

Older Adults in the Emergency Department: A Systematic Review of Patterns of Use, Adverse Outcomes, and Effectiveness of Interventions

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Study objective: We sought to synthesize the literature on patterns of use of emergency services among older adults, risk factors associated with adverse health outcomes, and effectiveness of intervention strategies targeting this population.

Methods: Relevant articles were identified by means of an English-language search of MEDLINE, HealthSTAR, CINAHL, Current Contents, and Cochrane Library databases from January 1985 to January 2001. This search was supplemented with literature from reference sections of the retrieved publications. A qualitative approach was used to synthesize the literature.

Results: Compared with younger persons, older adults use emergency services at a higher rate, their visits have a greater level of urgency, they have longer stays in the emergency department, they are more likely to be admitted or to have repeat ED visits, and they experience higher rates of adverse health outcomes after discharge. The risk factors commonly associated with the negative outcomes are age, functional impairment, recent hospitalization or ED use, living alone, and lack of social support. Comprehensive geriatric screening and coordinated discharge planning initiatives designed to improve clinical outcomes in older emergency patients have provided inconclusive results.

Conclusion: Older ED patients have distinct patterns of service use and care needs. The current disease-oriented and episodic models of emergency care do not adequately respond to the complex care needs of frail older patients. More research is needed to determine the effectiveness of screening and intervention strategies targeting at-risk older ED patients.

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INTRODUCTION

The steady increase in the size and age of the older population has had a major effect on health care delivery and costs. With the rapid growth of the oldest segment of the elderly population (≥85 years), the effect is expected to be even greater in the future. Emergency departments provide a critically important service to older people. They are used as a center for the treatment of emergencies, a point of entry into the high technology acute care and long-term health care services, a 24-hour accessible provider of primary medical care, and a safety net when a smooth transition between various systems of care is disrupted.^{1,2} However, as the number of older persons presenting to overcrowded EDs increases, greater attention has focused on the appropriateness and the patterns of use of emergency services by older adults, their special care needs, and the effectiveness of the current models of service provision to elderly patients in EDs.

This systematic review provides a synthesis of the literature on the patterns of use of emergency services among older adults, the risk factors associated with adverse health outcomes in older ED patients, and the effectiveness of intervention strategies targeting this population.

MATERIALS AND METHODS

A computer-aided English-language search of the MEDLINE, HealthSTAR, CINAHL, Current Contents, and Cochrane Library databases was carried out by an experienced medical librarian to identify the relevant literature from January 1985 to January 2001. Appropriate subject headings and text words were used for each database, and the “exploding” technique was performed to ensure inclusion of all indexed articles. In MEDLINE, HealthSTAR, and CINAHL, the specific search terms used were as follows: exp aged; emergency services, hospital; emergency service; and emergency (text word). In Current Contents and Cochrane library databases, the key words used were as follows: aged, elder\$, older, geriatric\$, gerontol\$, senior\$, aging, ageing, and emergency (text word).

The computer search generated a list of 471 articles. The titles or the abstracts (where available) of these articles were carefully read by the first author to select articles relevant to the 3 objectives of this review. The same author scanned the text and bibliographies of the retrieved articles to identify additional studies, commentaries, review articles, books, and any other publications related to the focus of this article.³ A quantitative review of the literature was not appropriate because of the heterogeneity of

the research evidence both in terms of the study design and the quality of research. Therefore, a qualitative approach was used to synthesize the literature and to attempt to draw meaningful conclusions.^{4,5}

The first author assigned each of the relevant articles to 1 of the 3 objectives of the review. As much as possible, tabular displays were used as structures for integrating research findings. Although the data extraction was primarily conducted by the first author, all studies presented in the tables were carefully reviewed by the second author to ensure reliable reporting. The tabular presentation of the studies was supplemented with a narrative critique of the evidence. Regular meetings were held between the 2 authors to discuss the findings and to reach consensus. No studies were excluded because of the methodologic limitations, although this was noted in the interpretation of the results, as appropriate.

RESULTS

Table 1^{1,6-15} presents the findings of 11 international, large-scale ED use studies by using data from single-site, multicenter, or nationally representative samples. As shown, visits by older adults composed 12% to 21% of all ED encounters. In almost all of these studies, the rates consistently showed an overrepresentation of older adults in EDs compared with their proportions in the general population in the same geographic areas.^{1,6,7,9-13,15} One exception was an American study of 3 rural hospitals that reported a disproportionately lower rate of ED use by older adults,⁸ suggesting possible differences in the patterns of use among the elderly living in rural versus urban areas. Also of note are the results of a longitudinal multicenter American study⁷ and a single-site British study¹⁶ that showed a progressive increase in the number of ED attendances and emergency admissions of older patients in the last decade.

Older adults use emergency services at higher rates and have substantially distinct patterns of presentation and emergency care needs. As shown in Table 1, compared with younger persons, older emergency patients are more likely to arrive at the ED by ambulance and to have higher rates of hospital admission. As indicated, between one third and one half of all ED visits by older patients result in a hospital admission. These rates are between 2.5 and 4.6 times higher than the hospitalization rates for younger patients.^{1,6-15}

Compared with their younger counterparts, older ED patients more often have a primary care physician (PCP) and are referred to the ED by their PCP.^{1,14,17-19} They also

have a higher proportion of urgent visits,^{1,6,7,10-12,14,15,20} and their length of ED stay is longer, requiring more staff time and resources.^{1,7,8,10,12,15,20,21} When admitted, older emergency patients are more likely to require an ICU bed.^{7,11,12} Their problems are more often of a medical nature, as opposed to surgical and psychiatric conditions.^{1,6,8-10,12-15,22} The most common medical diagnoses among older ED patients are ischemic heart disease, congestive heart failure, cardiac dysrhythmias, syncope, acute cerebrovascular accidents, pneumonia, abdominal disorders, dehydration, and urinary tract infections.^{1,6,9,11,14,23,24} Among surgical emergencies, traumatic injuries caused predominately by falls are the most prevalent diagnosis.^{1,6,12,21,22,25}

Although older adults undergo a greater number of diagnostic tests and procedures than younger ED patients,^{1,7,12,14,15} their ED diagnoses tend to be less accurate.^{2,15,21,25} This has been attributed to the atypical disease presentation, polypharmacy, and multiple comorbidities in the elderly, which complicate their ED presentation, diagnosis, and management.^{2,12,21,25} In fact, emergency physicians report greater difficulty managing older patients with various emergency clinical presenta-

tions.²⁶ Many older patients also complain of the lack of complete resolution of their presenting complaints after an ED visit.²⁷ When discharged, older patients are more likely to have follow-up arrangements,¹ but they experience higher rates of adverse health outcomes.^{1,17,21,23,28,29}

Table 2^{1,28-40} summarizes 14 recent prospective studies that have examined the patterns and predictors of adverse health outcomes among older ED patients. These studies differ in time intervals, data sources, measurement methods, and the age cutoff of the sample. Overall, the findings indicate that older patients seeking emergency care are at high risk for adverse health outcomes (ie, functional decline, hospitalization, ED return, death) in the 6 months after their ED index visit.^{1,28-40} As shown in Table 2, baseline functional dependence was the most prevalent risk factor predicting various adverse outcomes among elderly ED patients, identified in 7 of the 10 studies reviewed.^{28-30,34,35,39,40} Among other common risk factors cited in 3 or more studies were advanced age, recent hospitalization or ED visit, living alone, and lack of social support.^{30,34,35,38-40} Poor general health, comorbidity, polypharmacy, and certain diagnoses (ie, cardiovascular disorders, diabetes, cognitive impairment,

Table 1.
Studies of ED use by older adults (≥65 years).

Study (Year)	Design	Setting	Sample Size	ED/General Population Ratio,* %	Using Ambulance, %	Admitted to Hospital, %
Lim and Yap (1999) ⁶	Retrospective	Singapore hospital	455	12/NA	33	35
Strange and Chen (1998) ⁷	Retrospective	American multicenter billing database	2,126,578	16/13	33 (versus 10 in patients <65 y)	46 (versus 11 in patients <65 y)
Hamdy et al (1997) ⁸	Retrospective	Three American rural hospitals	1,056	15/19	41 (versus 11 in patients <65 y)	38 (versus 12 in patients <65 y)
Wofford et al (1996) ⁹	Prospective	American nationally representative sample	25,646	20/NA	NA	42 (versus 11 in patients <65 y)
Eagle et al (1993) ¹⁰	Prospective	Canadian teaching hospital	2,568	17/NA	38	45 (versus 12 in patients <65 y)
Strange et al (1992) ¹¹	Retrospective	American multicenter billing database	1,193,743	15/12	30 (versus 9 in patients <65 y)	32 (versus 8% in patients <65 y)
Singal et al (1992) ¹²	Prospective	American multicenter study	593	NA	35 (versus 11 in patients <65 y)	47 (versus 19 in patients <65 y)
Carmel et al (1990) ¹³	Retrospective	Israeli teaching hospital	1,231	18/5	35	36-42
Ettlinger et al (1987) ¹⁴	Retrospective	American teaching hospital	1,080	14/15	55 (versus 24 in patients <65 y)	51 (versus 14 in patients <65 y)
Baum and Rubenstein (1987) ¹⁵	Prospective	American community hospital	1,620	21/15	35 (versus 12 in patients <65 y)	46 (versus 10 in patients <65 y)
Lowenstein et al (1986) ¹	Prospective	American teaching hospital	468	19/15	NA	33-47 (versus 18 in patients <65 y)

NA, Information not available.

*Percentage of older adults in the ED population compared with their percentage in the general population in the same geographic area. For example, in the 1986 study by Lowenstein et al,¹ the elderly composed 19% of the ED population, whereas their proportion in the surrounding community was 15%.

Table 2.
Prospective studies of adverse health outcomes among older emergency patients.

Study (Year)	Setting	Sample Size	Age Group, y	Risk Factors	Outcomes
Follow-up period of ≤1 mo					
Caplan et al (1998) ²⁸	Australian hospital	468	≥65	Risk factors for hospital admission*: dependence in transport, use of community nurse	17%: hospital admission after D/C; 3%: mortality
McCusker et al (1998) ³⁰	Four Canadian hospitals	221	≥65	Risk factors for functional disability*: age, living alone, poor self-rated health, premorbid need for help, recent decline in function, history of diabetes, memory impairment, social isolation	NA
Sayers (1997) ³¹	Irish hospital	100	≥65	NA	10%: ↑ dependence in ADL; 28%: ↑ dependence in IADL; 3%: hospital admission after D/C
Lowenstein et al (1986) ¹	American hospital	234	≥65	NA	10%: ED return in patients age 65–75 y; 29%: ED return in patients age >75 y
Angelos (1993) ³²	American hospital	189	≥65	NA	34%: ↑ dependence; 16%: ED return; 11%: hospital admission after D/C
Rowland et al (1990) ²⁹	British hospital	450	≥75	Risk factors for hospital admission*: dependence for mobility, dependence for shopping, dependence for dressing, use of Meals on Wheels, use of Home Help, attending a day center, attending a hospital day unit	43%: ↑ dependence; 6%: hospital admission after D/C
Roberts (1990) ³³	British hospital	100	≥75	NA	26%: ↑ dependence; 8%: hospital admission after D/C
Follow-up period of 3 mo					
Chin et al (1999) ³⁴	American hospital	983	≥65	Risk factors for poor recovery*: lack of adequate help, greater baseline functional impairment, comorbidity, proxy responding	10%: mortality
McCusker et al (1997) ³⁵	Canadian hospital	167	≥75	Risk factors for ED return*: male sex, living alone, greater functional problems	24%: ED return
Richardson (1992) ³⁶	Australian hospital	191	≥75	Risk factors for mortality†: fractured neck or femur, cardiac failure; risk factors for mortality or dependence*: social-placement problem, referral by other than family, neurologic disease, cardiac failure, assessed as needing admission	10%: ↑ dependence; 12%: mortality
Rosenfeld et al (1990) ³⁷	Australian hospital	92	≥65	No variables predicted outcomes	45%: ↑ dependence; 24%: hospital admission after D/C; 9%: mortality
Follow-up period of 6 mo					
McCusker et al (2000) ³⁸	Four Canadian hospitals	1,122	≥65	Risk factors for frequent ED return*: hospitalization in past 6 mo, feeling depressed, history of diabetes, ED visit in past mo, lack of support; risk factors for early ED return*: hospitalization in past 6 mo, feeling depressed, history of heart disease, having ever been married, not drinking alcohol daily	44%: ED return; 8%: frequent ED return (≥3 visits); 19%: early ED return (≤1 mo)
McCusker et al (2000) ³⁹	Four Canadian hospitals	1,620	≥65	Risk factors for high hospital use*‡: age ≥85 y, living alone, poor self-rated health, recent decline in function, hospitalized in past 6 mo, >3 medications	25%: hospital admission after D/C; 35%: hospital readmission of patients admitted on index visit
McCusker et al (1999) ⁴⁰	Four Canadian hospitals	1,673	≥65	Risk factors for adverse health outcome*§: age, recent decline in function, visual impairment, memory impairment	29%: adverse health outcome§; 16%: ↑ dependence; 10%: mortality

D/C, Discharge; NA, information not available; ↑, greater/increase; ADL, activities of daily living; IADL, instrumental activities of daily living.

*Multivariate analysis.

†Bivariate analysis.

‡High hospital use was defined as the top decile of the distribution of hospital days.

§Adverse health outcome was defined as the occurrence of death, institutionalization, or a clinically significant functional decline.

depression) also emerged as risk factors in 1 or more of the studies.^{30,34,36,38-40}

Despite methodologic differences among the studies summarized in Table 2, the incidence rates of adverse health outcomes are fairly consistent for those studies that used similar follow-up time periods. The risks are particularly high in the first 3 months after an emergency visit, with an average mortality rate of about 10%,^{34,36,37} an ED return rate of about 24%,³⁵ and a 24% postdischarge hospitalization rate.³⁷ Although mortality and hospitalization rates tend to stabilize after the first 3 months, the cumulative rates of ED returns continue to increase in a slower fashion in the next 3 months,^{39,40} with a return rate of as high as 44% reported in a 6-month follow-up study.³⁸ The findings related to the changes in functional capacity are less conclusive because of the inconsistencies in the definitions and measures used across studies. Overall, these studies showed that between 10% and 45% of older ED patients experience increased functional dependence in the 3 months after an emergency visit.^{29,31-33,36,37}

It should be noted that the risk factors predicting adverse health outcomes in the ED studies of older adults reviewed in this section are consistent with the results of the previous large-scale studies of the predictors of ED and hospital use among representative samples of the community-living general older population.⁴¹⁻⁴⁵ These factors have also been recognized as indicators of frailty among older people and have generally been predictive of various adverse health outcomes in the elderly population.⁴⁶⁻⁴⁹ However, despite their importance, functional dependence, psychosocial concerns, and geriatric conditions are often underdetected, poorly documented, and inadequately addressed during ED encounters with older patients.^{25,31,35,40,50-55} The identification of high-risk elderly patients is the first step in targeting appropriate interventions to promote positive patient outcomes.³⁸

An increased awareness of the complexity of care needs of older emergency patients has led to the development of a growing number of hospital- and community-based geriatric screening and intervention programs targeting this population. However, most of the published studies are descriptive, with minimal evaluation of the effect of the interventions on patient outcomes. This section provides a brief summary of these studies, which are grouped according to the type of intervention.

Two multicenter studies tested the use of brief risk-screening tools by emergency nurses or medical students and reported the feasibility of the protocols in identifying at-risk elderly and uncovering health problems among

the screened patients.^{56,57} However, there were no evaluations of the clinical outcomes. In contrast, a single-site British study reported considerable practical difficulties in encouraging ED staff to use a brief screening questionnaire.⁵⁴ Contributing factors included time constraints, communication problems between shifts, and uncertainties about whether patients would be admitted.

Five studies provided comprehensive geriatric evaluation to elderly emergency patients by trained specialized nurses or interdisciplinary teams and reported some important benefits: (1) detecting geriatric syndromes and other missed diagnoses,^{53,58,59} (2) increasing community referrals,⁵⁷ and (3) avoiding hospital admission on the ED index visit.⁶⁰ However, in only 1 of these studies was a matched control group used to systematically examine the program's effectiveness.⁵⁸ This American nonrandomized trial recruited 760 community-living adults 65 years of age and older who visited the ED of an urban teaching hospital. The intervention group (n=385) received an on-site 30-minute multidimensional geriatric evaluation by a geriatric nurse clinician who also made recommendations to the patient, family, and attending emergency physician. Three-month follow-up telephone interviews revealed a clinically important trend toward fewer ED return visits in the intervention group compared with in the control group receiving usual care. However, the differences between the 2 groups did not reach statistical significance (0.26 versus 0.39; $P=.06$). There were no statistically or clinically significant differences in the mortality rates (9.3% versus 9.7%) and scores on a quality-of-life measure (60.1 versus 59.7) between the 2 groups (P values not reported). Contrary to the expectations, the intervention patients had slightly higher mean scores on tests of functional dependence (0.72 versus 0.65), a slightly longer average length of hospital stay (8.7 versus 8.0 days), and a higher rate of nursing home residency (5.0% versus 2.5%), but these differences were not statistically significant (P values not reported). Baseline data on functional status and living arrangements of the control group were not available to verify comparability of the 2 groups before the intervention. It should be noted that in the subgroup aged 75 years and older, the proportion of patients who lived at home at follow-up was higher in the intervention group (54% versus 67%; $P=.05$). Also of note are the following important findings: low rates of patient (37%) and emergency physician (62%) adherence rates with the recommendations made by the nurse and comparable mean numbers of new services initiated for the 2 groups (1.7 versus 1.5). Poor adherence, low intensity of intervention (which was limited to consultation

with no case management and long-term follow-up), inadequate targeting of at-risk patients, and the possibility of contamination bias (control group receiving similar intervention) are some possible explanations for the limited success of this program.⁶¹

A few studies used discharge planning, case management, and follow-up strategies with mixed results.^{52,54,62-70} In 1 American study, older ED patients with mental health problems were referred to an on-site social worker for counseling and discharge planning.⁶² Follow-up contacts were made with the patients at 14 days and with the involved community agencies at 90 days after discharge to verify service use. Despite low patient adherence with discharge referrals, a reduction in the number of ED repeat visits was reported (ie, 28% of participants that had used the ED before entering the program did not use it after the intervention; the follow-up time period was not specified). In contrast, in a randomized controlled trial of 427 Canadian community-living frail older persons (≥70 years) at risk for repeated hospital admission who were discharged from the ED, nurse case-managed patients (n=212) had a higher mean number of ED returns than their usual care counterparts (n=215; mean difference 0.32; 95% confidence interval [CI] 0.01 to 0.63).⁶³ The intervention group also had a slightly higher mean number of hospital admissions (mean difference 0.09; 95% CI -0.05 to 0.23) and longer length of hospital stay (mean difference 1.1; 95% CI -4.7 to 6.9), but these differences did not reach statistical significance. The nurse case management in this study consisted of coordination and provision of health care services by experienced geriatric nurses, both in and out of the hospital, for a 10-month period. No statistically significant or clinically important trends were found with regard to tests of functional capacity and quality of life. The authors blamed organizational factors (eg, lack of authority and credibility of the nurse case manager, weak link between the nurse and the patients' PCPs, structural barriers to the implementation of the program) and cross-contamination of the control group as possible reasons for the limited effect of the intervention.

A Scottish randomized controlled trial⁵⁴ evaluated the effect of a health visitor intervention 24 hours after ED discharge among 424 community-living adults aged 75 years and older. The health visitor identified the support needs of the patients and facilitated their access to appropriate community services. One-month follow-up home assessments showed higher rates of independence in instrumental activities of daily living (60 versus 76; $P=.03$) and greater use of community services (exact fig-

ures not provided) among the intervention group (n=232) compared with that in the control group receiving usual care (n=192). No other statistically significant health benefits were detected in the brief follow-up time frame of the study. In 2 descriptive studies, telephone follow-ups were made by nurses within 3 days after ED discharge.^{64,65} Although these studies reported utility of the contacts in clarifying the instructions, verifying compliance, and providing further advice, they did not provide any evaluations of patient outcomes.

A few studies incorporated home care into emergency services for older patients. For example, 4 Canadian studies described a "Quick Response Service" designed to provide rapid access to home-based services for older emergency patients.⁶⁶⁻⁶⁹ These programs were successful in identifying patients requiring home care services and reduced the need for hospital admission on the index visit but did not attempt to evaluate short- and long-term patient outcomes. In an American study,⁵² the use of department-based coordinators to assess home care needs prevented admission on the index visit in one fifth of the referred patients in the judgment of the nonblinded involved emergency physicians. Six months after referral, 17% of these patients had been admitted to the hospital at least once, and 4% had died. Finally, in a British randomized controlled trial,⁷⁰ one half of a cohort of 903 patients older than 75 years who received emergency admissions were provided with care attendant support of 12 hours a week for 2 weeks after the first and any subsequent discharge from the hospital. Retrospective review of hospital records revealed a significantly lower proportion of emergency readmissions (73% versus 83%; $P<.05$) and lower rates of multiple readmissions (7% versus 14%; $P<.01$) in the intervention group within the 18-month follow-up period. Moreover, among those living alone, the intervention resulted in significantly fewer mean days of hospital stay (17 versus 31; $P=.014$).

DISCUSSION

Older ED patients have distinct patterns of service use and care needs. They use emergency services at higher rates, require more resources, and are more likely to experience adverse health outcomes after an emergency visit compared with the rest of the adult population. However, to date, there is limited empiric research on the effectiveness of various clinical interventions targeting this group of ED patients. Therefore, the practice implications discussed below are based on a qualitative approach to synthesis of available evidence and expert clinical judgment.^{2,20,21,55}

Overall, there is a general consensus that the current disease-oriented and episodic models of emergency care do not adequately respond to the complex care needs of older patients experiencing multiple and often interrelated medical, functional, and social problems.^{2,20,21,55,61} Successful management of acute and chronic health concerns of older persons requires models of care that emphasize continuity, comprehensiveness, and integration of services.^{1,2,61}

In 1992, an American geriatric emergency medicine task force acknowledged the unique needs of older emergency patients, identified barriers to the care of elderly in this setting, and recommended fundamental changes in the system of emergency care for older adults.²⁰ On the basis of the work of this task force and the recent evidence, a number of strategies are recommended to improve the care of the elderly in ED. First, better staffing levels are required to respond to the demographic changes and rising numbers of older patients in EDs.^{20,22,55} Moreover, it is critically important to provide appropriate training to the emergency physicians and nurses to enhance their sensitivity, knowledge, and skills in dealing with geriatric issues.^{26,71,72} In particular, the training should improve their ability to deal with the common geriatric emergency presentations discussed earlier and to enhance their skills in recognizing elderly patients who would benefit from further referral and follow-up by specialized community services.

Appropriate screening and intervention protocols are needed to ensure effective targeting of high-risk elderly patients.³⁰ A 2-step screening protocol could be a cost-effective and practical approach.⁵⁷ In the first step, a simple and brief screening tool should be used by the ED staff to identify at-risk patients. The Identification of Seniors at Risk tool is an example of a practical risk-screening tool specifically designed and validated for use in the emergency setting (see Appendix).^{30,35,38-40} Patients at high risk can then be referred to an on-site clinician (eg, a geriatric nurse specialist, a discharge planner, any other ED staff member with geriatric training) for further in-depth assessment, discharge planning, and follow-up interventions.^{30,35,38-40,57,61} As appropriate, the follow-up interventions may include a referral to the comprehensive geriatric evaluation and management programs or any other specialized geriatric services available in the community to ensure that the patients' medical and psychosocial needs are addressed in an effective and timely fashion.

In addition to the interventions aimed at improving the quality of care of older people visiting the ED, action should be taken to reduce the need for emergency ser-

vices through primary and secondary prevention. There is some evidence that ED use can be reduced through better community services for older adults, such as home visits by PCPs,⁷³ personal medication reviews and education by pharmacists,⁷⁴ targeted outpatient comprehensive geriatric evaluation services,^{75,76} and integrated models of social and medical care.⁷⁷ In particular, there is growing evidence in support of the positive effect of a continuous relationship with a PCP in reducing the need for emergency services among community-living seniors.^{78,80} Similarly, the results of a few studies of ED use among nursing home residents suggest that systematic visiting and active involvement of a PCP and access to specialized geriatric programs can minimize the need for ED visits.^{81,82}

In discussing the results of this review, 3 types of limitations should be noted. First, it should be acknowledged that because of the limitations of the search method, this review may not be exhaustive. For pragmatic purposes, the search focused exclusively on published English-language literature and did not include a search of the EMBASE computer database, which may have identified additional European publications not captured in the 5 large databases used for the purposes of this review.

Second, in interpreting the findings, some important limitations of the studies reviewed should be considered. For example, most studies that examined health outcomes among older ED patients excluded those living in residential and long-term care facilities.^{28,29,31,33,40,54,58,63,70} Therefore, their results are not generalizable to this subgroup of the older population.

Moreover, it should be noted that most prospective studies of the predictors of adverse health outcomes summarized in Table 2 suffered from some methodologic weaknesses. For example, there is a possibility of selection bias among those studies that recruited small single-site samples,^{31,33,37} used nonprobability sampling techniques,^{28,30,35,40} and excluded patients who were medically unstable, had cognitive impairment with no proxy informant, and visited the ED on evenings, nights, and weekends.^{30,34,35,38-40} Furthermore, many of these studies relied on secondary sources of information (eg, hospital records, registry of deaths, health service use databases), resulting in incomplete and potentially biased data on patient outcomes.^{35,36,38,39} Therefore, the reported rates of negative health outcomes in these studies are most likely an underestimation of the true extent of the problem in the elderly population.

Finally, some of the methodologic limitations of the clinical trials of the effectiveness of various intervention

strategies should be noted because these may, at least in part, account for the negative findings of these trials. These included inadequate targeting of at-risk patients, resulting in small event rates and lower statistical power to detect significant differences^{54,58}; the possibility of cross-contamination bias^{58,63}; short follow-up time frames^{54,58}; and limited power of the interventions because of their low intensity, lack of adequate follow-up, and low adherence.^{54,58,63}

It has been argued that, in addition to the methodologic weaknesses, the limited success of the intervention studies targeting older ED patients may be a result of the fact that some adverse clinical outcomes, such as ED and hospital use, among the seriously ill older patients may not be avoidable.^{52,58,63} The provision of comprehensive geriatric assessment and coordinated discharge planning may lead to a better identification and treatment of the previously undetected health problems, which can result in an actual increase in the use of acute care services, at least in the immediate post-ED discharge period.^{83,84} For these patients, the potential benefits of the interventions may be realized only with longer follow-up periods and on such outcomes as enhanced patient and caregiver quality of life, improved functional level, and delayed institutionalization. Therefore, future ED intervention studies should include a variety of quality-of-life measures, as well as indicators of the quality of health care service delivery and appropriateness of use.

There is also a clear need for further research in this setting. Multicenter prospective studies recruiting representative samples of older ED patients are required to refine our knowledge of the predictors of adverse health outcomes and to further validate the psychometric properties of risk-screening tools appropriate for use in the ED. In addition, more randomized controlled trials are needed to test the effectiveness of various intervention strategies. These studies should include an assessment of the patients' and providers' adherence with the program recommendations and evaluate the effect of interventions on the patient quality of life, the quality of health care services, and the appropriateness of service use.

In addition, more longitudinal community-based studies are required to investigate the risk factors for ED use among the general older population and to test the effectiveness of primary and secondary care preventive interventions in reducing the need for emergency services. Finally, more research attention should be devoted to the patterns of ED use, risk factors, and preventive interventions among older people living in residential and long-term care facilities given the special characteris-

tics of this subgroup of the older population and their exclusion from most ED studies of older adults.

Author contributions: FA and WBD conceived the research questions for the review. FA designed the methods of literature search and data extraction, conducted the review, and synthesized and analyzed the data. WBD participated in the review of selected literature and in the interpretation of the findings. FA drafted the manuscript and both authors contributed to its revision. FA takes responsibility for the paper as a whole.

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APPENDIX.

Questions in the Identification of Seniors At Risk Screening Tool.

1. Before the illness or injury that brought you to the ED, did you need someone to help you on a regular basis? (yes*, no)
2. Since the illness or injury that brought you to the ED, have you needed more help than usual to take care of yourself? (yes*, no)
3. Have you been hospitalized for 1 or more nights during the past 6 months (excluding a stay in the ED)? (yes*, no)
4. In general, do you see well? (yes, no*)
5. In general, do you have serious problems with your memory? (yes*, no)
6. Do you take more than 3 different medications every day? (yes*, no)

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Two or more high-risk responses identified with an asterisk (*) indicate a positive screening.
