

# Emergency Department Utilization by Older Adults: a Descriptive Study



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## ABSTRACT

### Background

Emergency Departments (EDs) are playing an increasingly important role in the care of older adults. Characterizing ED usage will facilitate the planning for care delivery more suited to the complex health needs of this population.

### Methods

In this retrospective cross-sectional study, administrative and clinical data were extracted from four study sites. Visits for patients aged 65 years or older were characterized using standard descriptive statistics.

### Results

We analyzed 34,454 ED visits by older adults, accounting for 21.8% of the total ED visits for our study time period. Overall, 74.2% of patient visits were triaged as urgent or emergent. Almost half (49.8%) of visits involved diagnostic imaging, 62.1% involved lab work, and 30.8% involved consultation with hospital services. The most common ED diagnoses were symptom- or injury-related (25.0%, 17.1%, respectively). Length of stay increased with age group (Mann-Whitney U;  $p < .0001$ ), as did the proportion of visits involving diagnostic testing and consultation ( $\chi^2$ ;  $p < .0001$ ). Approximately 20% of older adults in our study population were admitted to hospital following their ED visit.

### Conclusions

Older adults have distinct patterns of ED use. ED resource use intensity increases with age. These patterns may be used to target future interventions involving alternative care for older adults.

**Key words:** aged, aged 80 and over, frail elderly, emergency service—hospital, emergency medical services, health services

## INTRODUCTION

Emergency Departments (EDs) are playing an increasingly important role in the care of older adults.<sup>(1-3)</sup> In the United States, patients older than 75 years have the highest ED visit rates after infants less than one year of age.<sup>(4)</sup> A study comparing rates of ED usage in the US and Canada found similarly high visit rates for patients over 75 years in Ontario (73.1 per 100 of the population).<sup>(5)</sup> EDs provide important services to older adults, often serving as a point-of-entry to the hospital system or long-term care, or providing after-hours care to those unable to access a primary care provider.<sup>(6,7)</sup> Addressing the complex care needs of older adults in an ED setting is expected to place increased strain on a system that is already burdened with overcrowding.<sup>(8-10)</sup> Recent research has focused on profiling older adult ED usage, with the end goal of planning ED care that meets the unique needs of this population.

Previous studies suggest that older patients presenting to the ED differ from younger patients in several important ways. Older adults are often more acutely ill than younger patients.<sup>(11,12)</sup> They are also more likely to have a longer stay in the ED,<sup>(13)</sup> and are more likely to be hospitalized subsequent to their visit.<sup>(11,12)</sup> According to a report of ED usage in Canada, of the 9.1% of patients who are admitted following their ED visit, approximately half (47.1%) are over the age of 65 years.<sup>(14)</sup> Reports from the United States demonstrate increased resource use intensity among older adults visiting the ED in the form of increased admissions, use of ICU services, imaging, and use of laboratory services.<sup>(15)</sup> Common reasons for older adults visiting the ED include ischemic heart disease, congestive heart failure, syncope, cardiac dysrhythmias, acute cerebrovascular accidents, pneumonia, abdominal disorders, urinary tract infections, and fall-related injuries.<sup>(2)</sup>

Though several studies have described ED usage by older adults, relatively few have focused on Canadian populations. Studies set in Canada have mainly addressed predictors of use and return visits, rather than providing a purely descriptive profile of ED use for this population. The aim of this study is to characterize the population of older Canadians seeking care in the ED, and to add to the current body of literature

by providing a detailed description of primary diagnosis and resource use intensity.

## METHODS

### Design and Setting

This retrospective, cross-sectional study examined ED visit data from four sites within the Capital District Health Authority (CDHA) in Nova Scotia, Canada. These include a tertiary care hospital (Queen Elizabeth II Health Sciences Centre with approximately 62,000 annual visits), two community hospitals (Dartmouth General Hospital and Hants Community Hospital with approximately 39,000 and 17,000 annual visits, respectively), and a community health centre (Cobequid Community Health Centre with approximately 28,000 annual visits). This study was approved by the CDHA Research Ethics Board.

### Population

All patients 65 years of age or older presenting to one of the four study EDs between April 1, 2012 and March 31, 2013 were eligible for inclusion. Patients may have had multiple visits to the ED during the study period. All visits were included.

### Variables

Administrative (age, gender, date and time of ED visit) and clinical (presenting complaint, diagnosis, consult services, length of stay, and disposition) data were extracted from our data source.

Length of stay (LOS) was defined as from the time of patient registration to the time the patient leaves the ED. Calculations of mean and median length of stay in the ED included only completed visits (i.e., excluded patients who left without being seen or against medical advice). LOS calculations also excluded visits lasting 15 minutes or less to eliminate outliers created by errors in time stamping.

For the purposes of this study, patients were defined as having a family physician if the name of a family physician was listed for the patient at the time of ED registration.

The database from which the study data was obtained contained ED diagnoses coded in both ICD-9-CM and ICD-10-CA formats. The closest matching categories for ICD-9-CM and ICD-10-CA codes were used to group ED visit diagnoses into major clinical categories and diagnostic clusters.

### Data Source

Data were obtained from the Emergency Department Information System (EDIS), a real-time system that electronically captures administrative and clinical data on patients visiting

the ED. The same system is used at all four study sites. Patient transfers from one facility to another are treated as separate events by EDIS.

### Statistical Methods

All analyses were conducted using STATA statistical software (STATA Corp., College Station, TX; Version 9). Visits were characterized using standard descriptive statistics. Standard deviations (SD) and confidence intervals (CI) are shown, where appropriate. Differences between groups were assessed using a  $\chi^2$  test for categorical data and the Mann-Whitney U test for continuous data (not normally distributed).

## RESULTS

There were 158,344 ED visits in the CDHA between April 1, 2012 and March 31, 2013, of which 34,461 were for patients 65 years and over (21.8%). Seven observations were excluded from the analysis because key demographic information (age, gender) was omitted or erroneous ( $n = 6$ ), or because information on ED disposition was not available ( $n = 1$ ). The total number of visits included in the analysis was 34,454.

Table 1 describes patient- and visit-related characteristics for our study cohort. Most ED visits occurred on weekdays (71.9%). A friend or relative was the most common mode of arrival (43.3%), followed by ambulance (32.4%). A family physician was listed for 95.4% of patients for this age group. The most common presenting complaints included shortness of breath (9.3%), chest pain (8.1%), and lower extremity pain or injury (7.9%). Overall, 74.2% of patients were triaged as urgent or emergent. Almost half (49.8%) of visits involved some kind of diagnostic imaging, 62.1% involved lab work, and 30.8% involved consultation with other departments or services. By far, the most common form of diagnostic imaging used was X-ray (42.8%). Mean LOS was 7.8 hours (median = 4.8 hours). Most visits resulted in discharge of the patient (71.6%), while 20.8% of visits resulted in admission to hospital.

The primary ED diagnosis for each visit was clustered according to major clinical category (Table 2). The most common diagnoses were non-specific, relating to "symptoms, signs, and ill-defined conditions" (25.0%). Injury and poisoning constituted 17.1% of diagnoses, while diagnoses related to the circulatory system and respiratory system constituted 10.1% and 9.4% of diagnoses, respectively. Within the category of "symptoms, signs and ill-defined conditions", 8.2% of ED diagnoses were related to general symptoms, most commonly syncope (1.5%) and malaise and fatigue (2.0%). A further 29.8% of ill-defined diagnoses were related to chest and respiratory symptoms. Within this category, 3.5% were specified as chest pain and 3.0% were specified as respiratory abnormalities. Symptoms related to the digestive system constituted 4.9% of this category. Of the diagnoses related to injury and poisoning, 30.7% were categorized as

TABLE 1.

Patient- and visit-related characteristics for ED visits by older adults

<i>Characteristic</i>	<i>Value</i>	<i>N</i>
Age		
Mean ± SD	76.3±8.1 (range 65–104)	N/A
65-74 years, %	47.8	16,113
75-84 years, %	35.0	12,074
85+ years, %	18.2	6,267
Gender (%)		
Female	54.7	18,854
Male	45.3	15,600
Weekend or Weekday Visit (%)		
Weekday	71.9	24,763
Weekend	28.1	9,691
Mode of Arrival (%)		
Friend or Relative	43.26	14,904
Ambulance	32.43	11,173
Self	23.36	8,047
Other	0.83	285
Life Flight	0.13	45
Family Physician Listed (%)		
Yes	95.4	32,869
Most Common Presenting Complaints (%)		
Shortness of breath	9.3	3,216
Chest pain	8.1	2,800
Lower extremity pain/ injury	8.0	2,740
Abdominal pain	7.6	2,631
General weakness	4.6	1,601
Triage Level (%)		
Urgent/ emergent (CTAS 1-3)	74.2	25,574
Less urgent (CTAS 4,5)	25.8	8,880
Diagnostic Testing (%)		
X-RAY	42.8	14,753
CT	12.6	4,340
US	2.2	751
MRI	0.01	9
Any imaging	49.8	17,165
Lab work	62.1	21,393
Consulting Services (%)		
Any consult	30.8	10,617
Length of Stay <sup>a</sup> (hours)		
Mean ± SD	7.8±9.5 (range 0.27–221)	33,380
Median	4.8	33,380
Departure Disposition (%)		
Discharged	71.6	24,658
Admitted	20.8	7,175
Transferred	4.2	1,440
LWBS	2.42	834
Left AMA	0.62	212
Deceased	0.39	135

<sup>a</sup>Excluding LWBS, LAMA, visits < 15 mins in duration.

TABLE 2.

Proportion of ED visit diagnoses for older adults, major clinical categories

<i>Disease / Disorder Category</i>	<i>%</i>	<i>N</i>
Symptoms, signs and ill-defined conditions	25.0	8,605
Injury and poisoning	17.1	5,874
Circulatory system	10.1	3,471
Respiratory system	9.4	3,232
Digestive system	7.1	2,457
Musculoskeletal system and connective tissue	6.9	2,365
Genitourinary system	5.8	1,999
Skin and subcutaneous tissue	4.6	1,588
Nervous system and sense organs	3.7	1,290
Mental and behavioural	2.0	699
Other	5.2	1,409
Diagnosis not available (LWBS, LAMA, not recorded)	3.1	1,072

a fracture, while 17.7% involved other injuries (e.g., internal injuries, wounds, contusions, burns). Dislocations, sprains, and strains of joints and muscles were also common (17.5%), as were open wounds (14.1%). External cause-of injury coding was not available.

Visit characteristics according to age group are presented in Table 3. The proportion of patients arriving by ambulance increased with age ( $\chi^2, p < .0001$ ). Patients in older age groups were more likely to be admitted to hospital as a result of their ED visit ( $\chi^2; p < .0001$ ). Mean and median ED LOS also increased with age group (Mann-Whitney U;  $p < .0001$ ). Just over 5% of ED visits had a LOS of over 24 hours. The proportion of visits associated with a LOS of more than 24 hours increased with age group to a high of 8.9% ( $n = 553$ ) for patients age 85 years and older. Of patients 85 years and over with a LOS of greater than 24 hours, the most common diagnoses were ill-defined (21.7%), diseases of the respiratory system (17.9%) or circulatory system (13.4%), or injuries (11.6%). Following the ED visit, 72.2% of patients in this group were admitted. The likelihood of having diagnostic imaging, lab work or a consultation with a hospital service as part of the ED visit also increased with age group ( $\chi^2, p < .0001$ ).

Only study sites that admit patients were included in the analysis of ED visits resulting in hospital admission ( $N = 28,034$ ) (Table 4). Of admitted patients, 4.6% were triaged as low acuity on arrival at the ED. ED LOS was more than twice as long for admitted patients (mean = 15.4 hours; median = 11.7 hours) than for patients who were not admitted (mean = 6.2 hours; median = 4.3 hours). The proportion of ED visits from each major clinical category resulting in admission is presented in Figure 1. Categories for which there was a high proportion of admissions included neoplasms (51.9%), diseases relating to the circulatory system (50.6%), and diseases relating to the digestive system (44.0%).

TABLE 3.  
ED visit characteristics for older adults by age group

<i>Characteristic</i>	<i>Age Group (yrs)</i>			<i>p value<sup>b</sup></i>
	65 to 74	75 to 84	85+	
Mode of Arrival (%)				<i>p</i> < .0001
Friend or Relative	45.1	44.9	35.6	
Ambulance	23.1	34.3	52.9	
Self	30.9	19.8	10.9	
Other	0.9	0.9	0.6	
Life Flight	0.2	0.14	0.02	
Triage Level (%)				<i>p</i> < .0001
Urgent/ emergent (CTAS 1-3)	70.7	75.3	81.4	
Less urgent (CTAS 4,5)	29.3	24.7	18.6	
Length of Stay <sup>a</sup> (hrs)				
Mean ± SD	6.75±8.1 (range 0.27–179)	8.1±10.1 (range 0.27–221)	9.61±11.1 (range 0.28–195)	
Median	4.4	5.1	5.9	
Departure Disposition (%)				<i>p</i> < .0001
Discharged	74.6	71.0	65.0	
Admitted	17.2	21.8	28.2	
Transferred	4.0	4.2	4.4	
LWBS	3.1	2.0	1.5	
Left AMA	0.8	0.6	0.3	
Deceased	0.2	0.4	0.7	
Diagnostic Testing (%)				
Any Imaging	45.9	50.8	57.8	<i>p</i> < .0001
Lab work	57.0	64.3	70.8	<i>p</i> < .0001
Consulting Services (%)				
Any consult	27.8	31.7	36.7	<i>p</i> < .0001

<sup>a</sup>Excluding LWBS, LAMA, visits < 15 mins in duration.

<sup>b</sup> $\chi^2$  test for categorical variables; Mann-Whitney U test for continuous variables.

TABLE 4.  
ED visit characteristics for older adults by hospital admission<sup>a</sup>

<i>Characteristic</i>	<i>Admitted</i>		<i>p value<sup>c</sup></i>
	Yes	No	
Triage Level (%)			<i>p</i> < .0001
Urgent/ emergent (CTAS 1-3)	95.4	69.1	
Less urgent (CTAS 4,5)	4.6	30.9	
Length of Stay <sup>b</sup> (hrs)			<i>p</i> < .0001
Mean ± SD	15.4±12.3 (range 0.28–221)	6.2±8.1 (range 0.27–214)	
Median	11.7	4.3	
Diagnostic Testing (%)			
Any Imaging	66.4	43.0	<i>p</i> < .0001
Lab work	90.1	54.5	<i>p</i> < .0001
Consulting Services (%)			
Any consult	82.9	18.0	<i>p</i> < .0001

<sup>a</sup>Includes only study sites that admit patients.

<sup>b</sup>Excluding LWBS, LAMA, visits < 15 mins in duration.

<sup>c</sup> $\chi^2$  test for categorical variables; Mann-Whitney U test for continuous variables.

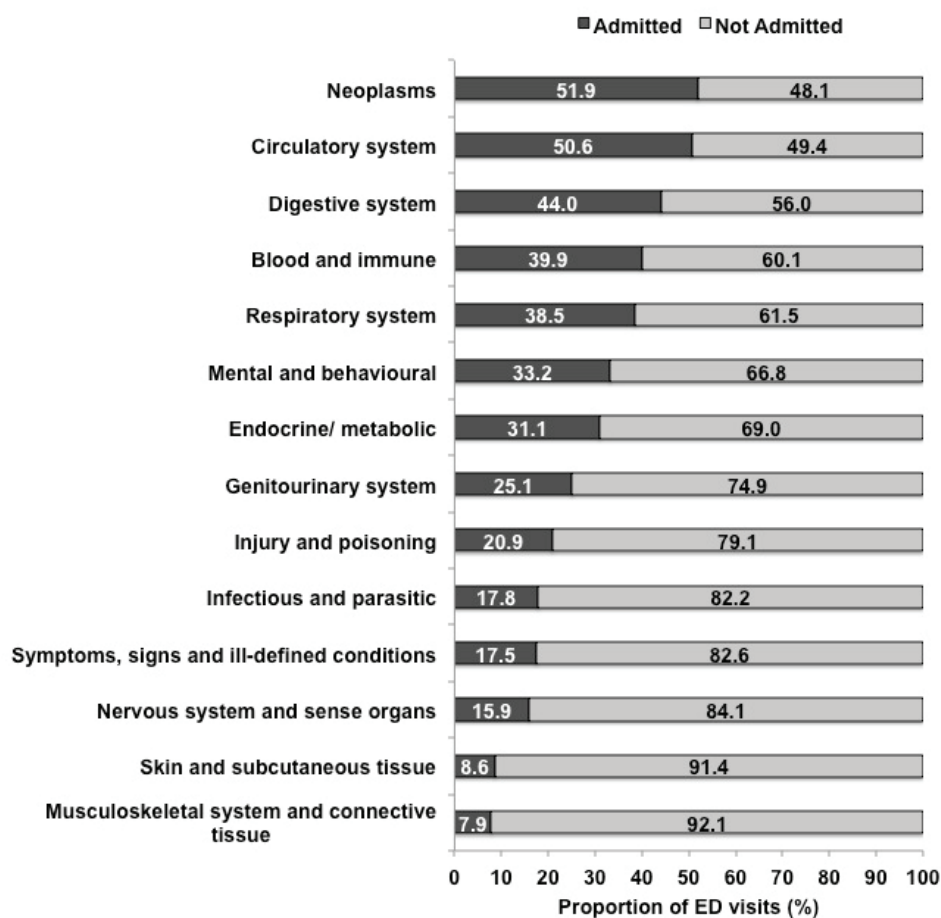


FIGURE 1. Proportion of ED visits by older adults from each major clinical category that resulted in admission (includes only study sites that admit patients)

## DISCUSSION

We analyzed 34,454 ED visits by older adults in one Canadian health authority, and provided a detailed profile of ED utilization for this population. Although 13% of people living within the CDHA are over 65 years of age according to current census data, this group accounted for 21.8% of ED visits in the CDHA, suggesting higher ED usage by older adults compared with younger age groups. Almost three quarters of ED visits by older adults are triaged as urgent or emergent (Canadian Triage and Acuity Scale or CTAS 1-3). Resource use in the ED for older adults is substantial, with almost half of visits involving diagnostic imaging, 60% involving lab work, and 30% involving a consultation with hospital services. Approximately 20% of older adults in our study population were admitted to hospital following their ED visit. We have demonstrated that a quarter of older adults leave the ED without a definitive diagnosis. This is expected, considering the primary role of ED care is to rule out acute and life-threatening conditions. However, as more older adults rely on EDs for timely care, it is important to consider that the rapid, goal-directed model of care delivery

in the ED may not be an adequate substitute for primary care, particularly for this population that often requires thorough assessment, continuity, and follow-up.<sup>(16)</sup>

Injuries and circulatory and respiratory problems are the most common definitive ED diagnosis categories among older adults. The likelihood of arriving to the ED by ambulance and admission to hospital following the visit increased with age group. Mean ED LOS also increased with age, as did the likelihood of receiving diagnostic testing or consultation. Increased intensity of resource use may reflect the complexity of illness and comorbidities that are known to occur with age.<sup>(1)</sup> Importantly, almost 9% of patients over 85 years of age had a LOS of greater than 24 hours. This is concerning, as longer lengths of stay in the ED may expose these vulnerable “oldest” older adults to increased risk of adverse events such as delayed diagnosis and medication errors.<sup>(17-20)</sup> Since the population over 85 years of age is a growing demographic in Canada,<sup>(21)</sup> reducing LOS in the ED and examining the effect of ED overcrowding on this vulnerable population is an important place to focus attention in the planning of care. Expectedly, acuity and resource use were associated with hospital admission following an ED visit. Longer LOS for

patients who are admitted may reflect increased time required to appropriately work-up patients, and/or access block due to a lack of available inpatient beds.

The results of this study are largely consistent with others that have examined patterns of ED utilization for older adults. While discharge disposition is generally similar across descriptive studies of older adults ED usage, a lower percentage (20%) of visits in our study resulted in hospital admission compared with other studies of the same age group (30–50%);<sup>(2,15,22)</sup> however, the admission rate varied across study sites to a high of 30%. A very similar proportion of visits in our study were associated with diagnostic testing, compared with other studies.<sup>(15)</sup> Common presenting complaints and primary ED diagnoses are also consistent with previous work.<sup>(22)</sup>

The results of this study may be used in a number of settings. First, patterns of use identified in this study may be helpful in the planning of ED services for older adults. For instance, approaches to improving ED care for older adults, including geriatric case-management, geriatric assessment, and re-designs of the physical environment of ED, may choose to focus resources and training on common ED diagnoses for this age group, such as injury, and may include supported self-management of acute exacerbations of cardiovascular and respiratory disease.<sup>(23–28)</sup> Because ED visits appear to become more resource-intensive with age, it may be appropriate to allocate more resources or staff for EDs with a high proportion of older patients. It may also be important to closely examine continuity and coordination of care in the ED for older adults, specifically those over the age of 85 years who are more likely to receive multiple tests and consultations.

Older adults are vulnerable to adverse outcomes related to ED visits, owing in part to declines in functional status, lack of social support, co-morbidities, and polypharmacy.<sup>(2,29,30)</sup> Research has demonstrated that the fast-paced, goal-directed environment of the ED is not always conducive to the treatment of older adults, who often have more acute, complex or atypical presentations of illness.<sup>(31)</sup> Therefore, a second use for descriptive information on ED use is to identify populations of older adults visiting the ED for health concerns that may be amenable to other forms of care delivery that are more suited to the needs of this population. Patients with diagnoses accounting for the highest proportion of visits (symptoms and ill-defined conditions [25%] and injury and poisoning [17.1%]) were not as likely to require hospital admission following their visit. This suggests that patients in this group may be amenable to other forms of care. Several examples illustrate the efficacy of alternative modes of care targeted to older adult populations. Implementation of a collaborative outreach program for a small number of patients with chronic obstructive pulmonary disease (COPD) reduced ED visits, hospital admissions, and length of stay for patients participating in the program.<sup>(32)</sup> The use of paramedics specially trained for on-site management has been shown to reduce the need for ED transport of older adults from long-term care facilities,<sup>(33)</sup>

and decrease ED attendances for community-dwelling older adults with minor injuries.<sup>(34)</sup>

Strengths of this study include the detailed analysis of diagnostic testing and consultation provided during ED visits—information which is often unavailable for large datasets. We also provide a more specified analysis of common diagnoses and rates of admission for major clinical categories of disease.

This study had several limitations. The data from EDIS are not population-based, or necessarily representative of the population outside of CDHA. However, the generalizability is enhanced because the study analyzes data from different types of facilities (i.e., tertiary care, community hospital, community health centre).

Our analysis was limited to data specific to the ED visit. We did not have information on patient comorbidities, functional status, frailty, or polypharmacy—factors that are known to influence ED resource use and visit outcomes.<sup>(8,29,30)</sup> No follow-up information was available for visits resulting in hospital admission. We attempted to use a listed family physician at the time of the ED visit as a marker for access to primary care. This marker may have limited value as we have no information regarding previous contact with, or access to, the family physician. The majority of patients identified a family physician at ED registration.

Further research will be required to determine what specific populations of older adults visiting the ED may be amenable to other types of care delivery. Additional study is also warranted to differentiate utilization patterns of community-dwelling older adults and those who live in nursing homes.<sup>(1,35)</sup> Investigation of predictors of intensive resource use during ED visits by older adults may also help to target interventions to reduce costs.

## CONCLUSION

Older adults have distinct patterns of ED service use. ED resource use intensity (diagnostic testing, consultation, length of stay, and hospital admission) appears to increase with age. Prolonged ED lengths of stay are more likely to be experienced by patients over 85 years of age, potentially exposing this vulnerable group to an increased risk of adverse events in the ED. Patterns of use were described and may be used in resource planning, or to target future interventions involving improved or alternative care options.

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## CONFLICT OF INTEREST DISCLOSURES

The authors declare that no conflicts of interest exist.

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