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Marincowitz, C. orcid.org/0000-0003-3043-7564, Preston, L. orcid.org/0000-0001-7477-4517, Cantrell, A. orcid.org/0000-0003-0040-9853 et al. (3 more authors) (2022) Factors associated with increased Emergency Department transfer in older long-term care residents: a systematic review. The Lancet Healthy Longevity, 3 (6). e437-e447. ISSN 2666-7568

https://doi.org/10.1016/s2666-7568(22)00113-1

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Factors associated with increased Emergency Department transfer in older long-term care residents: a systematic review

Carl Marincowitz, Louise Preston, Anna Cantrell, Michael Tonkins, Lisa Sabir, Suzanne Mason

The proportion of adults older than 65 years is rapidly increasing. Care home residents in this age group have disproportionate rates of transfer to the Emergency Department (ED) and around 40% of attendances might be avoidable. We did a systematic review to identify factors that predict ED transfer from care homes. Six electronic databases were searched. Observational studies that provided estimates of association between ED attendance and variables at a resident or care home level were included. 26 primary studies met the inclusion criteria. Seven common domains of factors assessed for association with ED transfer were identified and within these domains, male sex, age, presence of specific comorbidities, polypharmacy, rural location, and care home quality rating were associated with likelihood of ED transfer. The identification of these factors provides useful information for policy makers and researchers intending to either develop interventions to reduce hospitalisations or use adjusted rates of hospitalisation as a care home quality indicator.

Lancet Healthy Longev 2022; 3: e437–47

Centre for Urgent and Emergency Care Research (CURE), Health Services Research (C Marincowitz PhD, M Tonkins MBChB, L Sabir MBBChir, Prof S Mason MD) **and Health Economics and Decision Science** (L Preston PhD, A Cantrell MA)**, School of Health and Related Research, University of Sheffield, Sheffield, UK**

Correspondence to: Dr Carl Marincowitz, Centre for Urgent and Emergency Care Research (CURE), Health Services Research, School of Health and Related Research, University of Sheffield, Sheffield S1 4DA, UK
c.marincowitz@sheffield.ac.uk

For the **study protocol** see https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=213068

See **Online** for appendix

Introduction

The proportion of the UK population older than 65 years and particularly older than 85 years is rapidly increasing. Around 2·8% of the population older than 65 years live in care homes, yet care home residents account for 6·5% of Emergency Department (ED) attendances and 8% of emergency admissions in this age group.[1] Although there is no uniform definition for appropriate transfer of residents to the ED, a systematic review found that inappropriate transfers ranged between 4% and 55%.[2] An estimated 41% of emergency admissions for care home residents in England are for conditions "potentially manageable, treatable or preventable outside of a hospital setting".[1] In the USA, nearly 20% of care home residents are discharged from the ED without diagnostic testing and a median of 33% of residents are hospitalised in the last month of life across health-care settings.[3,4] It is argued that, given the high mortality rate and harms associated with hospital admission including nosocomial infection and reduced functional level, urgent care pathways should focus on managing care home residents in the community.[5,6] However, once care home residents attend the ED, they are more likely to undergo diagnostic investigations and have prolonged inpatient admissions compared with other older patients.[7]

Up to nine-fold variation in ED attendance and hospital admission rates between care homes has been observed in the UK, other European countries, and the USA.[6,8,9] Identifying care home-level and resident-level factors that are associated with increased ED transfer might explain the reasons for this variability and identify potentially modifiable factors that could be targeted by interventions to reduce avoidable hospitalisations.

We aim to identify known factors that predict ED transfer from care homes and synthesise the existing evidence regarding their importance.

Methods

We report a systematic review conducted in accordance with PRISMA guidelines. The review is registered with the PROSPERO prospective register of systematic reviews (CRD42020213068) and the protocol is available online.

Search strategy and selection criteria

We searched the following electronic databases from Jan 1, 2000, to Oct 24, 2020, with results restricted to English language studies: Embase (via Ovid), MEDLINE (via Ovid), CINHAL Plus (via EBSCO), APA PsycInfo, Web of Science, and Scopus. The search strategy, including search terms, is reported in the appendix (pp 4–17). The search was repeated on April 4, 2022, to identify new relevant studies. A search for qualitative studies assessing factors that influence stakeholder decision making in transferring residents was completed concurrently (also on Oct 24, 2020), the results of which will be reported elsewhere.

We also conducted reference and citation searches of several national guidelines, reports, and reviews, including: UK National Institute for Health and Care Excellence quality standard 136 on transitions between hospital and care homes settings,[10] a Health Foundation report on hospital use by care home residents,[1] a Nuffield Trust report on inpatient admissions of care home residents,[6] and six previous relevant reviews.[2,4,11–14] All included studies' references and citations were searched.

Observational studies that provided cross-sectional or longitudinal data and estimates of association between ED attendance and predictive variables at a resident or care home level, conducted on care home residents 65 years or older or in care homes where most residents were 65 years or older, were included. A care home is defined as a residential setting specialised to meet personal or medical care needs to its residents, including both residential care homes and care homes with nursing care.

Studies conducted solely on care home residents with specific medical conditions or nursing needs (eg, patients with dementia or requiring palliative care) were excluded. Studies published before 2000 were excluded as they were conducted before the publication of key guidance

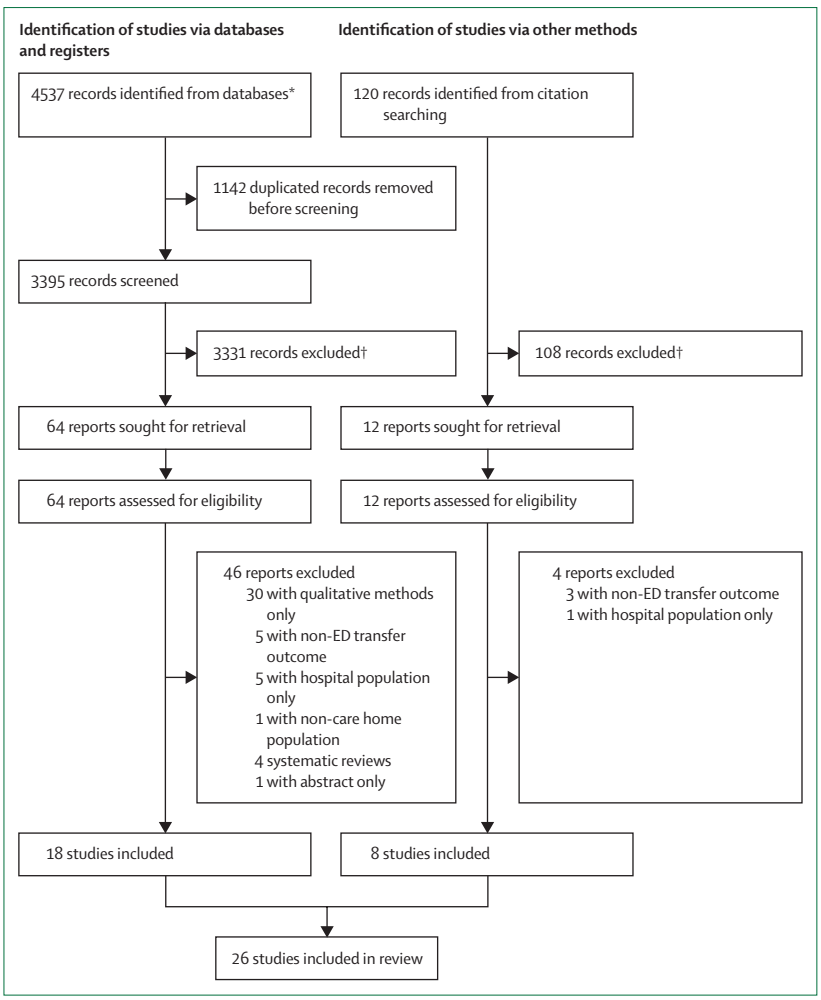

Figure: **PRISMA flow diagram for results of systematic search**
ED=Emergency Department. *The number of records identified from each database and search is reported in the appendix (pp 4–17). †Did not meet inclusion criteria on abstract and title screening (different study domain, different study population or outcome).

regarding the management of care home residents in the acute hospital setting.

Data extraction and analysis

Identified studies were stored in EndNote X9 and duplicates removed. Four reviewers (CM, MT, LS, and AC) independently completed title and abstract screening. Full reports of any studies that potentially met the inclusion criteria were selected and screened. Studies that did not meet the inclusion criteria were discarded with documented reasons. Disagreements were resolved through discussion.

All patient-level or care home-level factors potentially affecting the risk or rate of ED transfer were extracted and included in the analysis, provided that a quantitative estimate of effect was reported for a relevant outcome. Namely, the following data were extracted: study population, demographics, sample size, outcome, predictive factor assessed, and results of univariable or multivariable modelling. Outcome measures included measures of the number, proportion, or rate of care home residents being conveyed to the ED.

The NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used to assess the quality of included studies, particularly for the risk of bias.[15] 14 domains were assessed: study title, study population, participation rate, recruitment, sample size, time exposures measured, timeframe of the study, exposure measurement, times exposure assessed, outcome measurement, blinding of assessors, loss to follow-up, and adjustment for confounding factors.

Due to heterogeneity in study design and the statistical methods used to estimate the effect of care home and resident factors on ED conveyance, a narrative synthesis was completed. Common factors assessed in different studies were identified and grouped into themes. The effect of the theme across studies on likelihood of transfer to the ED was summarised with a description of the adjustment for other potentially predictive factors in multivariable modelling.

Results

Search results and study characteristics

The search strategy identified 4537 studies. Following removal of 1142 duplicates, 3395 studies underwent title and abstract screening (figure). In total, 60 primary studies[16–75] and four previous relevant systematic reviews[12–14,76] were retrieved. Citation and reference searching of the four reviews and included studies identified a further 120 studies for abstract and title screening, of which 12 were retrieved.[77–88] Overall, 72 primary studies and four systematic reviews were retrieved; 30 of these studies used qualitative methods and were considered for inclusion in an accompanying review.[18,19,21,22,26–29,31,32,37–40,44–46,51,54–56,58–61,66–70] The remaining 42 retrieved primary studies were considered for inclusion in this review.[16,17,20,23–25,30,33–36,41–43,47–50,52,53,57,62–65,71–75,77–88] Of the 42 retrieved primary studies, 26 met the inclusion criteria and four previous reviews formed part of the narrative synthesis.[12–14,16,24,25,30,33,35,36,41,42,47–50,53,57,62,74–76,78,79,81,83,84,86–88] The reasons for the exclusion of the 12 other studies, as well as the four studies excluded from the citation and referencing searching, are presented in the appendix (p 18).

Characteristics of the included primary studies and previous systematic reviews are reported in the appendix (pp 19–58). Overall, eight primary studies had a cross-sectional design,[24,25,30,33,48,49,79,83] 12 studies were retrospective cohort studies,[35,36,41,42,50,57,62,74,75,81,87,88] and two studies were prospective cohort studies.[16,78] Of the remaining included primary studies, two had an ecological study design assessing factors associated with ED transfer at a care home level[47,53] and one compared characteristics and ED attendances between rural and urban care homes using a range of regression techniques.[86] 15 included

primary studies used linked routinely collected administrative data.[30,35,36,41,42,48,50,53,62,74,75,81,86–88]

Of the included primary studies, 17 were conducted in North America (USA and Canada), three in Hong Kong or Taiwan, and six in European countries. No included studies were conducted in the UK.

A variety of statistical modelling methods were reported. Seven studies used logistic regression to predict ED attendance in residents. Five studies used Poisson regression and four studies linear regression methods to estimate the effects of patient and care home characteristics on ED transfer rates. Five studies used other regression methods to identify care home characteristics associated with higher transfer rates. Four studies compared groups to identify univariable associations with ED transfer. 15 studies included adjustment for other factor effects using the various multivariable models previously described. Only four studies reported multilevel models to adjust for care home-level effects. The heterogeneity in statistical methods reported prevented meta-analysis through pooling of summary statistics.

Quality assessment

Using the NIH quality assessment tool,[15] 13 studies' methods were rated fair, eight studies were rated good, and five studies were rated poor (appendix pp 19–58). Only four studies accounted for the clustering of effects of residing in a specific care home, and even though most studies presented multivariable analysis, there was often no justification for inclusion of the chosen variables in the models or of the sample size used. Studies presenting multivariable models also did not explain how missing data were handled or how this affected the sample size. In studies using administrative data sets, there was often a description of the final study cohort but no STROBE diagram or other explanation as to how the study cohort was created and what proportion of potentially eligible care home residents had been excluded.

Narrative synthesis

Table 1 summarises seven common domains that had been assessed across studies as potentially affecting likelihood of transfer to the ED of care home residents. Table 2 presents the strengths of associations extracted from individual studies for each factor assessed.

	Number of studies	Significant univariable analysis	Significant multivariable analysis
Demographics			
Age	10[24,25,30,35,36,42,49,50,57,87]	1/2	6/8
Sex	9[24,25,30,35,36,42,50,57,87]	1/2	6/7
Ethnicity	4[30,36,42,87]	..	3/4
Marriage status	3[30,36,87]	..	2/3
Length of placement	3[42,50,81]	..	2/3
Comorbidities			
Dementia	9[16,25,30,36,42,48,50,79,83]	1/2	4/7
Number of comorbidities or presence of multimorbidity	4[33,49,50,78]	..	2/4
Congestive cardiac failure	3[25,30,50]	1	2/2
Depression, anxiety, or unspecified mental health illness	4[25,30,33,87]	0/1	2/3
Ischaemic heart disease	3[25,30,87]	0/1	2/2
Chronic obstructive pulmonary disease	3[25,30,50]	0/1	2/2
Pain	3[30,84,87]	0/1	1/2
Renal failure	3[25,50,87]	..	3/3
Diabetes	2[25,30,50]	0/1	2/2
Cancer	2[25,50]	0/1	0/1
Frailty			
Activities of daily living	5[25,30,50,57,87]	1/1	4/4
Recent falls	2[25,87]	..	1/2
Medication use			
Type or number of medications	4[25,30,36,57]	..	4/4
Permanent indwelling device			
Feeding tube	4[25,30,36,87]	1/1	3/3
Urinary catheter	3[25,30,87]	0/1	2/2
Advance directives			
Do-not-attempt-cardiopulmonary-resuscitation or Do-not-hospitalise orders	3[36,42,48]	..	1/3
Care home organisation			
Ownership status of care home (profit *vs* non-profit)	9[25,35,41,47,49,53,86–88]	0	5/9
Proportion of staff/residents	4[25,47,49,53]	..	2/4
Facility size	4[35,47,53,86,88]	1/1	2/5
Rural *vs* urban	4[41,49,86,87]	..	3/4
Specialist dementia unit	3[30,36,87]	..	3/3
Star rankings	2[62,87]	..	2/2

Data in the third column (n/N) refer to: number of studies finding a statistically significant association between the variable and likelihood of ED transfer/number of studies that assessed that variable in a univariable model. The same principle applies to the fourth column, with multivariable models.

Table 1: **Domains and factors assessed across studies (factors only included if assessed in two or more studies)**

Demographics

Age and sex were the most assessed demographic factors. Age was assessed in ten studies and eight of these included multivariable models. Six studies that reported multivariable models found an association between age and likelihood of ED transfer, but the findings were conflicting.[30,36,42,50,57,87] Four of the included studies[30,50,57,87] found increasing age to be associated with increased likelihood of transfer, with Stephens and colleagues[30] finding the 76–85 years age group (odds ratio [OR] 1·11 [95% CI 1·07–1·115]) and Gruneir and colleagues[50] finding the 95 years and older age group (incidence rate ratio [IRR] 1·17 [95% CI 1·1–1·25]) most likely to be transferred to ED. Two studies found increasing age to be associated with a reduced likelihood of transfer, with the 86 years and older age group least likely to be transferred in one study (IRR 0·90 [0·88–0·92])[36] and a 1-year age

	Association multivariable modelling (95% CI)
Age	
Age group (OR)	
76–85 years	1·11 (1·07 to 1·15)
≥86 years	1·03 (0·99 to 1·07)
1-year age increase (OR)	1·00 (1·00 to 1·00)
Age group (OR)	
76–85 years	0·95 (0·93 to 0·97)
≥86 years	0·90 (0·88 to 0·92)
1-year age increase (OR)	0·98 (0·98 to 0·99)
1-year age increase (regression coefficient)	−0·19 (−0·83 to 0·44)
Age group (OR, IRR)	
75–85 years	1·01 (0·91 to 1·11), 1·03 (0·99 to 1·07)
85–95 years	1·00 (0·88 to 1·06), 1·05 (1·01 to 1·10)
≥95 years	0·91 (0·79 to 1·04), 1·17 (1·10 to 1·25)
Age group (Poisson regression)	
70–79 years	1·24 (0·93 to 1·67)
80–89 years	1·49 (1·14 to 1·96)
≥90 years	1·43 (1·05 to 1·96)
1-year age increase (OR)	0·99 (0·99 to 0·99)
Sex	
Male (OR)	1·05 (1·02 to 1·09)
Male (Poisson regression)	1·38 (1·28 to 1·49)
Male (overdispersed Poisson regression)	1·14 (1·12 to 1·17)
Female (proportional hazards)	1·05 (0·95 to 1·15)
Male (OR)	1·27 (1·19 to 1·36)
Male (Poisson regression)	1·43 (1·20 to 1·71)
Female (OR)	0·86 (0·84 to 0·88)
Ethnicity	
African-American (OR)	1·38 (1·32 to 1·45)
Black (OR)	1·18 (1·15 to 1·21)
Black (HR)	1·13 (1·03 to 1·24)
Non-Hispanic (OR); White (OR)	0·71 (0·69 to 0·73); 2·11 (1·92 to 2·32)
Marriage status	
Married (OR)	1·06 (1·03 to 1·10)
Married (OR)	1·05 (1·02 to 1·07)
Married (OR)	0·91 (0·89 to 0·93)
Length of placement	
Length of stay (OR)	
30–89 days	0·71 (0·56 to 0·89)
90–364 days	0·60 (0·49 to 0·73)
≥365 days	0·45 (0·38 to 0·57)
Years (proportional hazards)	1·02 (0·97 to 1·08)
Newly admitted (OR); shorter stay (OR)	1·9 (1·7 to 2·1); 1·5 (1·4 to 1·7)

(Table 2 continues in next column)

(Continued from previous column)

	Association multivariable modelling (95% CI)
Dementia	
Level of cognitive impairment, 1 to 10 (OR)	
1 (least severe cognitive impairment)	1·13 (1·08 to 1·19)
2	1·09 (1·04 to 1·14)
3	1·03 (0·98 to 1·08)
4	0·96 (0·91 to 1·01)
5	0·93 (0·88 to 0·98)
6	0·93 (0·87 to 0·99)
7	0·90 (0·85 to 0·96)
8	0·78 (0·73 to 0·84)
9	0·71 (0·65 to 0·77)
10 (most severe cognitive impairment)	0·60 (0·55 to 0·65)
Level of cognitive impairment, 1 to 10 (Poisson regression)	
1 (least severe cognitive impairment)	1·08 (1·06 to 1·12)
2	1·06 (1·03 to 1·1)
3	1·05 (1·02 to 1·09)
4	1·02 (0·99 to 1·06)
5	1·02 (0·98 to 1·07)
6	1·02 (0·97 to 0·06)
7	1·02 (0·97 to 1·06)
8	0·96 (0·91 to 1·00)
9	0·86 (0·91 to 0·92)
10 (most severe cognitive impairment)	0·79 (0·74 to 0·84)
Moderate dementia (HR); advanced dementia (HR)	0·98 (0·87 to 1·09); 1·05 (0·87 to 1·27)
Dementia status (OR)	1·03 (0·92 to 1·15)
Moderate cognitive impairment (OR, IRR); severe cognitive impairment (OR, IRR)	0·92 (0·86 to 1·01), 0·98 (0·95 to 1·01); 0·92 (0·84 to 0·99), 1·03 (0·99 to 1·07)
No dementia (OR); potential undiagnosed dementia (OR)	1·15 (0·95 to 1·39); 1·25 (0·99 to 1·57)
Dementia (Poisson regression)	1·1 (1·1 to 2·7)
Comorbidities	
Multiple comorbidities (OR)	1·48 (1·04 to 2·10)
Charlson Comorbidity Index (regression coefficient)	0·99 (−1·51 to 3·49)
Number of chronic conditions (OR, IRR)	
2	0·95 (0·85 to 1·05), 0·99 (0·95 to 1·04)
3	0·90 (0·81 to 1·01), 0·96 (0·92 to 1·01)
4	0·88 (0·78 to 1·00), 0·95 (0·90 to 1·00)
5 or more	0·82 (0·71 to 0·95), 0·94 (0·89 to 0·99)
Charlson Comorbidity Index (OR)	1·69 (1·20 to 2·39)

(Table 2 continues in next column)

increase associated with reduced transfer in the other (hazard ratio [HR] 0·98 [95% CI 0·98–0·99]).[42] Two previous reviews identified by our search strategy found a similarly conflicting association between increasing age and ED transfer.[12,76]

Sex was assessed in nine studies, of which seven presented multivariable models. Of studies

	Association multivariable modelling (95% CI)
(Continued from previous column)	
Congestive cardiac failure	
Heart failure (OR)	1·61 (1·56 to 1·67)
Congestive heart failure (OR, IRR)	1·26 (1·16 to 1·37), 1·14 (1·10 to 1·18)
Mental health comorbidity	
Depression (OR)	0·91 (0·89 to 0·94)
Two mental health conditions (OR)	1·50 (0·00 to 2·28)
Anxiety (OR)	1·15 (1·13 to 1·17)
Ischaemic heart disease	
Cardiovascular disease (OR)	1·09 (1·05 to 1·12)
Cardiovascular disease (OR)	1·27 (1·23 to 1·32)
COPD	
Emphysema or COPD (OR)	1·56 (1·50 to 1·62)
COPD (OR)	1·26 (1·17 to 1·37)
Pain	
Pain (OR)	0·81 (0·78 to 0·84)
Pain in last 5 days (OR)	1·20 (1·17 to 1·22)
Renal failure	
Renal failure (OR)	3·17 (1·48 to 6·79)
Renal failure (OR)	1·35 (1·23 to 1·49)
End stage renal disease insurance coverage (OR)	2·68 (2·54 to 2·84)
Diabetes	
Diabetes (OR)	1·25 (1·22 to 1·29)
Diabetes (OR)	1·28 (1·19 to 1·37)
Cancer	
Cancer (OR)	1·06 (0·95 to 1·17)
Activities of daily living and frailty	
Moderate impairment level (OR); severe impairment level (OR)	1·23 (1·19 to 1·28); 1·32 (1·26 to 1·39)
Moderate dependence (OR); severe dependence (OR)	1·11 (1·02 to 1·21); 1·07 (0·98 to 1·18)
Level of dependency (Poisson regression)	
2 (heavily care dependent)	1·34 (1·12 to 1·60)
3 (most severe care dependence)	1·30 (0·93 to 1·82)
Mild or moderate impairment (OR); severe impairment (OR)	1·14 (1·11 to 1·17); 1·39 (1·34 to 1·44)
ADL total score, MDS-ADL Long Form scale, 0 to 28 (OR)	1·02 (1·02 to 1·03)
Recent falls	
Falls in last 180 days (OR)	3·81 (2·52 to 5·77)
Fall in last 30 days (OR); fall in last 31–180 days (OR)	1·44 (1·37 to 1·50); 2·05 (1·96 to 2·14)
Type or number of medications	
New medication (OR)	1·42 (1·00 to 2·03)
New medications (OR); psychotropic medications (OR)	1·10 (1·06 to 1·14); 1·21 (1·17 to 1·24)
Psychotropic medicine (Poisson regression)	1·14 (1·12 to 1·16)
Number of medications (Poisson regression)	
5–9	1·04 (0·84 to 1·29)
≥10	1·22 (0·97 to 1·53)
Feeding tube	
Feeding tube present (OR)	2·10 (1·94 to 2·20)
Feeding tube present (Poisson regression)	1·22 (1·19 to 1·25)
Urinary catheter	
Any indwelling catheter (OR)	1·28 (1·24 to 1·33)
Any urinary catheter use (OR)	1·59 (1·53 to 1·66)
Any indwelling catheter (OR)	1·28 (1·24 to 1·33)
Advance directives	
Do-not-resuscitate order (OR)	0·91 (0·89 to 0·93)
Do-not-resuscitate order (Cox proportional hazards)	0·91 (0·82 to 1·00)
Do not hospitalise order (OR)	1·25 (0·98 to 1·59)
Care home ownership status	
For-profit (OR)	6·51 (3·26 to 13·01)
Private pay (OR)	0·44 (0·42 to 0·47)
Public (HR)	0·65 (0·59 to 0·71)
Non-profit (OR)	1·64 (0·76 to 3·56)
For-profit (coefficient, p value)	7·6, p<0·01
Private (coefficient)	1·41 (−2·46 to 5·28)
Non-profit (coefficient, p value)	0·441, p=0·069
Non-profit (coefficient)	−0·24 (−0·45 to −0·04)
For-profit (coefficient, p value)	0·25, p=0·10
Government ownership (IRR)	0·8186, p<0·01
Proportion of staff and residents	
Number of staff per 100 residents (OR)	1·02 (1·00 to 1·04)
RN-to-resident ratio (coefficient, p value)	0·7, p=0·46
Number of employees per 100 beds (coefficient)	0·03 (−0·03 to 1·04)
RN staffing rating (coefficient, p value)	−0·394, p<0·01
Faculty size	
Number of beds (coefficient, p value)	0·6, p=0·52
Number beds (coefficient, p value)	
51–100	0·391, p=0·215
101–150	0·056, p=0·217
≥151	−1·160, p<0·01
Bed size (IRR, p value)	1·0005, p<0·01)
Number of beds (coefficient, p value)	−0·57, p<0·05

(Table 2 continues in next column)

presenting multivariable models, six found an association between male sex and increased likelihood of ED transfer when adjusted for age and other factors (adjusted OR range 1·05 [95% CI 1·02–1·09] to 1·27 [1·19–1·36]).[30,35,36,50,57,87] Although the study inclusion criteria were quite different to our study, two previous reviews identified by our search strategy also found male residents to be more likely to hospitalised.[12,76] Therefore, male sex appears to be independently associated with ED transfer.

Four studies assessed ethnicity,[30,36,42,87] three studies marriage status,[30,36,87] and three studies length of care

	Association multivariable modelling (95% CI)
(Continued from previous column)	
Rural *vs* urban	
Urban (OR)	0·41 (0·67 to 2·41)
Rural (coefficient)	−6·15 (−10·15 to −2·1)
Rural (coefficient, p value)	−1·67 (p>0·01)
Urban county (coefficient)	1·19 (0·93 to 1·45)
Dementia specialist unit	
Dementia special care unit (coefficient)	0·72 (0·67 to 0·76)
Dementia specialist care (coefficient)	0·78 (0·75 to 0·82)
Alzheimer's disease unit (coefficient)	−0·27 (−0·44 to −0·11)
Quality rating	
Overall 5-star rating ≥3 stars (coefficient)	−0·22 (−0·32 to −0·12)
Star rating	Weak statistical association between Star rankings and ED attendances, and unexplained variance in ED attendances

ADL=activities of daily living. COPD=chronic obstructive pulmonary disease. HR=hazard ratio. IRR=incidence rate ratio. OR=odds ratio. RN=registered nurse.

Table 2: **Strength of association with Emergency Department transfer for individual factors (factors only included if assessed in two or more studies)**

home placement[42,50,81] on likelihood of ED transfer using multivariable models. Three studies found an association with ethnicity,[30,36,42] with Black residents more likely to be transferred in two studies.[30,36] These two studies were produced using extracts from the same North American administrative dataset and these studies also found an association between being married and increased likelihood of transfer.[30,36] Two studies using Canadian administrative datasets found that short-term residents (in facility <30 days) were more likely to be transferred compared with other residents after adjusting for other factors in multivariable modelling (OR 1·9 [95% CI 1·7–2 ·1]).[50,81]

Comorbidities

14 studies assessed the effect of comorbidity on likelihood of ED transfer.[16,25,30,33,36,42,48–50,78,79,83,84,87] A formal diagnosis of dementia or presence of some degree of cognitive impairment was the most commonly assessed comorbidity and was assessed in nine studies. Eight reported multivariable models,[16,30,36,42,48,50,79,83] and in four of these models,[16,30,36,50] there was a statistically significant association between dementia and ED conveyance. The findings were mixed, with two similar studies finding that lower levels of cognitive impairment were associated with increased likelihood of ED transfer, while high levels of cognitive impairment were associated with reduced ED transfers.[30,36] Additionally, two studies[50,79] found a diagnosis of dementia to be associated with reduced ED transfers and one of these studies[79] found potential dementia without a formal diagnosis to be associated with increased ED transfer.[50,79] One previous review assessed dementia and identified six studies in which dementia was associated with inpatient admission and two studies in which increased cognitive impairment was associated with decreased ED transfer.[76]

Four studies assessed the impact of multimorbidity, either as measured by the Charlson Comorbidity Index or number of comorbidities using multivariable modelling.[33,49,50,78] Of these, two found a significant association with ED transfer; however, one study found the presence of more than five comorbidities to be associated with reduced ED transfer (OR 0·82 [95% CI 0·71–0·95]),[50] while the other study found increasing comorbidity (measured by the Charlson Comorbidity Index) to be associated with increased likelihood of ED transfer (OR 1·69 [1·20–2·39]).[78] This might be due to a non-linear association between increasing comorbidity and likelihood of transfer, with increasing comorbidity initially increasing likelihood of transfer, but, in some contexts, a high comorbidity burden reducing likelihood of transfer due to more limited scope for transfers to improve resident outcomes.

Other specific comorbidities that were assessed included congestive cardiac failure (four studies),[25,30,50,87] ischaemic heart disease (three studies),[25,30,87] chronic obstructive pulmonary disease (three studies), [25,30,50] renal failure (two studies),[25,50] diabetes (two studies),[25,30] and cancer (two studies).[25,50] Of these, congestive cardiac failure, chronic respiratory disease, and renal failure were associated with increased likelihood of ED transfer in all studies that assessed these factors using multivariable modelling.[25,30,50,87]

Frailty

Five studies assessed the association of frailty with ED transfer, with frailty measured using the Clinical Frailty Scale, the Changes in Health, End-stage disease, and Signs and Symptoms (CHESS) scale, or other measures of dependency.[25,30,50,57,87] In the four studies that presented multivariable models, measures of increased frailty or dependency were associated with increased ED transfer.[30,50,57,87] Two of these studies found severe frailty or functional impairment to be most strongly associated with ED transfer (OR 1·32 [95% CI 1·26–1·39], and OR 1·39 [1·34–1·44]).[30,87] However, another study found moderate frailty (OR 1·11 [1·02–1·21]) but not severe frailty to be associated with increased likelihood of transfer.[50]

Medication use

Four studies assessed polypharmacy or type of medication use and all studies presented multivariable models. One study found polypharmacy to be associated with increased ED transfer, with the strength of association increasing with the number of medications prescribed.[57] Two studies found new medication prescription,[25,30] and two studies found psychotropic medication use,[30,36] to be associated

with increased ED transfer. One previous review identified by our search strategy specifically assessed medication and prescribing patterns associated with hospitalisation (primarily inpatient admission) in care residents.[13] The review found polypharmacy, psychotropic medication use, and prescription of inappropriate medications to be associated with increased hospitalisation across a range of high-quality studies.

Permanent indwelling devices

Three studies assessed how presence of long-term urinary catheters or feeding tubes affected likelihood of ED transfer;[25,30,36] however, only two studies did so using multivariable modelling.[30,36] Both these studies found presence of long-term urinary catheters and feeding tubes to be independently associated with increased likelihood of ED transfer (feeding tube: IRR 1·22 [95% CI 1·19–1·25], OR 2·1 [95% CI 1·94–2·2]; urinary catheter: OR 1·59 [1·53–1·60]).[30,36] One included previous review also identified indwelling devices, particularly feeding tubes, as being associated with increased ED transfers across included studies.[76]

Advance directives

Three studies assessed the effect of advance directives (two do-not-resuscitate directives, one do-not-hospitalise directive) on ED transfer using multivariable modelling.[36,42,48] Both studies assessing do-not-resuscitate directives found their presence to be associated with reduced likelihood of ED transfer (IRR 0·91 [95% CI 0·89–0·93], HR 0·91 [95% CI 0·82–1·00]).[36,42] The single study that assessed do-not-hospitalise directives found these to be present in a small proportion of residents (6%), and associated with a near statistically significant reduction (p=0·07) in ED transfer when adjusted for other factors (OR 1·25 [95% CI 0·98–1·59] for residents without a do-not-hospitalise order).[48] One included review found advance directives to reduce resident hospitalisations (inpatient admission and ED transfers).[11]

Organisational factors

11 studies assessed care home-level factors association with ED transfers.[25,30,35,36,41,47,49,53,86–88] Care home funding was assessed with multivariable modelling in ten studies.[25,30,35,41,47,49,53,86–88] Of these, three studies found a statistically significant association between non-profit status or public funding and reduced ED transfer (table 2).[35,87,88] One study[25] found private pay to be associated with reduced ED transfer (OR 0·44 [95% CI 0·42–0·47]), while two studies[30,47] found private pay to be associated with increased ED transfers (table 2). These three studies were conducted in different countries where the different health-care service and medicolegal setting might lead to different thresholds for transfer of residents to the ED.

Other care home-level factors assessed included staff-to-resident ratios (four studies),[25,47,49,53] facility size (five studies),[35,47,53,86,88] rural versus urban location (four studies),[41,49,86,87] presence of a specialist dementia unit (three studies),[30,36,87] and quality rating (two studies).[62,87] Of these factors, the presence of a specialist dementia unit and higher care home quality rating were associated with reduced ED transfer in all studies reporting multivariable models. Three of four studies found urban care homes to have increased ED transfers of residents compared with rural care homes when adjusting for other factors,[49,86,87] while the remaining study found no association between location of care home and likelihood of transfer.[41] Two studies found increased staff-to-resident ratio to be associated with reduced transfers,[25,53] and two studies found increased facility size to be associated with reduced ED transfer rates when adjusted for other factors.[53,86]

One previous review in the USA identified care home organisational factors associated with ED transfer and inpatient admissions.[11] It identified multiple studies in which increased proportion of residents funded by Medicaid was associated with reduced likelihood of hospitalisation. This review also found increased staffing ratios to be associated with reduced likelihood of hospitalisation. No consistent relationship between size of facility and hospitalisation of residents was found in this review.

Discussion

Summary

This review identifies a broad range of factors associated with transfer of care home residents to the ED. Previous reviews have either assessed inpatient admission and ED transfer as a composite outcome, or, where specifically assessing factors associated with ED transfer, have limited included studies to specific demographic or other factors.[12–14,76] Of demographic factors assessed, the most consistent relationship identified across studies was an association between male sex and increased ED transfer when adjusted for other factors. Although only assessed in a small number of studies, we also found marital status and length of care home placement to potentially affect likelihood of ED transfer, factors not identified in previous reviews. These factors could not be targeted by interventions but might require inclusion for adjustment in comparative predictive models for ED transfers.

Dementia was the most the commonly assessed comorbidity and seven included studies assessed it as part of a multivariable model. Increasing cognitive impairment was associated with reduced ED transfer in the two studies that assessed cognitive impairment as a scale (table 2). However, two studies found either dementia or undiagnosed cognitive impairment to be associated with increased ED transfers (table 2). The previous review assessing factors associated with inpatient admissions and ED transfer of residents found dementia be associated with both increased and reduced transfer to the ED.[76] Other comorbidities were assessed

in three or fewer studies, but a consistent association of chronic obstructive pulmonary disease, renal failure, and congestive cardiac failure with increased ED transfer was found across studies. Although assessed in four or fewer studies, all studies assessing reduced performance status, polypharmacy or medication alterations, and presence of feeding tubes found these factors to be associated with increased ED transfer when adjusted for other factors. Two previous reviews that assessed the relationship of these factors with hospitalisations (inpatient admissions and ED transfers) similarly identified these factors as associated with increased hospitalisations.[13,76]

At the care home level, the factor assessed most frequently in included studies was care home ownership or funding. A previous review hypothesised that increased care home resources associated with private funding should result in reduced resident hospitalisations.[76] We found no consistent relationship between care home funding and likelihood of ED transfer, with three studies finding ED transfers to be reduced in publicly funded institutions.[35,47,87] Although assessed in only four or fewer studies, rural care homes, those with higher quality ratings, and those with specialist dementia units were consistently found to have reduced ED transfers when adjusting for other factors, and these factors were not identified in previous reviews. No consistent relationship across studies between ratio of staff to residents and likelihood of ED transfer was identified. Increased staff-to-resident ratio was found to be associated with reduced likelihood of inpatient admission in one previous review.[11] However, only four studies included in our review assessed this factor, of which only two found increased staff-to-resident ratios to be associated with reduced ED transfers.

Strengths and limitations

This paper reports a thorough search done in six electronic databases identifying 21 relevant primary studies and four previous systematic reviews. Our review fulfils all the relevant AMSTAR systematic review checklist quality domains apart from item 10, regarding reporting of funding for included studies.[89] However, the non-interventional and descriptive nature of the included studies means this domain is less relevant. Our review is also at low risk for bias in the four domains assessed by the Risk of Bias in Systematic reviews (ROBIS) tool.[90]

There was a large degree of variation in the methods used in included studies, with five types of study design and some studies limiting statistical analysis to univariable comparisons between conveyed and non-conveyed residents or care homes with high and low rates of ED transfer. The majority of studies did present multivariable models; however, five different statistical methods were used with different factors included in modelling. This prevented meta-analysis and meaningful comparison of estimates of association. Moreover, only four studies presented multilevel models to adjust for clustering effects of care homes.

Most included studies were conducted in North America, which has a specific model of organisation and funding of health and social care. Therefore, the findings, especially regarding care home level factors, might not be generalisable to other settings—particularly the UK, which has a different health-care system and where no included studies were conducted.

Only five included studies used prospectively collected research study data (two of these studies undertook a secondary analysis on randomised control study data).[33,78,79,83,84] All other studies used administrative or other routinely collected clinical and social care data sources. The linkage and handling of missing data was poorly described in these studies, with most studies excluding residents with incomplete data. Studies using routine data were also limited to assessing factors that are routinely measured. In particular, residents with routinely recorded comorbidities, medications, and other clinical characteristics might be systematically different from other residents.

Implications

Variability in quality and nature of care available in different care homes has been previously highlighted, with continuous monitoring of emergency admissions proposed as one way to identify care homes with a larger-than-expected number of admissions requiring potential intervention.[87,91] Although limited to ED transfers, this review has comprehensively identified factors that affect likelihood of ED transfer and might need adjustment in such modelling. Identifying care home-level and resident-level factors, particularly related to services available, quality rating, or polypharmacy, associated with increased transfers could support targeted interventions to reduce transfers and improve other measures of quality in specific care homes. Demographic and other unmodifiable factors might simply need adequate adjustment to allow fair comparison between different institutions.

Although the association between polypharmacy and adverse outcomes in care home residents is well established in the literature, previous reviews have highlighted a lack of robust evidence for the effectiveness of interventions to reduce polypharmacy in this setting.[92,93] Our review further highlights the association between prescribing practices and transfer of residents to the ED. Our review also found an association between specific chronic diseases and increased ED transfers across studies. There is evidence that integrated care for specific conditions might reduce hospitalisations and other adverse outcomes in a care home setting.[94]

Multiple methods were used in the included studies to identify factors associated with ED transfers. Studies had common methodological weaknesses in handling

of missing data, model derivation, and validation. Consistent methods are needed that follow recommendations for deriving predictive models and include important factors that predict hospitalisations if monitoring of emergency transfers are to be used as a quality indicator.[91,95] Adjustment for other important factors and use of appropriate statistical methods are also required to identify modifiable risk factors that could be targeted by interventions to reduce avoidable ED transfers.

Conclusion

Our review has identified multiple factors that might be associated with the transfer of care home residents to the ED. This provides useful information for policy makers and researchers intending to either develop interventions to reduce hospitalisations of residents or use adjusted emergency hospitalisations as a care home quality indicator. However, the variability and weaknesses in the methods used in included studies prevented meta-analysis and estimation of association of identified factors. Research following guideline recommendations is needed to apply our findings to specific health-care contexts if modelling is to be used to inform interventions to reduce hospitalisations.

Contributors

SM, LP, and CM conceived the idea for the study. AC designed the electronic search strategy. CM, AC, LP, MT, and LS performed title screening, study selection, and data extraction. The synthesis was completed by CM and LP with specialist advice from SM. All authors contributed to interpretation of results and read and approved the final manuscript. CM takes responsibility for the paper as a whole.

Declaration of interests

We declare no competing interests.

Acknowledgments

CM is a National Institute for Health Research (NIHR) Clinical Lecturer in Emergency Medicine. MT is an NIHR Academic Clinical Fellow in Emergency Medicine. This report is independent research, part funded by the NIHR Yorkshire and Humber Applied Research Collaboration. The views expressed in this publication are those of the author(s) and not necessarily those of the National Health Service, the NIHR, or the Department of Health and Social Care.

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