

Care Homes: A Literature Review

Understanding morbidity and co-morbidity of disease within the care homes population and identify approaches to prevent avoidable non-elective admissions

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1. Introduction

In 2011 there were an estimated 400,000 individuals residing in care homes in the UK, and the number of elderly individuals who will require support in care homes is expected to rise over the coming decades.¹ A previous literature review undertaken in 2010 highlighted that care home residents in general have greater health needs than the elderly population living in the community, are frequent users of health care services, and that hospital admissions from this population group can be reduced through provision of evidence-based interventions.

This literature seeks to expand on the findings of the previous literature review, with the following objectives:

- to report the prevalence of diseases amongst care home residents, and identify any conditions where prevalence is higher amongst care home residents compared to the elderly population residing in the community
- compare the rates of hospital admissions amongst care home residents with the elderly population living in the community, and identify the main diagnoses that result in admissions for care home residents
- identify interventions that are effective at reducing hospital admissions among care home residents

1.1 Definition

Throughout this report, the term “care home” is used and encompasses all homes offering nursing and personal care, such as residential homes and nursing homes.

2. Methodology

Generic and topic-specific search strategies were used, with details provided in **Appendix 1**. Sources searched included EMBASE, Medline, CINAHL and NHS Evidence. A search of the grey literature was also undertaken. References of studies were reviewed to identify additional studies.

As the characteristics of care home residents in the UK may differ from the care home population in other countries, the searches on the prevalence of conditions, hospital admission rates and main diagnoses for hospitalisation were limited to studies undertaken in UK or Irish care homes. International studies were included when reviewing the effectiveness of interventions to reduce hospitalisations amongst care home residents, due to the limited evidence-base if this search was restricted to UK and Irish care homes.

When reviewing the literature that assessed the effectiveness of interventions in reducing hospital admissions among care home residents, only systematic reviews, meta-analyses and randomised controlled trials were included. Randomised controlled trials that were included within a systematic review or meta-analysis have not been summarised separately. In general, studies have only been included if use of hospital services was specified as an outcome measure. However for certain topics when an outcome increases the likelihood of hospitalisation (for example falls), studies that measured a change in outcome were included. In addition, as national policy recommends that care home residents are vaccinated against influenza and pneumococcal disease (and healthcare workers in the case of influenza) then the review was limited to studies that assessed the effectiveness of campaigns to increase vaccination uptake rates, rather than the effectiveness of vaccination in reducing rates of hospitalisation.

A summary of all studies included in the literature review can be found in **Appendix 2**.

3. Key findings

3.1 Mortality

Standardised mortality rates are 10 times higher amongst care home residents, compared to the elderly population living in the community.

The main causes of death amongst care home residents are dementia (22% of deaths), cardiovascular disease (21%) and respiratory disease (8%).

3.2 Morbidity

The needs of care homes residents tend to be complex, with the average number of **long term conditions** being between three and six.

There appears to be much **under-diagnosis and recording** of conditions amongst residents of care homes, for example diabetes and heart failure.

Studies have identified an increase in the prevalence of dementia over the last decade; however it is not known whether this is due to better diagnosis and/or recording or a true increase.

Very few studies were identified that compared the prevalence of health conditions amongst the care home population to the prevalence amongst elderly people residing in the community. However, higher rates of the following conditions have been reported amongst care home residents:

- 35-83% of residents with **chronic kidney diseases**, compared to 30% of elderly people in the community
- 26-67% of residents with **dementia**, compared to 1-4% of elderly people in the community
- Carriage rates of **multi-drug resistant E. coli** of 41% amongst care home residents, compared to 1% of elderly people in the community
- 16-31% of care homes residents have **cerebrovascular disease**, compared to 6% of elderly people in the community

The rates of the following conditions have been reported to be similar amongst care home residents and the elderly population living in the community:

- 34-51% of care home residents have been diagnosed with **hypertension**, compared to 56% in the elderly population in the community
- 13-17% of care home residents have been diagnosed with **atrial fibrillation**, compared to 12% in the elderly population in the community
- 12-20% of residents have been diagnosed with **hypothyroidism** compared to 11% in the elderly population in the community
- 10-19% of residents have been diagnosed with **diabetes** compared to 11% in the elderly population in the community
- 9-19% of care home residents have been diagnosed with **coronary heart disease**, compared to 20% in the elderly population in the community
- 3-8% of care home residents have had a **myocardial infarction** compared to 3% in the elderly population in the community

The prevalence of the following conditions have been reported amongst care home residents, although with no comparison to prevalence rates in the elderly population living in the community available:

- 67-79% of residents are **incontinent**, and of these
 - 31-56% have dual incontinence

- 13-29% are urinary incontinent
- 2-4% are faecal incontinent
- 40-76% of residents have **mobility issues**
- 41-58% of residents are suffering from **weight loss, malnutrition and dehydration**
- 42% of residents have **problems swallowing**
- 6-38% of residents have been diagnosed with **depression**
- 18-37% of residents have **musculo-skeletal conditions** such as arthritis and osteoporosis
- 34% of care home residents have been diagnosed with **respiratory conditions**
- 7-23% of care home residents have been diagnosed with **heart failure**
- 20-23% of care home residents are carriers of **MRSA**
- 14-23% of residents have a history of **falls** with 18% of residents having a history of **fractured hip**
- 17% of residents require **palliative care**
- 13% of residents have been diagnosed with **anxiety disorders**
- 5-13% of residents have a diagnosis of **cancer**
- 3-12% of residents have **hearing problems**, and 6-7% of residents **have vision loss**
- 11% of residents have **pressure ulcers**
- 11% of residents have **epilepsy**
- 7-10% of residents have been diagnosed with **more complex mental health conditions** such as bipolar disorder
- 8% of residents are **smokers**
- 7% of residents are **obese**
- 5% of residents have **learning disabilities**
- 6% of residents have an **infection**
-

3.3 Hospital admission rates and reasons for admission

Care home residents appear to have higher hospital admission and Emergency Department attendance rates than older people that live in the community, although this is based on results from only two studies.

The most common diagnoses that result in admission or attendance at secondary care for care home residents include respiratory infections, injuries resulting from falls, infections at other sites, neurological disorders and disorders of the digestive system. Hospitalisation rates for some conditions are significantly higher among care home residents compared to the elderly population living in the community, for example fractured neck of femur and diseases of the respiratory system.

Hospitalisation rates for care home residents may increase out of hours, at times when there may be limited specialist geriatric provision within the hospital.

Approximately half of all attendances or admissions by care home residents are potentially avoidable (although elderly people living in the community have a similar proportion of avoidable admissions) , and rates of avoidable admissions may increase out of hours.

3.4 Interventions effective at reducing hospitalisations

There is evidence that the following interventions **are effective**:

- there is evidence that vitamin D supplementation reduces the risk of falls and hip fractures
- there is evidence that interventions that target multiple risk factors may reduce the incidence of falls

- there is evidence that campaigns that include multiple components, including education, improving availability of vaccine and use of role models are effective at improving the uptake rates of influenza vaccine by healthcare workers. Access to free vaccination, an understanding that influenza is a serious illness and an understanding that influenza vaccine does not cause the disease were identified as key motivators in for healthcare workers to receive vaccination

There is some evidence that the following interventions **may be effective**, although the evidence-base has limitations, often due to the small number of studies conducted:

- there is some evidence that improving end of life care, through the use of palliative care services and advance care planning may reduce hospitalisation rates among care home residents
- there is some evidence that integrated working may be effective in reducing hospitalisation rates, however no firm conclusion can be currently drawn due to short term follow-up of existing research and differences in service models assessed.
- the evidence on the effectiveness of hip protectors in reducing hip fractures among care home residents remains unclear
- there is some evidence that improving oral care may reduce rates of respiratory infection
- there is some evidence that use of a clinical pathway for treating residents with pneumonia or other lower respiratory tract infections can reduce hospitalisation rates
- there is limited evidence that interventions that target multiple morbidities may reduce hospitalisation rates, although no studies using this approach were identified amongst care home residents
- there is some evidence that programs that combine a proactive approach to identifying and managing conditions, integrated working and use of end of life tools may reduce hospitalisation rates

There is evidence that the following interventions are **not effective**:

- there is no evidence that the use of risk assessment tools alongside staff clinical judgement, lavender patches, sunlight exposure, oral fluoride and multisensory stimulation reduce the risks of falls or hip fractures
- there is no evidence that vitamin E supplementation reduces the incidence of respiratory tract infections
- there is no evidence that multivitamin and mineral supplementation reduces the incidence of infections or hospitalisation rates
- there is no evidence that medication reviews reduce hospitalisation rates

Finally, there is currently conflicting evidence on the effectiveness of medication reviews and exercise interventions on reducing the risk of falls and hip fractures.

3.5 Comparison to findings from previous literature review

In general, findings reported by studies and reports included in this literature review are consistent with the studies included in the literature review undertaken in 2010. However, due to the amount of literature concerning the care home population published since 2010 then additional findings are reported within this review.

4. Strengths and Limitations

This literature review identified a large number studies that met the inclusion criteria. Many of the studies have been published within the last three years and therefore the findings should remain current. In addition, as the criteria of the searches for the prevalence of conditions and hospitalisation

rates and diagnoses were limited to care homes in the UK and Ireland then the results should be generalizable to the care home population of Derbyshire.

The prevalence of a wide range of conditions amongst the care home population was identified, and in addition, the prevalence of some conditions were reported by more than one study, thus allowing the prevalence to be stated with greater certainty. However, there were very few studies that compared the disease prevalence of the care home population to the elderly population in the community and therefore it remains unclear as to the extent that the care home population has greater needs than the elderly community population. In addition, only a single study was identified that analysed the changes in prevalence of conditions over time. This literature review has therefore not been able to identify any diseases other than dementia for which the prevalence may be increasing amongst care home residents. It has also been difficult to determine whether the prevalence of conditions differs amongst nursing homes and residential homes. Also, very few of the studies provided an estimation of the precision of the results reported.

A number of systematic reviews and randomised controlled trials were identified that assessed the effectiveness of interventions to reduce hospitalisations amongst care home residents. These study designs are considered the most robust, with their findings less likely to be affected by bias and confounding compared to other designs. However, as studies were not limited to UK and Ireland, then the results may not be generalizable to the care home population locally.

Finally, as the search on interventions effective at reducing hospitalisations was limited to systematic reviews and randomised controlled trials then it will have overlooked high quality observational studies. This may be particularly true for research that evaluates the impact of new models of care, such as integrated working and addressing multi-morbidity in this population group.

5. Summary and Recommendations

There is a growing body of evidence published on the health status of care home residents, perhaps indicative of the greater interest in the health of this population group. The evidence suggests that the majority of care home residents have complex health needs and experience a combination of chronic conditions. Unsurprisingly, for a number of conditions, the prevalence is higher amongst the care home population than the elderly population living in the community. There is also evidence that there is under-diagnosis of health conditions, resulting in individuals not receiving appropriate care.

Hospitalisation rates among care home residents would appear to be higher than the elderly population living in the community. Additionally, a significant proportion of hospital use amongst care home residents is potentially avoidable, and could be reduced through better management of conditions in the care home. Much hospital use appears to occur out-of hours.

Despite the increase in published literature relating to care home population, there have been few quality intervention studies that have assessed interventions aiming to reduce hospitalisation usage by this population. However, there is evidence that there are a number of interventions that are effective at reducing hospitalisation rates. In addition, there is a growing evidence base for other interventions, for example integrated care and multi-interventional models of care.

With an aging population across the UK, and projections indicating that higher numbers will require support in a care home setting in the future, ensuring that the health of the care home population is managed effectively is key. A failure to do so will impact on other aspects of health and social care services, causing pressures in demand and increased costs.

The following recommendations are made for local commissioners and providers to allow more effective provision of care to manage the health care needs of the care home population within Derbyshire. It is noted that there is a Care Homes Steering Group within Derbyshire that has already developed a programme of work and therefore a number of these recommendations may already be being addressed.

5.1 Recommendation 1 - Information

- monitor on an ongoing basis the prevalence of a wide range of conditions among care home residents
- monitor hospitalisation rates from care homes, including diagnoses for hospitalisation
- monitor out-of-hours use of emergency services by care homes
- ensure that monitoring of information from care homes includes influenza and pneumococcal vaccination rates amongst residents
- audit uptake of influenza vaccination rates by staff in care homes, and assess whether an increase in vaccination rates has an impact on staff absence rates, use of agency staff or mortality rates of residents to enable development of an economic argument for care home owners to provide free vaccination to staff
- to develop a tool to allow sharing of the above information between care homes, GP practices and other primary care services, public health and commissioners to allow analysis of variability and equity in outcomes between care homes
- audit the vaccination rates of community staff, for example district nurses, community matrons and physiotherapists who have direct care responsibilities for care home residents

5.2 Recommendation 2 - Service Design and Delivery

- review whether out-of-hours care services have access to sufficient information about the health and personal preferences of a care home resident to determine whether that individual requires hospitalisation
- ensure that models for the provision of primary care services to care homes incorporate management of those conditions experienced by a significant proportion of care home residents
- ensure that protocols for primary care services includes systematic screening for those conditions where there is national evidence of under-diagnosis amongst the care home population, such as diabetes. However, as some care home residents are particularly frail and may not benefit from being screened, protocols should emphasise the need for there to be clear benefits for screening, and this should be decided on an individual basis
- review the existing provision within care homes of interventions that have a strong evidence-base for reducing hospitalisation rates, such as falls prevention
- ensure that any interventions introduced to reduce hospitalisations focus on the most common reasons for hospitalisation
- ensure that interventions implemented locally that have not yet been proven to be effective are evaluated
- review the provision of geriatric services within secondary care, with a focus on out-of-hours provision
- identify any needs assessment work undertaken locally with links to the care home population, for example end of life care, oral health

5.3 Recommendation 3 - Further Research

- repeat a full literature review in 3 years to allow analysis of further evidence
- undertake an annual review of the evidence of effectiveness of integrated care models and multi-interventional strategies in reducing hospitalisation rates, and due to the current focus on these delivery models, that the scope of the review is broadened to include high quality observational studies

Appendix 1: Search Strategy

Within the generic search strategy, the following search terms were used	Within the topic-specific search strategy, the following search terms were used	
care home* nurs* home* residential home* residential care rest home care facility prevalence incidence census survey proportion hospitali* emergency admission avoid* admission emergency care	vaccin* flu influenza respiratory staff worker* nurs* resident* diabetes multimorbid* multi* chronic* multi* condition training education knowledge confidence end of life	palliative "advance care plan*" ACP fall* fracture* prevent* hip ADJ protector* "hospital at home" integrated care virtual ward inreach in-reach pharmac* medication* drug* prescri* prescription* infection ADJ control

Appendix 2: Studies Identified by the Literature Review

Prevalence of Conditions

A total of 19 papers, conference reports and survey reports were identified. The results of an additional audit report undertaken in Derbyshire were also included. The evidence is reported here by study, listed chronologically by date of publication, with results collated in the key findings section.

Gordon (2013):ⁱⁱ this survey of 227 residents of 16 care homes in Nottingham reported that the mean number of diagnoses per resident was 6.2. The ten most common diagnoses reported amongst the study population were dementia (62%), essential hypertension (45%), primary generalised osteoarthritis (37%), cerebrovascular disease (31%), osteoporosis with pathological fracture (20%), chronic renal failure (15%), non-insulin dependent diabetes (15%), recurrent depressive disorder (15%), atrial fibrillation/flutter (14%) and chronic ischaemic heart disease (13%).

Hancock et al (2013):ⁱⁱⁱ A survey of 405 residents of 33 care homes in the North East of England reported that 22.8% of residents had heart failure. The majority of residents diagnosed with heart failure during the study were previously undiagnosed, and of those that were previously recorded, three-quarters had been misdiagnosed. There was no statistically significant difference in the rates of heart failure between nursing home and residential home residents. The study also reviewed GP records to identify recorded co-morbidities; hypertension 48.4%, osteoarthritis 35.6%, cognitive impairment 30.3%, diabetes 18.8%, ischaemic heart disease 18.5%, atrial fibrillation 16.8%, COPD 10.0% and myocardial infarction 8.0%. The mean number of co-morbidities was three with a range from one to seven.

Centre for Policy on Aging (2012)^{iv}: A survey of Bupa care home residents (n=12,724) reported that the vast majority of admissions to care homes were for long term care (94.3%), but that individuals were also admitted for respite care (2.7%), end of life care (1.8%) and rehabilitation or intermediate care (1.2%). The two main reasons for admission were frailty (51% of admissions) and dementia care (41%).

The survey identified a higher prevalence of dementia amongst care homes residents than amongst those living in the community. The rate was much higher amongst care home residents for all age groups, with the exception of those over 95 years of age (*Table 1*). Within the UK, the prevalence of dementia amongst care home residents has increased from 36% in 2003, to 46% in 2012. It is not known whether this is due to a true increase in prevalence, or an improvement in diagnosis and recording since 2003.

Table 1: Prevalence rates of dementia amongst community and care home residents in the UK

	Proportion with dementia (%) by age group					
	<65 years	65-74 years	75-84 years	85-94 years	95+ years	All ages
Community residents*	0-0.16	1.3-2.9	5.9-12.2	20.3-28.6	32.5	1.1
Care home residents	16.8	44.3	52.6	47.4	35.8	45.6

*Prevalence rates derived from Knapp et al (2007) and the ranges demonstrate the prevalence in the first 5-year age period and last 5-year age period for each age group

The prevalence of depression amongst care home residents ranged from 6-11% and decreased with age (*Table 2*). The 2012 census reported a decrease in the proportion of care homes residents with dementia compared to the previous survey in 2009, and this was observed across all age groups.

Table 2: Prevalence rates of depression amongst care home residents in the UK

	Proportion with depression (%) by age group				
	<65 years	65-74 years	75-84 years	85-94 years	95+ years
Care home residents	10.9	9.8	8.7	7.4	5.8

The prevalence of stroke amongst care home residents was 15.9%, and this decreased with age (*Table 3*). The prevalence of stroke had decreased from approximately 22% in 2003 to 16% in 2012.

Table 3: Prevalence rates of stroke amongst care home residents in the UK

	Proportion with stroke (%) by age group					All ages
	<65 years	65-74 years	75-84 years	85-94 years	95+ years	
Care home residents	20.4	18.8	17.2	14.3	12.1	15.9

Other findings reported by the survey were:

- 56.4% of care home residents had dual incontinence, 13.3% were urinary incontinent only, 1.7% were faecal incontinent only, and 28.6% were continent
- 9.7% of residents had been diagnosed with diabetes
- 9.4% of residents had been diagnosed with heart disease
- 5.7% of residents had sight problems and 2.7% had hearing problems
- 5.3% of residents had been diagnosed with cancer
- 4.2% had been diagnosed with lung/chest illness

A previous version of the survey undertaken in 2009 reported that 18% of residents had arthritis and 9% osteoporosis.

Devine and May (2012)^v: A survey of 170 residents registered with four GP practices in Derbyshire reported the prevalence of conditions recorded in primary care. Prevalence was presented by GP practice:

- 67% of care homes residents had dementia (with a range between care homes of 42-86%)
- 35% of care homes residents had chronic kidney disease (with a range between care homes of 24-50%)
- 34% of care home residents had hypertension (with a range between care homes of 16-56%)
- 25% of care home residents had a diagnosis of stroke (with a range between care homes of 14-30%)
- 17% of care homes residents are in need of palliative care (with a range between care homes of 12-19%)
- 15% of care home residents had atrial fibrillation (with a range between care homes of 6-30%)
- 13% of care home residents had a diagnosis of cancer (with a range between care homes of 4-26%)
- 13% of care home residents had a diagnosis of hypothyroidism (with a range between care homes of 8-16%)
- 12% of care home residents had coronary heart disease (with a range between care homes of 8-16%)
- 11% of care home residents had chronic obstructive pulmonary disease (with a range between care homes of 4-18%)
- 11% of care home residents had epilepsy (with a range between care homes of 4-24%)
- 10% of care home residents had diabetes (with a range between care homes of 5-16%)
- 10% of care home residents had a serious mental illness (with a range between care homes of 0-18%)
- 8% of care home residents smoked (with a range between care homes of 0-20%)
- 7% of care home residents were obese (with a range between care homes of 4-10%)
- 7% of care home residents had heart failure (with a range between care homes of 0-8%)
- 5% of care home residents had learning disabilities (with a range between care homes of 0-10%)
- 4% of care home residents had asthma (with a range between care homes of 0-6%)

Participants had a median of three medical conditions, with the range being from 0 to 7.

Horner et al (2012)^{vi}: A survey of 238 residents in care homes in Leeds reported a prevalence of MRSA colonisation of 20%.

Onder et al (2012)^{vii}: A survey of 507 residents from nine care home facilities in the UK, reported that 35.7% had mild/moderate cognitive impairment and 28.6% had severe impairment, 32.0% had depression, 14.2% had a history of falls, 10.7% had pressure ulcers and 79.3% were incontinent.

Healthcare Associated Infections (HALT) study (2011, 2012)^{viii ix}: Residents of care home facilities are at higher risk for the acquisition and development of healthcare associated infections and antimicrobial resistant micro-organisms. They often receive antimicrobial therapy for acute and chronic infections and have multiple admissions and earlier discharge to and from acute care hospitals, which increase the risk of import of resistant micro-organisms to the care home. Nursing home facilities in Wales and Scotland have recently participated in a European-wide study to assess the prevalence of healthcare associated infections in long term care facilities.

Nineteen care homes in Wales (n=819) participated in the study and reported a crude prevalence rate of infection of 6.1% (range between homes was 0-26%), based on signs and symptoms of infection. When the McGeer infection definitions were applied, the prevalence of infection reduced to 3.2%. Using signs and symptoms of infection, the commonest site of infection was urinary tract (however the majority of these did not meet the McGeer definition of infection), followed by respiratory and skin/soft tissue infections.

Within Scotland, 83 care homes participated in the study (n=4,870) and reported a crude prevalence rate of infection of 6.0%, based on signs and symptoms of infection. Using the McGeer definition of infection, the prevalence of infection reduced to 2.3% (range between homes was 0-10.9%). The most common infection types were urinary tract (52.7% of infections), respiratory tract (19.4%) and skin/soft tissue (15.5%). Based on univariate analysis, the authors reported that residents who were non-ambulant, incontinent, had a urinary catheter in situ or had pressure sores or other wounds were at significantly higher risk of having an infection.

The prevalence of antimicrobial use was 7.1% amongst the care homes in Wales that participated in the study (range between care homes was 0-26%), with a similar prevalence of 7.3% reported by the care homes in Scotland (range 0-27.8%).

Additional data reported by the study was:

- 67% of residents in the care homes in Wales and 40% of residents in the care homes in Scotland were non-ambulant
- 55% of residents in the care homes in Wales and 63% of residents in the care homes in Scotland were disorientated
- 78% of residents in the care homes in Wales and 67% of residents in the care homes in Scotland were incontinent

Lingard (2011)^x: A Health Needs Assessment of NHS-funded nursing home residents (n=230) in South Tyneside extracted patient data from GP practices to identify the prevalence of a number of conditions:

- 63% of residents had been diagnosed with dementia
- 43% of residents had been diagnosed with a neurological condition (such as stroke, Parkinson's disease and epilepsy)
- 42% of residents had problems with swallowing, and 58% exhibited weight loss, malnutrition and dehydration. In turn feeding problems led to other disorders such as inhalation of foreign bodies and aspiration pneumonias
- 40% of residents had been diagnosed with cardiovascular conditions
- 36% of residents had been diagnosed with hypertension
- 34% of residents had been diagnosed with respiratory conditions such as COPD, asthma
- Falls were documented for 23% of residents, with 18% having suffered a fractured hip

- 23% of residents had musculoskeletal conditions, such as rheumatoid arthritis, osteoarthritis and back pain
- 19% of residents had been diagnosed with diabetes
- 17% of residents had been diagnosed with depression
- 15% of residents had been diagnosed with hypothyroidism
- 13% of residents had been diagnosed with anxiety disorders
- 12% of residents had hearing problems and 7% of residents had vision loss
- 7% of residents had been diagnosed with “more complex mental health conditions requiring closer monitoring”, such as bipolar disorder

The author states that the reported prevalence is likely to be an underestimate of the true prevalence for the majority of conditions. Patients who were not included in the prevalence rates were identified through prescribing data thus suggesting under-recording on disease registers.

The HNA also reported that age-standardised mortality rates were approximately 10 times higher for nursing home residents compared to the non-nursing home population. The main causes of death were dementia (22% of all deaths), cardiovascular disease (21%) and respiratory disease (8%).

In addition, the HNA reported that 77% of residents had a combination of 3 or more long term conditions Ragubeer and Jerrams (2011)^{xi}: A survey of 630 residents in seventeen nursing, residential and mental health homes using the Malnutrition Universal Screening Tool (MUST) identified 17% of residents as being at medium risk of malnutrition, and 24% as being at high risk.

Shah et al (2011)^{xii}: A large study of care home residents (n=10,387) used GP practice records to compare the disease prevalence among care home residents compared to individuals aged 65 years and over and resident in the community. The authors calculated age- and sex-standardised rates of disease, but did not calculate whether the differences between disease rates were statistically significant or not. Care home residents were reported to have higher rates of stroke/TIA (17.9% vs 6.3%), ischaemic stroke (10.3% vs 3.3%) and dementia (41.0% vs 3.7%). Care home residents were found to have lower rates of hypertension compared to the community population (42.8% vs 56.1%). There were similar rates of coronary heart disease (19.1% vs 20.2%), myocardial infarction (3.0% vs 2.5%), heart failure with left ventricular dysfunction (3.5% vs 3.8%), atrial fibrillation (13.4% vs 12.1%), diabetes (13.5% vs 11.2%) and hypothyroidism (12.0% vs 11.0%) between care home residents and community population. As the study was based on primary care records, only individuals who had had their condition diagnosed and recorded were included.

Cowman et al (2010)^{xiii}: A cross sectional survey of 3,239 residents in 60 randomly selected care homes in Ireland reported a prevalence of stroke of 18%. The majority had had their stroke prior to admission to the care home, with only 1% of residents having had a stroke since admission.

Diabetes UK (2010)^{xiv}: A survey of approximately 180 NHS, local authority and private care homes reported that 13% of residents had diabetes. However, the survey also reported that only 23% of care homes reported screening residents for diabetes on admission, and only 28% reported screening residents on an annual basis. It is therefore very likely that the true prevalence of diabetes amongst care home residents is higher.

Wild et al (2010): A survey 151 residents in 4 care homes (3 residential and 1 nursing home) reported the prevalence amongst residents of dementia was 42.4%(range between homes of 18-68%), prevalence of depression was 38.4% (range 23-50%) and prevalence of mobility issues was 75.8% (range 53.8-100%). There was a higher proportion of residents with mobility issues in the nursing home compared to the residential home.^{xv}

Baldwin (2009)^{xvi}: A survey of 1,111 residents from 45 nursing homes in Northern Ireland reported a prevalence rate of MRSA colonisation amongst residents of 23.3% (with a range between nursing homes of 0-73%). The MRSA carriage rate amongst staff was 7.5% (with a range between nursing homes of 0-28%).

Rooney et al (2009)^{xvii}: A survey of 294 residents from sixteen private nursing homes in Northern Ireland reported faecal carriage rates of multi-drug resistant E. coli of 40.5% (range 0-75% between care homes) compared to community rates of approximately 1%. This highlights the importance of care home residents as a reservoir population for infections, and that public health measures to combat spread of these organisms needs to consider this population group. Multivariate analysis concluded that days of fluoroquinolone use and history of urinary tract infection were significantly associated with carriage.

Carter (2008)^{xviii}: A survey of 250 residents from 52 randomly selected residential care homes in Kent reported a prevalence of chronic kidney disease (CKD) of 83%. The prevalence of CKD amongst elderly (>80 years) individuals living in the community was estimated to be approximately 30%. Clinical histories were reviewed to identify co-morbidities, with the most common being: vascular disease 78.4% (hypertension 51.2%, cardiovascular disease 43.2%, stroke 26.0%), dementia 25.6%, joint replacement 21.2%, osteoporosis 20.0%, thyroid disease 20.0% and diabetes 17.6%.

Rodriguez et al (2007)^{xix}: A survey of 1,869 residents in 66 care homes across Birmingham reported that 31% of residents had dual incontinence, 29% had urinary incontinence and 4% were faecally incontinent. The total rate of incontinence was considerably higher amongst nursing home residents compared to residential home residents (80% vs 49% respectively). The survey also reported that more than half of all residents had mobility issues (56%), with 15% of residents bed-bound.

Aspray et al (2006)^{xx}: a survey of 1,275 residents in 68 care homes in Newcastle reported a recorded prevalence of diagnosed diabetes of 12.7%. Following screening, the overall prevalence of diabetes increased to 19.9%.

Sinclair et al (2001)^{xxi}: A survey of 636 residents in 30 care homes in Birmingham reported a recorded prevalence of diabetes of 12.0. Following screening, the total prevalence increased to 26.7%.

Hospitalisation Rates and Reasons for Hospitalisation

A total of 9 studies were identified that assessed the rates and reasons for hospitalisation among care home residents in the UK and Ireland. The studies are summarised below in chronological order.

Briggs (2013)^{xxii} the study reviewed use of the Emergency Department by care home residents at a hospital in Ireland over an 18-week period. The most frequent reasons for ED use were pneumonia (29%), falls (17%) and urinary tract infection (8%). The admission rate was 70%, with individuals with a diagnosis of urinary tract infection or pneumonia significantly more likely to be admitted. More than half (55%) of ED visits were deemed potentially preventable. The decision to refer an individual to a hospital was often made by an out-of-hours GP who was not familiar with the patient. Referrals by out-of-hours GPs led to individuals attending outside normal working hours with more limited access to specialist geriatric services and palliative care advice.

Romero-Ortuno (2012)^{xxiii} this study reviewed acute medical admissions by care home residents to a hospital in Ireland over an eight year period. The most common reasons for admissions were disorders of the respiratory system (accounting for 26.9% of admissions), nervous system (16.9%), circulatory system (15.7%), digestive system (9.2%) and kidney and urinary tract (8.9%). Compared to non-nursing home patients aged 65 years and over, nursing home residents were significantly more likely to be admitted for disorders of the kidney and urinary tract, and significantly less likely to be admitted for disorders of the circulatory system.

Girio-Fragkoulakis (2011):^{xxiv} this study reviewed all admissions of patients aged 65 years and above to a large Emergency Department in Sheffield over a six-month period. Patients were identified as either living in a care home or residing in the community. Care home residents were significantly more likely to have arrived at the Emergency Department by ambulance and be admitted to hospital than individuals not residing in a care home. In addition, care home residents were significantly more likely to present with a fall or other acute medical condition compared to non-care home residents. The authors suggest that that majority of attendances at Emergency Department by care home residents may therefore be appropriate (based on the higher rate of admissions) and could reflect the higher number of co-morbidities and more frail nature of care home residents.

Lingard (2011):^x this health needs assessment reviewed secondary care use by residents of care homes in South Tyneside over a one year period. Age-standardised rates of admission were 16% higher for nursing home residents compared to the non-nursing home population aged over 65 years, but this difference was not significant. The most common reasons for admissions included respiratory infections (14% of all admissions), swallowing and nutrition problems (7%), gastrointestinal bleeds (4%), urinary tract infections (4%) and hip fractures (4%). Age-standardised rates of A&E attendance were 124% higher for nursing home residents compared to the non-nursing home population aged over 65 years, and this was statistically significant.

Quinn (2011):^{xxv} this study reviewed admissions from care home residents to a hospital in Glasgow. The study was limited due to the small number of admissions reviewed (n=83). There were no reported significant differences in the rates of admission between care home residents and controls aged 65 and over who lived in the community for sepsis (pneumonia and urinary tract infection), fracture, falls without fracture, dehydration, chest pain or gastrointestinal bleed. However the study did report that readmissions were significantly higher amongst care home residents. The authors also reported that 56% of admissions could have been managed in the community, but this was not significantly different to the proportion of admissions amongst controls that were potentially avoidable (58%).

Mitchell and Young (2010):^{xxvi} this study reviewed all attendances by care home residents to an Emergency Department in Paisley, Scotland over a twelve month period. Over this period, care home residents comprised 1.3% of all attendances. The vast majority (84%) arrived at the Emergency Department by ambulance. Almost half (46%) of all attendances occurred out-of-hours. The main diagnoses for attendance were trauma (37% of attendances), respiratory conditions (11%), cardiovascular complaints (11%) and gastrointestinal complaints (9%). Of care home residents who attended the Emergency Department, 57% were admitted to hospital, a similar admission rate to the population aged 65 years and above (59%).

Carter (2009):^{xxvii} the authors reviewed all attendances from care homes to the Emergency Department at a hospital in Scotland over a one month period. The most common reasons for attendance were orthopaedic injuries, soft tissue injuries, respiratory tract infections and falls. Of all attendances by care home residents, 68% occurred out of hours. The authors concluded that approximately 40% of attendances could have been managed within the care home and that communication between care homes and the Emergency Department were poor.

Bowman et al (2001):^{xxviii} the study reviewed admissions from care home residents to acute hospital care in England over a one year period. Only a small number of admissions were reviewed (n=57), and the reasons for admissions were neurological/psychiatric (n=25, including stroke, acute confusion, parkinsonism, fall/deterioration and depression), infection (n=16, with the most common sites of infection being chest and urinary tract), cardiovascular (n=11, including chronic heart failure and arrhythmia) gastrointestinal/metabolic (n=10, including diabetes, diarrhoea, dehydration and haematemesis), anaemia (n=1) and malignancy (n=1).

Godden and Pollock (2001):^{xxix} the study reviewed acute hospital admissions from care home residents in London over a one year period. Emergency admission rates were significantly higher amongst care home residents than admissions from community-living elderly people (with a relative risk of 1.39), and there were significantly higher admission rates from residential homes compared to nursing homes (relative risk of 1.40).

The authors suggest that when the level of nursing input increases within a care home environment, the rate of emergency admissions to hospitals fall. Highest rates of admission from care homes were for diseases of the respiratory system, injuries (including fractured neck of femur) and diseases of the digestive system. The relative risk of admission from a care home compared to the community-living population was significantly higher for fracture neck of femur (relative risk of 3.96), diseases of the respiratory system (relative risk of 1.88), diseases of the digestive system (relative risk of 1.66), stroke (relative risk of 2.02) and diseases of the skin (relative risk of 1.87).

Interventions to reduce hospitalisation rates

A total of 28 studies were identified that assessed the effectiveness of interventions at reducing hospitalisation rates amongst care home residents. The studies are summarised below, listed by topic.

End of Life Care

Robinson (2012):^{xxx} this systematic review assessed the effectiveness of advance care planning interventions for care home residents with cognitive impairment and dementia, and identified two studies that measured hospital admission rates. Both studies reported a significant reduction in hospital admissions. The authors however report that the quality of the studies was variable, and a meta-analysis could not be undertaken due to heterogeneity between the studies. The authors conclude that there is some evidence that ACP has the potential to reduce hospital admissions amongst care home residents with cognitive impairment.

Hall (2011):^{xxxi} this systematic review assessed the effectiveness of interventions for improving palliative care for care home residents, and identified a single study that monitored hospital admissions as a secondary outcome. The study (n=205) used a structured interview to identify care home residents suitable for palliative care provision, with a subsequent recommendation to the individual's physician to refer them to specialist palliative care provision in a hospice setting. The study reported that residents in the intervention group had significantly lower mean number of hospital admissions and days in hospital. Furthermore, almost all of the hospital admissions in the control group occurred when the participant was not enrolled in the hospice. The results may have been affected by bias as the allocation was not concealed and the study was not blinded to participants or researchers.

Caplan (2006):^{xxxii} this intervention study assessed the effectiveness of an advance care directive programme on reducing hospital admissions. The intervention utilised a clinical nurse consultant to educate staff, residents, families and general practitioners about the terminal nature of dementia, advance care planning and hospital in the home. The authors reported a progressive decrease in care home residents being admitted in the intervention group of care homes, whereas there was an increase amongst control nursing homes. Over the course of four years, the annual rate of admissions in the intervention care home group reduced from being significantly higher than the control care groups, to being significantly lower.

Integrated Working

Integrated working projects, often known as hospital at home or virtual wards, have been developed due to the increased demand for hospital beds and attempts to reduce avoidable admissions. Schemes often target elderly populations, and a recent systematic review identified a number of different models of care, for patients living in the community with a wide range of conditions.^{xxxiii}

Boorsma (2011).^{xxxiv} this randomised controlled trial assessed the effectiveness of a multidisciplinary integrated care scheme in reducing hospital admissions among care home residents. The intervention consisted of geriatric assessment of functional health every three months, individualised care plans, discussion of preferred outcomes and care priorities with a family physician and the resident and their family and monthly multidisciplinary meetings to discuss residents with complex needs. Hospital admissions were a secondary outcome within the study. The authors reported that the intervention resulted in improved quality of care for elderly people in residential care facilities compared to usual care, however there was no difference in the number of hospital admissions between the study groups. An associated cost-effectiveness analysis reported that the multidisciplinary integrated care scheme resulted in higher short term costs, however the analysis only followed residents up for six months and therefore did not assess possible longer term economic benefits.^{xxxv}

Davies (2011).^{xxxvi} this systematic review assessed the effectiveness of integrated working between primary healthcare professionals and care home staff on reducing hospital admissions. The authors identified three studies (only one of which was a controlled study) that included hospitalisation as an outcome measure. Due to heterogeneity between the studies then data was not pooled. Interventions included the use of interdisciplinary teams within care homes, including the use of nursing staff and physiotherapists to support primary care physicians in providing healthcare to care homes. Strategies included multidisciplinary team meetings, staff training and use of clinical guidelines. The three studies reported that use of integrated care teams reduced avoidable hospital admissions. However the authors conclude that firm conclusions cannot be reached yet due to the limited scope of the evidence-base.

Codde (2010).^{xxxvii} this intervention study assessed the impact of an enhanced primary care service on Emergency Department use by care home residents. The intervention consisted of provision of a nurse-based service that care home staff, GPs and hospital staff could refer to. The nurses had prior Emergency Department training, and all episodes of care provided by the nurses was reviewed by a supervising GP. The author reviewed admissions before and after the intervention, adjusted for seasonality. The service was associated with a 15% reduction in number of Emergency Department transfers, and this reduction was significant.

Foster (2012).^{xxxviii} this study has not yet published results but is designed to assess the effectiveness of a structured multi-disciplinary team and gerontology nurse specialist on reducing avoidable admissions amongst care homes.

Medication Reviews

Allred (2013).^{xxxix} this systematic review assessed the effectiveness of interventions to optimise prescribing for older people in care homes. The authors identified four studies that reviewed hospital admissions as an outcome measure. Interventions included medication reviews by pharmacists, case conferencing and staff education sessions. Results were not pooled due to heterogeneity between the studies. None of the studies reported significant reductions in hospital admissions. The authors concluded that there was no evidence that the interventions reduced hospital admission rates.

Lapane (2011).^{xl} this study assessed the effectiveness of a clinical informatics tool in reducing the incidence of delirium, falls, hospitalisations and mortality amongst care home residents. The tool identified care home residents at risk of delirium and falls to allow pharmacists and nursing staff to implement proactive monitoring plans. There was no significant difference in the rate of hospitalisations between the intervention and the control groups.

Burns (2000).^{xli} this cost analysis based on a randomised controlled trial included in Allred 2013, assessed the cost effectiveness of a single medication review by a pharmacist. Costs were only calculated over a 4 month period following the review. The authors conclude that a single medication review has the

potential for cost savings, primarily through a reduction in the costs of drugs and hospitalisations although due to the short follow-up period it is not known how frequently medication reviews should take place.

Falls and hip fractures: Falls Prevention Interventions

Cameron et al (2013).^{xlii} this systematic review assessed the effectiveness of interventions designed to reduce the incidence of falls in older people in care facilities and hospitals. The authors reviewed 43 trials (n=30,373) completed in care homes and reported that:

- vitamin D supplementation is effective at reducing the incidence of falls, with pooled data from five studies (n=4,603) showing a significant reduction. The average serum vitamin D levels of participants were low in all six studies and therefore these results may only be applicable to individuals with low serum vitamin D levels. Four studies reported the number of participants reporting a fracture, with none showing a significant reduction. Data was not pooled as different fracture sites were reported by the trials.
- results from exercise intervention trials were inconsistent and overall did not show a benefit. Exercise interventions included gait, balance and functional training and Tai Chi. Pooled data from eight studies (n=1,844) showed no significant difference in the rate of falling, or in the risk of falling. Sub-group analysis by level of care suggested that participants with greater disability may be less likely to benefit from exercise interventions.
- interventions targeting multiple risk factors may be effective at reducing the number of falls. An initial assessment was made by one or more health professionals and then interventions are tailored depending on the individual's risk profile. The intervention components varied between studies, however pooled data from seven studies (n=2,876) showed a possible benefit in the rate of falls, but the evidence was not conclusive.
- two studies that assessed medication reviews provided conflicting evidence in effectiveness at reducing the incidence of falls. Data were not pooled due to substantial heterogeneity. One study (n=334) reported that the use of monthly medication reviews by a pharmacist, targeting psychoactive medication prescribing, resulted in a significant reduction in use of medication, but a significant increase in the incidence of falls. The other study (n=661) reported that a single medication review by a pharmacist was associated with a significant reduction in the rate of falls.
- a single study (n=43) tested a wireless position-monitoring device and found no significant reduction in the rate of falls
- five studies that trained staff on falls and fracture prevention, implemented a falls guideline or used a risk assessment tool alongside nurses' judgement were not effective at reducing the incidence of falls

Other studies identified by the authors reported that use of lavender patches to achieve olfactory stimulation, increased sunlight exposure and multisensory stimulation did not reduce the incidence of falls amongst care home residents.

Sawka (2010).^{xliii} this systematic review assessed the effectiveness of interventions to reduce the risk of hip fracture amongst nursing home residents. There was significant overlap between the studies included in this review and that undertaken by Cameron et al (2013), but the aim of the two reviews were different and therefore both have been included in this literature review. The authors reported that:

- Pooled data for seven trials (n=12,875) suggested that oral vitamin D can significantly reduce the risk of hip fracture, with the largest reduction amongst studies that used vitamin D₃ at a dosage at ≥ 800 IU/day.
- Pooled data from two studies (n=522) that used 15 minutes of daily sunlight exposure as a form of vitamin D treatment did not significantly reduce the risk of hip fracture
- A single study that compared oral fluoride to placebo (n=981) did not significantly reduce the risk of hip fractures
- three studies of exercise or multimodal interventions all reduced the rate of falls, and a single multimodal study reported a significant reduction in the risk of hip fracture

- pooled data from five studies (n=2,594) suggested that hip protectors can significantly reduce the risk of hip fractures amongst care home residents. The authors also summarise the results of a large study that was not included in the systematic review. The results from this study contradicted their results and suggested that hip protectors are not effective at reducing hip fractures.

Becker (2011).^{xliv} this trial assessed the effectiveness of a multimodal intervention on reducing femoral fractures amongst care home residents. Components of the multimodal intervention included staff education on fall and fracture prevention strategies, strength and balance training, advice on environmental adaptations and medicine reviews (including the recommendation for prescribing vitamin D). The study recruited 256 nursing homes (n=13,653) who had been involved in previous falls prevention studies, and the control group consisted of 893 nursing homes (n=31,668). Within the control group, “change agents”, mostly senior nursing staff, were responsible for cascading information on falls and fracture prevention within the care homes. There had been no difference in femoral fracture rates in the intervention and control groups, but in the year following introduction of the programme, there was a significant reduction in femoral fractures in the intervention group, with a stronger effect observed amongst women, compared to men. An associated cost-effectiveness study reported that the incremental cost effectiveness ratio associated with the intervention was €7,481 per year free of femoral fracture. Following sensitivity analyses, the probability of an ICER<€50,000 per year free of femoral fracture was 83%.^{xlv}

Gregersen (2011).^{xlvi} this study assessed the effectiveness of a tailor-made hospital-at-home intervention for nursing home residents admitted with a hip fracture. The intervention comprised a number of visits to the patient over a 30 day period (the number of visits was dependent on individuals’ needs) by a physician, nurse and/or physiotherapist. Compared to a standardised hospital-at-home method, the tailor-made method significantly reduced 30 day mortality and 90 day readmission rates.

Falls and Hip Fractures: Hip Protectors

The effectiveness of hip protectors in reducing the incidence of hip fractures has been a point of great debate in the literature. Their use amongst the elderly was advocated in early systematic reviews and published studies.^{xlvii xlviii} However, more recent evidence has suggested that their effectiveness in care home residents was less certain than originally believed^{xlix}, although some authors continued to advocate their use.^l

Gillespie (2011):^{li} this is the most recent systematic review to assess the effectiveness of hip protectors in preventing hip fractures. The authors pooled data from thirteen studies investigating the use of hip protectors amongst care home residents. There was a small significant reduction in hip fractures amongst those who used hip protectors (risk ratio 0.81, 95% confidence interval 0.66 to 0.99), but this result became non-significant when five studies assessed by the authors as being at high risk of bias were excluded (relative risk 0.93, 95% confidence intervals 0.74 to 1.18). The authors conclude that the effectiveness of hip protectors in reducing the incidence of hip fractures amongst care home residents remains unclear. They also state that acceptance and adherence by care home residents may be poor.

Respiratory infections: Oral Hygiene

Sjogren (2008)^{lii}: this systematic review considered the effect of enhanced oral hygiene on pneumonia and respiratory infection among elderly people in hospitals and care homes. The review identified two studies but data was not pooled due to heterogeneity between the studies. In one trial (n=88), the intervention group received weekly professional oral health care, and the mortality rate from pneumonia was lower in the intervention group, but this reduction was not significant. In the other trial (n=366) the intervention group received oral care given by caregiver after each meal, in addition to weekly professional oral health care. The authors reported lower rates of pneumonia and death from pneumonia in the intervention arm,

but only the reduction in mortality was significant. The authors concluded that enhanced oral care may reduce respiratory infections in care home residents.

Respiratory Infections: Use of clinical pathways

Loeb (2006):^{liii} this randomised controlled trial (n=680) assessed the effectiveness and cost-effectiveness of a clinical pathway for treating nursing home residents with pneumonia and other lower respiratory tract infections on-site in the nursing home, rather than admitting them to hospital. Enrolment took place in twenty two nursing homes, with each home having a minimum of 100 beds. A clinical pathway had been previously developed, and in the intervention group a study nurse clinically assessed patients with lower respiratory tract infections according to the clinical pathway, and determined whether the patient was eligible for on-site treatment or required admission to hospital. In the control group patients received usual care with determination as to whether the patient required hospitalising being made by physician and nursing home staff. The primary outcome measure was hospitalisation rates, and a significantly lower rate of hospitalisation was observed in the intervention group. There was also a significantly lower mean number of days of hospitalisation per resident reported in the intervention group. There was no difference in mortality rates or rates of adverse events observed between the groups. In the economic analysis, the authors estimated that implementation of the clinical pathway saved an average of \$1016 per resident.

Respiratory infections: Vitamin E Supplements

Meydani (2004)^{liv}: this study assessed the effectiveness of vitamin E supplements on the incidence of respiratory tract infections in care home residents. Participants (n=617) were randomised to receive a daily dose of vitamin E or placebo capsule for a year. There was no significant difference in the incidence or duration of respiratory infections between the study groups.

Respiratory Infections: Influenza and Pneumococcal Vaccination

Within the UK, the Department of Health recommends that all care home residents are annually vaccinated against influenza and pneumococcal infection.^{lv} In addition, it is recommended that health and social care workers with direct patient contact receive annual influenza vaccination to reduce rates of illness, hospitalisation and mortality amongst vulnerable individuals that they are caring for.^{lvi} A detailed search of the evidence for the effectiveness of vaccinating care home residents or healthcare workers was therefore not undertaken, with the focus rather on interventions that increased uptake of vaccination amongst care home staff or residents.

Gaughran (2007):^{lvii} this randomised controlled trial (n=276) assessed the effectiveness of administering a booster influenza vaccination to care home residents who were insufficiently sero-protected after initial vaccination. The authors reported that providing a booster vaccination did not reduce hospitalisation in the study group. The study was undertaken in a year when there was limited seasonal influenza in circulation, and therefore the benefit of adopting a booster vaccination strategy when influenza is more prevalent is uncertain.

Music (2011):^{lviii} this review summarised four studies and the author identified the following barriers and motivators to influenza vaccination amongst care home workers:

Barriers to Healthcare worker vaccination	Motivators for healthcare worker vaccination
Perception of vaccine efficiency	Vaccinated previously
Fear of side effects	Easy access to free vaccine
Belief vaccine should be used for people at higher risk	Aged over 45 years
Misperception of influenza illness risks and transmission to patients	Understanding of influenza as a serious illness
Fear of injections	Understanding vaccine does not cause influenza
Lack of time	Personal protection
Lack of (or perceived lack of) conveniently available	

Lam (2010):^{lix} this systematic review identified five studies conducted in long-term care facilities that assessed the effectiveness of campaigns to increase influenza vaccination rates amongst health care workers in the care facilities. A range of staff were included in the studies, including physicians, nurses, nursing assistants, housekeeping staff and administrators. Various types of campaign strategies were utilised, including education of promotion, improved access to the vaccine, regulation and role models. Campaign components were often used in combination. Results from studies were not pooled due to study heterogeneity. Eight out of the nine campaigns undertaken in the studies reported a significant increase in the proportion of healthcare workers receiving influenza vaccine in the intervention groups. Campaigns that only involved education or promotion reported smaller increases in vaccination rates compared to campaigns that had multiple components.

Looijmans-van der Akker (2010):^{lix} this cluster randomised controlled trial assessed the effectiveness of a multi-component program to increase uptake of influenza vaccine amongst health care workers in care homes. Thirty-six care homes (n=6,636) were allocated to either a control or intervention arm. The intervention consisted of outreach visits to the nursing homes by study staff, one-hour information sessions for staff and appointment of a local programme co-ordinator to and promote vaccination. Only homes that offered routine influenza vaccination to their staff were eligible for inclusion in the study. Vaccine uptake rates were significantly higher in the intervention group than in the control group, with 25% of healthcare workers in the intervention group being vaccinated, compared to 16% in the control group. There was considerable variation in vaccination rates between individual care homes.

Chen (2010):^{lxi} this randomised control trial assessed the effectiveness of a multi-interventional programme to increase vaccination amongst care home workers (n=1,419). Components of the programme included staff information sessions, a telephone consultation service and vaccine promotion sessions prior to administration. Care homes were randomised to receive either the intervention or undertake usual practice. Both care homes groups reported a significant increase in vaccination rates compared to the previous year, and there was no significant difference in vaccination rates between the intervention and control groups. Factors identified as influencing vaccination rates amongst care home staff included a belief that the vaccine was effective, between 1 and 10 years of service and providing direct care to residents.

Nace (2011):^{lxii} this randomised controlled study assessed the effectiveness of staff training to increase the influenza and pneumococcal vaccination rates amongst care home residents and influenza vaccination rates of healthcare workers. Six care homes were selected to receive a written toolkit and shared information through email. In addition, three of the homes were randomly selected to participate in a one-off training session. The authors reported that the care homes within the intervention group increased pneumococcal vaccination rates by 29.9% over a one year period, and the control group saw a 13.9% reduction in vaccination rates. There was a 4.0% increase in influenza vaccination rates amongst residents in the intervention group, compared to a 20.8% reduction in the control group. Finally, there was a 10.9% increase in influenza vaccination rates amongst health care workers in the intervention group, compared to a 3.5% reduction amongst control homes. No analysis is presented to determine whether these differences are significant.

Diabetes

No studies were identified that reviewed interventions to reduce hospitalisations amongst care home residents diagnosed with diabetes. However, Diabetes UK recommends that care homes should screen all new residents for diabetes on admission and screen all residents at two yearly intervals.^{lxiv} In addition, Diabetes UK have also published good practice guidelines on the management of care home residents

with diabetes, that focus on providing sufficient support for self-management and ensuring individualised care.^{lxiii}

Infection control

Liu (2006).^{lxiv} this randomised controlled study assessed the effectiveness of multivitamin and mineral supplementation on reducing infection rates amongst care home residents. Participants (n=763) were randomised to receive either a daily multivitamin and mineral supplementation tablet or placebo for 19 months. The primary outcome measure was number of infections per subject, and the authors reported that there was not a significant difference in the number of infectious periods between the study groups. There was also no reduction in hospital visits in the intervention group.

Multimorbidity

No studies specifically relating to managing care home residents with multi-morbidity were identified.

Smith (2012).^{lxv} this systematic review assessed the effectiveness of interventions designed to improve outcomes in patients with multimorbidity in primary care and community settings. The authors identified two community-based studies that reported statistically significant improvement in reducing hospital admissions, based on a small number of admissions. Four other studies reported no change in use of health services. No pooling of results was undertaken by the authors. Interventions were either organisational (for example case management, coordination of care and enhancement of skill mix in multidisciplinary teams) or patient orientated (dealing with patient health related behaviour).

Multiple Interventions

Ouslander (2011).^{lxvi} this study reviewed the effectiveness of the INTERACT II tool in reducing hospitalisation amongst care home residents. The tool comprises three main strategies; identifying, assessing and managing conditions proactively to prevent them from becoming severe enough to require hospitalisation, managing selected conditions in the nursing home when the resident does not meet specific criteria for hospitalisation and improving advance care planning. Hospitalisation rates were significantly reduced in all participating nursing homes, with the greatest reduction in rates observed in those care homes defined as most engaged with the tool. The hospitalisation rate was also reduced in comparison care homes, but this reduction was not significant.

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