adaptation\$.tw.
12. minor works.tw.
13. assistive technolog\$.tw.
14. equipment.tw.
15. mobility aids.tw
16. self-help devices/ or communication aids for disabled/ or sensory aids/
17. universal design.tw.
18. home improvement agenc\$.tw.
19. HIAs.tw
20. unmet need.tw.
21. community occupational therapy.tw.
22. exp activities of daily living/ or exp occupational therapy/
23. ADL.tw.
24. stay\$ put.tw.

25. ramps.tw.
26. (chairlift\$ or chair-lift\$ or chair lift\$).tw.
27. (stairlift\$ or stair-lift\$ or stair lift\$).tw.
28. lifts.tw.
29. Baths/
30. showers.tw
31. toilet\$.tw.
32. bathing modification\$.tw.
33. central heating.tw.
34. heating controls.tw.
35. heating/ or housing/ or environment design/
36. environmental control equipment.tw.
37. door entry systems.tw.
38. Lifting/
39. hoists.tw.
40. extensions.tw.
41. (rail\$ or handrail\$).tw.
42. wheelchair acces.tw.
43. level access.tw.
44. cost and cost analysis/ or cost allocation/ or cost-benefit analysis/
or cost control/ or cost of illness/ or cost sharing/ or health care
costs/ or health expenditures/
45. cost prevention.tw
46. Evaluation Studies/
47. (value\$ or savings or outcome\$ or benefit\$ or evaluation or
effective\$ or evidence).tw
48. Financial Audit/
49. audit.tw
50. Quality of Life/

51. employment opportunities.tw.
52. (family adj1 (role\$ or responsibilit\$)).tw
53. disabled persons/ or amputees/ or disabled children/ or hearing impaired persons/ or mentally disabled persons/ or mentally ill persons/ or visually impaired persons/
54. (disab\$ or handicap\$ or health).tw
55. ill health.tw
56. Arthritis/
57. Multiple Sclerosis/
58. Muscular Dystrophies/
59. Cerebral Palsy/
60. Austistic Disorder/
61. autism.tw
62. autistic spectrum disorder\$.tw
63. paralysis/ or hemiplegia/ or paraplegia/ or quadriplegia/ or respiratory paralysis/
64. tetraplegia.tw
65. Spinal Cord Injuries/
66. chronic illness.tw
67. multiple impairment.tw
68. Attention Defecit Disorder with Hyperactivity/
69. ADHD.tw
70. Frail Elderly/
71. old\$ people.tw
72. respiratory disease.tw
73. complex needs.tw
74. Postpoliomyelitis Syndrome/
75. post polio syndrome.tw
76. mobility.tw

77. Dementia/
78. Parkinson Disease/
79. parkinson's disease.tw
80. Cerebrovascular Accident/
81. stroke.tw
82. Mental Health/
83. Depression/
84. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 43 [expressed as: (or/1-43)]
85. 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 [expressed as: (or/44-52)]
86. 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 [expressed as: (or/53-83)]
87. 84 and 85 and 86
88. limit 87 to (humans and English language and yr=1996-2006)

Similar terms, depending on the databases' functionality, were used to search other databases.

Results from the electronic databases were imported into Reference Man-

agement software (Procite). Duplicate records were removed and various terms were entered in order to weed irrelevant records. Due to the large volume of records that were produced, it was decided to do a second search within Procite by substituting vast general terms e.g. equipment, for more specific and likely terms. Thus the following terms were used:

"home adaptation*" "
"home alteration*" "
"home modification*" "
"home improvement*" "
"house adaptation*" "
"house alteration*" "
"house modification*" "
"house improvement*" "
"housing adaptation*" "
"housing alteration*" "
"housing modification*" "
"housing improvement*" "
repairs
"disability facilit*" "
"disabled facilit*" "
"disabilities facilit*" "
"disability adaptation*" "
"disabled adaptation*" "
"disabilities adaptation*" "
"disability alteration*" "
"disabled alteration*" "
"disabilities alteration*" "
"environmental modification*" "
"heating improvements"
"major adaptation*" "
"minor adaptation*" "

"minor works"

"assistive technolog*"

"mobility aid*"

"universal design"

"home improvement agenc*"

HIAs

"community occupational therapy"

ramps

hoist*

lift*

stairlift*

"stair lift*"

"stair-lift*"

chairlift*

"chair lift*"

"chair-lift*"

rail*

handrail*

raiser*

"bed raiser*"

"chair raiser*"

"loo raiser*"

"level access"

toilet*

bathing

"bath seat*"

"bath board*"

"bath cushion*"

"bath lift*"

extension*

"stay put"

"stays put"

disab* AND design AND hous*

"central heating" OR "heating controls"

heating AND hous*

heating AND home

"environmental control equipment"

"wheelchair access"

shower*

walking

manipulating

standing

seating

alerting

alarm*

colour AND contrast

liquid AND level AND indicator

"low vision"

lighting

"tactile control*"

"hearing impairment" OR deaf* AND NOT "hearing aid*"

"hearing impairment" OR deaf* AND device* AND NOT "hearing aid*"

"hearing impairment" OR deaf* AND sensor* AND NOT "hearing aid*"

blind* OR "visually impaired" AND equipment

blind* OR "visually impaired" AND device*

blind* OR "visually impaired" AND sensor*

"spend to save" AND hous*

Once again all duplicates were removed.

A separate search was also performed within Procite, using the following terms, in order to identify those records specifically concerned with costs. All duplicate records were removed:

Cost* AND "social care"

Economics AND "social care"

Cost* AND "health care"

Economics AND "health care"

Cost* AND healthcare

Economics AND healthcare

Cost* AND residential

economics AND residential

cost* AND hospital

economics AND hospital

cost* AND "delayed discharge"

economics AND "delayed discharge"

cost* AND "bed blocking"

economics AND "bed blocking"

Websites

The following websites were searched:

AgeInfo (restricted access)

Care & Repair (England)

Foundations

ICES (Integrating Community Equipment Services)

King's Fund: library catalogue and website in general

College of Occupational Therapists

The COT (College of Occupational Therapists) library performed a relevant search of dissertations on our behalf.

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