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Review Article

Taxonomy of Interventions to Reduce Acute Care Transfers From Long-term Care Homes: A Systematic Scoping Review

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A B S T R A C T

Objective: To develop a taxonomy of interventions aimed at reducing emergency department (ED) transfers and/or hospitalizations from long-term care (LTC) homes.
Design: A systematic scoping review.
Setting and participants: Permanent LTC home residents.
Methods: Experimental and comparative observational studies were searched in MEDLINE, CINAHL, Embase Classic + Embase, the Cochrane Library, PsycINFO, Social Work Abstracts, AMED, Global Health, Health and Psychosocial Instruments, Joanna Briggs Institute EBP Database, Ovid Healthstar, and Web of Science Core Collection from inception until March 2020. Forward/backward citation tracking and gray literature searches strengthened comprehensiveness. The Mixed Methods Appraisal Tool was used to assess study quality. Intervention categories and components were identified using an inductive-deductive thematic analysis. Categories were informed by 3 intervention dimensions: (1) "when/at what point(s)" on the continuum of care they occur, (2) "for whom" (ie, intervention target resident populations), and (3) "how" these interventions effect change. Components were informed by the logistical elements of the interventions having the potential to influence outcomes. All interventions were mapped to the developed taxonomy based on their categories, components, and outcomes. Distributions of components by category and study year were graphically presented.
Results: Ninety studies (25 randomized, 23 high quality) were included. Six intervention categories were identified: advance care planning; palliative and end-of-life care; onsite care for acute, subacute, or uncontrolled chronic conditions; transitional care; enhanced usual care (most prevalent, 31% of 90 interventions); and comprehensive care. Four components were identified: increasing human resource capacity (most prevalent, 93%), training or reorganization of existing staff, technology, and standardized tools. The use of technology increased over time. Potentially avoidable ED transfers and/or hospitalizations were measured infrequently as primary outcomes.
Conclusions and Implications: This proposed taxonomy can guide future intervention designs. It can also facilitate systematic reviews and precise effect size estimations for homogenous interventions when outcomes are comparable.

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Residents living in long-term care (LTC) homes that provide 24-hour nursing care have complex health problems and/or are dependent in activities of daily living.[1] These frail residents are frequently transferred to the emergency department (ED) during episodes of acute health decline.[2] Transfers for episodes that could be managed by timely and effective in-facility care are commonly defined as "potentially avoidable."[3,4] Reported prevalence estimates of potentially avoidable ED transfers and subsequent hospitalizations are considerably high, at up to 44%[5] and 67%,[6] respectively. When appropriate, it is recommended to clinically manage acute episodes within the LTC setting itself in order to maintain continuity of care,[7] reduce transfer-related adverse events,[8] and promote the efficient use of health resources.[9]

Transfer decision-making processes from LTC are influenced by factors related to residents and families, facility characteristics and resources, and local care processes and practices.[10] Interventions aimed at reducing transfers and/or hospitalizations from LTC by acting on these factors are composed of specific components implemented to address specific needs at certain point(s) on the continuum of care (eg, end of life). However, confusion exists in the literature in this field, and terms such as "categories" and "components" have been used interchangeably, mainly because of the lack of a theory or framework for such interventions. For example, studies where the primary intervention involved assessing the effects of adding nurse practitioners to the care team have often been categorized as being "nurse practitioner interventions."[11] However, the addition of nurse practitioners can also be thought of as being an intervention component, one that could be included within several different intervention categories. This type of inconsistency in the literature exacerbates the heterogeneity of the terminology, making it difficult to compare and assess specific intervention attributes that contribute to reducing transfers from LTC.[12] This speaks to a need for a clinically and methodically meaningful intervention taxonomy tailored to this population and these particular outcomes.[13]

The heterogeneity in outcome reporting among studies evaluating ED transfers and hospitalizations represents another key challenge. Many intervention evaluation studies have focused on reductions in hospitalizations among LTC residents as a primary outcome.[11,12,14,15] Transfers to the ED, however, are—arguably—a more relevant outcome measure for interventions implemented at the LTC level, given that they are directly controlled by LTC stakeholders (ie, residents, families, and staff). To our knowledge, only 1 scoping review as of this writing has evaluated interventions to reduce preventable LTC transfers to the ED.[16] That review, however, did not sufficiently address the clinical heterogeneity associated with study designs, outcomes, and intervention categories and components.[16]

Given these shortcomings in the literature, the aim of this systematic scoping review[17] was to develop a taxonomy (ie, a classification system)[18] of interventions aimed at reducing ED transfers, both with and without subsequent hospitalization, from the LTC setting. In this paper, intervention "categories" are described as a function of 3 specific intervention dimensions, as follows:

Dimension 1: *When/at what point(s)* on the continuum of LTC care (eg, at admission, throughout stay, when acute situations develop, or at end-of-life) the intervention would be appropriate;
Dimension 2: *For whom* the intervention would be targeted (eg, all LTC residents or a subpopulation of residents, such as those with chronic conditions); and
Dimension 3: *How* the intervention is expected to effect change.

Intervention "components" describe the logistical intervention elements that are required for implementation (eg, increased resources, new technology, and tools). The specific research objectives were to answer the following 4 research questions.

1. Which interventions have been assessed in the literature?
2. Under which *categories* do these intervention fall?
3. What intervention *components* were required to implement these interventions?
4. Which outcome(s) have been measured?

Methods

Design

This systematic scoping review was conducted as part of a larger published review protocol.[19] It followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.[20] The process of identification, selection, eligibility, and the inclusion of research articles was reported using the PRISMA 2020 flow diagram for new systematic reviews, which includes searches of databases, registers, and other sources.[21] As the research data for this review used publicly available published documents (ie, did not collect individual participant data), no institutional review board approval was required.

Inclusion Criteria

Inclusion and exclusion criteria (Supplementary Table 1) were established following a 2-step iterative pilot test of the preliminary eligibility criteria using a 10% random sample of references retrieved from Medline (Ovid). This process was subsequently repeated on the results obtained from the remaining 11 databases. Experimental and comparative primary observational studies employing quantitative and mixed methods that reported on the impact of interventions on ED transfers and/or hospitalizations from LTC homes were included.

The target LTC home resident population under study pertains to permanent full-time residents aged 18 years and older. Studies were included if they were implemented in a non–community-dwelling setting, providing a wide range of health and personal care services for persons with medical or physical needs that require access to 24-hour nursing care, personal care, and other therapeutic and support services.[22] Any facility that matched this definition was considered to be an LTC home, regardless of the terminology used in the article (eg, nursing homes, residential aged care facilities, and care homes) as variations in facility nomenclature often occur because of geography or intrinsic facility characteristics.[23] Facilities that exclusively provided care to individuals at other points along the health care continuum (eg, respite, rehabilitation, post-acute) were not included within the scope of this review.

Interventions included programs, models of care, or innovations designed to reduce emergency transfers in the event of an acute or complex change in residents' health. Acute care transfer outcome measures included ED transfers and/or hospitalizations. For each study included in our review, intervention outcomes were identified as being either primary or secondary, and whether they were specified as being "potentially avoidable" or not.

Identification of Studies via Databases and Registers

We searched the following sources from inception until March 2020: (1) Subject heading and text word–based searches: MEDLINE (Ovid), CINAHL, Embase Classic + Embase (Ovid), the Cochrane Library, APA PsycINFO (Ovid); (2) text word–based searches (Ovid): Social Work Abstracts, AMED (Allied and Complementary Medicine),

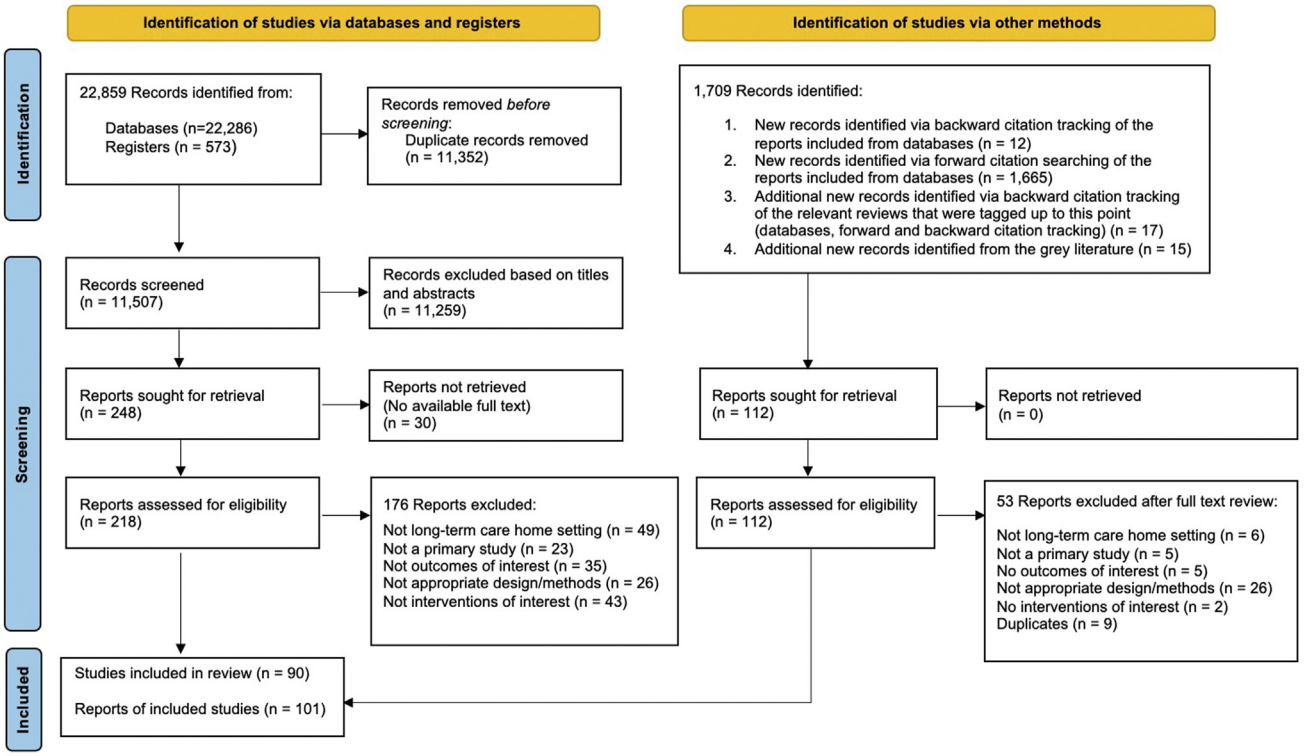

Fig. 1. PRISMA flow diagram for new systematic reviews that included searches of databases.

Global Health, Health and Psychosocial Instruments (HaPI), Joanna Briggs Institute EBP Database, Ovid Healthstar; and (3) Web of Science Core Collection. A research librarian guided our search strategy. The search strategy used for Medline (Ovid) (Supplementary Table 2) was subsequently adjusted for the other data sources. EndNote X9 reference manager,[24] the Covidence systematic review platform,[25] and Excel worksheets were used to remove duplicates and to manage the review process. Unpublished trials and comparative observational studies with results were searched within the ClinicalTrials.gov registry.[26,27]

Identification of Studies via Other Methods

References cited within the set of articles (reports) deemed eligible for inclusion from our initial searches of databases and registers (ie, after undergoing full text review) were subsequently reviewed using backward citation tracking.[28] Using the Web of Science citation database, forward citation tracking was conducted to identify relevant new studies that cited this same set of eligible articles. Relevant review articles were tagged throughout the screening process (databases, forward and backward citation tracking), and their cited references were subsequently also screened for relevance. Finally, a gray literature[29] search strategy was performed (Supplementary Table 3) to ensure that our review was comprehensive.[30]

Selection of Primary Studies

Two peer reviewers (from a pool of 5) independently screened each title and abstract retrieved from the database search and then reviewed the full texts of potentially eligible records. Disagreements between peer reviewers were resolved by consensus,[31] and if needed, the decision was deferred to a third adjudicator. Reports of included studies presenting the same studies or samples were identified, and those with more comprehensive or updated reporting were retained.[27] The same selection process was applied to potentially relevant references identified via backward and forward citation tracking. One reviewer performed the selection from the gray literature searches.[30]

Quality Appraisal of Studies Included in the Final Sample

The Mixed Methods Appraisal Tool (MMAT)[32] was used to assess the quality of our included randomized and nonrandomized studies. Similar to the process used to determine study inclusion, disagreements about quality were resolved through consensus between the 2 appraisers and discussed with a third adjudicator when they persisted. The MMAT tool encourages reporting each question, but when needed, it suggests classifying the overall quality as low vs high based on the number of quality items flagged (ie, at least 4 items would have to be satisfied for a study to qualify as being of “high” quality).[32] We included all studies in the synthesis regardless of their quality.

Data Extraction

After pilot testing and calibrating a preliminary data extraction Excel spreadsheet, 2 independent reviewers extracted the following data from each study: general study information, specifics of the target population under study (ie, point(s) on the continuum of care and eligibility criteria), text segments of intervention descriptions, intervention participants who were involved with the implementation, outcome measures (ie, ED transfers and hospitalizations, including potentially avoidable ones). If needed, study corresponding authors were contacted for clarification about their measures, analyses, or unreported endpoints.

Table 1
Taxonomy of Intervention Categories

Category	Dimension 1: When or at What Point(s) on the Continuum of Care	Dimension 2: For Whom	Dimension 3: How
1. Advance care planning	At all stages of frailty or chronic illness, not just at the end of life	For residents who are (1) newly admitted to the LTC home; (2) residing in the LTC home, and therefore may benefit from ACP at regular intervals; (3) observed to have had a change in their health status; and (4) experiencing advanced or terminal illness or nearing end of life	By focusing on goals of care to meet a resident's and family's full range of needs (ie, physical, psychosocial, and spiritual)*
2. Palliative and end-of-life care	When the goal of care decision is established as being palliative and end-of-life care	For residents living with a life-limiting illness that is (usually) at an advanced stage, and for their families	By active provision of comfort and dignity to residents at this life stage, to assist residents and their families attain the best quality of life†
3. Onsite care for acute, subacute, or uncontrolled chronic conditions	When there is a time-limited and condition-specific change in residents' health status	For the subset of residents with specific health conditions (eg, pneumonia, neuropsychiatric symptoms of dementia, chronic obstructive pulmonary disease) or those who have had multiple emergency transfers or hospitalizations	By early identification of and treatment for health conditions onsite, to prevent health deterioration to the point where an emergency department visit is required‡
4. Transitional care	Once the unplanned transfer to acute care decision has been made	For residents for whom the transitional process has begun (ie, ambulance andemergency paramedics have been called, or residents were sent to the emergency department or have been hospitalized)	By integrating care between LTC home, acute care, and emergency paramedic staff, to reduce gaps in information exchanged between settings and increase the quality of transitional care§
5. Enhanced usual care	Can occur at any time point from admission until palliative and end-of-life care	For (1) all residents regardless of diagnoses or conditions, (2) a subset based on time since LTC home admission, or (3) a subset based on eligibility for certain health care insurance plans and policies	By implementation of priority-based quality improvements to enhance the quality of usual LTC clinical practices‖
6. Comprehensive care	Can occur at any time point from admission until palliative and end-of-life care	For all LTC home residents regardless of diagnoses, conditions, time since admission, etc	By incorporating many if not most intervention categories for quality assurance performance improvement**

*Canadian Hospice Palliative Care Association. *Essential Conversations. A Guide to Advance Care Planning in Long-Term Care Settings*. Canadian Hospice Palliative Care Association; 2021.

†Canadian Hospice Palliative Care Association. Hospice Palliative Care. Accessed February 8, 2022. https://www.chpca.ca/about-hpc/.

‡Canadian Institute for Health Information. *Sources of Potentially Avoidable Emergency Department Visits*. Canadian Institute for Health Information; 2014

§Canadian Institute for Health Information. *Patient Pathways: Transfers from Continuing Care to Acute Care*. Canadian Institute for Health Information; 2009.

‖Canadian Institute for Health Information. Long-term care homes in Canada: How many and who owns them? Accessed December 21, 2021. https://www.cihi.ca/en/long-term-care-homes-in-canada-how-many-and-who-owns-them.

**Ouslander JG, Bonner A, Herndon L, Shutes J. The Interventions to Reduce Acute Care Transfers (INTERACT) quality improvement program: an overview for medical directors and primary care clinicians in long term care. *J Am Med Dir Assoc*. 2014;15(3):162-170. https://doi.org/10.1016/j.jamda.2013.12.005.

Taxonomy Development

Our taxonomy was guided by the concept of person-centered care, which encompasses the needs and expectations of residents and families and respects their right and desire for autonomy, confidentiality, dignity, choice of providers, and prompt and timely care.[33] A hybrid inductive-deductive thematic analysis approach[34] was used.

First, categories were identified inductively using intervention description details provided in each included study. Three dimensions informed the identification and definitions of categories: (1) When/at what point(s) on the continuum of care, based on the dynamic nature of residents/families' needs and expectations over the course of an LTC stay; (2) For whom the intervention was implemented (ie, intervention target population and eligibility criteria), and (3) How the intervention was expected to effect change such that a transition is avoided.

Components were then defined as the set of logistical elements required for intervention implementation that would have the potential to influence outcomes.[35] To qualify as a component, an intervention element had to be distinct, and not composed of multiple elements. The first author performed the initial development, refined the categories and components in a series of meetings with the senior author, and all authors reviewed and agreed on the final taxonomy.

Finally, all interventions were mapped to the developed taxonomy based on their categories, components, and outcomes, and the results were tabulated. Distributions of components by category and year of publication were presented graphically.

Results

Figure 1 presents the search results. In total, 330 full texts were reviewed from among 20,859 records identified from database searches and 1709 records from other searches. Supplementary Table 4 outlines the characteristics of 90 studies included for synthesis. The sample included 25 randomized (including cluster randomized) controlled trials and 65 nonrandomized studies. Mixed settings (ie, where LTC comprised only part of the study population) were identified in 18 studies. Studies were conducted in the United States (34), Australia (20), the United Kingdom (10), Canada (8), and other countries (18). Twenty-three studies (26%) were of high quality. The MMAT quality appraisal of included studies is provided in Supplementary Table 5.

Six intervention categories were identified: advance care planning (ACP); palliative and end-of-life care; onsite care for acute, sub-acute, or uncontrolled chronic conditions; transitional care; enhanced usual care; and comprehensive care. Because of its unique and specific nature, ACP evolved as a distinct category in our review given that it is a care process that involves multiple components (ie, tools and often also HR and training). Table 1 presents the taxonomy of intervention categories and their definitions for each dimension. Four intervention components emerged from the analysis: "increasing human resource capacity," "training or reorganization of existing staff," "technology," and "standardized tools." For simplicity, these are henceforth shortened to Human Resources (HR), Training, Technology, and Tools,

Table 2
Intervention Components Identified via Thematic Analysis

Component	Definition	Examples
Increasing human resource capacity	"Changes in who provides care, to include the qualifications of who provides care; and the recruitment, distribution and retention of additional health workers"	- Increasing the number of existing LTC home staff (physicians, nursing and support staff) for specific roles (eg, technician to assist with telemedicine, provide palliative care) - Adding new expertise (eg, nurse practitioner, geriatrician, geriatric nurse specialist, specialized nursing expertise). These external personnel may acquire specialized training. - Providing outreach services from various disciplines (eg, emergency department staff, community pharmacist, wound care team or consultations with specialists) - Research or program personnel to assist with intervention implementation
Training or reorganization of existing staff	"Educational materials/meetings, audit/feedback, Changes in how existing health workers interact with each other or with residents/families to ensure timely and efficient care delivery"	- LTC home staff training for clinical skills development to provide enhanced care (eg, geriatric care, palliative and end-of-life care) or manage residents with specific (physical or mental health) problems - Education to assist residents and families on identifying goals of care (advance care planning) - Audit and feedback via a summary of health workers' performance over a specified period of time, given to them in a written, electronic or verbal format (eg, ED transfer or hospitalization). The summary may include recommendations for clinical action. - Assigning new innovative roles (eg, identifying champions) or allocating more time to existing LTC home staff to assist with implementation - Multi- or interdisciplinary team meeting implementation among preexisting staff
Technology	"Information and communication technology to manage delivery of healthcare, or to deliver healthcare"	- Web-based visual system for telemedicine: direct provision of a clinical service (diagnosis or management) - Technology for diagnostic testing, imaging (eg, portable X-ray machine) or treatment - Health information exchange system to facilitate electronic transfer of clinical information or documents or secure messaging - Systems (hardware or software) that alert frontline staff or outreach teams to the status of a resident (eg, increased mortality risk)
Standardized tools	"Tools to guide coordination of care and management of care processes"	- Clinical assessment and decision-making tools (eg, care pathways aiming to link evidence to practice for specific health conditions and local arrangements for delivering care, for acute conditions, or end-of-life care) - Packages of care (practice guidelines or protocols) - Communication tools for use between stakeholders

Definitions were adapted to the long-term care home context from the Effective Practice and Organisation of Care, EPOC Taxonomy; 2015. Our adaptations are underlined. Available at: https://epoc.cochrane.org/epoc-taxonomy.

respectively. Table 2 presents definitions and examples for each component.

Table 3 presents the results of mapping 90 interventions to our proposed taxonomy, with each category stratified by study design (ie, randomized controlled trials vs nonrandomized studies). Almost one-third of all studies fell into the enhanced usual care category (31%), whereas onsite care for acute, subacute, or uncontrolled chronic conditions and palliative and end-of-life care were the next most prevalent intervention categories, representing 18% and 17% of our sample, respectively. Intervention component details for all 90 studies are provided in Supplementary Table 6.

Figure 2A presents the distribution of intervention components by intervention category. In total, 93% of all interventions included an HR component, whereas Training and Tools (ie, those usually used in conjunction with training) were the second and third most frequent components, present in 72% and 49% of interventions, respectively. The least frequent component was Technology, reported in 30% of intervention studies. The intervention category that more commonly included Technology was onsite care for acute, subacute, or uncontrolled chronic conditions (50%). Technology was largely absent among advance care planning (0%) and palliative and end-of-life care interventions (13%). Transitional care interventions were least likely to include tools as components (18%). All eight comprehensive care interventions included all 4 intervention components. Figure 2B illustrates the evolution of component distribution over time. The majority of interventions included an HR component, either alone or in combination with Training, which remained stable during the study period. There was a shift among the most recently published interventions (post-2019) that reveal an uptick in increased inclusion of Technology and Tools components as compared with the time period before it (ie, a 105% and 52% increase, respectively).

Four outcome measure groups emerged: only ED transfers (8%), only hospitalizations (40%), both ED transfers and hospitalizations (42%), and composite outcomes (10%). Composite outcome measures were reported as varying combinations of ED transfers, hospitalizations, intensive care unit stays, and observation days. Studies

Table 3
Interventions Mapped to Categories and Components

Design	Study	Target LTCH Resident Population	Intervention	Components				Outcomes*		
				HR	Training	Technology	Tools	ED	H	Co
Category 1. Advance Care Planning Interventions										
RCT (n = 9)	Brazil (2018)	Residents having dementia without decisional capacity to complete an ACP	Advance care planning (ACP) intervention	✓	✓	—	✓		d	
	Casarett (2005)[36]	All permanent residents	Improving the use of hospice services	✓	—	—	✓		d	
	Garland (2022)	Residents with elevated risk of dying within the next 6-12 months	Better tArgeting, Better outcomes for frail ELderly patients (BABEL) ACP	—	✓	—	✓			d
	Hanson (2017)	Residents with advanced dementia	Goals of care intervention for advanced dementia	✓	✓	—	✓		d	
	Martin (2019)	All permanent residents	Goals of patient care	✓	—	—	✓	b,d	b,d	
	Mitchell (2020)	All long- stay residents (>100 d) enrollment in the Medicare fee-for-service program	PROVEN advance care planning video intervention	✓	✓	—	✓			b
	Molloy (2000)	All residents	Let Me Decide Advance Care Directive program	—	✓	—	✓		d	
	Morrison (2005)	New residents within 7 d of admission	Multicomponent ACP	✓	✓	—	✓		d	
	Overbeek (2019)	All residents	Respecting Choices ACP programme	—	✓	—	✓	b	b	b
NRS (n = 3)	Baron (2015)	All residents	ACP education program	✓	✓	—	✓		b	
	Caplan (2006)	Mentally competent residents as determined by capacity screening	Let Me Decide Advance Care Directive program	—	✓	—	✓	b	b	
	O'Sullivan (2016)	All residents mostly having cognitive impairment	Let Me Decide ACP program	—	✓	—	✓		b	
Category 2. Palliative and End-of-Life Care Interventions										
RCT (n = 4)	Agar (2017)	Residents with advanced dementia	Facilitated case conferencing on end-of-life care	✓	✓	—	—	d	d	
	Forbat (2020)	Residents at greatest risk of dying without a plan in place and who have a high symptom burden	Specialist palliative care needs rounds	✓	✓	—	—		b,d	
	Kinley (2014)	Residents at end of life	High facilitation + action learning (arm 1) or GSFCH programme (arm 2)	✓	✓	—	✓		b	
	Temkin-Greener (2018)	Medicare beneficiary residents at end of life	Improve Palliative Care through Teamwork (PCTeams)	✓	✓	—	✓		b	
NRS (n = 11)	Comart (2012)	Residents at end of life	Palliative care consult service	✓	—	—	—	b	b	
	Finucane (2013)	Residents approaching end of life	"Sustainability project of Gold Standards Framework for Care Homes (GSFCH) programme	✓	✓	✓	✓		b	
	Hockley (2010)	Residents at end of life	GSFCH and an adapted Liverpool Care Pathway for Care Homes	✓	✓	—	—		b	
	Horey (2012)	Residents entering end of life	Adding end-of-life pathways on the Good Death project	✓	—	—	✓		**a**,b	
	Levy (2008)	Residents at end of life	Making advance planning a priority targeting residents at high risk of mortality for palliative care	—	✓	✓	✓		b	
	Livingston (2013)	Residents at end of life with dementia	Interactive staff training program	✓	✓	—	✓		b	
	Miller (2001)	Residents at end of life	Enrollment in Medicare hospice care	✓	—	—	—		b	
	Miller (2016a)	Residents at end of life	Palliative care consultations	✓	✓	—	—		b	
	Miller (2016b)	Residents at end of life	Palliative care consultations	✓	✓	—	—	b	b	**a**
	Rainsford (2020)	Residents approaching at end of life	Palliative care needs rounds	✓	✓	—	✓	b	b	
	Teo (2014)	Residents at end of life	Project Care at the End-of-Life for Residents in homes for the Elderly program	✓	✓	—	—	b	b	

Category 3. Onsite Care for Acute, Subacute, or Uncontrolled Chronic Conditions Interventions											
RCT (n = 6)	Grabowski (2014)	Residents necessitating urgent or emergent calls	Telemedicine	✓	✓	✓	—		b		
	Lee (2002)	Having COPD, at least 1 hospitalization in previous 6 months	Care protocol for chronic obstructive pulmonary disease	✓	✓	✓	—	b	b		
	Loeb (2016)	Residents meeting a standardized definition of lower respiratory tract infection	Clinical pathway for on-site treatment of pneumonia and other lower respiratory tract infections	✓	—	✓	✓	b	b		
	Rolland (2020)	Without documented dementia, not bedridden, Living in NH at least 1 month Life expectancy >1 year	Systematic dementia screening, multidisciplinary team	✓	—	—	✓	b,d	c		
	Romoren (2017)	Patients received antibiotics or fluids (for pneumonia, dehydration, etc)	Structured training program for health workers	✓	✓	—	—		b		
	Stern (2014)	Residents with stage II or greater pressure ulcers	Enhanced multidisciplinary teams	✓	✓	✓	✓	d	d		
NRS (n = 10)	Ashcraft (2017)	Residents with multiple comorbidities requiring complex nursing care	Customized electronic Situation, Background, Assessment, Recommendation communication tool (SBAR)	✓	✓	✓	✓			b	
	Chan (2018)	Residents with acute, subacute, end-of-life conditions	Acute Geriatric Outreach Service (AGOS)	✓	✓	—	—	d			
	Crilly (2011)	Residents with an illness that required hospital services but not necessarily in-hospital admission, could have treatment continued in LTCH	Hospital in the Nursing Home Admission Avoidance Programme	✓	✓	–	✓		b		
	Hutchinson (2015)	Residents who are at imminent risk of acute care management (at least 1 ED attendance or inpatient admission)	Residential Care Intervention Program in the Elderly (RECIPE)	✓	—	—	✓	b	b		
	Hutt (2011)	Residents with 2 or more signs and symptoms of systemic lower respiratory tract infection	Multifaceted intervention to implement national consensus guidelines for nursing home–acquired pneumonia	✓	✓	✓	✓		**a**		
	Lau (2013)	Residents with the following diagnoses: dehydration, pneumonia, urinary tract infection, gastroenteritis, deep venous thrombosis, terminal care	Residential Care Intervention Program in the Elderly	✓	—	—	—		d		
	Lisk (2012)	Residents who were admitted to hospital	Regular liaison of consultant geriatricians with LTCH facilities	✓	—	✓	✓		b		
	McCarthy (2020), USA	Long-stay (>100 days) residents who had recently progressed to the advanced stages of dementia, CHF, or COPD	National initiatives to reduce hospitalizations with Affordable Care Act	✓	✓	—	✓			**a**,b	
	Montalto (2015)	Residents required admission to the hospital for nursing home–acquired pneumonia	Hospital in the Home intervention model	✓	—	✓	—		b		
	Wills (2018)	Residents with and without dementia who sometimes might be "in crisis"	Community matron Care Home Teams	✓	✓	—	—	b	b		
Category 4. Transitional care interventions											
RCT (n = 1)	Cordato (2018)	Permanent residents admitted to the hospital's geriatric service	Regular Early Assessment Post-Discharge protocol of coordinated care	✓	—	—	—	b	b		
NRS (n = 10)	Brock (2013)	Medicare fee-for-service (FFS) insurance beneficiaries who reside in the community for both the index hospitalization and rehospitalization	Quality improvement organizations	✓	✓	—	✓		d		
	Craswell (2020)	All residents who were transferred to the ED	NP candidate-led service	✓	✓	✓	—	b	b		
	Fan (2016)	Permanent residents who presented to the ED	Hospital in the Nursing Home Program	✓	✓	—	—	b	b		

(*continued on next page*)

Table 3 (*continued*)

Design	Study	Target LTCH Resident Population	Intervention	Components				Outcomes*		
				HR	Training	Technology	Tools	ED	H	Co
	Jensen (2016)	Residents with acute illnesses or injuries attended by Extended Care Paramedics or emergency paramedics	Extended Care Paramedic program	✓	—	—	—	b	d	
	Marsden (2020)	Residents presented to the ED	Geriatric emergency department intervention	✓	✓	✓	—	d	b	
	Marshall 2016	Residents with a 911 call	Care by Design program (CBD)	✓	✓	—	✓	b		
	McCarthy (2020), Ireland	Residents presented to the ED	Community Medicine for the Older Person outreach program	✓	✓	—	—	b	b	
	Shrapnel (2019)	Residents presented to the ED	Mater Aged Care in An Emergency service	✓	✓	✓	—	b	b	
	Street (2015)	Residents presented to the ED	Residential Care In-Reach	✓	✓	✓	—	d	b	
	Zafirau (2012)	Residents admitted to an inpatient unit from ED	Advance Directive Transfer Communication Protocol	✓	✓	—	—		d	
Category 5. General onsite care interventions										
RCT (n = 4)	Arendts (2018)	Permanent residents (life expectancy >180 d)	Coordinated model of NP/physician care	✓	✓	—	✓	d	d	
	Boyd (2014)	All residents receiving government-funded residential aged care	The Residential Aged Care Integration Program (RACIP)	✓	✓	✓	✓		b	
	Cavalieri (1993)	Newly admitted to LTCF, having no terminal illness	Comprehensive Geriatric Assessment Team	✓	—	—	—	b	b	
	Connolly 2015	All residents within all 4 levels of care	Aged Residential Care Healthcare Utilisation Study (ARCHUS)	✓	✓	—	—		**a**,b	
NRS (n = 24)	Ackermann (1998)	All residents (mostly having dementia)	Regular transfers by a gerontologist physician assistant	✓	—	—	—		b	
	Aigner (2004)	All residents with a full-year follow-up	NP/physician team model	✓	—	—	—	b	b	
	Burl (1998)	Health maintenance organization residents	Geriatric NP/physician program	✓	—	—	—	b	b	
	Codde (2010)	All residents	An enhanced primary care service for residential aged care facilities	✓	✓	✓	—	b	d	
	Connolly (2018)	All residents	Aged Residential Care Healthcare Utilisation Study (ARCHUS)	✓	✓	—	—	b		
	Gloth (2011)	All residents	Post-Acute Care Hospitalist Model	✓	—	—	—	b		
	Graham (2017)	All residents	Responsive Education and Collaborative Health (REaCH) programme	✓	✓	—	✓	b	b	
	Hex (2015)	All residents	Telemedicine	✓	—	✓	—	c	c	
	Hullick (2016)	All long-stay residents	Aged care emergency service	✓	✓	✓	✓	b	b	
	Lacny (2016)	All residents who were alive	NP/physician model of care	✓	—	—	—	b		
	Lloyd (2019)	All residents receiving Principia enhanced support or from one of the 6 comparable local authorities	Enhanced support intervention	✓	✓	—	—	b	**a**,b	
	Lukin (2016)	All residents	Hospital in the Nursing Home program	✓	✓	—	—	b	b	
	Jung (2015)	Eligible for MassHealth Standard (ie, Medicaid)	Senior care options	✓	—	—	—		b	
	Kane (1989)	New admitted or long-stay residents	Geriatric NPs in LTCH facility care	✓	—	—	—	b	b	
	Kane (1991)	Medicaid eligible, and eligible for either part A or part B of Medicare	Medicare waiver for NPs and physician assistants to deliver primary care	✓	—	—	—	b	b	
	Kane (2003)	All residents	Evercare: a novel managed care program using NPs	✓	—	—	—	b	**a**,b	
	Kane 2004	Dual-eligible residents for at least one month in study areas	Minnesota Senior Health Options (program for dually eligible older persons)	✓	✓	—	—	**a**,b	**a**,b	
	Kumpel (2020)	All individuals insured with the Techniker Krankenkasse (Germany's largest HMO)	Additional reimbursement for outpatient physicians treating LTCH residents	✓	—	—	—		**a**,b	
	Ono (2015)	All residents admitted to the LTCH during the study period	Government designated NP Clinical Trial Practice	✓	✓	—	—	b	b	

	Reuben (1999)	All residents staying in LTCH at least 6 wk	Innovative programs for providing primary care for long-stay LTCH residents	✓	—	—	—	b	b		
	Rolland (2016)[37]	All residents staying in LTCH at least 30 d	Quality improvement initiative on nursing practices and functional decline	✓	✓	—	✓	b			
	Weatherall (2019)	All residents alive during the study period	Danish Ministry of Social Affairs and Integration Program	✓	✓	—	—		**a**,b		
	Wieland (1986)	All residents	Academic (Teaching) Nursing Home program	✓	✓	—					b
	Xing (2016)	All residents staying in LTCH at least 90 d and whose care was not exclusively reimbursed by Medicare	Implementation of Medi-Cal Long-Term Care Reimbursement Act	✓	—	—	—		**a**		
Category 6. Comprehensive care interventions											
RCT (n = 1)	Kane 2017	All residents	Intervention to Reduce Acute Care Transfers (INTERACT)	✓	✓	✓	✓	d	**a**,b		
NRS (n = 7)	Blackburn (2020)	All long-stay residents	Optimizing patient transfers, impacting medical quality, and improving symptoms' care model	✓	✓	✓	✓		b		
	Giebel (2020)	All residents	The Care Home Innovation Programme (CHIP)	✓	✓	✓	✓	**a**	b		
	Ouslander (2011)	All residents	INTERACT	✓	✓	✓	✓		b		
	Tena-Nelson (2012)	All residents	INTERACT + education and training sessions	✓	✓	✓	✓		b		
	Vadnais (2020)	All long-stay residents	Enhanced Care and Coordination Providers care improvement models	✓	✓	✓	✓	**a**,b	**a**,b	**a**,b	
	Vogelsmeier (2021)	All Medicare/Medicaid long-stay residents	Missouri Quality Initiative (MOQI)	✓	✓	✓	✓			b	
	Zúñiga (2022)	All long-stay residents	Comprehensive, contextually adapted geriatric nurse–led model of care (INTERCARE)	✓	✓	✓	✓	b			

Co, composite; EOL, end of life; H, Hospitalization; HR, human resources; LTCH, Long-Term Care Home (used for all types of facilities regardless how they were reported in each reference); NRS, nonrandomized study; PC, palliative care; RCT, randomized controlled trial.

*a: potentially avoidable primary; b: other primary; c: potentially avoidable secondary; d: other secondary.

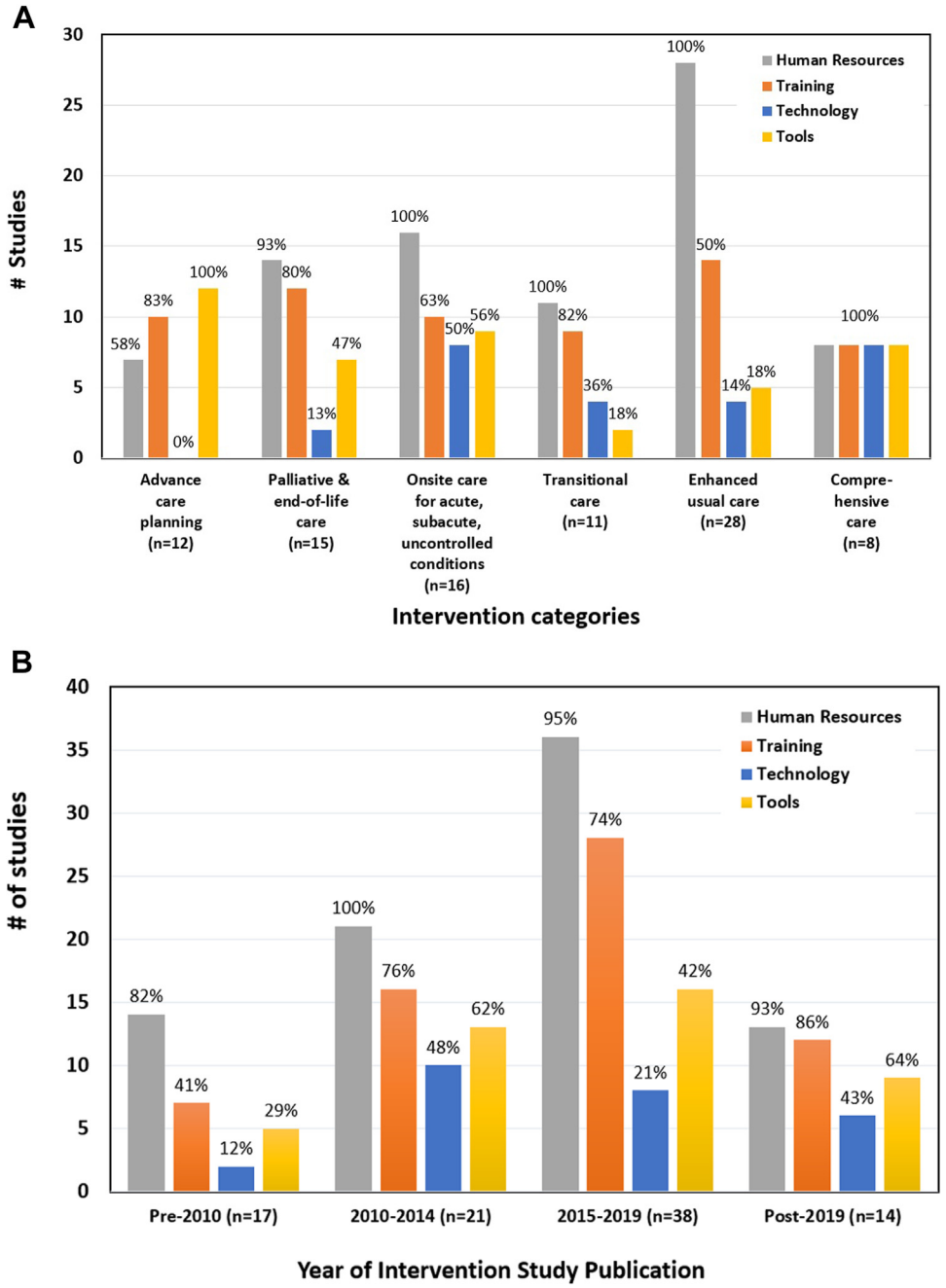

Fig. 2. (A) Distribution of intervention components by intervention category. (B) Distribution of intervention components by study year.

measuring potentially avoidable outcomes as their primary outcome were infrequent: 3 studies measured potentially avoidable ED transfers, 11 studies measured potentially avoidable hospitalizations, and 3 studies measured potentially avoidable composite outcomes. Thirteen studies included in the synthesis measured our review outcome measures as secondary outcomes, whereas 9 studies reported them as both primary and secondary outcomes.

Discussion

In this systematic scoping review, we first identified all studies that described interventions aimed at reducing acute care transfers from LTC, including those transfers that were considered to be potentially avoidable. We then proposed a taxonomy whereby interventions can be classified as belonging to one of 6 identified categories and consisting of 1 or more among 4 identified components. Given that interventions were typically complex, with the vast majority including multiple and interacting components, this proposed taxonomy can inform future study designs. It will also facilitate future literature reviews that aim to synthesize intervention effectiveness and efficacy via subgroup analysis, thereby increasing confidence in the evidence obtained.

Six Intervention Categories

Enhanced usual care, the largest category comprising almost one-third of all interventions, targeted either all or newly admitted residents. This category often included local models of care and programs

involving stakeholders at the level of organizations and health care systems,[38] such as the addition of geriatric nurse practitioners,[39] gerontologist physician assistants,[40] or implementation of a Hospital in the Nursing Home program.[41] It also included interventions arising from policy changes and government-led interventions, such as the Senior Care Options,[42] the Danish Ministry of Social Affairs and Integration Program,[43] the Medi-Cal Long-Term Care Reimbursement Act,[44] or the Medicare waiver allowing nurse practitioner and physician assistants to deliver primary care.[45]

Advance care planning addresses the changing needs and expectations of residents and their families throughout their LTC trajectory. These directives are meant to be revised on admission to LTC, when residents have a change in health status or experience advanced illness, or near the end of life.[46] In cases of advanced dementia, for example, timely ACP updates help facilitate decision making (eg, to decline transfer to a hospital when death is imminent). In our synthesis, ACP evolved as a distinct category (and not a component), which appears to be promising in terms of feasibility of implementation from a managerial standpoint, because fewer studies in this category required acquiring additional HR. Our MMAT evaluations, however, indicate that most studies in the ACP category were of poor quality, thereby limiting future evaluation of their overall effectiveness.

Comprehensive care interventions were those that, by definition, encompassed all 4 intervention components and some aspects from other categories. As such, these interventions are the most complex programs usually addressing a multitude of factors (ie, those related to residents and families, facility characteristics and resources, and local care processes and practices).[38] It is important to note that the comprehensive care category is distinct from a comprehensive geriatric assessment, the latter of which is a multidimensional and multidisciplinary diagnostic process focused on determining personalized care plans for older adults. In the LTC setting, residents may indeed benefit from this type of assessment in terms of improved quality of care and reduced hospitalizations,[47] but this is not what is meant by the comprehensive care category.

Although 6 distinct categories have been proposed, though uncommon, it was also possible that interventions had characteristics that were amenable to more than 1 category. For example, 4 of 15 interventions in the palliative and end-of-life care category also involved discussions about goals of care.[48-51] Similarly, among our 28 enhanced usual care intervention studies, 1 also incorporated aspects of palliative and end-of-life care[52] and another 2 included advance care planning.[53,54] In this study, the category that was deemed to be the best match according to the 3 dimensions of our taxonomy was selected for mapping.

Finally, although most intervention categories had similar distributions of HR, and to a smaller extent Training, considerable variation was noted with regard to the inclusion of Technology and Tools components by category. As such, there might be an opportunity within a given category to tease out the components that produce the most impact on outcomes via a component network meta-analysis, which would estimate the relative efficacy of specific components or combinations therein.[55]

Four Intervention Components

Most interventions required additional HR by appointing supplemental personnel with specific expertise (eg, geriatrician consultants or geriatric nurse practitioners) or by augmenting their regular composition of front-line staff. Significant heterogeneity in intervention providers (eg, nurses, physicians, and/or allied health care professionals) was previously reported in a systematic review of the efficacy of interventions led by staff with geriatrics expertise in reducing hospitalization in LTC residents.[12] As such, future systematic reviews might report subgroup analyses within a category by HR expertise. Training, which can involve assigning existing LTC staff to newly established tasks and roles or implementing new remuneration strategies that allow for more time to perform specific duties (eg, communication with families), may also be valuable when the inclusion of outside resources is either unavailable or infeasible.

Technology, the least prevalent component, typically involved (1) web-based visual systems for telemedicine, (2) tele-coaching for consultations with outside expertise, (3) health information systems implementation, or (4) alert mechanisms. There is some evidence that telemedicine is reliable and effective in achieving glycemic control, reducing medication use, improving medication safety, and in providing needed health care services in general medicine, geriatrics, psychiatry, and neurology to LTC residents.[56]

The value of care delivery using technology was underscored in 2020 with the emergence of the COVID-19 pandemic.[57] A paradigm shift toward the use of telemedicine services, particularly with older adults at highest risk of infection and mortality, was observed, and models of care were developed to determine if residents could be treated in the LTC setting or if transfer to the ED was needed.[57] Our results reveal that the proportion of interventions including a technology component doubled post-2019, as compared to the period preceding it. It is worth noting, however, that this finding is conservative, as interventions that were carried out in the year 2020 and beyond may not have been published in time to have been captured by our review.

ACP and palliative and end-of-life care were the 2 intervention categories that rarely included a Technology component. The Residential Care Transition Module is an example of a psychosocial and psychoeducational telehealth intervention designed to help families successfully adapt to the LTC admission of a cognitively impaired relative.[58] Our review points to an opportunity that may exist to adapt technologies to future interventions in these categories.

A large number of interventions incorporated Tools aimed at improving processes of care for specific resident care situations. Some tools, for example, targeted assisting staff in managing residents with neuropsychiatric symptoms. In our review, 11 interventions targeted neuropsychiatric symptoms management. The majority were included in the comprehensive care category, as these interventions assessed the effectiveness of the INTERACT program, which includes an "Evaluation of Medical Causes of New or Worsening Behavioral Symptoms" carepath[59] tool, 2 were categorized into enhanced usual care,[37,52] and the other 2 were categorized into the onsite care for acute, subacute, or uncontrolled chronic conditions.[60,61]

It is interesting to note that only 18% of transitional care interventions included tools as a component. The lack of quality indicators and tools to comprehensively assess the quality of transitions from LTC to the ED and back has been highlighted in the transition literature,[62,63] with a current focus on improving care processes for specific resident conditions, in specific transition settings, as opposed to across the entire transition.[64]

Methodologic Implications regarding Outcome Measures

Although the impact of often-complex interventions aimed at reducing ED transfers from the LTC setting has been widely studied, evidence synthesizing their effectiveness has been inconclusive. This is likely due to a multitude of issues, beginning with an inadequate specification of the population, intervention, comparator, and outcome (ie, PICO)[26] under study—the building blocks of any quantitative research question under investigation.

Our proposed taxonomy addresses some of these issues observed in the literature, and our findings suggest 2 key implications regarding outcome measures used in these (and future) evaluation studies. First, 76 (84%) intervention studies included in this review measured

hospitalizations and not ED visits as outcomes. Unlike previous reviews on this subject,[11,12,14,65] we have emphasized the importance of targeting ED transfers irrespective of subsequent hospitalizations, to reflect the fact that the decision to transfer (and not hospitalize) can be modified via interventions at the LTC level, where these interventions are implemented and ultimate decisions regarding transfers are made.

Second, the literature is inconsistent regarding targeting potentially avoidable transfers and all transfers as outcomes, with the latter being more widely represented. In addition, definitions of potentially avoidable transfers or hospitalizations have lacked specificity, in that preventable conditions (eg, falls, infections, or pressure ulcers) have often not been distinguished from conditions considered to be clinically manageable in the LTC setting (eg, pneumonia management).[66] For example, one review of interventions reducing hospitalizations from LTC homes included influenza vaccination as a preventative intervention.[15] Preventing vs managing acute conditions in the LTC represent distinct focuses, and—in our opinion—should be investigated separately, which is why we have defined potentially avoidable transfers as pertaining to "episodes of clinical decline corresponding to specific ACSCs that would more appropriately be managed in the LTC home."[4]

Strengths and Limitations

This was the first review to propose a taxonomy of interventions aimed at reducing both ED transfers and/or hospitalizations (ie, including those that are potentially avoidable or not) following an analysis of intervention categories and components that focuses on conditions that are manageable in LTC. We believe that our inductive qualitative synthesis strategy represented the best option given that there was no available appropriate framework for guidance. Although the Effective Practice and Organisation of Care (EPOC) taxonomy of health systems interventions, which classifies interventions into categories based on conceptual or practical similarities within 4 main domains (ie, delivery arrangements, financial arrangements, governance arrangements, and implementation strategies), does exist, it focuses on different dimensions of care.[13] In our taxonomy, we opted to focus on dimensions that were directly related to person-centered care, which differentiates ours from the EPOC taxonomy.[67] In doing so, complex and diverse interventions in this field can now be described via relatively homogenous and clinically meaningful categories and components.

This review included both randomized and nonrandomized studies to ensure full inclusion of the best available evidence. It also underscores the extent of the clinical heterogeneity present in both individual studies and in previous reviews.[11,14] Although our inclusion criteria limited our analyses to interventions delivered in LTC homes that provide 24-hour nursing care, we did not exclude interventions in mixed settings that can refer to different target populations, but rather identified them in our Supplementary Table 4. We recommend that future reviews in mixed settings provide subgroup analyses (eg, of intervention effectiveness) by setting, to ensure comparison among clinically homogeneous studies. Although our review inclusion criteria were broad, it is possible that our exclusion of studies not published in either English or French might be an additional limitation. Finally, although we included studies with quantitative outcomes in our review, other relational and qualitative outcome measures, such as resident care satisfaction,[68] family ratings of quality of care for residents,[36] or continuity of care,[69] might be important to consider in future reviews as well.

Conclusions and Implications

We have proposed a taxonomy of interventions aimed at reducing acute care transfers from LTC homes. Our findings have implications for researchers, clinicians, and policy makers. This taxonomy can serve as a tool to improve future study designs and to harmonize outcome measures on this topic. This approach can ultimately assist in reducing the high levels of clinical, methodological, and statistical heterogeneity that currently exists in the literature. Next steps will involve investigating intervention effectiveness or the efficacy of interventions using this proposed taxonomy to allow for the clear identification and evaluation of categories, components, and outcomes. Future work in this area should also focus on synthesizing the impact of interventions aimed at improving the quality of transitional care processes.

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