Received: 24 August 2023 | Revised: 18 March 2024 | Accepted: 25 March 2024

DOI: 10.1111/jocn.17165

Journal of Clinical Nursing WILEY

SYSTEMATIC REVIEW

A systematic review of reasons and risks for acute service use by older adult residents of long-term care

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Abstract

Aims and Objectives: To identify the reasons and/or risk factors for hospital admission and/or emergency department attendance for older (≥60 years) residents of long-term care facilities.

Background: Older adults' use of acute services is associated with significant financial and social costs. A global understanding of the reasons for the use of acute services may allow for early identification and intervention, avoid clinical deterioration, reduce the demand for health services and improve quality of life.

Design: Systematic review registered in PROSPERO (CRD42022326964) and reported following PRISMA guidelines.

Methods: The search strategy was developed in consultation with an academic librarian. The strategy used MeSH terms and relevant keywords. Articles published since 2017 in English were eligible for inclusion. CINAHL, MEDLINE, Scopus and Web of Science Core Collection were searched (11/08/22). Title, abstract, and full texts were screened against the inclusion/exclusion criteria; data extraction was performed two blinded reviewers. Quality of evidence was assessed using the NewCastle Ottawa Scale (NOS).

Results: Thirty-nine articles were eligible and included in this review; included research was assessed as high-quality with a low risk of bias. Hospital admission was reported as most likely to occur during the first year of residence in long-term care. Respiratory and cardiovascular diagnoses were frequently associated with acute services use. Frailty, hypotensive medications, falls and inadequate nutrition were associated with unplanned service use.

Conclusions: Modifiable risks have been identified that may act as a trigger for assessment and be amenable to early intervention. Coordinated intervention may have significant individual, social and economic benefits.

Relevance to clinical practice: This review has identified several modifiable reasons for acute service use by older adults. Early and coordinated intervention may reduce the risk of hospital admission and/or emergency department.

Reporting method: This systematic review was conducted and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology.

Patient or public contribution: No patient or public contribution.

KEYWORDS
aged, emergency service, hospital, hospitalisation, long-term care

1 | INTRODUCTION

As health services grapple with the impact of population ageing, there is increasing investment in preventing the hospitalisation of older adults. These efforts often focus on specific conditions and disease processes. Significant opportunities exist for care planning, risk mitigation, medication management and continuity of care for specific populations. Older adults are at disproportionate risk of complications and injury resulting from hospitalisation. Injuries and illnesses that may require secondary/acute care services should be avoided where possible. High-quality clinical assessments and electronic medical records create opportunities to identify common reasons and risks for acute service use (Richardson et al., 2020). It is possible that the early identification of these risk factors could avoid some unplanned service use. Understanding risk factors may allow clinicians to avoid acute clinical deterioration, reduce the demand for health services and improve quality of life. Early identification may allow for the prevention of initial harm, and subsequent need for emergency department (ED) use or unplanned hospitalisation and potential iatrogenic harm (Hullick et al., 2021). The objective of this review was to provide a systematic search and analysis of the global evidence on the risks (likelihood of event) and reasons (cause of an event) for unplanned emergency department (ED) use/hospitalisation of the older resident of long-term care facilities (LTCF). Residents of LTCF were chosen due to high rates of multimorbidity, functional impairment and frailty, which may be amenable to intervention at the level of both the individual and facility.

1.1 | Aim

The aim of this study was to identify the reasons and/or risk factors for hospital admission and/or emergency department attendance for older (≥60 years) residents of long-term care facilities.

What does this paper contribute to the global clinical community

- The first 3 months to 1 year following LTCF admission is associated with higher incidence of hospitalisation.
- Use of acute services is more common for cardiorespiratory conditions, frailty, ADL dependence and hypotensive medications.
- Future research should seek to evaluate if care bundles/protocols reduce the incidence of avoidable service use.

2 | METHOD

2.1 | Protocol registration

This systematic review was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology (Guideline for reporting systematic reviews (Data S1); Page et al., 2021). The objective of the review was to identify reported risk factors for hospital admission and/or emergency department attendance for older residents of long-term care facilities. Our study was registered in PROSPERO (International Prospective Register of Systematic Reviews; CRD42022326964; Merrick et al., 2022).

2.2 | Search and selection criteria

The CINAHL (EBSCOhost), MEDLINE (EBSCOhost), Scopus and Web of Science Core Collection databases were searched on 1 August 2022 to identify relevant studies. The search strategy was developed in consultation with an academic librarian. The strategy used MeSH terms and relevant keywords on hospitalisation, emergency service, risk factors, older adult, long-term care, aiming to cover all articles

on this topic (Data S2). To ensure that evidence was contemporary and useful for informing practice, only articles published since 2017 in English were included in this review.

The following inclusion criteria were adopted for the studies: (i) randomised control trials, case–control, prospective and retrospective cohort, cross-sectional and longitudinal methodologies; (ii) outcomes that identified physical and/or psychosocial factors that increase the risk of unplanned hospitalisation or the risk of unplanned emergency department attendance; (iii) and participants over the age of 60 years (iv) who were resident in long-term care facilities (defined as accommodation with personal care, nursing, and/or general health services available). Additional outcomes included the identification of the age and/or health characteristics of the older adults who require unplanned acute care services. Measures of effect included frequency and descriptive statistics of outcomes, relative risks, odds ratios and risk difference. Reviews, editorials/comments/discussion, qualitative inquiry, study protocols and research published in a language other English were excluded from this review. Also, excluded were studies that reported outcomes based on a single diagnosis or condition for which the population was intentionally sampled (e.g., SARS-COV-2).

2.3 | Review process

All studies were imported into Covidence™, and duplicates were removed. All reviewers underwent training to perform the selection of studies according to the eligibility criteria. Training included independent screening followed by measuring degree of (dis) agreement and discussion of points of difference. All reviewers then independently screened the titles and abstracts against the inclusion and exclusion criteria. Selected studies were then read in full by two blinded reviewers who evaluated the study against the eligibility criteria and voted for inclusion or exclusion (across the eight reviewers Cohen's Kappa was > .714). Where there was disagreement a third reviewer evaluated the study.

2.4 | Data extraction and quality assessment

Data were extracted from each study by two independent reviewers using a template prepared by the authors. The template included fields for author/year/country, characteristics of the population (age, sex, race/ethnicity, (co)morbidities, prescribed medications and free text), sample size (inclusion and exclusion criteria), study design (including start and end dates), loss to follow-up, number of hospitalisations and/or readmissions and/or emergency department attendance (summary statistics and associated *p*-values and/or CI's). Morbidity associated with acute service use was classified by two blinded authors into four categories:: respiratory, cardiovascular, cognitive impairment/neurological and other. Categorisation was necessary due to heterogeneity in the reporting of disease/conditions associated with acute service use. There was 70% agreement between two blinded authors on the classification of conditions, and disagreements were resolved by consensus (Data S2—search strategy). The quality of evidence was described using the Newcastle Ottawa Scale (NOS) for cross-sectional and cohort studies, with a minimum time period for data collection/follow-up of 12 months (Wells et al., 2022). Studies with scores higher than seven were considered high-quality with a low risk of bias, 4–6 as moderate and 0–3 as low-quality high risk of bias.

3 | RESULTS

This review identified 2485 articles, and after exclusion of duplicates, 1834 articles remained. After title and abstract screening, 172 were selected for full-text reading. During full-text reading, two studies had unclear definitions of long-term care. These studies were excluded after the authors were emailed for clarification and no response was received. A total of 39 articles met the eligibility criteria and were included in this systematic review (Figure 1); the researchers were unable to undertake a meaningful meta-analysis due to heterogeneity of outcomes and measures of effect. Twenty-six studies were able to be classified according to the diseases/conditions reported as a reason for admission to acute services. The authors identified eight combinations of four classifications of morbidity including: respiratory, cardiovascular, neurological and other (Figure 3 and Table S1 consensus on categorisation).

3.1 | Study characteristics

Most of the research included in this review was conducted in Australia ($n = 12$), followed by the United States of America ($n = 10$) and Canada ($n = 6$); the most common methods were retrospective ($n = 23$) (Aryal et al., 2021; Bosco et al., 2021; Caughey et al., 2022; Chiswell et al., 2022; Do et al., 2021; Dongjuan et al., 2019; Fassmer & Hoffmann, 2020; Gruneir et al., 2018; Hirdes et al., 2019; Hsiung et al., 2018; Inacio, Jorissen, Wesselingh et al., 2021; Inacio, Jorissen, Khadka, et al., 2021; Inacio, Moldovan, et al., 2021; Kadu et al., 2019; Kalisch Ellett et al., 2021; Kim et al., 2019; Leutgeb et al., 2019; Li et al., 2018; Mowbray et al., 2020; Moyo et al., 2020; Ogarek et al., 2018; Unroe et al., 2020; Xu et al., 2021) and prospective ($n = 4$) cohort studies (Simo et al., 2021; Stock et al., 2017; Unroe et al., 2018; Valmorbida et al., 2020), with 23 of these studies extracting data from medical and/or administrative records. Also included in this review was a case–control study (Ryan-Atwood et al., 2017), group-based trajectory analysis (Testa et al., 2021), randomised control trials (Connolly et al., 2018; Kane et al., 2017; Martin et al., 2019) and a cross-sectional study (Honinx et al., 2021). Data collection periods ranged from 2006 to 2009 (Stock et al., 2017) and most recently 2016–2019 (Dai et al., 2021). Sample sizes ranged from 144 in a prospective cohort study using direct recruitment (Valmorbida et al., 2020) to 3,584,797 in a retrospective cohort study using administrative data (Ogarek et al., 2018). The mean age of participants

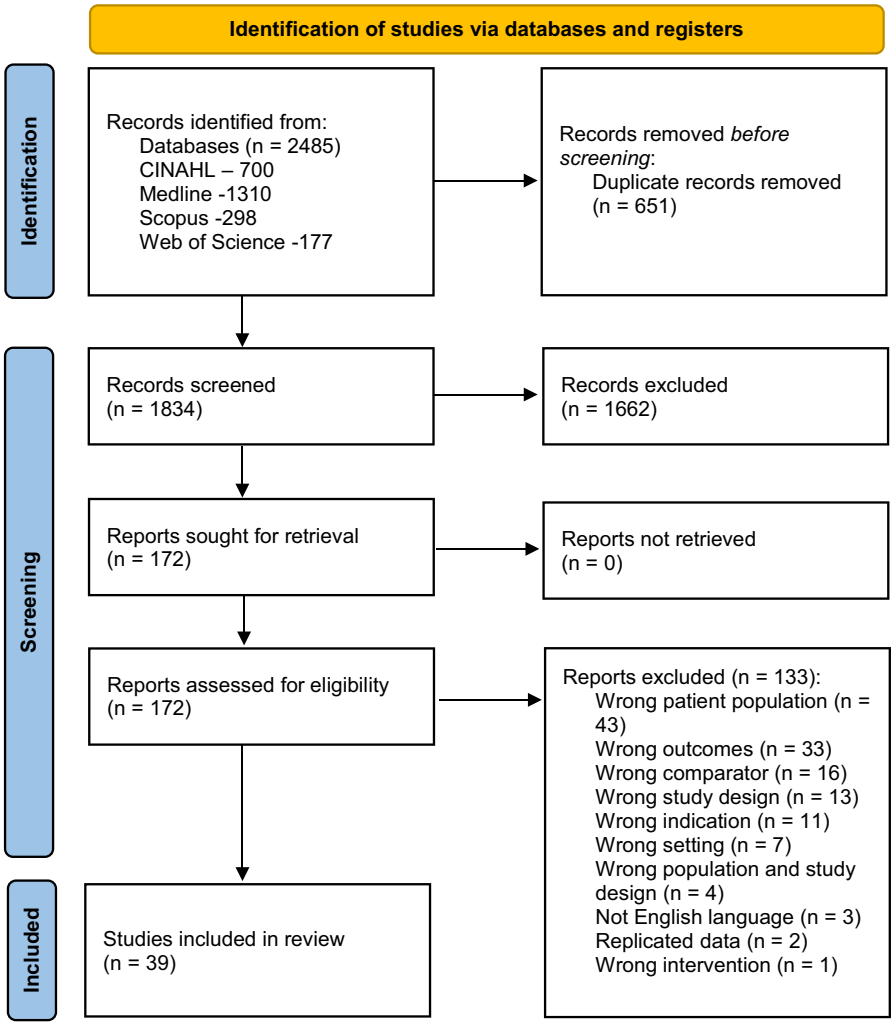

FIGURE 1 PRISMA flowchart of review process.

ranged from 76.2 to 86.1 years, with SDs ranging from 0.3 to 10.9. Table 1 provides a summary of the aims, country, funding sources, population, sample, research design, method of recruitment and age of participants (mean, median, SD, IQR).

3.2 | Study quality

Twenty-eight studies were assessed for quality using the NOS (1 case–control (Ryan-Atwood et al., 2017), 4 prospective cohort (Simo et al., 2021; Stock et al., 2017; Unroe et al., 2018; Valmorbida et al., 2020) and 23 retrospective cohort study's (Aryal et al., 2021; Bosco et al., 2021; Caughey et al., 2022; Chiswell et al., 2022; Do et al., 2021; Dongjuan et al., 2019; Fassmer & Hoffmann, 2020; Gruneir et al., 2018; Hirdes et al., 2019; Hsiung et al., 2018; Inacio, Jorissen, Wesselingh, et al., 2021; Inacio, Jorissen, Khadka, et al., 2021; Inacio, Moldovan, et al., 2021; Kadu et al., 2019; Kalisch Ellett et al., 2021; Kim et al., 2019; Leutgeb et al., 2019; Li et al., 2018; Mowbray et al., 2020; Moyo et al., 2020; Ogarek et al., 2018; Unroe et al., 2020; Xu et al., 2021)). Eleven studies used study designs that could not be scored on the NOS. The case–control study was scored as a five indicating moderate quality/risk of bias. Scores for the cohort studies ranged from four to seven. Figure 2 presents NOS criteria and scores for each study.

All the included research lacked a comparable control cohort, and this is likely a reflection of the design of the included research rather than a reflection of quality. It is also likely that the lack of a control cohort is the reason that 11 of the assessed cohort studies did not demonstrate that the exposed cohort was drawn from the same population as the non-exposed cohort. Thirteen of the included studies failed to adequately describe the follow-up of exposure cohorts with either no statement provided or no description of ≥5% of participants lost to follow-up. Three studies did not demonstrate that the outcome of interest was not present at start of study. Other threats to quality included failing to describe how the selected cohort was representative of the population and relying on self-report for the assessment of outcome.

3.3 | Reasons and risk factors for hospitalisation and/or emergency department use

Transitions to acute care services were more likely to occur in the first year of residence in a LTCF, with Kadu et al. (2019) reporting

one-third of residents with heart failure in Canada being hospitalised within 90 days of admission, and Li et al. (2018) finding that one-third of residents in the United States experienced at least one hospitalisation within the first 90 days of residence. In Germany, Fassmer and Hoffmann (2020) reported that 'nursing home' residents had three acute service utilisation episodes per year; more frequent than community dwelling older adults (Leutgeb et al., 2019). Older age was identified as a risk factor for frequency of hospital use by (Testa et al., 2021), and by Hsiung et al. (2018) with residents ≥85 years accounting for 85% of unplanned hospitalisations; however in Australia Do et al. (2021) identified an association between being ≥90 years with fewer subsequent admissions, and Inacio, Jorissen, Wesselingh, et al. (2021) reported men ≤90 years as more likely to access hospital and ED services. Men are consistently identified as more likely to access acute services (Gruneir et al., 2018; Inacio, Jorissen, Wesselingh, et al., 2021; Moyo et al., 2020). Distance to the nearest hospital has been associated with lower hospitalisation rates in urban and rural areas (Xu et al., 2021), and remote areas (Inacio, Jorissen, Wesselingh, et al., 2021). Acute service use was observed to be more frequent on weekends due to the unavailability of medical or geriatric assessment services at the LTCF (Dai et al., 2021; Fassmer & Hoffmann, 2020); although Dubucs et al. (2021) observed an increase in the number of 'inappropriate' transfers from LTCF to ED standard working hours of 0800–2000 h. Socioeconomic status (Inacio, Jorissen, Wesselingh, et al., 2021), race (Moyo et al., 2020), a history of medical service use (Inacio, Jorissen, Wesselingh, et al., 2021) and comorbid health conditions (Testa et al., 2021) have also been associated with the frequency of hospitalisation. In this review morbidity(s), cognitive impairment, frailty, medication(s), falls, ADLs and nutrition were identified as risk factors for ED use and/or hospitalisation.

3.3.1 | Morbidity(s)

The most frequently identified morbidities associated with hospitalisation and/or ED use were respiratory conditions and symptoms (including 'shortness of breath', 'pneumonia', 'asthma', 'chronic obstructive pulmonary disease' (COPD), 'bronchitis' and 'respiratory failure'; Aryal et al., 2021; Chiswell et al., 2022; Dongjuan et al., 2019; Moyo et al., 2020). With Unroe et al. (2020) reporting that 'respiratory symptoms' increased the likelihood of hospitalisation; and Gruneir et al. (2018) identifying that people diagnosed with COPD had increased odds of repeat visits to an ED. Bosco et al. (2021) asserted that in the United States many 'cardiorespiratory' hospitalisations of the LTCF residents could be attributed to seasonal influenza and respiratory syncytial virus. Cardiovascular diagnoses *'heart disease'* were reported as a risk factor of hospitalisation ($p \leq .05$; Hsiung et al., 2018); 'congestive heart failure' was associated with a potentially avoidable transition to ED (Aryal et al., 2021); and 'dysrhythmia' and 'congestive heart failure' as a significant risk factors for repeat ED attendance (Gruneir et al., 2018) and readmission (Horney et al., 2017). Urinary tract infections were identified as a having a positive association with hospitalisation in two studies (Dongjuan et al., 2019; Hsiung et al., 2018). Figure 3 presents the classifications of disease/conditions as reasons/risks for acute service by author and year of publication, the figure notates the sample size of each study, and the country in which study was conducted.

The presence of multiple comorbidities was associated with potentially avoidable transfers to ED (Aryal et al., 2021) and hospitalisation (Moyo et al., 2020). In Germany, 'accidental injuries' and 'poisoning' were identified as the most common diagnostic categories assigned to older adults attending ED from a LTCF (Fassmer & Hoffmann, 2020), and in Australia, over a quarter of re-presentations to ED were for older adults from LTCF were assigned to low priority/urgency care (Chiswell et al., 2022).

3.3.2 | Cognitive impairment

European evidence indicates that older adults with Alzheimer's disease, other dementias and/or serious cognitive impairment are low frequency users of ED (Italy) (Giacomini et al., 2022); however in Canada, LTCF residents presenting to ED had the highest rates of cognitive impairment (67.5% of $n = 121$; $p = <.001$) and impaired cognition (27.3%; $p = <.001$) (Mowbray et al., 2020); but older adults with dementia were less likely to re-present to ED following discharge (Gruneir et al., 2018). Older adults diagnosed/assessed with cognitive impairment (excluding delirium) were identified as less likely to be hospitalised in Australia (Inacio, Jorissen, Wesselingh, et al., 2021; Testa et al., 2021) and the United States (Moyo et al., 2020; Unroe et al., 2020). Interestingly Russo et al. (2020) identified that even when there is a diagnosis of pneumonia those with a dementia diagnosis were less likely to be hospitalised.

3.3.3 | Frailty

Six studies identified an independent association between *a measure* of frailty and hospitalisation (Hirdes et al., 2019; Ogarek et al., 2018; Simo et al., 2021; Stock et al., 2017), or ED use (Aryal et al., 2021; Mowbray et al., 2020). Simo et al. (2021) identified that older adults with the highest measures of frailty had higher risk of hospitalisation and increased length of stay independent of age and/or gender. This finding was echoed by Stock et al. (2017) who identified that baseline frailty status was significantly associated with hospitalisation over 1 year. In addition, frail residents using antipsychotic agents had a significantly increased risk of hospitalisation when compared to non-frail residents (adjusted hazard ratio: 1.54; 95% CI: 1.01–2.36; Stock et al., 2017). Although not a formal measure of frailty less 'health instability' as measured

TABLE 1 Study characteristics ($n = 39$).

	Country	Study design	NOS score	Funding source(s)	Declared conflicts of interest
Prospective cohort					
Simo (2021)	France	Prospective cohort study	7	Pfizer	No conflicts of interest declared
Valmorbida (2020)	United Kingdom	Prospective cohort study	6	Did not receive any funding	No conflicts of interest declared
Stock (2017)	Canada	Prospective cohort study	7	The Canadian Frailty Network (formerly Technology Evaluation in the Elderly Network, grant number SIG2014-M1); and the Alberta Heritage Foundation for Medical Research (grant number 200400893), the Canadian Institutes of Health Research (CIHR) (grant number MOP81216) and the CIHR Institute of Aging Northern and Rural Health Research Initiative (grant number HAS-63179)	Consultancy provided to Janssen and Glaxo Smith Kline on projects unrelated to the current work
Unroe (2018)	United States	Prospective cohort study	5	U.S. Department of Health and Human Services, Centers for Medicare and Medicaid Services (Funding Opportunity 1E1CMS331082)	No conflicts of interest declared
Retrospective Cohort					
Xu (2021)	United States	Retrospective cohort study	5	Did not receive any funding	An author owns commercial interest, which provides consulting services to long-term care providers
Chiswell (2022)	Australia	Retrospective cohort study	5	Did not receive any funding	No conflicts of interest declared
Moyo (2020)	United States	Retrospective cohort study	7	Sanofi Pasteur	Authors employed by funding body
Mowbray (2020)	Canada	Retrospective cohort study	4	Not stated	No conflicts of interest declared
Li (2018)	United States	Retrospective cohort study	7	National Institutes of Health (grants numberR01AG33134, K05CA134923, R01HD069443, K12HD055929, P2CHD065702 and P30AG024832) & Agency for Healthcare Research and Quality (grant numberR24HS22134)	No conflicts of interest declared
Kalisch Ellett (2021)	Australia	Retrospective cohort study	6	Australian Government Department of Veterans Affairs & Australian Government National Health and Medical Research Council (APP1101788)	No conflicts of interest declared
Kadu (2019)	Canada	Retrospective cohort study	5	Not stated	No conflicts of interest declared

Population	Method of recruitment	Number of participants	Age				
			Mean	Median	SD	Low IQR	High IQR
LTCF residents with a French administrative ADL score of between 2 and 5 inclusive (1 indicates fully dependent/ bedridden and 6 indicates fully independent)	Other	768	86.1		7.6		
≥65 years admitted to a single LTCF	Direct recruitment	144		86		82	91
≥65 years in publicly funded LTCF	Direct recruitment	1066	84.4		7.3		
LTCF residents for ≥100 days	Passive recruitment	1174					
Privately owned LTCF's with at least 20 beds	Record extraction	14,600 LTCF's					
≥65 years who presented to public ED from LTCF	Record extraction	28,648					
1,711,497 individuals residing in 15,740 Medicare-certified LTCF's	Record extraction	1,711,497 in 15,740 in LTCF's; 65.3% ($n=1,118,054$) short-stay and 34.7% ($n=593,443$) long-stay residents	82.9		8.3		
≥75 years, 121 from LTCF's	Record extraction	2274 of which 121 were LTCF residents	82.5				
New admissions to LTCF	Record extraction	535,202	83.1		8.5		
Registered with Department of Veterans Affairs and admitted to hospital with a condition	Record extraction	18,874		88		86	91
≥65 years admitted to LTCF	Record extraction	5977					

(Continues)

TABLE 1 (Continued)

	Country	Study design	NOS score	Funding source(s)	Declared conflicts of interest
Inacio (2021)	Australia	Retrospective cohort study	6	The Hospital Research Foundation Mid-Career Fellowship (MCF-27-2019) and National Health and Medical Research Council (NHMRC) Investigator Grant (APP119378). JKS is supported by a NHMRC Early Career Fellowship (APP1156439)	No conflicts of interest declared
Inacio (2021)	Australia	Retrospective cohort study	5	Australian Government's Medical Research Future Fund	Author is a board member of the aged care organisation Helping Hand
Inacio (2021)	Australia	Retrospective cohort study	6	Australian Government's Medical Research Future Fund	No conflicts of interest declared
Hsiung (2018)	Taiwan	Retrospective cohort study	7	Chang Gung Memorial Hospital Research Project Fund (CMRPF1A0071)	No conflicts of interest declared
Hirdes (2019)	Canada	Retrospective cohort study	7	Did not receive any funding	No conflicts of interest declared
Gruneir (2018)	Canada	Retrospective cohort study	6	Institute of Health Services and Policy Research (FRN#123315) at the Canadian Institutes of Health Research (CIHR) & Clinical Evaluative Sciences (ICES) Ontario Ministry of Health and Long-Term Care (MOHLTC)	No conflicts of interest declared
Fassmer (2020)	Germany	Retrospective cohort study	5	Innovation Committee of the Federal Joint Committee (G-BA) in Germany (Grant Number: 01VSF16043)	No conflicts of interest declared
Caughey (2022)	Australia	Retrospective cohort study	7	MCI is supported by a Hospital Research Foundation Mid-Career Fellowship	No conflicts of interest declared
Bosco (2021)	United States	Retrospective cohort study	6	This study was funded by Sanofi Pasteur; NHI grants R21AG061632, R01AG065722, RF1AG061221 and R01AG062492	Authors employed by funding body. Grants received from Seqirus, Pfizer and Sanofi Pasteur, Jansen, Merck, National Institutes of Health and the US Department of Veterans Affairs outside the submitted work
Aryal (2021)	Canada	Retrospective cohort study	6	Ontario Ministry of Health (MOH) the Ministry of Long-Term Care (MOLTC)	No conflicts of interest declared
Dongjuan (2019)	United States	Retrospective cohort study	7	Not stated	No conflicts of interest declared
Do (2021)	Australia	Retrospective cohort study	7	Dementia Centre for Research Collaboration	No conflicts of interest declared
Unroe (2020)	United States	Retrospective cohort study	7	Not stated	No conflicts of interest declared
Leutgeb (2019)	Germany	Retrospective cohort study	6	Not stated	No conflicts of interest declared
Kim (2019)	South Korea	Retrospective cohort study	7	Chung-Ang University Research Grants in 2018	No conflicts of interest declared

Population	Method of recruitment	Number of participants	Age				
			Mean	Median	SD	Low IQR	High IQR
≥65 years who entered LTCF between 2009 and 2016	Record extraction	32,316	85			80	89
≥65 years entering a LTCF	Record extraction	116,192		85		80–89	
Non-indigenous adults ≥65 years	Record extraction	22,130		83		77	87
New (≥1 month) residents of LTCF	Record extraction	622	76.2				
≥65 years who have at least one assessment using interRAI 2.0	Record extraction	162,045 with 1,088,336 assessments					
75,000 living in LTCF	Record extraction	25,653 residents in 604 LTCF's	84.5		75		
256,000 insured (more than 1 year) older residents of LTCF	Record extraction	1665	80.5		11		
LTCF residents ≥65 years	Other	26,8657		86		81	90
LTCF residents ≥65 years	Record extraction	2,909,106					
Population-level health administrative databases, the Continuing Care Reporting System and the National Ambulatory Care Reporting System	Record extraction	56,433					
24,530 residents ≥65 years from 368 LTCF's	Record extraction	20,518 residents in 345 LTCF's	84.1		9.4		
LTCF residents ≥65 years	Record extraction	1896					
LTCF residents for ≥100 days/or with no plan for discharge	Record extraction	867	77.6				
Insured population	Record extraction	31,079	80.58				
LTCF residents ≥65 years transferred to an academic hospital emergency department	Record extraction	1131					

(Continues)

TABLE 1 (Continued)

	Country	Study design	NOS score	Funding source(s)	Declared conflicts of interest
Ograrek (2018)	United States	Retrospective cohort study	4	National Institute on Aging Grant P01 AG027296 Changing Long Term Care in America: Policies, Markets, Strategies and Outcomes. AHRQ National Research Service Award 4T32 HS000011-32. U.S. Department of Veterans Affairs Health Services Research and Development Career Development Award (#CDA 14–422)	No conflicts of interest declared
Case–control					
Ryan-Atwood (2017)	Australia	Case control study	5	Dept of Health and Human Services, Stat Govt of Victoria, National Health and Medical Council	No conflicts of interest declared
Randomised control trial					
Martin (2019)	Australia	Randomised controlled trial	NA	Northern Health Foundation and the Northern Health Aged Care Research Department and the University of Melbourne	No conflicts of interest declared
Kane (2017)	United States	Cluster-randomised clinical trial	NA	National Institute for Nursing Research (grant No.1R01NR012936), & Medline Industries	Multiple potential funding and commercial interests stated
Connolly (2018)	New Zealand	Randomised Control Trial	NA	Project Grant (12/884) Health Research Council of New Zealand	University of Auckland, the Health Research Council of New Zealand, Waitemata District Health Board, Metlifecare (provider of residential aged care services)
Other					
Testa (2021)	Australia	Retrospective group-based trajectory analysis	NA	Faculty of Medicine and Health Science PhD scholarship; NHMRC and MRFF grants	No conflicts of interest declared
Honinx (2021)	Belgium, England, Finland, Italy, the Netherlands and Poland	Cross sectional study	NA	Polish Ministry of Science and Higher Education 3202/7PR/2014/2, the European Unionâs Seventh Framework Programme (FP7/2007e2013) grant agreement 603,111 (PACE project Palliative Care for Older People)	No conflicts of interest declared
Dubucs (2021)	France	Secondary analysis of a prospective observational multi-centre study	NA	French Ministry of Health (Programme de recherche sur la performance du systÃ¨me de soins; PREPS 2014, 14-0185)	No conflicts of interest declared

Population	Method of recruitment	Number of participants	Age				
			Mean	Median	SD	Low IQR	High IQR
Medicare beneficiaries ≥65 years and newly admitted to a nursing home in 2012 with no MDS assessments in the prior year and a 5-day prospective payment system assessment, or an entry tracking record immediately followed by a 5-day prospective payment system or admission assessment	Record extraction	3,584,797	81.7	8.2			
Patients admitted to hospital due to falls or fall-related injuries from residential aged care facilities LTCF's	Record extraction	474 cases, 168 controls	Case 87.0 Control 96.4		6.6 7.6		
Residents from 6 LTCF's	Direct recruitment	326		Intervention = 88 Control = 88			
85 LTCF's with 936,717 residents	Record extraction	9050 pre-intervention, 8380 intervention NHs; and in control LTCF 14,428 pre-intervention and 13,472 in intervention	81		10.9		
LTCF residents from 21 facilities	Direct recruitment	247					
≥65 years from 43 local LTCF & and 2 public hospitals	Record extraction	807 (intervention), 6395 (usual care)					
Deceased residents of LTCF in six European countries: Belgium, England, Finland, Italy, the Netherlands and Poland	Other	1384	85.3				
LTCF residents who attended 17 EDs	Direct recruitment	572	87.3		0.3		

(Continues)

TABLE 1 (Continued)

	Country	Study design	NOS score	Funding source(s)	Declared conflicts of interest
Dai (2021)	Australia	Interrupted time series	NA	Not stated	No conflicts of interest declared.
Hullick (2021)	Australia	Step-wedge evaluation	NA	Not stated	Not stated
Giacomini (2022)	Italy	Cross-sectional study	NA	Not stated	No conflicts of interest declared
Russo (2020)	Italy	Prospective Observational	NA		No conflicts of interest declared
Horney (2017)	United States	Secondary analysis of cost & utilisation	NA	NIH KL2 TR001080	No conflicts of interest declared

by the interRAI Change in Health End Stage Symptoms (CHESS) scale was found to be associated with less frequent hospitalisation (Ogarek et al., 2018); and higher CHESS scores were associated with a higher rate of death in hospital or care facility (Hirdes et al., 2019; Ogarek et al., 2018).

3.3.4 | Medication(s)

The results of this review identified several classes of medications that were investigated in relation to acute care services use, and these included antipsychotic agents and Selective Serotonin Reuptake Inhibitors (SSRI's) (Dongjuan et al., 2019; Inacio, Jorissen, Wesselingh, et al., 2021; Inacio, Jorissen, Khadka, et al., 2021; Moyo et al., 2020; Stock et al., 2017), proton pump inhibitors, anticoagulation therapies, diuretics (Inacio, Jorissen, Wesselingh, et al., 2021), opioids (Honinx et al., 2021) and medications associated with orthostatic hypotension (Inacio, Jorissen, Wesselingh, et al., 2021; Kalisch Ellett et al., 2021; Ryan-Atwood et al., 2017). Positive associations were identified between polypharmacy and hospitalisation (Aryal et al., 2021; Fassmer & Hoffmann, 2020).

Mixed results were identified for associations between antipsychotic agents and acute service use. In a large administrative study, Moyo et al. (2020) identified that antipsychotic use was associated with lower incidence of hospitalisation ($n = 1{,}711{,}497$, United States), and Stock et al. (2017) reported no association between antipsychotic agents and risk for hospitalisation. In contrast, Dongjuan et al. (2019) suggested that preventable hospitalisation was associated with the prevalence of antipsychotic use in the absence of a diagnosis of psychosis. Inacio, Moldovan, et al. (2021) identified a higher risk of unplanned ED attendance and hospitalisation in older adults with a higher exposure to sedative medications, and in people prescribed SSRI's.

3.3.5 | Medications and falls

Medications that could be linked to the cause or consequence of falls (i.e., diuretics, or other medications associated with hypotension, and anticoagulation therapies) consistently emerged as associated with acute care services use. For example, Inacio, Moldovan, et al. (2021) found a higher risk unplanned ED attendance and hospitalisation in older adults who were prescribed sulfonamides diuretics (i.e., furosemide and bumetanide), beta blockers and organic nitrates; an association was identified with vitamin K antagonists (warfarin). Suggesting that medications that could lead to alterations blood pressure may increase the likelihood of falls; and the presence of an anticoagulation agent could exacerbate the negative consequence of a fall. These findings are supported by Kalisch Ellett et al. (2021) who reported that 87% ($n = 18{,}874$) of hospital fracture admissions occurred in residents using falls-risk medications prior to hospital admission in the aged care population; and Ryan-Atwood et al. (2017) who found that the presence of a prescribed medication that can cause orthostatic hypotension was associated with the number of falls-related hospital admissions, particularly in the presence of polypharmacy (four or more medications). A greater number of medications were associated with higher probability of presentation to ED (Aryal et al., 2021; Inacio, Jorissen, Wesselingh, et al., 2021), with Fassmer and Hoffmann (Fassmer & Hoffmann, 2020) reporting a relative risk ratio of 1.94 for acute hospital admissions (≥10 medications compared ≤4).

3.3.6 | Falls, activities of daily living and nutrition

Testa et al. (2021) identified approximately one-third of hospitalisations ($n = 807$, Australia) as attributable to falls-related injuries, this is consistent with Inacio, Moldovan, et al. (2021) who identified that older Australian men were at higher risk of hospitalisation following

Population	Method of recruitment	Number of participants	Age				
			Mean	Median	SD	Low IQR	High IQR
LTCF residents ≥65 years	Record extraction	24,331					
LTCF residents from the intervention group who attended ED (small rural to metro trauma centres)	Record extraction	18,837					
LTCF residents admitted to ED	Record extraction	20,800					
LTCF residents who had nursing home acquired pneumonia	Direct recruitment	146	81.5				
LTCF residents ≥65 years admitted to acute care hospital and discharged	Secondary analysis of empirical data	81,173	81				

falls, and that a history of falls and fractures combined with dementia/delirium were key characteristics of this group. In this study, a poor nutrition rating was associated with a higher risk of falls. This is supported by the findings of Aryal et al. (2021) who asserted that decreased nutritional intake led to an increase in transfers from LTCF to ED, and the finding by Valmorbida et al. (2020) that malnutrition (as measured by calf circumference as surrogate indicator of muscle mass and sarcopenia) was associated with increased hospitalisation and mortality. Inacio, Moldovan, et al. (2021) suggested that the association between better nutrition and hospitalisation is mediated by increased mobility and therefore increased risk of fall leading to injury. It is not clear if this is the case, as research included in this review identified associations between higher functional and ADL dependence and hospitalisation. For example, Unroe et al. (2020) reported that two-thirds of 1174 long-term residents who were hospitalised required assistance getting into or out of bed. This is further supported by scores on the Barthel Index being associated with unplanned hospitalisation in Taiwan ($p < .001$; Hsiung et al., 2018); in Canada were most likely present with an ADL impairment ($p < .001$), but least likely to present with an acute functional decline (Mowbray et al., 2020), and higher ADL dependence being associated with risk of unplanned hospitalisation in Australia (Inacio, Jorissen, Wesselingh, et al., 2021). Only Giacomini et al. (2022) associated higher ADL dependence with lower likelihood of ED attendance (Italy, $n = 37,311$).

4 | DISCUSSION

4.1 | Evidence for practice

Several sociodemographic risk factors are associated with acute service use, many of them unmodifiable (age, sex and ethnicity). The influence of the time of week and location (urban/rural) indicate policy makers should review resources available in facilities, the community and secondary care services that may influence these findings. This review has identified that respiratory and cardiovascular conditions and falls are among the most prevalent reasons for a transfer to acute services (Aryal et al., 2021; Chiswell et al., 2022; Dongjuan et al., 2019; Gruneir et al., 2018; Inacio, Moldovan, et al., 2021; Moyo et al., 2020; Testa et al., 2021; Unroe et al., 2020), consistent with these conditions being common in the ageing population (Jaul & Barron, 2017). Older people transferred from LTCF to ED/hospital tended to have higher scores on measures of frailty (Aryal et al., 2021; Hirdes et al., 2019; Mowbray et al., 2020; Ogarek et al., 2018; Simo et al., 2021; Stock et al., 2017). This is unsurprising given frailty indicates vulnerability to adverse health outcomes, and it is probable that this association is mediated by the potential for falls in frail older adults. In this review, the prevalence of falls as a reason for hospitalisation was associated with higher use of medications that can cause hypotension (Inacio, Moldovan, et al., 2021; Kalisch Ellett et al., 2021; Ryan-Atwood et al., 2017). Therefore, early and ongoing assessment of falls risk for people using hypotensive medications may reduce the number of falls (Seppala et al., 2018; Seppala, van de Glind, et al., 2018). The relationship between hypotensive medications, falls and hospitalisation is likely confounded by levels of functional dependence (ADL's) (Hsiung et al., 2018; Inacio, Jorissen, Wesselingh, et al., 2021; Mowbray et al., 2020; Unroe et al., 2018), and functional dependence as a reason for LTCF admission. These factors can be accounted for by making such a review part of a bundle of care that includes an assessment of cognition and measures of cardiorespiratory function, mobility and nutritional intake (Chiswell et al., 2022; Valmorbida et al., 2020). In this review, there was mixed evidence if LTCF residents with cognitive impairment were more or less likely to access ED or be hospitalised (Giacomini et al., 2022; Inacio, Jorissen, Wesselingh, et al., 2021; Moyo et al., 2020; Testa et al., 2021; Unroe et al., 2020). Previous

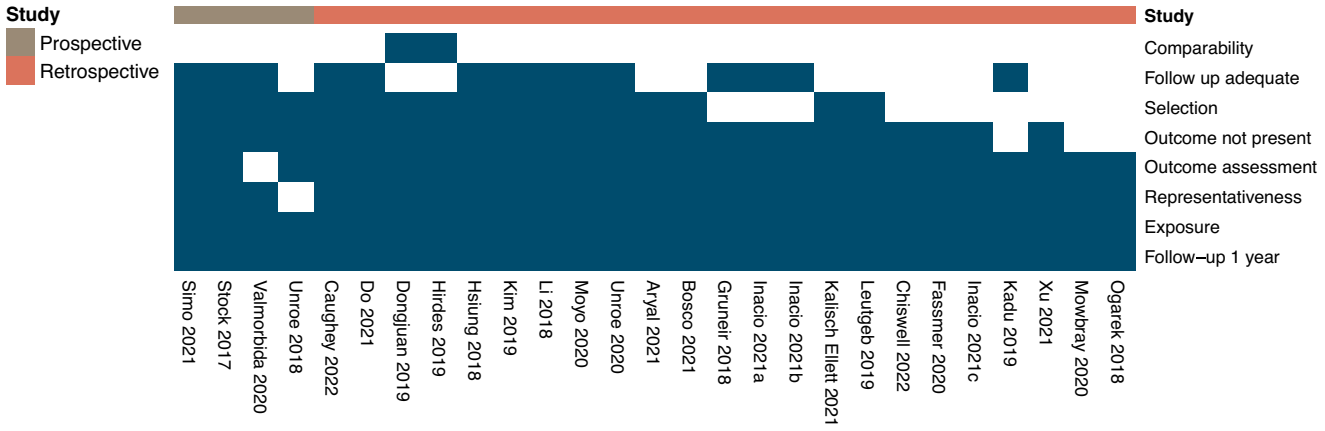

FIGURE 2 NewCastle Ottawa Scale assessment of quality.

descriptive evidence has shown that older adults are less likely to be assessed as 'in pain' as levels of cognitive impairment increase (Merrick et al., 2023), potentially attributable to lower rates of assessment within this population. The association of falls with hypotensive medications and the mixed results regarding cognition (and the proxy of psychoactive medications) may indicate a need for medication optimisation; however, recent research indicates that more evidence is required in this area (Ali et al., 2021; Almutairi et al., 2020). The timing of assessments and/or interventions could be important. It may be most effective for most assessments and interventions (for adults ≥85 years) to occur during the first 90 days, and then the first year after entering the LTCF (Kadu et al., 2019; Li et al., 2018), acknowledging that rates of hospitalisation increase significantly in the months prior to LTCF admission and then decrease subsequently (Jorissen et al., 2022). The findings of this review support recently published guidelines, which recommend multifactorial assessment on admission and annually (Jorissen et al., 2022), and may inform the development of systems that promote early and comprehensive assessment of older adults.

4.2 | Recommendations for future research

Future research should seek to use standardised naming conventions for the classification of conditions, or where conditions are grouped authors should stipulate the diagnosis within each grouping. Doing so will allow for the combination and comparison of findings. Where possible demographic variables should be reported in as transparent a manner as possible; consistent reporting could be adopted immediately. In the medium-term further interventional research assessing the impact of care bundles/protocols should be undertaken. Concurrently work is required to identify if there is a common causative pathway in the relationship between frailty, medications that cause hypotension, falls and acute services use. The findings of this review suggest that older adults with cognitive impairment are less likely to have an acute presentation. This finding is unexpected and warrants further investigation.

4.3 | Limitations of the review process

The keywords used for this review are likely to have excluded significant influences on the incidence of acute presentations, including staffing levels and attitudes, structure and ownership of facilities, provision of hospice and/or palliative care support, and family preferences. The heterogeneity of outcomes, and measures of effect, precluded the authors undertaking a meta-analysis.

5 | CONCLUSION

This review has identified sociodemographic factors and modifiable risks that may act as a trigger for assessment and may be amenable to early intervention in LTCF and consequently avoid the need for acute services. Future work should seek to clearly describe the associations identified in this review as the pathways of causation between modifiable risks remain opaque. Nonetheless, work to establish effective early interventions to address modifiable risks should be prioritised. Such interventions should seek to deliver coordinated and high-quality care in the most appropriate place for each person within the context of the health system. It is likely that coordinated and regular assessment and intervention will have significant individual, social and economic benefits.

6 | RELEVANCE TO CLINICAL PRACTICE

Service providers and clinicians can identify older adults who are at greater risk of requiring acute care services. It is plausible that understanding these risks and assessing or intervening early may avoid acute clinical deterioration, reduce the demand of health services, and improve quality of life. Early assessment and preventative intervention should be prioritised. This systematic review has identified several categories of risk that may result in unplanned and avoidable hospitalisation. In the future, these categories can provide

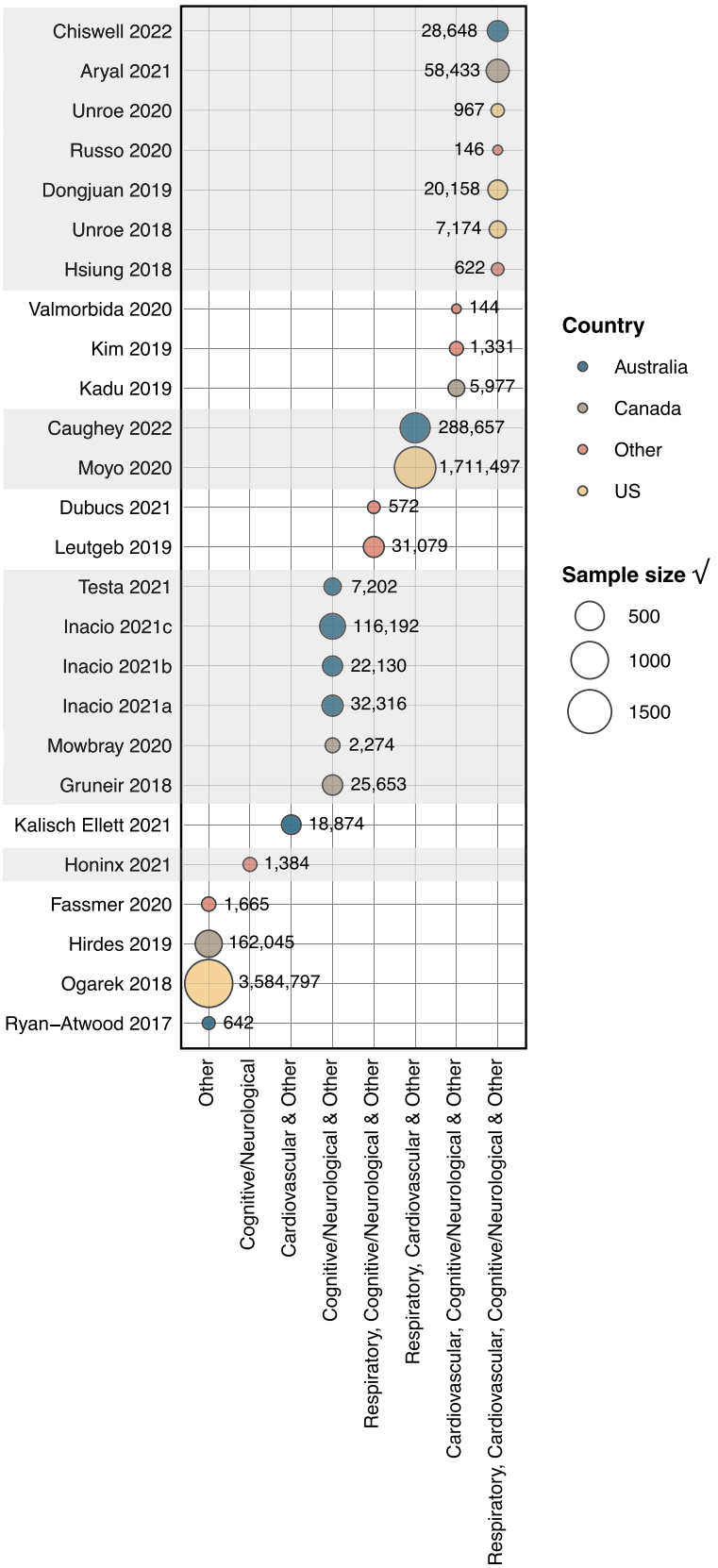

FIGURE 3 Conditions leading to or associated with hospitalisation and/or ED attendance* ($n = 26$). * Circle size is scaled to reflect the square root of the sample size.

a framework for targeted analysis of administrative data sets and the development of nursing interventions.

ACKNOWLEDGEMENT

Open access publishing facilitated by University of Technology Sydney, as part of the Wiley - University of Technology Sydney agreement via the Council of Australian University Librarians.

FUNDING INFORMATION

No funding was received to undertake this study.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Merrick, E., Bloomfield, K., Seplaki, C., Shannon, K., Wham, C., Winnington, R., Neville, S., Bail, K., Fry, M., Turner, M., & MacFarlane, J. (2024). A systematic review of reasons and risks for acute service use by older adult residents of long-term care. *Journal of Clinical Nursing*, *00*, 1–18. https://doi.org/10.1111/jocn.17165