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Review Article

Do Geriatric Interventions Reduce Emergency Department Visits? A Systematic Review

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Background. Hospital emergency departments (EDs) serve an aging population with an increased burden on health resources. Few studies have examined the effects of comprehensive geriatric assessment interventions on ED use. This study aimed to systematically review the literature and compare the effects of these interventions on ED visits.

Methods. Relevant articles were identified through electronic databases and a search of reference lists and personal files. Inclusion criteria included: original research (written in English or French) on interventions conducted in non-institutionalized populations 60 years old or older, not restricted to a particular medical condition, in which ED visits were a study outcome. Data were abstracted and checked by the first author and a research assistant using a standard protocol.

Results. Twenty-six relevant studies were identified, reported in 28 articles, with study samples obtained from EDs (9), hospitals (4), outpatient or primary care settings (10), home care (4), and community (1). The study designs included 17 randomized controlled trials, 3 trials with nonrandom allocation, 4 before–after studies, 1 quasi-experimental time-series study, and 1 cross-sectional study. Hospital-based interventions (mostly short-term assessment and/or liaison) had little overall effect on ED utilization, whereas many interventions in outpatient and/or primary care or home care settings (including geriatric assessment and management and case management) reduced ED utilization. Heterogeneity in study methods, measures of comorbidity, functional status, and ED utilization precluded meta-analysis of the results.

Conclusion. Further research, using improved methodologies and standardized measures, is needed to address the effects of innovative geriatric interventions on ED visits.

OLDER people constitute an increasingly important population served by the emergency department (ED), one that is characterized by multiple comorbid medical conditions, cognitive and functional impairment, and social problems (1,2). 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 ED, are more likely to be admitted or to have repeat ED visits, and experience higher rates of adverse health outcomes after discharge (3). However, the ED environment may not be conducive to the care of older patients. Furthermore, there are documented problems with the quality and continuity of care provided to older ED patients, including failure to recognize problems that could benefit from more careful assessment (either in the ED or another setting), failure to refer to appropriate community services, and failure to communicate to the primary physician in a timely fashion the problems identified and interventions implemented at the ED visit (4–8). The search for solutions to increasing rates of ED utilization and resulting crowding has focused attention on reducing the demand for ED services; the older population is a natural target for these efforts.

In view of the above problems, it is of interest to determine whether comprehensive geriatric assessment (CGA) interventions affect rates of ED utilization. Previous reviews of CGA interventions have investigated their effects on health and functional outcomes, and on other types of service utilization (9). None, to our knowledge, have examined their effects on ED utilization. CGA interventions have been classified as hospital-based geriatric evaluation and management units, hospital-based consultation services, home-based assessment services, hospital–home assessment services (for patients recently discharged from hospital), and outpatient assessment services (9). More recently, the ED has also been considered to be a site for CGA (10). Although CGA often involves a multidisciplinary team (11), it may sometimes involve only one discipline. CGA may be provided either in conjunction with referral to other services (a liaison intervention) or as part of an ongoing management program (sometimes referred to as a geriatric evaluation and management [GEM] program), either on an inpatient or outpatient basis (12). Because access to primary medical care is one of the determinants of ED utilization (13), another relevant aspect of a CGA intervention is the degree to which it is coordinated or integrated with primary medical care. We therefore undertook this systematic review of controlled studies of CGA interventions for older hospital- and community-based populations, to explore what characteristics of the intervention (site, type, duration) are associated with ED utilization. A secondary objective of this review was to develop recommendations for future research.

Methods

The search strategy for relevant studies identified published studies through computerized databases

(MEDLINE and the Cochrane database of clinical trials, 1965–2004) and hand searches of the bibliographies of relevant studies and review articles. The authors also consulted with colleagues. The search strategy included the following terms, which were subsequently combined using the Boolean terms ''or'' and ''and'': aged, health services research, health services for the aged, emergency service, emergency, case management, geriatric assessment, geriatric nursing, nursing assessment, needs assessment, patient discharge, program evaluation, evaluation studies, comparative study, needs assessment, outcome and process assessment, and outcome assessment.

A research assistant screened the abstract of each article identified through the search. Articles were excluded if: (a) they did not report data from an original study; (b) the study sample included patients less than 60 years old (unless the results for those 60 years old and older were presented separately); (c) the study sample was from a nursing home or other long-term care facility; (d) no intervention was investigated or the intervention did not meet criteria for CGA (see introduction); (e) the study outcomes did not include a measure of ED utilization; or (f) the paper was written in a language other than English or French. Although there has been much interest in disease-management interventions (e.g., for congestive heart failure, chronic obstructive pulmonary disease, diabetes), frail elders typically do not fall into a single disease category, but have multiple comorbidities that affect their overall functional status and service utilization. Therefore, we also excluded studies that were restricted to a particular medical diagnosis or procedure (e.g., mental health diagnoses, surgical case-series). Finally, we excluded studies that did not compare those individuals who received a CGA intervention with those in a comparison group (e.g., randomized or non-randomized trial, before–after or other quasiexperimental design). We decided to include designs other than randomized controlled trials (RCTs) because of the paucity of studies; furthermore, randomization of some CGA interventions is not feasible. The senior author reviewed all exclusions related to type of intervention and reviewed all articles in which the exclusion criteria were not clear-cut.

The research assistant and the senior author (both with doctoral training in epidemiology and biostatistics) independently abstracted the following from eligible articles using a standardized abstraction form: study setting; study design (cross-sectional or longitudinal, use of a control group, randomized or nonrandomized allocation to intervention); characteristics of the study sample (age, unselected or high-risk, source of sample [ED, hospital inpatient, primary ambulatory care, home care, community]); inclusion and exclusion criteria; intervention (description, type, location, duration); sample size for the analysis; length of follow-up; ED utilization measure (definition, reference time period, source of data); method of analysis (adjustment for confounding, analysis by intention to treat); and results (effect measures with 95% confidence intervals or p values). Discrepancies were discussed and resolved at regular meetings.

The senior author grouped the interventions into 5 categories: unidisciplinary assessment with referral and/or liaison (UA); multidisciplinary assessment with referral and/or liaison (MA); unidisciplinary assessment and management (UAM); multidisciplinary assessment and management (GEM); and case management, in which a case manager—usually a nurse or social worker—coordinated community services (CM). Interventions were also classified by their relationship to the primary physician. GEM interventions were considered to be integrated with primary care if the primary physician was part of the multidisciplinary team. Interventions were considered to be coordinated with primary care if the intervention staff consulted with the patient's primary physician. The second author, a geriatrician, reviewed these classifications.

Results

Twenty-six (26) studies were found of the effects of geriatric interventions on ED utilization (Table 1) (14–41). The studies were reported in 28 articles; 2 studies were each reported in 2 articles at different stages of follow-up (30,31,33,34). The study designs included 16 RCTs, 3 trials with nonrandom allocation, 4 before–after studies, and 1 cross-sectional study (24). Further details of the studies are described by intervention setting.

ED-Based Samples

Seven of the interventions used samples of ED patients; 4 RCTs, 1 nonrandomized trial, and 2 before–after studies (Table 1). Four interventions were unidisciplinary assessments by a nurse with short-term liaison with community services; short-term telephone follow-up helped to ensure that this liaison had been implemented (20,33,35,40). One intervention used a multidisciplinary team to help with management for up to 4 weeks followed by referral to community services (38). Two longer-term interventions included a 10-month post-ED case-management intervention with home visits (19), and a 12-month unidisciplinary assessment and management intervention by a social worker (18).

Only two of the interventions for ED patients reduced return ED visits; neither was an RCT, and the effects were of borderline statistical significance (Table 2) (20,40). In contrast, the long-term case-management intervention significantly increased ED visits (19), and two others showed a trend to a short-term (30-day) increase in ED visits (34,35). These short-term increases had disappeared by 4 months in both studies.

Hospital Inpatient Interventions

Four interventions targeted hospitalized patients: Study designs included 2 RCTs, a nonrandomized trial, and a before–after study (Table 1). Three were unidisciplinary discharge planning interventions: Two were conducted by a nurse with pre- and postdischarge visits, for up to 4 weeks (16,17), and one was given by a nurse or social worker in-hospital only (36). The fourth intervention was a multidisciplinary geriatric team consultation service (21). None of these interventions significantly affected ED return visits (Table 2).

Table 1. Studies of Effects of Interventions on Emergency Department Utilization by Intervention Setting

Author, Year (Ref.)	Country	Design	Study Population	Exclusions	Sample Size*	Interventions		Group	PC**
						Type	Duration		
Emergency Department									
Brooks and Ertl, 2000 (18)	United States	Before–after	High risk, age 65+	Not specified	12	Home visits by SW in consultation with MD vs UC	12 mo	UAM	C
Caplan et al., 2004 (38)	Australia	RCT	Age 75+	Hospitalized, NH	739	CGA, including home visit vs UC	Initial assessment, 4-wk follow-up	MA	C
Gagnon et al., 1999 (19)	Canada	RCT	High risk, age 70+	Hospitalized, CI, NH	427	Nurse CM (in consultation with MD) vs UC	10 mo	CM	C
Guttman et al., 2004 (40)	Canada	Before–after	Unselected, age 75+	Admitted to hospital, CI, NH	1724	Nurse discharge planning coordination vs UC	14 d	UA	C
McCusker et al., 2003 (33,34)	Canada	RCT	High risk, age 65+	Admitted to hospital, NH	345	Nurse assessment + liaison vs UC	One-time, limited telephone follow-up	UA	C
Mion et al., 2003 (35)	United States	RCT	Age 65+	Hospitalized, NH	650	CGA and liaison	One-time, limited telephone follow-up	UA	C
Miller et al., 1996 (20)	United States	Nonrandomized trial	High risk, age 65+	Acutely ill, <1 h stay	770	Nurse case-finding and liaison service vs UC	One-time	UA	C
Hospital Inpatient									
Dellasega and Zerbe, 2000 (16)	United States	RCT	High risk, mean age 74	Not specified	140	Pre- and postdischarge visits by APN vs UC	2 wk	UA	N
Gayton et al., 1987 (21)	Canada	Nonrandomized trial	High risk, age 70+	None specified	404	Geriatric team consultation service	During admission	MA	C
Naylor et al., 1999 (17)	United States	RCT	High risk, age 65+	CI	363	Pre- and postdischarge visits by APN and consultation with MD vs UC	4 wk	UA	C
Rosswurm and Lanham, 1998 (36)	United States	Before–after	Age 65+	NH	575	Discharge planning with standard instrument by nurse or SW vs UC	One-time	UA	N
Outpatient									
Baldwin et al., 1993 (24)	United States	Cross-sectional	Unselected, age 60+		208	Multidisciplinary care center vs UC	Ongoing	GEM	I
Beck et al., 1997 (25)	United States	RCT	High risk, age 65+	None reported	321	Monthly group and individual visits with PCP and RN	Ongoing	GEM	I
Boult et al., 1994 (26)	United States	RCT	High risk, age 65+		154	Nurse home visit, clinic assessment by SW and MD, team conference vs UC	Average 3–4 mo	GEM	I
Coleman et al., 1999 (32)	United States	RCT	High risk, age 65+		127	Quarterly visits to PCP, RN, pharmacist and self-management group vs UC	24 mo	GEM	I
Coleman et al., 2001 (15)	United States	RCT	High risk, age 60+		295	Monthly group and individual visits with PCP and RN	Ongoing	GEM	I

Table 1. Studies of Effects of Interventions on Emergency Department Utilization by Intervention Setting (Continued)

Author, Year (Ref.)	Country	Design	Study Population	Exclusions	Sample Size*	Interventions		Group	PC**
						Type	Duration		
Dalby et al., 2000 (27)	Canada	RCT	High risk, age 70+	NH	113	RN preventive home visit, consultation with PCP, follow-up as needed vs UC	14 mo	UA	C
Keeler et al., 1999 (28)	United States	RCT	High risk, elderly	None	351	Case conference and liaison vs UC	One-time	MA	C
Scott et al., 2004 (39)	United States	RCT (randomized before consent)	High risk, age 60+	Dementia, homebound, no transportation, not interested	294	Group outpatient model (monthly meetings with PCP, nurse, and others as needed) vs UC	24 mo	GEM	I
Silverman et al., 1995 (29)	United States	RCT	High risk, age 60+	NH, terminal, schizophrenia	442	Case conference and liaison vs UC	One-time	MA	C
Toseland et al., 1996 (30); Engelhardt et al., 1996 (31)	United States	RCT	High-risk male veterans, age 55+	Psychiatric dx, severe CI, NH	160	Team GEM vs UC	16 mo	GEM	I
Community									
Catellier et al., 2000 (14)	United States	Before–after	High risk, age 65+	Medicaid insurance	120	Medication review and education by pharmacist vs UC	12 mo (2 sessions)	UA	—
Home Care									
Bernabei et al., 1998 (22)	Italy	RCT	High risk, age 65+		199	Geriatric team CM vs UC	Ongoing	CM	I
Eggert et al., 1991 (23)	United States	RCT	High risk, median age 77 y	NH	476	Neighborhood vs centralized CM	Ongoing	CM	I
Tinetti et al., 2002 (37)	United States	Nonrandomized trial	Age 65+	<7 d home care, severe CI, terminal, bedridden	1382	Multidisciplinary ‘‘restorative’’ home care vs UC	25 d	GEM	I
Tourigny et al., 2004 (41)	Canada	Quasi-experimental	High risk, age 75+		482	Case management by SW vs UC	3 y	CM	C

Notes: *Sample size used in the analysis of outcomes.

**Integration with primary care (for GEM interventions): N = none; C = consultation; I = integration.

APN = Advanced practice nurse; CGA = comprehensive geriatric assessment; CI = cognitive impairment; CM = case management; GEM = geriatric evaluation and management; MD = physician; NH = nursing home residents; PCP = primary care physician; RCT = randomized controlled trial; RN = registered nurse; SW = social worker; UC = usual care; UA = unidisciplinary assessment; MA = multidisciplinary assessment; UAM = unidisciplinary assessment and management; GEM = multidisciplinary geriatric and evaluation management.

Table 2. Results of Studies, by Intervention Setting

Author, Year (Ref.)	Outcome Measure	Time Period	Source	Results			Comments
				Exp	Control	Effect*	
Emergency Department							
Brooks and Ertl, 2000 (18)	Mean No. of ED visits	1 y (before–after)	Admin. data	5 visits	8 visits		
	Mean No. of ED hours	1 y (before–after)	Admin. data	20 h	27 h		
	Mean ED cost per patient	1 y (before–after)	Admin. data	\$1,656 ($n = 12$)	\$1,803 ($n = 12$)		
Caplan et al., 2004 (38)	ED return visit (y/n)	30 d after discharge	Admin. data	15.7% ($n = 370$)	13.3% ($n = 399$)	Difference: 2.4% (–2.7%, 7.5%)	Nurse sent some patients back to ED for medical management
Gagnon et al., 1999 (19)	Mean No. of ED visits	10 mo	Self-report	1.2 ($n = 212$)	0.9 ($n = 215$)	Mean difference: 0.32 (0.01, 0.63)	
Guttman et al., 2004 (40)	Unplanned return ED visit (y/n)	14 d	Self-report and admin. data	12.9% ($n = 819$)	16.1% ($n = 905$)	HR (adjusted): 0.74 (0.57, 0.96)	Adjustment for perceived severity of presenting illness and disability
McCusker et al., 2003 (33,34)	ED return visit (y/n)	30 d	Admin. data	34.9% ($n = 166$)	26.8% ($n = 179$)	Adjusted OR: 1.6 (1.0, 2.6)	
	Mean No. of ED visits	120 d	Same	1.01 (1.14) ($n = 177$)	0.94 (1.31) ($n = 209$)		
Mion et al., 2003 (35)	ED return visit (y/n)	30 d	Self-report and medical records	20% ($n = 326$)	15% ($n = 324$)	OR 1.42 (0.95, 2.14)	
	Same	120 d	Same	37% ($n = 326$)	40% ($n = 324$)	OR 0.90 (0.66, 1.24)	
Miller et al., 1996 (20)	Mean No. of ED visits	3 mo	Self-report ED records	0.26 ($n = 356$)	0.39 ($n = 331$)	$p < 1.0$	
Hospital Inpatient							
Dellasega and Zerbe, 2000 (16)	No. of ED visits	1 mo after discharge	Self-report	0.15 (0.41)	0.18 (0.45)		Data provided by author
Gayton et al., 1987 (21)	No. of ED visits	2 wk, 3 mo, and 6 mo postadmission	Self-report	NA	NA	No significant difference	
Naylor et al., 1999 (17)	Mean No. of visits not resulting in hospital admission	24 wk	Self-report and medical records	0.1 visits	0.2 visits	$p = .21$	
	Aggregate cost of ED use	Same	Same	\$9,138	\$10,600	$p = .78$	
Rosswurm and Lanham, 1998 (36)	Unplanned ED visit (y/n)	30 d after discharge	Self-report	19.5% ($n = 202$)	18.2% ($n = 373$)		

Table 2. Results of Studies, by Intervention Setting (Continued)

Author, Year (Ref.)	Outcome Measure	Time Period	Source	Results			Comments
				Exp	Control	Effect*	
Outpatient							
Baldwin et al., 1993 (24)	Mean No. of ED visits	6 mo	Self-report	Better health: 0.03; worse health: 0.17	0.18 0.54	Significantly fewer visits	Computed from stratified results
	Mean ED charges	12 mo	Survey and charge data	$43	$144		
Beck et al., 1997 (25)	Mean No. of ED visits	12 mo	Admin. data	0.41 (0.87) ($n = 160$)	0.67 (1.62) ($n = 161$)	$p = .009$	
Boult et al., 1994 (26)	Annual No. of ED visits	17 mo	Admin. data	0.6 (0.86) ($n = 43$)	1.0 (0.86) ($n = 111$)	$p = .01$	
Coleman et al., 1999 (32)	Mean No. of ED visits	24 mo	Admin. data	0.23/y ($n = 78$)	0.27/y ($n = 49$)	$p = .77$	
Coleman et al., 2001 (15)	Mean No. of ED visits	24 mo	Admin. data	0.65 (1.28)	1.08 (1.28)	Adjusted mean difference = −0.42 ($p < .05$)	
	ED visit (y/n)	Same	Same	35% ($n = 146$)	52% ($n = 149$)	Adjusted RR = 0.64 ($p < .05$)	
Dalby et al., 2000 (27)	Mean No. of ED visits	14 mo	Medical record review	0.4 (0.6) ($n = 70$)	0.5 (1.0) ($n = 69$)	$p = .33$	
Keeler et al., 1999 (28)	Mean No. of ED visits	64 wk	Postcard diary	0.67 ($n = 161$)	0.75 ($n = 158$)	NS ($p > .01$)	
Scott et al., 2004 (39)	Mean No. of ED visits	24 mo	Admin. data	0.66 (1.3) ($n = 145$)	1.1 (1.5) ($n = 149$)	$p = .008$	294/2315 participated (related to interest)
	Mean cost per ED visit	Same	Same	$325 (675)	$607 (985)	$p = .001$	
Silverman et al., 1995 (29)	Mean No. of ED visits	12 mo	Monthly telephone interviews	NA	NA	NS	
Engelhardt et al., 1996 (31)	Mean No. of ED visits	8 mo 16 mo	Admin. data Same	1.5 (2.5) 2.5 (1.93) ($n = 80$)	1.9 (2.5) 3.3 (2.03) ($n = 80$)	$p = .23$ $p = .04$	
Community							
Catellier et al., 2000 (14)	Any ED visit (y/n)	12 mo before: baseline 6 mo 12 mo	Self-report	 — 51% 39%	 57% — —	— OR = 0.77 ($p = .077$) OR = 0.42 ($p < .001$)	
Home Care							
Bernabei et al., 1998 (22)	Time to first ED visit		Research assistant follow-up			HR = 0.64 $p < .025$	

Table 2. Results of Studies, by Intervention Setting (Continued)

Author, Year (Ref.)	Outcome Measure	Time Period	Source	Results: Exp	Results: Control	Results: Effect*	Comments
Eggert et al., 1991 (23)	Mean No. of ED visits	12 mo	Health care utilization diary	1.5 ($n = 273$)	1.3 ($n = 203$)	NS	
	Average daily cost of ED visits			$0.25	$0.22	NS	
Tinetti et al., 2002 (37)	ED visit during home care episode (y/n)	Mean 24.8 d (experimental) vs 34.3 d (controls)	Admin. data	10% ($n = 691$)	20% ($n = 691$)	Adjusted OR = 0.44 (0.32, 0.61)	After exclusion of outliers, similar duration of home care in 2 groups
Tourigny et al., 2004 (41)	1) Mean ED visits per person-year	2 y pre-intervention 3 y postintervention	Admin. data	0.77, 1.11 1.15, 0.94 1.14.	1.23, 1.51 1.16, 1.01, 1.02	$p < .0001$[a]	
	2) ED visit (y/n)	Pre Post		39.3, 47.1 49.8, 41.2, 44.3	53.3, 63.3 47.2, 44.8, 39.8	$p = .005$[a]	
	3) Return visits in 10 days	Pre Post		19.6, 22.7 16.3, 9.3, 18.8	23.2, 21.1 27.4, 22.1, 30.1	$p = .17$[a]	

Notes: *95% confidence interval (if available) in parentheses.

[a]Comparison of change profiles in experimental vs usual care groups, adjusted for level of autonomy at baseline. Differences in (1) and (2) due to high emergency department (ED) utilization in control group at baseline. HR = hazard ratio; OR = odds ratio; NS = not statistically significant (as reported by authors); NA = not available.

Outpatient and/or Primary Care

Ten interventions were conducted in outpatient and/or primary care settings—9 RCTs and 1 cross-sectional study (Table 1). Among the RCTs, 7 were longer-term (3–24 months) GEM programs, 6 of which were integrated with primary medical care. Among the 7 RCTs of longer-term interventions, 5 significantly reduced ED utilization (Table 2) (15,25,26,31,39). One cross-sectional study of a GEM intervention at a health center found a significantly lower rate of ED visits in comparison with the number in a health center not offering GEM (24).

Two RCTs evaluated a multidisciplinary assessment and/or liaison intervention, a case conference, and liaison with primary care; neither of these interventions significantly reduced ED utilization (Table 2) (28,29).

Home Care Interventions

Three studies were found of case-management programs in home-care settings (Table 1). One of these, an RCT, found a significant reduction in the time to the first ED visit (Table 2) (22). The second, a quasi-experimental study, reported a significantly greater reduction in ED utilization in the control versus the intervention group (41). However, this effect appeared to be explained by a higher initial ED utilization rate in the control group. The third, an RCT that compared two alternative case-management models, found no difference between them in ED utilization (23). The fourth study in this group, a nonrandomized trial of a short-term multidisciplinary ‘‘restorative’’ intervention, found a significantly lower rate of ED visits in the intervention group (37).

Community Intervention

The only study in this group of a unidisciplinary assessment and management intervention (medication review and education by a pharmacist) found a significant reduction in ED visits from 57% during the 12 months before the intervention to 39% during the 12 months after (14).

ED Utilization Comparisons Between Studies

Table 3 shows the rates of ED utilization from the control groups of the studies. The mean number of ED visits was standardized to 12 month for comparative purposes. Among 15 studies that reported the mean number of visits, most of those based on ED and hospital samples reported higher rates [a notable exception is the Naylor study (17) that excluded ED visits at which patients were hospitalized]. After excluding this study, the median number of visits in this group was 2.16 visits per 12 months. In contrast, the median number of visits in the 10 nonhospital-based studies was 0.67–0.71 per 12 months.

Among 9 studies that used a dichotomous measure of ED visits, the reference time period varied between 30 days and 2 years, making comparisons difficult. Only hospital-based and home-care studies reported rates per 30-day (or shorter) periods (excluding 2 studies that reported only unscheduled return visits (36,40); the rates varied from 20% to 30%. with higher return rates among high-risk (20,34) than

Table 3. Control Group ED Utilization Rates by Setting

Author, Year (Ref.)	Population Risk	Type of ED Visit	Mean No. of ED Visits		ED Visits (%)
			Original Time Period	Per 12 Mo	
Emergency Department					
Brooks and Ertl, 2000 (18)	High	Return visits	8 per 12 mo	8	—
Caplan et al., 2004 (38)	Normal	Return visits	—		13.3% per 30 d
Gagnon et al., 1999 (19)	High	Return visits	0.9 per 10 mo	1.08	
Guttman et al., 2004 (40)	Normal	Unscheduled return visits	—		16.1% per 14 d
McCusker et al., 2003 (33)	High	Return visits	0.94 per 120 d	3.76	26.8% per 30 d
Mion et al., 2003 (35)	Normal	Return visits	—		15% per 30 d 40% per 120 d
Miller et al., 1996 (20)	Normal	Return visits	0.39 per 3 mo	1.56	—
Hospital Inpatient					
Dellasega and Zerbe, 2000 (16)	High	Return visits	0.18 per 1 mo	2.16	—
Naylor et al., 1999 (17)	High	Return visits excluding hospital admissions	0.2 per 24 wk	0.43	—
Rosswurm and Lanham, 1998 (36)	Normal	Unscheduled return visits	—		18.2% per 30 d
Outpatient					
Baldwin et al., 1993 (24)	Low	All	0.18 per 6 mo	0.36	—
	High		0.54 per 6 mo	1.08	
Beck et al., 1997 (25)	High	All	0.67 per 1 y	0.67	—
Boult et al., 1994 (26)	High	All	1.0 per 17 mo	0.71	—
Coleman et al., 1999 (32)	High	All	0.27 per 24 mo	0.14	
Coleman et al., 2000 (15)	High	All	1.08 per 2 y	0.54	52% per 2 y
Dalby et al., 2000 (27)	High	All	0.5 per 14 mo	0.43	—
Keeler et al., 1999 (28)	High	All	0.75 per 64 wk	0.61	—
Scott et al., 2004 (39)	High	All	1.1 per 24 mo	0.55	—
Engelhardt et al., 1996 (31)	High	All	1.9 per 8 mo 3.3 per 16 mo	2.85 2.48	
Community					
Catellier et al., 2000 (14)	High	All	—		57% per 12 mo
Home Care					
Eggert et al., 1991 (23)	High	All	1.3 per 12 mo	1.3	—
Tinnetti et al., 2002 (37)	Normal	All	—		20% per 30 d
Tourigny et al., 2004 (41)	High	All	1.01–1.51 per y*	1.01–1.51	39.8%–63.3% per y
		Return visits among ED users			21.1%–30.1% per 10 d

Notes: *Mean of last 2 years.
ED = emergency department; — = no data were presented.

among unselected samples (35,38). Only the outpatient and community-based studies and 1 home-care study reported dichotomous rates per 12-month (or longer) period; these varied from 21.1% to 57%.

Discussion

This systematic review identified 26 studies of the effects of geriatric interventions on ED utilization. Because of heterogeneity in interventions, study designs, outcome measures, and other methodological features, the results were presented descriptively. Both substantive and methodological aspects of the results are of interest.

As regards substantive results, this review suggested that two inter-related factors may affect rates of ED utilization: type of intervention and source of patients. Interventions conducted in hospital settings (ED, inpatient) or that recruited patients from these settings, had little overall effect on ED utilization, whereas most interventions conducted in outpatient or home-care settings were successful in reducing ED utilization. However, almost all of the hospital-based interventions were of the short-term assessment and/or liaison type. In the outpatient studies, most of the GEM interventions reduced ED utilization, whereas the two short-term assessment and/or liaison interventions did not. Although both type of intervention and the source of patients may be important, the two factors were confounded in this review because of the high degree of overlap in these two characteristics: Most interventions in hospital samples were less than 1 month in duration, whereas most community interventions were longer than 1 month. Clearly, community-based programs have an advantage over hospital programs in their potential to provide continuity of care and an alternative location to the ED for management of many

acute problems. It may be more difficult for hospital- and ED-based programs to link patients with appropriate community programs. Indeed, many patients use EDs because of problems with access to primary medical care (13). Additional reasons for the differences by setting may include the higher rates of prior ED utilization and greater medical severity and/or functional dependency among hospital versus community-based patient populations, and the greater familiarity of the former with the staff and resources available in the hospital.

Some interventions that recruited patients from EDs resulted in an increase in ED utilization, although this was statistically significant in only 1 study (a 10-month nurse case-management intervention) (19). In 2 studies, this increase was observed within the first month after the initial visit and had disappeared by 4 months (33–35). Possibly, a return ED visit may have been needed to stabilize or complete treatment of an acute problem. An alternative explanation is that the assessment process itself sensitizes patients and their families to previously undetected health problems. This greater awareness of problems may increase patients' perceptions of need for care, and result in higher ED utilization (34,42). Although they did not reduce ED utilization, several of the ED-based interventions had beneficial effects on health outcomes, including reduced rates of functional and cognitive decline (34,38,43).

Other characteristics of interventions that may reduce ED utilization include greater integration with primary medical care and targeting of the intervention to higher-risk patients. There was, unfortunately, an insufficient number of studies to allow us to assess the effects of these factors, which are important areas for future research.

The methodological heterogeneity of the studies in this review limited our ability to compare their results, and precluded a meta-analysis. Most important were the differences in the way ED visits were measured, with regard to the level of measurement (continuous vs categorical), the reference time period, and the types of visit excluded (e.g., planned return visits, visits at which patients were admitted to hospital). There are advantages and disadvantages of different ED utilization rates. Dichotomous measures indicate the proportion of the population visiting the ED; continuous measures look at the number of visits. Whereas dichotomous measures using different reference time periods cannot be directly compared, continuous measures can. In the future, it is recommended that investigators report two measures: the proportion using the ED and, among users, the mean (and standard deviation) number of visits. For comparative purposes, we recommend that investigators always report the total number of ED visits, in addition to other more restrictive definitions. Different reference time periods may be required for hospital-based versus community-based studies; in the former, the short periods of time are useful to measures early return visits (e.g., 2 weeks, 30 days) which are more likely to be for the same (unresolved) problem (44).

There was also heterogeneity between studies with regard to study design. Only 16 of the 26 studies in this review used the RCT, the strongest design for evaluation of interventions. In situations where, for ethical or practical reasons, an RCT is not feasible, a controlled time-series design (as used by one of the studies; 41) is preferable to an uncontrolled before–after design. Other methodological differences between studies existed with regard to the measurement of important patient characteristics (severity of illness, comorbidity, physical functional status, cognitive impairment).

Apart from the methodological heterogeneity of the studies discussed above, there are four limitations of this review. First, it proved difficult to identify relevant studies in electronic searches. For example, unless ED visits were a primary study outcome, they were often not mentioned in the study abstract and could only be identified by reading the original article. This problem might lead to an underrepresentation of studies that found no association between interventions and ED visits. Second, there may be a publication bias, where studies with null results are less likely to be published. Third, studies in languages other than English or French were excluded because translation was not available. Fourth, some studies did not report the information needed; some but not all authors responded to requests for additional information.

There are implications of this review for future research (including standardization of measures, described above) and for practice. In particular, more complex interventions may be needed in hospital settings (inpatient units or EDs) if return visits to the ED are to be reduced. It is important to consider the context of these interventions, in particular the availability for alternative locations for care. It may be useful to refer to the disease-management literature, e.g., for chronic obstructive pulmonary disease (45). These interventions target populations with high rates of ED utilization, and provide education in disease self-management and ongoing support from a case manager. Interventions that increase continuity of care may also reduce ED utilization (46). Interventions for hospital-based populations may need to incorporate some of the principles followed by these programs to reduce ED return visits.

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References

1. Lowenstein SR, Crescenzi CA, Kern DC, Steel K. Care of the elderly in the emergency department. *Ann Emerg Med.* 1986;15:528–535.
2. Dickinson ED, Verdile VP, Kostyun CT, Salluzzo RF. Geriatric use of emergency medical services. *Ann Emerg Med.* 1996;27:199–203.
3. Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med.* 2002;39:238–247.
4. Currie CT, Lawson PM, Robertson CE, Jones A. Elderly patients discharged from accident and emergency departments–their dependency and support. *Arch Emerg Med.* 1984;1:205–213.

5. Hedges JR, Singal BM, Rousseau EW, et al. Geriatric patient emergency visits part II: perceptions of visits by geriatric and younger patients. *Ann Emerg Med.* 1992;21:808–813.
6. Brookoff D, Minniti-Hill M. Emergency department-based home care. *Ann Emerg Med.* 1994;23:1101–1106.
7. Gerson LW, Rousseau EW, Hogna TM, Bernstein E, Kalbfleisch N. Multicenter study of case finding in elderly emergency department patients. *Acad Emerg Med.* 1995;2:729–734.
8. McCusker J, Ardman O, Bellavance F, Belzile E, Cardin S, Verdon J. Use of community services by seniors before and after an emergency visit. *Can J Aging.* 2001;20:193–209.
9. Stuck AE, Siu AL, Wieland DG, Adams J, Rubenstein LZ. Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet.* 1993;342:1032–1036.
10. Rubenstein L. The emergency department: a useful site for CGA? *J Am Geriatr Soc.* 1996;44:601–602.
11. Wieland D, Hirth V. Comprehensive geriatric assessment. *Cancer Control.* 2003;10:454–462.
12. Applegate WB, Graney MJ, Miller ST, Elam JT. Impact of a geriatric assessment unit on subsequent health care charges. *Am J Public Health.* 1991;81:1302–1306.
13. McCusker J, Karp I, Cardin S, Durand P, Morin J. Determinants of emergency department visits by older adults: a systematic review. *Acad Emerg Med.* 2003;10:1362–1370.
14. Catellier D, Conlisk E, Vitt C, Levin K, Menon M, Upchurch G. A community-based pharmaceutical care program for the elderly reduces emergency room and hospital use. *N C Med J.* 2000;61:99–103.
15. Coleman EA, Eilertsen TB, Kramer AM. Reducing emergency visits in older adults with chronic illness. *Eff Clin Pract.* 2001;4:49–57.
16. Dellasega C, Zerbe T. A multimethod study of advanced practice nurse postdischarge care. *Clin Excel Nurs Pract.* 2000;4:286–293.
17. Naylor MD, Brooten D, Campbell R, et al. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA.* 1999;281:613–620.
18. Brooks MM, Ertl JM. Social work home visits: impact on recidivism and health care costs. *Continuum.* 2000;(6):3–9.
19. Gagnon AJ, Schein C, McVey L, Bergman H. Randomized controlled trial of nurse case management of frail older people. *J Am Geriatr Soc.* 1999;47:1118–1124.
20. Miller DK, Lewis LM, Nork MJ, Morley JE. Controlled trial of a geriatric case-finding and liaison service in an emergency department. *J Am Geriatr Soc.* 1996;44:513–520.
21. Gayton D, Wood-Dauphinee S, De Lorimer M, Tousignant P, Hanley J. Trial of a geriatric consultation team in an acute care hospital. *J Am Geriatr Soc.* 1987;35:726–736.
22. Bernabei R, Landi F, Gambasi G, et al. Randomised trial of impact of model of integrated care and case management for older people living in the community. *Br Med J.* 1998;316:1348–1351.
23. Eggert GM, Zimmer JG, Hall WJ, Friedman B. Case management: a randomized controlled study comparing a neighborhood team and a centralized individual model. *Health Serv Res.* 1991;26:471–507.
24. Baldwin L, Inui T, Stenkamps S. The effect of coordinated multidisciplinary ambulatory care on service use, charges, quality of care and patient satisfaction in the elderly. *J Community Health.* 1993;18:95–108.
25. Beck A, Scott J, Williams P, et al. A randomized trial of group outpatients visits for chronically ill older HMO members: the cooperative health care clinic. *J Am Geriatr Soc.* 1997;45:543–549.
26. Boult C, Boult L, Murphy C, Ebbitt B, Luptak M, Kane RL. A controlled trial of outpatient geriatric evaluation and management. *J Am Geriatr Soc.* 1994;42:465–470.
27. Dalby D, Sellors J, Fraser F, Fraser C, van Ineveld C, Howard M. Effects of preventive home visits by a nurse on the outcomes of frail elderly people in the community: a randomized controlled trial. *Can Med Assoc J.* 2000;162:497–500.
28. Keeler EB, Robalind DA, Frank JC, Hirsch SH, Maly RC, Reuben DB. Cost-effectiveness of outpatient geriatric assessment with an intervention to increase adherence. *Med Care.* 1999;37:1199–1206.
29. Silverman M, Musa D, Martin DC, Lave JR, Adams J, Ricci EM. Evaluation of outpatient geriatric assessment: a randomized multi-site trial. *J Am Geriatr Soc.* 1995;43:733–740.
30. Toseland W, O'Donnell C, Engelhardt B, Hendler SA, Richie J, Jue D. Outpatient geriatric evaluation and management: results of a randomized trial. *Med Care.* 1996;34:624–640.
31. Engelhardt JB, Toseland RW, O'Donnell JC, Richie JT, Jue D, Banks S. The effectiveness and efficiency of outpatient geriatric evaluation and management. *J Am Geriatr Soc.* 1996;44:847–856.
32. Coleman E, Grothaus L, Sandhu N, Wagner E. Chronic care clinics: a randomized controlled trial of a primary care for frail older adults. *J Am Geriatr Soc.* 1999;47:775–783.
33. McCusker J, Jacobs P, Dendukuri N, Latimer E, Tousignant P, Verdon J. Cost-effectiveness of a brief 2-stage emergency department intervention for high risk elders: results of a quasi-randomized controlled trial. *Ann Emerg Med.* 2003;41:45–56.
34. McCusker J, Dendukuri N, Tousignant P, Verdon J, Poulin De Courval L, Belzile E. Rapid two-stage emergency department intervention for seniors: impact on continuity of care. *Acad Emerg Med.* 2003;10:233–243.
35. Mion LC, Palmer RM, Meldon SW, et al. Case finding and referral model for emergency department elders: a randomized clinical trial. *Ann Emerg Med.* 2003;41:57–68.
36. Rosswurm MA, Lanham DM. Discharge planning for elderly patients. *J Gerontol Nurs.* 1998;24:14–21.
37. Tinetti ME, Baker D, Gallo WT, Nanda A, Charpentier P, O'Leary J. Evaluation of restorative care vs usual care for older adults receiving an acute episode of home care. *JAMA.* 2002;287:2098–2105.
38. Caplan GA, Williams AJ, Daly B, Abraham K. A randomized controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department–The DEED II Study. *J Am Geriatr Soc.* 2004;52:1417–1423.
39. Scott JC, Conner DA, Venohr I, et al. Effectiveness of a group outpatient visit model for chronically Ill older health maintenance organization members: a 2-year randomized trial of the cooperative health care clinic. *J Am Geriatr Soc.* 2004;52:1463–1470.
40. Guttman A, Afilalo M, Guttman R, et al. An emergency department-based nurse discharge coordinator for elder patients: does it make a difference? *Acad Emerg Med.* 2004;11:1318–1327.
41. Tourigny A, Durand PJ, Bonin L, Hébert R, Rochette L. Quasi-experimental study of the effectiveness of an integrated service delivery network for the frail elderly. *Can J Aging.* 2004;23:231–246.
42. Hansell S, Sherman G, Mechanic D. Body awareness and medical care utilization among older adults in an HMO. *J Gerontol Soc Sci.* 1991;46:S151–S159.
43. McCusker J, Verdon J, Tousignant P, Poulin de Courval L, Dendukuri N, Belzile E. Rapid emergency department intervention for elders reduces risk of functional decline: results of a multi-centre randomized trial. *J Am Geriatr Soc.* 2001;49:1272–1281.
44. McCusker J, Cardin S, Bellavance F, Belzile É. Return to the emergency department among elders: patterns and predictors. *Acad Emerg Med.* 2000;7:249–259.
45. Bourbeau J, Julien M, Maltais F, et al. Reduction of hospital utilization in patients with chronic obstructive pulmonary disease. *Arch Intern Med.* 2003;163:585–591.
46. Gill JM, Mainous AG III, Nsereko M. The effect of continuity of care on emergency department use. *Arch Fam Med.* 2000;9:333–338.

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