



Emergency Department Interventions for Older Adults

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PREFACE

The VA Evidence-based Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of particular importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. QUERI provides funding for four ESP Centers, and each Center has an active University affiliation. Center Directors are recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Centers. The ESP is governed by a Steering Committee comprised of participants from VHA Policy, Program, and Operations Offices, VISN leadership, field-based investigators, and others as designated appropriate by QUERI/HSR&D.

The ESP Centers generate evidence syntheses on important clinical practice topics. These reports help:

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- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The ESP disseminates these reports throughout VA and in the published literature; some evidence syntheses have informed the clinical guidelines of large professional organizations.

The ESP Coordinating Center (ESP CC), located in Portland, Oregon, was created in 2009 to expand the capacity of QUERI/HSR&D and is charged with oversight of national ESP program operations, program development and evaluation, and dissemination efforts. The ESP CC establishes standard operating procedures for the production of evidence synthesis reports; facilitates a national topic nomination, prioritization, and selection process; manages the research portfolio of each Center; facilitates editorial review processes; ensures methodological consistency and quality of products; produces “rapid response evidence briefs” at the request of VHA senior leadership; collaborates with HSR&D Center for Information Dissemination and Education Resources (CIDER) to develop a national dissemination strategy for all ESP products; and interfaces with stakeholders to effectively engage the program.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP CC Program Manager, at Nicole.Floyd@va.gov.

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This topic was developed in response to a nomination by Dr. Thomas Edes, Executive Director, VHA Geriatrics and Extended Care Operations, and Dr. Chad Kessler, Director, VHA Emergency Medicine, for the purpose of identifying and evaluating intervention strategies in emergency care for older adults and with the goal of implementation across 141 VA emergency departments (EDs) and urgent care centers (UCCs). The scope was further developed with input from the topic nominators (*ie*, operational partners), the ESP Coordinating Center, the review team, and the technical expert panel (TEP).

In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

The authors gratefully acknowledge the following individuals for their contributions to this project:

Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend TEP participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

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To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advises on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below

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TABLE OF CONTENTS

Executive Summary	1
Introduction.....	1
Methods.....	1
Results.....	2
Abbreviations Table.....	7
Introduction.....	8
Methods.....	10
Topic Development.....	10
Search Strategy	13
Study Selection	14
Data Abstraction	14
Risk of Bias Assessment.....	14
Data Synthesis.....	14
Strength of the Body of Evidence.....	15
Peer Review	15
Results	16
Literature Flow.....	16
Key Question: How effective are emergency department (ED) interventions in improving clinical, patient experience, and utilization outcomes in older adults (age ≥ 65)?	17
Key Points.....	17
Detailed Findings.....	17
Effects on Clinical Outcomes	20
Effects on Patient Experience Outcomes.....	23
Effects on Utilization Outcomes.....	23
Summary and Discussion	30
Findings in Context of Prior Reviews.....	31
Clinical and Policy Implications.....	31
Limitations	32
Research Gaps/Future Research	33
Conclusions.....	36
References.....	37
TABLES	
Table 1. Emergency Department Intervention Strategies.....	10
Table 2. Definitions of Key Emergency Department Intervention Components.....	12
Table 3. Randomized Studies (n=9)	18
Table 4. Nonrandomized Studies (n=6).....	18
Table 5. Evidence Profile for Emergency Department Interventions for Older Adults	19
Table 6. Strength of Evidence for Effects of Interventions to Improve Outcomes for Older Adults in Emergency Departments.....	30
Table 7. Highest Priority Evidence Gaps.....	34

FIGURES

Figure 1. Conceptual Framework	13
Figure 2. Literature Flow Chart	16
Figure 3. Forest Plot of Effect of ED Interventions on Mortality ^a	22
Figure 4. Forest Plot of Effect of ED Interventions on Hospitalization After the Index Visit ^a	25
Figure 5. Forest Plot of Effect of ED Interventions on Readmission ^a	27
Figure 6. Risk of Bias Ratings for Randomized Studies ^a	28
Figure 7. Risk of Bias Ratings for Nonrandomized Studies ^a	29
APPENDIX A. Intervention Strategies and Components.....	41
APPENDIX B. Search Strategies.....	45
APPENDIX C. Study Selection.....	48
APPENDIX D. Study Risk of Bias Assessment	50
APPENDIX E. Peer Reviewer Comments	53
APPENDIX F. Study Characteristics Tables.....	67
APPENDIX G. Intervention Characteristics Tables	75
APPENDIX H. Excluded Studies	79
APPENDIX I. Glossary	87

EVIDENCE REPORT

INTRODUCTION

Older adults, especially those 75 years of age and over, have some of the highest rates of emergency department (ED) visits. In the United States, older adults make 64 ED visits per 100 persons annually, nearly twice the frequency of their younger counterparts.¹ Within VA, older Veterans account for 40 percent of 2.4 million annual ED visits. This number will continue to rise, as the number of older Veterans is expected to increase significantly over the next decade.²

Older adults presenting to the ED can have a myriad of challenges that make care more difficult compared with younger adults. Such challenges include extensive medical histories with multiple morbidities, atypical symptoms or disease states, polypharmacy and adverse drug-drug interactions, and misunderstandings or misuse of prescription and over-the-counter medications.^{3,4} Additionally, older adults have different physiology compared with younger patients and may be challenged by functional disabilities, impaired cognition, communication problems, and reduced social support.^{5,6} These factors can make it difficult both for the older patient to navigate the hurried pace of the ED and for the health care provider to obtain a complete and accurate history, evaluate symptoms, make appropriate diagnoses, and optimize treatment.^{3,7,8} Any of these challenges can complicate assessment, diagnosis, treatment, and discharge, thereby negatively impacting care received while in the ED, transitions to home or other setting, and postdischarge health outcomes.^{9,10} In fact, older adults aged 75 and over are 3 times more likely to be admitted to the hospital from the ED.¹

In addition to the factors noted above, optimal care for older adults visiting the ED may be difficult due to the physical space or design of the ED¹¹ and decreased comfort of providers and staff in the care of older adults.³ However, individual and systems-level interventions may help address some of these challenges and improve both care processes and patient-related outcomes.

A broad range of interventions have been designed to improve clinical and utilization outcomes in older adult ED users. Broadly speaking, these interventions can be grouped into several categories including staffing, physical infrastructure, care delivery (including functional and geriatric assessments, and risk-prediction tools), case management, and transitional care or discharge planning.^{7,12-15}

There has been growing attention to systems-level changes in geriatric emergency medicine practice and education, including the publication of the 2014 Geriatric Emergency Department Guidelines.¹⁶⁻¹⁸ These guidelines were a joint effort by the American College of Emergency Physicians, American Geriatrics Society, Emergency Nurses Association, and Society for Academic Emergency Medicine. These consensus guidelines offer a standard set of guidelines that are designed to be implemented in both general EDs and standalone geriatric EDs. More specifically, these guidelines provide a template for staffing, equipment, education, policies and procedures, follow-up care, and performance-improvement measures. They were the first multidisciplinary geriatric guidelines not aimed at addressing a specific condition or barrier, but rather addressing known challenges in caring for the elderly population at a systems level. The guidelines offer recommendations about important principles and processes in the care of older adults in the ED but do not recommend specific interventions or programs, acknowledging

uncertainty in effectiveness. This gap highlights the need for a systematic review of ED intervention strategies.

The American College of Emergency Physicians (ACEP) has established an accreditation process for geriatric ED recognition. The standards to gain accreditation are meant to be applied across all settings, from rural to academic, within a regular ED or in a separate area. While there is not sufficient evidence that geriatric accreditation leads to improved clinical outcomes in ED settings, improved outcomes have been shown with accreditation for specific disease processes such as stroke.¹⁹

A 2017 scoping review to identify evidence addressing the identification and management of frail older people in the ED identified substantial literature and called for a careful synthesis to inform policy and clinical practice.⁷ Most prior studies of geriatric ED practices have focused on systems-level utilization outcomes, including length of stay, hospital admission, and repeat ED visits; few prior reviews have focused on patient-centered outcomes. Further, these reviews often classified interventions simply, potentially obscuring relationships between intervention components and outcomes, and no review has comprehensively evaluated a broad range of strategies. Our review aims to fill this gap by synthesizing evidence and including functional status and quality of life—2 clinical outcomes prioritized by VHA providers committed to preserving functional independence as critical to supporting older Veterans' ability to age in place. Additionally, our review carefully classifies individual intervention components and uses rigorous analytic techniques to compare the effectiveness of selected interventions on outcomes of interest.

This review is intended to be used by the VHA Offices of Geriatrics and Extended Care Operations and Emergency Medicine to identify and evaluate intervention strategies in emergency care for older adults, with the goal of implementation across 141 VA EDs and urgent care centers. The review is also intended to provide guidance and establish priorities for an update of the Geriatric Emergency Medicine section of the ED Handbook to inform the future research agenda in VA geriatric emergency medicine.

METHODS

We followed a standard protocol for this review. Each step was pilot-tested to train and calibrate study investigators. The PROSPERO registration number is CRD42018087660. We adhered to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines, including the PRISMA Harms extension.²⁰

TOPIC DEVELOPMENT

This topic was nominated by the VHA Offices of Geriatrics and Extended Care Operations and Emergency Medicine. The Key Question (KQ) and protocol, including the identification of intervention strategies and components, were developed *a priori* by the Durham Evidence-based Synthesis Program team in consultation with the operational partners and a technical expert panel. Topic development was informed by a search for recent systematic reviews, scoping reviews, or evidence maps. We rated the quality and retained those judged moderate^{3,21-25} or good¹²⁻¹⁵ to inform the final KQ and methods. We did not include studies that addressed the development of risk-assessment tools, as these have been reviewed recently and were not a priority for VHA.²²

Key Question

The KQ for this report was: How effective are emergency department (ED) interventions in improving clinical, patient experience, and utilization outcomes in older adults (age ≥ 65)?

Emergency Department Intervention Strategies

For this review, ED interventions included the 4 major strategies described in Table 1. These strategies were identified before data abstraction and were based on prior reviews, existing literature, and consultation with our technical expert panel. We classified each study by its primary intervention strategy. Although 4 potentially distinct strategies are described, some studies evaluated multiple strategies (*eg*, discharge planning followed by case management, or case management that includes strategies for medication safety), and in these instances, we classified the intervention as “multi-strategy.”

Table 1. Emergency Department Intervention Strategies

Intervention Strategy	Definition
Discharge planning	Discharge planning is time-limited, taking place fully within the ED, and encompassing the process of thinking about and formalizing a plan of care prior to a patient’s discharge from the ED. Discharge planning may incorporate 1 or more of the following: geriatric consultation or geriatric assessment in the ED ^a , patient/caregiver education, or a follow-up plan. Although the initial assessment and discharge planning take place within the ED, the responsibility for coordinating and obtaining follow-up care rests with the patient or caregiver.

Intervention Strategy	Definition
Case management	Case management takes place over time and across settings, initially beginning within the ED and continuing after discharge, and includes the activities that a physician or other health care professional performs to ensure coordination of medical services needed by the patient ^b . The ultimate goal of case management is to help support successful transition from the ED to post-ED settings. Unlike discharge planning, in which the patient or caregiver may be responsible for identifying and securing services, in case management the major responsibility and coordination rests with 1 or more providers.
Medication safety or management	Interventions that assist patients or caregivers in managing and monitoring drug therapy for older adults with chronic conditions ^c .
Geriatric EDs	EDs designed or guided by the 2014 Geriatric ED Guidelines. ¹⁶⁻¹⁸

^a The geriatric assessment is a multidimensional, multidisciplinary assessment designed to evaluate an older person's functional ability, physical health, cognition and mental health, and socio-environmental circumstances. It must include a geriatrician or geriatric-trained nurse practitioner or physician assistant and may be a focused assessment that is customized for ED settings.

^b We define case management narrowly to require a non-physician, either onsite in the ED or offsite, who is involved in coordinating follow-up care related to an ED visit. This may include home-based services.

^c Interventions may incorporate a clinical pharmacist or other expert in drug therapy, or computerized interventions if they are conducted in real time (during patients' ED admission). Interventions may be targeted to the clinician, patient, or family if they focus on the proper selection of medications, reduction in polypharmacy or medication errors, or use of medications. These interventions do not include shared decision-making approaches to choosing 1 treatment versus another.

Abbreviation: ED=emergency department

Emergency Department Intervention Components

In addition to the major ED intervention strategies, we abstracted detailed information about the intervention structure. This included the timing and setting (*eg*, before ED discharge, after ED discharge, or both); target of intervention (*eg*, patient, caregiver/family member, provider); mode of delivery (*eg*, telephone, in-person); number and type of providers; number of planned contacts; and number of actual contacts. We also abstracted details about patient-focused intervention components (*eg*, assessment/screening, patient and/or caregiver education or support) and provider- or service-driven components (*eg*, referral to provider and/or community resources, follow-up call or visit, continuity of care/care coordination, environmental or procedural changes in response to 2014 Geriatric ED guidelines). An in-depth description of intervention strategies and components is in Appendix A.

Informed by prior literature,²⁶ and using information from the detailed intervention abstractions, we hypothesized that 3 key intervention components would be associated with positive outcomes, as described in Table 2.

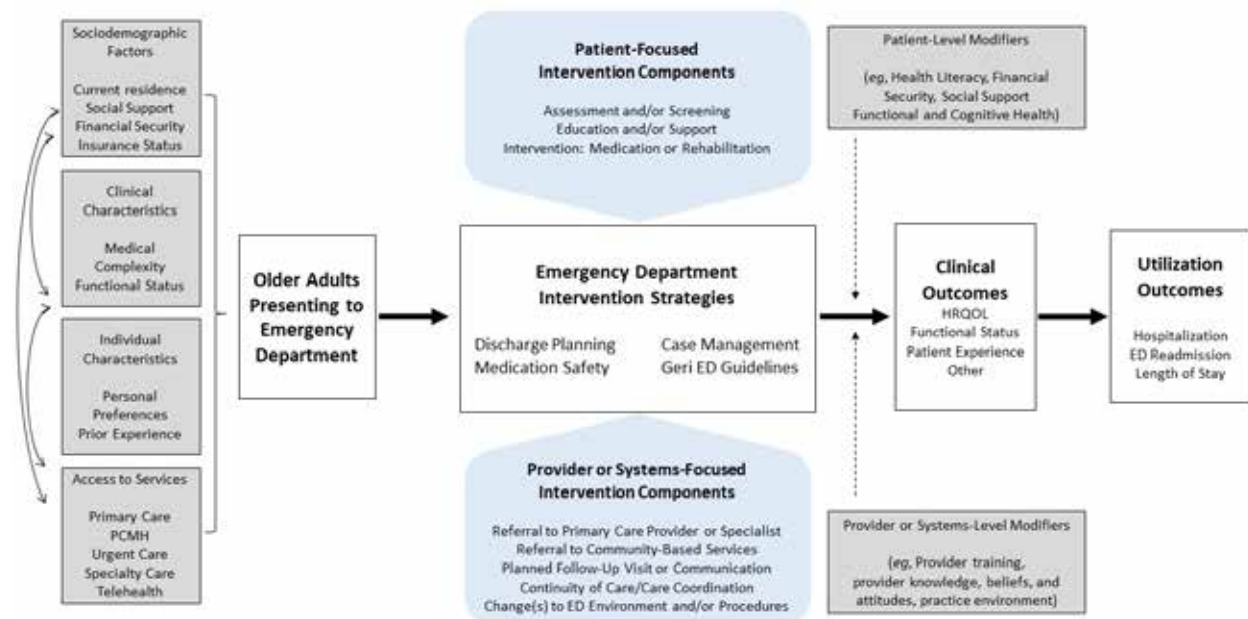
Table 2. Definitions of Key Emergency Department Intervention Components

Intervention Component	Definition
Assessment	A structured and/or targeted assessment performed as a part of the intervention. A structured assessment may include a comprehensive geriatric assessment or biopsychosocial assessment covering common domains including cognitive performance, functional status, social status and living environment, health behaviors, and psychosocial factors. Brief or targeted assessments may include 1 or more specific domains, such as cognitive performance or functional status.
Referral plus follow-up	Referral to 1 or more of the following: primary care provider, specialty provider, or community resource or services plus planned communication or visit(s) with intent of following up on referral.
Bridge	An intervention that takes place across settings, including 1 or more planned contacts before discharge from the ED and again after discharge.

Abbreviation: ED=emergency department

Conceptual Framework

Conceptual frameworks are theory-driven and depict the hypothesized, or causal, relationships between behavioral determinants, intervention strategies, and key outcomes. Models also examine potential mediators and moderators of causal processes. In collaboration with our stakeholders and technical expert panel, and prior to the start of our review, we developed a conceptual framework (Figure 1) informed by existing research in geriatric emergency medicine. Existing literature suggests that, for older adults, the process of accessing and utilizing ED care results from an interaction between sociodemographic factors, clinical characteristics, personal preferences and prior experiences, and access to services.^{27,28} Although prior reviews have evaluated the effect of common ED interventions such as geriatric assessment and/or discharge planning, to our knowledge no reviews to date have mapped specific components of these interventions to a conceptual model, nor have any reviews examined interventions that use multiple strategies. In addition to evaluating the effect of the different ED intervention strategies described in the above, we collected additional details of the interventions. As depicted below, we grouped the intervention components into 2 main categories: (1) patient-focused intervention components (*ie*, intervention processes that gathered information from, or provided information to, the patient and/or caregiver) and (2) provider- or systems-focused components (*ie*, intervention processes that involve a provider, service, resource, or workflow in the larger healthcare system). Note that boxes shaded in gray depict constructs believed to influence initial need for ED care and modify the effect of the intervention. However, information depicted in these boxes was rarely included in the studies and was not abstracted or analyzed as a part of this report. Also not shown in the model are aspects of the intervention structure, described above (*eg*, setting, target, providers, number of planned contacts).

Figure 1. Conceptual Framework

Abbreviations: ED=emergency department; Geri=geriatric; HRQOL=health-related quality of life; PCMH=patient-centered medical home

SEARCH STRATEGY

In collaboration with an expert reference librarian, we employed a 2-stage search strategy, searching first for recent systematic reviews (SRs) or scoping reviews, and then conducting a search for primary literature not identified in these reviews. We searched MEDLINE® (via PubMed®) and the Cochrane Library for high-quality SRs published from inception through October 17, 2017. We identified 7 relevant reviews, with the most recent being a high-quality scoping review whose search was conducted in Fall 2016.⁷ We searched MEDLINE (via PubMed), Embase, and CINAHL for primary literature published from January 1, 2016 through December 4, 2017. Overall, our approach was to utilize existing moderate- to high-quality SRs and scoping reviews to identify literature up to the most recent comprehensive search date, supplemented by a new literature search to the current date, and perform a *de novo* literature synthesis.

Our search strategy was informed by the Cochrane Effective Practice and Organization of Care (EPOC) Group.²⁹ EPOC criteria were developed to capture both randomized and nonrandomized study designs. We used a combination of medical subject headings (MeSH), keywords, and selected free-text terms for the eligible interventions, geriatrics or older adults, and EDs (Appendix B). All citations were imported into 2 electronic databases (for referencing, EndNote® Version X7, Thomson Reuters, Philadelphia, PA; for data abstraction, DistillerSR; Evidence Partners Inc., Manotick, ON, Canada).

STUDY SELECTION

Using prespecified inclusion/exclusion criteria (Appendix C), 2 reviewers independently evaluated titles and abstracts to identify potentially eligible primary studies. Studies then advanced to the full-text review stage. To be eligible for inclusion at the full-text review stage, studies had to meet all eligibility criteria. Disagreements were resolved by consensus between the 2 investigators or by a third investigator. Articles meeting all eligibility criteria were included for data abstraction. Eligibility criteria included (1) older adults ≥ 65 of age presenting to the ED, (2) an eligible intervention (see Table 1), (3) a randomized or quasi-experimental study,²⁹ and (4) conducted in an Organisation for Economic Cooperation and Development (OECD) country.

DATA ABSTRACTION

Data from published reports were abstracted into a customized DistillerSR database by 1 reviewer and over-read by a second reviewer. Disagreements were resolved by consensus or by obtaining a third reviewer's opinion when consensus was not reached. Key characteristics abstracted included patient descriptors, intervention characteristics, comparator, and outcomes. Multiple reports from a single study were treated as a single data point; we prioritized results based on the most complete and appropriately analyzed data. When critical data were missing or unclear in published reports, we requested supplemental data from the study authors. Key features relevant to applicability included the match between the sample and target populations (*eg*, age and Veteran status).

RISK OF BIAS ASSESSMENT

Study risk of bias (ROB) was assessed independently by 2 investigators. Disagreements were resolved by consensus between the investigators or, when needed, by arbitration by a third investigator. We used the key ROB criteria described in the EPOC guidance.²⁹ These criteria are adequacy of randomization and allocation concealment; comparability of groups at baseline; blinded outcomes assessment; completeness of follow-up and differential loss to follow-up; whether incomplete data were addressed appropriately; protection against contamination; and selective outcomes reporting (Appendix D). We assigned a summary ROB score (low, unclear, or high) separately to non-patient reported outcomes, hereafter referred to as objective outcomes (*eg*, mortality, ED readmission), and patient-reported outcomes (*eg*, quality of life).²⁹ Summary ROB ratings were defined as follows:

- Low ROB: Bias, if present, is unlikely to alter the results seriously.
- Unclear ROB: A risk of bias that raises some doubts about the results.
- High ROB: Bias may alter the results seriously.

DATA SYNTHESIS

We summarized the primary literature using relevant data abstracted from the eligible studies. Summary tables describe the key study characteristics of the primary studies: study design, patient demographics, and details of the intervention and comparator. We then determined the feasibility of completing a quantitative synthesis (*ie*, meta-analysis) to estimate summary effects. Feasibility depended on the volume of relevant literature, conceptual homogeneity of the studies,

and completeness of results reporting. All analyses were stratified by randomized versus nonrandomized study designs.

We aggregated outcomes when there were at least 3 studies with the same outcome, reported at similar time points; for nonrandomized studies, we required adequately adjusted analyses to be reported. When quantitative synthesis was possible, dichotomous outcomes (*ie*, mortality, hospitalization after the ED visit, ED readmission) were combined using risk ratios random-effects. Continuous outcomes (*eg*, quality of life) were summarized using the mean difference. We used the Knapp Hartung approach to adjust the standard errors of the estimated coefficients in the random effects analyses.^{30,31} We evaluated statistical heterogeneity using visual inspection and Cochran's Q and I^2 statistics. We planned to assess publication bias using funnel plots but there were too few studies for these analyses to be meaningful. We planned subgroup analyses of moderator variables (*eg*, intervention strategy, intervention components), but there were too few studies to conduct these analyses.

When quantitative synthesis was not feasible, we analyzed the data qualitatively (*ie*, functional status, QOL, patient experience, hospitalization at the ED index visit). We gave more weight to the evidence from studies with a lower ROB and more precise estimates of effect. Qualitative synthesis focused on documenting and identifying patterns in efficacy and safety of the interventions across conditions and outcome categories. We analyzed potential reasons for inconsistency in treatment effects across studies by evaluating differences in the study population, intervention, comparator, and outcome definitions.

STRENGTH OF THE BODY OF EVIDENCE

The strength of evidence (SOE) was assessed using the Grading of Recommendations Assessment, Development and Evaluation working group (GRADE) approach.³² In brief, this approach requires assessment of 4 domains: risk of bias, consistency, directness, and precision. These domains were considered qualitatively for the primary outcomes, and a summary rating of high, moderate, low, or very low SOE was assigned after evaluation in the GRADEpro software³³ and discussion by 2 reviewers. SOE was assessed only for outcomes considered critical to decision making: functional status, ED readmission, hospital readmission, and patient experience.

PEER REVIEW

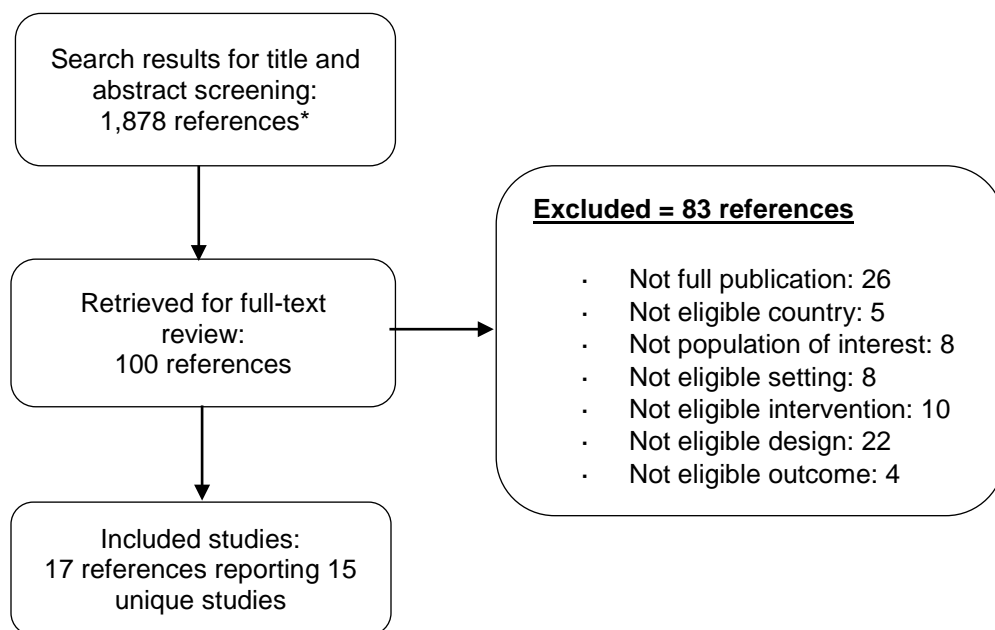
A draft version of this report was reviewed by technical experts and clinical leadership. A transcript of their comments and our responses is in Appendix E.

RESULTS

LITERATURE FLOW

We identified 1,799 studies through searches of MEDLINE® (via PubMed®), Embase®, and CINAHL. An additional 79 articles were identified by reviewing the bibliographies of relevant review articles,^{7,12-15} a search of ClinicalTrials.gov, and a targeted search of Scopus for publications citing the 2014 Geriatric ED Guidelines,¹⁸ for a total of 1,878 unique citations (Figure 2). After applying inclusion and exclusion criteria to titles and abstracts, 100 articles remained. Seventeen articles, describing 15 unique studies, met eligibility criteria and were retained for data abstraction. Of the 15 studies, 9 were randomized and 6 were nonrandomized. All were conducted in the United States, Canada, Europe, or Australia.

Figure 2. Literature Flow Chart



* Unique citations after combining all searches and manual bibliography review

Key Question: How effective are emergency department (ED) interventions in improving clinical, patient experience, and utilization outcomes in older adults (age ≥65)?

KEY POINTS

- The literature addressing intervention strategies for older adults presenting to EDs is diverse, with varying approaches to selecting patients for services and an array of intervention strategies that typically incorporate geriatric care and/or chronic care principles that have been effective in other settings.
- ED interventions showed a mixed pattern of effects on clinical outcomes. Evidence suggested a small benefit for functional status (very low SOE), but no effects on quality of life (QOL). However, only 2 studies reported effects on QOL.
- ED interventions did not show a reduction in mortality, but no study identified mortality as a primary outcome. This finding was based on few events, and confidence intervals do not exclude an important effect.
- Overall, there were no effects of ED interventions on hospitalization at the index visit (very low SOE), subsequent hospitalizations (low SOE), or ED readmission (high SOE).
- Studies with the greatest effects on clinical and health care utilization outcomes employed more comprehensive interventions, but this pattern was not consistent across all effective interventions:
 - Multi-strategy interventions, defined as those using more than 1 intervention strategy (*eg*, discharge planning, case management, medication management), may be associated with less decline in functional independence.
 - More intensive, or higher touch, interventions, as indicated by the presence of 3 key intervention components (*ie*, assessment, referral plus follow-up, and bridge design), may be associated with less decline in functional independence, and decreased hospitalization after the ED index visit and/or ED readmissions.
 - Single-contact interventions, whether delivered in the ED or after discharge, do not improve utilization outcomes.

DETAILED FINDINGS

Description of Included Studies for ED Interventions for Older Adults

We identified 9 randomized studies³⁴⁻⁴² and 6 nonrandomized studies⁴³⁻⁴⁸ that evaluated interventions to improve the outcomes of older adults who present for care in an ED. Studies recruited a broad patient population (*ie*, not limited to a specific diagnosis or condition). No studies enrolled mixed samples of younger and older patients. Just over one-half of the studies enrolled older adults at higher risk for poor health outcomes as determined by either a risk-assessment tool or clinical criteria (*eg*, dependent in 1 or more activities of daily living [ADLs]). The remainder of the studies included unselected older adults. No studies specified enrollment of Veterans. All studies compared an intervention to usual care or attention control. Interventions were delivered during the index ED visit, post-ED discharge, or across settings (*ie*, bridge). Case management was the most common intervention strategy (n=12), followed by discharge planning

(n=7), and medication management/medication safety (n=3). Roughly one-half of studies (n=7) used more than 1 intervention strategy and thus were classified as “multi-strategy.” The most common combinations were discharge planning plus case management (n=5) and case management plus medication safety (n=2). Tables 3 and 4 show the pattern of interventions, classified by strategy and components.

Table 3. Randomized Studies (n=9)

Intervention Strategy (# Studies)	Components		
	Assessment	Referral Plus Follow-up	Bridge
Discharge planning (n=0)	–	–	–
Case management (n=4)	4	1	1
Medication safety (n=0)	–	–	–
Geriatric EDs (n=0)	–	–	–
Multi-strategy (n=5)	3	4	3

Table 4. Nonrandomized Studies (n=6)

Intervention Strategy (# Studies)	Components		
	Assessment	Referral Plus Follow-up	Bridge
Discharge planning (n=2)	2	0	0
Case management (n=1)	1	1	0
Medication safety (n=1)	0	0	0
Geriatric EDs (n=0)	–	–	–
Multi-strategy (n=2)	2	0	1

Across the strategies, interventions included the components of risk assessment (n=12, including 8 that specified use of a comprehensive geriatric assessment), referral plus follow-up (n=6), and bridge designs (n=5). All 3 of these intervention components were present in 4 of the randomized studies. The number of team members involved in a single intervention ranged from 1 to 4, and included physicians, nurses, social workers or case managers, and physical or occupational therapists. Eight studies used a geriatrician, geriatric nurse provider, or other provider with geriatrics training. The number of planned contacts was reported in only 8 of the 15 studies, with 6 of these reporting 1 planned contact.

Measures of healthcare utilization, such as ED readmission, were the most commonly reported outcomes. Effects on physical functioning were reported in almost half the studies; QOL was reported in only 2 studies. The ROB for objective outcomes was judged low for 4 studies,^{37,40,41,48} unclear for 3,^{36,39,42} and high for 7^{34,35,43-47}; 1³⁸ study did not report an objective outcome. The ROB for patient-reported outcomes was judged low for 2 studies,^{40,41} unclear for 3,^{37,39,42} and high for 6^{34-36,38,46,47}; 4 studies^{43-45,48} did not report patient-reported outcomes. Demographic factors were reported infrequently, including race, socioeconomic status, and insurance status. Seven randomized and 5 nonrandomized studies described the most common presenting condition or discharge diagnosis, but used variable methods for classifying them. All

studies were conducted in the United States, Canada, Europe, or Australia between 1996 and 2017. The comparators for all studies were treatment as usual.

Table 5 shows the evidence profile for the included studies.

Table 5. Evidence Profile for Emergency Department Interventions for Older Adults

	Randomized (n=9)	Nonrandomized (n=6)
Study designs	8 randomized studies 1 cluster-randomized study	5 nonrandomized studies 1 controlled before-after study
Number of patients	4,561	11,580
Patient eligibility	4 high-risk patients only 5 unselected older adults	4 high-risk patients only 2 unselected older adults
Exclusion criteria	3 need for immediate treatment 6 long-term care facility 5 cognitive impairment	3 need for immediate treatment 0 long-term care facility 1 cognitive impairment
Median patient age (range)	79 (74-82) (1 study NR)	78.5 (75-86)
Patient sex (%)	59% women	59% women
Race (%)	64% white (6 studies NR) 25% black	67% white (5 studies NR) 32% black
Patients with cognitive impairment^a	27.3% (5 studies NR)	8.5% (5 studies NR)
Patients' living status (%)	789/4688 (16.8%) living alone (5 studies NR)	3072/11580 (26.5%) living alone (2 studies NR)
Patient has primary care^b	88% (8 studies NR)	NR
Intervention strategy^c	3 discharge planning 9 case management 2 medication safety 0 geriatric EDs	4 discharge planning 3 care management 1 medication management 0 geriatric EDs
Multi-strategy interventions	5 studies	2 studies
Major intervention components^c	7 assessment 5 referral plus follow-up 4 bridge design ^d	5 assessment 1 referral plus follow-up 1 bridge design ^d
Outcomes reported	7 ED readmission 6 functional status 5 hospitalization after ED discharge 4 patient experience 2 quality of life 3 mortality 2 hospitalization at ED index	5 ED readmission 1 functional status 3 mortality 3 hospitalization after ED discharge 1 patient experience 2 hospitalization at ED index 1 quality of life
Risk of bias for objective and patient-reported outcomes	Objective: 2 high risk 3 unclear risk 3 low risk 1 NA Patient-reported: 4 high risk 3 unclear risk 2 low risk	Objective: 5 high risk 1 low risk Patient-reported: 2 high risk 4 NA

^a Definitions of impairment varied from abnormal cognitive screen to dementia to delirium/confusion.

^b 6 randomized and 5 nonrandomized studies were conducted in countries with National Health Service.

^c Numbers sum to more than 15 because studies employed more than 1 intervention type.



^dDesign refers to interventions that include contact both within the ED and after discharge.

Abbreviations: ED=emergency department; NA=not applicable; NR=not reported

Summary of Findings

Next, we organize the findings from the 15 ED intervention studies by effects on (1) clinical outcomes of functional status, QOL, and mortality; (2) patient experience outcomes; and (3) utilization outcomes. We describe results from randomized studies first, as these are more likely to report valid estimates of intervention effects. Because of the small number of studies reporting outcomes that used comparable measures, we conducted meta-analyses only for randomized studies reporting hospitalization after the index visit and ED readmission. Other outcomes are synthesized qualitatively, giving more weight to larger studies with a lower ROB. In some cases, results are grouped by how outcomes were measured (*eg*, hospitalization as dichotomous outcome followed by hospitalization length of stay).

Appendix F presents detailed study characteristics; Appendix G provides detailed intervention characteristics; Appendix H lists the excluded studies and reasons for exclusion; and Appendix I contains a glossary of terms.

EFFECTS ON CLINICAL OUTCOMES

Functional Status

A total of 6 studies, of which were 5 randomized, evaluated the effect of ED interventions on functional status using a variety of outcome measures and analysis approaches.^{37-40,42,46}

Functional status was a primary outcome in all but 1 study³⁷ and was evaluated using measures of ADLs or independent ADLs (IADLs), reported categorically (*eg*, dependent ADLs) or using a continuous scale. Three randomized studies evaluated single-strategy interventions of case management.^{37,39,42} Three studies, including 2 randomized^{38,40} and 1 nonrandomized,⁴⁶ evaluated multi-strategy interventions, all using discharge planning plus case management. Positive intervention effects were observed in 4 of the 5 randomized studies,^{37,38,40,42} and of these, 2 focused on high-risk older adults and included all 3 intervention components of interest (*ie*, assessment, referral plus follow-up, and bridge).^{38,40} Two other randomized studies recruited unselected older adults; 1 included all 3 intervention components and also followed participants for up to 4 weeks,³⁷ while the second included only 1 intervention component (assessment).⁴² Findings of individual randomized studies are described below, focusing first on those reporting categorical changes in function, then those reporting functional status as a continuous outcome.

Three randomized studies defined functional status as changes in dependence in ADLs/IADLs; all found positive effects.^{38,40,42} One moderate-sized, low ROB study evaluating a multi-strategy intervention (*ie*, discharge planning plus case management) found a statistically significant lower odds of clinically important functional dependency, defined as less decline in ADLs/IADLs (odds ratio [OR] 0.53; 95% CI 0.31 to 0.91) at 3 and 4 months, respectively.⁴⁰ A second small, high ROB study evaluating discharge planning plus case management found a significantly greater odds of functional improvement, as defined by improvement in ADL performance on the staircase measured at 3 months (OR 2.37; 95% CI 1.20 to 4.68) and 12 months (OR 2.04; 95% CI 1.03 to 4.06).³⁸ Both studies recruited high-risk populations and evaluated interventions with all 3 intervention components present. A third moderate-sized study with unclear ROB evaluated case management and found that intervention participants reported higher levels of functional

independence in IADLs compared with the control group ($p=0.027$), but there were no significant differences in ADL independence ($p=0.47$).⁴²

Two randomized studies evaluated change in functional status, reporting the Barthel Index of ADLs and Older Americans Resources and Services (OARS) as a continuous outcome.^{37,39} One study with a relatively small sample size ($N=427$) and unclear ROB recruited a high-risk population of older adults who were admitted to the hospital in the prior 12 months and evaluated case management (*ie*, referral to community services) delivered after ED discharge.³⁹ There were no differences in ADL or IADL mean scores between intervention and control groups. A second study with moderate sample size ($N=739$) and unclear ROB evaluated case management delivered pre- and post-ED discharge, and found that intervention participants reported less functional decline at 6 months compared with control (-0.25 intervention vs -0.75 decline; $p<0.001$).³⁷ At 18 months, there were no significant differences in the rate of functional decline between intervention and control groups. This intervention included all 3 components including follow-up by intervention staff for up to 4 weeks after study enrollment.

One nonrandomized study with a moderate sample size and high ROB evaluated a multi-strategy intervention (*ie*, discharge planning plus case management) and examined the number of older adults reporting basic and intermediate dependency in ADLs based on the Katz scale.⁴⁶ The number of participants reporting each level of dependency at 3 months was similar for intervention and control groups, although no statistical tests were presented.

Quality of Life

Three studies^{39,41,46} (2 randomized) evaluated the effects of ED interventions on QOL—1 of multiple primary outcomes in 2 studies.^{39,46} One study evaluated case management³⁹ while 2 studies^{41,46} (1 randomized) evaluated multi-strategy interventions (*ie*, discharge plus case management). The 2 studies evaluating multi-strategy interventions included all 3 intervention components.^{41,46} Results are sparse for this outcome, but based on limited data do not suggest an intervention effect.

Two randomized studies reported physical and mental health-related QOL using the SF-36 physical function and mental health component scores.^{39,41} One study, judged unclear ROB, recruited high-risk older adults and evaluated a case management intervention with assessment only.³⁹ The second, judged low ROB, recruited unselected older adults and evaluated a discharge plus case management intervention with all 3 intervention components.⁴¹ Assessment time points included 30 and 120 days⁴¹ and 10 months.³⁹ There were no statistically significant effects of the ED interventions on either physical or mental health-related QOL at any time point. Although there was no significant effect on QOL, results favored the intervention.

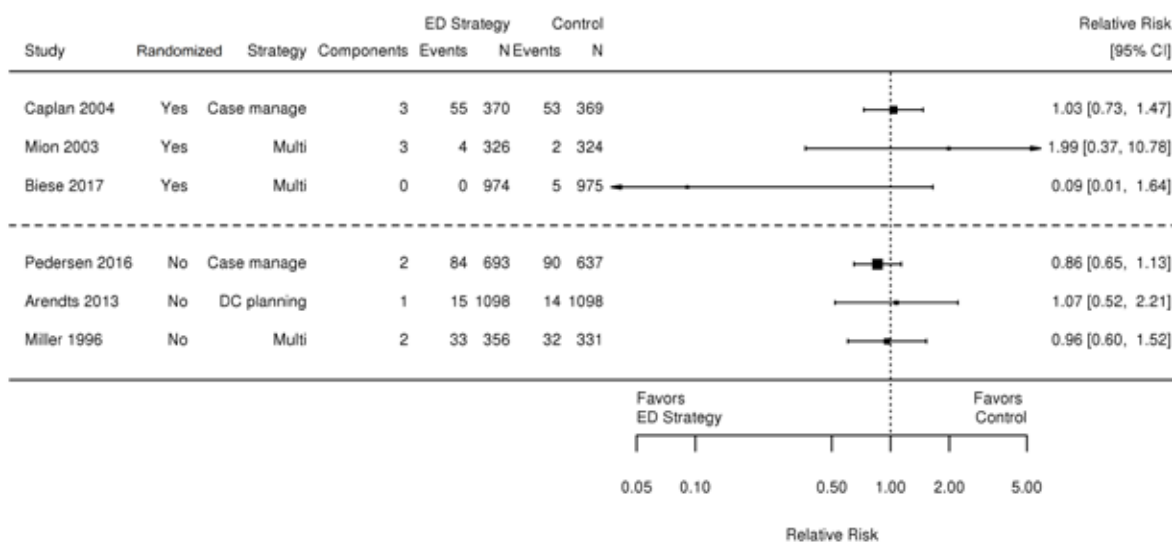
One nonrandomized study reported an unadjusted analysis of QOL at 3 months using a single item drawn from a validated scale.⁴⁶ Scores were similar for intervention and control participants, yet there was not sufficient information reported to conduct an analysis.

Mortality

Six studies evaluated the effect of ED interventions on mortality based on data in the electronic health record (EHR).^{36,37,41,44,46,48} Mortality was a primary outcome in 3 nonrandomized studies^{44,46,48}; no randomized studies included mortality as a primary outcome. Two studies evaluated single intervention types, including discharge planning (n=1, nonrandomized)⁴⁴ and case management (n=2, including 1 randomized).^{37,48} Four studies evaluated multi-strategy interventions, 3 consisting of discharge planning plus case management^{40,41,46} and 1 case management plus medication safety.³⁶ Two randomized studies and 1 nonrandomized study included all 3 intervention components.^{37,41,46} The overall pattern of results suggests no effect on mortality, but no studies had a large enough sample and number of events to exclude a clinically important effect.

Three randomized studies evaluated the effect of ED interventions on mortality (Figure 3).^{36,37,41} Two were judged low ROB^{37,41} and 1 high ROB.³⁶ All 3 studies recruited unselected older adults. The studies varied in their assessment time points, ranging from 30 days^{36,37,41} to 180 days.³⁷ There was no significant effect of the ED interventions on mortality. Two of the 3 studies had few deaths (proportion of deaths in intervention and control groups: 0% to 1%), with resulting imprecise estimates indicated by wide confidence intervals (CIs).

Figure 3. Forest Plot of Effect of ED Interventions on Mortality^a



^a No summary estimate of effect is reported for the randomized studies due to the highly variable timing of the assessment, and for nonrandomized studies due to the small number of studies and high ROB. Abbreviations: CI=confidence interval; DC=discharge; ED=emergency department

Three nonrandomized studies evaluated the effect of ED interventions on mortality.^{44,46,48} Two recruited high-risk older adults. Only 1 study, judged low ROB, reported an adequately adjusted analysis.⁴⁸ The studies varied in their assessment time points, ranging from 28 days⁴⁴ to 30 days⁴⁶ to 3 months.⁴⁸ There were no significant effects of the ED interventions on relative risk of mortality.

EFFECTS ON PATIENT EXPERIENCE OUTCOMES

Five studies evaluated the effect of ED interventions on patient experience based on a range of outcome measures, including the Client Satisfaction Questionnaire, Satisfaction with Care Scale, and 2 unnamed scales in which items were drawn from existing instruments.^{39-42,47} Patient experience was not included as a primary outcome in any studies. The randomized studies were judged low ROB (n=2)^{40,41} and unclear ROB (n=2),^{39,42} while the single nonrandomized study was judged high ROB.⁴⁷ Interventions assessed were case management (n=2, both randomized^{39,42}) and medication safety (n=1, nonrandomized⁴⁷). Two studies evaluated multi-strategy interventions consisting of discharge planning plus case management.^{40,41} Overall, these studies show a mixed pattern, with 2 of the 5 studies reporting higher satisfaction with care or greater patient knowledge of community resources. Findings of individual studies are described below.

Two randomized studies evaluated patient satisfaction with care using continuous outcome measures, Client Satisfaction Questionnaire and Satisfaction with Care Scale.^{39,40} Both studies had small to moderate sample sizes and were judged unclear and low ROB. Assessment time points occurred at 1 month and 10 months. There were no statistically significant effects of the ED interventions on patient experience in either study, although results favored the intervention. A third study of moderate sample size (N=650) and low ROB evaluated multi-strategy interventions and included all 3 intervention components.⁴¹ This study reported mean satisfaction values from a single item that assessed satisfaction with the information received about agencies or organizations to help with needs after leaving the ED, and was included as part of routine ED care. Using a 5-point Likert Scale (1=poor to 5=excellent), this study found a significant difference between intervention and control participants in level of satisfaction regarding information received while in the ED (3.42 vs 3.03; MD 0.37; 95% CI 0.13 to 0.62). A fourth randomized study with a small sample size and unclear ROB evaluated satisfaction with care 4 weeks after the intervention utilizing an unnamed instrument and found that 40% of intervention participants recalled helpful interventions while 28% reported benefits of improved confidence and self-esteem.⁴²

One nonrandomized study with a small sample size and high ROB evaluated patient satisfaction with a care provider using a 13-item survey drawn from a validated questionnaire.⁴⁷ However, no summary or average scores were reported; thus no conclusions could be drawn from this outcome.

EFFECTS ON UTILIZATION OUTCOMES

Hospitalization at the ED Index Visit

Four studies (2 randomized) examined the effect of hospitalization at the index ED visit,^{34,40,43,45} 3 of which included this as a primary outcome.^{34,43,45} All 4 studies reported hospitalization at the index visit as a dichotomous variable. Data regarding admission versus discharge disposition were collected prospectively. Interventions included discharge planning (n=1),⁴³ case management (n=1),³⁴ and 2 multi-strategy interventions consisting of discharge planning plus case management (n=2).^{40,45} All interventions were delivered in the ED prior to discharge. Only 1 study included all 3 intervention components.⁴⁰ Overall, only 1 nonrandomized study showed a benefit of ED interventions on hospitalization at the index visit.⁴³

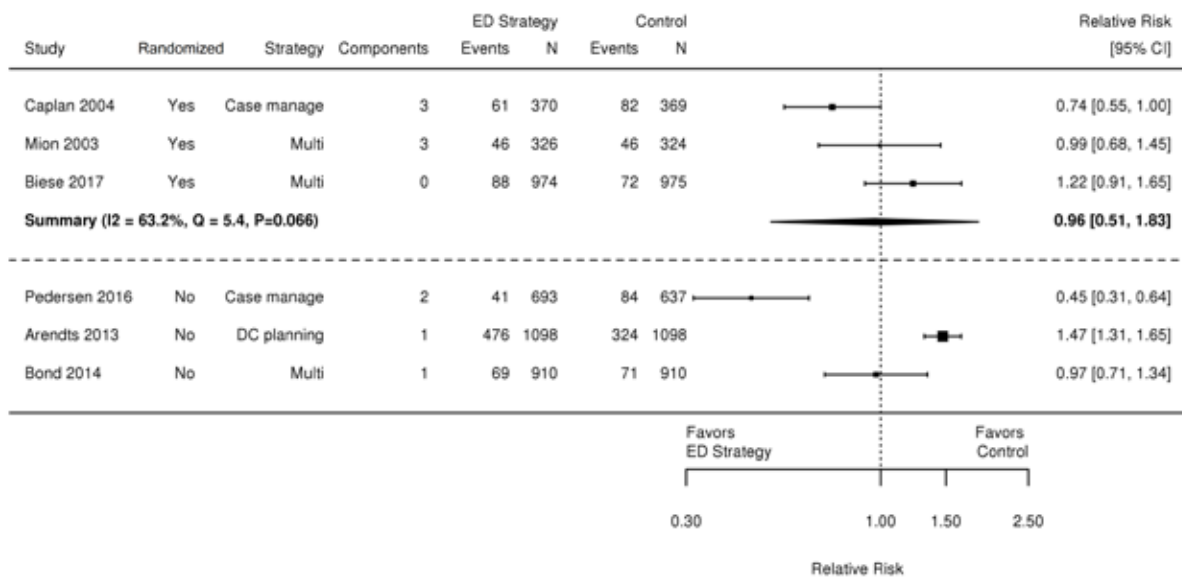
The 2 randomized studies recruited high-risk older adults and used intervention components that included geriatric assessments³⁴ and risk assessments plus referrals and follow-up.⁴⁰ In 1 study, anticipated admission was an exclusion criteria, and therefore this study had a very small number of admitted participants, 14 of 178 in the intervention group and 26 of 210 in the control group.⁴⁰ The second study had a very high admission rate of 76%.³⁴ Participants in this study were specifically referred to an “aged care” nurse, and randomization occurred after a detailed baseline assessment.

Two large nonrandomized studies were both judged high ROB.^{43,45} Both enrolled high-risk older adults. Both included an assessment, but only 1 also included referral to community services.⁴⁵ One included older adults who resided in nursing homes, although these patients made up <20% of the sample.⁴⁵ One study used propensity scores to appropriately adjust for nonrandomization and found a lower admission rate in older adults receiving discharge planning (OR 0.88; 95% CI 0.76 to 1.0).⁴³ However, admission to the ED observation unit and deaths in the ED were also categorized as admissions. In a subgroup analysis, older adults whose presenting problem was musculoskeletal symptoms or angina had lower admission rates. However, those subgroup analyses were performed *post hoc* and should be considered exploratory. The second nonrandomized study had poor matching between the intervention and control groups.⁴⁵ There were no effects on admission rates overall, or when comparing only those cases with high matching.

Hospitalization after the ED Index Visit

Eight studies reported effects of ED interventions on hospitalization after the index ED visit,^{36,37,39,41,42,44-46} including 5 randomized studies.^{35-37,39,41} Three studies evaluated single intervention strategies including discharge planning (n=1)⁴⁴ and case management (n=2).^{37,39} Five studies evaluated multi-strategy interventions including discharge planning plus case management (n=3)^{41,45,46} and case management plus medication management (n=2).^{35,36} Three randomized studies included all 3 intervention components.^{37,41,46}

Three moderate to large randomized studies reported hospitalization as a dichotomous outcome.^{36,37,41} It was a primary outcome for 2 of these studies, both of which had a low ROB.^{37,41} All 3 studies targeted unselected older adults. One study evaluated case management³⁷ while 2 studies evaluated multi-strategy interventions, including case managing plus discharge planning⁴¹ and case management plus medication safety.³⁶ Outcomes were assessed by patient report, with confirmation via EHR.^{36,37,41} Overall, there was no intervention effect (RR 0.96; 95% CI 0.51 to 1.83, Figure 4), but the confidence interval was wide and intervention effects varied significantly (Q=5.4, p=0.07; I²=63%). When looking at the effects reported by individual studies, 2 found no impact on hospitalization at 30 days.^{36,41} One of these studies included all 3 intervention components.⁴¹ The other had none of the intervention components hypothesized to be important.³⁶ Two studies had prolonged follow-up periods of 120 days and 18 months.^{37,41} One found a decreased risk of hospitalization at each of the follow-up time points, with a reported number needed to treat of 18 to prevent 1 hospitalization at 30 days, and a number needed to treat of 10 to prevent 1 hospital admission at 18 months.³⁷ An analysis of time-to-first-emergency hospitalization as a continuous variable also showed an intervention benefit. This study included all 3 intervention components and had the most intensive intervention of the included studies, with presentation of each case at a weekly interdisciplinary conference and ongoing involvement of the intervention team for up to 4 weeks after the index ED visit.

Figure 4. Forest Plot of Effect of ED Interventions on Hospitalization After the Index Visit^a

^a No summary estimate of effect is reported for nonrandomized studies because of the small number of studies and high ROB.

Abbreviations: CI=confidence interval; DC=discharge; ED=emergency department

Three randomized studies also reported hospitalization after the ED index visit using a variety of continuous outcome measures.^{37,39,41} One was judged unclear ROB³⁹ and 2 low ROB.^{37,41} Two studies evaluated case management.^{37,39} One study evaluated a multi-strategy intervention consisting of discharge planning plus case management.⁴¹ Only 1 study, which used all 3 intervention components, found a significant effect of the intervention on hospitalization after the ED index, detailed in the above section.³⁷ Another study, which also included all 3 intervention components, reported the number of subsequent hospital days at follow-up time points of 30 and 120 days.⁴¹ There was no difference between the intervention and control groups. The last study reported the mean number of admissions at 10 months' follow-up, with no difference between groups.³⁹ Only 1 intervention component, a comprehensive assessment, was used in this study. Participants were initially enrolled in the study if they had been discharged from the ED in the previous 12 months. This study aimed to enroll high-risk older adults,³⁹ while the other 2 enrolled unselected older adults.^{37,41}

Four nonrandomized studies reported hospitalization after the index visit: 3 using a dichotomous outcome^{44,45,48} and 1 using a continuous measure.⁴⁶ A low ROB study that enrolled high-risk older adults evaluated case management and included all 3 intervention components.⁴⁸ This study found a lower likelihood of hospitalization at 30 days (RR 0.55; 95% CI 0.36 to 0.82). In this study, a statistically significant higher percentage of participants in the intervention group were discharged to home at the index ED visit and had a longer length of sustained contact with the geriatric ED team than did those in the control group (14 days as opposed to 1 day). A high ROB study that evaluated discharge planning and included only 1 intervention component, assessment, found that intervention participants had a higher risk of hospitalization at 1 year.⁴⁴ The matching used for this study involved matching a high-risk intervention participant with a

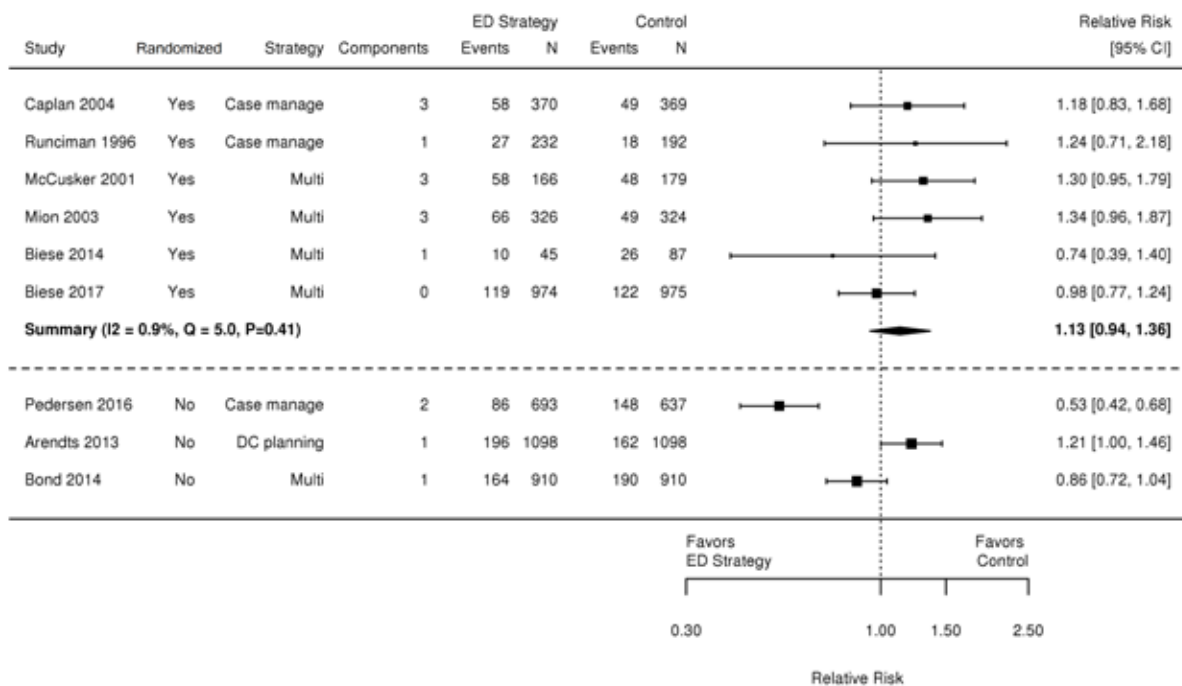
low-risk control participant. Risk was determined using a 4-question screening tool, and a positive answer to any question led to a high-risk designation. The last 2 studies evaluated case management plus discharge planning. Another study also used pair matching that was not robust; it found no effect on hospitalization.⁴⁵ This study included only 1 intervention component, assessment.⁴⁵ A final study reported hospitalization after the index visit as a continuous measure.⁴⁶ This prospective cohort study matched pairs only by age and gender and over one-half were admitted to the hospital at the index visit. There was no difference in number of nights spent in the hospital between the intervention and control groups. This held true even when performing subanalysis on participants who were discharged to home at the index visit. Only 1 intervention component, *assessment*, was used in this study.

Emergency Department Readmission

Twelve studies (7 randomized) reported ED readmission after the index ED visit using a variety of methods and data sources including patient report and EHR data.^{35-37,39-42,44-48} Six randomized studies reported ED readmission as a dichotomous outcome,^{35-37,40-42} but this was a primary outcome in just 2 studies.^{36,41} One study reported a composite outcome of ED readmission and hospitalization after the index visit.³⁵ When queried, the author reported that a majority of these visits were ED readmissions, although a breakdown of numbers could not be provided. Six studies evaluated single-type intervention strategies including case management (n=4; 3 randomized^{37,39,42,48}), discharge planning (n=1; nonrandomized⁴⁴), and medication safety (n=1; nonrandomized⁴⁷). Six studies evaluated multi-strategy interventions including discharge planning plus case management (n=4)^{40,41,45,46} and case management plus medication management (n=2).^{35,36} All 3 intervention components were present in 3 randomized studies^{37,40,41} and 1 nonrandomized study.⁴⁶ Overall, these interventions did not decrease ED readmission.

When considered altogether, the randomized studies that reported ED readmission as a dichotomous outcome found no effect on ED readmission (RR 1.13; 95% CI 0.94 to 1.36, Figure 5).^{35-37,41,42} As described above, 2 studies evaluated single-strategy interventions of case management^{37,42} while 3 studies evaluated multi-strategy interventions of case management plus medication safety and discharge planning plus case management.^{35,36,41} However, patients in the case management plus medication management studies were identified days after ED discharge and the interventions were delivered via a single phone call.^{35,36} A single low ROB study (n=345) found that intervention patients had an increased risk of ED readmission at 30 days.⁴⁰ This was a multi-strategy intervention that included discharge planning and case management. It also included all 3 intervention components of interest. In a *post hoc* stratified analysis, this effect was seen only in patients who had not visited their primary care physician in the month prior to the ED index visit.

Another randomized study reported ED readmission, a primary outcome, as a continuous variable, measuring both number of hospitalizations and mean length of stay at 10 months' follow-up.³⁹ This study evaluated case management and included only 1 intervention component, assessment. There were no differences between the intervention and control groups.

Figure 5. Forest Plot of Effect of ED Interventions on Readmission^a

^a No summary estimate of effect is reported for nonrandomized studies because of the small number of studies and high ROB.

Abbreviations: CI=confidence interval; DC=discharge; ED=emergency department

Four nonrandomized studies reported ED readmission as a dichotomous variable.^{44,45,47,48} Three of these involved a single intervention strategy; discharge planning,⁴⁴ case management,⁴⁸ and medication management.⁴⁷ One evaluated case management plus discharge planning.⁴⁵ Two studies failed to find a difference in ED readmission rates between groups.^{45,47} One study included no intervention components of interest,⁴⁷ while the other included assessment only.⁴⁵ All participants admitted to the hospital in 1 study received the medication management intervention that had been provided only to the intervention group in the ED, decreasing the potential to observe an intervention effect.⁴⁷ One study found that risk of ED readmission following an intervention was decreased (hazard ratio [HR] 0.49; 95% CI 0.33 to 0.72).⁴⁸ Two intervention components, assessment and referral plus follow-up, were included in this study. However, the assessment was part of the standard of care in this study. In this study, a higher percentage of participants in the intervention group were discharged to home at the index ED visit and had a longer length of sustained contact with the geriatric team. It was shown that a majority of ED readmission occurred in the first week following the index ED visit. A majority of participants (73%) in the intervention group received a follow-up visit within the first 24 hours following the index ED visit. One study, whose only intervention component of interest was an assessment, found the risk of ED readmission to be increased (risk difference 3%, $p=0.05$) following receipt of the intervention.⁴⁴ In this study, control case matches were low-risk participants while those in the intervention group were deemed to be high risk, meaning they had positively answered at least 1 of the 4 screening questions that gauge ability to care for self at home.

A final nonrandomized study reported ED readmission as a continuous outcome.⁴⁶ This study evaluation discharge planning plus case management and included 1 intervention component of interest, referral plus follow-up. The number of visits to the ED within the 3 month follow-up period did not differ between groups.

Quality of Evidence

Risk of bias is described for randomized studies in Figure 6. We separately evaluated objective outcomes (eg, mortality, ED readmission) and patient-reported outcomes (eg, QOL). For objective outcomes, 6 of the 9 studies were judged low or unclear ROB. Five studies were judged low or unclear ROB for patient-reported outcomes. Factors that led to higher ROB judgments included unclear randomization and allocation concealment, detection bias (patient-reported outcomes), and differences in baseline patient characteristics.

Figure 6. Risk of Bias Ratings for Randomized Studies^a

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Were baseline OUTCOME measurements similar	Were baseline PROVIDER characteristics similar	Blinding of outcome assessment (detection bias-objective outcome)	Blinding of outcome assessment (detection bias-patient-reported outcome)	Incomplete outcome data (attrition bias)	Protection Against Contamination	Selective reporting (reporting bias)	Other bias	Overall-objective outcome	Overall-patient-reported outcome
Basic,2005	+	+	-	?	+	-	-	+	+	+	-	-
Biese,2014	?	-	?	-	+	-	-	?	+	-	-	-
Biese,2017	+	+	?	?	+	-	+	?	+	?	?	-
Caplan,2004	+	+	+	?	+	-	+	+	+	+	+	?
Eklund,2013	?	+	+	?		-	+	?	+	+		-
Gagnon,1999	+	+	+		+	?	+	-	+	?	?	?
McCusker,2001	+	+	+	?	+	+	+	+	+	?	+	+
Mion,2003	+	+	+	?	+	+	+	+	+	+	+	+
Runciman,1996	?	?	-	?	?	?	?	+	+	+	?	?



^a White indicates items that were not applicable. Green/positive indicates items that were judged low ROB. Yellow/question mark indicates items that were judged unclear ROB. Red/negative indicates items that were judged high ROB.

Nonrandomized studies (Figure 7) were judged high ROB for objective outcomes, with 1 exception that was judged low ROB.⁴⁸ Because the EPOC quality criteria consider random sequence generation even for nonrandomized designs, this was a major factor in the high ROB ratings. Other concerns were lack of proof that baseline provider characteristics (eg, experience) were similar, and lack of proof that baseline outcome measurements were similar. Also, many studies had fundamental differences in baseline patient characteristics, which may affect outcomes.

Figure 7. Risk of Bias Ratings for Nonrandomized Studies^a

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Were baseline OUTCOME measurements similar	Were baseline PROVIDER characteristics similar	Blinding of outcome assessment (detection bias-objective outcome)	Blinding of outcome assessment (detection bias-patient-reported outcome)	Incomplete outcome data (attrition bias)	Protection Against Contamination	Selective reporting (reporting bias)	Other bias	Overall-objective outcome	Overall-patient-reported outcome
Arendts,2012	+	+	+	?	+		+	+	+	+	+	+
Arendts,2013	+	+	?	?	+		+	+	+	+	+	+
Bond,2014	+	+	?	?	+		+	+	+	+	+	+
Miller,1996	+	+	?		+	+	+	+	+	+	+	+
Mortimer,2011	+	+	?	?	+	+	+	+	+	+	+	+
Pedersen,2016	+	+	+	?	+		+	+	+	+	+	+

^a White indicates items that were not applicable. Green/positive indicates items that were judged low ROB. Yellow/question mark indicates items that were judged unclear ROB. Red/negative indicates items that were judged high ROB.



SUMMARY AND DISCUSSION

We evaluated interventions to improve ED care for older adults, examining effects on a range of outcomes of importance to patients, clinicians, and policymakers. Our review is unique in the approach to classifying intervention strategies and specific components, careful ROB assessment, and the inclusion of randomized and stronger nonrandomized designs. We identified 9 randomized and 6 nonrandomized studies, all conducted in economically developed countries. Just over half of these enrolled high-risk older adults—patients that are medically similar to Veterans presenting to VA EDs. The interventions most commonly used case management or multiple intervention strategies. No studies were informed by an explicit conceptual model. When considering the interventions collectively, we found a small benefit on functional outcomes but no overall effect on ED readmission or subsequent hospitalizations. Although there was no overall effect on healthcare utilization, 2 studies with a more comprehensive intervention and longer duration of follow-up were associated with decreased healthcare utilization.^{37,48} Other outcomes were reported less frequently, and intervention effects could not be determined definitively.

We evaluated interventions applicable to a broad range of older adults, rather than focusing narrowly on condition-specific interventions. We were particularly interested in determining if specific strategies or intervention components were associated with greater benefit to older adults. Two strategies were evaluated infrequently (medication management) or not at all (guideline informed). Interventions evaluated were relatively low intensity (*ie*, short duration and limited number of planned patient contacts), and thus our findings are applicable only to low-intensity geriatric management interventions in the ED.

Strength of evidence (SOE) was rated for outcomes judged critical to decision making on the basis of study design, risk of bias (ROB), consistency, directness, and precision (Table 6). The SOE was rated high for effects on ED readmission. SOE was low or very low for all other outcomes. Concerns that contributed to the lower SOE were high ROB, inconsistent effects, and imprecision that was attributed to the 95% CI not excluding a small or small-to-moderate effect.

Table 6. Strength of Evidence for Effects of Interventions to Improve Outcomes for Older Adults in Emergency Departments

Outcome	Studies (Patients)	Findings	Strength of Evidence (Rationale by Domain)
Physical function	Randomized: 5 (2233)	3 of 5 showed benefit; beneficial interventions were multi-strategy	Very low SOE (Serious ROB, inconsistent, imprecise)
	Nonrandomized: 1 (687)	No effect	
ED readmission	Randomized: 7 (4629)	Relative risk 1.13 (0.94 to 1.36) (9 fewer to 53 more per 1,000)	High SOE (No serious ROB, consistent, precise)
	Nonrandomized: 5 (6432)	2 of 5 showed lower readmission; beneficial interventions were multi-strategy or case management	
Hospital admission after index	Randomized: 3 (3338)	Relative risk 0.96 (0.51 to 1.83) (59 fewer to 100 more per 1,000)	Low SOE (No serious ROB, inconsistent, imprecise)
	Nonrandomized: 3 (5346)	No consistent effects on readmission	

Outcome	Studies (Patients)	Findings	Strength of Evidence (Rationale by Domain)
Patient experience	Randomized: 4 (1889)	2 of 4 showed benefit for satisfaction, helpfulness, or self-esteem; beneficial interventions were multi-strategy or case management	Low SOE (No serious ROB, consistent, indirect, imprecise)
	Nonrandomized: 1 (199)	No usable data	

Abbreviations: ROB=risk of bias; SOE=strength of evidence

FINDINGS IN THE CONTEXT OF PRIOR REVIEWS

Most prior reviews focused on single strategies including case management,³ comprehensive geriatric consultation,¹² nursing interventions,¹³ discharge planning,¹⁵ or risk-assessment tools.²² In contrast, our review included a broad range of intervention strategies as well as studies that used 1 or more intervention strategies. Only 1 of the prior reviews was published in the past 5 years (search date 2013) and judged of good quality.¹⁵ This review evaluated “community transition planning,” described as discharge planning in our review, and identified 9 studies. Consistent with our findings, they found no effect of discharge planning on utilization outcomes or mortality and found the evidence too limited to draw conclusions about effects on functional status.

An older systematic review of case management found that these interventions did not impact quality of life, but the evidence for this outcome was sparse.³ That review also carefully classified interventions and used qualitative case analyses to identify patterns but included studies at higher ROB, such as program descriptions and noncomparative observational studies. The review found that case management strategies utilizing multiple elements had a positive effect (defined inclusively as a positive effect on any outcome). The review was limited by the inclusion of study designs with high ROB and the lack of any careful quality or ROB assessment of the included studies. Across these reviews, general themes are that more comprehensive interventions are associated with greater effects, but that interventions tested to date do not show a consistent effect on utilization outcomes.

A recent good-quality evidence mapping review described a broad literature of studies examining risk-assessment tools and ED interventions for older adults.⁷ Evidence maps do not assess the quality of included studies, focusing instead on a description of the quantity and type of evidence, interventions, and outcomes reported. The authors found an extensive literature—much of it published only in meeting abstracts—and recommended formal literature syntheses.

CLINICAL AND POLICY IMPLICATIONS

The diversity of interventions and outcome measures among included studies limits the ability to determine definitively the clinical utility of any single intervention strategy or set of intervention components. However, our structured approach to analyzing these heterogeneous findings, including careful examination of intervention components, suggests that future research could benefit from using a conceptual model to both guide a more comprehensive reporting of intervention components and enable researchers to analyze mechanisms of action. Some studies selected patients at higher risk for poor outcomes, but there was no clear relationship between intervention effects and selection of high-risk patients. Our findings suggest that multi-strategy,

longitudinal interventions may be more effective than single-touch interventions isolated to the ED on improving clinical outcomes. ED interventions that bridge into more intensive outpatient management tended to reduce ED and hospital readmission rates as well as functional decline. From a clinical and policy perspective, these findings suggest that future research in this area may benefit from working across settings and disciplines. Furthermore, incorporating input from patients, family members, clinical staff, and policymakers representing both ED and post-ED community settings and services may help to identify and prioritize key outcomes.

Similar to previous reviews²³ and the 2014 Geriatric Emergency Department Guidelines,¹⁶⁻¹⁸ our findings suggest that ED visits should not be considered in isolation, but rather as an integral part of the geriatric patient's continuum of care, bridging inpatient and outpatient management. The patient's functional status, access to community resources, and capacity for follow-up should be considered when planning their disposition. However, the relative benefit of individual interventions is unclear and requires further studies to elucidate.

LIMITATIONS

Our protocol-driven review has several strengths, including input from an expert panel, a conceptual model, rigorous methods, and a structured approach to describing the key components of the tested interventions. This approach allowed for a theory-driven, standardized classification of the study interventions. A significant limitation of this approach is that intervention descriptions were not always detailed enough to describe some components with confidence. We limited our review to English-language publications, which may have excluded potentially informative evidence. Other limitations are described below.

Publication Bias

Given the small number of studies, statistical methods to detect publication bias are not useful. We searched ClinicalTrials.gov for completed but unpublished studies, but this is not a particularly effective way to identify publication bias.⁴⁹ Thus, although no publication bias was detected, tools for detection are poor.

Study Quality

We were also limited by the existing literature. Of the 9 randomized studies, only 3 were evaluated as low ROB for objective outcomes. The most common limitation was lack of blinded outcome assessment. Almost all nonrandomized studies were judged high ROB for patient-reported outcomes and for objective outcomes. The basic study design, differences between intervention and control participants, and lack of analyses that adjusted for potential confounders were common problems. In addition, some key outcomes, such as quality of life, were infrequently reported. No studies reported adverse effects.

Heterogeneity and Sparse Information

There was substantial diversity in study designs, including the choice to randomize and the intervention approaches. This made coherent synthesis and identification of themes difficult. Interventions typically did not specify a conceptual framework, and interventions differed substantially in goals, components, delivery, and intensity. Specifically, few studies reported detailed information on intervention strategies and components. This limited amount of

information prevented us from conducting further analyses on patient- and provider-level intervention components. A lack of detail around patient characteristics, including medical history and presenting condition, further prevented us from mapping outcomes back to intervention strategies and predisposing characteristics, as depicted in our conceptual model. No studies used the 2014 Geriatric ED Guidelines¹⁶⁻¹⁸ to inform intervention development, and few studies explicitly addressed medication management.

Applicability of Findings to the VA Population

None of the studies included Veteran samples. Seven studies were conducted in North America, and the others were conducted in economically developed countries. Thus, the staffing and training of ED staff and geriatric specialists should be broadly similar to VA EDs. Almost all Veterans have an assigned primary care provider, similar to studies conducted in countries with a national health service, and a health system that facilitates post-ED care. However, it is uncertain if the community and specialty care referral resources available to study patients were similar to those available to Veterans. Studies had a representative mix of men and women, but only 4 studies reported race; these studies had a representative mix of white and black patients. Few studies reported participants' sociodemographic characteristics (*ie*, income, education), preventing us from abstracting this information, and further limiting the ability to evaluate the degree of sociodemographic similarities compared to Veteran populations. Most randomized studies excluded patients from long-term care facilities or individuals with important cognitive impairment. Therefore, results are most applicable to community-dwelling older adults without important cognitive impairment.

RESEARCH GAPS/FUTURE RESEARCH

We structured our analysis of gaps in evidence by considering each element of the PICOTS framework (Table 7).⁵⁰ Although it would be possible to generate an extensive list of gaps in evidence, we restricted this list to the areas judged to be highest priority, given the current state of evidence. To facilitate future literature syntheses, we encourage investigators conducting clinical trials to include these studies in trial registries.

Table 7. Highest Priority Evidence Gaps

PICOTS Domain	Evidence Gap
Population	<ul style="list-style-type: none"> ● No studies actively recruited Veterans. ● Few studies report clinical and sociodemographic characteristics of older adults using the ED, or subgroup (interaction) effects, limiting the ability to examine whether effects of interventions may vary across different clinical or demographic subgroups. ● Although some studies recruited high-risk older adults, it is unclear which subgroups of older adults are most likely to benefit from geriatric ED interventions.
Interventions	<ul style="list-style-type: none"> ● No studies included a conceptual model to guide selection of intervention strategies and components or propose relationships between intervention strategies and study outcomes. Most interventions did not explicitly address domains such as unmet biopsychosocial and/or psychological needs. ● Limited reporting around intervention strategies and components make it difficult to identify the relationship between intervention structure and outcomes. ● Few studies included elements of caregiver education or support. ● Limited information makes it difficult to identify the optimal dose of ED interventions (eg, number of contacts, frequency and duration of contacts, overall length of intervention). ● To date, no studies have evaluated interventions guided by the 2014 Geriatric ED Guidelines.
Comparators	<ul style="list-style-type: none"> ● Additional research is needed to identify effective intervention strategies and components before undertaking head-to-head comparison of different intervention types, doses, or modalities.
Outcomes	<ul style="list-style-type: none"> ● Lack of a uniform, core set of patient/stakeholder prioritized outcomes limits comparisons across studies.
Timing	<ul style="list-style-type: none"> ● The optimal time to assess significant changes in clinical and utilization outcomes for ED-based interventions is unknown.
Setting	<ul style="list-style-type: none"> ● Interventions that “bridge” pre- and post-ED care, meaning those that include contacts both before and after discharge, may be most effective. However, additional information is needed around the timing and coordination of care within these interventions. ● There is limited information on interventions taking place in large, integrated healthcare systems similar to VA healthcare system.

Abbreviations: ED=emergency department; VA=Veterans Affairs

Given its integrated structure, including presence of a primary care medical home (*ie*, patient-aligned care team, or PACT), high proportion of complex patients, and continuum of available Geriatrics and Extended Care services (*ie*, ambulatory care, inpatient care, home and community-based long-term services and supports, and facility-based care), VA is an ideal setting to pursue additional research in geriatric emergency medicine and address some of the evidence gaps noted above. In considering future research, we recommend considerations across several major domains as follows.

Conceptual Model/Framework

A more holistic model describing multilevel factors that influence older ED use and resulting clinical and utilization outcomes may help to guide the selection of intervention strategies and explore how particular strategies do or do not address unmet needs and other determinants of ED use. A conceptual model can also be used to hypothesize and evaluate relationships between determinants of ED use, intervention strategies, and outcomes of interest. Further, the conceptual model should expand beyond medical/clinical factors influencing ED use to also acknowledge social determinants of health, personal preferences, and access to care. Interventions guided by a conceptual model may help researchers better identify subgroups of high-risk patients who may benefit the most from ED interventions. The use of a conceptual model also may motivate more complete data collection and reporting, including details on participant characteristics (*ie*, sociodemographics) as well as intervention strategies and components. The availability of such data, combined with hypothesized relationships outlined in a conceptual model, may allow researchers to better understand the mechanisms through which selected intervention strategies influence key outcomes.

Innovation in Intervention and Study Design

An inherent challenge in developing and evaluating ED intervention strategies is to balance the need for broad interventions that are applicable for a diverse patient population while also recognizing that patient-centered interventions or those designed for high-risk subgroups may be most effective. Adaptive interventions, including those that optimize delivery by tailoring the dose and content of an intervention to each individual, may help to maximize intervention effects. Research methods and study designs must be appropriate for these emerging intervention designs. Traditional randomized trials prevent researchers from isolating intervention components and identifying which individual components may be associated with intervention effects. Incorporating alternative frameworks, including factorial designs, to the intervention development process may enable researchers to not only examine average treatment effects but also disentangle the relative contribution of individual intervention strategies and combinations of intervention components. Hybrid designs enable researchers to simultaneously explore intervention and implementation effects.

Outcomes and Measurement

Several measurement challenges should be resolved before conducting additional research. First, utilization outcomes, including hospitalization and ED readmission, have been studied most frequently in prior ED studies. However, important clinical and utilization outcomes may have been overlooked. For example, clinical outcomes such as functional status, psychological health, and improved chronic disease self-management may impact health status while access to or use of primary care and specialty services may impact both health and acute care utilization. Second, the heterogeneity of older ED users requires use of more general, compared to disease-specific, outcome measures. However, their responsiveness to ED strategies may be limited and may not fully capture important states or concerns related to an ED visit. Third, it is essential to select measures, particularly those related to physical function, that lack floor or ceiling effects and are sufficiently responsive to changes in older, complex patient populations. Given these considerations, there is a substantial opportunity for patient- and stakeholder-engaged research, such as that prioritized by VA and the Patient-Centered Outcomes Research Institute.

Geriatric Emergency Department Guidelines

As noted, no studies were guided by the 2014 Geriatric ED Guidelines. However, this is not unexpected given the time needed to gain awareness of such guidelines, implement changes, evaluate results, and disseminate findings. These guidelines provide a template for developing geriatric-friendly EDs, giving particular emphasis to elements that may enhance the care experience and improve outcomes for older adults. Although not reported in our results, we identified many of these elements as being present in the included studies, including the use of a geriatric-trained physician or nurse, interdisciplinary team, referrals or partnerships with community services, and care coordination strategies (*eg*, interdisciplinary team meeting). Future research may consider these guidelines to inform conceptual models and/or research interventions.

CONCLUSIONS

We focused only on studies recruiting general patient populations as opposed to focusing on interventions for specific presenting conditions or diagnoses upon ED discharge (*eg*, falls, heart failure). Our results indicate mixed effects of ED intervention strategies on select clinical and utilization outcomes. The small number of studies using any single intervention strategy makes it difficult to draw definitive conclusions because of imprecise estimates of effect and variability in study populations, intervention strategies, and intervention components. However, we found evidence that studies evaluating multi-strategy interventions and those with a more intensive structure, as indicated by the presence of three key intervention components (*ie*, assessment, referral plus follow-up, and planned contacts both pre- and post-ED discharge) may be associated with a small benefit in functional status, decreased hospitalization after the ED index visit, and/or lower likelihood of ED readmission. Future research should be informed by a comprehensive conceptual model, consider emerging intervention approaches (*eg*, adaptive, or dynamic, treatment designs), employ rigorous evaluation strategies, adhere to more thorough reporting of intervention structure, and engage patients and relevant policymakers in selecting outcomes of interest.

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