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Narrative Review

Frailty in a Post-Acute Care Population: A Scoping Review

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Abstract

Frailty is a complex and growing phenomenon facing health care providers throughout the continuum of care. Frailty is not well understood in post-acute care (PAC) settings. The purpose of this scoping review was to summarize current evidence of frailty impact on outcomes and frailty mitigation initiatives in PAC. Three major publication databases were searched from January 2000 to June 2017 that identified 18 articles specifically addressing frailty in PAC. Three themes were identified: scales used to measure frailty, factors that led to an adverse outcome or diagnosis of frailty, and interventions to address frailty in PAC. Scales used to measure frailty were dominated by physical factors and scarce on nutrition and social support. Functional decline, grip strength, gait speed, polypharmacy, and nutrition were identified in the studies as factors that identify frailty and are associated with poor outcomes. All these frailty characteristics compromise patients' ability to benefit from rehabilitation, which further establishes the importance of PAC providers to identify, prevent, and treat frailty. Intervention studies had mixed outcomes, suggesting a need for further development in this area. The findings of this scoping review highlight the need for a comprehensive multidimensional assessment of frailty risks in PAC.

Level of Evidence: IV

Introduction

Frailty is a commonly used term to describe a phenotype reflecting attributes of vulnerability, multiple morbidity, decreased capacity, and physical reserves. It is recognizable and often associated with advanced age. However, frailty consists of multiple factors that may be present in both young and old patients [1]. Key factors include functional impairments in activities of daily living (ADL), cognitive impairment, the burden of comorbidity, and gender [2-4]. There is no universally accepted method to measure frailty. Several methods are used in acute care settings. Common assessments include the Clinical Frailty Scale, the Katz Assessment for Activities of Daily Living, the Barthel ADL Index, and utilization of the Fried frailty phenotype indicators [5-8]. Frailty is not well understood, especially in the post-acute care (PAC) population.

PAC settings, such as rehabilitation hospitals and units and skilled nursing facilities, are frequent destinations for patients who require rehabilitation and skilled nursing care after an acute care episode [9]. Discharges to PAC settings have steadily increased over time as hospital lengths of stay have decreased. This has resulted in PAC admissions for patients with greater variation in medical severity, thereby increasing the PAC population's overall risk for hospital readmission [10,11]. In addition, it has been found that there is a higher incidence of frailty in patients discharged from acute care to PAC than discharged to the community [12].

Among persons living in the community, DePalma and colleagues found that 2 or more new ADL disabilities were associated with hospital readmission [13]. In addition, a community study performed by Arbaje et al found that having unmet functional needs at hospital discharge increased the likelihood of readmission in Medicare beneficiaries [14]. Greysen and colleagues also found that as functional impairment in elderly Medicare beneficiaries increased, readmission rate increased [15]. In one Canadian study, the Clinical Frailty Scale was significantly associated with hospital readmission [4]. These studies demonstrate that functional impairment, a contributor to frailty, increases the chance of readmission and suggest the importance of identifying and providing intervention to frail patients in order to maintain patients living in the community.

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Little research has been conducted to identify and treat frailty in PAC and there is a need to both identify and develop interventions to address frailty. The purpose of this scoping review is to summarize current evidence of frailty impact on PAC outcomes and frailty mitigation initiatives in rehabilitation.

Methods

For this study, a scoping review was performed to answer the question, "How can frailty be identified and addressed in PAC to reduce adverse outcomes?" Themes and gaps identified in the literature may serve as focal points for future studies [16]. A scoping review of the literature was performed as opposed to a systematic review because there were not enough studies on this topic to create the narrow search parameters required for a systematic review. The decision to use a scoping review allowed for a broader approach to the topic that encompassed more studies than a systemic review.

The literature search for this scoping review covered peer-reviewed papers, published from January 2000 to June 2017, that included patients aged 18 years or older. Only articles in English were included. Studies from all countries were included in order to provide a global perspective of the topic. Dissertations were excluded. In order to evaluate only individual studies, meta-analysis and literature reviews were also excluded. The publication databases used were ProQuest, PubMed, and CINAHL. Articles were included if they discussed frailty as a predictive factor for outcomes or if frailty was addressed as a primary or secondary condition in an intervention.

The terms used in the search were "frailty," "rehabilitation," "outcomes," and "readmissions." For CINAHL, the search parameter "(rehabilitation or readmissions) and frailty and outcomes" was used to further narrow the search. This search across 3 publication databases resulted in 1022 articles. The abstracts from the initial sample were used to reduce the article sample size to 87 articles based on the criteria of discussing frailty-associated adverse outcomes such as readmission, functional decline, falls, readmissions and mortality. From here, the articles were thoroughly reviewed in order to address the question that this scoping review was studying. Articles were excluded if they did not address PAC settings (n = 65), and an additional 4 articles in PAC were excluded because their treatment of frailty was peripheral. After exclusions based on the criteria, the final sample was 18 articles (Figure 1).

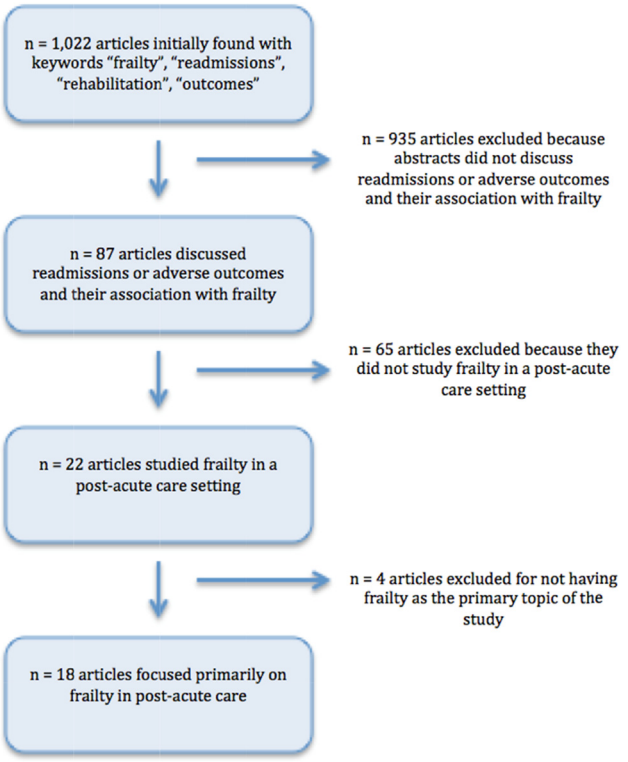

Figure 1. A procedural breakdown of how articles were selected for this scoping review.

Results

Table 1 presents general information about the 18 articles used in this study. Five of the articles (28%) were randomized controlled trials, one article was a controlled trial (6%), and the remainder were a mixture of retrospective (28%), observational prospective (22%), cross-sectional (11%), and longitudinal (6%) studies. Eleven (61%) of the studies were performed in a rehabilitation setting, 3 (17%) were performed in a skilled-nursing facility, and the remainder were performed in an unspecified PAC setting (22%). Studies from around the world were used, including 2 (11%) from the United States, 7 (39%) from Australia, 7 (39%) from Europe, one (6%) from Asia, and one (6%) from South America.

Frailty Study Themes

Table 2 presents a breakdown of the 18 articles used in this review. Analysis of these articles led to the identification of 3 major themes in the literature. One theme was a focus on scales used in frailty identification. A second theme focused on the individual characteristics that led to adverse outcomes or diagnosis of frailty. The third theme was a focus on the efficacy of frailty intervention programs.

Scales Used in Frailty Studies

The studies in this review used assessment scales to evaluate their subjects. Physical and activity measurements like the Barthel index and the timed up-and-go test, were used in 15 studies (83%). Cognitive assessments, such as the Mini-Mental State Exam (MMSE),

Table 1
Overview of Frailty in Post-Acute Care Sample (n = 18)

Article	Country	Study Design	Sample Size	Setting	Patient Population	Purpose	Result
Charlton, 2012 [17]	Australia	Retrospective cohort	476	Rehabilitation hospital	Admitted patients 65+	To assess whether nutritional status at hospital admission predicted clinical outcomes at the 18-month follow-up	Malnutrition predicts adverse outcomes in sub-acute patients
Chen, 2014 [18]	Singapore	Retrospective cohort	12804	Rehabilitation hospital	Acutely disabled admitted patients	To identify predictors of mortality and to describe the combined effect of comorbidity and disability on mortality with reference to models of frailty	Mortality is associated with discharge disposition not to home, socioeconomic status, and marital status
Coleman, 2012 [19]	Ireland	Prospective observational	36	Inpatient rehabilitation	Admitted patients 65+	To evaluate changes in strength, mobility, balance, endurance, frailty and quality of life following a 6-week multidisciplinary inpatient rehabilitation program	Rehab program increased functional outcomes and quality of life. Calls for more randomized controlled trials to test different therapies
Faber, 2006 [20]	Netherlands	Randomized controlled trial	287	Long-term care center	Long-term care residents	To determine the effects of moderate intensity group-exercise programs on falls, functional performance, and disability in older adults; and to investigate the influence of frailty on these effects	Fall-preventative intervention increased fall risk in frail patients, while reducing fall risk in prefrail and nonfrail patients. Intervention should be used as preventative measure as opposed to a treatment
Fairhall, 2014 [21]	Australia	Randomized controlled trial	241	Rehabilitation hospital	Patients 70+	To assess the effect of a frailty intervention on risk factors for falls and fall rates in frail older people	Frail older people have increased risk of falls; intervention improved performance on risk factors for falls but not on actual fall risk itself
Galloway, 2016 [22]	United States	Retrospective cohort	45424	Inpatient rehabilitation	Medicare beneficiaries with debility	To examine rates, temporal distribution, and factors associated with hospital readmission for patients with debility up to 90 days following discharge from inpatient rehabilitation	Higher FIM discharge motor rating was associated with lower hazard for readmissions prior to 60 days
González-Vaca, 2014 [12]	Spain	Cross-sectional	331	Skilled nursing facility	Admitted patients 65+	To determine the association between frailty and mortality or incident disability in basic activities of daily living (BADL) in institutionalized Spanish older adults	Frailty associated with females, functional status, and recent adverse geriatric outcomes

(*continued on next page*)

Table 1 (*continued*)

Article	Country	Study Design	Sample Size	Setting	Patient Population	Purpose	Result
Haley, 2014 [23]	Australia	Observational prospective cohort	86	Rehabilitation hospital	Admitted patients 60+	To determine whether level of frailty can predict length of stay, discharge destination, level of participation in physiotherapy, and degree of physical improvement with physiotherapy in older, sub-acute hospital patients	Frailty measures not associated with LOS, discharge destination, or mobility changes
Hussain, 2009 [24]	United States	Retrospective cohort	2261	Skilled nursing facility	Admitted patients 60+	To determine the relationship between 2-year mortality and 30-day hospital readmission status from the nursing home	Rehospitalization from skilled nursing facility greatly increases risk of mortality
Jerez-Roig, 2017 [25]	Brazil	Longitudinal	280	Skilled nursing facility	Admitted patients 60+	To verify the probability of maintaining functional capacity in basic activities of daily living and identify the prognostic factors of functional decline in institutionalized older adults	Functional decline in ADL associated with cognitive impairment, incontinence, and hospitalization
Latham, 2003 [26]	Australia	Randomized controlled trial	243	Rehabilitation hospital	Admitted patients 65+	To determine the effectiveness of vitamin D and home-based quadriceps resistance exercise on reducing falls and improving the physical health of frail older people after hospital discharge	Isometric quadriceps resistance exercise was harmful to the patients
Maddocks, 2016 [27]	United Kingdom	Prospective cohort	816	Pulmonary rehabilitation hospital	COPD patients 35+	To determine the prevalence of frailty among patients with stable COPD and examine whether frailty affects completion and outcomes of pulmonary rehabilitation	Frail individuals had greater trouble performing rehabilitation/completing the program compared to other groups
Morandi, 2013 [28]	Italy	Retrospective cohort	2735	Inpatient rehabilitation	Admitted patients 65+	To describe the rate of unplanned rehospitalization occurring within 30 days and to identify clinical risk factors for rehospitalization, considering the importance of controlling the phenomenon to avoid the stress to elderly frail patients induced by repeated hospital readmissions	Polypharmacy, LOS, and functional status are indicators of readmission
Peel, 2014 [29]	Australia	Prospective cohort	351	Post-acute care	Elderly patients	To examine whether there was a meaningful improvement in gait speed in post-acute care patients, and to determine whether gait speed predicted outcomes at 6-month follow-up	Good gait speed means better outcomes

Potter, 2016 [30]	Australia	Randomized controlled trial	95	Aged care facility	Aged care facility residents 65+	To reduce the number of medicines consumed by people living in residential aged care facilities (RACF); secondary objectives were to explore the effect of deprescribing on survival, falls, fractures, hospital admissions, cognitive, physical, and bowel function, quality of life, and sleep	Can withdraw symptom-modifying medicines without adverse effects
Roberts, 2014 [31]	United Kingdom	Cross-sectional	248	Rehabilitation hospital and skilled nursing facility	Admitted patients 70+	To describe grip strength of older people in rehabilitation and nursing home settings	Grip strength associated with Barthel score; skilled nursing facility and rehabilitation settings had lower grip strength than home settings
Singh, 2012 [32]	Australia	Randomized controlled trial	124	Rehabilitation hospital and geriatric hospital	Admitted hip fracture patients 50+	To test a novel, evidence-based treatment strategy to improve long-term outcomes after hip fracture by targeting sarcopenia with 12 months of high-intensity progressive resistance training	Resistance training group had less decline in Katz ADL, reduced mortality and skilled nursing facility use, reduced ADL dependency, reduced assistive device use
Trombetti, 2013 [33]	Switzerland	Controlled Study	122	Inpatient Rehabilitation	Admitted patients 65+	To assess the effects of the program in improving gait and balance performances and the level of independence in ADL as compared to standard "usual care"	Program improved physical parameters related to risk of fall and ADL independence. (Exercise: 1 individual session/wk for 3-5 wk, 1 group session/wk for 5 wk; balance training, and power/strength training with machine-based exercises)

Summary of the selected literature.

FIM = Functional Independence Measure; LOS = length of stay; ADL = activities of daily living; COPD = chronic obstructive pulmonary disease.

Table 2
Categorization of Studies

	Charlton, 2012 [17]	Chen, 2014 [18]	Coleman, 2012 [19]	Faber, 2006 [20]	Fairhall, 2014 [21]	Galloway, 2016 [22]	Gonzalez-Vaca, 2014 [12]	Haley, 2014 [23]	Hussain, 2009 [24]	Jerez-Roig, 2017 [25]	Latham, 2003 [26]	Maddocks, 2016 [27]	Morandi, 2013 [28]	Peel, 2014 [29]	Potter, 2016 [30]	Roberts, 2014 [31]	Singh, 2012 [32]	Trombetti, 2013 [33]	Frequency (n)	Percent (%)
Frailty scales																				
Physical tests	1	0	1	3	2	1	0	1	1	1	0	2	6	5	2	6	6	4	42	54%
Cognitive tests	0	0	2	1	0	0	0	2	2	0	0	1	2	1	1	1	1	2	16	21%
Comorbidity assessments	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	3%
Frailty scale	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	3	4%
Quality of life	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	1	1	0	6	8%
Nutrition	0	0	0	1	0	0	1	0	0	0	0	0	2	0	1	0	0	0	5	6%
Social support	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1%
Other	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	3	4%
Factors that lead to adverse outcomes or diagnosis of frailty																				
Functional decline						X	X			X			X						4	22%
Grip strength																X			1	6%
Gait speed														X					1	6%
Number of prescription medications													X						1	6%
Malnutrition	X																		1	6%
Frailty intervention in PAC																				
Focused on physical component			X	X	X						X	X					X	X	7	39%
Focused on cognitive component																		X	1	6%
Focused on medication component					X										X				2	11%
Intervention successful in frail patients			X												X		X	X	4	50%

Summary of the literature by how many types of frailty scales were used in each study, what factors were found to lead to adverse outcomes or diagnosis of frailty, and what types of interventions were performed along with their success rates.

were used in 11 studies (61%). Five studies employed a quality of life scale (28%), 4 studies a nutrition scale (22%), 3 studies a frailty scale (17%), 2 studies a comorbidity scale (11%), and one study a social support scale (6%). Table 2 presents the scales within each category. The sum of the physical measurement scales used in all studies was 42, whereas the sum of the cognitive scales used was 16. Table 3 shows a breakdown of what specific tests comprised each category. Physical and activity measurements were most frequently used in evaluating subjects, followed by cognitive assessments. Comorbidity scales and social support scales were the least used assessments in evaluating subjects.

Table 3
Frailty Study Scales

Tests	Frequency (n)
Physical Tests	
Gait Test	7
Barthel Index	7
Timed Up-and-Go Test	5
Functional Independence Measure	3
Physical Battery Test	3
Katz Assessment for Functional Status	2
Hand Grip Strength Test	2
Berg Balance Scale	2
Fried Phenotype Indicators	1
Groningen Activity-Restriction Scale	1
Performance Oriented Mobility Assessment (POMA)	1
Falls Self-Efficacy Scale	1
Physical Performance Scale	1
Physiological Profile Assessment	1
Tinetti Falls Efficacy Scale	1
Elderly Mobility Scale	1
Assessment of Living Skills and Resources (ALSAR)	1
Harvard Alumni Physical Activity Index	1
Physical Activity Scale for the Elderly	1
Cognitive Tests	
Mini-Mental State Exam	11
Geriatric Depression Scale	3
Confusion Assessment Method	1
Neuropsychiatric Inventory	1
Quality of life	
Medical Outcomes Study Short-Form SF-36 (QoL)	3
Quality of Life in Alzheimer's Dementia (DEMQOL)	1
EuroQol—5 Dimensions	1
EuroQol—Visual Analogue Scales	1
Nutrition	
Mini Nutrition Assessment	3
Malnutrition Universal Screening Tool	1
National Health and Nutrition Examination Survey (NHANES)	1
Frailty scale	
Canadian Study on Health and Aging Clinical Frailty Scale	1
Edmonton Frail Scale (EFS)	1
Cardiovascular Health Study Frailty Index	1
Comorbidity assessments	
Charlson Comorbidity Index	2
Social support	
Duke Social Support Index	1
Other	
Cumulative Illness Rating Score (CIRS)	1
Pittsburg Sleep Quality Index	1
Visual Contrast Sensitivity Score	1

The tests used in the selected literature and how many times each was used throughout the selected literature.

Factors That Led to an Adverse Outcome or Diagnosis of Frailty

Ten (56%) articles studied factors that either led to an adverse outcome or a diagnosis of frailty (Table 2). Functional decline was the most prominent factor associated with adverse outcomes or diagnosis of frailty (22% of articles). Specifically, Morandi et al found that a significant decline in functional status (defined here as a decrease of 56 points or more on the Barthel index) within the month prior to hospital admission was associated with hospital readmission in the elderly with a hazard ratio [HR] of 2.67 (95% confidence interval [CI] 1.35-5.27) [28]. Similarly, González-Vaca et al found functional status to be associated with frailty status through the use of functional measures like the Barthel index, with frailty being defined as having 3 of the 5 Fried phenotype criteria [12]. From the literature, functional status was found to be a strong predictor of adverse outcomes or a diagnosis of frailty, but it was not the only factor associated with adverse outcomes or a diagnosis of frailty. Morandi et al found that elderly patients taking greater than or equal to 7 prescription medications at rehabilitation admission had a higher risk of hospital readmission (HR 3.94, 95% CI 1.62-9.54) [28]. Furthermore, Charlton and colleagues found malnutrition to be associated with death in elderly sub-acute patients (HR 3.41, 95% CI 1.07-10.87) [17]. Overall, functional status, number of prescription medications, and malnutrition were the common factors that led to adverse outcomes or diagnosis of frailty.

Interventions to Address Frailty in PAC

Eight (44%) articles discussed intervention programs. Two (11%) of these studies evaluated the efficacy of a rehabilitation program already in place. Six (33%) studies tested an intervention to treat a component of frailty, with the majority focusing on the physical aspect (Table 2). A common practice intervention to address the physical component of frailty was resistance training. Five (28%) studies had resistance training in their intervention program. The type of resistance training varied between studies. For example, Latham et al used a single-jointed movement by using the leg extension while Singh et al used movements that used multiple joints such as the seated leg press [26,32]. In addition, studies such as that performed by Maddocks et al used free weights for part of the resistance training whereas other studies used only machines for resistance training (eg, Trombetti et al) [27,33]. Although many studies used resistance training in their programs, a few

intervention studies attempted to address the physical component of frailty without using resistance training. For example, Faber and colleagues tested a functional walking program and a Tai Chi—based balance program [20]. One intervention tested the effect of reducing the number of medications in frail PAC patients [30]. Not all interventions studied were successful. For example, Latham et al inadvertently found that isolated quadriceps training with vitamin D supplementation was harmful to frail patients [26]. Topics of frailty not thoroughly represented in the intervention literature are the social and emotional vulnerability components of frailty.

Discussion

Three themes were identified from this scoping review of the literature on identification and management of frailty in PAC. Articles addressed frailty scales or methods of measuring aspects of frailty, individual characteristics associated with frailty, and frailty interventions.

Scales

The studies in this scoping review used a total of 42 physical scales and only 16 cognitive scales as noted in Tables 2 and 3. In addition, quality of life scales, nutrition scales, and social support scales were only used in the sample 6, 5, and one time, respectively. Current scales used in PAC frailty evaluation, such as the Functional Independence Measure (FIM), largely focus on the physical component of frailty (mostly motor skills) and may have a ceiling effect (lack of functional level discrimination at the higher functional levels) when it comes to evaluating patients [34]. These kinds of scales do not put as much focus on the other components of frailty, such as cognition, emotional state, social networks, and comorbidities [35,36].

Comprehensive frailty scales that contain a nonphysical component, like the Canadian Study on Health and Aging (CSHA) clinical frailty scale exist in acute care. Frailty assessment methods, such as the Risk Instrument for Screening in the Community (RISC) were developed for the community setting [5,37]. PAC lacks a scale specific to patients receiving care to prepare them for community living that can identify frailty based on multidimensional specific risk factors.

Factors

PAC settings and rehabilitation interventions are concerned with the patient's ability to perform activities of daily living and participate in the community, underscoring the importance of identifying the impact of frailty on PAC outcomes. Four articles (22%) found an association between functional decline, a feature of frailty, with adverse outcomes or with diagnosis of frailty [12,22,25,28]. There is no specific ICD-10 code for frailty; however, ICD-10 code R54 defines frailty as exhibiting symptoms of age-related physical debility. Grip strength, gait speed, polypharmacy, and nutritional status were other factors identified as being associated with frailty. All these frailty characteristics compromise patients' ability to benefit from rehabilitation, which further establishes the importance of PAC providers to identify, prevent, and treat frailty.

Interventions

The literature revealed that there were few studies designed to treat frailty. In one study, Coleman et al monitored changes in quality of life and functional status of frail patients during a PAC rehabilitation program through the use of outcome measures like the Berg Balance Scale (BBS) and EuroQol-Visual Analogue Scale (EQ-VAS) [19]. They found that the PAC rehabilitation program had a positive effect on outcomes among frail patients. This noteworthy result led Coleman and colleagues to call for more randomized controlled trials in frailty intervention in order to find the better ways to treat frailty in PAC.

Two randomized controlled trials on frailty in PAC were identified that attempted to address frailty through physical activities. Faber and colleagues tested the effects of a functional walking therapy and a Tai Chi therapy on 2 separate groups, and each group was broken down into a robust subgroup, a prefrail subgroup, and a frail subgroup [20]. After performing the intervention once a week for 4 weeks and twice a week for the following 16 weeks of the 20-week program, it was found that in both therapy groups, the robust and pre-frail subgroups had reduced fall risk. However, in the frail subgroup, both exercise therapies increased the risk of fall. In addition, Maddocks and colleagues found that when a cohort of COPD patients that were a part of a physically intensive rehabilitation program were divided into frail, prefrail, and robust groups, the frail group had double the odds of not completing the program [27]. These 2 studies demonstrate that frail patients require unique rehabilitation treatments compared to their nonfrail counterparts. As a result of these studies, it is critical that frailty be identified in PAC in order to prevent further adverse events or worse outcomes to the patient while in PAC settings.

Future Research

The findings of this scoping review highlight the need for a comprehensive multidimensional assessment of frailty risks in PAC. Using a systematic comprehensive assessment as a guide, an intervention program can be developed to address the specific cause(s) of frailty for each patient. A comprehensive assessment and targeted

intervention may be able to avoid some of the harmful side effects observed in studies targeting single frailty factors as noted by Maddocks et al and Faber et al [20,27].

Limitations

This scoping review found gaps in frailty research in PAC and provided future recommendations. However, there are limitations to the study. Only 3 databases were searched using the keywords mentioned above. This may have reduced the number of articles that may have met our inclusion criteria. Further, this study does not account for frailty research that may be in progress. Although these various limitations exist, this scoping review may provide a future direction for frailty research using features of frailty identified in PAC studies that exist in today's literature.

Conclusion

After reviewing 3 databases, it was found that limited research exists on frailty in the PAC setting. This review pointed out the lack of effective frailty scales, frailty factors, and interventions in the PAC setting and proposed the creation of a comprehensive approach to frailty in PAC.

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