Promoting Health and Wellbeing in Later Life

Interventions in Primary Care and Community Settings

CHIEF SCIENTIST OFFICE

MRC | Scottish Collaboration for Public Health Research and Policy

Helen Frost PhD, MSc, MCSP

Sally Haw BSc, HnMFPH

John Frank MD, CCFP, MSc, FRCP (C), FCAHS, FFPH

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Acknowledgements

Table of contents

Glossary

Disability
Disability refers to restriction or lack of ability to perform an activity in a normal manner.

Disablement
Disablement refers to the impact that chronic and acute conditions have on bodily function and the ability of individuals to cope in society. The main pathways lead from pathology, to impairment, to functional limitations and disability.

Impairment
Impairment refers to loss or abnormality of psychological, physiological or anatomical structure or function.

Odds ratio (OR)
The odds of an event happening in the experimental group expressed as a proportion of the odds of an event happening in the control group. The closer the OR is to one, the smaller the difference in effect between the experimental intervention and the control intervention. If the OR is greater (or less) than one, then the effects of the treatment are more (or less) than those of the control treatment. Note that the effects being measured may be adverse (e.g. death or disability) or desirable (e.g. survival).

P value
The probability that an observed or greater difference occurred by chance, if it is assumed that there is in fact no real difference between the effects of the interventions. When the probability is less than 1/20 (P < 0.05), then the result is regarded as being 'statistically significant'.

RCT
Randomised controlled trial.

Rate of falls (RaR)
The rate of falls refers to the total number of falls over a period of time including repeat falls of the same person: for example, number of falls per person per year. This is the statistically preferred outcome although may not be as useful in studies that are focused on primary prevention.

Relative risk (RR)
The number of times more likely (RR > 1) or less likely (RR < 1) an event is to happen in one group compared with another.

Risk of falls (RR)
The risk of falls compares the number of participants in each group with one or more fall events during the trial, or during a number of trials if the data are pooled i.e. the occurrence of more than one fall per person is essentially ignored and treated the same as one fall.

Standardised mean difference (SMD)
A measure of effect size used when outcomes are continuous (such as height, weight or symptom scores) rather than dichotomous (such as death or myocardial infarction). The mean differences in outcome between the groups being studied are standardised to account for differences in scoring methods (such as pain scores). The measure is a ratio; therefore, it has no units.

Weighted mean difference (WMD)
A measure of effect size used when outcomes are continuous (such as symptom scores or height) rather than dichotomous (such as death or myocardial infarction). The mean differences in outcome between the groups being studied are weighted to account for different sample sizes and differing precision between studies. The WMD is an absolute figure and so takes the units of the original outcome measure.

Executive Summary

Background

The population of older people in Scotland has been growing over the last century and projections estimate that 26% (1.3 million) of the total population will be aged 60 or over by 2031. The dependency-ratio[1] is projected to remain more or less stable until 2018 but by 2033 it is expected to increase rapidly to 68 per 100 (1). In addition projections for 2031 compared with 2008, suggest that there will be an 84% increase in the number of people aged over 75, the age at which a dramatic increase in the prevalence of physical disability occurs. This is a concern as it will become increasingly difficult to maintain adequate pension and social security systems for older people. It is not inevitable that all older people will live with disability and ill health, but these trends are strongly patterned by socioeconomic position. In Scotland the balance of evidence suggests that the top social and economic groups are living longer and healthier lives whereas the bottom groups are disabled earlier, and their period of living with disability is more prolonged. The scan aims to provide an overview of the evidence for interventions that prevent or delay physical disablement in later life with a view to informing policy makers and developing equitable intervention strategies in Scotland.

In order to prepare for the challenge of an increasing older population, the Later Life Working Group of the Scottish Collaboration for Public Health Research and Policy chose to focus their priority on interventions in primary care and community settings that prevent or delay functional decline in older people. Functional decline is integral to the 'disablement process' which refers to the impact that chronic and acute conditions have on bodily function and the ability of individual's to cope and live independently in society (2).

The overall objective of the environmental scan is to investigate interventions in primary care and community settings that aim to prevent or delay physical disablement in older people and promote healthy ageing. The scan includes: 1) a brief summary of relevant international and Scottish policies for healthy ageing; and 2) a review of evidence for interventions in primary care and community settings that focus on preventing physical disablement in older people.

Methods

A search of websites was conducted to find information, resources and documents relevant to research, interventions, policies and programmes delivered in Scotland or internationally that aim to impact on health and reduce inequalities in older people.

A literature search was carried out in conjunction with the National Collaborating Centre for (Public Health) Methods and Tools at McMaster University, Canada. The search was carried out for the period September 1999 to September 2009, of the following databases: Ovid MEDLINE, EMBASE (ovid) and CINAHL (Cumulative Index to Nursing and Allied Health). The search focused on review articles, randomised controlled trials (RCTs) and experimental studies that aimed to prevent disablement of older people (50+ years) living in a community setting. Studies carried out in nursing homes and hospitals were excluded along with interventions primarily focused on treatment or management of specific disease or problems (i.e. chronic heart disease, stroke, diabetes, incontinence and dementia), as many older people suffer from comorbidities and synthesis of all disease-specific interventions would have been untenable within the time frame.

[1]The **dependency ratio** is an age-population ratio of those typically not in the labour force (the **dependent** part) and those typically in the labour force (the **productive** part).

Results

Policy review: International

International policies for active ageing have been advocated by the World Health Organization, and more recently the Organisation for Economic Co-operation and Development (OECD). They all aim to promote healthy ageing amongst people over 50 years. Policy recommendations particularly relevant to the aims of this scan include: 1) improving social integration to prevent loneliness/isolation and to provide opportunities for voluntary work for older people; 2) addressing social relationships, poverty, discrimination that have an impact on mental health; 3) improving access to safe and stimulating indoor and outdoor environments; 4) promoting healthy food and eating habits; 5) increasing level of physical activity to reach recommended 30 minutes per day; 6) initiating safety promotion and injury prevention; 7) promoting smoking cessation and reducing alcohol consumption; 8) using quality indicators for drug use and improving coordination among care providers; 9) improving preventative health services (e.g. immunisation programmes) and considering preventative home visits under certain conditions. In addition the more recently published policies for healthy ageing from the OECD (Oxley 2009)(3) recommend adapting health systems to the needs of older people to make them more patient-centred and coordinated.

Policy review: Scottish

There are a number of overarching Scottish policies that have been introduced since the Kerr Report in 2005 that are relevant to the health and wellbeing of older people. The *Building a Health Service Fit for the Future* (2005) policy outlines plans over a 20 year period to shift the emphasis of care from hospital to community care. It also advocates preventative rather than reactive management and improving systems of care delivery through a framework for joint services.

The *Equally Well* (2008) policy emphasises that the overall goal of the government, sustainable economic growth, can only be achieved through a reduction in health inequalities. This is a challenging problem to tackle as research suggests that whilst the health of the country as a whole is improving, some inequalities are widening and virtually none are narrowing (4). Tackling poverty is also addressed in *Achieving Our Potential* (2008), a framework aimed at tackling poverty and income inequality in Scotland. This policy sets out the approach of the Scottish Government in the fight against poverty. The action plans specifically aimed at older people include abolishing prescription charges, providing assistance for central heating and supporting community planning partnerships.

Various initiatives have been proposed that aim to support the overarching policies. The Long Term Conditions Collaborative (2008–2009) has been designed and developed by the Improvement and Support Team (IST) and NHS health boards with an aim to improve the quality of care provided for people with long term conditions and that generally, although not exclusively, involves older people. Ten actions are identified as being important factors in the management of older people. These include stratifying and identifying those at risk, introducing anticipatory care plans, targeting and delivering a proactive case/care management approach, communicating and sharing data across the system, developing intermediate care alternatives to acute hospital, providing telehealth and telecare support, developing falls prevention pathways and services, providing pharmaceutical care and ensuring timely access, flexible homecare and carer support.

The most recent proposal, *Reshaping Care for Older People* (Dec 2009–ongoing), is based on demographic projections. Current arrangements for the care of older people are not sustainable due to the inevitable dramatic increase in the population of older people, consequent rising cost of care, and lack of sufficient human resources to deliver the care (5). The proposal to reshape the care of older people is being developed through a framework of eight workstreams and collaboration with clinical experts, MSPs, government policy makers and members of special interest groups. Five of the workstreams

focus on service design (care homes, care at home, care pathways, planning for ageing communities and healthy life expectancy), two on demographics and funding, and one relates to the workforce. There is an over-riding theme of supporting unpaid voluntary care in the community to reduce unnecessary hospital admissions. The workstream Promoting Healthy Life Expectancy is the most relevant to the content of this scan as it focuses on evidence for effective interventions to promote healthier lifestyle choices and prevent functional decline in older age. In contrast with this scan the proposal takes a largely disease-specific approach to management that doesn't encompass all factors associated with disablement in older people.

Literature review

The search identified 62 structured reviews or meta-analysis of complex and specific interventions in the peer-reviewed and grey literature that predominantly included randomised controlled trials. It was not possible to include all primary studies in the literature review although the most recent studies were discussed, if they were not included in the reviews or if they were particularly high quality or relevant to policy makers. The reviews were grouped into complex (comprehensive geriatric assessment, preventive home visits, falls prevention, case management and integrated service delivery) and specific or single interventions (exercise, nutritional interventions, information communication technology [telecare/telehealth], social integration, environmental modifications/advice on assistive devices and vision screening) but there were many overlapping components.

Complex interventions

Overall, there was a lot of inconsistency in the literature and determining the benefits of complex interventions is difficult due to heterogeneity of the populations studied, content and context of the interventions and particularly the lack of standardisation of outcome measures. Outcomes of complex interventions for older people are generally focused on preventing hospital admission, although there is good evidence that simply monitoring admission rates cannot assess the effectiveness of interventions without a matched control (6) and it is important to consider other NHS use and non-NHS institutional admission in order to accurately measure the effects of intervention. In addition, improvement in function is not always associated with a reduction in hospital or institutional admission, suggesting that the driver for institutional admission may have more to do with factors such as poverty, support at home or carer/patient preferences.

Evidence from review level and primary studies suggest that the case for implementation of complex interventions is relatively weak but there are some areas of potentially promising development.

For the general *older population, comprehensive geriatric assessment* followed by multi-factorial intervention can be effective, in terms of both reducing institutional admission, risk of falls and improving physical function but effects are generally small and more research is needed to identify which components of care are most effective. Promising evidence from review-level data suggests that, at least for the general population of older people, nursing home admission may be reduced by approximately 14% (7). A focus on nursing home admission may be more worthwhile than other outcomes such as mortality rates, which are clearly more difficult to modify. Ideally, it seems important to assess all institutional and private nursing home admissions alongside mortality rates, as assessing one without the other may lead to misinterpretation of the effectiveness of interventions.

For *frail older people at higher risk* the evidence for *comprehensive geriatric assessment* is mixed and less robust. The challenge for researchers is to identify which group of older people are most likely to benefit from this type of intervention.

Multi-factorial home visits interventions have the potential to achieve small positive benefits but evidence is not consistent and may be dependent on factors such as the experience of the care provider, easy access to provision of follow up services and length of follow up. A comprehensive approach that incorporates a variety of intervention strategies (e.g. disease management and health promotion) targeting risk factors, addressing the person's multiple co-existing medical, functional, psychological and environmental problems, may have potential to prevent and delay physical disablement, but the evidence is far from conclusive. This scan did not focus on interventions for older people discharged from hospital but home visits for this group of older people, who are most likely to be frail, have been shown to be effective in reducing the risk of nursing home admissions.

There is inadequate evidence to support strategies to deliver health promotion and preventative care in older people through universal broad-based screening and assessment in primary care. Preventative strategies based on advice alone do not appear to be effective for older people (8).

Integrated service delivery programmes have been shown to prevent functional decline but long term follow up is essential and more evidence is required to support the implementation of a large-scale programme in the Scottish context.

There is a paucity of good quality data on cost-effectiveness but programmes providing intensive follow up are more likely to be beneficial whether they be preventative home visits or include an all-inclusive integrated approach. Recently published RCTs suggest that multidisciplinary, geriatric assessment is an effective addition to primary care, for frail older people, at a 'reasonable' cost and integrated care, including case management for older people with moderate disability, has the potential to shift institutional care to home care services without additional costs (9–11). This is not to say that these interventions reduce disablement per se but they may allow older people to remain in their own homes for longer with no additional costs to the public sector.

Falls prevention

A large body of work, including a vast number of RCTs, has been carried out in the field of falls prevention and many diverse programmes have already been implemented across Scotland. There is consistent evidence for the benefits of exercise in preventing the risk and rate of falls (12;13), particularly for long term exercise programmes and they may be cost-effective (14;15). There is no strong evidence that any specific type of exercise is better than another although balance exercises are preferable to walking. The evidence for multi-factorial programmes is less convincing (12). Multi-factorial assessment followed by targeted intervention appears to be effective in reducing the rate of falls, but not risk of falls. In lay terms, the effects are stronger for reducing fall recurrences than first falls and, whilst it appears difficult to prevent falls completely, people who fall frequently may be helped to fall less. The success of multi-factorial falls prevention programmes is likely to depend on two main factors: 1) targeting specific groups of older people with modifiable risk factors and; 2) adequate integration of service delivery working across the community-hospital interface, incorporating a range of professional care. Multi-factorial programmes that rely on referral rather than direct management are less likely to be effective.

Specific interventions

Evidence for specific interventions is also mixed. There is good evidence that exercise programmes for older people can improve strength, aerobic capacity, balance and function. The magnitude of effects range from small to large, reduce with age and are smallest for the older age group (80+) and those with pre-existing disability. There is also evidence that aerobic exercise has an effect on some measures of cognitive function, such as cognitive speed, but the magnitude of effect is small, and not consistent for all

measures. There is a lack of evidence to link gains in impairment[2] with reduction of disability[3] per se – an outcome much more relevant to the ability to maintain independence and live in the community. However, this may be due to the outcome measures used to assess function in older people that may not be sensitive enough to detect important change.

Benefits gained from exercise are dependent on long term adherence and ingrained exercise behaviour, which is generally established earlier in life and difficult to shift. The most promising primary-care-based interventions for increasing physical activity in older people are those that offer written material as reminders and are tailored to participants' characteristics. In addition, it appears to be important to make an impact 'upstream' before retirement, and focus on activities that generate feelings of enjoyment and satisfaction (16).

The evidence-base for the effectiveness of *nutritional interventions* and *vision screening* is relatively weak for older people. There is some evidence that dietary advice, in combination with supplements improve dietary intake and weight gain (at 1 year) in undernourished older people, but there is no evidence of effect on mortality or hospital admission rates. *Medication review* by pharmacist or other health professionals does not have any effect on reducing mortality or hospital admission. Effects on quality of life are minimal, although there is evidence (from two studies) that medication review may reduce the rate of falls. There is limited evidence that *advice on assistive devices* and environmental modification, given by occupational therapists, can improve functional ability and reduce the risk of falls in older people, but none of these rather specific interventions are likely to have a large impact on reducing disablement, when deployed in isolation.

The information and communication technology (telecare and telehealth interventions) literature is a newly emerging field that has not been subjected to high quality evaluation and most of the evidence is based on observational cohort studies without control groups or small, low quality, RCTs. There is very little evidence for the impact of telecare at the population level for older people. The best evidence for telecare is improved clinical outcomes, such as enhanced quality of life for frail older people and their carers, by increasing their ability to live independently in their own homes. There is limited evidence that telemedicine is a cost-effective means of delivering healthcare and whilst there is some evidence from observational studies in Scotland that suggest cost savings may be made in terms of reduced hospital admission, home check visits and sleepover nights from telecare (safety and security monitoring systems), this potential needs to be assessed in a controlled study. Experts in the field of information and communication technology advise that overly optimistic assessment of the effects of telecare on the demand for institutional care, both in the short and long term, should be avoided (17).

Social isolation is a common problem in later life and is associated with poor physical health and increased mortality, mental ill health, depression, suicide and dementia (18) but it has not been extensively researched in older people, particularly in the UK. There is limited evidence (from small RCTs of variable quality) for the effectiveness of group activities, that include some form of educational or training input and social activities that target specific groups of people, but the effects are likely to be small and not generalisable. One-to-one interventions (home visits), telephone friendships and nurse-moderated computer links are not effective in reducing loneliness or social isolation (19;20). The research to date has focused on a few potential causes of social isolation and loneliness, but in reality the causes are complex and related to many environmental, social and cultural factors. It is therefore not surprising that the effectiveness of the interventions studied to date is variable and generally small.

[2] Impairment (loss or abnormality of psychological, physiological or anatomical structure or function).
[3] Disability (restriction or lack of ability to perform an activity in a normal manner).

Conclusion

Scottish policies advocate many of the interventions reviewed in this scan such as falls prevention, telecare and integrated service delivery. Overall, the case for implementation of complex and specific strategies to prevent physical disablement in older people is weak and there is very little evidence from population-based interventions that focus on low-socioeconomic groups, suggesting that much of the evidence may not be generalisable to those living in deprived areas of Scotland.

A plethora of tools are in use for screening, case-finding and outcome assessment which makes comparison across study populations difficult. Many tools that aim to identify and target older people at risk of disablement have not been fully validated in different contexts and further development of these tools is essential in order to accurately target individuals at risk and assess interventions for older people. Most studies focus outcome on hospital and institutional admission, but admission data needs to be viewed with caution (6). There is no standardisation of outcomes across studies for measurement of quality of life for older people. The most extensive evidence for use of generic quality of life and health status measures has been reported for the SF-36 and EQ-5D but there is limited evidence of reliability and in particular, limited evidence of responsiveness to change, for most of the disease specific health measures (21;22).

This scan identified many areas of conflicting evidence, along with areas of unknown effectiveness, partly due to non-standardised use of outcomes and poor experimental design, but also because modifying disablement risk factors for older people is difficult and sometimes simply not possible. The review is limited by the lack of detail reported in the review-level literature which makes it difficult to conclude whether or not an intervention has failed due to the poor methodological design of the study, an inadequate theoretical basis to the intervention, or poor implementation. Researchers should endeavour to design studies that take into account both the social (personal and environmental) and medical aspects of disability that are integral to the disablement process, and also follow recommended guidelines for evaluation of complex interventions (23).

In the meantime policy makers have little choice but to base decisions about allocation of scarce resources on the most promising interventions. One of the biggest challenges for researchers and policy makers is to determine which group of older people are likely to benefit most from intervention. Some would argue that frail older people have a lot to gain from comprehensive geriatric assessment and multi-factorial intervention but overall, the evidence is generally stronger for multi-factorial interventions targeted at older people at lower risk. Ideally strategies should be developed for both high and low risk groups that focus on interventions that are tailored to the individuals' needs.

The feasibility, affordability, sustainability, effects on equity, potential side effects and acceptability to stakeholders needs to be considered in the process of developing any new and innovative intervention (24). There is clear evidence for encouraging exercise-related activities for older people but in isolation, the impact of any exercise intervention, at a population-level is probably low, unless started earlier in life. The fact that most risk factors for chronic disease and physical decline originate in early life and develop insidiously, has a large part to play in shaping the health and wellbeing of older people (25). That is not to say that interventions for older people should be overlooked as there are areas of promising research, such as exercise programmes for falls prevention and integrated service delivery programmes for frail or disabled older people, but at present the precise impact of these services in Scotland is unknown.

1 Chapter 1 – Introduction

The ageing process is a biological reality which has its own dynamic, largely beyond human control although it is influenced by a number of factors, some of which are difficult, if not almost impossible to modify. The age of 60 or 65, roughly equivalent to retirement ages in most developed countries is said to be the beginning of old age but age is not a reliable indicator of health and wellbeing. In many parts of the developing world, chronological time has little or no importance in the meaning of old age and other socially constructed meanings of age are more significant such as the roles assigned to older people. In some cases it is the loss of roles accompanying physical decline which is significant in defining old age. Thus, in contrast to the chronological milestones which mark life stages in the developed world, old age in many developing countries is seen to begin at the point when active contribution is no longer possible (4;26).

The terms active ageing, healthy ageing and successful ageing are used commonly by policy makers and researchers. The World Health Organization defined active ageing as:

> *'The process of optimising opportunities for health, participation and security in order to enhance Quality of Life as people age.' (World Health Organization 2002) (27)*

This term was defined further by the Healthy Ageing Project Group as:

> *'The process of optimising opportunities for physical, social, and mental health to enable older people to take active part in society, without discrimination, and to enjoy an independent and good quality of life.'*

Population demographics

The population of Scotland is projected to rise from 5.17 million in 2008 to 5.36 million in 2018 and it is then expected to continue to rise to 5.54 million in 2033 (an increase of 7% over the 25 year period). The population of older people is expected to rise rapidly, reaching 1.34 million in 2033 (an increase of around 31% compared to 2008) (1). The number of people aged 75 and over is projected to increase by around 23% from 0.39 million in 2008 to 0.48 million in 2018. It is then projected to continue to rise, reaching 0.72 million in 2033 (an increase of 84% over the 25 year period – see figure 1.1). This is due to the ageing of the baby boomers born after the Second World War and the effect of improved mortality rates. Figure 1.2 shows that the age structure of the population is projected to change markedly between 2008 and 2033. The dependency-ratio[4] is projected to remain more or less stable at around 60 per 100 until 2018; it is then expected to increase slightly between 2018 and 2023 to 62 per 100. It then remains more or less steady until 2028 before increasing relatively rapidly to 68 by 2033 (1). Figure 1.2 shows the projected percentage change in Scotland's population by age group between 2008 and 2033. This a concern as it will become increasingly difficult to maintain adequate pension and social security systems for older people.

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[4] The **dependency ratio** is an age-population ratio of those typically not in the labour force (the **dependent** part) and those typically in the labour force (the **productive** part).

Figure 1.1. Population projections for Scotland.
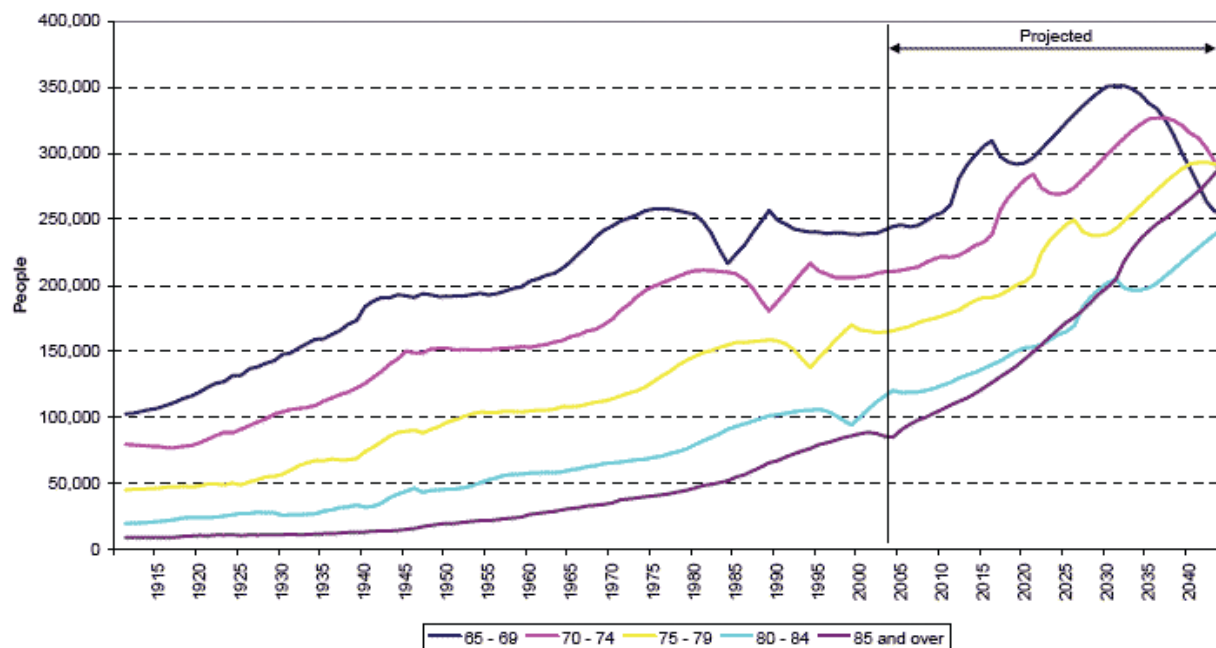
Source: Registrar General for Scotland, 2005 (28)

Figure 1.2. The projected percentage change in Scotland's population by age group, 2008–2033.
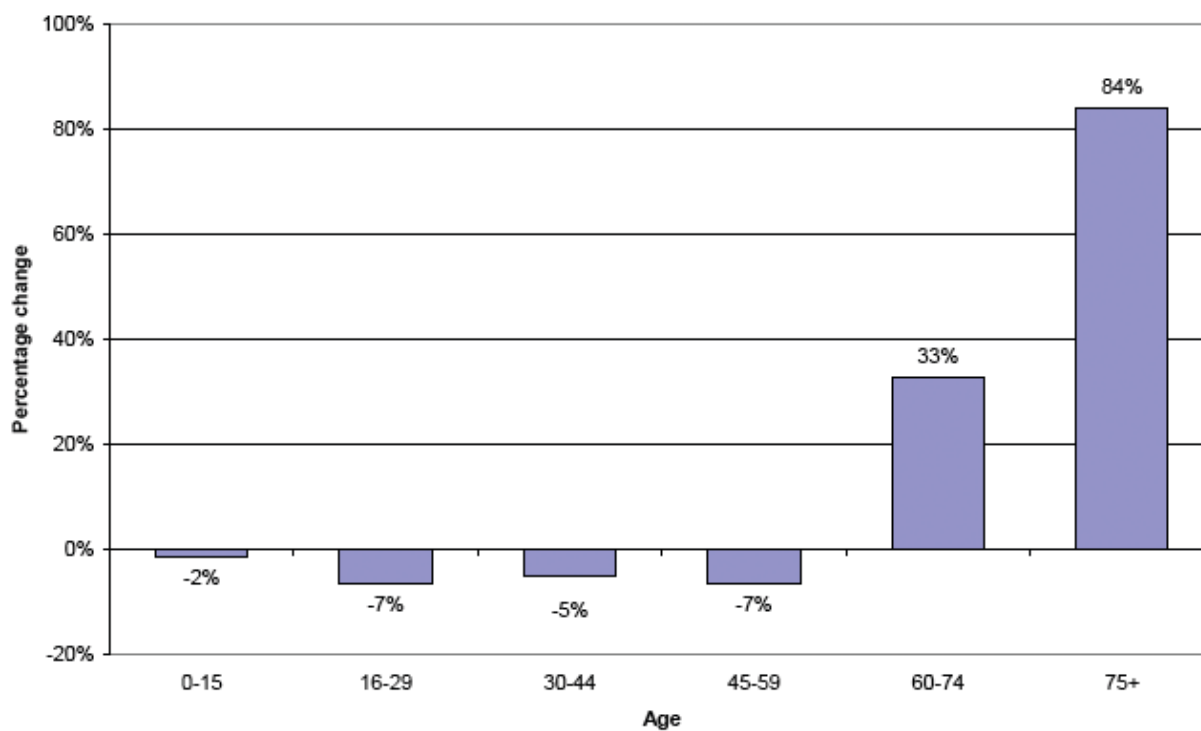
Source: Registrar General for Scotland, 2009 (1)

There are uncertainties about the past and future trends of age-specific ill health and dependency among older people and experts are unwilling to make definite predictions (29). The important issue to consider concerns the relationship between increasing life expectancy and changes in healthy life expectancy and there are a range of views about current trends and likely patterns in Scotland. The theory of compression of morbidity describes a paradigm of a reduction in cumulative lifetime morbidity by postponing the age of onset of morbidity to a greater degree than life expectancy primarily by reducing lifestyle health risks (30). An alternative view, the expansion of morbidity theory, postulates that as medical advances lead to greater life expectancy, mortality in the older age group falls but increase in total life expectancy comes at the expense of an increase in time spent with chronic ill health. The third theory, the dynamic equilibrium theory, combines both compression and expansion of morbidity in that the proportion of life spent with serious disabling disease will decrease while the proportion of life spent with less severe disability will increase (31). The balance of evidence in Scotland suggests that some older people have been living longer and healthier lives whilst some are living longer with ill health (32). These trends are strongly patterned by socioeconomic position, the top social and economic groups are living longer and healthier lives while the bottom groups are disabled earlier and their period of living with disability has become longer. In the USA, the overall prevalence of disability started declining in 1982 particularly the prevalence of chronic disability in older people (33). The evidence for disability decline in the population of older people in the USA is encouraging but the risk factor trends for future disability, such as potential disability caused by obesity suggest that this optimistic view may be reversed in future decades.

A life course approach to active ageing highlights the importance of focusing on lifelong change. Figure 1.3 demonstrates that physical capability generally rises rapidly until maturity and then declines with age. Healthy active ageing is determined by a number of factors such as socioeconomic position (SEP) diet, exercise and genes, and depends on both the peak of health attained and the rate of decline. The focus of this scan is to investigate interventions that may reduce the rate of decline and thereby have the potential to shift the curve from position D to A.

Figure 1.3. A life course approach to healthy ageing, frailty and capability.
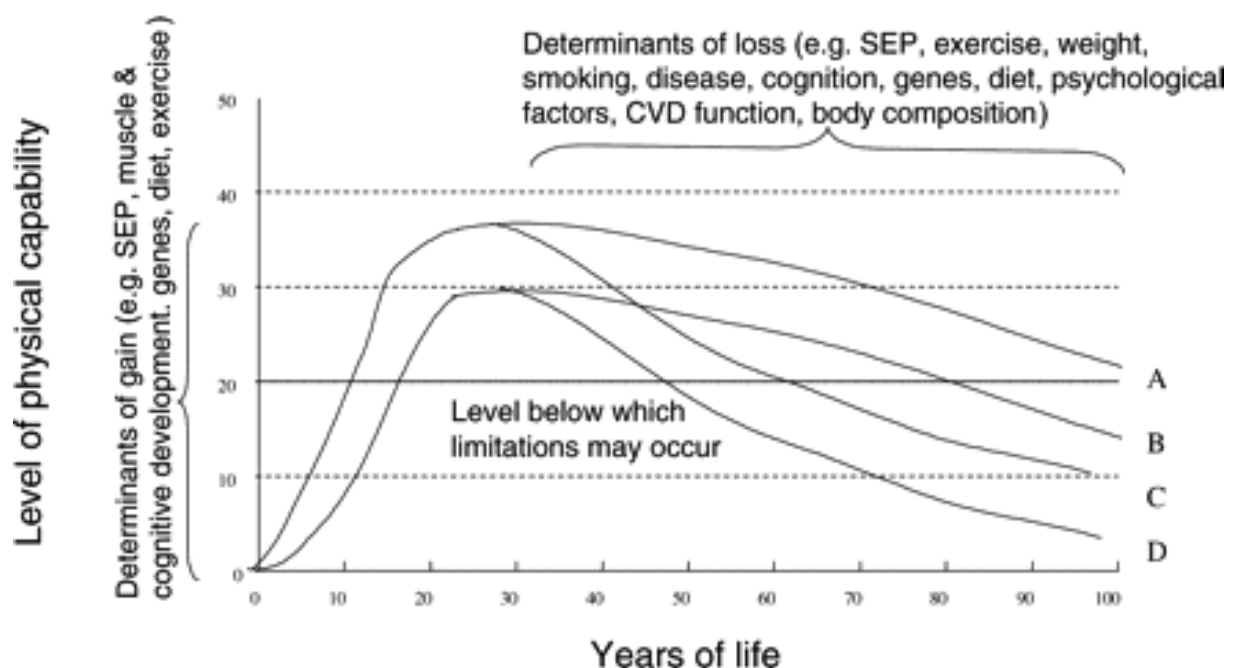
Source: Kalache and Kirkbusch, 1997

Determinants of health

The main determinants of health are well documented and the model widely cited by Dahlgren and Whitehead (34) (figure1.4) illustrates that whilst the healthcare system is important, other factors play a larger part in determining lifetime health and wellbeing. Health and social wellbeing are intrinsically connected but the services that provide for them generally operate in disconnected ways with different perspectives on how to optimise the health and wellbeing of the ageing population (35).

Figure 1.4. Model of determinants of health.
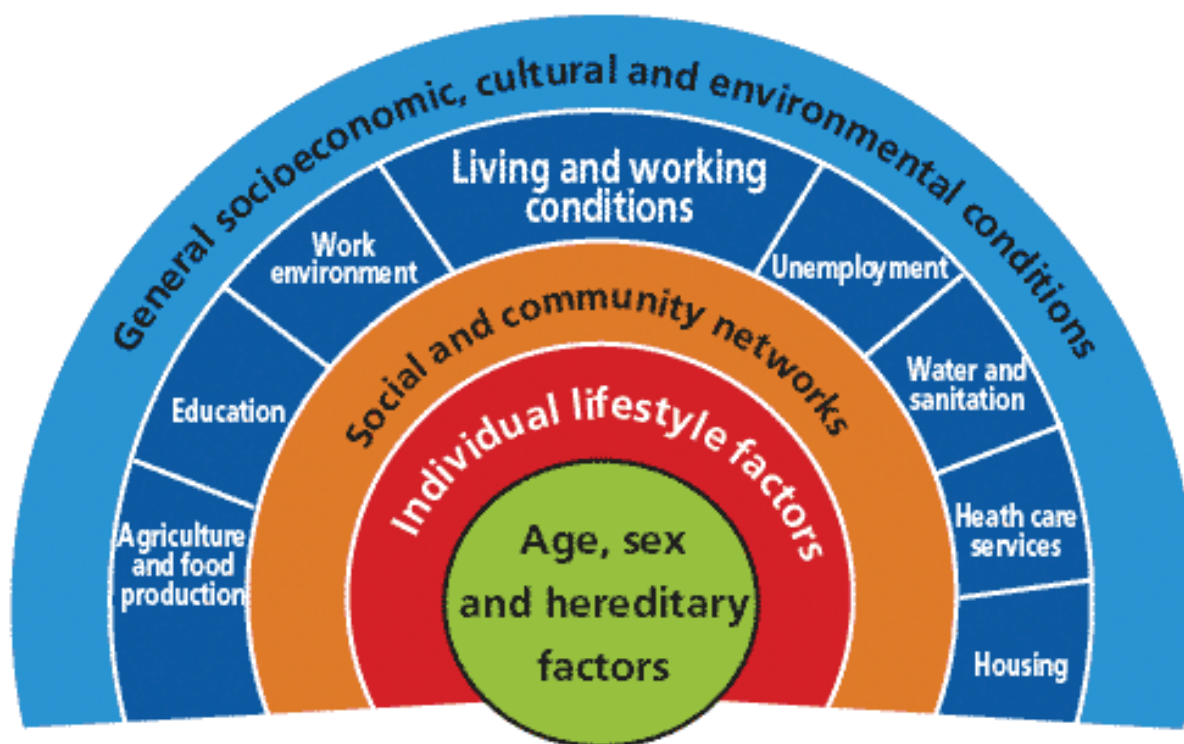
Source: Dahlgren and Whitehead, 1991 (34)

Social and community networks are particularly important determinants of health. In a recent study of health promotion for older people the important social factors determining health, that were prioritised by older people and service providers were; recent life event; housing and garden maintenance; transport, both public and private; financial management and carer status and needs (35).

World Health Organization classification of functioning, disability and health (ICF)

The World Health Organization (WHO) developed a taxonomy of diseases and described the International Classification of Impairment, Disability and Handicap in 1988 (ICIDH) (36). It has three central concepts:

- Impairment (loss or abnormality of psychological, physiological or anatomical structure or function disability).

- Disability (restriction or lack of ability to perform an activity in a normal manner).

- Handicap (disadvantage due to impairment or disability that limits or prevents fulfillment of a normal role).

This taxonomy was updated in 2001 to include a classification system that places less emphasis on disease and more emphasis on function in relation to personal and environmental factors (see figure 1.5.).

Figure 1.5. Framework of disability.
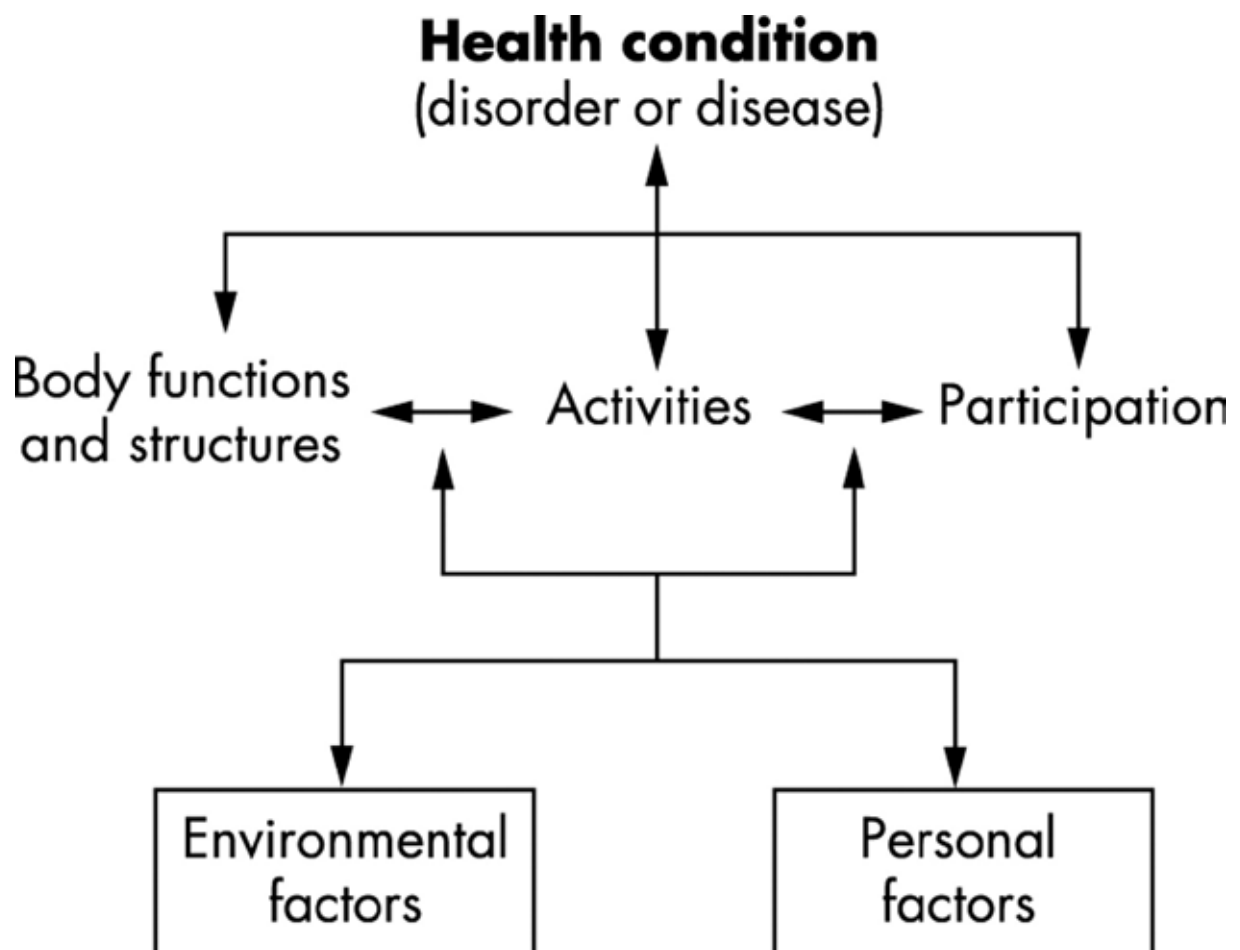
Source: World Health Organization International Classification of Functioning, Disability and Health (ICF) 2001(37)

Terms such as disability, impairment and functional limitation have various interchangeable meanings and the disablement process was reported by Verbrugge and Jette in 1994 (2) as an alternative taxonomy to the WHO definition to encompass intra-individual factors (lifestyle and behavioural changes), extra-individual factors and risk factors.

The disablement process

Disablement refers to the impact that chronic and acute conditions have on bodily function and the ability of individual's to cope in society. The main pathways lead from pathology, to impairment, to functional limitations and disability. Risk factors play a central role in the disablement process. Risk factors can be demographic, social, lifestyle, behavioural, environmental and biological characteristics that can affect the presence and severity of impairment, functional limitation and disability. In addition, extra-individual (medical care and rehabilitation, medication and other therapeutic regimens, external support and built physical environment) and intra-individual factors (lifestyle and behaviour changes, coping mechanisms, psychosocial attributes and activity involvement) contribute to the disablement process. The model helps to isolate the multiple factors that contribute to the development of disability and is often used as a framework for research.

Socioeconomic inequalities

Socioeconomic inequalities in health persist into old age and these include those between men and women, people from different ethnic backgrounds and socioeconomic circumstances and those living in different geographical areas. The potential for compression of morbidity in a population is determined by many factors primarily those that influence development in early life. There is growing evidence that social, behavioural and psychological exposure in early life is associated with physical and cognitive capability in later life but this should not deter us from implementing effective evidence-based interventions in later life (38). Whilst some life course factors may not be modifiable, there are substantial opportunities to influence how people age.

A systematic review of the effects of intervention on health inequalities concluded that evidence was unclear, but certain categories of interventions (mainly in the field of housing) may impact positively on inequalities (39).The challenge for policy makers and health professionals is to target those that are most likely to benefit from preventative interventions in order to maximise healthy life years, and prevent disablement at an early stage, rather than simply provide crisis reactive health and social care management for all.

Frailty

The term frailty is used throughout the literature although there is no consensus on the definition amongst experts and different terms are used to describe different concepts. Some definitions are based purely on biomedical factors and others include psychological factors (40). It has been defined simply as:

>   'A decreased ability to withstand illness without loss of function.' (41)

Campbell defines frailty in a more complex manner:

>   'A condition or syndrome which results from a multi-system reduction in reserve capacity to the extent that a number of physiological systems are close to, or past the threshold of symptomatic failure. As a result the frail person is at risk of disability or death from minor external stresses.' (42)

Fried *et al* (2001) formulated specific criteria that define the frailty syndrome based on the presence of at least three or more defined characteristics. These include unexplained weight loss, muscle weakness, self-reported exhaustion, poor endurance, and low activity levels (43). Frailty can appear suddenly and should not be confused with disability (a physical or mental impairment that substantially limits one or more of essential life activities) or comorbidity (the concurrent presence of two or more chronic diseases or conditions). Frailty can lead to an increased risk of multiple adverse health-related outcomes, disability, morbidity, falls, institutionalisation, hospitalisation and death (40). A number of frailty measures have been developed with different domains and different functions either as case finders, screening instruments or assessment tools (44).

Ferrucci (2004) (45) described eight indicators and potential outcome measures that are often used in trials (table 1.1) but there is no consensus on the classification of frailty or standardisation of outcome measures and hence conclusions about interventions are often difficult to draw. Cognitive indicators are recognised as important but there are methodological and ethical difficulties associated with measuring older people with dementia. That is not to say that older people with dementia should be excluded from interventions or research but careful consideration should be given that takes into account the cognitive factors.

Whilst attempts have been made to improve clinical outcomes for frail people there are no interventions developed that specifically reverse the syndrome of frailty (46).

Table 1.1 Frailty indicators

Indicator	Possible measure
Mobility	Gait speed.
Strength	Grip strength, chair rise, knee extensor strength.
Endurance	Lack of energy, tiredness, oxygen-uptake.
Nutrition	Under-nutrition, weight loss, body mass index, obesity.
Physical inactivity	Frequency and duration of walking and cycling in previous weeks and average amount of time spent monthly on hobbies, gardening, odd jobs and sport.
Balance	Items from Berg scale, sitting to standing, standing support, standing to sitting.
Motor processing	Coordination, movement planning and speed.
Cognition	Cognitive status measures.

Source: Ferrucci *et al.* A Consensus Report. J Am Geriatr Soc, 2004.

Risk factors for functional decline

Stuck *et al* (1999) (47) conducted a systematic literature review of longitudinal studies that analysed the association of individual risk factors with functional status outcome in community-living older subjects. The highest strength of evidence for increased risk factors of functional decline in older people is presented in Box 1.1.

Box 1.1. Risk factors for functional decline in older people

The highest strength of evidence for an increased risk of functional decline in older people includes:

- Cognitive impairment.
- Depression.
- Disease burden (comorbidity).
- Increased or decreased body mass index.
- Lower extremity functional limitation.
- Low frequency of social contacts.
- Low level of physical activity.
- High level of alcohol use in men.
- No alcohol use compared to small.
- Poor self-perceived health.
- Smoking.
- Vision impairment

Source: Stuck *et al*. Soc Sci Med. 1999; Feb 48(4):445–69.

The highest predictors of nursing home admission in the USA were three or more activities of daily living dependency. In another meta-analysis of risk factors, that predict nursing home admission in the USA, Gaugler *et al* (2007) found that activity of daily living dependencies, cognitive impairment, non-caucasian race/ethnicity, prior nursing home admission and social support/caregiver factors were identified as the most important precursors of entry (48).

Identification of older people at risk

Identification of older people in the community that are at risk of becoming disabled is considered to be an important component of care. Risk prediction tools have been developed across Scotland although they are generally focused on risk of unscheduled hospital admission and despite policy recommendations, they are not used universally. This is probably due to the fact that it is difficult logistically to adequately screen older people (45). Distinction should be made between tools that aim to screen for health problems and those that aim to detect disability. Raiche *et al* (2008) distinguish between case-finding and screening:

- Case-finding refers to identifying individuals who are already affected by a condition (current state: prevalent cases).

- Screening refers to identifying individuals who will be affected by a condition (prediction of incident cases) (49).

The evidence-base for identifying people at high-risk of hospital admission was developed extensively in the USA due to the nature of insurance-based USA healthcare systems, but few have been developed in the UK (50). Examples of tools that have been used the UK are:

The Patients at Risk of Re-Hospitalisation (PARR) case-finding tool commissioned by the Department of Health and developed in England. This tool uses retrospective hospital-based inpatient and outpatient information as predictors of high risk older people and is therefore focused 'downstream' (51).

The Scottish version of PARR called the Scottish Patient at Risk of Readmission and Admission (SPARRA) uses historic data and is based on patients who have an emergency admission in the previous three years (52).

The PEONY (Predicting Emergency Admission Over the Next Year) model developed in Tayside is a population-derived algorithm that was developed for use by clinicians and policy makers in predicting future admissions to hospital (53).

The Emergency Admission Risk Likelihood Index (EARLI) developed in Runcorn, UK is a simple triage tool used to identify older people at high risk of an acute admission to hospital in the UK in the following 12 months. It differs from other tools as it does not rely on a retrospective time-consuming search through hospital and primary care databases, the disadvantage of this method of data collection is that it requires an additional administrative cost of postal questionnaires and the validity of the questionnaire would depend on a high response rate (54).

Health Risk Appraisal in Older People (HRA-O)

The Health Risk Appraisal tool was developed initially in the USA and more recently in a European setting by the PRO-AGE project group (Prevention in Older People-Assessment in Generalists' Practices) (55). The HRA-O takes a systematic approach to collecting data from individuals that identifies risk factors by questionnaire and provides individualised feedback using computer software, to the individual, general practitioner (GP) or healthcare provider. It was designed for a healthcare setting and includes a list of 19 domains in a questionnaire of over 30 pages long (http://www.biomedcentral.com/content/supplementary/1471-2288-7-1-S1.pdf).

The domains include: accident prevention, alcohol use, falls, functional status, health status, hearing, incontinence, mediation use, medical history, memory, mood, nutrition, oral health, pain, physical activity, preventative care, social factors, tobacco use and vision. Each individual's answers are entered into a computer that analyses answers to questions using an 'expert system' which compares the response with an evidence-based knowledge set. The system then produces a series of recommendations for change. It would obviously be difficult to integrate this tool into a clinical setting without additional administrative support. However, the HRA-O has been piloted and evaluated in British general practice and it has recently been developed further to incorporate additional questions relating to the social determinant of health (35).

There are many other predictive tools that have been developed elsewhere. Examples of some of these tools include:

Functional Autonomy Measurement System (SMAF). This multi-domain tool focuses on identifying older people with moderate-to-severe disability rather than those that have already been admitted to hospital and it can be administered in a community setting (56). It includes five dimensions of disability: activities of daily living (ADL), communication, mental function, mobility, and instrumental activities of daily living (IADL). The SMAF was used to develop a simple-to-administer case-finding tool (PRISMA-7). The PRISMA-7 was validated in a cross-sectional study of 594 community-dwelling older people in Canada (49). See Appendix 11 for further details.

The Vulnerable Elders Survey (VES-13). The VES-13 was developed in the USA by the Assessing Care of Vulnerable Elders (ACOVE) group. It is a simple function-based screening tool for community-dwelling populations that aims to identify older people at risk of deteriorating health. The VES tool includes measures of age, self-rated health, limitations in physical function and functional disabilities (57).

Prognostic score for frailty. Ravaglia *et al* (2008) developed an easy-to-collect screening tool that includes only self-reported information and easy-to-perform standardised measurement recommended in routine geriatric care. Nine independent mortality predictors are included in the tool: age >80 years, male gender, low physical activity, comorbidity, sensory deficits, calf circumference <31cm, independent activity of daily living dependence, poor gait and performance (Tinnetti test <24) and pessimism about health. This scoring system is promising but still in the development phase and is not recommended for detection of frailty in clinical practice until it has undergone further research (58).

Tools that predict risk of falls

A vast number of different objective and subjective tools, such as walking tests and the functional reach test have been developed to assess the risk of falling. A study of risk assessment tools for mobility suggests that the most sensitive tools are the Sit to Stand test times 5 (STS-5), the Alternate Step Test (AST) and the 6m Walking Test (SMWT), but these do not take into account other risk factors such as medication use and psychological factors (59). No single tool can be recommended for use in the community, nursing home or mental health setting to measure baseline risk of falling. In a recent systematic review of 29 different screening tools, Gates *et al* (2008) found that the tools discriminated poorly between fallers and non-fallers and no strong evidence exists that any screening test is useful for identifying people who are most likely to fall (60). A history of falls and reported abnormalities of gait or balance are consistently found to be the best predictors of future falls and little or no additional value is gained by further screening (61).

Predictive tools, such as PARR and SPARRA, primarily focus on identifying older people at high risk of hospital admission by previous admission history and caution is needed when attributing reduction in admission rate in high risk patients to a particular intervention without careful comparison of a control group. Recent work in this field by LaMantia (2010) suggests that using return emergency admission as a quality indicator may be inappropriate because of the difficulty in identifying those likely to return (62). Sociodemographic factors can affect outcome and there is evidence that 'regression to the mean' may result in misrepresentation of hospital admission data as rates have been shown to fall without intervention (6). Tools that do take into account other health and social determinants tend to be time consuming and costly to administer in clinical practice.

The SPARRA risk predictor tool is being used sporadically in Scotland to identify people with complex or frequently changing needs, who are likely to benefit from proactive, planned and coordinated care management. However, screening and case-finding is unlikely to benefit older people if there is no clear pathway for any necessary intervention, or if the screening or intervention is not fully accepted by healthcare workers.

Background of the Scottish Collaboration for Public Health Research and Policy (SCPHRP)

In mid-2006 the Scottish Collaboration for Public Health Research and Policy (SCPHRP) was established to strengthen the fields of public health research and policy in Scotland. The collaboration's core mandate is to:

- Identify key areas of opportunity for developing novel public health interventions that equitably address major health problems in Scotland, and move those forward.

- Foster collaboration between government, researchers and the public health community in Scotland to develop a national programme of intervention development, large-scale implementation and robust evaluation.

- Build capacity within the public health community for collaborative research of the highest quality, with maximum impact on Scottish policies, programmes and practice.

The initial workshops resulted in the formation of four working groups through which the collaboration aims to execute its mandate. Each group was charged with drafting a three-year work plan focusing on one of the four life-course stages for public health interventions. The Later Life Working Group identified two priority areas:

- Interventions in primary care/community settings that optimise the early detection of, and slowing down/prevention of, declining function.

- New models of integrated social and healthcare to more promptly detect the need for and provide appropriate support to allow older people to live longer at home.

The first and most important public health priority is to identify interventions that may help to prevent functional decline and disablement. An environmental scan is a process of gathering, synthesising, analysing and dispensing information for strategic purposes in public health. This environmental scan takes a pragmatic approach which aims to use the best evidence available within a limited time-frame taking account of interventions that target individuals as well as communities or populations.

Aim of scan

The overall aim of the environmental scan is to:

- Investigate interventions in primary care and community settings that aim to prevent or delay physical disablement in older people and promote healthy ageing at a national and global level.

Objectives

The objectives of the environmental scan are to:

- Identify high level policies, recommendations or strategies internationally and in Scotland that aim to improve the health and wellbeing of older people and determine whether the policies are evidence-informed.
- Identify and synthesize evidence from the global peer-reviewed and grey literature of interventions in primary care and community settings that aim to prevent or delay physical disablement in older people.
- Identify potential evidence-based interventions for development by the Later Life Working Group.
- Enable transfer of evidence-based knowledge into effective health policy and practice.

Further work, led by Professor Sally Wyke and colleagues, will extend the findings of this scan with an aim to:

1. Identify and describe current policies, programmes and interventions delivered in Scotland that are designed to enable health and wellbeing in older people.

2. Idenitfy gaps in policies and programmes designed to promote innovation in primary and community settings.

2

Chapter 2 – Literature search methods

A review of peer-reviewed and grey literature, published between September 1999 and September 2009, was conducted. The focus of the review was on systematic reviews, meta-analyses and evidence summaries. Review-level data was supplemented by key, high quality primary studies where further details were required to investigate the components of the interventions in more depth or where more recent studies were excluded from the reviews.

Peer-reviewed literature search

A search was carried out with the National Collaborating Centre for (Public Health) Methods and Tools at McMaster University, Canada, for the period September 1999 and September 2009, of the following databases: Ovid MEDLINE , EMBASE (ovid) and CINAHL (Cumulative Index to Nursing and Allied Health). An example of the search strategy for MEDLINE is shown in Appendix 1. This was adapted for the other databases. In addition extensive hand searching of reference lists in relevant publications was undertaken along with citation tracking using Web of Science. Experts in the field were contacted by email for additional reports and opinions.

Key search words

Population: adults, mid-life, middle-aged, elderly, frail, primary care, primary healthcare, family practice, old age, aging, older people, community, later life, elderly persons, community, home based.

Intervention: prevention, exercise programme/program, activity, lifestyle change, social integration, disease management, cognitive behavioural, multidisciplinary, nurse-led, nutrition, anticipatory care, community-based multi-factorial, social, rehabilitation, case management.

Outcomes: cognitive decline, functional decline, disability, disablement, activity of daily living, mortality, life expectancy, health status, socioeconomic, physical function, lifestyle change, functional status, functional outcomes, falls/falling, drug misuse, longevity, costs, management, hospital and nursing home admissions.

General: effectiveness evaluation; intervention studies; randomised (randomised) controlled trial, meta-analysis, systematic review, quasi-randomised (randomised).

Inclusion criteria

- Reviews, meta-analysis and randomised controlled trials, cluster randomised controlled trials, quasi-experimental studies focused on prevention of disablement in the community and primary care setting published between September 1999 – September 2009.

- Older people (over the age of 50) including the general and frail older population, and those with impairment or disability living independently (alone or with a partner).

- Studies including at least one of the following outcomes: impairment, physical function, cognitive function, social function (e.g. isolation and loneliness), disability, quality of life (e.g. depression, SF-36), activities of daily living, nursing home and hospital admission, mortality, risk or rate of falls and cost effectiveness.

- Interventions aimed at preventing disablement at a population and/or individual level e.g. promoting physical activity, injury prevention, healthy eating and healthier behaviour, improving mental health, improving environment and social contact, anticipatory care and case management, home visits or comprehensive geriatric assessment.

Exclusion criteria

- Interventions including surgery and/or specific drugs.

- Intervention primarily focused on treatment or management of specific disease (i.e. chronic heart disease, stroke, diabetes).

- Interventions focused on older people already in nursing home institutions and those already in or recently discharged from hospital.

- Papers not written in English.

Publication selection

Two reviewers (HF and SP-R) independently searched the literature and one reviewer (HF) selected relevant titles and abstracts and identified papers that met the selection criteria.

Website search

A search of websites was conducted to find additional information in the grey literature. This included resources and documents relevant to research, interventions, policies and programmes delivered in Scotland or internationally. Further information was drawn from the following websites:

www.scotgov.uk The Scottish Government

www.gro-scotland.gov.uk/files2/stats/projected-population-of-scotland-2008-based
Registrar General for Scotland

www.who.int World Health Organization

www.oecd.org/health Organisation for Economic Co-operation and Development

www.nice.org.uk National Institute for Clinical Excellence

www.sign.ac.uk Scottish Intercollegiate Guidelines Network

www.hta.ac.uk Health Technology Assessment

www.opensigle.inist.fr System for information on grey literature in Europe

www.isdscotland.org Information Services Division, Scotland

www.healthyageing.nu Healthy Ageing Project, Europe

www.keepwellscotland.com Keep Well (formerly Prevention 2010)

www.achp.scot.nhs.org.uk Association of Community Health Partnership

www.scotpho.org.uk The Scottish Public Health Observatory (ScotPHO) collaboration

www.sdo.lshtm.ac.uk The National Institute for Health Research Service Delivery and Organisation

www.effectiveolderpeoplecare.org Cochrane Library of Systematic Reviews

www.campbellcollaboration.org Library of Systematic Reviews

www.profane.eu.org Prevention of Falls Network Europe

www.health.gov.on.ca/english/providers/program/mas/mas_about.html
Ontario Health Technology Advisory Committee

www.hsmc.bham.ac.uk/publications/policy-papers
Health Services Management Centre, School of Social Policy

www.otseeker.com Occupational therapy reviews

www.Pedro.org.au Physiotherapy evidence database

Assessment of quality of reviews

The quality of the meta-analyses and systematic reviews was assessed using the AMSTAR measurement tool (63). This is a relatively new instrument based on data from other well validated tools, and consensus of expert opinion. Details of the scoring system are shown in Appendix 2. The narrative reviews were summarised in the discussion section, if they included additional information regarding the theoretical basis of interventions, or they included details of the content and context of interventions that were not reported in the higher quality systematic reviews.

3

Chapter 3 – International and Scottish policies for older people

Introduction

Numerous policies, strategies and frameworks have been published in Scotland over the last 10 years that include recommendations for care of older people. Some policies cover aspects of the determinants of ageing and focus on a general vision of care for the increasing ageing population, whilst others are more specific to the context of this review. This chapter summarises some of the key policies and frameworks that have been published internationally and in Scotland. A brief overview of the policy documents that are relevant to this scan are presented in figure 3.1.

International policies

The WHO Active Ageing Policy Framework (2002)

The policy framework for active ageing was guided by the United Nations principles for older people. The framework is broad and cross cutting but also focuses on specific age groups. The policy is based on three pillars:

- *Health*. Policies aim to keep risk factors both environmental and behavioral, for chronic disease and functional decline, low and protective factors high.

- *Participation*. Policies aim to support full participation in socioeconomic, cultural and spiritual activities.

- *Security*. Policies aim to address social, financial and physical security needs and rights of people as they age.

The Healthy Ageing Project. A Challenge for Europe (2004–2007)

This project was initiated by the EU Public Health Programme and supported by the Swedish National Institute of Public Health, the European Commission and twelve other partners including WHO, AGE, EuroHealthNet, public health institutes, ministries and universities (64). The healthy ageing project was co-funded by the European Commission between 2004 and 2007 with an aim to promote healthy ageing among people over 50 years. The project members reviewed the literature, statistics, policy and good practice throughout Europe. The objectives were to exchange ideas, knowledge and experience among European member states and provide recommendations to EU and WHO active ageing policy framework. The ten major topics were retirement and pre-retirement, social capital, mental health, environment, nutrition, physical activity, injury prevention, substance use/misuse, use of medication and preventative health services. The report made recommendations for research with a focus on development of projects to assess the effectiveness and cost effectiveness of health-promotion interventions for the prevention of disease or ill health especially in later life.

The recommended priority policy topics for action include:

- Increasing participation of older people in meaningful work without discrimination and support stress free transition from work to retirement.

- Improving social integration to prevent loneliness/isolation and to provide opportunities for voluntary work for older people.

- Addressing social relationships, poverty, discrimination that has an impact on mental health.

- Improving access to safe and stimulating indoor and outdoor environments.

- Promoting healthy food and eating habits.

- Increasing level of physical activity to reach recommended 30 minutes per day.

- Initiating safety promotion and injury prevention.

- Promoting smoking cessation and reducing alcohol consumption.

- Use quality indicators for drug use and improve coordination among care providers.

- Improving preventative health services (e.g. immunisation programmes) and considering preventative home visits under certain conditions.

Policies for Healthy Ageing. Organisation for Economic Co-operation and Development (Oxley 2009)

The Organisation for Economic Co-operation and Development discusses healthy ageing policies across Europe with a particular focus on evidence for programme effectiveness on health outcomes and cost-effectiveness (3). The policies are grouped into four broad headings:

1. Improved integration in the economy and into society.

2. Better lifestyles – specifically tackling increased physical activity, nutrition and substance use or misuse.

3. Adapting health systems to the needs of older people. The need for better coordinated and more patient-centered care.

4. Attacking underlying social and environmental factors affecting healthy ageing.

The review suggests that improvement in the health and welfare of older people may be possible from some combination of: delayed retirement, increased community activities, improved lifestyles, healthcare systems that are better adapted to the needs of older people but it remains unclear as to which are the most cost-effective.

Scottish Government policies

Building a Health Service Fit for the Future (Kerr Report, May 2005)

This policy sets out a 20 year plan for the NHS that aims to shift the emphasis of care from hospital-based care to preventative management. It has a number of key messages relevant to the care of older people:

- A shift of care from hospital to community.
- Preventative or anticipatory care rather than reactive management.
- Better integration of the NHS to improve the system of care delivery.
- Development of a systematic approach for caring for the most vulnerable with long term conditions.
- Targeting action in deprived areas including using anticipatory care to prevent ill-health.
- Improve support for carers.
- Improve Community Health Partnerships between primary and secondary care including better integration of social care.

Delivering for Health (2005)

Delivering for Health was launched by the Scottish Health Minister in October 2005. It builds on the vision and principles of the Kerr Report and describes a policy agenda for NHS Scotland that aims to improve the health of the people of Scotland, and close the gap in life expectancy. The policy emphasises the need to encourage people to take greater control over their own health and avoid unnecessary hospital admission by increasing local primary care service. Specific changes planned for older people include shifting care locally to GP practice, community pharmacies, community health centres and day care centres. It highlights the need to develop dedicated resources in primary care for those with long term conditions particularly those living in deprived areas.

Better Health, Better Care (2007)

Better Health, Better Care (2007) follows on from the *Building a Heath Service Fit for the Future* (Kerr Report, May 2005). The three main components of the policy are health improvement, tackling health inequality and improving the quality of healthcare. The action plan sets out the Scottish Government's plans to extend anticipatory care approaches. There is a particular emphasis on commitments to public participation, improving patient experiences, patient rights and enhanced local democracy and a more mutual approach to healthcare. The report emphasises the need to ensure that older people get the services and support they need to live as independently as they can, whether they are living at home, with carers or in a care home.

The report of the ministerial taskforce on health inequalities, *Equally Well* (2008), emphasises that the overall goal of the government, sustainable economic growth, can only be achieved through a reduction in health inequalities. Reducing inequalities in health is therefore critical to achieving the Scottish Government's aim of making Scotland a better, healthier place for everyone, no matter where they live. However this is a challenging area to tackle as research suggests that whilst the health of the country as a whole is improving, some inequalities are widening and virtually none are narrowing. Despite the entire medical, public health, social, economic, and political changes over the last century patterns of UK poverty and mortality have not changed much over the last century (4).

Better Outcomes for Older People: A Framework for Joint Services (2008)

The Framework promotes the development and mainstreaming of joint and integrated services, as part of the Joint Future drive for better outcomes for individuals and their carers. It sets out the requirements which the local partnerships of NHS health boards and local authorities should meet in developing and delivering joint and integrated services such as augmented care at home, extra care housing, equipment and adaptations, to support older people better in their own homes. The Framework focuses on development of joint and integrated services which assist older people to lead more independent lives and have more personal control over their lifestyles, care and environment. The framework emphasises the need for joint services for health promotion, prevention and early intervention (such as GP exercise referral schemes) which can assist older people to lead healthy and active lives in their own homes.

Achieving Our Potential (2009)

Achieving Our Potential is a framework aimed at tackling poverty and income inequality in Scotland launched by the Scottish Government on 24 November 2008. Supported by funding of £7.5 million, *Achieving Our Potential* sets out the approach of the Scottish Government in the fight against poverty. It highlights that in 2006–07 relative poverty affected 20% of the Scottish population. The action plans specifically aimed at older people include abolishing prescription charges, providing assistance for central heating and supporting community planning partnerships.

Figure 3.1. Scottish Government policies, framework, strategies and action plans relevant to the care of older people living in the community

Building a Health Service fit for the Future
(Kerr report 2005)
(20 year plan)

Delivering for Health (2005)
Builds on vision of Kerr report

Better Health, Better Care (2007)
Health improvement
Health inequality
Improving quality of care

Better Outcome for Older people (2008)
Framework for joint services

Achieving our Potential (2009)
Framework for tackling poverty

People and society
All our Futures: Planning for a Scotland with an Ageing Population

Health and Community Care

Community care

NHS Health Scotland

Improving Health

Action Plan for Health and Well Being

The Future Care of Older People (2009)

Joint Improvement Team (JIT) (2004)

Healthy Ageing Project (2003-2007)

Free Personal Care (2008)

Range and Capacity Review (2006)

The Long Term Conditions Collaborative (2008-2009)

Keep Well (2010)
(Well North, Equally Well)

Dementia Strategy (2010)

Falls Group (2003)
Up and About. Prevention and Management of Falls and Fractures (2008)

Shifting the Balance of Care (2008)

Reshaping Care for Older People (2009-2010)

Mental Health and Well Being in Later Life (2006)

Delivery Framework for Adult Rehabilitation (2008)

Seizing the Opportunity Telecare Strategy (2008)

People and society

All Our Futures: Planning for a Scotland with an Ageing Population

All Our Futures: Planning for a Scotland with an Ageing Population was published in March 2007 and deals with the issues around the demographic ageing of the population in Scotland. *All Our Futures* sets a vision for a future Scotland which values and benefits from the talents and experience of older people. In particular *All Our Futures* sees older people as contributors to life in Scotland, seeks to break down barriers between generations, and aims to ensure that services are in place so that people can live life to the full, as far as possible, as they grow older. The extensive consultation and engagement process that led to *All Our Futures* identified six priority areas for action:

1. Improving opportunities and removing barriers.

2. Forging better links between the generations.

3. Improving and maintaining health and wellbeing.

4. Improving care, support and protection for older people.

5. Developing housing, transport and planning services.

6. Offering learning opportunities throughout life.

Towards a Mentally Flourishing Scotland. Policy and Action Plan (2009–2011)

The Scottish Government is planning to improve the treatment and care for those suffering with dementia as well as improving support for carers. Five areas have been identified as important: tackling discrimination, supporting participation in meaningful activity, supporting positive relationships, improving physical health and tackling poverty.

Health and community care

Community care

Free Personal Care (2008)

The Free Personal Care policy, unique to Scotland, offers older people aged over 65 years access to free personal care at home, arranged via the local authority social service. Assessment and intervention includes any of the following:

Continence management; food and diet; problems with immobility; counselling and support; simple treatment (behaviour management, psychological support, reminding devices, assistance with medication [including eye drops], application of creams and lotions, simple dressings); personal assistance including assistance with dressing, surgical appliances, prostheses, mechanical and manual aids and mobility and help with personal hygiene.

Whilst many these interventions are associated more with end-of-life care, interventions such as help with food and nutrition and medication intake may impact on health and functional decline in community-living older people.

Range and Capacity Review Group. The Future Care of Older People in Scotland (2006)

Faced with the challenges of an ageing population the Range and Capacity Review Group focuses on the future provision of care services for older people over the next 15 years with a view to develop an appropriate model of care. The group recommends more flexible service delivery including: increased use of technology and telecare services; better intermediate care; active ageing programmes; increased anticipatory care and development of forward looking capacity plans in community partnerships.

Falls Group (2003)

The Falls Group was established in 2003 with a view to providing helpful advice, primarily for Community Health Partnerships (CHPs). NHS Health Scotland sent a falls prevention resource pack, including the conference report Taking Positive Steps to Avoid Trips and Falls to 5,000 health professionals throughout Scotland. Commissioned research followed in 2003 to assess the nature and uptake of the falls prevention resource pack (Health in Later Life: Evaluation of the NHS Health Scotland Falls Prevention Scheme. November 2003). A final report was published in February 2007. The group recommended development of falls prevention strategies linked with the Delivery Framework for Adult Rehabilitation in Scotland (65).

NHS Quality Improvement Scotland: Up and about. Pathways for the prevention and management of falls and fragility fractures (2010)

Community and Practice NHS Quality Improvement Scotland, in conjunction with NHS Education for Scotland, launched a Prevention and Management of Falls Community of Practice Strategy in April 2008. The final Pathways for the Management of Falls report has recently been published. Up and About aims to assist planning and development of falls prevention services across Scotland. These range from foot clinics, rehabilitation and exercise classes, multidisciplinary falls service (Greater Glasgow & Clyde), environmental interventions (Perth), telecare (NHS West Lothian), home safety education, screening for visual problems (Perth & Kinross) and specialist pharmacy medication reviews (Glasgow & Clyde). Initially, Community Health Partnership Falls Leaders in Scotland formed the core membership, but since then it has expanded. Now the community comprises a number of active subgroups with specific interests or purposes, and a wider, online falls community (www.fallscommunity.scot.nhs.uk).

Improving health

As well as the *Healthy Ageing Project* other policies aiming to promote mental and physical health in older people include the *Mental Health and Wellbeing in Later Life* project and *Keep Well.*

Mental Health and Wellbeing in Later Life (2006)

Mental Health and Wellbeing in Later Life was developed in partnership with Age Concern Scotland, the Mental Health Foundation and NHS Scotland. The overall aim of the project was to promote healthy ageing with mental health and wellbeing identified as being central to the success of the policy. The first three years of the programme focused on developing research to underpin health promoting activities with older people, building older people's capacity to engage in activities at a local, national and regional level and develop education and information resources.

Keep Well (formerly Prevention 2010)

www.keepwellscotland.com

Keep Well is an example of anticipatory care in practice, developed as part of plans to tackle health inequalities in Scotland. The programme focuses on specific diseases, primarily coronary heart disease and diabetes and aims to increase the rate of health improvement in 45–64 year olds in areas of greatest need. It is not directly focused on older people but could be viewed as part of an upstream preventative strategy for older people. The intention is to further develop primary care services to deliver anticipatory care, and where appropriate link with other partner agencies. This approach involves:

- Identifying and targeting those at particular risk of preventable serious ill-health (including those with undetected chronic disease).
- Offering appropriate interventions and services to them.
- Providing monitoring and follow up.

Keep Well was evaluated over two phases. Phase 1 focused on lessons learnt during the implementation phase. Phase 2 does not provide evidence of efficacy but provides case studies of the most promising approaches identified in phase 1.

Action Plan for Health and Wellbeing (2007)

The *Action Plan* outlines the actions the government plans to take to improve health and is based on the strategies outlined in *Better Health, Better Care.* The central themes of the *Action Plan* are patient participation, improvement in healthcare access, and a focus on the twin challenges of improving Scotland's public health and tackling health inequalities.

NHS Health Scotland

Joint Improvement Team (2004)

The Joint Improvement Team (JIT) was established in late 2004 to work directly with local health and social care partnerships across Scotland. One of the tasks of the JIT is to work in partnership with the Scottish Government to help reshape care for older people. The JIT has been involved in evaluation of projects such as the re-ablement services that involve a holistic, needs-led assessment with service user-active participation in the process. The re-ablement approach follows key policy objectives of supporting people to live healthy and independent lives at home, for as long as possible. Another example of a strategy developed by the JIT includes the telecare strategy that aims to 'help thousands of people to live at home for longer with safety and security by promoting the use of telecare and thereby providing the foundation on which telecare systems can become an integral part of community care services in Scotland' (66).

Shifting the Balance of Care Framework (2008)

The overall aim of the Improvement Framework is to focus on collaboration between local health boards and their partners on the key areas where shifting the balance of care is necessary for the delivery of Single Outcome Agreements, HEAT targets and Local Delivery Plans. Eight improvement areas have been identified as key to the delivery of national and local outcomes and targets, most of which are relevant to reducing disablement in the community. The eight improvement areas are:

1. Maximise flexible and responsive care at home with support for carers.

2. Integrate health and social care for people in need and at risk.

3. Reduce avoidable unscheduled attendances and admissions to hospital.

4. Improve capacity and flow management for scheduled care.

5. Extend the range of services outside acute hospitals provided by non medical practitioners.

6. Improve access to care for remote and rural populations.

7. Improve palliative and end-of-life care.

8. Improve joint use of resources (revenue and capital).

The Long Term Conditions Collaborative (2008–2009)

The *Long Term Conditions Collaborative* is one of a number of initiatives within the Scottish Government that aim to improve the quality of care provided for people with long term conditions and that generally, although not exclusively involves older people. The *Long Term Conditions Collaborative* has been designed and developed by the Improvement and Support Team and NHS health boards in support of *Better Health, Better Care* as part of a new and ambitious improvement agenda. The main changes outlined by the Collaboration are:

• To empower and support people living with long term conditions, their carers and the voluntary sector to be full partners in planning, improving quality and enhancing the experience of care.

• To commission peer support groups for people with long term conditions and their carers and provide relevant, accessible information and to train staff to deliver the care.

• To provide better, local and faster access to services for long term conditions.

• To have information systems that support registration, recall and review for people with multiple conditions and support data sharing.

In a recently published report (Long Term Conditions Collaborative: Improving Complex Care 2009) ten actions were identified as being important factors in the management of older people:

1. Stratify your population and identify those at high risk.

2. Target and deliver a proactive case/care management approach.

3. Introduce advanced/anticipatory care.

4. Communicate and share data across the system.

5. Develop intermediate care alternatives to acute hospital.

6. Provide telehealth and telecare support.

7. Develop a falls prevention pathway and services.

8. Provide pharmaceutical care.

9. Ensure timely access, flexible homecare and carer support.

10. Promote mental health and wellbeing in later life.

Reshaping Care for Older People (Dec 2009–ongoing)

The overall focus of this strategy is based on demographic projections. Current arrangements for the care of older people are not sustainable due to the inevitable dramatic increase in the population of older people and consequent rising cost of care, along with lack of sufficient human resources to deliver the care (5). The proposal to reshape the care of older people is being developed through a framework of eight workstreams and collaboration with clinical experts, MSPs, government policy makers and members of special interest groups. Five of the workstreams focus on service design (care homes, care at home, care pathways, planning for ageing communities and healthy life expectancy), two on demographics and funding, and one relates to the workforce. The work stream Promoting Healthy Life Expectancy is the most relevant to the content of this scan as it focuses on primary and secondary prevention strategies and evidence for effective interventions to promote healthier lifestyle choices and prevent functional decline in older age.

4

Chapter 4 – Literature search results

Introduction

There are inherent problems involved in reviewing the effectiveness of highly complex interventions that are delivered to diverse populations by different professional groups. The Medical Research Council defines complex interventions as those comprising 'a number of separate elements which seem essential to the proper functioning of the interventions, although the active ingredients of the intervention, that is effective, are difficult to specify' (67). In order to improve the description and conceptual understanding of the content of a complex intervention, Shepperd *et al* (2009) advise using typologies to guide the classification of interventions into homogenous groups and to include where possible, supplementary evidence from qualitative research (67). Unfortunately compliance with these recommendations is not evident in most of the research literature relating to older people. This chapter summarises the overall results of the search and describes the framework used throughout the scan.

Results

The published literature search identified 3,185 papers in EMBASE (1647), CINAHL (28) and MEDLINE (1665). A total of 2,737 remained after duplications were removed. Titles were screened to identify those that fit the criteria, and 541 abstracts of reviews and meta-analyses were checked carefully to check for inclusion. Further screening resulted in 30 reviews and meta-analyses being identified as fitting the study criteria. A further 32 reviews were identified through hand searching and citation tracking. Similarly the database was checked to identify RCTs and controlled experimental cohort studies. 1,133 abstracts were read and 94 studies were identified as fitting the review criteria. Only recently published, primary studies of high quality were included in the review due to time constraints.

Classification of older people

The recommendation published by Gomez *et al* (2008) was used to classify the populations where possible. The classification includes five groups (68):

- *General/healthy older people.*
- *Frail or at risk older people.*
- *Older people with chronic disease.*
- Dependent older people.
- Older people at the end of life.

This review focuses on the first three groups since older people who are already dependent or at the end of life are not eligible for interventions aimed at prevention of disablement.

Classification of interventions

Interventions are grouped into complex or specific interventions although there are clearly overlapping components in each category. A distinction is made between interventions that focus on specific problems related to ageing (falls and social isolation) and specific interventions that are more generally implemented. The results of each review are considered in the context of the classification of population, the type of intervention (i.e. primary, secondary or tertiary prevention[5]) and content of intervention.

The interventions aimed either to delay or prevent physical disablement and subsequent hospital/institutional admissions by primary prevention (e.g. exercise, adaption of slippery floor surfaces for the prevention of falls), secondary prevention (e.g. detection of untreated problem/case management) and tertiary prevention (e.g. improvement in medication use). The framework for the classification is presented in figure 4.1 and a brief summary of content of the interventions, outcomes and main conclusions of the reviews, that met the inclusion criteria, are summarised in Appendix 3 to 10.

Figure 4.1. Classification of reviews

Classsification of population

- General older people.
- Frail or at risk older people.
- Older people with chronic disease/disability.

Health promotion and disease prevention

(Primary and secondary prevention)

Prevention of functional decline

(Tertiary prevention)

Classification of interventions

Complex Home visits, case management, comprehensive geriatric assessment, prevention programmes, integrated service delivery, falls prevention.

Specific Exercise, nutrition/vitamin supplements, medication review, information communication technology (telecare/telehealth), vision screening, social integration, environmental modification and assistive devices.

The type and number of meta-analyses and systematic reviews identified in the search are presented in table 4.1.

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[5] **Primary prevention** strives to prevent activity limitation and disease.
Secondary prevention focuses on discovering early signs of activity limitations and taking urgent, relevant steps to prevent the disablement process from spiralling or to restore daily activities.
Tertiary prevention aims to avoid further decline in cases where impairment, activity limitations, and nonparticipation are irreversible.

Table 4.1 Number and type of interventions included in reviews

Type of intervention	Number of reviews
Complex	
Comprehensive geriatric assessment	3
Preventative home visits by healthcare professionals	9
Integrated service delivery/case management	3
Falls prevention	17
Specific	
Exercise	15
Nutritional needs (one review of exercise also included nutrition)	3
Medication review	2
Telecare/telehealth	5
Social integration	3
Vision screening	2
Total	62

The following documents were identified in the grey literature as relevant to the aims of the scan although not all contain review level information:

- World Health Organization (WHO). Active Ageing Framework Policy (2002) (27)

- Healthy Ageing. A Challenge for Europe (2007) (64)

- Policies for Healthy Ageing (2009) (3)

- Proven Strategies to Improve Older People's Health (1999) (3)

- The Health and Wellbeing of Older People in Scotland (2001) (32)

- What is the Effectiveness of Home Visiting or Home-based Help Support for Older People? (69)

- The Effectiveness of Domiciliary Health Visiting: A Systematic Review of International Studies and a Selective Review of the British literature (70)

- Older People Living in the Community-Nutritional Need, Barriers and Interventions: A Literature Review (71)

- Scoping Exercise on Fallers' Clinics (72)

- Telecare: A Crucial Opportunity to Help Save Our Health and Social Care System. Yeandle (2009) (5)

- Case-Managing Long Term Conditions: What Impact Does it Have in the Treatment of Older People? (73)

- Telecare: A Rapid Review of the Evidence. A Report Prepared for the West Midlands Strategic Health Authority 2005–2008 (74)

- Building an Evidence Base for Successful Telecare Implementation: Updated Report of the Evidence Working Group of the Telecare Policy Collaborative (17)

- Up and About. Pathway for Prevention and Management of Falls and Fragility Fractures. Quick Reference Guide 2010 (75)

- Medical Advisory Secretariat. Ontario Health Technology Assessment Series 2008 (76)

5

Chapter 5 – Complex interventions

Summary

General points

- Determining the benefits of complex interventions is difficult due to the heterogeneity of the literature and particularly the lack of standardisation of outcome measures.

- There is widespread confusion in the literature regarding the terminology of complex interventions for older people.

- There is little evidence provided from reviews of the different intensities of programmes i.e. there is no clear dose response effect.

- There is inadequate evidence to support strategies to achieve health promotion and preventative care in older people through broad-based screening and assessment in primary care. There is no evidence to support preventative strategies based on advice alone.

- There is no evidence to support the use of lay or voluntary care givers in the care of older people as a means of achieving either health or functional improvement or reduced institutional admission, but that does not mean such assistance is not critical to the quality of life for older people.

- Evidence from review level and primary studies suggest that the case for implementation of complex interventions is relatively weak but there are some areas of potentially promising development.

Interventions for older people at low risk.

- Universal assessment of *all* older people aged over 75 years is no more effective than targeted assessment and is not recommended.

- For older people at lower risk, comprehensive geriatric assessment followed by multidimensional intervention *may* be moderately beneficial in reducing nursing admission but more research is needed to identify which components of care are most effective.

Evidence for frail or disabled older people.

- Multi-dimensional home visits interventions have the potential to achieve small positive improvements in disability but evidence is not consistent and may be dependent on factors such as the experience of the care provider, easy access to provision of follow up service and length of follow up.

- A comprehensive approach that incorporates a variety of intervention strategies (e.g. disease management and health promotion) addressing the multiple co-existing medical, functional, psychological and environmental problems, and all risks of older people, may have potential to prevent and delay disablement but the evidence is not conclusive.

- Integrated service delivery programmes have the potential to prevent functional decline but long term follow up is essential and more evidence is required to support implementation in the UK setting.

- There is evidence from two high quality RCTs that advice and instruction given by occupational therapists on assistive devices and home hazard assessment increases functional ability.

Critical components of care

- Home visit interventions associated with favourable outcome include those that employ professionals with experience in assessment, multiple visits, health provider collaboration, multidimensional assessment and those that use a theoretical approach to intervention.

- To ensure that longer term risk factor modification responds to change over time, home visit programmes may need to be tailored to the individual needs and preferences.

- Coordination of care between health and social services *may* be the crucial factor in determining whether a programme is beneficial or not.

- Long term follow up is essential to monitor change over time.

- Most of the interventions rely on high compliance but this is often low or unrecorded. Interventions should include strategies to improve compliance.

Outcomes

- A plethora of outcome variables were identified in the reviews making comparisons difficult. Standardisation of outcomes such as disability and hospital admissions are needed to help comparison of trial data.

- Outcomes used to assess complex interventions for older people are generally focused on hospital admission.

- There is good evidence that simply monitoring admission rates *cannot reliably assess interventions* without a matched control. It seems important to measure emergency hospital admission as well as NHS and private nursing home admissions, as assessing one without the other may lead to misinterpretation of the effectiveness of interventions.

- Improvement in functional outcome is not always associated with a reduction in hospital and institutional admission suggesting that the driver for institutional admission may have more to do with other factors such as poverty, support at home or carer/client preferences.

- Follow up is too short in many trials to demonstrate a difference in effect between experimental and control groups.

Introduction

In 1964 Williamson *et al* (77) reported that many older Scottish people living with health problems and disability were not known to their GP and screening for social and medical problems in the community may prevent functional impairment. This observation led to the development of numerous preventative screening programmes and interventions. This chapter provides a summary of complex interventions targeting older people living independently in the community setting. The terms used to describe the interventions are listed below but are used loosely and are interchangeable.

Definitions

Anticipatory care. Planned intervention to achieve early diagnosis and/or treatment of a condition which may not yet be producing symptoms, or recognised as causing symptoms.

Preventative home visits. Visits to older people living in the community, which are aimed at multidisciplinary medical, functional, psychological, environmental evaluation of their problem and resources. The objectives of the visits are to improve or maintain quality of life and optimise functional health status and independence. The ultimate goals are not only to contribute to quality of life but also to prevent hospital/institutional admission.

Comprehensive geriatric assessment (CGA). Multidimensional interdisciplinary diagnostic process, focused on determining an older person's medical, psychological and functional capabilities, in order to develop a coordinated and integrated plan for treatment and long term follow up.

Case management. The coordination of various system components for a successful outcome (integrated and coordinated care). This entails the assessment of a person's longer term care needs followed by appropriate recommendations for care, monitoring and follow up. There are six core elements and any or all of them may be used; case-finding or screening, assessment, care planning, implementation/management, monitoring and review.

Integrated service delivery. A model of care delivery that uses all public, private or voluntary health and social service organisations involved in caring for older people. The models can be fully or partially integrated. These services ultimately include services such as case management and geriatric assessment but the focus is on the system of organisation.

It was not possible, due to time constraints, to include a description of all primary studies identified in the search. However, recent high-quality studies have been included if they were not identified in the reviews or in the case of the large MRC funded trial of multidimensional assessment of older people in UK general practice (8), if they were particularly influential to policy decision making.

Review literature: complex interventions

The interventions included in the reviews were generally poorly described and there was considerable overlap between the different types of interventions, particularly in reviews of preventative home visits that sometimes include comprehensive geriatric assessment. Whilst there are fundamental differences in the way in which these programmes are delivered in terms of who assesses the participants and if they are assessed using a case finding tool or not, the intensity and frequency of any suggested intervention, number of follow up sessions and length of follow up, there are also many similarities. For example most include assessment of mobility and some type of training either by a nurse, physiotherapist or occupational therapist. Most of the reviews failed to include enough detail of the content, duration and frequency of the interventions and for this reason details from some of primary studies are included in Appendix 5.

Most of the reviews in this section include some form of home visit programme either as an individual intervention or part of a multidisciplinary package of case management. Table 5.1 and 5.2 illustrates that

the conclusions drawn from the reviews are generally inconsistent. This is partly due to the differences in the populations studied, the variation in type of interventions included, heterogeneity of the RCTs included in the reviews, differences in baseline disability levels across the RCTs reviewed and the quality of the reviews themselves. This chapter focuses on the results of the most recent, higher quality reviews as many of the early papers included the same RCTs as those published in 2008 and 2009. None of the reviews focused entirely on the general older population although five reviews selected only frail older people (78) (79) or those with disability (80;81).

Table 5.1 Brief summary of findings and quality of reviews of home visit interventions

Reference No of studies	Intervention	Health category	Outcome	Scores for methodological criteria[6]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Byles 2000 (81) 21 RCTs	Home visits/ health assessments.	Older people with chronic disease.	Inconsistent findings.	y	n	y	n	n	n	y	y	na	na	ca	4/9
Elkan et al 2001 (82) 15 studies (13 RCTs)	Preventative home visits.	General population and frail older people.	Positive for nursing home admission. No effect on function.	y	y	y	y	n	y	y	y	na	na	ca	7/11
Steultjens et al (2004) (83) 17 studies	Occupational therapy home visits.	General population and impaired older people.	Positive for advising on assistive devices for QoL and function.	y	y	y	y	n	y	y	y	na	na	ca	7/9
Huss et al (2008) (84) 21 RCTs	Preventative home visits and geriatric assessment.	General population and impaired older people.	Little effect on function OR 0.89 (95% CI 0.76 to 1.03). Positive for younger age group <77 on mortality OR 0.74 (95% CI 0.58 to 0.94).	y	y	y	y	n	y	y	y	y	y	ca	9/11
Van Haastregt et al (2000) (85) 15 RCTs	Preventative home visits.	General population and impaired older people.	No clear evidence. Only 1-out-of-12 RCTs focused on specific risk factors.	y	y	y	y	n	y	y	y	na	na	ca	7/9
Markel–Reid et al (2006) (86) 12 RCTs	Home visits (nurse only).	General population.	Inconsistent findings.	y	y	y	y	n	y	y	y	na	na	ca	7/9
Stuck et al (2002) (87) 18 RCTs	Preventative home visits.	General population of older people and at risk.	Positive for selected groups >9 visits RR =0.66 (95% CI 0.48 to 0.92) < visits RR 1.05 (95% CI 0.85 to 1.30).	y	y	y	y	n	y	y	y	y	y	ca	9/11
Bouman (2008) (78) 8 RCTs	Home visits (at least 4).	Frail older people at risk.	No long term benefit for mortality, health status, service use or cost.	y	y	y	n	n	y	y	y	na	na	ca	6/9
Liebel et al (2009) (80) 10 RCTs	Multiple home visits.	Older people with disability.	Inconsistent findings.	y	n	y	n	n	y	y	y	na	na	ca	5/9

[6]   1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of included and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review. y=yes, n=no, na=not applicable, ca =can't answer.

Table 5.2 Brief summary of findings and quality of peer-reviewed reviews of geriatric assessment, case management and integrated service delivery

Reference No of studies	Intervention	Health category	Outcome	Scores for methodological criteria[7]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Beswick *et al* (2008) (7) 89 RCTs	Complex including home visits, geriatric assessment and falls.	General population and frail older people.	Modest effects for reduction of hospitals admissions, nursing home admissions, fall. Small effect for improvement in physical function. Not consistent across groups.	y	y	y	y	n	y	y	y	y	y	ca	9/11
McCusker and Verdon (2006) (88) 26 controlled studies	Geriatric assessment and case management.	High risk older people.	Inconsistent findings for emergency admission.	y	y	y	n	n	y	n	n	na	na	ca	4/9
Wieland (2003) (89) 22 trials and reviews	Geriatric assessment.	General population and impaired older people.	Inconsistent. Targeting people at risk most promising.	y	n	n	n	n	n	n	ca	na	na	ca	1/9
Hallberg and Kristensson 2004 (90) 26 studies	Case management.	General population and frail older people.	Inconsistent findings.	y	n	y	n	n	n	n	n	na	na	ca	2/9
Johri 2003 (91) 7 controlled studies	Integrated service delivery.	General population and frail older people.	Inconsistent but overall positive. Mainly based on downstream care.	y	n	y	n	n	y	n	n	na	na	ca	3/9
Eklund and Wilhelmson 2009 (79) 9 controlled studies	Integrated service delivery and case management.	Frail older people.	Inconsistent but overall results in favour of intervention.	y	y	y	n	n	y	y	y	na	na	ca	6/9

[7] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of included and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review. y=yes, n=no, na=not applicable, ca =can't answer.

Comprehensive geriatric assessment and home visits for general and frail older people

Beswick *et al* (2008) published a comprehensive meta-analysis of complex interventions including 89 RCTs published between 1945 and January 2005 (7). The interventions were grouped into the following categories:

- Comprehensive geriatric assessment (CGA) for the general older population (28 RCTs).
- CGA for the frail population (24 RCTs).
- Home visits after hospital discharge for frail and disabled older people (21 RCTs).
- Falls prevention for general and frail older people (13 RCTs).
- Group counselling and education (3 RCTs).

Only trials including an intention-to-treat analysis were included in the meta-analysis. The majority of the trials (40%) were carried out in the USA and 19% in the UK (table 5.3). Very few trials carried out in the UK targeted frail older people. No effects were seen for the intensity of the interventions or for those interventions with multidisciplinary assessment and intervention compared with single component intervention (single component interventions RR 0.95, 95% CI 0.93 to 0.97; at least 3 component intervention 0.97, 95% CI 0.89 to 1.07). In addition no benefit was seen for intensity of the interventions when the interventions were classified into groups (i.e. CGA in the general older people or at risk group). Overall, the effects of complex interventions for all groups were modest (risk of hospital and nursing home admission were reduced from 40.5% to 38.2% [number needed to treat=44] and 10.6% to 9.2% respectively (number needed to treat=71).

Table 5.3 Number of trials from different countries in review by Beswick et al (2008)

	CGA (general older people)	CGA (frail older people)	Community care after hospital discharge	Falls	Group education or counselling
USA	8	15	6	3	3
UK	8	1	5	3	
Australia	3		3	4	
Netherlands	2	1		1	
Denmark	4		2		
Thailand	1				
Sweden			1		
Italy		1	1	2	
Canada		5			
Japan		1			
Germany			2		
China			1		
Switzerland	2				
Total	28	24	21	13	3

Source: Reproduced from Complex Interventions to Improve Physical Function and Maintain Independent Living in Elderly People: A Systematic Review and Meta-Analysis. Beswick *et al.* Lancet; 2008, 371 (9614): 1022–102 with permission from Elsevier.

Table 5.4. Relative risk (95% confidence intervals) of outcome by intervention context (standardised mean difference[8] for physical function) and I^2 heterogeneity statistic [9]

Study context	Not living at home N=79578	Death N=93754	Nursing home admission N=79575	Hospital admission N=20047	People with falls N=15607	Physical function N=21651 (SMD‡)
Geriatric assessment of general older people	0·95 (0·93 to 0·98)*	1·00 (0·98 to 1·03)	0·86 (0·83 to 0·90)*	0·98 (0·92 to 1·03)	0·76 (0·67 to 0·86)*	−0·12 (−0·16 to −0·08)
I^2	35·3%	39·7%	47·5%	61·4%	0	0
Geriatric assessment of older people selected as frail	1·00 (0·87 to 1·15)	1·03 (0·89 to 1·19)	1·01 (0·83 to 1·23)	0·90 (0·84 to 0·98)*	0·99 (0·89 to 1·10)	−0·01 (−0·06 to 0·04)
I^2	43·3%	0	28·8%	11·0%	0	57·9%
Community-based care after hospital discharge	0·90 (0·82 to 0·99)*	0·97 (0·89 to 1·05)	0·77 (0·64 to 0·91)*	0·95 (0·90 to 0·99)*	0·82 (0·61 to 1·08)	−0·05 (−0·15 to 0·04)
I^2	2·2%	5·2%	0	57·0%	40·3%	0
Fall prevention	0·86 (0·63 to 1·19)	0·79 (0·66 to 0·96)*	1·26 (0·70 to 2·27)	0·84 (0·61 to 1·16)	0·92 (0·87 to 0·97)*	−0·25 (−0·36 to −0·13)
I^2	0	0	0	0	65·8%	4·1%
Group education and counselling	0·62 (0·43 to 0·88)*	0·80 (0·42 to 1·55)	0·50 (0·05 to 5·49)	0·75 (0·51 to 1·09)	na	0·05 (−0·20 to 0·30)
I^2	0	0	na	na	na	na
All complex interventions	0·95 (0·93 to 0·97)*	1·00 (0·97 to 1·02)	0·87 (0·83 to 0·90)*	0·94 (0·91 to 0·97)*	0·90 (0·86 to 0·95)*	−0·08 (−0·11 to−0·06)
I^2	29·3%	10·6%	29·0%	43·0%	52·8%	45·9%#

na=not applicable. #Activities of daily living −0·08 (−0·11 to −0·04, I^2=37·5%) and generic physical function −0·09 (−0·13 to −0·05, I^2=64·0%). *p<0.05.
‡Negative value for the standardised mean differences for physical function indicates benefit of intervention compared with control.

Source: Reproduced from Complex Interventions to Improve Physical Function and Maintain Independent Living in Elderly People: A Systematic Review and Meta-Analysis. Beswick *et al*. Lancet; 2008, 371 (9614): 1022–102 with permission from Elsevier.

[8] A measure of effect size used when outcomes are continuous (such as symptom scores). The mean differences in outcome between the groups being studied are standardised to account for differences in scoring methods.

[9] I^2 test for heterogeneity. Classification suggests 25% low, 50% medium and 75% high heterogeneity. Random effect models are used for high heterogeneity. Fixed effect model used for low heterogeneity as it is assumed that the estimated effect sizes only differ by sampling error.

A small reduced risk (5%) was reported for 'no longer living at home' and larger reduced risk (14%) for 'nursing home admission' in the comprehensive geriatric assessment (CGA) group targeting general older people (table 5.4) although the intervention had little impact overall on mortality and hospital admission in this group. It seems important to measure hospital admission as well as NHS and private nursing home admissions, as assessing one without the other may lead to misinterpretation of the effectiveness of interventions. Interestingly, the risk of nursing home admission is reduced (23%) in the group of frail and disabled older people who received community- based care following discharge from hospital. Whilst this scan did not focus on interventions aimed at frail older people discharged from hospital this risk reduction should not be over-looked.

Only 30 of the 89 trials were included in the meta-analysis for assessment of physical function and 19 (63%) reported no improvement. The benefits were more consistently in favour of CGA for general older people than for frail older people. Overall improvement (including all subgroups) in physical function/ disability equated to a 0.5 point increase on the 20 point Barthel Index which is a small effect. The ten variables addressed in the Barthel Index are: presence or absence of faecal incontinence; presence or absence of urinary incontinence; help needed with grooming; help needed with toilet use; help needed with feeding; help needed with transfers (e.g. from chair to bed); help needed with walking; help needed with dressing; help needed with climbing stairs; help needed with bathing.

An overall increase of 0.5 on the Barthel Index may equate to a small improvement in the ability to transfer from bed to chair, or being able to dress independently or not. Whilst that may seem to be a minor change, on an individual level it may be the difference between independence and institutionalisation. Closer inspection of the data reveals that the overall improvement in physical function was derived from data calculated for the general older population and fall prevention programmes whilst the frail older group showed almost no improvement in physical function (see table 5.4). This suggests that comprehensive geriatric assessment alone is not effective for frail older people and interventions designed to reduce disability in this group may need to include more complex strategies of care.

Further details of the content of the interventions are presented in Appendix 5 with other trials that were also included in the reviews by Beswick et al (2008) (8;92–95). Methodological problems such as high attrition rates and large variations in interventions limit the interpretation of some of these studies.

Key summary points of review of complex interventions to improve physical function and maintain independent living in older people (Beswick *et al*, 2008)

- No 'dose response gradient' was found for intensity of the interventions.

- Overall improvement in physical function was small for all interventions measured on the Barthel Index.

- Combined effects of interventions (including all groups) reduced the risk of no longer living at home and nursing home admission but the risk was not uniform across the groups. The most impressive reduction in risk of nursing home admission was reported for CGA for the general older population and community-based care for older people after hospital discharge (although the latter group was not the focus of scan).

- There was no overall improvement in physical function, no effect on mortality, no reduced risk of no longer living at home and no reduced risk of nursing home admission in the group of frail older people as a result of the CGA interventions.

- There were small-to-moderate changes seen in physical function and nursing home admission, no effect on mortality, a small reduced risk of no longer living at home, and no effect on hospital admission in the group of general older people.

Home visits for frail older people

The review carried out by Bouman et al in 2008 (96) applied strict entry criteria, including only RCTs that targeted frail older people with functional impairment and only home visit programmes with multidimensional assessment and multiple follow ups (at least four) over a period of at least one year. The reviewers assessed the quality of the RCTs and excluded under powered post-hoc, sub-group analysis. Only eight papers, all generally of high quality, were included in the review. None of the trials showed a significant effect (between the control and interventions group) on mortality, health status, service use or cost. No evidence was found that intensive home visit programmes carried out by a nurse alone were beneficial for frail older people within the healthcare setting of western countries.

Key summary points of effects of intensive home visiting programmes for older people with poor health status.

- Interventions included multidimensional nurse visits of low intensity ranging from 4.5 to 7.5 visits over 1 to 2 years.

- The one trial that demonstrated positive effects of home visits was of poor methodological quality.

- The review did not include targeted multidimensional interventions.

- Analysis from the trials of adequate methodological quality showed no effect of home visits on mortality, health status, service use or costs.

Home visits for older people with disability

The review by Liebel *et al* (2009) of nurse-led home visit interventions for community-dwelling older people with disability included 10 trials (80). All the studies in the review used focused intervention components and strategies to prevent or postpone disability worsening. Improvement in disability was reported in only three of the eight studies, two reported no change and three trials reported deterioration (97–99). Details of the interventions included in these studies are reported in Appendix 5. Only one of these trials reported sufficient data to calculate an effect size and that was small (0.2) (98). In 4 of the 10 studies frequent, multiple visits were associated with positive outcome such as improved physical function (measured using SF-36) and disability. These ranged from monthly to quarterly visits per year, with an average of 6 to 34 visits of, on average, 60 minutes duration.

Key summary points of review of nurse home visiting interventions for community dwelling older persons (Liebel *et al*, 2009)

- There was great variability in components of the interventions and evaluation.

- There was no standard method for recruiting or screening people for inclusion.

- Whilst the review aimed to assess home visits it also included trials of case management and all the studies included a comprehensive geriatric assessment carried out be nurses.

- Only four of the nine studies using an extensive case management approach reported positive disability outcomes.

- Only 4 of the 10 studies showed a favourable effect of a multidisciplinary, team-based approach.

- Most of the successful interventions used a comprehensive approach that incorporated a variety of intervention strategies (e.g. disease management and health promotion) and targeted the multiple risk factors associated with disability.

- Ineffective interventions were associated with lack of process evaluation measures, poor physician collaboration, inadequate documentation regarding dose and content, insufficient training of care givers and lack of specific strategies to target disability.

- Only two studies reported statistically significant differences between the experimental and control group in disability measures.

Multidimensional preventative home visit programmes for general and frail older people

The review by Huss *et al* (2008) (84) reported results of a meta-analysis that add to the findings of Beswick *et al* (2008) (84). The review includes more recently published RCTs of interventions that incorporated multiple follow up assessments. Twenty one RCTs were identified of which only five were carried out in the UK. The effects of the programmes varied and were affected by four major factors:

• Characteristics of the intervention.

• Characteristics of the population.

• Adherence.

• Setting (i.e. underlying patterns of healthcare use).

The confidence intervals of the outcomes for nursing home admission, functional decline and mortality were wide and not statistically significant, although generally in favour of the intervention. The overall chance of these programmes making a large impact on functional decline, in isolation, is small. More favourable effects on functional status were shown for those programmes that included clinical examination in the assessment. Effects on mortality were also more favourable for the group of older people with a mean age less than 77. A summary of the results is presented in table 5.5.

Table 5.5. Multidimensional home visits programmes for general and frail older people. Combined odds ratios from 21 trials for nursing home admission, functional status decline and mortality (84).

	Nursing home admission (95% CI)	Functional status decline (95% CI)	Mortality (95% CI)
Combined odds ratio[10] (random effects) *p>0.05	0.86 (0.68–1.10)*	0.89 (0.77–1.03)*	0.92 (0.80–1.05)*
I^2 Test for heterogeneity[11]	42.5% p=0.037	52.4% p=0.008	35.6% p=0.055

Source: Reproduced from Journals of Gerontology Series A–Biological Sciences and Medical Sciences with permission Huss *et al* (2008)

Key points of review of multidimensional preventative home visits programs for community–dwelling older adults (Huss *et al*, 2008)

• The reviewers reported widespread confusion about terminology.

• Overall there was no beneficial effect of nurse home visits on rates of nursing home admission, even in trials of intensive intervention.

• In some cases nursing home admission increased in the intervention group suggesting that home visits might even increase nursing home admission perhaps because unmet needs were identified by the health carers.

• Heterogeneity among trials was high.

• The most promising interventions included multi-dimensional geriatric assessment with a clinical examination and regular follow up.

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[10] The odds ratio is a way of comparing whether the probability of a certain event is the same for two groups. An odds ratio of 1 implies that the event is equally likely in both groups.

[11] I^2 test for heterogeneity. Classification proposed by Higgins and Thompson (2002) suggests 25% low, 50% medium and 75% high heterogeneity. Random effect models are used for high heterogeneity.

Integrated service delivery and case management

Integrated service delivery (ISD) has been a key policy objective of Scotland and aims to reduce the frustration, delay, inefficiency and gaps that frequently exist in care systems (100). Integrated service delivery has been described as fully integrated, linked or coordinated and there are subtle differences between them. Fully integrated models are arranged under one organisation that is responsible for all services, either under one structure or by contracting services. Linked service delivery systems develop protocols to facilitate referral or collaboration between service delivery providers. Coordinated integrated service delivery involves the development and implementation of structures to manage patients whereby each organisation keeps its own structure but agrees to collaborate and adapt its operation and resources to the agreed requirement and process (101).

The objectives of ISD programmes include:

• Implementation of case management.

• Maintaining frail older people in the community for as long as possible.

• Reduction of unnecessary institutional/hospital admission.

• Improve general health.

• Improve satisfaction of service delivery.

• Promote the autonomy of frail older people.

• Improve the burden on informal care givers.

Case management is integral to ISD, and became a key component of the NHS national 'community matron' policy in England, in 2005. England adopted 'the Evercare Programme from the USA company, United Health Group' and evaluation followed. Evaluation of the Evercare Programme was aimed at older people already in institutional care and therefore lies outside the scope of this scan (102), however it is worthy of note due to the interest in case management in Scotland.

There were three key elements of the Evercare case management programme in England:

1. Analysis of data to identify high risk patients using history of unplanned admissions as a means of identifying patients.

2. Redesigning staff roles through a new role of advanced primary nurse care with extended generalist skills.

3. Organisation of care around the patient's needs rather than organisational boundaries.

Sixty-two Evercare intervention practices were included in the study but they found no significant effects on rates of emergency admissions, emergency bed days, or mortality for a high risk population aged over 65 with a history of two or more emergency admissions in the preceding 13 months compared with the control group. With uncertain impact from community matrons in England there was no incentive to develop new posts in Scotland.

Reviews of integrated case management

Two reviews of integrated service delivery with case management were identified. One high quality review of coordinated and integrated interventions targeting *frail older people* included 9 RCTs published between 1998 and 2006 (79). The RCTs originated from Italy (1), the USA (3) and Canada (5). A meta-analysis was not carried out in this review due to the bias identified in the quality assessment of the RCTs, the heterogeneous settings, interventions and outcome measures (general health and physical function measures, along with benefits to the caregiver). This review provides some evidence that integrated and coordinated care is beneficial for the frail older people. There is also some evidence that integrated and coordinated care can decrease healthcare utilisation.

Key summary points of review of coordinated and integrated interventions targeting frail older people (Eklund and Wilhelmson, 2009)

- There was no significant difference in the majority of outcome measures between the experimental and control groups, including perceived health, depression, quality of life, physical function, activities of daily living and cognitive status.

- Seven of the nine RCTs reported at least one outcome measure significantly in favour of the intervention including improvement in quality of life and mental health. One RCT reported no difference, and one was in favour of the control group.

- Overall the results in favour of the intervention exceeded those in favour of the control.

- The only two studies that focused on the caregiver reported significant results in favour of the intervention for caregiver satisfaction, but no effect on the 'burden of care giving'.

- Five out of nine studies reported significant 'health system benefits' in terms of reduced healthcare utilisation.

International experiments in integrated care for older people

A review by Johri *et al* (2003) included seven programmes of acute and chronic integrated care services including five quasi-experimental controlled trial and two RCTs. The studies were implemented in Canada (1) Italy (2) USA (3) and Darlington UK (1) (91). The UK study included in this review was a quasi-experimental, controlled, non-randomised design that aimed to compare the effects of community care with institutional care, for frail older people who were being discharged from hospital (therefore not the direct focus of this scan). The common key features that are thought to be effective components of integrated service delivery (ISD) intervention are presented in box 5.1.

Box 5.1. Key features of integrated service delivery intervention

- Single entry point.

- Comprehensive geriatric assessment.

- Central use of case managers to promote cost-effectiveness and integrated delivery.

- Case managers organise and provide support for members of a multidisciplinary team to assess needs, plan care and ensure concerted action amongst health and social services.

The seven ISD programmes were not directly comparable, some focused on frail and disabled individuals being discharged from hospital, whilst others were more broadly focused including general older people as well as frail and some studies were limited to six months follow up. The only study (USA) to include general older people as well as frail older people failed to show cost savings or improvement in outcomes but this may have been due to the case manager's lack of authority for provision of care and the lack of multidisciplinary teamwork (103). However, reduction in unscheduled hospital visits was shown in three of the studies (104–106).

Primary studies of complex interventions

A more recent study, investigated the impact of a coordinated, integrated service delivery programme (ISD) at a population level, on frail older people in Quebec. A validated instrument, the Functional Autonomy Measurement System (SMAF), designed to assess disabilities related to 29 functions, including measures of Activity of Daily Living (ADL), mobility, communication, mental functions was used in the evaluation (107). Details of the PRISMA model are shown in figure 5.1 and a further description of the SMAF tool is reported in Appendix 11. The study design was a population-based quasi-experimental design with pre-test, multiple post tests and comparison group. 2,019 people aged 75 or older were identified for inclusion in the study. A total of 920 older people (501 experimental and 419 controls) agreed to participate over four years.

The annual incidence of functional decline (defined as an increase of 5 points or more on the SMAF; admission to nursing home or long term hospital care or death) was not significantly different over the first three years but it was lower by 137 cases per 1,000 in the experimental group in the fourth year of the study. Over the first 3 years of the study there was no difference in functional decline between the experimental and control groups but in the fourth year the incidence of functional decline was significantly lower by 314 (95% CI 57% to 216%) cases per 1,000 in the experimental group. Satisfaction and empowerment were also significantly higher in the experimental group (p<0.001). The study failed to show a statistically significant impact of ISD on hospital admission, as was the case for the Evercare case management study in the UK that targeted older people in institutional care (102). However, a RCT of integrated care for older people in Canada with moderate disability demonstrated a clear shift from institutional services to home care services without additional costs (9).

Figure 5.1. The PRISMA model of coordinated integrated service delivery
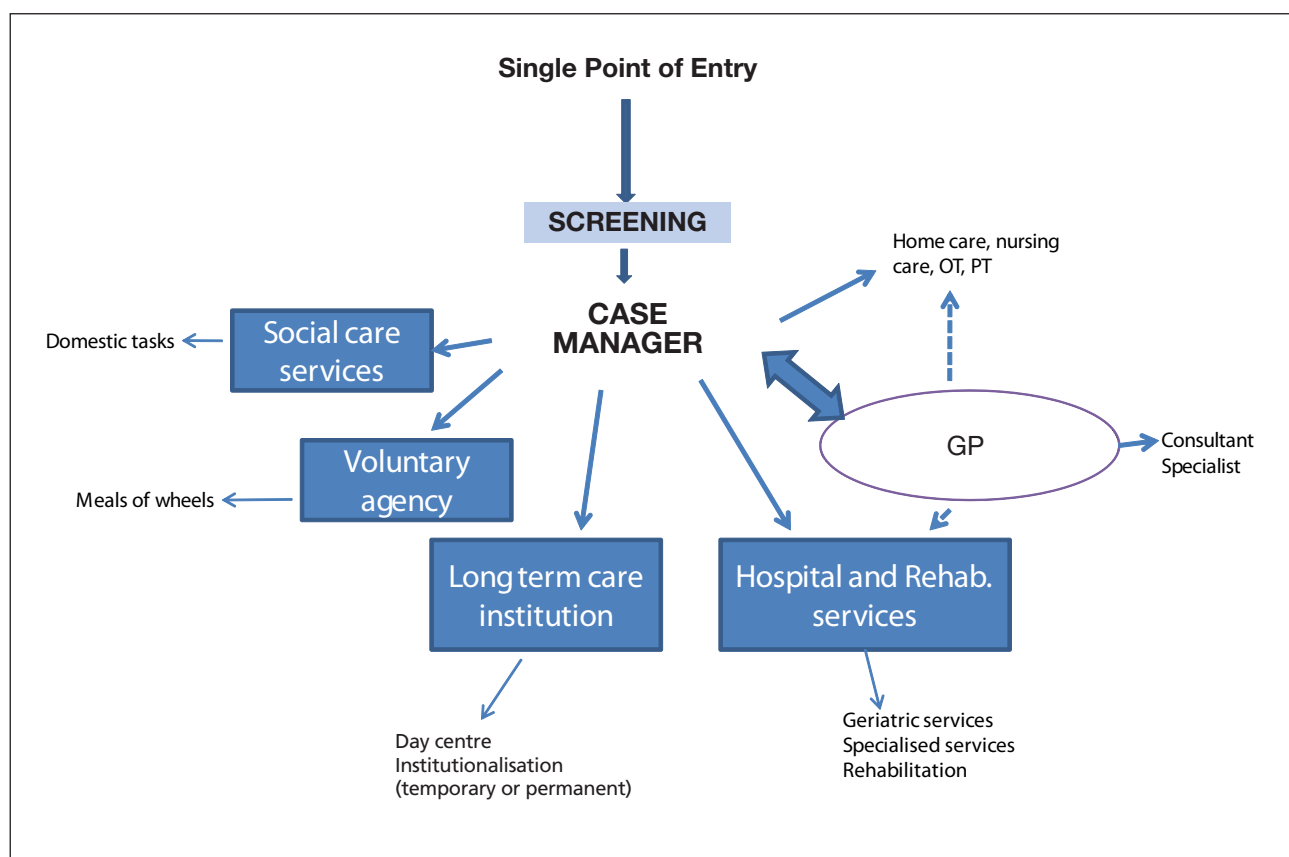
Source: Hebert *et al*. PRISMA: A New Model of Integrated Service Delivery for the Frail Older People in Canada. Int J Integr Care; 2003 (101).

Case management

A large multinational cohort study explored the relationship between a case management approach and risk of nursing home admission in 11 European countries including the UK (Maidstone and Ashford, England) for older people over 65 with comorbidity who were already receiving home care services (108). The intervention included case managers who were trained to manage problems, monitor the provision of services and provide additional services as requested by participants. A multidisciplinary team provided the services whilst the case manager facilitated the service. A standardised and comprehensive Minimum Data Set for Health Care version 2.0 (MDS-HC) was included in the assessment in all 11 countries. The MDS-HC contains more than 350 questions including sociodemographic variables, numerous clinical items, physical and cognitive status and clinical diagnoses (109). The study included 1,184 (36%) older people who received a home care programme and 2,108 (64%) older people who received a traditional care approach, without case management. During the one year follow up 81 of the 1,184 (6.8%) people in the case management group compared with 274 of 2,108 (13%) in the traditional group (p<0.001) were admitted to institutional care homes. After adjustment for confounders the risk of nursing home admission was lower in the case management group (adjusted odds ratio 0.56, 95% CI 0.43 to 0.63). Whilst the strength of this evidence is limited by the lack of randomisation the results are promising and provide some evidence that case management has potential to reduce institutionalisation in older people with chronic disease. However, in an RCT, including 951 older people on low income, Counsell *et al* (2007) (110) investigated the effectiveness of a case management intervention group, including comprehensive geriatric assessment compared with a control of usual care. Improvement in four out of eight components of a quality of life scale (SF-36) was reported in the intervention group but there was no difference in other outcomes such as hospital admission rates (further details in Appendix 5).

Primary studies of screening for unmet health needs

The large MRC funded population-based British trial of comprehensive screening for unmet health needs for older people over 75, failed to demonstrate any benefits in quality of life or health outcomes (8) (see Appendix 5 for further details). The trial compared a targeted approach with a universal approach to home visit assessment and management. It is the largest trial of geriatric assessment ever published. General or frail older people (75+) were included and no differences were found between the groups in mortality, institutional or hospital admission or function. The conclusions of this trial were limited by a number of factors. The main limitation was that the trial lacked a true control group and therefore it was impossible to conclude that the intervention had no effect, rather the trial showed that offering CGA universally to all patients was no more effective than targeted intervention. In addition there was little long term follow up involved in the intervention. However, it was a high-quality trial and resulted in the withdrawal of a policy for preventative home visits for the 75+ age group in England.

In another high-quality RCT (n=792) of screening and case finding for high risk community-dwelling older people in the USA, Rubenstein *et al* (2007) also failed to show differences in functional status and hospital admission rates between the intervention and control group at 1,2 and 3 year follow up assessment (111).

One of the problems with trials of health promotion is that they are dependent on uptake of advice or treatment offered. Lifestyle interventions based in general practice often show promise in effecting small changes in behaviour but none appear to have a large impact on health (112). A recent large-scale British RCT (part of a collaborative European project [PRO-AGE prevention in older people–assessment in generalists practice(55)]), used the Health Risk Appraisal for Older Persons (HRA-O) tool incorporated into electronic patient records to evaluate the effect on health behaviour and preventative care uptake in low-risk older people in primary care (113). The RCT included 2,503 people over 65 years old. Eighty percent (n= 2006) responded to the self-administered Health Risk Appraisal questionnaire resulting in a 20–35 page individualised feedback report including advice on modifying behaviour and health checklists and sources of support such as exercise classes for older people. Those randomised to the intervention group received feedback including advice on modifying health risks, a personalised preventative health checklist,

sources of support (such as local exercise schemes for older people) and national helplines advertising information on when to seek medical or other social advice. Feedback to GPs summarised clinical information to be used for reinforcement of preventative health and health behaviour. The intervention group respondents reported slightly higher pneumococcal immunisation uptake and improvement in physical activity levels (>5 times a week moderate-to-strenuous exercise 10.8% versus 7.8%; intervention versus control respectively p=0.03) but no significant differences were observed for any other categories of health behaviour or preventative care measures at one year follow up. Health risk assessment resulted in minimal improvement of health behaviour or uptake of preventative care measures suggesting that simple advice is not effective in changing behaviour in older people.

Overall, the evidence for health promotion, case management and integrated service delivery programmes for older people is mixed, and few studies provide strong evidence for any large difference in health outcomes. This may reflect the lack of long term follow up of most studies, lack of sensitivity of the outcomes used to measure change in physical function and quality of life or because it is difficult to modify health outcomes in older people.

However, there appear to be promising areas of development, that require a systemic change of health and social services system delivery, that have the potential to reduce rates of institutionalisation, healthcare costs and functional decline in frail older people. Integrated service delivery is compelling but requires coordination and support at a local and regional level along with easily accessible shared information systems. Some would also argue that many of the complex interventions, such as integrated service delivery, simply alter the place of care rather than interrupt the disablement process and input probably at an earlier life stage would be necessary to make a greater impact on disablement later in life.

Integrated service delivery has not been successfully implemented or evaluated on a large-scale in Scotland but components of these programmes are recommended in Scottish strategy documents (114) to improve the care of older people. Potential investment into any large-scale project should carefully consider affordability, feasibility, sustainability, effects on equity, potential side effects and acceptability for stakeholders and care workers (24).

6

Chapter 6 – Interventions to prevent falls and fractures

Summary

- A large body of work, including a vast number of RCTs, has been carried out in the field of falls prevention and many diverse programmes have already been implemented across Scotland.

- The economic burden of falls is high. Clinical and cost-effectiveness analysis is hindered by a lack of standardised outcomes and analysis.

- There is consistent evidence for the benefits of exercise in preventing the *risk and rate of falls,* particularly for long term exercise programmes and they may be cost-effective.

- There is no strong evidence that any one type of exercise is better than another although programmes that include balance exercises are advised.

- The evidence for multi-factorial intervention programmes is mixed but multi-factorial assessment followed by targeted intervention appear to be effective in reducing the rate of falls, but not risk of falls. In other words the effects are stronger for reducing fall recurrences than first falls. Multi-factorial programmes that rely on referral rather than direct management are less likely to be effective.

- The delivery of a single-factor intervention may be as effective, in reducing falls, as delivering multi-factorial intervention; research is underway in the UK to investigate this possibility.

- There is no evidence that referral for correction of vision as a single intervention is effective in reducing the number of people falling.

- There is limited evidence (1 trial) that interventions targeting withdrawal of unnecessary or hazardous psychotropic medication reduces the rate of falls and maybe cost effective.

- There is limited evidence that falls prevention interventions improve physical function but the effects are small.

- Vitamin D supplements *alone* do not appear to be effective for preventing fractures in healthy older people in the community although they may help those with low vitamin D levels.

- Vitamin D supplements in combination with calcium are effective in reducing the risk of fracture in women and this intervention may be cost effective.

- There is limited evidence from *population-based, controlled studies* of falls prevention programmes, of a trend towards a reduction in fall-related injuries, but none of these studies were carried out in the UK and results may not be generalisable.

- The success of multi-factorial falls prevention programmes is likely to depend on *integration of service delivery* working across the community-hospital interface and incorporating a range of professional care.

- There are gaps in knowledge and serious questions relating to the generalisability of interventions across cultures, countries and settings.

Introduction

Falls[12] are a major problem for older people living in the community and a major international public health challenge. More than 30% of people over 65, living in the community, fall each year and many fall more than once (115). In the UK primary care populations, the rate rises with age and is generally higher in women, and in socioeconomically deprived populations (116). Falls can cause fractures and head injuries along with longer term problems such as loss of function, disability, loss of independence and social isolation (117). Hip fractures are the most common fall-related injury and between 25% and 75% of people who fall do not recover their pre-fracture function (118). In the UK, the cost of falls in older people living in the community has been estimated to be £981 million per year (119). A large amount of research has been published in this field, in comparison with other interventions aimed specifically at older people, and recommendations for management of older people at risk of falling were reported by the National Institute for Clinical Excellence (NICE) in 2004 (120). This chapter provides a summary of up-to-date evidence for the effectiveness of fall prevention interventions, aimed at older people in the community.

Categories of falls prevention

There are two main categories of falls prevention:

1) Services for individual patients referred for specialist management e.g. fallers' clinics. These are generally based on screening, comprehensive patient assessment and diagnosis followed by a multidisciplinary team approach and onward referral.

2) Community programmes directed at a population of older people living in the community and at high risk of falling. These programmes are generally delivered by a single health professional, working to a protocol, and suitable for widespread dissemination (121).

In addition, interventions are grouped into either single (e.g. exercise, home safety, medication education, physiotherapy [PT] or occupational therapy [OT]) or multi-factorial (e.g. a combination of assessment and targeted intervention, exercise, falls clinics, PT, OT, medication adjustment, advice, environmental assessment).

Outcome measures for falls prevention

The cause of falling in older people is complex and dependent on a number of risk factors related to the person's health and environment. The strongest risk factors for falling are: *previous falls, low muscle strength, unsteady gait, balance impairments and use of specific medication* (122). The risk of falling increases from 8% amongst general older people, to 78% amongst those with four or more risk factors (115).

Commonly used assessments, based on the 2004 NICE guidelines (120), from most common to least common are: gait and balance, environmental and home hazards, medication review, cardiovascular health, vision, incontinence, cognitive function, foot care, geriatric assessment, diet and nutrition, bone health, hearing and others (mobility, personal protection, daily functioning, fear of falling) (72).

[12] A fall is defined by the Prevention of Falls Network Europe (ProFaNE) as 'an unexpected event in which the participants come to rest on the ground, floor or lower level'. It is not the fall, per se, that is the problem but the loss of mobility or injury that it causes.

Trials generally measure *rate of falls*[13] or the *number of people falling*[14] during follow up but also report proportion of falls in a given time, number of recurrent fallers (two or more fallers in a given time frame), time to first fall and fall related injuries. Other outcomes include admission to hospital, unscheduled contact with health services, death, move to institutional care, health-related quality of life and physical activity or mobility (123). It may be useful to measure 'falls for unit of activity' but a validated and reliable tool would be needed to measure activity levels.

Review literature: falls prevention interventions

One review of reviews of falls prevention interventions was identified (124) along with 14 systematic reviews that assessed services for individual, older people living in the community (see Appendix 8), and one review of community programmes directed at a population of older people. One review of cost effectiveness, published in 2010 after the initial search, is included as it provides rare review level information on costs.

Overall, the quality of the review literature on falls prevention was higher than other interventions discussed in this scan. The comprehensive meta-analysis by Gillespie *et al* (2009) (13) included 111 RCTs and scored 10/11 on the AMSTAR quality scale. Most of the RCTs reported in other reviews between 1999 and 2009 were also included in the review by Gillespie *et al* (2009) and therefore emphasis is placed on this larger, high quality review. The other most recently published reviews, reported slightly conflicting findings, and are presented in this chapter for comparison (table 6.1 and Appendix 8).

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[13] The rate of fallers is the total number of falls over a period of time including repeat falls of the same person: for example, number of falls per-person-per-year. The statistic used to report this is the **rate ratio (RaR)** which compares the rate of all events (falls) in the two groups during the period of follow up in the trial, or during a number of trials if the data are pooled. This is the statistically preferred outcome although may not be as useful in studies that are focused on primary prevention.

[14] The number of falls compares the number of participants in each group with one or more fall events during the trial, or during a number of trials if the data are pooled. The statistic used to report this is the **risk ratio (RR).** The risk ratio is the most frequently reported statistic. It is used to report whether an intervention has a significant effect on the risk of falling one or more times, across the individuals studied i.e. the occurrence of more than one fall per person is essentially ignored and treated the same as one fall. This is statistically not ideal since it ignores important recurrent events in the same person, although it is the most frequently reported statistic.

Table 6.1 Brief summary of findings and quality of reviews of falls prevention interventions. (Most recent high quality reviews only.)

Reference No of studies	Intervention	Health category	Outcome	Scores for AMSTAR methodological criteria[15]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Campbell and Roberston (2007) (121) 45 RCTs	Single and multi-factorial interventions.	General and frail high risk older people.	Targeted single interventions are as effective as multi-factorial.	y	y	y	n	n	y	y	y	y	y	ca	8/11
Davis et al (2010) (15) 9 RCTs (cost effectiveness studies only)	Single, multi-factorial and population based multi-factorial.	General and frail high risk older people.	Best value for money from single factor interventions in older group (>80). (Otago exercise programme.)[16]	y	y	y	n	n	y	y	y	na	na	ca	6/9
Gates et al (2007) (12) 19 RCTs	Multi-factorial assessment and targeted intervention.	Frail and high risk older people.	Limited evidence for multi-factorial falls prevention in reducing number of falls.	y	y	y	y	n	y	y	y	y	y	ca	9/11
Gillespie et al (2009) (13) 111 RCTs	Single and multi-factorial interventions.	Frail and high risk older people.	Exercise interventions reduce risk and rate of falls. Variable for multi-factorial.	y	y	y	y	y	y	y	y	y	y	ca	10/11
Medical Advisory Secretariat (2008) (125) 60RCTs	Single (11 interventions) and multi-factorial interventions.	General and frail high risk older people.	High quality evidence for exercise and environmental modifications.	y	n	y	n	y	y	y	y	y	y	ca	8/11
McClure et al (2008) (126) 6 Controlled studies	Population based multi-strategy interventions.	General and frail older people.	Coordinated programme using multi-strategy initiatives have positive effect.	y	y	y	y	y	y	y	y	na	na	ca	8/9
Sherrington et al (2008) (134)	Exercise programmes	General older people	Greater effects for exercise that challenge balance and use high dose.	y	y	y	y	n	y	n	n	y	y	ca	7/11
Vaapio et al (2009) (127) 12 RCTs	Single and multi-factorial interventions with focus on QOL.	General and frail older people.	6 out of 12 studies showed positive effect on QOL.	n	n	y	y	n	y	y	y	na	na	ca	5/9

[15] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of include and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review.

y=yes, n=no, na=not applicable ca =can't answer

[16] 2010 publication identified after initial search.

Reviews of individual-level interventions for falls prevention

Gillespie *et al* (2009), in a comprehensive review of 111 RCTs, found evidence of effectiveness for a number of different approaches to falls prevention in the community for older people without cognitive impairment (13). The effect of the interventions on rate of falling (RaR) risk of falling (RR) and risk of fracture (RR fracture) are shown in table 6.2.

Exercise

Exercise was grouped into categories according to the ProFaNE (the Prevention of Falls Network Europe) taxonomy which include: gait, balance, functional training, strength/resistance training, flexibility, 3D (tai chi, dance), general physical exercise, endurance and others. In general, exercise was found to be an effective intervention in reducing the risk and rate of falls when compared with a control group. The effects are reported in table 6.2. Multi-component group exercises, that include a combination of two or more types of exercise, and individually prescribed home-based exercise, is effective in reducing the rate of falls and risk of falling. Tai chi, as a group exercise, reduces rate of falls and risk of falling. Gait, balance and functional training exercise reduced rate of falls but not risk of falling. None of the other comparisons (i.e. strength training) achieved statistical significance and musculoskeletal injury was more common in groups participating in resistance training (intervention 18/112 (16%) versus control 5/110 (5%), RR 3.54 95% CI 1.36 to 9.19). No statistically significant differences were found for rate or risk of falling between different types of exercise e.g. strength versus balance.

Multi-factorial interventions

Multi-factorial interventions, integrating assessment with individualised intervention, usually involving a multi-professional team, are effective in reducing rate of falls but not risk of falling. There is no strong evidence that any specific types of service delivery is any better than another and no evidence that multi-factorial interventions are more effective in participants selected as being at higher risk of falling.

Environmental assessment and intervention

Overall, home safety interventions, including hip protectors, do not appear to reduce rate of falls or risk of falling. Although evidence so far published is relatively limited, people at higher risk of falling may benefit. An anti-slip shoe device for icy conditions significantly reduced winter outside falls in one study but that is irrelevant in most countries where ice and snow are uncommon. Interventions to improve vision appear to have a negative effect on the risk and rate of falls possibly because older people go out more if their vision is improved (see table 6.2).

Medication interventions

There is limited evidence (from two RCTs) for the effectiveness of interventions targeting medications (e.g. withdrawal of psychotropics, educational programmes for family physicians).

Nutritional interventions

Overall, vitamin D alone does not appear to be an effective intervention for preventing falls in older people living in the community, but there is provisional evidence that it may reduce falls risk in women with low vitamin D levels particularly when combined with calcium.

Table 6.2. Effect of interventions on rate of falling (RaR) risk of falling (RR) and risk of fracture (RR fracture)

Intervention	Number of trials (participants)	Effect (pooled in the case of >1 RCT)	Significance level NS= non significant
Multiple-component group exercise versus control	14 trials (2,364) 17 RCTs (2,492)	RaR 0.78 95% CI 0.71 to 0.86 RR 0.83, 95% CI 0.72 to 0.97	P<0.05 P<0.05
Home exercise (including>1 exercise) versus control	4 RCTs (666) 3 RCTs (566)	RaR 0.66 95% CI 0.53 to 0.82 RR 0.77 95% CI 0.61 to 0.97	P<0.05 P<0.05
Tai chi (balance and strength) versus control	4 RCTs (1,294) 4 RCTs (1,278)	RaR 0.63 95% CI 0.52 to 0.78 RR 0.65 95% CI 0.51 to 0.82	P<0.05 P<0.05
Gait, balance and functional training versus control	3 RCTs (461) 3 RCTs (461)	RaR 0.73 95% CI 0.54 to 0.98 RR 0.77 95% CI 0.58 to 1.03	P<0.05 NS
Pooled data for all exercise (risk of fracture) versus control	5 trials (719)	RR (fracture) 0.36 95%CI 0.19 to 0.70	P<0.05
Vitamin D versus control	5 RCTs (3,929) 10 RCTs (21,110) 7 RCTs (21,377)	RaR 0.95 95% CI 0.80 to 1.14 RR 0.96 95% CI 0.92 to 1.01 RR (fracture) 0.98 95% CI 0.89 to 1.07	NS NS NS
Withdrawal of psychotropic medication versus placebo GP education with medication review	1 RCT (93) 1 RCT (849)	RaR 0.34 95% CI 0.16 to 0.73 RR 0.61 95% CI 0.32 to 1.17 RR (fracture) 2.83 95% CI 0.12 to 67.7 RR 0.61 95% CI 0.41 to 0.91	P<0.05 NS NS P<0.05
Environment (home safety and aids for personal mobility)	3 RCTs (2367)	RaR 0.90 95% CI 0.79 to 1.03 RR 0.89 95% CI 0.80 to 1.00	NS NS
Environment (intervention to improve vision) (non slip devices on shoes)	1 RCT (616) 1RCT (109)	RaR 1.57 95% CI 1.19 to 2.06 RR 1.54 95% CI 1.24 to 1.91 RaR 0.42 95% CI 0.22 to 0.78	P<0.05 (negative effect of intervention) P<0.05 (negative effect of intervention) P<0.05 for outdoor falls
Multiple interventions (exercise, home safety and education)	1 RCT (285)	RaR 0.69 95% CI 0.50 to 0.96	P<0.05
Multifactorial interventions based on individual assessment	15 RCTs (8141) 26 RCTs (11173) 7 RCTs (2195)	RaR 0.75 95% CI 0.65 to 0.86 RR 0.95 95% CI 0.88 to 1.02 RR (fracture) 0.70 95% CI 0.47 to 1.04	P<0.05 NS NS

Source: Gillespie *et al*. Cochrane Database Syst Rev.(2009) (13)

Multi-factorial assessment and targeted intervention for preventing falls and injury among older people in the community

Gates *et al* (2008) evaluated interventions designed to prevent falls and fall related injuries in trials that included an assessment of multiple risk for falling, to identify modifiable risks and targeted intervention (12). All 18 studies involved interventions that targeted the risk factors via health service delivery systems either in primary care, the community or an emergency department. They excluded population-level studies and studies that did not report falls outcome. No clear reduction was found in the number of people with at least one fall during follow up (18 studies: RR 0.91 95% CI 0.82 to 1.02), the number of people with fall related injuries (8 studies 0.90 95% CI 0.68 to 1.20) or any other outcomes with the exception of attendance at a GP's surgery, which increased in the intervention group in one study (see table 6.3). The heterogeneity amongst studies was high in this review, particularly in the four studies that analysed the number of people falling (I^2=74.6%), and therefore the results should be viewed with some caution.

Table 6.3 Results of meta-analyses of multi-factorial interventions for falls

	No of studies	Risk ratio (random effects) (95% CI)	I^2 (%) [17]
Recurrent falls	4	0.81 (0.54 to 1.21)	74.6
Admission to hospital	9	0.82 (0.63 to 1.07)	0
Attendance at Emergency Dept	4	0.96 (0.72 to 1.27)	38.9
Attendance at GP's surgery	1	1.39 (1.11 to 1.74)	na
Death	15	1.08 (0.87 to 1.34)	0
Move to institutional care	5	0.92 (0.59 to 1.43)	0

na=not applicable

Source: Reproduced from Multifactorial Assessment and Targeted Intervention for Preventing Falls and Injuries Among Older People in Community and Emergency Care Settings. BMJ. 2008 Jan 19; 336(7636):130–3 (copyright notice year 2010) with permission from BMJ Publishing group.

Individual and community fall prevention strategies

Campbell and Roberston (2007) (121) compared trials of multi-component interventions with single interventions that addressed a single risk factor, in community-based falls programmes, with follow up for at least 12 months. Fourteen trials (5,968 participants) out of 90 were identified that met the review criteria. Meta-analysis showed that interventions with multiple components reduced falls by 22% (pooled RaR 0.78, 95% CI 0.68 to 0.89) and single interventions by 23% (pooled rate ratio 95% CI 0.67 to 0.89) suggesting that delivery of a single factor intervention may be as effective in reducing falls as delivering multi-factorial interventions. This evidence conflicts with NICE guideline that recommend multi-factorial interventions (120).

The comprehensive review carried out by the Medical Advisory Secretariat in Canada assessed 11 interventions for prevention of falls: exercise programmes, vision assessment and referral, cataract surgery, environmental modifications, vitamin D supplementation, vitamin D plus calcium supplementation, hormone replacement therapy (HRT), medication withdrawal, gait-stabilising devices, hip protectors, and multi-factorial interventions (125).

[17] I^2 =Test for heterogeneity. Classification proposed by Higgins and Thompson (2002) suggests 25% low, 50% medium and 75% high heterogeneity. Random effect models are used for high heterogeneity. Fixed effect model used for low heterogeneity as it is assumed that the estimated effect sizes only differ by sampling error.

This review adds to the results of Gillespie *et al* (2009) as it stratified exercise into targeted programmes where the exercise routine was tailored to the individuals' needs, and untargeted programmes that were identical among subjects. Furthermore, analyses were stratified by exercise programme duration (<6 months and ≥6 months) and fall risk of study participants. A total of 17 studies investigating multi-factorial interventions were included in the review. Of these studies, 10 reported results for a high-risk population with previous falls, while six reported results for study participants representative of the general population. The summary of the results are shown in Appendix 12.

Overall, the authors' conclusions were similar to that of Gillespie *et al* (2009) other than they report high quality evidence that long term exercise programmes and environmental modifications in the homes of frail older people reduces the risk of falling (RR=0.76; 95% CI 0.64 to 0.91), vitamin D in addition to calcium is effective in reducing the risk of falling and vision interventions including assessment and referral is not effective (RR 1.12; 95% CI 0.82 to 1.53). Chou *et al* (2009) also reported that direct screening for visual impairment for older adults in primary care settings is not associated with improved vision or any other clinical outcome and may be associated with an increase in falls (128). In a separate review of cost effectiveness carried out by the Medical Advisory Secretariat (2008) (14), the authors report:

• High-quality evidence to suggest that long term exercise programmes and environmental modifications in the homes of frail older people are cost-effective in *reducing rate of falls* in Ontario's older population.

• A combination of vitamin D and calcium supplementation in older women is cost-effective in reducing rate of falls.

• The use of outdoor gait-stabilising devices for mobile older people, during the winter in Ontario, is cost effective in reducing falls (based on 1 trial of moderate quality).

• Withdrawal of psychotropic medication may be a cost-effective method for reducing falls but evidence is limited and long term compliance has been demonstrated to be difficult to achieve.

Review of population-based studies of falls prevention

McClure *et al* (2008) assessed the effectiveness of population-based interventions, defined as: coordinated, community-wide, multi-strategy initiatives for reducing fall-related injuries amongst older people (126). The six controlled studies included in the review were carried out in Australia, Sweden, Taiwan, Denmark and Norway. The interventions were primarily educational, some were based on the WHO Safe Community Strategy (129–131), and others included tai chi exercise (132) home visits and home hazard adaption (133). The educational components were delivered via brochures, posters, media and policy development, local clinicians and health professionals. A meta-analysis was not possible due to the heterogeneity of the studies and only a non-statistically significant trend towards a reduction in fall-related injuries across all six programmes was reported. None of the trials were carried out in the UK, making conclusions difficult to generalise, particularly in the case of tai chi in Taiwan where the specific intervention may depend on cultural patterns of behaviour.

Cost effectiveness of falls prevention interventions

In the most up-to-date review of the cost of strategies to prevent falls in older people living in the community, Davies *et al* (2010) (15) identified nine studies including eight cost-effectiveness analyses, one cost-utility and one cost-benefit analysis[18]. The review included one multi-factorial, community level intervention based in Australia (Stay on Your Feet Campaign (133)), individualised multi-factorial interventions and single factor interventions (i.e. exercise), but only one of the nine studies was carried out in the UK.

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[18] There are three main types of economic analysis; cost-effectiveness benefits are measured using clinically relevant outcomes such as life years gained or number of falls prevented. The primary outcome used is the incremental cost-effectiveness benefit (ICER= the difference between the cost of providing the competing intervention divided by the difference in effectiveness i.e. number of falls prevented). Cost-utility analysis; health benefits are measured in quality adjusted life years and for cost–benefits in monetary units.

The review was limited by the lack of good quality data mainly because hospital costs are often skewed and the fact that the trials were powered for the primary outcomes (i.e. number falls) rather than costs. Overall the authors concluded that the best value for money came from single factor interventions such as the Otago Exercise programme which produced cost savings in the higher risk group of adults over 80 years old. Other programmes that appeared to be cost-effective were a multi-factorial programme that targeted eight fall risk factors and a home safety programme for those recently discharged from hospital. This suggests that targeting the high-risk group may be a cost-effective strategy for falls prevention.

Disparity in the falls literature

Experts tend to agree that various types of exercise are effective, when used in isolation. The review by Gillespie *et al* (2009) shows consistent evidence for the effect of exercise intervention in reducing the risk and rate of falling, although some types of exercise (resistance training) are less effective and have been shown to occasionally cause injury. Sherrington *et al* 2008 pooled data from 44 trials of exercise interventions including 9,603 participants, and found a statistically significant (17%) reduction in rate of falls (RaR 0.83, 95% CI 0.75 to 0.91) (134). They found a statistically greater relative effect in programmes that included balance exercises, used a higher dose of exercise, or did not include a walking programme. Otherwise the overall findings of the review by Sherringham *et al* (2008) were similar to that of Gillespie *et al* (2009) (13).

The main inconsistency in reporting of reviews of falls prevention appears to be concerned with multi-factorial interventions aimed at targeting risk factors. The four most recent reviews that focused on multi-factorial interventions for falls prevention report different outcomes. Beswick 2008 (7) reported that the risk of falling was reduced by 8% (RR 0.92, 95% CI 0.87 to 0.97) and physical function improved by a small amount (standardised mean difference -0.25 [-0.36 to -0.13]). They included 12 trials, all of which were also included in the review by Gillespie *et al* (2009). However, the results differed from Gillespie *et al* (2009) (based on 26 studies) and Gates *et al* (2009) (based on 19 RCTs) who reported non-significant effects for the risk of falling.

A fall rate comparison (considered the optimal analytic technique for assessing falls prevention trials) was not possible in the review by Gates *et al* (2008) (12) and therefore their comparison was based on the cruder comparison of the relative number of fallers between groups. Interestingly, the sub-group analysis in the review by Gates *et al* (2008) showed that the effect size in trials, where more intensive interventions were provided, was similar to that reported by Campbell and Robertson (2008) (121). The degree of heterogeneity in most of the comparisons was high, for example in the primary analysis carried out by Gates *et al* the I^2 was 59.8%, suggesting that caution should be exercised when considering the conclusions (13). In addition, the interventions in the review by Gates *et al* (2008) included ten trials that assessed risk factors and referral for intervention of which only three were positive, whereas four of the six trials that provided direct treatment reported positive results. This raises the question of whether it is the referral and delivery system that fails rather than the intervention per se. Low adherence and uptake are crucial factors in intervention studies and 'higher intensity programmes that provide interventions to address risk factors rather than information and referral may be more effective' (12). It seems intuitive that simply screening high risk individuals and advising care providers about people who fall, without adequate, quick access to appropriate intervention, is very unlikely to be a successful management approach.

Overall, the differences in results across the reviews appear to be due to the inclusion of additional trials in the more recent reviews, the type and intensity of the intervention and/or the method of analysis, suggesting that the true effects of multi-factorial interventions are probably modest at best, and further investigation is needed to tease out which are the most effective components.

7

Chapter 7 – Physical activity and exercise interventions

Summary

- There is consistent evidence that exercise programmes for older people can improve strength, balance, aerobic capacity and function, particularly walking. This is evident for primary, secondary and tertiary prevention. The magnitude of effects range from small to large. Effect sizes are smaller for the older age group (80+) and those with pre-existing disability.

- There is limited evidence that aerobic exercise has an effect on some measures of cognitive function, such as cognitive speed, but the magnitude of effect is small, and not consistent for all measures of cognitive function.

- There is evidence that aerobic exercise can improve some measures of psychological wellbeing but the magnitude of effect is small.

- There is a lack of evidence to link gains in impairment and functional outcomes with reduction of disability.

- More research is necessary to evaluate the effects of exercise 'dose', including type and duration of each exercise, number of sessions per week, number of weeks of participation as well as intensity, on outcome.

- Lack of strong evidence for the benefits of specific types of exercise, such as progressive resistance training, on disability outcomes (e.g. the Barthel Index and SF-36) suggest that, in order to be successful in preventing disablement, a more eclectic approach is needed including a combined, task specific approach.

- Outcome measures used to assess function in older people may not be sensitive enough to detect important change in older people and more research is needed in this area.

- Most exercise trials do not address social inequality or include people who are most in need of exercise. Older people who sign up to trials of exercise are those most likely to be in the higher socioeconomic groups.

Introduction

Preventative exercise programmes are generally recommended, in both policy documents and the peer reviewed literature, to be strongly linked to improved health and wellbeing in all age groups, including older people. Muscle weakness in old age is mainly determined by sarcopenia, a term used to describe the natural process of age related muscle loss. Numerous articles have been published over the last decade that review factors associated with sarcopenia. There is evidence that sarcopenia can be delayed, but no evidence that it can be prevented completely (135). Physical activity and exercise are terms that are poorly defined and often used interchangeably, which has led to some of the discrepancies in the interpretation of the literature (136).

A definition of exercise and physical activity used by Caspersens *et al* (1985) is given in box 7.1 (137).The reviews in this section focus on exercise or physical activity interventions aimed at reducing impairment, function and disability outcomes, rather than hospital or institutional admission. Reviews specifically focused on fall prevention programmes are reported in Chapter 6.

Box 7.1. Definition of physical activity and exercise

Physical activity is defined as 'any bodily movement produced by contraction of skeletal muscle that substantially increases energy expenditure above basal rate'.

Exercise is defined as 'planned structured, repetitive bodily movements that are performed, with or without the explicit intent of improving one or more components of physical fitness.'

Review literature: exercise interventions

Different types of exercise were included in a variety of physical activity programmes. The reviews included the following groups of exercise, but the majority included a combination of all types of exercise:

- Flexibility exercise including yoga, tai chi and stretching.
- Progressive resistance training (PRT) or strength training using weights or power training.
- Aerobic exercise including aquatic, low impact aerobics, walking and cycling.
- Balance/proprioceptive exercise.

A plethora of outcomes were used to assess the various exercise programmes which are summarised in table 7.1. Fifteen review papers were identified as fitting the review criteria including one review of reviews and nine moderate to high quality reviews (table 7.2). This chapter focuses on the most recent higher-quality reviews and reports effect size data for interventions, where available.

Table 7.1. Examples of outcomes used in trials of exercise and physical activity for older people

Measures of disablement	Example of outcome measure
Impairment	Strength measures including dynamometry, single maximum lifts, strain gauge load cell and single maximum lift, range of motion, goniometry, sit and reach tests for flexibility.
Function	Walking distance, speed and gait assessment, chair rising, weighted lift tasks, general mobility e.g. sit-to-stand and floor-to-stand tests, stair climbing and balance.
Disability	
Physical	ADL and IADL outcomes e.g. SF-36 physical component, Sickness Impact Profile (SIP), Barthel Index.
Social	SF-36 social role subscale.
Emotional	Centre for Epidemiology studies – Depression Scale, SF-36 emotional sub scale, the State-Trait Anxiety Inventory.
Overall	SF-36 physical and mental scores and Sickness Impact Profile (SIP).

Table 7.2. Brief summary and quality of reviews of exercise interventions. (Further details in Appendix 6.)

Reference No of studies	Intervention	Health category	Outcome	Scores for methodological criteria[19]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Angevaren (2008) (138) 11 RCTs	Aerobic and combined exercise.	General population without chronic disease (CD)/cognitive impairment	Positive effects on cognitive function (effect size 1.17, 0.52, 0.5).	y	y	y	y	y	y	y	y	y	n	ca	9/11
Bean (2004) (139)	Combined exercise.	General population and CD.	Positive for physical activity	y	n	n	n	n	n	n	n	na	na	ca	1/9
Columbe and Kramer (2003) (140) 18 RCTs	Aerobic and combined exercise.	General population and CD.	Positive for cognitive function (combined effect size 0.5).	y	n	y	n	n	n	n	n	y	n	ca	3/11
Conn (2003) (141) 17 RCTs	Combined exercise.	General population and with CD.	Inconsistent findings.	y	n	n	n	n	y	n	n	na	na	ca	2/9
Cyarto et al (2004) (142) 21 RCTs	General physical activity and PRT exercise (health promotion).	General population.	Positive effect of health promotion on activity levels.	n	n	y	n	n	n	n	n	na	na	ca	1/9
Daniels et al (2008) (143) 10 RCTs	Combined exercise and nutritional interventions.	Frail older people.	Positive for aerobic exercise of high intensity.	y	y	y	y	n	y	y	y	na	na	ca	7/9
Howe et al (2008) (144) 34 RCTs	Balance exercise.	General population and frail older people.	Positive effects on balance ability in short term.	y	y	y	y	y	y	y	y	na	na	ca	8/9
Keysor and Jette (2001) (145) 31 Studies (29 RCTs)	Aerobic and combined.	General population and CD.	Positive for physical function. Unclear for disability.	y	y	y	n	n	n	y	y	na	na	ca	5/9
Keysor (2003) (145) 4 Reviews	Combined.	General population and older people with arthritis.	Positive for physical function. Unclear for disability. Effect size 0.28, 0.23 for ADL.	y	n	y	n	n	y	n	n	na	na	ca	3/9
Latham et al (2004) (146) 66 RCTs	Progressive resistance training.	General population and with CD.	Positive for impairment (SMD 0.68, 95% CI 0.52 to 0.84). Unclear for disability[20]	y	y	y	y	y	y	y	y	y	n	ca	9/11
Netz et al (2005) (147) 36 studies	Combined.	General Population and frail older people (OP).	Positive for psychological wellbeing. (WMD effect size for experimental group=0.24 compared with 0.09 for control.)	y	n	y	n	n	y	n	n	y	n	ca	4/11
Orr et al (2008) (148) 29 studies	Progressive resistance training.	General population, frail OP with chronic disease.	Inconsistent effects of PRT on balance.	y	y	y	n	n	n	y	y	na	na	ca	5/9
Taylor et al (2004) (149) Number not specified	Aerobic exercise and combined.	General population, frail OP with CD.	Positive for cognitive and physical function.	n	n	ca	ca	n	n	n	c	na	na	ca	0/9
Van der Bij et al (2002) (150) 38 studies	Aerobic and combined.	General population and frail OP.	Positive effect on activity levels.	y	y	y	n	n	y	n	n	na	na	ca	4/9
Yeom et al (2009) (151) 28 RCTs	Aerobic and combined.	General population and frail OP.	Positive effect of exercise (USA studies only)	y	n	n	n	n	y	n	n	na	na	ca	2/9

[19] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of included and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review.
y=yes, n=no, na=not applicable ca =can't answer.

[20] SMD=the standardised mean difference is the difference in means divided by a standard deviation. The standard deviation is usually the pooled standard deviation.

Progressive resistance training programmes

A high quality Cochrane Review aimed to quantify the effectiveness of progressive resistance strength training (PRT) to reduce physical disability in older people. It included 66 RCTs, mainly targeting general older people (34 RCTs), published up to 2003. The effects of PRT programmes were compared with control groups and a number of other interventions in terms of physical disability, impairment and functional measures. The main results are shown in table 7.3.

Pooled analysis of 41 trials (1,955 participants) assessing the effect of PRT on strength of the lower limb extensor muscle group found a moderate to large beneficial effect (SMD 0.68, 95% CI 0.52 to 0.84). As there was significant heterogeneity in these results, a sub-group analysis was also conducted of the ten highest quality trials. This analysis still found a slightly reduced but positive effect. Thirty two trials used high intensity PRT and nine low to moderate intensity. The analysis suggests that both training approaches are effective in improving strength, but higher intensity, not surprisingly, has a larger effect on strength (high intensity: 32 trials, SMD 0.81, 95% CI 0.60 to 1.01 =<0.001; low intensity: 9 trials, SMD 0.34, 95% CI 0.18 to 0.51 p <0.001). Analysis of general, frail and impaired older people also showed effects of PRT exercise although the effect size for those with functional impairment was lower than those for healthy individuals (general older people SMD 0.76 [95% CI 0.59, 0.94; p<0.0001]: impaired older people 0.36 [95% CI 0.11 to 0.60; p<0.004]). Interestingly, despite relatively large effects of PRT on leg power, benefits were not transferred to any gains in physical function or disability measures suggesting that exercise specifically linked to functional tasks may be more useful in preventing disablement in older people. However, this has to be balanced against the evidence that exercise is often prescribed below the threshold for physiological adaption or therapeutic efficacy (152). In addition, whilst there are numerous articles that provide evidence of short term efficacy there is a lack of evidence for benefits of long term adherence (150). Assessment of risk of exercise was not measured although some adverse effects, mainly musculoskeletal, were documented in some trials. High drop-out rates suggest that risk of injury may be under-reported.

Table 7.3 Summary of main results of effects of PRT training on strength and disability

Outcome	Number of trials	Effect size (95% confidence Interval)	Probability of effect P>0.05 =non significant
Strength (leg power)	41	SMD 0.68 (0.52 to 0.84)	P< 0.0001
Balance	12	SMD 0.11 (-0.03 to 0.25)	P=0.11
Chair rise	4	SMD -0.67 (-1.31 to -0.2)	P<0.04
Speed (metres per sec)	14	WMD 0.07 (0.04 to 0.09)	P<0.0001
Timed walk* (seconds)	4	WMD 0.77 (-0.65 to 2.2)	P=0.3
Physical disability			
Higher score=less disability	10	SMD 0.01 (-0.14 to 0.16)	P=0.9
Lower score=less disability*	6	SMD-0.17 (-0.53 to 0.18)	P=0.4
Physical function of SF-36	7	WMD 0.96 (-3.35 to 5.26)	P=0.7

*Lower score indicates better performance otherwise higher score indicated better performance.
Physical function domain of the SF-36 (range 0–100). WMD=weighted mean difference. SMD=standardised mean difference.

Source: Latham et al. J Gerontol (A Biol Sci Med Sci), 2004 (146).

The review by Orr *et al* (2008) focused on PRT as a single intervention for improving balance performance in older adults (148). Twenty-nine RCTs, of variable quality, were included and due to heterogeneous outcomes and interventions a meta-analyses was not performed. Effect sizes were highly variable across the 29 studies ranging from no effect (0.00; 95% CI -0.53 to 0.53) to large effects (0.8; 95% CI 0.34 to 1.25), the majority being small in magnitude. Overall the results of PRT on balance were inconsistent, with small or no effects reported in 78% of the outcomes. Whilst gains can be made in leg strength these benefits don't necessarily impact on balance, suggesting that strength is probably not the major underlying mechanism for poor balance.

Key summary points of review of progressive resistance training in older adults

- Overall the quality of the trials included in the reviews was poor. The low quality trials overestimated the effects of PRT. The sensitivity analysis showed that the higher quality trials showed positive, but smaller, effects.

- Overall PRT has a moderate to large effect on lower leg strength, an important measure of impairment, and a small to moderate positive effect on other aspects of impairment such as walking speed.

- Gains in muscle strength can be made in healthy older people and those with pre-existing functional impairment but the effects of exercise are less for older people with impairment.

- Lower limb strength gains can be achieved from low intensity exercise (SMD effect size 0.34) but gains are greater for high intensity (SMD effect size 0.81).

- The improvements in strength did not translate to reduced physical disability or improve balance.

Effects of aerobic exercise and physical activity interventions

The other reviews identified in this section all assessed some form of aerobic exercise in combination with other exercise programmes or physical activity. Angeveran et al (2008) assessed the effect of aerobic exercise on cognitive function in older people without impairment. This was a high-quality review (quality score 9/11) including 11 RCTs. Significant positive effects of aerobic exercise compared to any other intervention were shown for cognitive speed (SMD 0.26, 95% CI 0.04 to 0.48 p<0.02) and visual attention (SMD 0.26, 95% CI 0.02 to 0.49, p< 0.03). In addition, positive effects of aerobic exercise compared with a control were shown for auditory attention (WMD 0.53, 95% CI 0.13 to 0.91, p<0.01) and motor function (WMD 1.17, 95% CI 0.19 to 2.15, p<0.02)[22]. However, nine of the 11 cognitive function outcomes yielded no effects of the interventions, compared with controls or any other interventions.

In a similar review published in 2003, Columbe and Kramer (2003) examined the hypothesis that aerobic training enhances the cognitive vitality of healthy, sedentary older adults. They concluded that executive processes (relating to planning, inhibition and scheduling of mental procedures) were significantly and positively related to aerobic exercise and that physical activity is beneficial for all the cognitive functions they analysed. However, these conclusions should be considered with caution as the quality of the review was poor (4/11) and the conclusions were based on non-randomised trials. The review by Angeveran et al (2008) is a more reliable summary of the evidence.

Howe et al (2008) assessed the effect of exercise interventions involving gait assessment, balance, functional exercises and muscle strengthening on balance in older people living in the community and institutional care. Thirty four studies were included and statistically significant benefits were found for balance ability in the short term. However, many of the studies had methodological weaknesses and there was a lack of standardised outcome measures or long term follow up making conclusions difficult to draw.

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[22] WMD=weighted mean difference, SMD =Standardised mean difference.

Interventions to prevent disability in frail community-dwelling older people

Daniels *et al* (2008) reviewed RCTs of interventions aiming to prevent further disability in frail older people (143). The review criteria specified that only trials that measured disability outcomes were eligible for inclusion. This resulted in only ten studies of variable quality out of the 58 full papers screened for inclusion, two studies assessed nutritional interventions and eight assessed combined exercise interventions. No evidence was found for effectiveness of nutritional interventions for frail older people on disability measures. In addition no evidence was found that lower leg strength training, despite the improvements in walking function, had an effect on disability measures. Most striking was the difference in the intensity of interventions that ranged from 10 weeks to 18 months duration, making conclusions difficult to draw. The RCTs included in this review that demonstrated some beneficial effects of aerobic exercise on disability outcomes included high-intensity exercise, and followed up subjects over 12–18 months period. Both RCTs were carried out in the USA and results may not be comparable in the UK setting (153;154). It seems that whilst exercise can improve *impairment and functional outcomes* the evidence for any effect on *disability* is weak.

Physical activity and psychological wellbeing in older people

Netz *et al* (2005) examined the effect of physical activity on psychological wellbeing in older people together with variables that potentially moderate any effect (147). Exercise had a small but significant effect (effect size WMD 0.19) on wellbeing in *healthy older people* with an almost 3 times greater pre-test/post-test change in the experimental groups compared with the control. No strong relationship was found between session length and outcome (overall psychological wellbeing) but moderate intensity exercise benefited older people's psychological wellbeing more than light intensity exercise (WMD 0.34 CI 95% CI 0.26 to 0.42). The largest differences, between treatments and control groups, for the effect of physical activity were shown in measures of self-efficacy (WMD 0.38; 95% CI 0.24 to 0.52), overall wellbeing (WMD 0.37; 95% CI 0.15 to 0.59), view of self (WMD 0.16; 95% CI 0.11 to 0.21) and effect on anxiety levels (WMD 0.23 95% CI 0.14 to 0.44). It seems that the potential effects of increased cardiovascular function and strength add to the overall experience of improved wellbeing. Whilst there were significant effects of physical activity on wellbeing and mood, the magnitude of the effect sizes were small and they decreased in the older age groups (80+).

Behavioural factors

There is evidence to support the efficacy of physical activity and exercise for older people in terms of improved strength, aerobic capacity and function, but the effectiveness of any exercise programme is dependent on adherence and compliance. Older people with or without disability encounter barriers to initiating and adhering to exercise programmes (155), such as lack of confidence to exercise and a belief that exercise is likely to do more harm than good. The review by Van Bij *et al* (2002) does not provide evidence to support the effectiveness of long term behavioural interventions, such as counselling sessions, to encourage older people to exercise. Whilst older people can be encouraged to exercise, the evidence tends to be derived from white, well educated populations which don't include those who are at greatest risk of functional decline (150).

Eakin *et al* (2000) reviewed the literature on primary-care-based interventions for increasing physical activity. Only 4 out of 15 studies included in the review focused on older people (156). However, for the small number of studies that were reported on older people, the most promising results were found for interventions that were tailored to participants' characteristics and those that offered written material as reminders. Undoubtedly policy should focus on encouraging adherence to an active lifestyle in early life when lifetime activity habits are determined. In addition, it appears to be important to make an impact 'upstream' before retirement and focus on activities that generate feelings of enjoyment and satisfaction (16).

Limitations

The reviews of exercise rely on the quality of the trials included, as has been the case for other areas of the literature and in many cases quality of the included RCTs was reported as poor or not assessed, making firm conclusions difficult to draw. The lack of effect of exercise and physical activity on disability measures may reflect the lack of sensitivity to change over time of the outcome measures. The SF-36 has been recommended for assessment of general health in older people (21) but it may not be a sensitive enough tool to detect changes that are important to older people. The physical component measure of the SF-36 includes only three categories that define limitation of activity (limited a lot, limited a little and not limited). For older people, even if strength and function improves it may not be enough to shift the scores from 'limited a little' to 'no limitation' in walking more than a mile, climbing stairs or lifting and carrying.

8

Chapter 8 – Nutritional interventions

Summary

- There is limited evidence to support the use of nutritional supplements for older people living in the community.

- There is limited evidence that dietary advice in combination with supplements improve dietary intake and weight gain (at one year) in undernourished older people but there is no evidence of effect on mortality or hospital admission rates.

- There is no consistent evidence that vitamin supplements (vitamin B or folic acid) have any effect on cognitive function in healthy or cognitively impaired older people.

- There is limited evidence for the effectiveness of vitamin D supplements in combination with calcium for reducing risk of falls in women.

Introduction

An increase or decrease in body mass has been shown to be a risk factor associated with functional decline in older people and is one of the seven indicators of frailty described by Ferrucci *et al* (2003) (157). Good nutrition plays a vital part in the health and wellbeing of older people, and in delaying and reducing the risk of contracting disease (47). Emphasis is placed on good diet to prevent obesity but it is generally agreed that the risk of under-nutrition, rather than obesity, is the main cause of concern for older people (158). Ageing is associated with deterioration in taste, smell and the state of teeth and all of these factors can impact on dietary intake and nutritional status. This chapter includes a brief summary of the effectiveness of nutritional interventions on the health and wellbeing of older people living in the community.

Review literature: nutritional and supplement interventions

The search identified a limited number of reviews in this field that were relevant to older people living in the community. Most of the nutritional research focused on dietary interventions with multi-nutrient supplements. Two reviews were identified in the peer reviewed literature along with one recent review in the grey literature and one Cochrane Review. Details of the quality of the reviews are summarised in table 8.1.

Table 8.1 Quality scores for reviews of nutritional interventions

Reference No of studies	Intervention	Health category	Outcome	Scores for methodological criteria[23]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Daniels et al (2008) (143) 2 RCTs only	Nutritional interventions.	Frail older people.	No effect of nutritional interventions.	y	y	y	n	n	y	y	y	na	na	ca	7/9
Milne et al (2009) (158) 62 RCTs	Nutritional supplement. Oral protein and energy supplements (62 trials).	Frail older people.	No reduction in mortality in total population (RR 0.92; 95% CI 0.81 to 1.04). Increase in weight gain (WMD of 2.2% (95% CI 1.8 to 2.5).	y	y	y	y	n	y	y	y	y	y	ca	9/11
Jones et al (2009) (71) 19 studies	Nutritional needs and interventions.	Older adults living in the community.	Limited benefits for nutritional supplements in community settings.	y	n	y	n	n	y	n	n	na	na	ca	3/9
Jia et al (2008) (159) 22 RCTs	Nutritional supplements (22 trials).	Older people >65+ with subset of trials in community.	Little effect of vitamin B or antioxidant supplements on global cognitive function.	y	n	y	y	n	y	y	y	y	y	ca	8/11

[23] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of include and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review.
y=yes, n=no, na=not applicable ca =can't answer

A systematic review of interventions to prevent disability in frail community-dwelling older people identified only two studies that failed to provide evidence that nutritional interventions had a positive effect on reducing disability, despite an observed effect on total energy intake and weight gain, in undernourished frail older people (143).

The high-quality review by Milne *et al* (2009) (158) included 62 trials that evaluated whether additional protein and energy supplements had a beneficial effect on mortality in older people. The overall evidence for the supplements was weak. There was a statistically significant difference in the pooled weighted mean (WMD[24]) between experimental and control groups in weight gain of 2.2% (95% CI 1.8 to 2.5) but there was no significant difference in mortality. However, when the data was limited to older, undernourished people there was a small significant difference (RR 0.79, 95% CI 0.64 to 0.97) suggesting that this type of intervention may be more effective if targeted at frail older people.

A recent report, commissioned by the Scottish Government, aimed to review evidence to support current practice and nutritional interventions in Scotland, in keeping with the Scottish Government's policy to help older people reach their health potential. The review focused primarily on review of reviews but did not take into account the quality of the literature. The main findings from the review evidence by Jones *et al* (2009) of nutritional interventions for older people are summarised in table 8.2 (71).

A recently published double blind RCT, carried out in the UK, suggests that a combination of vitamin B12, B6 and folic acid can slow the rate of accelerated brain atrophy in older people with mild cognitive impairment (160). This new research is encouraging but the trial was relatively small, the 24 month follow up rate was low (62%) and the study was not powered to detect effects of treatment on cognitive test scores.

Overall there is very limited evidence for the benefits of nutritional interventions for older people living in the community and whilst Jones *et al* (2009) suggest that vitamin D supplements should be provided for people over 65 years old there is only limited evidence to support their recommendation (13).

Table 8.2 Summary of nutritional interventions	
Intervention	Evidence
Dietary interventions without supplements	There is limited research on dietary interventions without supplements. Where there is evidence, dietary interventions improved dietary intake and weight gain at one year. There is no improvement in mortality or hospital admission rates.
Dietary interventions with supplements	Older people who took supplements in addition to dietary advice had higher nutritional intakes and greater weight gains but there was no difference in mortality rates.
Multi-nutrient supplements	Nutritional supplements have been shown to promote weight gain and reduce complications and mortality rates (mainly from hospital settings). However more evidence to support their use in older community-dwelling individuals has been called for.
Vitamin supplementation for cognition	There is no consistent evidence for vitamin supplementation to prevent or improve cognitive decline in older people.
Single nutrient supplementation	Vitamin D: A vitamin D supplement should be provided to people over 65 to enable them to meet requirements.

Source: Jones *et al*. Scottish Government Social Research, 2009.

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[24] A measure of effect size used when outcomes are continuous rather than dichotomous (such as death or myocardial infarction). The mean differences in outcome between the groups being studied are weighted to account for different sample sizes and differing precision between studies. The WMD is an absolute figure and so takes the units of the original outcome measure.

Improvement in diet and nutrition has been identified by the Scottish Government as a way of optimising the health of older people and the shift in provision of care in recent years, to increased care in the community, has highlighted the significant problem of poor food preparation and dietary requirements. Scotland's *Free Personal Care policy* offers assistance with food preparation and the fulfilment of special dietary needs of older people (aged 65+) who are considered by social services, to be at risk. However, good dietary habits are set in early life and any intervention to improve nutrition initiated during later life is unlikely to have a large impact on the disablement process.

9

Chapter 9 – Information and communication technology interventions

Summary

- The information and communication technology (ICT) literature is a newly emerging field that has not been subjected to high quality evaluation.

- There is little evidence available on the impact of telecare at the population level.

- There is limited evidence of small effects for telecare in clinical outcomes, such as enhanced quality of life for frail older people and their carers.

- There is limited evidence that ICT prevents or reduces disablement in frail older people.

- There is limited evidence that telemedicine is a cost-effective means of delivering healthcare.

- There is limited evidence from observational data only that suggest cost savings may be made in terms of hospital admission, home check visits and sleepover nights from telecare (safety and security monitoring systems) in Scotland.

- There is no strong evidence that telecare reduces hospital or institutional admission. Overly optimistic assessment of the effects of telecare on the demand for institutional care in the short and long term should be avoided.

Introduction

The demographic trend towards a growing population of older people, together with fragmented service delivery, and the rising cost of healthcare, have driven UK governments towards developing ICT with an aim to modernise the NHS and provide a more cost efficient, person-centred service. ICT interventions fall into two main categories:

- **Electronic integration dimension.** ICT that helps to integrate service delivery and access to information between institutions and professionals with an aim to provide a single assessment process.

- **User-centred dimension.** The use of ICT to support older people and their carers to remain living independently in the community. The user-centered dimension of ICT tends to be referred to as telecare (161).

Some of the definitions of ICT, reported in the literature, are shown in box 9.1.

Box 9.1. Information communication technology definitions

Telecare/telehomecare involve the delivery of health and social care to individuals within the home or wider community outside formal institutional settings, with the support of systems enabled by information and communication technology. Telecare systems are designed either for risk management or for assessment and information sharing.

Telemonitoring refers to telecommunication device that enables automated transmission of a patient's health status and vital signs from a distance, to the respective healthcare setting.

Telehealth refers to provision of health related services, home health and patient education at a distance using telecommunication technologies. Telephone based care services can combine telemonitoring with health messages.

Telemedicine is defined as the direct provision of clinical care, including diagnosing, treating, or consultation via telecommunication for patients at a distance.

Telecare, in particular, is a rapidly growing field that policy makers and health professionals alike are embracing. Ambitious targets have been set for strategies in England to provide all homes that need it by 2010 (162). Similarly in Scotland, a commitment to ICT, and in particular telecare, was made in 2006–8 with £8.35 million funding made available to 32 health and social care partnerships. The primary aim of the telecare strategy is to keep older people, and those with disability, living independently in their own homes by providing increased safety and reassurance to them and their carers (66). The expectations for telecare are high with hopes that it will reduce institutionalisation and delay frailty progression, by detecting early indication of the first signs of deterioration, and acting upon them (163). Some argue that misplaced optimism about the success of pilot studies, of poor methodology, may result in inappropriate policy or practice decisions (164). This chapter aims to review the literature on ICT interventions with a view to establish if the claims of benefits for the healthcare system are evidence-based.

Review literature: Information communication technology interventions

Information communication technology, and in particular telecare, is a relatively new field with an expanding research literature. Since 1997, when the first research paper was identified there has been a rapid rise in the publication rate (165). The evidence in this field is dominated by small-scale pilot studies or observational studies and there are no high quality RCTs. Some would argue that this reflects the fact that ICT interventions are service delivery innovations, supported by new technology, and RCTs are difficult to conduct in this field because of the complexity of care delivery (17).

Five reviews were identified that included frail, older people or older people with comorbidity as the main population or a large sub-group in the review. The quality of the reviews was assessed using the AMSTAR method (63) and was generally poor, ranging from 2 to 5 out of 9 (see table 9.1). Further details of the reviews are reported in Appendix 7. A number of reviews evaluating ICT were excluded as they either focused on specific disease, younger adults and children (166;167) (168) (169;170) or were narrative reviews describing process of delivery rather than evaluation of outcome (161;163;169).

Table 9.1 Quality scores for reviews of information and communication technology interventions for older people

Reference No of studies	Intervention	Health category	Outcome	Scores for methodological criteria[25]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Barlow et al (2007) (171) 98 studies including 68 RCTs	Telecare.	Frail and chronic disease.	Variable. Most benefit for vital signs monitoring.	y	y	n	n	n	y	n	n	na	na	ca	3/9
Botsis et al (2008) (172) 54 studies	Telecare.	Chronic disease.	Variable outcome.	n	n	n	n	n	y	n	n	na	na	ca	1/9
Dellifraine (2008) (173) 29 studies	Telehealth.	Sub-group of older people.	Positive effect on clinical outcome. Effect size 0.41 (95% CI 0.10 to 0.73).	y	n	n	n	n	n	n	ct	y	n	ca	2/11
Gaitwad (2009) (174) 27 studies	Telemonitoring. Telehealth. Telehome-care.	Sub-group of older people.	Positive effect on independence enhancement.	y	n	n	n	n	y	n	n	na	na	ca	2/9
Jennett et al (2003) (175) 53 studies	Telehealth.	Sub-group of older people.	Positive for quality of life but limited generalisability.	y	n	y	n	n	n	y	y	na	na	ca	4/9

[25] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of include and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review.
y=yes, n=no, na=not applicable ca =can't answer.

Home telecare for frail older people and those with long term conditions

The review by Barlow *et al* (2007) was one of the higher quality reviews in this section although only scoring 3 out of 9 on the AMSTAR quality scale (171). Failing to report details of the included and excluded studies, not assessing the quality of the studies nor reporting any descriptive or quantitative measure of benefit, were the main limitations of the review. The review included 68 low quality RCTs, and 30 observational studies. Most studies originated in the USA (64%) with only 10% in carried out in the UK. In addition the RCTs included in the review were small suggesting that they may be underpowered, with the possibility of unreported type II errors[26]. Only six studies (7%) focused primarily on older people with the majority concentrating on heart disease and diabetes. Interventions were categorised into vital signs monitoring, safety and security monitoring, and information and support services. Overall, the authors reported the most benefit from vital signs monitoring for reducing health service use, and telephone monitoring by nurses for improving clinical indicators and reducing health service use. In the frail older group, most of the benefits were shown for 'information and support services' where case management by telephone was found to improve clinical outcomes and improve adherence to treatment. No details were given regarding the magnitude of effects in the studies making it difficult to make firm conclusions.

Socioeconomic impact of telehealth and telemedicine

Jennett *et al* (2003) included 53 studies of older people, as a subgroup in a larger systematic review of the socioeconomic impact of telehealth (175). Only 16 out of 53 studies (30%) provided good to fair scientific evidence of benefit, in terms of enhanced quality of life. There were no high quality comparative studies to support telehealth which clearly demonstrate the socioeconomic benefits of video-consultation. Further details of benefits are reported in Appendix 7. The authors identified problems in the literature particularly regarding evaluation of costs savings and cost effectiveness. The lack of precision in the cost analyses created uncertainty around the general applicability of results, making comparison between studies and populations misleading (175).

Grey literature reviews and reports

The search identified three recently published reports and reviews of telecare interventions that provide summaries of effectiveness (5;17;74). The reviews were variable in quality and whilst all reported benefits of different types of telecare interventions, and cost savings in terms of hospital admissions, none included clear details of the magnitude of effects or considered the potential bias caused by the lack of a control group in many studies.

Two separate reviews of evidence for telecare interventions were published by West Midlands NHS in 2008 (74) and the Department of Health in 2006 (17). The findings of both reviews are presented in table 9.2. It should be noted that the evidence is based on small-scale RCTs, feasibility or pilot studies and observational data, and a large percentage of the evidence originates from studies of people with heart disease and diabetes, not specifically aimed at older people. Barlow (2006) reported limited evidence for telecare, aimed at a general population of frail older people, on care outcomes and almost no evidence of cost benefits.

A recent report by The BOW Group[27] from the Centre for International Research on Care, Labour and Equalities (CIRCLE) published a very positive review of the effectiveness of telecare. The authors suggest that: 'telecare offers a proven 'win-win' for the health and social care system'. The benefits of telecare

[26] In statistics, the terms 'type I error' or 'false positive' and 'type II error or 'false negative' are used to describe possible errors made in a statistical decision process.
Type I (α): reject the null hypothesis when the null hypothesis is true – a 'false positive' finding.
Type II (β): accept the null hypothesis when the null hypothesis is false – a 'false negative' finding.

[27] The Bow Group is the oldest – and one of the most influential – centre-right think-tanks in Britain.
The Group exists to develop policy, publish research and stimulate debate within the Conservative Party. It has no corporate view, but represents all strands of Conservative opinion.

interventions reported by The BOW Group (5) include:

- Delayed entry of people with dementia and other comorbidities to institutional care.

- Enabling more people to be discharged early from hospital.

- Cutting unnecessary costs from health and social service care such as home visits and overnight sleeping services.

- Reducing risks such as fire, smoke, gas and falls in the homes of older people.

- Assisting in the management of specific conditions e.g. monitoring vital signs, detecting problems at night or enabling carers to sleep.

- Enabling frail older people to summon assistance rapidly when needed.

- Providing support and re-assurance for carers.

The report was based on information from a number of UK government documents and the peer reviewed literature, including some of the reviews shown in table 9.1. The report makes reference to cost savings in the Scottish Telecare Development Programme of £11.15 million between 2007–8 (176) but it should be recognised that these costs are estimated. The evaluation of the Scottish Telecare Development Programme, carried out by the York Health Economics Consortium, predicted savings of around £43 million for 2007 to 2010 mainly in reduced unplanned hospital admissions. Telecare innovation including general safety and security monitoring, has been incorporated in a wide range of changes to service delivery in West Lothian, Scotland (Smart Support at Home Scheme) (177). Further evaluation of these programmes is recommended.

Table 9.2. Summary of results of telecare interventions

Telecare type	Nature of evidence base	Evidence of feasibility and impact	Implementation issues	Individual outcomes	Systemic outcomes
Information, advice and support	Absence of large-scale RCTs and detailed cost-effectiveness analyses.	Evidence of feasibility and acceptability. Small-scale evidence of individual and system benefits.	Importance of ongoing professional support and commitment to offset lack of face-to-face contact. Newer technologies require greater technical support during and following implementation.	Some evidence for telephone support systems for impact on clinical or care outcomes.	Limited evidence for telephone support systems on cost benefit.
Vital signs monitoring	Dominated by small-scale observational studies. Absence of longitudinal and cost-effectiveness analysis.	Increasing evidence of feasibility and acceptability but with some exceptions. Small-scale evidence of individual and system benefits.	Training, education and technical support is very important. Ease of use and response protocols should be considered in implementation. Integration with technological infrastructure and working practices will enhance adoption levels.	Most of the emerging evidence supports vital signs monitoring for patients with diabetes. No evidence for older people group.	No evidence for older people.
Safety and security monitoring	Small-scale feasibility studies.	Observational studies suggest patient satisfaction. Equivocal evidence on system benefits.	Technical, attitudinal and behavioural barriers have been experienced by early implementers. Multi-agency professional engagement is a pre-requisite of successful application.	Limited evidence for telecare aimed at the general population of frail older people showing impact on care outcomes.	No evidence for older people.

Source: Adapted from Williams et al (2008) (74) and Barlow et al (2006) (17).

10

Chapter 10 – Interventions to prevent social isolation and loneliness

Summary

- Social isolation and loneliness has not been extensively researched in older people, and virtually not at all in the UK. The most recent review only identified 11 quantitative studies of diverse interventions.

- There is limited evidence from six studies of variable quality for group activities that include some form of educational or training input and social activities that target specific groups of people, but the effects are likely to be small and not generalisable.

- Group exercise programmes, peer and professional-led (social worker) support groups were shown to be effective in reducing social isolation and loneliness, but they are dependent on compliance and long term follow up.

- One-to-one interventions (home visits) were not found to be effective in reducing loneliness or social isolation.

- Evidence for technology-assisted interventions for frail older people and their carers is limited to a few studies and the studies have focused on basic technology only, such as phone or computer-mediated support groups.

- Most interventions involve a change in behaviour and therefore the outcomes are likely to be variable across settings as they depend on personal factors and/or cultural context.

- The research to date has focused on a few potential causes of social isolation and loneliness, but in reality the causes are complex and related to many factors including environmental, social and health-related. It is therefore not surprising that the effectiveness of the interventions is variable and generally small.

- Targeting interventions in the community, simply to reduce social isolation and loneliness, is unlikely to reduce neither hospital admissions nor institutionalisation.

Introduction

Social isolation is a common problem in later life and is associated with poor physical health, increased mortality, mental ill health, depression, suicide and dementia (18). Prevention of social isolation has been an aim of the World Health Organization for many years and low frequency of social contact has been shown to be a risk factor for functional decline in older people (47). However, whilst there is evidence from epidemiological research of the deleterious effects of social isolation on health, the causal association is not well understood and policies and interventions aiming to improve social participation in older people have not been subjected to extensive research (178). Social isolation is defined in various ways in the literature. Van Baarsen *et al* (2001) differentiated between two constructs:

- Social isolation: an objective measure of social interaction.

- Social loneliness or emotional isolation; the subjective expression or dissatisfaction with a low number of social contacts (179).

These two constructs have also been combined in a single definition:

- Social isolation: poor or limited contact with others, perceived as inadequate and/or limited contact causing adverse personal consequences for the individual (180).

This chapter provides a brief summary of the effectiveness of interventions that aim to prevent or alleviate social isolation and loneliness amongst older people living in the community.

Review literature: interventions to prevent social isolation

Two review articles were identified in the peer-reviewed literature that focused on interventions to reduce social isolation amongst older people (table 10.1). In addition, a recent evidence-based analysis of social isolation in community-dwelling seniors was identified in the grey literature.

The reviews were scored using the AMSTAR methodological criteria and details are presented in table 10.1 and Appendix 9.

Table 10.1 Quality scores for reviews of interventions to prevent social isolation

Reference No of studies	Intervention	Subjects	Outcome	Scores for AMSTAR methodological criteria[28]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Findlay (2003) (180) **17 studies (6 RCTs)**	Interventions including telecare and home visits, social groups.	Socially isolated older people.	Weak evidence for interventions that target social isolation and loneliness.	y	n	y	n	n	y	n	n	na	na	ca	3/9
Cattan and White (2005) (19) **30 studies**	Health promotion intervention[29]	All older people.	Group interventions alleviate social isolation and loneliness.	y	y	y	n	n	y	y	y	na	na	ca	6/9
Medical Advisory Secretariat (2008) (20) **11 RCTs**	Single focused interventions (exercise, social work group activities).	Community dwelling older people aged >65.	Group activities reduce depression and loneliness.	y	n	y	n	n	y	y	y	na	na	ca	5/9

Interventions to reduce social isolation amongst older people

The lower quality review by Findlay *et al* (2003) identified 17 evaluative studies published between 1982 and 2002, of which only six were RCTs. Eight of the published studies were conducted in the USA, the others were conducted in Australia, Canada, the Netherlands, Italy and Sweden. The interventions were grouped into one-to-one interventions (telephone support systems, telecare alarm systems and the Gatekeeper Programme); group interventions (discussion groups and educational programmes); service provision (community support networks and retirement village living); and internet usage (provision of information and support via websites and online course). Findlay *et al* (2003) concluded that there was little evidence for interventions that targeted social isolation in older people. The authors identified many limitations in the literature yet highlighted some factors that may contribute to successful interventions. They suggested that interventions had a better chance of success if they involved existing community resources and aimed to build community capacity. This seems an important point, in view of the Scottish Government's plan to involve community and lay volunteers in the care of older people. The Gatekeeper Programme is an example of a type of community programme that focuses on building capacity amongst volunteers (181). The Gatekeeper Programme was established in the Washington State, USA in 1978

[28] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of include and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review. y=yes, n=no, na=not applicable ca =can't answer.

[29] Health promotion was defined as ' the process of enabling older people to increase control over and improve their health'.

and was rolled out across the USA and Canada. It aimed to help members of the community learn to identify the signs of an older person at risk of social isolation, who may need support services to ensure safety and wellbeing. The programme linked these people to programmes of care before a crisis situation developed. The programme relied on volunteers to increase awareness of the signs of an older person at risk. These included: difficulty communicating/memory loss, becoming withdrawn, hostile or angry, changes to personal appearance, deteriorating home conditions, deteriorating health/difficulty seeing, speaking or hearing, poor mobility, decreased ability to handle money or pay bills, neglect or abuse/ isolation and wandering.

This programme was assessed in a non-randomised, matched controlled trial. Results suggest that the Gatekeeper model does not result in high service utilisation and is inexpensive to implement, although it is a method for identifying older people at risk of social isolation rather than an intervention per se (182).

The higher quality review by Cattan *et al* (2005) (19) included studies published between 1970 and 2002, involving health promotion for older people that targeted social isolation and loneliness. Thirty studies were identified of which 19 stated a theoretical framework for the intervention. The majority utilised some form of behavioural theory such as cognitive behavioural education or social learning. The interventions were grouped into:

- One- to-one.
- Service provision.
- Group activities and community development programmes.

Only thirteen studies were judged as high quality, of which six were identified as being effective, one was partially effective, although the intervention had no effect on loneliness, and six were ineffective or inconclusive. The review suggests that group activities that included some form of educational or training input and social activities that targeted specific groups of people were effective in reducing subjective feeling of isolation. One-to-one interventions, conducted in people's own homes were not found to be effective in reducing loneliness or social isolation. This is not a surprising outcome as instinctively any home visit or phone call/internet intervention, carried out on a one-to-one basis, seems unlikely to have any impact on social integration, although 'befriending'[30] is one of the most frequently provided activities. The success of 'befriending schemes' probably relies on the volunteers being of the same generation and social background as the older person they are visiting. Programmes that enabled older people to be involved in the planning, development and delivery of activities were the most likely to be effective.

The review carried out by the Medical Advisory Secretariat (part of the Ontario Ministry of Health and Long Term Care) focused on interventions for social isolation and loneliness in community-dwelling older people (20). The criteria for the review excluded pilot studies of less than 30 subjects, case reports, integrated models of outreach care, and studies in which loneliness and social isolation were not measured quantitatively. Eleven quantitative studies, published between 1980 and 2008, of single, focused intervention were identified as fitting the criteria, interestingly only one more than identified by Cattan *et al* in 2005 (19). Only six of the eleven were RCTs, seven were conducted in the USA and four in Europe (none in the UK). Most of the studies included older people (mainly women) less than 75 years of age. The studies' interventions were categorised into:

- Group support activities (focus groups led by social workers, senior citizens groups, exercise and professionally-led, educational groups, self help groups led by social workers).
- Technology-assisted interventions (social work 'crisis' phonelines, friendly interviewer phone visits, telephone based support groups, social worker-led telephone support groups).

Loneliness was measured either as a 1-item response to a question about frequency of loneliness or by specific instruments, such as the UCLA Loneliness Scale (183). Measures of social isolation and loneliness were extracted from generic assessment tools, such as the SF-36 (184). A summary of the effectiveness of the interventions are include in table 10.2. Overall the quality of the group interventions was reported to be moderate, whereas the overall quality of the technology-assisted interventions was lower.

[30] Befriending is a scheme that encourages volunteers to visit older people in their own homes on a one-to-one basis.

Table 10.2 Effectiveness of diverse interventions for social isolation, loneliness and depression

	Country, year	Intervention type	N	Findings
1. Wait list for senior apartments	Sweden, 1985	Social worker–led self-help groups.	108	▼ Isolation†
2. Residents of senior apartments	Sweden, 1983	Support groups.	60	▼ Isolation†
3. Physically inactive seniors	Netherlands, 2002	Group exercise programmes.	382	▼ Isolation‡ ▼ Loneliness‡
4. Physically inactive seniors	United States, 2000	Group exercise programmes.	174	▼ Loneliness†
5. Bereaved seniors	United States, 1993	Peer- and professional- led self-help support groups.	339	NS
6. Users of mental health services at senior centres	United States, 1982	Social worker–led self-help groups.	68	▼ Isolation‡ ▼ Loneliness§
7. Seniors experiencing mental health crisis	United States, 1998	Social worker crisis phoneline.	61	▼ Isolation‡ ▼ Depression†
8. Seniors with low income and low perceived social support	United States, 1991	Telephone friendships.	291	NS
9. Hearing-impaired seniors	Germany, 1997	Hearing aids.	148	▼ Loneliness†
10. Informal caregivers of persons with Alzheimer's disease	United States, 1995	Nurse moderated computer link .	102	NS
11. Informal caregivers of persons with dementia	United States, 2007	Social worker–led telephone-based support.	103	▼ Depression† (subgroup > 65 yr)

▼ =decrease; NS=not significant; p>0.05; †P<0.05; ‡P<0.0; §P<0.001

Source: Reproduced with permission from the Medical Advisory Secretariat (2008) (20)

On close inspection of the data there are a number of limitations. Firstly, the lack of generalisability of the evidence makes it difficult to assess as most studies were carried out in the USA on highly selected groups, including mainly women and older people in their 60s and 70s. In addition the follow up periods were short, generally less that 12 months in duration, which is not long enough to adequately assess effectiveness. It is also unclear if the reduction in isolation and loneliness had any impact on long term behavioural change. Most notably, many of the studies with positive findings had very small sample sizes (n=60–70) yet the two larger studies, that were less likely to be under-powered, reported non-significant results. This suggests that some of the smaller studies should be viewed with caution and larger studies would be needed to confirm the findings.

The interventions identified in this review were all directed at the individual or group level, were narrowly based and did not include proactive case-finding of those at risk of social isolation and loneliness. In conclusion, social isolation and loneliness are difficult outcomes to measure and factors such as environmental and economic aspects that influence older people's views and behaviour are important and not generally taken into account in these narrowly based trials.

11

Chapter 11 – Medication review

Summary

- Medication review by pharmacist or other health professionals has no effect on reducing mortality or hospital admission.

- There is no evidence of significant benefits for pharmacist-led medication review on quality of life.

- There is limited evidence from one large multi-centre RCT that educational programmes, including information about medication review for GPs, may reduce risk of falling and injury and improve medication use in older people.

- There is very limited evidence from one small RCT that gradual withdrawal of psychometric medication can reduce the rate of falls in older people.

Introduction

Medication intake can impact significantly on the wellbeing of older people who often find themselves on a cocktail of drugs for multiple ailments. The complexity and toxicity of some drugs can affect the health of older people and can have more of a negative effect than positive outcome. Medication related adverse effects in primary care represent an important common cause of morbidity although there has been little research aimed at evaluating interventions that might lead to safer prescribing (185). Medication review is a structured evaluation of a patient's medicines, aimed at reaching agreement with the patient about drug therapy, optimising the impact of medicines and minimising the number of medication-related problems. Most interventions include medication review by pharmacists or other health professionals. This chapter includes a brief summary of the effectiveness of interventions that aim to prevent drug related morbidity for older people living in the community.

Review literature: medication review (pharmacy and GP-led interventions)

Three systematic reviews were identified that included studies of medication review and interventions in primary care that aimed to reduce medication related adverse events in older people. Details of the quality of two of the reviews are summarised in Table 11.1. Further details are presented in Appendix 10. A summary of the third review by Gillespie *et al* (2009) (13) is included in tables 6.1 and 6.2 in the previous chapter on falls prevention interventions.

Table 11.1 Quality scores for reviews of medication review

Review	Intervention	Subjects	Outcome	Scores for AMSTAR methodological criteria[31]											Total score
				1	2	3	4	5	6	7	8	9	10	11	
Holland *et al* (2007) (186)	Medication review (pharmacy-led). (32 studies, 20 in community settings)	Older people with disease >65.	No sig benefit on mortality RR 0.96 (95% CI 0.82 to 1.13) hospital admission or QOL.	y	y	y	n	n	y	y	y	y	y	ca	8/11
Royal *et al* (2006) (187)	Interventions aiming to reduce drug related adverse effects.	Older people with disease.	No evidence for pharmacist- led or other interventions. (OR 0.92 (95% CI 0.81 to 1.05)	y	y	y	y	n	y	y	y	y	y	ca	9/11

[31] 1=research question and criteria included; 2=duplicate assessors; 3=comprehensive search; 4=list of include and excluded studies reported; 5=status of publication stated; 6=characteristics of included studies provided; 7=quality assessment documented; 8=quality assessment used appropriately; 9= appropriate test for heterogeneity if meta-analysis used; 10=assessment of publication bias; 11=conflict of interest stated for included studies and review. y=yes, n=no, na=not applicable ca =can't answer.

Royal *et al* (2006) included 38 observational studies and RCTs, 17 were pharmacist-led interventions, eight were led by primary healthcare professionals and 13 were interventions included as part of a more complex falls prevention programme (187). When all the data was pooled in a meta-analysis, including randomised and non-randomised trials the pharmacy led interventions were found to be effective at reducing hospital admission (OR 0.64 [95% CI 0.43 to 0.96]) however, when a sensitivity analysis was carried out that restricted the included studies to RCTs, there was no significant difference between groups (OR 0.92 [95% CI 0.81 to 1.05]) suggesting that selection bias may have skewed the data in the initial analysis. No other effects were found for the falls group or medication review by other primary healthcare professions.

The high quality meta-analysis of pharmacist-led medication review by Holland *et al* (2007) also failed to demonstrate any significant effect on all cause admission to hospital (RR 0.99 95% CI 0.87 to 1.14 p=0.92) or mortality (RR 0.96 [95% CI 0.82 to 1.13 p=0.62] (186) but the interventions appeared to have positive effects on outcomes such as number of drug-related problems, knowledge, adherence, satisfaction and adverse drug reactions which are important outcomes. On closer inspection of the data only one third of the trials that measured quality of life found any benefit and they were not statistically significant. The lack of effect did not seem to be related to the type of pharmacist or intensity of the medication review. It is surprising that there are few studies that focus on GP's review of older people's medication as generally GPs are most likely to be responsible for prescription.

The meta-analysis of falls interventions by Gillespie *et al* (2009) included two trials that demonstrated some benefit of medication review. One placebo-controlled trial found a significant reduction in the rate of falls (RaR 0.34 95% CI 0.16 to 0.73) but not risk of falls or fractures. However, this was a very small trial (188) carried out in New Zealand with only 93 participants and results should be viewed with some caution.

The higher-quality trial reviewed by Gillespie *et al* (2009) (13) of GP's management of medication use, investigated the effectiveness of an educational programme aiming to improve medication use on number of falls and quality of life for people aged 65 and over (189). The trial was a cluster RCT design including 849 patients from 20 GP practices in Australia. The intervention consisted of three components:

1. Education-academic programme, giving prescribing information and feedback.

2. Medication risk assessment.

3. Completion of medicine review checklist.

Doctors received practice incentive payments after completing ten medication reviews and were reimbursed for their time, but despite this bonus, there was a low doctor's response rate to the educational programme. Participants in the experimental group had a lower odds ratio for having a fall (OR, 0.61; 95% CI, 0.41 to 0.91), injury (OR, 0.56; 95% CI, 0.32 to 0.96), and injury requiring medical attention (OR, 0.46; 95% CI, 0.30 to 0.70) at 12 months. The increased odds of having an improved medication use (combined use of benzodiazepines, non-steroidal anti-inflammatory drugs [NSAIDs] and thiazide diuretics) of composite score (OR, 1.86; 95% CI, 1.21 to 2.85) was significant at 4-month but not at 12 months follow up. Quality of life scores were unaffected by the intervention. This suggests that education programmes and systems for medication review conducted by GPs can lead to improved use of medicines and potentially reduce risk factors for functional decline in older people but it would rely on a good GP take-up rate, and long term follow up.

12

Chapter 12 – Discussion

Introduction

This scan of policy documents and research includes information on a wide range of different interventions aimed at preventing disablement in community-dwelling older people. Critical appraisal of the evidence is difficult because of the unstandardised outcomes and different terminologies used for models of care e.g. home visits, comprehensive geriatric assessment and case management models that are heterogeneous and include overlapping components. The disablement process was used as a framework to develop the search strategy for identifying interventions. The complexity of the disablement process means that many risk factors and outcomes are relevant and therefore this scan has a very broad focus. There is a large degree of uncertainty in the literature for many interventions.

Many of the studies focus on hospital admission rates rather than function, activities of daily living or quality of life, making conclusions regarding the prevention of disablement difficult. Nursing home or institutional admission, although difficult to measure precisely is probably one of the most important endpoints for policymakers and researchers to consider, not least because loss of independence is important to older people. Some of the reported risk factors for nursing home admission are difficult to modify (48), but interventions that impact on activity of daily living dependency, should be encouraged. Overall, there is good evidence for exercise interventions for a number of outcomes, particularly for prevention of falls, but effect size estimates are often lower in studies of higher quality (146) and impact at a population level is probably low. Most of the evidence for other interventions is mixed with small or inconsistent effects, making conclusions difficult to draw with confidence. The lack of clear evidence is partly due to the fact that there are so many determinants of healthy ageing, as described by Dahlgren and Whitehead (34) including hereditary and individual lifestyle factors. The fact that chronic diseases and physical decline originate in early life and develop insidiously, has a large part to play in shaping the health and wellbeing of older people (25) and modifying these determinants of health in later life is difficult and not always possible. That is not to say that interventions for older people are not worthwhile but the evidence, feasibility in context of the setting, and potential impact should be carefully considered.

The strength of the evidence for complex and specific interventions is summarised in tables 12.1 and 12.2. The tables are split into complex and specific interventions although there are common characteristics within many of the interventions, such as exercise in falls prevention programmes and case management within integrated service delivery programmes. The evidence in the tables is based on review-level data of mainly randomised or controlled studies, unless otherwise stated. Where possible the magnitude of effect is stated in the tables as effect size, relative risk (RR) or odds ratio (OR), SMD or WMD. The evidence is categorised as: evidence of no effect (evidence that the intervention is ineffective), limited or mixed evidence (conflicting evidence or very small effects), evidence of effect (where there is consistent evidence of small to moderate effects) or unknown effectiveness (where no evidence was found). The overall picture is inconclusive and strong evidence of effect is rare for all outcomes relating to the disablement process. The most commonly reported outcomes were hospital and institutional admission although they are difficult to measure accurately and need to be reported alongside a control group.

Table 12.1. Strength of evidence for effectiveness of complex interventions. (RR=risk ratio or OR=odds ratio [95%CI] SMD=standardised mean difference.)

Interventions	Target population	Physical function	Disability (ADL)	Cognitive function	Quality of life	Social isolation	Risk or rate of falls	Institutional admission	Hospital admission (HA)/death
Preventative home visits	General and frail/impaired older people.	Variable results OR 0.89 (0.77 to 1.03).	2 out of 8 studies reported improvement 0.2 effect size.	Unknown effectiveness.	Difference in outcomes makes comparison difficult. Some benefits in self-efficacy for general population.	Unlikely benefit of one-to-one. Evidence for home visits is unclear.	Evidence for OT/nurse visits for home modification.	OR 0.86 (0.68 to 1.10). Home visits might increase admission due to identification of unmet needs.	HA dependent on number of home visits OR for death 0.92 (0.80 to 1.05).
Comprehensive geriatric assessment	General older people.	Very small effect size SMD -0.12 (-0.16 to -0.08).	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	24% reduction in risk RR 0.76 (0.67 to 0.86).	14% reduction in risk of nursing home admission RR=0.86 (0.83 to 0.90).	Very limited (HA) (RR 0.98 (0.92 to 1.03). Evidence of no effect for death 1.00(0.98 –1.03).
Comprehensive geriatric assessment	Frail/impaired older people.	Effect size difference SMD -0.01 (-0.06 to 0.04).	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Very limited effect RR 0.99 (0.89 to 1.10).	Very limited to no effect RR 1.01 (0.83 to 1.23).	Small effect for (HA. RR 0.90 (0.84 to 0.98). Evidence of no effect for death 1.03 (0.98–1.03).
Multiple-factorial falls interventions	Frail older people.	Small effect on physical function measures (SF-36).	Unknown effectiveness.	Unknown effectiveness.	Fear of falling may be reduced. 6 out of 12 RCTs showed improvement in QOL.	Unknown effectiveness.	Conflicting results RaR 0.75 (0.65 to 0.86). RR 0.95 (0.88 to 1.02).	Evidence in favour of intervention but CIs wide. Based on 5 RCTs RR 0.92 (0.59 to 1.43).	Based on 9 RCTs 0.82 (0.63 to 1.07) for HA Based on 15 studies RR for death 1.08 (0.87 to 1.34).
Case management	Frail older people.	Use of different outcomes makes comparisons difficult.	Unknown effectiveness.	Improvement seen in depression scales and mental status. (1 RCT only)	Unknown effectiveness.	Evidence from 1 RCT of improved social function. (SF-36 p<0.008)	Unknown effectiveness.	Inconsistent evidence from studies using different models of care. OR for cohort study 0.56 (0.43 to 0.63).	Inconsistent evidence from studies using different models of care mainly in the USA.
Integrated service delivery	Frail older people.	Large population-based controlled study shows incidence of functional decline at 4 years.	Unknown effectiveness.	Improvement in mental health and depression. (1 RCT only)	Improvements in empowerment and satisfaction. satisfaction for caregivers.	Unknown effectiveness.	Unknown effectiveness.	Potential for delaying nursing home admission. OR 0.56 (0.43 to 0.63). Cohort study only.	Health systems benefits and reduction in emergency visits reported but size of effect uncertain.

Evidence of effect | Limited/mixed evidence or based on RCTs only | Evidence of no effect | Unknown effectiveness

Table 12.2. Strength of evidence for effectiveness of specific interventions (RR=risk ratio or OR=odds ratio (95%CI) SMD=standardised mean difference.)

Interventions	Target population	Physical function	Disability (ADL)	Cognitive function	Quality of life	Social isolation	Risk or rate of falls	Institutional admission	Hospital admission (HA)/ death
Exercise (aerobic, progressive muscle training tai chi, balance)	General and frail older people.	Strength SMD 0.68 (0.52 to 0.84). Smaller effects for disabled older people.	Inconsistent evidence from SF-36. Longitudinal data suggests exercise prevents disability in later life.	Effect size range (1.17, 0.52, 0.5). Combined effect =0.5 for selected function.	Small (0.19) effects on psychological wellbeing (reduced with increased age).	Small effect of group activity on feelings of isolation and loneliness.	Good evidence for risk of falls. RaR 0.78 (0.71 to 0.86) and risk of fracture 0.36 (0.19 to 0.70).	Unknown effectiveness.	Unknown effectiveness.
Assistive devices or environmental modifications	Frail older people.	OT advice &intervention (SMD =0.42 CI 0.08 to 0.77) 2 RCTs only	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	RR 0.85 (0.75 to 0.97) (general) RR 0.66 (0.54 to 0.81) (frail).	Unknown effectiveness.	Unknown effectiveness.
Telecare/telehealth	Frail/impaired older people.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Small effects for information and support services.	No effect for telephone friendship or computer links.	Unknown effectiveness.	Very limited evidence from observational study.	Very limited evidence from observational study.
Social interventions	General and frail older people.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Mixed evidence of effect for reducing depression from small RCTs.	Effective for group intervention only, 6 out of 13 studies effective.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.
Medication review	Frail/impaired older people.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Positive effect on satisfaction measures and knowledge.	Unknown effectiveness.	RaR 0.34 (0.16 to 0.73) OR 0.61 (0.41 to 0.91) 2 RCTs only.	Unknown effectiveness.	No evidence of effect on hospital admission (0.99 95% CI 0.87 to 1.14) or mortality 0.96 95% CI 0.82 to 1.13).
Nutritional intervention	General/frail older people.	Unknown effectiveness.	Unknown effectiveness.	No consistent evidence for vitamin supplements.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Effect on subgroup of undernourished group RR 0.79 95% CI 0.64 to 0.97).
Vision screening/ corrective Intervention	General older people.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	Unknown effectiveness.	No evidence for screening. Possibility of risk of falls.	Unknown effectiveness.	Unknown effectiveness.

Legend: Evidence of effect | Limited/mixed evidence or based on RCTs only | Evidence of no effect | Unknown effectiveness

Complex interventions

The search identified 9 reviews of preventative home visit interventions published between 2000 and 2009, three reported positive findings, four reported inconsistent findings and two reported negative results. The most recently published (negative) review by Bouman et al (2008) (96) did not find any evidence of effect for home visits for frail older people (intensity 4.5 to 7.5) but the trials included in the review did not use risk-targeted assessment. Liebel (2009) also reported inconsistent findings for home visit programmes but the most successful interventions targeted risk factors associated with functional decline (80). The authors that report beneficial effects of home visits advocate multi-dimensional, high-intensity follow up, targeted at the appropriate population. However, Beswick *et al* (2008) found little evidence that interventions with a higher intensity were more effective in improving outcomes than those that had less health care involvement, shorter duration or number of visits. The strength of evidence for effects of untargeted home visits on hospital and nursing home admission is weak (84).

Overall the effects of the complex interventions appear small to modest at best. For instance, when data from all interventions in the meta-analysis by Beswick et al (2008) were combined, the risk of hospital and nursing home admission was reduced from 40.5% to 38.2% and from 10.6% to 9.2% (numbers needed to treat 42 and 71[32]) respectively and changes in physical function were small (7). In addition, when the data was analysed in subgroups for general and frail older people, the effects for comprehensive geriatric assessment, for frail older people, is even smaller and for most outcomes not statistically significant. Stott *et al* (2008) point out that:

> *'The true benefits are likely to be higher because of contamination of control groups and the use of intention-to-treat analysis, as this method of analysis generally underestimates the magnitude of benefits for those who receive an intervention because it also includes those that have not adhered to the intervention.'* (190)

Complex interventions contain several interacting components and characteristics that need to be considered during evaluation. These include: the interacting components within the experimental and control intervention, behavioural changes required by those delivering or receiving the intervention, the groups or organisational levels targeted by the interventions and degree of flexibility or tailoring of the intervention permitted (23). These components were usually not described well in the reviews or primary studies, making data synthesis difficult.

The belief that screening and case-finding can prevent functional decline in older people is appealing to policy makers, researchers and clinicians. The large MRC trial of universal screening for people over 75 years old in England, that failed to show beneficial effects of population-based screening was a good example of a policy-driven strategy, implemented without a sound evidence-base or well coordinated care pathways to follow (8). An interesting finding of the MRC trial was that the specialist in geriatric medicine performed no better than the GPs when implementing the comprehensive geriatric assessment. This suggests that management of older people identified as in need of comprehensive geriatric assessment would be best placed in general practice, *if* GP time allowed, the GPs received additional training and time-consuming administration could be kept to a minimum. The incorporation of the 75+ annual check into GPs contracts in England was ineffective, partly because it was resisted by GPs and never fully integrated properly (191).

The evidence for case management and integrated service delivery for older people is equally contradictory (192), but experts suggest that the programmes most likely to be successful are those that are targeted at frail older people at low risk, focusing on multi-dimensional geriatric assessment and include multiple follow up visits (193). A recent high-quality primary RCT demonstrated that even with targeted intervention and long term follow up of three years, success is not always guaranteed in terms of reducing functional decline and disability (111).

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[32] The number needed to treat (NNT) is the number of patients who need to be treated in order to prevent one additional bad outcome (i.e. the number of patients that need to be treated for one to benefit compared with a control in a clinical trial). The ideal NNT is 1, where everyone improves with treatment and no-one improves with control. The higher the NNT, the less effective is the treatment.

Cost effectiveness of complex intervention for older people

There are relatively few reports on the cost effectiveness of complex care for older people. In a low quality review of the cost of comprehensive geriatric assessment, Wieland *et al* (2003) (89) suggest that implementation of case-management may not increase care costs whilst Elkan (2000) concluded that home visits have the potential for producing cost savings. More recently, Hunt *et al* (2004) reviewed the cost and impact of case management for long term conditions and found that the methodology varied considerably between studies, due to differences in reported hospital payment systems, making conclusions difficult to draw. Hunt *et al* (2004) found that only one out of nine RCTs reported a statistically significant reduction in costs, four reported increased costs and six reported non-significant reductions in overall costs (including cost of case management, nursing home and hospital-bed days and emergency department visits) (192). Two recently published RCTs, not included in the reviews, report positive findings. In a small RCT (n=155), Mellis *et al* (2008) compared the costs of a multidisciplinary, geriatric assessment model with usual care in Holland, and found that the intervention was an effective addition to primary care, for frail older people, at a 'reasonable' cost (10). Beland *et al* (2006) in Canada, also showed that integrated care, including case management for older people with moderate disability, has the potential to shift institutional care to home care services without additional costs (9). This is encouraging but it is difficult to compare cost effectiveness between countries that offer different health and social services and further evaluation is needed in Scotland before firm conclusions can be made about cost savings. Most research to date seems to suggest that whilst care can be delivered successfully in the community, with appropriate integrated and coordinated service delivery, it may not result in overall cost savings.

Integrated service delivery and case management

Evidence for integrated service delivery from the review literature is limited and many of the interventions developed in the USA (91) may not be feasible to implement in Scotland. Those that have been implemented in the UK, (such as the Evercare Programme aimed at older people in institutional care) failed to provide evidence of effectiveness (102).

Whilst there are a number of promising interventions for integrated service delivery developed, mainly in the USA and Canada, they rely on adequate information systems. There are concerns over the adequacy of care-coordination across Europe because information systems that permit the transmission of patient information between providers, is only emerging, and it is often not fully coordinated (3). It seems that, unless all the key points for integrating care are in place, such as single entry point, coordination between decision makers and managers, comprehensive geriatric assessment, central use of case managers and an easily accessible computerised system for sharing data between different care systems (such as NHS 24 and out of hours services), the success of any intervention is likely to be limited. In addition, it seems essential that a long term follow up process is developed for evaluation, as demonstrated by the Canadian PRISMA model that showed no difference in functional decline in frail older people in the first three years of a population-based trial but reported significant reduction in functional decline in the fourth year, when recruitment to the programme increased (194).

There are a number of important factors that need to be in place in order to achieve successful integration of healthcare systems. In a comprehensive report, produced by the Organisation for Economic Co-operation and Development (OECD) on improved health system performance through better care coordination, Hofmarcher *et al* (2007) highlight four key areas for policy consideration for implementation and development of integrated care:

- The need for better patient information and systems permitting its transfer between providers and across institutional boundaries.

- The need for ambulatory care, and primary care in particular, to have the capacity to respond to emerging patient needs. Key elements in this context are whether scope-of-practice rules for health professionals are flexible enough, and whether overall resources in the ambulatory and long term care sector are adequate.

- How coordination can best be organised and whether payment arrangements for providers help to encourage the desired coordination and cooperation among providers.

- A final challenge concerns breaking down barriers between care silos through increased integration of care (195).

Stuck and Kane (2008) suggest that investment in complex preventative care should consider two strategies(196):

1. Older people at low risk – multidimensional, preventative strategies, addressing the multiple potential co-existing medical, functional, psychological and environmental problems and risks of older people. Long term follow up needs to be included to ensure modification of long term risk factors and respond to change over time.

2. Older people at higher risk or for those that are already disabled – multidimensional interventions that target specific problems.

Based on the current evidence these recommendations seem sensible but it is not clear: 1) how the groups are best identified and targeted; 2) what content of programme delivery is optimal; or 3) how feasible the interventions are in the Scottish context. Intervention needs to be tailored to the individuals' needs and a one size fits all approach is unlikely to be effective. The focus on health service utilisation as the success of these programmes is limited by the fact that hospital and nursing home admission are unreliable measures without a control for comparison (6). More emphasis is needed on evaluation, including an unbiased control group for comparison, and use of reliable and valid measures of quality of care and patient satisfaction.

Falls prevention

The search identified a vast number of publications relating to falls prevention but the heterogeneity of RCTs, in term of outcomes and type of intervention, make comparison of review and RCT data difficult. Conclusions from reviews and meta-analysis appear to be highly dependent on how falls are measured and analysed. In addition, the variation in outcomes, in trials using a multi-factorial approach, may be due to the method of service delivery. The reviews' different conclusions are potentially confusing for those committed to using research evidence to guide clinical practice and policy, and highlight the importance of considering the methodological quality and limitations of systematic reviews.

Exercise appears to be the main component of successful intervention for reducing the rate and risk of falls. However, exercise is usually incorporated as a substantial part of multi-factorial fall prevention interventions that appear to be effective in reducing the rate of falls but not the risk of falls. One of the authors of the three recent reviews of falls was contacted for comment on the discrepancy in the literature. Professor Lamb's comment on the current literature is reported below:

> 'Some of the successful multi-factorial falls programmes (MFFPs) use very similar exercise programmes to 'exercise alone' studies i.e. one of the reasons why there is discrepancy in the literature is that the type of exercise used in MFFPs varies a lot, but more importantly, the sicker people tend to be recruited to MFFP, so it may just reflect that we can't modify outcomes for people who are more sick. All in all, quite a complicated picture. The main question at the moment seems to be whether or not exercise alone is just as good as MFFP.' (Lamb 2009; personal communication).

Other experts in the field believe that: 'a return to a single intervention approach for all patient subgroups is unlikely to advance our ability to maximise health and functioning in persons with multiple risk factors and multiple comorbidities.' (197).

Most of the research to-date has targeted frail older people, excluding those with cognitive impairment, who are probably at greatest risk. Whilst this scan has not focused on older people with specific cognitive disorders, such as dementia, it appears that the effectiveness of fall prevention in this group of older people remains unknown (122).

In spite of conflicting results published by Gates *et al* (2008) (12) and the National Institute for Health Research (NIHR) scoping exercise on faller's clinics (72) that conclude 'the evidence indicates that faller's clinics have a negligible clinical effect', current NICE guidelines recommend multi-component fall prevention programmes (120). These guidelines have not changed since the publication of the recently published negative reviews and trials. As with all complex interventions for older people, falls prevention management presents various challenges and barriers to successful implementation, not least the standardisation of screening tools to provide reliable and valid baseline assessment, as well as integrating service delivery, so that care is coordinated and communicated across different disciplines and between professional groups. On balance, taking into account all current evidence, it seems intuitive to support a multidimensional approach, but not without ongoing evaluation.

A report on management of falls, Up and About, was published by NHS Quality Improvement Scotland in 2010 and numerous interventions for falls prevention have been implemented across Scotland. They include environmental street and pavement audit (Perth), home safety units, risk assessment and falls clinics, vision screening (Perth & Kinross) rehabilitation and exercise classes, multidisciplinary falls service (NHS Greater Glasgow & Clyde, NHS Lanarkshire), interventions to raise public awareness (Perth & Kinross), risk assessment of falls, fractures and osteoporosis (NHS Lothian, Edinburgh), pharmacy risk assessment (Glasgow), mobile emergency care service (Falkirk and NHS Forth Valley), fracture liaison services (NHS Greater Glasgow), telecare to prevent falls (West Lothian), falls response service, podiatry screening (Fife), home based rehabilitation (NHS and Social Work, Isle of Bute), falls prevention advice (NHS Borders), occupational therapy assessment (NHS Grampian), falls training packages (Lanarkshire) and an integrated health and care service delivery model training package (East Renfrewshire). It is unclear whether or how these services have been evaluated and further research in this field may be justified.

The Prevention of Falls Network Europe (ProFaNE www.profane.eu.org) has published high-quality standardised definitions to assist in the development and reporting of research that is based on evidence and consensus of experts. The guidelines recommend:

- A common definition of falls should be used.

- Fall data should be summarised as number of falls, number of fallers/non fallers/frequent fallers, fall rate-per-person-per-year and time to first fall.

- The method of data collection should consider the problem of recall of information, particularly over 3–6 months, as some older people have problems with short and long term memory.

- The number of radiologically confirmed fracture events per year should be recorded accurately. Injuries should be classified according to the International Classification of Disease and Injuries (ICDI).

- Psychological consequences of falls should be conceptualised in terms of fall-related self-efficacy and measured using the modified Falls Efficacy Scale (mFES) (198).

- Health-related quality of life should be measured using the short form 12 version2 (SF-12) and European Quality of Life Instrument (EuroQol EQ-5D) (123).

Falls prevention is another example of a complex intervention for which there is some evidence of effectiveness but the optimum content and delivery of the intervention needs further investigation. The key components of the intervention need to be 'teased out' and priority given to activities that are most likely to be beneficial. Similar to other complex interventions, fall prevention programmes can be delivered as part of an integrated service delivery package. Martin (2009) describes a systematic approach to falls and fracture prevention that sets out key component to be considered by commissioners and care providers (see figure 11.1) (199). The success of this approach relies on integrating care across the hospital-community interface as described in the Delivery Framework for Adult Rehabilitation in Scotland.

Figure 12.1. A systematic approach to falls and fracture prevention
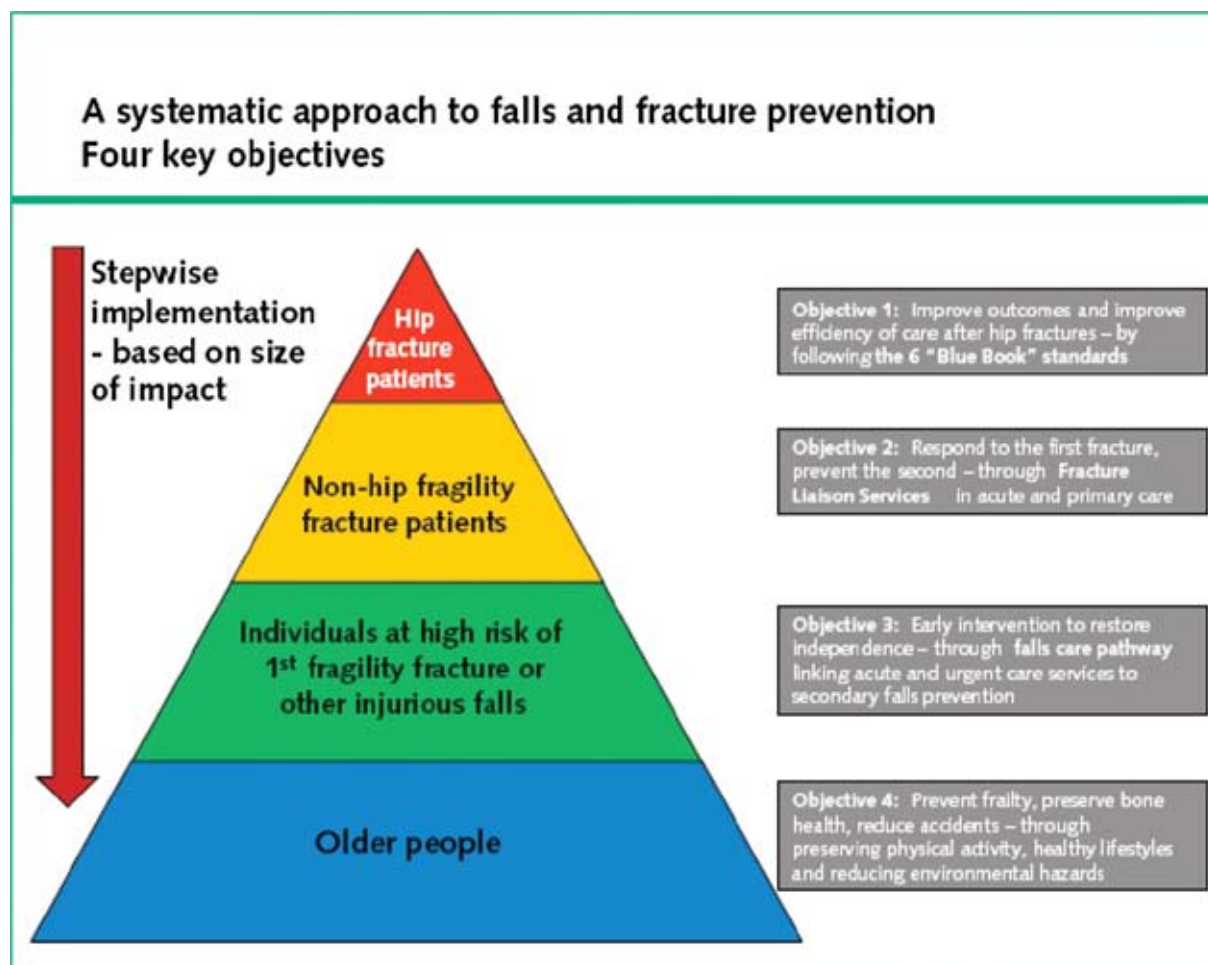
Source: Reproduced from Next Steps for Falls and Fracture Reduction. Age and Ageing, 2009
Nov; 38(6):640–3. Martin F, 2009 with permission.

Cost effectiveness of falls preventions interventions

In a recent review of the cost of falls in older people, Heinrich *et al* (2010) (200) included 32 studies
that focused on fall-related injuries. The authors concluded that falls are a relevant economic burden
but more comprehensive and standardised cost-of injury studies of falls are required, in particular the
societal costs (direct and indirect cost), NHS and private costs need to be documented fully in order
to clarify the overall costs. Similar conclusions were also drawn by Davis *et al* (2010) in an international
comparisons of the cost of falls and clearly a consensus is needed to address: (1) variation in the
definition of falls and fall-related injuries; (2) variation in clinical outcomes (the cost items collected and
units reported); (3) the population denominator that cost estimates are based on; (4) variation in time
intervals when costs are measured; and (5) perspective of the analysis (201). Both reviews suggest that
the economic cost of falls is likely to be more than policy makers appreciate.

 Reviews of cost-effectiveness of falls prevention programmes have been published by the Medical
Secretariat (2008) (14), and Davis *et al* 2010) (15). Both are limited by the lack of comprehensive and
standardised cost measures.

Specific problems associated with ageing

Many of the complex interventions, such as home visits and comprehensive geriatric assessment, tend to focus on a plethora of diverse problems associated with ageing (falls, activities of daily living, cognitive impairment, communication, incontinence, infection, nutrition, oral infection, visual impairment, swallowing and social isolation). Some risk factors have been identified as the strongest predictors of functional decline and admission to institutional care (47). It has not been possible to review individually, all the problems associated with ageing in this scan, although some were identified in the original search. Some reviews have focused more specifically on the individual risk factors associated with ageing, but older people often suffer with comorbidity and considering individual risk factors in isolation does not account for the majority of older people.

 The Ontario Health Technology Assessment (2008) (76) identified dementia, falls, social isolation and urinary incontinence as the main risk factors for functional decline.

Dementia, in particular, affects at least 6% of people over 65 years in Scotland and the total number of people with dementia may increase by 75% in the next 25 years. For this reason the Scottish Government has launched a research network built around four research hubs in Glasgow, Grampian, Lothian and Tayside, with an aim to develop new treatments for this devastating illness. Primary prevention, in particular, regular exercise and regular leisure-time physical activity, preferably starting in early to mid-life, has been shown to be associated with reduced risk of dementia in later life (76), although other factors such as level of basic education probably play a larger part in prevention of later life dementia (202). There is very limited, inconclusive evidence that later life cognitive training can offset deterioration in the performance of self-reported activity of daily living.

Urinary incontinence is a health problem that affects a substantial number of older people and can impact on health, social integration, wellbeing and quality of life. The literature in this field is limited to subjective outcomes, measures derived from patient observations and symptoms, and there is very limited data based on long term follow up. The most promising interventions for preventions are multi-component behavioural interventions including a combination of bladder control strategies, pelvic floor muscle training and self monitoring techniques (76;203) but these are probably more effective if started in early to mid-life.

Specific interventions

Overall, the review of specific interventions demonstrated a lack of strong evidence of effectiveness with the exception of fairly good evidence for effects of exercise on physical and cognitive function, and falls, where the evidence is relatively clear. A summary of the specific interventions is shown in table 12.2.

Exercise

The review of exercise was focused on review-level data of mainly RCTs of intervention and did not take into account well-conducted, high-quality observational studies that show a protective effect of physical activity on incident disability and age-related morbidity. A large population-based study from the Established Population of Epidemiological Studies (EPESE) for older people showed that older people who reported high levels of physical activity (frequency of walking, gardening and vigorous activity) were more likely to die without disability compared to sedentary older people (odds ratio=1.86; 95% CI, 1.24 to 2.79) (204). However, changing behaviour in later life is difficult and the limitation of observational studies is that they can be entirely related to self-selection and these results should therefore be viewed with caution. Overall, there is good evidence that older people can improve their muscle strength, joint flexibility and balance through regular moderate activity and this can be crucial for frail older people in terms of performing activities of daily living and compressing morbidity.

There are few studies that have assessed the threshold or intensity of exercise required to produce and maintain gains in function, particularly for progressive resistance training. Epidemiological data suggest that there appears to be a minimal threshold of at least moderate, if not moderately vigorous activity, in the range of 60%–70% VO_2max[33] that is required to elicit improvement in aerobic fitness in older people

(135). This can be achieved by three hours or more of moderate intensity exercise per week, such as brisk walking. This is a substantial amount of exercise for some older people but it appears that routine physical activity, such as housework, is not enough to prevent loss of aerobic capacity (205) although it may help flexibility and general strength. Frail and older people of both sexes can improve their aerobic function similarly to young adults, and long term benefits of exercise can 'compress morbidity' and allow longer periods of active independence (135). However, the challenge remains to find what degree of improvement in strength and power is needed to transfer the positive gains of exercise to functional change in everyday life and prevent or reduce disability (206).

The Ontario Health Technology Advisory Committee found moderate to high quality evidence that regular exercise can significantly improve health outcomes in community-dwelling older people through both primary and secondary prevention of falls, urinary incontinence, dementia and social isolation. Physical activity recommendations for older people have been published by the World Health Organization and International Society for Ageing and Physical Activity (www.isapa.org/guidleines/index.cfm) and more specifically in the UK, Canada, USA and Australia (135).

Exercise and health promotion

Exercise is one of the most commonly recommended interventions for prevention of disablement in older people. The Swedish National Institute of Public Health (2007) concluded that exercise is 'the best preventative medicine for old age and significantly reduces the risk of dependency in old age'. More emphasis should be placed on encouraging and promoting physical activity in older adults. Recommendations include:

1. Reducing sedentary behaviour.

2. Increasing moderate activity and giving less emphasis to attaining high levels of activity.

3. Taking a gradual stepwise approach.

Basic recommendations for healthy older people over 65 are:

> 'Do moderately intense aerobic exercise 30 minutes a day, five days a week or do vigorously intense aerobic exercise 20 minutes a day, 3 days a week and do 8-to-10 strength-training exercises, 10–15 repetitions of each exercise twice to three times per week. If you are at risk of falling, perform balance exercises and have a physical activity plan.' (207;208).

There is doubt about how best to persuade older people to be more active and to sustain this over time as interventions, such as 'exercise on prescription schemes', have not had a significant impact on activity participation of older people (16).

There is some evidence that primary-care-led health promotion strategies can improve physical activity levels in older people but health promotion strategies are unlikely to be effective unless they incorporate substantial follow up and employ dedicated professional input (113). Simply advising people to engage in exercise appears to be ineffective (209;210). In addition, adverse socioeconomic position across the life-course is associated with an increased cumulative risk of low physical activity and those people living in the most deprived areas tend to have less access to exercise facilities (211;212). Limited evidence exists that explain the factors that influence exercise adherence among older people as most of the evidence on exercise is derived from research on younger people. Variables that are often associated with continued physical activity include perceived self-efficacy[34] and behavioural control (213).

There is substantial scope to improve the health of the Scottish population through increasing activity but there is no clear evidence that current recommendations are being followed in Scotland, where

[33] VO_2 max (maximal oxygen consumption, maximal oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and utilise oxygen during incremental exercise, which reflects the physical fitness of the individual. The name is derived from V–volume per time, O_2–oxygen, max–maximum.

[34] Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes.

the majority of older people do not take the minimum recommended amount of physical exercise, and approximately one in five people aged 65–74 years in Scotland are inactive (32). Meeting current recommendations will require considerable public health input. Oxley *et al* (2009) recommend focusing on opportunities for affordable, accessible and attractive exercise in areas that are safe with professional support in both home and community settings (3). In Scotland, when for at least 2–3 months of the year in the winter, it can be difficult to go outside for a walk, due to risk of falling, it may be better to focus policies on incentives for indoor activities of a more informal nature (214).

Nutritional interventions

Overall, some of the interventions for nutritional needs may have potential but require long term commitment and continued reinforcement of any educational component is needed, to be successful.

Nutritional interventions focus mainly on nutritional supplements rather than on interventions that change dietary habits. This is not surprising considering the difficulties faced by most people to change dietary habits. Jones *et al* (2009) suggest that the evidence to support the use of some nutritional supplements is generally strong although not necessarily for community-dwelling older adults (71). In combination with exercise, nutritional interventions may have potential to help reduce disablement but no studies have combined these in older undernourished people living in the community.

Medication review

It seems unlikely that medication review alone would have a large impact on disablement in older people. It is likely to be more effective if implemented as an integral part of a programme of risk assessment and targeted long term intervention.

The most promising effects of medication review appear to be for falls prevention although the evidence is based on a single trial. Withdrawal of psychotropic drugs appears to reduce the rate of falls but not the risk of falling or risks of fracture. In other words, medication review can prevent recurrent falls but not necessarily first falls. However it is important to note that older people can suffer unrecorded adverse effects of medication and changes in medication can have dramatic effects on their health and wellbeing. Gillespie *et al* (2009) (13) point out that:

> *'Medication withdrawal involves a fine balance between benefit and risk, and cannot be as accurately implemented as other initiatives and that psychotropic medications are not prescribed unless there are specific needs (such as wandering, inability to sleep, hitting and other abusive behaviour). In these cases, it is difficult (and perhaps inappropriate) to withdraw medication since doing so can greatly increase caregiver burden.' (13)*

Vision screening

Poor vision is associated with decreased functional decline and quality of life in older people yet there is no evidence to support vision screening in primary care or community settings (128;215). The aim of vision screening is to improve other outcomes such as falls and fractures, independent activities of daily living and overall quality of life. However, the two high-quality reviews that assessed the effect of vision screening in community-based (215) and primary care settings (128) both concluded that the intervention did not result in improvement in vision. This may have been due to the fact that whilst screening identifies the problem, compliance with recommended treatment does not always follow and barriers to intervention such as cost or lack of easy access to treatment may reduce the impact of screening interventions. In addition, Cummings *et al* (2007) in a RCT of 616 frail older people, found that vision screening followed by intervention (e.g. new glasses, home visit from an occupational therapist, glaucoma management, and cataract surgery) did not reduce the risk of falls and fractures and could possibly even increase the risk (216). Confidence intervals were wide in this trial and therefore the results should be viewed with some caution. There is some evidence to support corrective intervention for older people with severe vision impairment but further research is needed in this field, including interventions that introduce gradual stepwise changes to prevent overwhelming frail and vulnerable older people (217).

Social integration

Social integration is considered to be an important issue, globally and nationally, yet intervention research addressing social isolation has not been carried out extensively, particularly in the UK. In a review of factors associated with social participation in older people Dahan-Oliel *et al* (2008) conclude, from longitudinal studies, that higher levels of participation in different types of leisure activities is associated with survival, improved health-related quality of life, wellbeing and function. In addition the authors suggest that engagement in different types of social activities, most likely mediated by personal factors such as education and financial resources, is associated with a decreased risk of developing dementia. However, there are limitations with longitudinal studies in this field, not least due to the problems of maintaining a stable population over-time, and more research would be necessary to confirm these findings (218).

The interconnecting causal pathways of social isolation are complex and it is highly unlikely that a single, focused intervention would provide a comprehensive and sustained solution to the problem (20). In addition, it is assumed by policy makers and clinicians that isolated older people will need more health and social services and those policies that reduce social isolation could reduce illness burden and have implications for service delivery. However this assumption has been challenged (18). Iliffe *et al* (2007) conducted a cross-sectional study of community-dwelling, non-disabled people aged 65 and over in the UK (London). The authors found that 15% of older people, out of a cohort of 2,598 (82% of total sample), were at risk of social isolation and the risk increased with advancing age. However, those at risk of social isolation did not appear to make greater demands on the medical services nor were they at greater risk of hospitalisation (18).

It was not possible within the scope of this review to include interventions on income, housing and broad environmental factors, although they are considered to be central to health and quality of life, and should probably be factored into health implementation strategies for community-living older people (219).

Taking into account the small potential effect of some the interventions from the review literature, assumptions should not be made by service commissioners that even the more effective group-based interventions, such as exercise and group activities, will reduce primary care service use or hospital admission. In isolation, these interventions are unlikely to make a significant impact on the disablement process.

Information communication technology (telecare and telehealth)

Information communication technology (ICT) innovations are widely advocated, in policy documents in Scotland, to help reorganise health and social care management for older people. At first glance, the use of ICT in modernisation of the NHS is compelling, with potential to enable more 'joined up, integrated service provision' as advocated in the Scottish Government policy *Better Outcomes for Older People: A Framework for Joint Services* (2008). It also appears to offer the possibility of empowering older people, to enable them to live independently in their own homes.

Whilst ICT technologies are considered as a specific intervention they also fall into the 'complex intervention category' as defined by the MRC (23). Telecare involves services targeted at individuals with a wide variety of conditions and brings together a number of different stakeholders across the NHS and housing systems (161). Randomised controlled trials are particularly difficult to implement in this field and more emphasis has been placed, in policy document and the peer-reviewed literature, on 'evidence-informed decision-making' and pragmatic evaluation (17).

The positive interpretation of the evidence in policy documents should be considered, along with the more critical reviews that report less favourable conclusions (170;220). A high-quality systematic review of cost-effectiveness of telemedicine interventions (not to be confused with telecare innovation) for all age groups, reported no good evidence that telemedicine is a cost-effective means of delivering healthcare. The authors identified 600 cost-related articles but only 9% contained any cost-benefit analysis and only 4% met the quality criteria to justify inclusion in a formal analysis (221). It appears to be particularly difficult

to generalise the results of individual cost-effectiveness studies. For example, a telemedicine service that is cost-effective in the remote highlands of Scotland is unlikely to generate the same cost effectiveness in the middle of Glasgow. It is important to recognise that a service may be highly clinically and cost-effective in one context but highly ineffective when transferred to another context in which accessibility and quality of local services are far higher.

Most of the ICT review literature does not specifically relate to older people, and age is an important determinant of people's use of ICTs. Older people have not embraced the use of computer and mobile phone technology in the way that younger generations have, and any attempt to integrate new technology into the lives of older people, should consider the beliefs and attitudes of the users, along with other potential barriers to successful implementation.

The electronic integration dimension of ICT that aims to assist in 'joined up' information sharing of health and social care for older people is undoubtedly desirable. Weiner *et al* (2003) maintain that information technology can help clinicians meet the challenges of complexity of care for older people but moving this science forwards requires geriatricians working with GPs, informatics specialists and health service researchers (222).

Most of the policy documents relating to ICT are based on a 'best guess' approach. In a narrative overview of the impact of telecare innovation, Bayer *et al* (2007) (163) conclude from discussion with experts in the field that:

- Telecare will be particularly effective in preventing admission to institutional care in the 'medium-frail' group of older people.

- Telecare will be less effective in reducing hospital admission in the high-frailty group.

- It is hoped that telecare will have some effect on the progression of frailty by putting measures into place to slow down the process.

- Overly optimistic assessment of the effects of telecare, on the demand for institutional care in the short and long term, should be avoided.

Policies for healthy ageing

This scan has focused on evidence of interventions in primary care and community settings that aim to prevent disablement in older people, with an overarching aim to inform policy. Whilst there are some promising interventions, it remains unclear which are most effective and even more important for policy makers, which are most cost-effective. There are other high-level policy interventions, outside the scope of this scan that may be stronger determinants of health and wellbeing in older people. These include a combination of: delaying the age of normal retirement, changes to housing, education and reduction in economic and social precariousness (3).

In a consensus report of the outcome of the European Summit on age-related disease a number of recommendations were made for health promotion and preventative action (223). It seems clear that effective individual programmes such as exercise need to be incorporated in a broader policy framework that brings together the full range of measures to make them mutually reinforcing. Changing lifestyle risk factors for chronic disease, preferably in earlier life, have been reported to be the most promising measure to improve the health of older people in particular; cessation of smoking, improving nutrition, reducing alcohol intake and taking more exercise (3). The success of programmes are dependent on the willingness of older people to take on new and sometimes difficult changes and evidence suggest that it is difficult to sustain changes in behaviour in later life (64).

The Scottish Long Term Conditions Collaborative (2009) (114) advocate implementation of many of the interventions reviewed in this scan including case management, telecare/telehealth, and falls prevention, targeted risk assessment and integrated care delivery via a single clinical portal. In the absence of strong evidence, policy decisions still have to be made and sensible, evidence informed judgement is crucial. It is not unusual for policy to advance beyond the evidence but stakeholders should be aware of the dearth

of strong evidence in this field. Whilst the evidence doesn't fully support many of the interventions it may be that a combined, targeted multi-factorial approach, delivered within a well coordinated service delivery system, including easy access to necessary intervention and long term follow up would provide more promising results. It takes time (often 4–5 years) to properly evaluate complex interventions. In most cases studies are limited to 12–24 months follow up at best and are often not controlled adequately, making conclusions difficult to draw.

The broader picture

Most of the interventions reviewed in this scan are based on a biomedical model of successful ageing i.e. maintenance of physical and mental functioning. Few studies have considered the lay person view of what successful ageing means to the individual. In a population survey of perceptions of successful ageing among 854 people aged 50 or more, living at home in Britain, the most commonly mentioned definition of successful ageing was having good health and functioning (224). These factors were rarely mentioned in isolation, and most people mentioned more than one factor (figure 12.2). The current Scottish policy focus is on specific disease prevention yet older people are not a homogenous group and usually have multiple problems that can't be dealt with in isolation. Health is clearly important to older people but other factors such as social relationships and being financially secure may also impact on successful ageing. These factors may be stronger determinants of health than any of interventions reviewed in this scan. Bowling and Dieppe (2005) point out that 'there is little point in developing policy goals if older people do not regard them as relevant' (224).

Figure 12.2. Most common definitions of successful ageing given by 854 people aged >50 in Britain
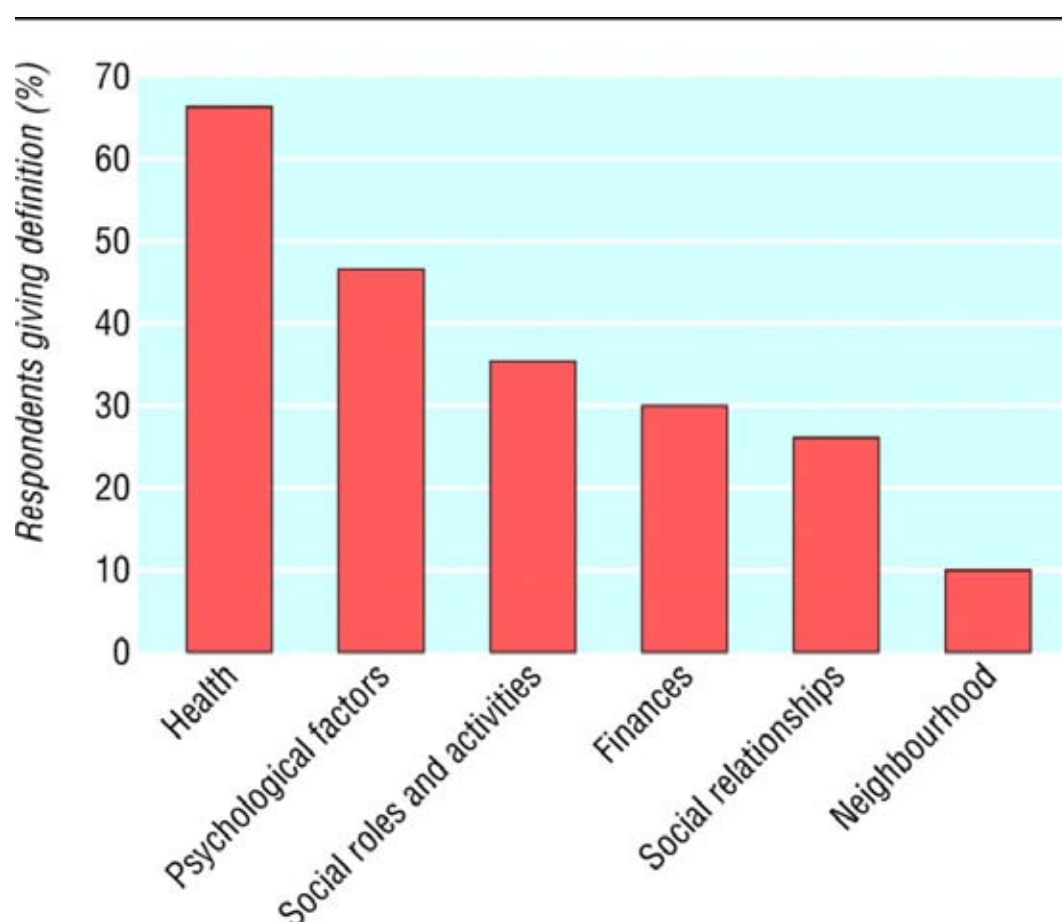
Source: Reproduced from What Is Successful Ageing and Who Should Define It? Bowling A, Dieppe P. BMJ. 2005 Dec 24; 331(7531):1548–51. (Copyright notice year 2010.) With permission from BMJ Publishing Group.

Poverty is an important socioeconomic health determinant that has a negative effect on health, life expectancy, disease and disability (64). Financial stress is clearly important to older people, yet state pensions in the UK are the lowest in Europe (see table 12.3) which is likely to have a detrimental effect on the ageing process for many pensioners on low income. Currently in the UK 2.5 million pensioners are living in poverty (defined as living below the official poverty line of £165 a week before housing costs) and this issue may become an even more important factor to consider when developing strategies to prevent disablement in older people.

Table 12.3 Comparison of state pensions across EU countries as a proportion of the average working pay	
Greece	95.7%
Luxembourg	88.3%
Netherlands	81.9&
Spain	81.2%
Denmark	79.8%
Italy	67.9%
Sweden	62.1%
AVERAGE FOR THE EU	60%
France	51.2%
Germany	39.9%
Estonia	32.9%
Ireland	32.5%
UK	30.8%

Source: The Guardian. March 27. 2010

Limitations of the review

The search strategy component of this scan was based on a very broad question, covering many interventions, and consequently it was difficult to focus the search terms. It is possible that some review articles were missed in the limited search of the three main databases. However, an extensive website search along with citation tracking was also utilised and many additional reviews were identified. Rigorous systematic reviews following the Cochrane framework take a considerable amount of time to complete and policy makers, more often than not, need evidence in a much shorter timeframe. Windows of opportunity to elicit change in policy and practice open sporadically (225) and the balance between quality and context were seriously considered in the planning phase of this scan and timeliness was considered to be an important factor in the process. Therefore the review endeavoured to include recent evidence (1999–2009), on the basis that quality of studies tend to be higher in recently published studies (226). It is recognised that some important research carried out in the 1990s may have been missed but

as the studies included in the reviews themselves were not restricted to such a short time frame it is likely that any large influential primary studies would have been captured in the reviews.

The quality of evidence is an important consideration when reviewing primary and review level data and the AMSTAR (63) method was used to assess the quality of the reporting of the reviews. Whilst this method was useful in terms of recognising the limitations of some of the reviews it was limited by the lack of focus on the quality of the interpretation of the included studies, the quality of the interventions or the quality of the outcomes used to measure them.

The heterogeneity of the studies and in particular, of the outcome measures used made conclusions difficult to draw, particularly in the area of falls prevention. This problem has been recognised by many other researchers and the collaborative work of the ProFaNE group (www.profane.eu.org), that has developed internationally agreed-upon taxonomy for falls prevention and standardisation of outcomes for falls, should help to improve the quality of the literature in this field. There are a vast number of generic and specific outcomes reported in the literature, many of which have not been fully validated or checked for responsiveness. In a high quality review of health and quality of life measures for use with older people Haywood *et al* (2004) identified 15 generic and 18 specific measures (21;22). The most extensive evidence for generic measures was found for the SF-36 and EuroQol (EQ-5D), but there was limited evidence of reliability and in particular, limited evidence of responsiveness, for most of the specific measures. This suggests that the findings of some of the studies that measure health status and quality of life may be questionable. In addition, hospital and nursing home admission rates need to be viewed with caution without a control group for comparison. In a cohort study of people aged 65 and over (n=227,206) with a history of emergency admission, Roland *et al* (2005) demonstrated that the effectiveness of admission avoidance schemes cannot be judged by tracking emergency admission rates without careful comparison with a control group (see figure 12.3) because rates fall without intervention due to factors such as nursing home admission, scheduled hospital admission or death (6).

Figure 12.3. Emergency admissions and emergency bed days per person for patients >=65 in 1997–89: comparison of those with two or more emergency admissions in 1997–8 ('high risk') with general population (England)
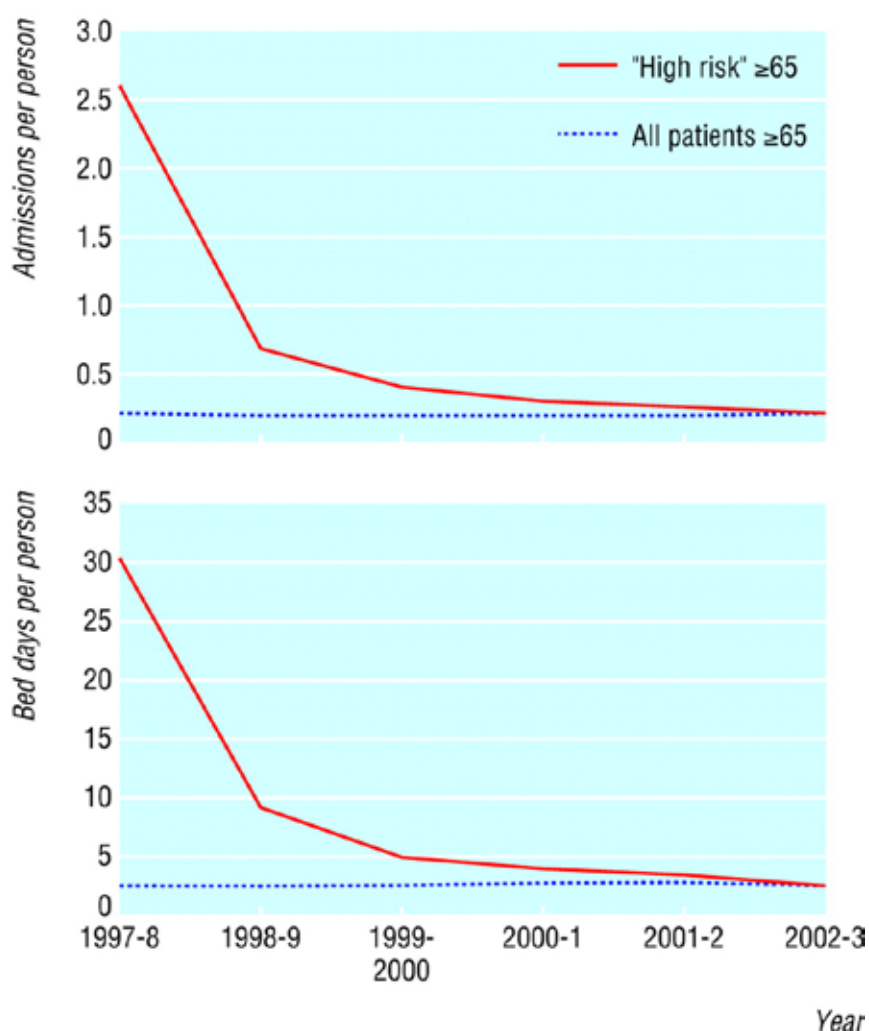
In the absence of high-quality evidence for implementation of interventions, a judgment call has to be made which takes into account all the evidence and many other factors such as acceptability and feasibility. Whilst RCTs are the most rigorous form of evaluation, and generally considered the gold standard for effectiveness evaluation, they are not always ideal for evaluating complex interventions as they often fail to capture the process of interactions and relationships between health professionals and the client. In addition they do not always include details of important factors associated with successful implementation such as the theoretical basis of the interventions, the context, and the extent to which older people except and comply with interventions.

A focused review of specific primary studies was not possible within the time frame and scope of this scan and therefore only selected high-quality, primary studies were discussed. This may have caused some bias in reporting. Most of the review papers did not give adequate details of the specific content

of interventions and due to the large number of primary studies it was not possible, for all studies, to describe the exact content and context of the interventions (e.g. duration, intensity and follow up of intervention). A recently published review of interventions to prevent disability in frail community-dwelling older people provides an update of primary studies. Daniels *et al* (2010) (227) reviewed 48 RCTs and controlled studies including 49 interventions evaluating comprehensive geriatric assessment, exercise, nutrition and technology assisted interventions. For 18 of the 49 interventions, disability was statistically significantly reduced in the experimental group. Overall the conclusions support the findings of this review. However, the review focuses on disability only and the authors made no attempt to report effect sizes making conclusions about any potential impact difficult to draw with confidence.

It was not possible within the broad scope of this scan to include all possible interventions. Those interventions targeting specific disease such as dementia, heart disease and stroke were not specifically included in the review as it would have been unmanageable to synthesise the data in this heterogeneous literature. In addition, focusing on specific disease does not generally capture the multiple nature of comorbidities associated with frailty and ageing.

The mandate of the SCPHRP is to identify key areas of opportunity for developing novel, public health interventions that equitably address major health problems in Scotland. There were very few studies in this review that focused on minority groups or specifically included those in deprived areas so it has not been possible to explicitly address the issue of inequality. It is note-worthy that most studies do not include older people living in deprived areas (228) but focus on subjects of relatively higher socioeconomic status, which is a major limitation. It is therefore not possible to generalisation some of the research findings, to deprived areas of Scotland.

Gaps in evidence

- There are no guidelines for standardisation of outcome measures, case-finding or assessment tools and whilst some of these issues are being tackled by the ProFaNE group for falls prevention more research and consensus is needed in this field. It would be useful to know which tools work best for case finding in primary care, which work best for diagnosis and which for assessing intervention (44).

- Whilst health service resources (hospital admission and emergency department visits) have been extensively measured, less interest has been focused on quality of life and psychological wellbeing measures.

- There are very few studies that include long term follow up, making it difficult to assess if benefits are sustained.

- There were very few RCTs identified that include information on carers.

- Most studies do not include older people living in deprived areas but focus on subjects of high socioeconomic status suggesting than more research is needed in this field (228).

- No studies evaluated interventions delivered by lay people or volunteers.

- There are significant gaps in the evidence-base relating to key measures of the impact of health and social services integration, especially around identifying change in performance across time, costs, use of healthcare resources, health outcomes and patient experience.

- There are gaps in knowledge and serious questions relating to the generalisability of interventions across cultures, countries and settings. The search did not identify any RCTs of disability prevention focusing on the general or frail population in Scotland. A case-control study of coordinated comprehensive geriatric assessment has been reported in Scotland with promising results (229) but further research is required to determine whether this approach can reduce functional decline and/or non-elective hospital admission in Scotland.

- Interventions designed for other healthcare systems may not be transferable.

Conclusions

The global case for implementation of specific strategies to prevent disablement in older people is weak and a thorough evaluation of available programmes, infrastructure and local experience of service delivery would be necessary, before any strong recommendations can be made that are specific to the current Scottish situation. The review has identified many areas of conflicting evidence along with areas of unknown effectiveness. There are areas of promising interventions, such as exercise programmes for prevention of falls and integrated service delivery programmes for frail older people but the affordability, feasibility, sustainability, effects on equity, potential side effects and acceptability to stakeholders needs to be considered in the process of developing innovative interventions in Scotland (24). The research agenda is clear that development of any complex interventions should follow the MRC recommended guidelines (23) and researchers should endeavour to design studies that take into account both the social (personal and environmental) and medical aspects of disability that are integral to the disablement process.

Following completion of work carried out by Professor Sally Wyke and colleagues that aims to report on policies and programmes already implemented in Scotland we recommend a 'managed consensus process' to include key policy makers, researchers, managers, clinicians and lay people to discuss the development of strategies for implementation of interventions for older people in Scotland. This is needed to:

1. Define a population of older people to target that is most likely to benefit from intervention.

2. Discuss the best methods and tools to identify, target and assess older people at most risk of disablement.

3. Discuss the content of any potential intervention based on current evidence.

4. Consider the feasibility of implementing a programme of coordinated, integrated intervention in Scotland, with a view to robust evaluation.

Recommendations

• Programmes most likely to be successful in preventing disablement are those that use a targeted approach to identify frail older people at lower risk and include multi-dimensional, comprehensive geriatric assessment with long term follow up.

• Future intervention studies should follow recommendations outlined by the Interventions on Frailty Working Group (45) and develop well-documented interventions based on a theoretical framework (23) including details of intensity, long term follow up (>1 year), defined target population, exact characteristics of setting and of the precise interventions utilised and preferably include the impact on carers where appropriate.

• Recommendation suggested by Shepperd *et al* (2009), to use typologies to guide the classification of interventions into homogenous groups and to include where possible, supplementary evidence from qualitative research are paramount (67).

• Standardisation of meaningful outcome tools for case-finding and health assessment for frail older people would improve the process of evaluation and allow comparisons across studies and between countries.

• Studies evaluating interventions that aim to reduce hospital admissions or institutionalisation need to include a control group for comparison and should preferably include a thorough analysis of all costs, private and NHS, in order to draw conclusions about NHS use and cost benefits.

• Interventions aimed at preventing functional decline should include strategies that encourage older people to be as active as possible and build in components that impact on activity of daily living dependency.

Appendix 1: MEDLINE (OVID) search terms

Effectiveness	Primary care community-based	Interventions	Prevent	Declining function	Adulthood	Study type	NOT
effect*	community	intervention*	prevent*	chronic condition*	aged/	meta analysis	drug therapy[sh]
evidence	community-based	program*	preserv*	chronic disease/	middle-aged	systematic	surgery[sh]
evaluat*	primary care	strateg*	reduc*	life style/		review	
efficacy	health promotion/	counsel*	improv*	activities of daily living/		randomised	
outcome*	primary healthcare/	project*	influenc*	physical function*		controlled	
impact	homebound	activit*	promot*	healthcare utilisation			
	housebound	initiative*	declin*	healthcare utilisation			
	family practice/			health status/			
				frail			
				disable*			
				disabilit*			
				quality of life/			

Appendix 2: AMSTAR quality assessment scoring system

Source: Shea *et al*, 2009 (63).   (Answer: Yes, no, can't answer or not applicable. One point given for each yes answer. Min=0, Max=11)

1. *Was an 'a priori' design provided?*
   The research question and inclusion criteria should be established before the conduct of the review.

2. *Was there duplicate study selection and data extraction?*
   There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.

3. *Was a comprehensive literature search performed?*
   At least two electronic sources should be searched. The report must include years and databases used (e.g. Central, EMBASE, and MEDLINE). Key words and/or MESH terms must be stated and where feasible the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialised registers, or experts in the particular field of study, and by reviewing the references in the studies found.

4. *Was the status of publication (i.e. grey literature) used as an inclusion criterion?*
   The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language etc.

5. *Was a list of studies (included and excluded) provided?*
   A list of included and excluded studies should be provided. (Those that included a detailed list of included studies and a detailed list of reasons why studies were excluded were awarded 1 point)

6. *Were the characteristics of the included studies provided?*
   In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the studies analysed e.g. age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.

7. *Was the scientific quality of the included studies assessed and documented?*
   'A priori' methods of assessment should be provided (e.g. for effectiveness studies if the author(s) chose to include only randomised, double-blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.

8. *Was the scientific quality of the included studies used appropriately in formulating conclusions?*
   The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.

9. *Were the methods used to combine the findings of studies appropriate?*
   For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e. Chi-squared test for homogeneity, I^2). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e. is it sensible to combine?).

10. *Was the likelihood of publication bias assessed?*
    An assessment of publication bias should include a combination of graphical aids (e.g. funnel plot, other available tests) and/or statistical tests (e.g. Egger regression test).

11. *Was the conflict of interest stated?*
    Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.

Appendix 3: Review of reviews of complex interventions

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Wieland (2003) (89)	22 trials and reviews. 65+ years.	General older people and frail people at risk. Community.	Comprehensive geriatric assessment (CGA) and multi-component treatment or preventative home visits.	Mortality, general and mental health measures, physical function, cognitive function, ADL.	Positive but inconsistent results. Targeting patient at risk, multidimensional assessment and management with long term follow up is most promising. Paucity of data on costs. Some evidence that there is an 'investment effect' i.e. programmes providing follow up are more likely to be beneficial whether they be preventative home visits or all inclusive integrated approach.	Poor quality review. Categorised CGA into hospital based, community, nursing home, integrated service model. **AQS=1/9**
Elkan *et al* (2004) (82)	60+ years. 4 reviews.	General and frail older people at risk.	Preventative home visits and CGA.	Mortality, general health, functional status.	Overall results of meta-analysis showed little effect on functional status unless multi-dimensional with long term follow up. Some evidence that home visits can reduce mortality and nursing home admissions and they have the potential to be cost effective.	Only four studies included in the meta-analysis. Confidence intervals for meta-analysis of functional decline were wide suggesting that conclusions should be drawn with caution. **AQS=7/11**

Appendix 4: Reviews of complex interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Beswick *et al* (2008) (7)	89 RCTs (97,984) Mean age 65+ years.	General older people. Frail older people.	Complex interventions, home visits, anticipatory care with variable follow up.	Living at home, death, admissions to hospital and nursing homes, falls, physical function.	Combined interventions reduced risk of not living at home, nursing home admissions (14% reduction for the general population) and falls. Physical function improvements were small. No difference for mortality. Combined modest effects. 40.5% to 38.2% hospitals admissions. 10.6% to 9.2% nursing home admissions, falls 33.6% to 30.5%, improvement in physical function 0.5 point on Barthel Index. When analysed in subgroups the benefits were minimal for the group of frail older people.	Benefits more evident prior to 1993 suggesting quality bias. Most of the analysis of the intervention aimed at the frail older people is non-significant. Large amount of heterogeneity in the studies. AQS=9/11
Bouman *et al* (2008) (78)	8 RCTs. 65+ years.	Frail older people with poor health/functional impairment, dependency. Community setting.	Preventative home visits with follow up period of 12+ months and multiple follow up for at least 4 months.	Functional status, hospital and nursing home admission and mortality.	Home visits alone targeting older people with poor health status are not effective. No long term benefits beyond 12 months in terms of mortality, health status, service use or cost. Multidisciplinary measures of higher intensity that target specific problems may be necessary.	Included only trials that scored over 4 out of 8 in quality assessment. AQS =7/9
Byles *et al* (2000) (81)	21 RCTs. 65+ years.	General older people and those with multiple morbidities.	Health assessments.	Clinical outcomes (blood pressure, weight, vision etc).	Results inconsistent, better quality papers suggest improvement in health.	Methodology unclear. No evidence that targeting assessment improved outcome. AQS=4/9
Eklund and Wilhelmson (2009) (79)	9 studies (1 Italy, 3 USA, 5 Canada).	Frail older people at risk. Community/primary care.	Integrated and coordinated interventions, case management, home and community-based service, risk factor plan and health promotion.	Client outcomes, Healthcare utilisation, caregiver outcomes, goal attainment scale, costs, depression, health behaviour and attitudes, ADL, Quality of Life (SF-36).	Some evidence that case management is beneficial for frail older people and can decrease healthcare costs. Many outcomes showed no difference between groups. Most common outcome was ADL. Lack of knowledge on effects of care giver. Only two RCTs reported caregiver outcome. Positive effect on caregiver satisfaction but no effect on caregiver burden.	Good quality review with clear search strategy and criteria. Large heterogeneity within the groups. Interventions not described well. AQS=6/9
Elkan *et al* (2001) (82)	15 studies. 13 RCTs and 2 quasi RCTs. 65+ years.	General and frail older people living at home. Community setting.	Home visits that offer health promotion and prevention.	Mortality, hospital and institutional admission, function, health status.	Mixed results. 7 studies showed no significant affect on ADL. 2 studies showed improvement in ADL. Home visits can reduce mortality and nursing home admission for general older people and those at risk. Preventative home visit must involve assessment or screening combined with regular home visits.	Good quality but meta-analysis of functional outcome only included 4 studies. No data on intensity of visits. AQS=7/11

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Hallberg et al (2004) (90)	26 studies. 65+ years.	Frail older people. Community setting.	Case management interventions.	Healthcare consumption and costs, quality of care, patient's health and functional ability.	Few interventions included secondary and tertiary and/or rehabilitation approach using psycho educational focus. Focus on the content of intervention is necessary.	No statistical analysis. Narrative review describing content of interventions and outcomes. **AQS=2/9**
Huss et al (2008) (84)	21 (5 UK) 14603 people. 70+ years.	General older people and those with chronic disease. Community setting.	Home visit programmes.	Mortality, nursing home admissions, functional decline.	Non significant (favourable) effects on mortality, functional decline, nursing home admissions. Nursing home admission: reduction in risk of admission was modest OR 0.86 95% CI 0.68 to 1.10). Home visits with <3 home visits had similar effect to programmes of >3 visits per year. Little effect on functional status or 0.89 (95% CI 0.76 to 1.03). Studies including a clinical examination showed beneficial effect on functional status OR 0.64 (95% CI 0.48 to 0.87). Prevention focusing on the younger population showed favourable results on mortality OR 0.74 (95% CI 0.58 to 0.94).	Good quality. Only included RCTs with multiple follow up either home visits or telephone. Excluded post hospital discharge programmes or home based case management. Important determinants may be clinical examination and regular follow up on function prevention most effective if targeted at the young. Nursing home admission may increase as a result of preventative home visits. **AQS=9/11**
Johri et al (2003) (91)	7 studies.	General and frail older people. Community setting.	Integrated service delivery including single entry point system, case management, geriatric evaluation, multidisciplinary team. Programmes implemented in Canada, UK (Darlington), USA, Italy.	Hospital admission or long term care institutionalisation, health outcomes and impact on process of care.	Includes common design features of integrated care that are thought to be effective. Case management. Geriatric assessment. Multidisciplinary teamwork.	Narrative review including quasi-experimental design. Highlights lack of coordination between medical and social care, acute and continuous and community and institutional care. Mainly based on studies 'downstream' after discharge from hospital. **AQS=3/9**
Liebel et al (2009) (80)	10 RCTs.	General older people with chronic disease. Community setting.	Preventative home visits carried out by nurses only.	Disability outcomes including Barthel, SF-36.	Home visits targeted at patients who are already disabled have potential to reduce disability. Multiple visits needed to impact on outcome. Research designs need to include contextual details.	Lack of consistency in studies. **AQS=5/9**

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/limitations
Markel-Reid *et al* **(2006) (86)**	12 RCTs. 65+ years old.	General older people and those at risk. Community.	Home based nursing care health promotion and preventative care. Nursing home visits defined as including: 1) home visit in the community; 2) multidimensional assessment of health and function; 3) identification of needs and strength leading to specific recommendations; 4) multiple follow up.	Mortality, admission to institution, health status, functional status, use of health and social services, mortality, ADL, (Barthel Index) and cost.	Descriptions of interventions were inadequate in most studies. Goals for intervention were based on preventative care or health promotion goals such as autonomy, empowerment, independent decision making. Diversity of home visiting interventions carried out by nurses can affect health, mortality rates, hospitalisation and costs.	Comprehensive review describing theory driven approach. Used criteria for assessment of quality of studies. **AQS=7/9**
McCusker and Verdon (2006) (88)	26 studies (16 RCTS). 60+years.	Frail older people and those at risk. 9 Emergency departments, 4 hospitals, 10 primary care, 4 home setting and 1 community.	Comprehensive geriatric assessment (CGA) carried out in primary and secondary care settings.	Rates of emergency department utilisation (EDU).	Inconclusive findings due to heterogeneity. 10 studies carried out in primary care (9 RCTs and 1 cross sectional). 6 were integrated with primary care. 1 study of medication review and education by pharmacists found reduction in ED visits from 57% to 39% during 12 months.3 studies increased EDU possibly due to increased perception of need. Recommend reporting both proportion using ED and mean (SD) number of visits.	Focused on characteristics of interventions (site, type and duration) associated with EDU. Used 5 categories. One-dimensional assessment (UA) with referral, multidimensional assessment (MA) with referral, UA and management, MA and management, case management. Standardisation of measures a problem. **AQS=4/9**
Steultjens *et al* (2004) (83)	17 RCT. 60+ years.	General older people and those at risk. Community setting.	Occupational therapy and advice interventions including: 1) training of sensory-motor function; 2) training and cognitive function; 3) training of skills; 4) advice and instruction regarding the use of assistive devices; 5) counselling of primary care giver.	Functional ability, quality of life and incidence of falling.	Strong evidence for advising on assistive devices on increasing functional ability, some evidence for efficacy of training skills combined with home hazard assessment. Limited evidence for efficacy of OT on functional ability, social participation, and Quality of Life (QoL) in general older people for reducing incidence of falls in those at high risk of falling. Insufficient evidence for efficacy of counselling of primary care giver of patients with dementia or enhancing functional ability of those patients.	Used Jadad's quality score and best evidence synthesis i.e. strong evidence=consistent stat significant findings in outcomes measures in at least 2 high quality RCTs, moderate evidence=stat sig findings in at least 1 high quality RCT and 1 Low quality RCT, limited evidence+ stat sig findings in at least 1 high quality RCT. Many trials were small. **AQS=7/9**

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Stuck *et al* (2002) (87)	18 RCTs (13447). 65+ years.	General older people and those at risk.

General practice and community setting. | Preventative home visits aimed at delaying or preventing functional impairment and nursing home admission by primary prevention, secondary and tertiary prevention. | Functional status, nursing home admission and mortality. | Effect of nursing home admission depended on intensity of home visits.
>9 visits RR=0.66 (0.48 to 0.92)
<4 visits RR=1.05 (0.85 to 1.30)
Benefits on mortality in younger age group (72 to 77).
Overall little benefit on functional status but results heterogeneous.
Beneficial effects were associated with multi-dimensional assessment and follow up. Therefore the type of intervention was the important factor. Absolute reduction in risk was 6.7%. | Good methodology but sub-group analysis may have introduced bias. Complex meta-analysis. Heterogeneity reduces the possibility of finding effect.
Home visits only beneficial if targeted at persons with low risk for death and younger people. Intervention needs to be based on multi-dimensional assessment and include multiple follow up.
NNT (visit) to prevent 1 admission with frequent follow up is 40.
AQS=9/11 |
| **Van Haagstregt *et al* (2000) (85)** | 15 RCTs. Age 65+ years. 6 RCTs focused on 75+ years. | General population of older people and those at risk.

Community setting. | Home visits. | Physical function, psychosocial function, falls, admission to institution, mortality. | Favourable results for physical function, but no clear evidence for preventative home visits. Five out of 12 RCTs showed effect of intervention on physical functioning. Only one RCT out of eight showed positive effect of psychosocial function. Any observed effects were modest. | Only 1 trial focused on specific risk factors, 9 trials interventions lasted more than 2 years, most tailored to subjects.
AQS=7/9 |

Appendix 5: Randomised controlled trials of complex interventions.

Reference	Health classification	Number of participants and age	Interventions			Outcome and limitations
			Main personnel	Content	Intensity and follow up	
Fletcher *et al* (UK) 2004 (8)	General older people and older people at low risk.	N= 43,219 75+ mean age 81.5.	Nurse. Groups also randomised to geriatric assessment or primary care.	Experimental group. Universal intervention. Brief assessment questionnaire followed by 1 detailed in-depth home assessment and referral to social, medical or social services clinics including ophthalmology, chiropody, audiology, community nursing and psychiatric services. No compliance measure. Control group. Received similar assessment (92.4%) but only 7.6% received further in depth assessment.	Over 36 months.	No difference between geriatric assessment and GP care. No control group. No measure of follow up assessments.
Vass *et al* (Denmark) (230)	General older people and older people at low risk.	N=4,060 75–80 years mean age.	Home visitors and GPs.	Experimental group. Home visits already standard practice in Denmark. Additional intervention included education for home visitors and GPs. (Primary prevention.) Control group Received no education.	Five home visits over 3 years.	Education of home visitors and GPs improved older people's functional ability but Odds ratios were wide 1.2 (95% CI 1.01 to 1.42).
Hebert *et al* (Canada) (2001) (231)	General older people and older people at low risk.	N=503 75+years.	Nurse home visit with referral to specialists.	Experimental group. Results of assessment were sent to GP. Nurse referred to physiotherapy, OT, balance and gait rehab, dietary and audiology assessment, education regarding incontinence, social support, hypertension and falls. Control group Received usual care.	One home visit and phone call follow up every month over a 12 month period.	There was no significant difference between the groups in functional decline at 1 year follow up (measured using the SMAF disability score (56)).
Sahlen (2006) Sweden (94)	General older people.	N=598 (542 included in analysis) 75+ years.	Professional healthcare workers. 1 nurse and 1 care manager.	Experimental group. Multidimensional questionnaire with structured themes including a focus on physical activity, prevention of falls immunisation, healthy food and prevention of diabetes, knowledge about home help, long term care and dental care. Control group. Received usual care.	Four visits over 2 years lasting for 1.5 to 3 hours.	Controlled trial. ITT analysis not included. Results do not support conclusion that preventative home visits reduce mortality rates. Difference in dropout rate between control and experimental group bias conclusion.

Appendix 5 Cont.: Randomised controlled trials of complex interventions.

Reference	Health classification	Number of participants and age	Interventions		Intensity and follow up	Outcome and limitations
			Main personnel	Content		
Markel-Reid (2006) (97) Canada	General older people.	N=288 (144 included in analysis).	Nurse-led home visit.	Experimental group. Multiple home visits with telephone follow up, personalised care plan with goal setting, individualised approach to care, community resource access and caregiver collaboration. Health promotion and empowerment strategies. Control group. Usual care.	Multiple visits followed up over 1 year only.	Improvement in QOL, mental health and depression.
Bouman *et al* **(2008) (232)**	Frail older people.	N=330 70–84 years mean age 76.	Auxiliary nurse-led with supervision of public health nurse.	Experimental group. Eight home visits over 18 months, subjects visited approximately every 2 month by community nurse that included a multidimensional geriatric assessment of problems and risks, advice and referral to professional and community services. Nutritional deficiency was the most common problem followed by medication. Control group. Received usual care but they could access available care.	Telephone follow up 8 home visits over 18 months.	No difference between groups in healthcare use and a low chance of being cost effective.
Counsell *et al* **(2007) (110)** USA	Low income high risk frail older people.	N=951 65+ years.	Nurse practitioner, social worker in collaboration with GPs and geriatric teams.	Initial and annual in-home CGA by a GRACE support team. Individualised care plan developed annually by team involving a geriatrician, pharmacist, physical therapist, mental health social worker, and community-based services liaison. Team suggestions for care related to the 12 targeted geriatric conditions: advance care planning, health maintenance, medication management, difficulty walking/falls, chronic pain, urinary incontinence, depression, hearing loss, visual impairment, malnutrition or weight loss, dementia, and caregiver burden Implementation of care plan.	Weekly GRACE interdisciplinary team meetings to review support team success in implementing care protocols and problem solving barriers to implementation. Ongoing GRACE support team home-based care management (including at least monthly patient contacts) supported by an electronic medical record and Web-based tracking system, and providing coordination and continuity of care among all healthcare professionals and sites of care.	At 24 months significant improvements were seen in the intervention group compared with usual care in 4 of 8 SF-36 scales and in the mental component summary (2.1 vs –0.3, P<0.001). No group differences were found for ADLs or death. The cumulative 2-year emergency department (ED) visit rate per 1000 was lower in the intervention group (1445 [n=474] vs 1748 [n=477], P=0.03) but hospital admission rates per 1000 were not significantly different between groups (700 [n=474] vs 740 [n=477], P=0.66).This was a high quality trial with acceptable attrition rate. There were no differences in functional outcome between groups.

Reference	Health classification	Number of participants and age	Interventions			Outcome and limitations
			Main personnel	Content	Intensity and follow up	
Gitlin *et al* (2006) (233)	Community-dwelling older people with functional difficulties.	N=319 70+ years.	Physiotherapist and occupational therapy.	A multi component intervention targeting modifiable environmental and behavioural factors.	Five occupational therapy contacts (four 90- minute visits and one 20-minute telephone contact) and one physical therapy visit. (90 minutes) 6 month duration.	Quality of life improvements with most benefits retained over a year. At 6 months, intervention participants had less difficulty than controls with instrumental activities of daily living (P=0.04, 95% confidence interval (CI)=-0.28 to 0.00) and activities of daily living (P=0.03, 95% CI=-0.24 to -0.01)
Mellis *et al* (2008) (10)	Frail older people with disability.	N=151 (70+ years. Mean age 82.)	Nurse home visit.	Experimental group. Subjects selected using a problem-based selection tool including assessment of cognition, nutrition, behaviour, mood or morbidity. Geriatric assessment and intervention including an individual treatment plan carried out by a nurse.. GPs were also involved. They made medication changes and referred for other multidisciplinary intervention when necessary. Control group had usual care.	Up to 6 visits planned over 3 months.	Trial showed reduction in functional decline and wellbeing over 3 but not 6 months. Number needed to treat was 4.7 and authors suggest it is an effective addition to primary care at a reasonable low cost. Small trial not including ITT analysis and high attrition (23%) with wide confidence intervals. Conclusions should be drawn with caution.
Gill *et al* (2002) (234)	Frail older people living at home.	N=188 75+ years.	Physical therapist assessment at home.	Intervention group. Physical therapist assessment of mobility, ADL, balance, ROM, and presence of environmental hazards. Recommended interventions included Instruction in safe, effective techniques to facilitate activities, training, training in proper use of assistive devices, removal or environmental hazards (loose rugs, clutter, improvement in lighting, repair of walking surfaces, stairways and railings, installation of adaptive equipment in bathroom), progressive competency-based exercise.	Protocol was 16 visits over 6 month (actual range 7–19). Monthly phone calls thereafter to check and feedback	Functional decline in the intervention group was significantly reduced at 3, 7 and 12 months. (Measured by a summary disability score). Subgroup analysis showed no significant difference in those that were classified as severely disabled. Poor compliance rate intervention (65%) limits the results of the study. No difference between groups in admission rate to nursing homes suggests that functional decline is not the only factor associated with institutionalisation.

Appendix 5 Cont.: Randomised controlled trials of complex interventions.

Reference	Health classification	Number of participants and age	Interventions		Outcome and limitations
			Main personnel	Content	Intensity and follow up	
Rubenstein et al (2007) (111)	High risk older people. (Dept of Veteran Affairs Care Centre.)	N=792.	Physician assistant.	Structured telephone geriatric assessment, individualised referrals and recommendations, selected referral to outpatient geriatric assessment, and ongoing telephone case management. Outcomes were evaluation of target geriatric conditions (depression, cognitive impairment, urinary incontinence, falls, and functional impairment), functional status and hospitalisation.	1, 2 and 3 year follow up.	Intervention increased recognition and evaluation of target geriatric conditions (depression, cognitive impairment urinary incontinence, falls, and functional impairment) but did not improve functional status or decrease hospitalisation. Achieving measurable improvement in functional status or hospitalisation rates is likely to require a more-intensive intervention than untargeted referrals and short-term consultations. The attrition rate in this trial was relatively high (25% in the intervention group at 3 years) but the sample size was higher than expected and the lack of effect was unlikely to be due to lack of power.

Appendix 6: Reviews of exercise and physical activity interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/limitations
Angevaren et al (2008) (138)	Mean age 55+ years. 11 RCTs.	General population of older people. Community-dwelling.	Physical activity.	Aerobic capacity test. Cardiovascular fitness linked to cognitive function (speed) including motor function, auditory attention and delayed memory.	Largest effects on cognitive function were found on motor function, auditory attention and delayed memory (effect size 1.17, 0.52, 0.5) only moderate effects for cognitive speed (0.26) and visual attention (0.26). Intensity rather than duration of exercise determines benefit for cognition. Majority of comparisons yielded NS effects.	Cochrane Review. Difficult to conclude if effects are due to cardiovascular exercise alone or could be achieved with other types of exercise i.e. balance, power and strength exercise. **AQS=9/11**
Bean et al 2004 (139)	Not specified.	General population and older people with chronic disease. Community-dwelling.	Progressive resistance training, aerobic training, dynamic exercise, tai chi, high velocity training e.g. concentric training performed at high speed.	Medical and disablement outcomes, self efficacy and Quality of Life (QoL).	Exercise has therapeutic effects for almost all community-dwelling older adults including reduction in morbidity and mortality, and enhanced physiologic capacity, leading to improvement in overall function but relationship between function and impairment is nonlinear. A threshold exists after which enhancement in impairment (e.g. strength) will not increase function.	No search strategy. Recommendations for exercise given for specific disease. Generally 2–3 times week PRT and aerobic training at 13–17 on the Borg scale of perceived exertion. Improvement in impairment and function don't always lead to decreased disability. **AQS=1/9**
Conn et al (2003) (235)	17 (6,391). 65+ years.	General population of older people. Community, primary healthcare.	Physical activity, endurance exercise, motivational interventions.	Physical tests walking, heart foundation measures of overall physical fitness.	10 studies reported significant increase in physical activity. Sex and ethnic differences not reported. Small sample sizes makes conclusions difficult to draw.	Poor quality review. **AQS=2/9**
Cyarto et al (2004) (142)	21 trials.	General population of older people and older people with chronic disease. Community, primary healthcare.	Physical activity interventions and progressive resistance training.	Functional tasks and strength measures.	Increased strength reported but further population-based studies including home and whole community interventions are required.	Paucity of strong evidence linking PRT to reduction/prevention of functional decline or improved QOL. **AQS=1/9**
Colcombe and Kramer (2003) (140)	18 RCTs and quasi RCTs. Age 55–80 years.	General population of older people and older people with chronic disease. Community-dwelling.	Aerobic fitness and combination strength training.	VO2 max and cognitive process (speed, visio-spatial, controlled processing and executive control).	Aerobic training had robust but selective benefits on cognition process particularly for executive control process (tasks relating to planning, inhibition and scheduling of mental procedures).	Complex coding system used to categorise results but unclear explanation and no quality score for trials. **AQS=3/11**

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Daniels *et al* (2008) (143)	10 trial 76–83 years.	Frail older people at risk. Community.	Nutritional and activity/ exercise. Ranging in intensity from 10 weeks to 18 months	Activities of daily living, disability, nutritional intake, balance, walking function, aerobic capacity.	9 trials reported improvement in, strength, aerobic capacity, fitness, balance, and O2 uptake or weight gain. Sub group analysis suggests gains were mainly obtained in people with moderate frailty. No evidence that nutritional interventions result in reduced disability. Long lasting high intensity exercise for moderate physical frailty may have effect on disability.	Improvement in exercise outcomes did not necessarily lead to reduced disability. Strict adherence to frailty definition included. **AQS=7/9**
Howe *et al* (2008) (144)	34 RCTs and quasi-experimental design.	General population and frail of older people. Community and institutions.	Exercise interventions aiming specifically to improve balance.	Gait, balance, coordination, functional exercise.	Limited evidence for improvement in balance but many studies are methodologically weak.	Failure to use standardised measures makes firm conclusions difficult. **AQS =8/11**
Keysor and Jette (2001) (145)	31 studies 29 RCTs, 2 quasi-RCTs. 60+ years.	General population of older people, and frail older people with chronic disease. Community and nursing home.	Exercise categories were: 1) flexibility including yoga and stretching; 2) strengthening or resistance; 3) aerobic; 4) balance (tai chi); 5) combined exercise.	Muscle strength, ROM, flexibility, max oxygen uptake, neuromuscular control and body composition. Direct impact on disability. Measures of health status SF–3, sickness impact profile and other generic disability scores.	No strong evidence for exercise as effective means alone of reducing disability. Effect size of selected studies >100 subjects 0.28, 0.23 (ADL), 0.30, 0.26 (physical disability). 8–12 weeks intervention may demonstrate physical and functional improvement but not behavioural change. Best evidence for a combination of exercise with cognitive behavioural components.	Small sample size in a number of studies may have led to type II error. Possible explanation of lack of large effects of exercise alone due to other factors linked to disablement such as individual's beliefs, emotions, coping strategies and physical and social environments. **AQS=5/9**
Keysor (2003) (236)	4 reviews. 65+ years.	General population and frail of older people and older people with chronic disease (arthritis only).	Physical activity and exercise.	Disablement outcomes (function, impairment and disability).	Aerobic exercise, particularly walking, increases muscle strength and reduces functional limitation but less clear for reducing disability.	Lack of consistency in the RCTs regarding benefits of exercise on disability. **AQS=3/9**
Latham *et al* (2004) (146)	66 trials (n=3,783). 60+ years.	General population of older people and older people with chronic disease. Community-dwelling.	Gym and home based exercise programmes where PRT was defined as a strength training programme where participants exercise against resistance that was progressed.	Limitation in the performance of socially defined roles and tasks (self care, work) Barthel, HRQOL SF-36, physical impairment strength and aerobic capacity, falls, hospital admission and death.	Progressive resistance training has large effect on strength and small to moderate effect on other aspects of impairment and functional limitation but unable to show translation into improvements in physical disability.	Quality assessment carried out on RCTs. Poor methodological quality of RCTs. **AQS=9/11**

Appendix 6 Cont.: Reviews of exercise and physical activity interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Netz et al (2005) (147)	36 studies. Age 54–64 (22 studies) 65–74 (50 studies). 75+ years (9 studies).	General population of older people and older people with chronic disease. Community-dwelling.	Exercise programmes.	Strength, flexibility, aerobic fitness, functional capacity, psychological wellbeing (anger, anxiety, confusion, depression, energy).	Small but significant effect overall of exercise on wellbeing in healthy older adults (weighted mean dif (0.19)). People with chronic disease had larger effect of exercise suggesting causal effect for physical activity on psychological wellbeing.	Investigated prior exercise participation and found subjects from sedentary background experienced larger effects. Complex multiple regression analysis of effects carried out. AQS=4/11
Orr et al (2008) (148)	29 studies (2,174). 50+ years. Mean 60.	General population of older people and those with chronic disease. Community-dwelling.	Resistance training and balance generally conducted in gym/ community setting.	Balance outcomes (68 tests). Static, dynamic and functional balance.	Limited evidence, heterogeneous outcomes and interventions did not show that resistance training in isolation improves balance. Recommendations to use progressive resistance training as an isolated intervention strategy to improve balance cannot be made.	Standardisation of balance testing needed. Strength not the major underlying mechanism for poor balance and other limiting factors influence postural stability. AQS=5/9
Taylor et al (2004) (237)	Number not specified. 65+ years.	General population and older people with chronic disease.	Physical activity.	Strength, ADL, aerobic fitness, cost effectiveness.	Age related changes can be reversed by increasing levels of physical fitness. Growing evidence for anti-depressant effect of exercise and its role in improving emotional, cognitive and perceived physical function. Important that exercise is tailored to needs. Personal choice and perceived behaviour influence participation. Benefits can outweigh costs based on muscle power, balance and falls prevention.	Narrative review combining cohort, case control, RCT and review level data. No search strategy. Focus on efficacy and effectiveness. Some evidence that GPs who are physically active themselves are 3–4 times more likely to promote exercise. AQS=0/9
Van der Bij et al (2002) (150)	38 studies. 50+ years.	General population and older people at risk. Community-dwelling.	Physical activity interventions. Home based activity (n=9) group based activity (n=38), educational physical activity interventions (n=10) where advice was given on exercise participation.	Physical activity levels, aerobic fitness, bone density, fracture risk. Participation levels, behavioural reinforcement.	Programmes can result in increased activity levels but no effect of behavioural reinforcement on initiation and maintenance of physical activity. Participation rate decline the longer the intervention duration, particularly in home based exercise. People over 60 have lower participation rate than younger participants but even very old (80+) can be motivated to increase activity rate.	This review focused on promoting exercise rather than the benefits. Most participants were white, from well educated backgrounds and had moderate to high income level. Good description of interventions. Participants advised to exercise 3 times a week on home-based programme. AQS=4/9
Yeom (2009) (151)	28 RCTs. 60+ years.	General population and frail older people at risk. Community-dwelling.	Promoting mobility, aerobic and resistance training, tai chi.	Walking speed and endurance, balance, strength measures.	Effective intervention includes walking, aerobic exercise and resistance training focusing on strength, balance, and flexibility. Subjects need to participate for at least 12 weeks. Exercise dose of physical activity 20–60 mins of aerobic exercise 3 times a week. (ACSM recommendations are 60 mins for older adults.)	Limited narrative review only including studies of interventions in the USA. AQS=2/9

Appendix 7: Reviews of information communication technology interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/limitations
Barlow et al (2007) (171)	98 studies. 68 RCTs and 30 observational.	Older people with multiple chronic disease and frail older people. Community setting.	Telecare (vital signs monitoring, safety and security monitoring, information and support monitoring).	Benefits to patients, clinical indicators, improved medication control, quality of life and reduced mortality.	Evidence inconsistent for vital signs, insufficient evidence for alert systems such as fall detectors, evidence that telephone support can improve clinical outcomes.	Most evidence measured in terms of health service use rather than improving clinical indicators. **AQS=3/9**
DelliFraine and Dansky (2008) (173)	29 studies. No age limit but including older people 65+ years.	Older people with chronic disease. Community and residential setting.	Telehealth interventions, monitor, internet, or monitor plus home health, video monitoring.	Multiple clinical outcomes.	Sub group analysis of older people (10 trials only) effect size for clinical outcomes; 0.41 95% CI 0.10 to 0.73.	Small sample size in many studies (22 out of 29 less than 100). No description of the clinical outcomes. **AQS=2/9**
Botis and Hartvigsen (2008) (172)	54 studies.	Older people with chronic disease. Community.	Telehealth, telemonitoring, telecommunication devices for assessing physical and cognitive problems.	1)Effects on patients and healthcare professionals; 2) Effects on chronic diseases; 3) Effects on health.	No significant benefit for Alzheimers compared to traditional methods. Benefits included satisfaction and reduced travel costs. There are organisational, ethical, legal, designs, usability and other matters that need to be resolved before widespread implementation can occur.	Limited by small studies and short follow up. Older people not entirely familiar with technology and later generation may gain more benefit from knowledge acquired in early life. **AQS=1/9**
Gaitwad and Warren (2009) (174)	27 studies including sub-group of older people.	General population of older people with chronic disease. Community.	Telemonitoring, teleassistance, telehomecare, videoconferencing and telecardiology.	Multiple outcomes ranging from qualitative to healthcare costs.	Telehome – 5 studies Telemonitoring – 8 studies. Long term Home based interventions targeting appropriate groups of chronic disease who are high users of healthcare can improve quality of management.	Need evidence based outcome indicators to confirm sustainable cost benefits. Only 1 paper from UK. 10 from USA. **AQS=2/9**
Jennet et al (2003) (175)	53 studies including reviews.	Older people with chronic disease. Community setting.	Telehealth	Multiple outcomes, health outcomes, quality of life, quality of care, cost and cost effectiveness, decreased health service utilisation, social isolation.	No high quality comparative studies which clearly demonstrated benefits of video-consultation. Enhanced quality of life of older people by increasing ability to live independently. Health education benefits from computer based applications. Electronic networks provided support for carers. Telephone consultation for provision of medical advice and video-consultations regarding wounds can reduce costs.	Only 16 of the 53 studies (30%) of telehealth for older people were rated good to fair. Measurement of costs, cost effectiveness was imprecise. There is uncertainty about general applicability. **AQS=4/9**

Appendix 8: Reviews of falls prevention interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Avenell et al (2009) (238)	45 RCTs. Hip (24,749). Vert (9,138). Other (25,016).	General population of older people and frail. Institutional care and community.	Vitamin D and calcium supplements.	Falls and fractures.	Vitamin D alone ineffective in preventing fractures. No strong evidence for reduction of fractures. Modest increase in GI and renal symptoms. Maybe more beneficial for institutionalised older people.	Cochrane Review. **AQS=10/11**
Beswick et al (2008) (7)	89 RCTs (97,984). Mean age 65+ years.	General population and frail older people. Community setting.	Complex interventions including fall prevention.	Living at home, death, admissions to hospital and nursing homes, falls, physical function.	Interventions reduced risk of not living at home, nursing home admissions and falls particularly in the general population. Falls 33.6% to 30.5%, improvement in physical function 0.5 point on Barthel Index.	Benefits more evident prior to 1993 suggesting quality bias. Large heterogeneity makes conclusion difficult to draw with confidence. **AQS=8/11**
Chang et al (2004) (239)	40 RCTs.	General population and frail older people. Community and institution.	Multi-factorial falls risk assessment and management, exercise intervention, education and environmental modification. Exercise categorised as balance, endurance, flexibility, strength.	Falling at least once during a specified period and monthly falling. Risk ratio estimated for most studies. Other clinically relevant outcomes not reported sufficiently.	Effective in reducing risk of falls and monthly rate of falls. Multi factorial falls risk assessment most effective, exercise programmes effective in reducing risk of falls.	Overall modest reductions usually less than 35% reduction in number of older people falling. Recommends that OP over 75 should have targeted assessment (balance, gait, walking and movement dysfunction). **AQS=10/11**
Campbell and Robertson (2007) (121)	90 RCTs in the community (32 in institutional care). 65+ years.	General population and frail older people at risk. Community setting.	Multi-factorial interventions compared with single intervention strategy targeting single risk for falls prevention.	Pooled rate ratio for falling.	Six interventions with multiple components reduced falls by 22% (pooled rate ratio 0.78 95% CI 0.68 to 0.89). 10 single interventions reduced falls by 23% (pooled rate ratio 95% CI 0.67 to 0.89). There was no sig dif between pooled rate ratios for single and multi factorial interventions.	Delivery of single factor interventions to selected populations is as effective in reducing falls as multi factorial interventions. **AQS=8/11**
Cumming (2002) (240)	21 RCTs.	General population and frail older people at risk. Community setting.	Multifactor interventions.	Falls, institutional admission.	Convincing evidence that exercise can prevent fall recurrence. Reducing use of psychotropic medications prevents falls, tai chi, intensive strength and endurance, home-based exercise.	Updated in 2009 by Gillespie et al.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Davis *et al* (2004) (241)	13 studies.	Older people with falls related injuries.	Balance and agility exercise.	Falls.	Agility training with balance component is likely to prevent falls.	Poor abstract. Updated by Gillespie *et al* (2009).
Davis *et al* (2010) (15)	9 RCTs. 60+ years.	General population and frail older people at risk. Community setting.	Multi-factorial individual level. Single interventions. Population-based multi-factorial including awareness campaign.	Incremental cost-effectiveness, cost-utility, and cost-benefit ratios.	Three effective falls prevention strategies: 1) customised multi-factorial programme for high risk older people; 2) home-based Otago Exercise programme in people >80; 3) home safety programme in subgroups with previous falls.	Best value for money from single factor interventions such as Otago exercise programme. Potential for bias as reviewers were authors on RCT of recommended intervention. AQS= 6/9
Gates *et al* (2008) (12)	19 studies. 65+ years.	General population and frail older people at risk. Primary care, community and emergency care settings.	Iintervention including exercise, education, drugs, knowledge transfer and assessments including balance, home environment, psychological, gait, disability.	Number of fallers, fall related injury, admission to hospital, death, quality of life, physical activity, move to institution, contact with NHS, disability (Barthel Index).	Little evidence to support effectiveness of multi-factorial risk assessment interventions. May reduce number of falls but not by much. Data insufficient to assess fall and injury rate.	High quality review. Used internationally agreed taxonomy for falls prevention. www.profane.eu.org AQS=9/11
Gillespie *et al* (2009) (13)	111 RCTs (55,303 participants).	General population and frail older people at risk. Community setting.	Multi-component group exercise, tai chi, exercise, assessment and multi-factorial intervention, Vitamin D, home safety interventions, anti slip shoes, reducing psychotropic drugs.	Primary: Rate of falls and number of fallers Secondary: fall related fractures, adverse effects of intervention economic outcomes.	Exercise interventions reduce rate and risk of falls. Research needed to confirm the contexts in which home safety, multifactorial assessment and intervention, vitamin D and other interventions are effective. Some evidence that falls prevention strategies can reduce costs.	High quality Cochrane meta-analysis. AQS=10/11
Gillespie *et al* (2005) (242)		General population and frail older people at risk. Community setting.	Vitamin D supplement	Rate of falls	Uncertainty remains about effectiveness of vitamin D.	Updated by Gillespie *et al* 2009
Low *et al* 2009 (243)	7 RCTs. 60+ years.	General population and frail older people at risk. Community setting and care homes (1 RCT only).	Tai chi.	Risk of falls. Number of falls. Rate of falls.	Tai chi has potential to reduce falls or risk of falls in the young and healthy group. This does not apply to the frail group.	Non English studies not reported and intervention should be investigated further. AQS=6/9

Appendix 8 Cont.: Reviews of falls prevention interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Medical Advisory Secretariat (2008) (125)	60 RCTs.	General population and frail older people at risk. Community setting.	11 interventions including exercise, vision assessment and referral, environmental modification, vitamin D and calcium supplements, hip protectors, HRT< gait-stabilising devices and multi-factorial programmes	Risk and rate of falls. Cost effectiveness.	Exercise interventions stratified into high and low risk groups, untargeted and targeted programmes and duration of intervention. High quality evidence that long term programmes in mobile general older people and environmental modifications in the homes of frail older people reduce risk of falls and injuries. Cost-effective in reducing rate of falling. Multi-factorial interventions in high-risk older people may be effective, but quality is low and effects are small.	Comprehensive review that used GRADE system to judge quality of RCTs. Interventions were stratified into targeted populations (high and low risk) **AQS=7/11**
McClure et al (2008) (126)	6 controlled studies. 60+ years.	General population and frail older people at risk. Community setting.	Population based interventions (home hazard reductions, medication review, and education).	Fall related injuries. Change in incidence of all related injury reported as being treated by a medical practitioner.	Trend in reported reduction in fall-related injuries across all programmes.	Randomised multiple community trials of population based approach are indicated. **AQS=8/9**
Sawka et al (2005) (244)	75,696 +1,188 participants. 8 RCTs.	General population and frail older people at risk. Community setting and institutional.	Hip protectors.	Hip fractures.	Little evidence to support the use of hip protectors outside nursing home settings. Fracture rate 1.1 to 7.4% Relative risk 1.07 (0.81 to 1.42), NNT = 25 (95% CI 13,200)	**AQS=9/11** High Quality Review
Rixt Zijlstra et al(245)	19 RCTs. 65+ years.	General population and frail older people at risk. Community setting and institutional.	Multifactorial interventions including medication review, vision screening, hip protectors, tai chi and exercise interventions.	Fear of falling, falls self-efficacy.	Limited but consistent evidence from trials of high methodology that exercise and multi-factorial interventions reduce fear of falling.	Limited by lack of evidence to link fear of falling to change in behaviour or actual fall rate. Need to develop measures in this area. **AQS=7/9**
Sherrington et al (2008) (134)	44 trials (9,603 subjects) yielding 49 estimates of the effects of exercise.	General population and frail older people at risk. Community setting and institutional.	Home exercise programmes of strength and balance. Most tailored to subject.	Number of fallers, fall rates or rate of falls (random effects meta-analysis).	Provides strong evidence that exercise can reduce fall rates in older people. Reduction in fall rate of 17%. Balance training, high intensity exercise dose and absence of walking programme are associated with efficacy of the programmes. Strength training increases strength but has a less clear effect on balance	Walking and strength training may provide benefits for other aspects of ageing but is not optimal intervention for prevention of falls. **AQS=7/11**

Appendix 8 Cont.: Reviews of falls prevention interventions.

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Vaapio *et al* **(2009) (127)**	12 RCTs.	General population and older people at risk. Community setting.	Falls preventative programmes.	Quality of life. SF-36, 15D, WHO QOL-BREF, EUROQOL, RAND-36, NHP (Nottingham health profile).	6 out of 12 showed positive results on quality of life (social and physical function, vitality, mental health, environmental domain).	Larger studies needed with longer follow up and multiple outcome measures. **AQS=4/9**
Weatherall (2004) (246)	19 RCTs.	General population and frail older people at risk. Community setting.	Interventions categorised into: 1) exercise as sole intervention; 2) multiple interventions; 3) assessment ad advice.	Number of people falling at least once or number of people with a fracture.	Exercise alone. Odds ratio 0.79 (95% CI 0.58 to 1.08). Multiple interventions Odds ratio 0.65 (0.052 to 0.81). Visits and advice (0.77 (0.54 to 1.11). Evidence for fracture prevention is sparse.	Review of guidelines and literature review. Evidence for exercise alone is in favour of intervention but confidence intervals are wide. Authors recommend trials report number of falls with at least 1 fall in follow up year. **AQS=4/11**

Appendix 9: Reviews of interventions aiming to prevent social isolation and loneliness

Author	Number of studies	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Cattan *et al* (2005) (19)	30 studies.	General population of older people. Community setting. Community centres and home.	Social health promoting interventions. Most group interventions with educational input.	Validated measurement tools, UCLA loneliness scale, de Jong Gierveld loneliness scale.	Educational and social activity group interventions that target specific activities can alleviate social isolation and loneliness. Effectiveness of home visits remains unclear.	1 study assessing community development. Most studies in USA or Canada. 7 of 1 to 1 interventions were home visits. **AQS=6/9**
Findlay (2003) (180)	17 studies only 6 RCTs.	General population and frail older people at risk. Community setting.	Health promotion, social support, community intervention programmes including telecare, gatekeeper programme 5 of 17 were 1-to-1 interventions, 6 group interventions, 4 discussion groups.	Subjective feeling of social isolation and loneliness, mortality rates, identification of older people at risk.	Dearth of evidence in this field. Teleconferencing may be cost effective in geographically isolated areas.	Money may be wasted on programmes that are not effective. High quality training need to support interventions, utilise existing community capacity. Greater chance of success if integrated into existing community resources. **AQS =3/9**
Medical Advisory Secretariat (2008) (20)	11 quantitative RCTs.	General population and frail older people at risk. Mainly older women 75+ years.	Group support activities and technology assisted interventions mainly based on behavioural change.	Validated measurement tools, UCLA loneliness scale, de Jong Gierveld loneliness scale.	Social support groups decreased social isolation. Community-based exercise featuring health and wellness for physically inactive older people was effective in reducing loneliness. Interventions for informal care givers of seniors with dementia had limited effectiveness. Very limited research of technology-assisted interventions.	Not a broad-based research literature of targeted groups involving only of a few of the many causes of social isolation. RCTs generally small n=< 100. **AQS=5/9**

Appendix 10: Reviews of vision screening, nutrition interventions and medication review

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Chou *et al* (2009) (128)	60 studies including 38 RCTs. Older adults 65+ years.	General population. Primary care or eye specialist settings.	Screening and treatment for impaired vision. Focus on screening, treatment and potential harm (health promotion).	Detection of cataracts, refractive errors, risk of falls.	Found no benefit of screening although strong effect for treatment of common causes of impaired visual acuity. Weak evidence for increased risk of falls.	**AQS= 7/9** Difficult to reach firm conclusions due to relatively small number of RCTs with good methodological design and wide confidence intervals.
Holland *et al* (2007) (186)	32 studies. Only 17 included in meta-analysis. Mean 65+ years.	General population in any setting.	Pharmacist-led review of medication including those that recommend optimising drug regime.	Proportion of people with one or more hospital admission and all cause mortality and mean drugs prescribed.	No effect on reduced mortality or hospital admission RR 0.99 (95% CI 0.87 to 1.14). Small effect on reduced drug use but large heterogeneity.	**AQS= 8/11** Not enough data to review quality of life.
Jia *et al* (2008) (159)	22 trials. Older adults 65+ years.	Mixed population. Community and hospital.	Single vitamins, minerals and omega-3 fatty acids.	Change in cognitive performance. 11 groups; global cognition, attention and concentration, short-term memory, long term memory, recognition, processing speed, executive function, verbal ability, verbal fluency.	Little evidence of effect of any vitamins or supplements on cognitive function.	**AQS= 8/11** Only 6 out of 22 trials were carried out in the community. Many trials only followed up for short-term < 6 months.
Jones *et al* (2009) (71)	19 studies. Older people.	Older people living in the community.	All interventions to improve diet and food access and use of supplements.	Weight gain, cognitive and physical function.	Dietary advice and supplements seem to be effective in managing under-nutrition.	**AQS=3/9** Benefits of nutritional supplements for older people in the community are unclear. Scientific advisory committee advise vitamin D supplements for people over 65.
Milne *et al* (2009) (158)	62 RCTs and quasi-RCTs with 10,187 participants 65+ years.	Mixed population excluding critical care.	Interventions aimed at improving protein intake. Supplements in the form of: commercial sip feeds, milk based supplements or via fortification of normal food sources.	All cause mortality with complications (e.g. DVT, infection), morbidity, functional status, cognitive and physical.	Pooled weighted change in body mass was significant (2.2% 95% CI 1.8 to 2/5). No significant difference in mortality apart from sub group of under-nourished older people. Small but consistent weight gains. Unclear outcome for other measures.	**AQS= 9/11** Poor quality trials included. Some adverse effects of nausea and vomiting reported.

Appendix 10 Cont.: Reviews of vision screening, nutrition interventions and medication review

Author	Number of studies (subjects) and age	Health category and setting	Interventions	Outcomes	Main findings and authors conclusions	AMSTAR Quality score (AQS) comments/ limitations
Royal *et al* **2005 (187)**	38 RCTs and controlled studies.	Primary care setting, community and nursing homes. Mixed age range mainly older people.	Interventions applied in primary care aiming to reduce drug related morbidity, hospitalisation, death.	Falls, HA, cognitive function, depression, death, adverse drug events.	Limited evaluation using RCT design aimed at reducing medication related adverse events. Weak evidence found that pharmacy led medication reviews are effective in reducing hospital admission. No effect of medication review on falls. OR 0.91 95%CI 0.68 to 1.21, (9 studies included in analysis).	**AQS=9/11** Quality score used EPOC Cochrane criteria. Paucity of high quality evaluation of interventions aimed at preventing medication related adverse events in primary care.
Smeeth and Iliffe (2008) (215)	5 RCTs (3,494 people) 65+ years.	General population of older people in the community.	Mass screening. (Health promotion.)	Self-reported measures of visual impairment (National Eye Institute Visual Function Questionnaire NEIVFQ-25) and other non-validated questionnaires. Length of follow up 2–4 years.	No evidence that community-based screening intervention improves vision of asymptomatic older people. In 4 trials those reporting visual problems were given advice only for intervention. Screening and recommendation for referral only led to treatment in 50% of cases in 1 RCT. Screening only effective if referral systems and intervention is adequate and compliance is high.	**AQS =9/11** No trials of vision screening alone. Need to investigate why those recommended for treatment were not referred or compliance was low.

Appendix 11: The PRISMA model of integrated service delivery

The components of the PRISMA model (Programme of Research to Integrate Services for the Maintenance of Autonomy (101;194)) are described in box 1.

Box 1. The six component of the PRISMA model

1. Coordination between decision makers and managers at the regional and local levels.

2. Single entry point.

3. Single assessment instrument coupled with case-mix management systems.

4. Case management.

5. Individual service plans.

6. Easily accessible computerised clinical charts.

Measurement of functional decline

The five domains of the SMAF tool (56) are:
- Functional ability. 7 items: eating, dressing, grooming, urinary and faecal incontinence and using the bathroom.
- Communication. 3 items: seeing, hearing, and speaking.
- Mobility. 6 items: walking inside and out, putting on prosthesis, transfers, using stairs, moving around in a wheelchair.
- Mental function. 5 items: memory, judgement, behaviour, orientation and understanding.
- Instrumental activities of daily living. 8 items: shopping, doing housework, preparing food, managing a budget, using the telephone, using public transport, taking medication, doing laundry (49) (56).

Functional decline was defined as the occurrence of one of the following:
- An increase of 5 points or more on the SMAF.
- Admission to nursing home or long term hospital care.
- Death.

In addition, satisfaction and caregiver's burden and caregiver's desire for institutionalisation was recorded.

Appendix 12: Effectiveness of interventions for the risk of falls

Interventions	RR [95% CI]	Grade of evidence (247)
Exercise programmes		
Targeted programmes		
General population	0.81 [0.67–0.98]	Low
High-risk population	0.93 [0.82–1.06]	High
Short duration	0.91 [0.73–1.13]	High
Long duration	0.89 [0.79–1.01]	Moderate
Untargeted programmes		
General population	0.78 [0.66–0.91]	Moderate
High-risk population	0.89 [0.72–1.10]	Very low
Short duration	0.85 [0.71–1.01]	Low
Long duration	0.76 [0.64–0.91]	Moderate
Combined targeted vs untargeted programmes		
General population	NA	NA
High-risk population	0.87 [0.57–1.34]	Moderate
Short duration	1.11 [0.73–1.70]	High
Long duration	0.73 [0.57–0.95]	High
Vision intervention		
Assessment/referral	1.12 [0.82–1.53]	Moderate
Cataract surgery	1.11 [0.92–1.35]	Moderate
Environmental modifications		
Low-risk population	1.03 [0.75–1.41]	High
High-risk population	0.66 [0.54–0.81]	High
General population	0.85 [0.75–0.97]	High
Drugs/nutritional supplements		
Vitamin D (men and women)	0.94 [0.77–1.14]	High
Vitamin D (women only)	0.55 [0.29–1.08]	Moderate
Vitamin D and calcium (men and women)	0.89 [0.74–1.07]	Moderate
Vitamin D and calcium (women only)	0.83 [0.73–0.95]	Moderate
Hormone replacement therapy	0.98 [0.80–1.20]	Low
Medication withdrawal	0.34 [0.16–0.74]†	Low
Gait-stabilising device	0.43 [0.29–0.64]	Moderate
Multifactorial intervention		
Geriatric screening (general population)	0.87 [0.69–1.10]	Very low
High-risk population	0.86 [0.75–0.98]	Low

† Hazard ratio is reported because RR was not available.
‡ The RR for the gait-stabilising device was adjusted to reflect the general population because the trial reported a RR for outdoor falls only. Risk was adjusted as per rate of outdoor falls for males and females reported in the literature.

Source: Reproduced with permission from the Medical Advisory Secretariat (2008) (125).

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