

The Epidemiology of Prehospital Emergency Responses for Older Adults in a Provincial EMS System

Judah Goldstein, MSc, PhD*^{†‡}; Jan L. Jensen, ACP, MAHSR^{†‡}; Alix J. E. Carter, MD, MPH^{†‡}; Andrew H. Travers, MD, MSc^{†‡}; Kenneth Rockwood, MD*

ABSTRACT

Objectives: Societal aging is expected to impact the use of emergency medical services (EMS). Older adults are known as high users of EMS. Our primary objective was to quantify the rate of EMS use by older adults in a Canadian provincial EMS system. Our secondary objective was to compare those transported to those not transported.

Methods: We analysed data from a provincial EMS database for emergency responses between January 1, 2010 and December 31, 2010 and included all older adults (≥ 65 years) requesting EMS for an emergency call. We described EMS use in relation to age, sex, and resources.

Results: There were 30,653 emergency responses for older adults in 2010, representing close to 50% of the emergency call volume and an overall response rate of 202.8 responses per 1,000 population 65 years and older. The mean age was 79.9 ± 8.5 years for those 57.3% who were female. The median paramedic-determined Canadian Triage and Acuity Scale (CTAS) score was 3 and the mean on-scene time was 24.2 minutes. Non-transported calls (12.3%) for the elderly involved predominantly (54.9%) female patients of similar mean age (78.3 years) but lower acuity (CTAS 5) and longer average on-scene times (32.6 minutes).

Conclusions: We confirmed the increasingly high rate of EMS use with age to be consistent with other industrialized populations. The low-priority and non-transport calls by older adults consumed considerable resources in this provincial system and might be the areas most malleable to meet the challenges facing EMS systems.

RÉSUMÉ

Objectifs: Le vieillissement de la population se répercutera sans doute sur l'utilisation des services médicaux d'urgence (SMU), et c'est un fait connu: les personnes âgées sont de grands utilisateurs de SMU. L'étude avait pour objectif principal de quantifier le taux d'utilisation des SMU par les

personnes âgées dans un système provincial de SMU, au Canada, et pour objectif secondaire de comparer les malades ayant été transportés à l'hôpital avec ceux ne l'ayant pas été.

Méthode: Les auteurs ont procédé à une analyse de renseignements provenant d'une base de données provinciale sur les SMU pour des interventions d'urgence faites entre le 1^{er} janvier et le 31 décembre 2010 et concernant toutes les personnes âgées (≥ 65 ans) qui ont passé un appel d'urgence aux SMU. L'utilisation des SMU a été calculée en fonction de l'âge, du sexe et des ressources.

Résultats: Il y a eu 30 653 interventions d'urgence faites chez des personnes âgées en 2010, ce qui représente près de 50% du volume d'appels d'urgence et un taux général de 202,8 interventions d'urgence pour 1000 personnes de 65 ans et plus. L'âge moyen était de $79,9 \pm 8,5$ ans, et 57,3% des personnes ayant appelé étaient des femmes. Le score médian sur l'Échelle canadienne de triage et de gravité (ECTG) et déterminé par les ambulanciers paramédicaux était de 3, et le temps passé sur place en moyenne, de 24,2 minutes. Les données sur les appels qui se sont soldés par le non-transport des personnes âgées à l'hôpital (12,3%) ont révélé que le phénomène concernait davantage les femmes (54,9%), qu'elles avaient un âge moyen comparable (78,3 ans), que le degré de gravité des troubles était faible (ECTG: 5) et que le temps passé sur place en moyenne était généralement plus long (32,6 minutes).

Conclusions: Les résultats de l'étude confirmant une utilisation de plus en plus grande des SMU en fonction de l'âge concordent avec ceux d'études menées dans d'autres pays industrialisés. Le faible degré de priorité des appels et le non-transport à l'hôpital des personnes âgées entraînent une forte consommation des ressources disponibles dans le système provincial de SMU en question, et ce sont peut-être là les points qui se prêteraient le plus à des changements afin de permettre aux SMU de faire face aux difficultés qu'ils rencontrent.

Keywords: Emergency medical services, aging, geriatrics, epidemiology, health service use, transport

From the *Division of Geriatric Medicine, Geriatric Medicine Research Unit, Dalhousie University, Halifax, Canada; †Nova Scotia Emergency Health Services, Halifax, NS; and ‡Department of Emergency Medicine, Division of EMS, Dalhousie University, Halifax, Canada.

Correspondence to: Judah Goldstein, 239 Brownlow Avenue, Suite 300, Dartmouth, Nova Scotia, Canada B3B 2B2; Email: judah.goldstein@dal.ca

© Canadian Association of Emergency Physicians

CJEM 2015;17(5):491-496

DOI 10.1017/cem.2015.20



INTRODUCTION

Populations are aging. In Canada, 14.1% of the population is aged 65 years or older. This is expected to accelerate over the next 20 years.¹ Population aging is of considerable concern for emergency medical services (EMS), as older adults tend to use emergency services at disproportionately higher rates compared with younger age groups.²⁻⁴ In a national sample (United States data), 38% of older adults seen in the emergency department (ED) arrived by EMS.⁴ The disproportionately higher EMS usage rate among older adults is well documented in other countries, including Australia and Turkey,⁴⁻⁶ and is notably highest in the oldest age group (>85 years), a rapidly growing segment of society.⁷

EMS utilization rates have been studied in relation to a number of factors, including age, socio-demographic characteristics, and insurance status.^{3,8} EMS use for older adults is higher in urban centers^{3,7} and among those with lower socio-economic status (United States data).⁹ The relationship between gender and transport rates is mixed, with women having higher overall rates of transport, whereas repeated transports were higher in men.^{9,10}

Non-transports are an important part of EMS demand and the risks associated with no transport are potentially high.¹¹ However, in some EMS systems, non-transport rates are often difficult to quantify or understand due to limited data.⁴

Despite the numerous studies on EMS use by the elderly, there appears to be little research exploring this topic in Canada. Our objective, therefore, was to quantify the rate of EMS use by older adults in a provincial EMS system, including both transport to the ED and non-transports.

METHODS

Ethics

The Nova Scotia (NS) Capital District Health Authority research ethics committee approved this study (CDHA-RS/2012-248).

Study design

We analyzed data from the NS provincial EMS administrative database that includes electronic Patient Care Record (ePCR) data for each patient.

Setting

In 2010, the Nova Scotia (NS) population was 942,506 people, of whom 51.5% (485,017) were female and 16% (151,160) were ≥ 65 years old.^{1,12} The population of NS is served by Emergency Health Services (EHS), a provincial EMS system and the sole provider of emergency and transfer services in the province. EHS provides single access to the EMS system, centralized computer-aided dispatch, standards for response times, and medical oversight.¹³ The ground ambulance service is staffed with primary, intermediate, and advanced care paramedics covering an area of 55,000 square kilometers.¹³ EHS receives approximately 120,000 to 130,000 requests for service per year, with close to half of requests being inter-facility transfers, resulting in over 100,000 patient transports per year. During the time frame of interest, a user fee was charged for all emergency responses.

Data collection

EHS requires that paramedics document all responses in an ePCR for which they have been dispatched, including transported and non-transported patients. Personal and clinical characteristics are documented along with operational details, including provider level and response time intervals. Each response is assigned a unique identifier generated from the computer-aided dispatch system. Once the ePCR is finalized, it is uploaded to a central server and stored in the EHS administrative database.

We requested data from EHS on all EMS emergency responses for older people (≥ 65 years) between January 1, 2010 and December 31, 2010. Data included the dispatch problem and response times. Demographic data included the patient's age, sex, and location by postal code. We categorized location as urban or rural by using the postal code, where the second digit indicates an urban (1-9) or rural (0) address. We requested clinical information consisting of the paramedic's clinical impression, the first documented Canadian Triage and Acuity Scale (CTAS) score, co-morbidity count, medication count, and number of interventions. Transport data included call disposition (transport to ED or no transport).

We included both community-dwelling older adults and residents of extended care facilities. We excluded air ambulance responses, inter-facility transfers or other scheduled responses (e.g., return to residence from the hospital).

Data analysis

We stored all data in Microsoft Excel 2007 (Redwood, CA) and conducted all statistical analyses using SPSS version 15.0 (Chicago, IL). Baseline characteristics are reported for those ≥ 65 years old, as this was the focus of our analysis. We reported EMS response and transport rates as per 1,000 population. We calculated the overall rate of EMS use for younger adults (16 to 64 years old) for comparison with no additional analyses performed with this cohort. We conducted chi-square tests to compare categorical variables between transported and non-transported in older adults only. Similarly, we applied independent *t*-tests to detect differences between continuous variables. We reported the level of significance using a pre-specified cutoff of alpha equal to 0.05 for the first test for each of the two comparison categories.

RESULTS

There were 63,076 emergency responses (excluding inter-facility transfers) for adults in 2010, and 48.6% of these were for the 16% of the population ≥ 65 years old (Figure 1). The mean age of the older group was 79.9 ± 8.5 years (median 80; IQR 73-86), 57.3% were women and 47.9% were from an urban location.

Most (39.7%) were triaged as CTAS 3 and almost half had no intervention (Table 1).

Response, transport rates, and non-transport rates per 1,000 were all higher in the older population and again in the oldest of the old (≥ 85 years) (Table 2).

A comparison of the characteristics of older adults by transport decision shows that those patients not transported were more commonly female and had lower acuity (e.g., CTAS 5). The most common presenting complaint for both transported ($n = 3,701$) and non-transported patients ($n = 1,177$) was fall. Common clinical impressions of transported patients included cardiovascular ($n = 3,607$; 13.7%), respiratory (3,563; 13.5%), trauma (4,197; 15.9%), and gastrointestinal (3,541; 13.4%) complaints. The most common clinical impression identified for non-transported patients was wellness check/no complaint ($n = 1,534$; 41.5%). The average on-scene time for non-transport patients, however, was significantly longer than those who were transported but with significantly fewer interventions performed (Table 3).

DISCUSSION

To our knowledge, this is the first Canadian EMS study to quantify the rate of EMS use by older adults, including both transport to the ED and non-transport.

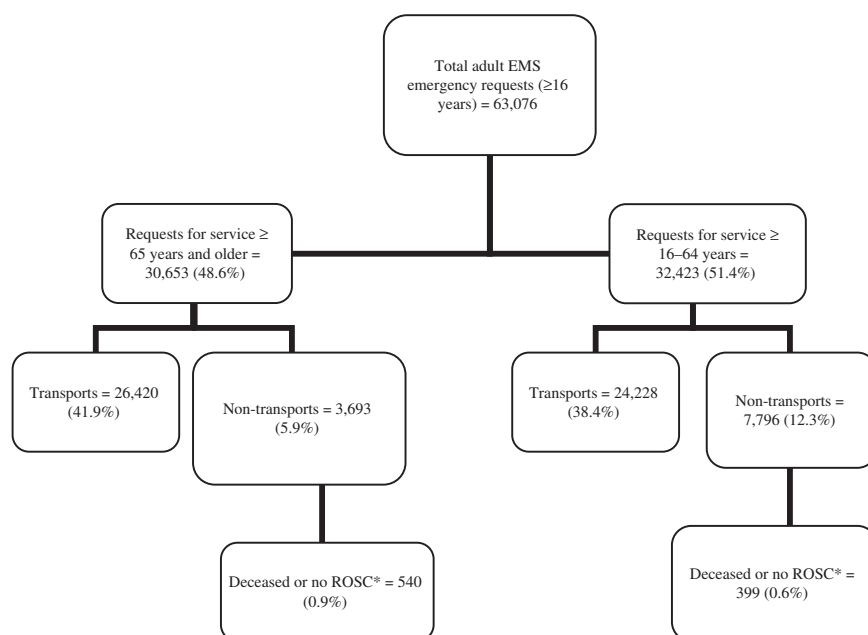


Figure 1. All adult ground ambulance emergency responses in Nova Scotia in 2010.
*ROSC = Return of Spontaneous Circulation.

Characteristic (n = 30,653)	Value
Age (years)	mean (SD) 79.9 (8.5) range 65–111
Sex	n (%)
Female	17,572 (57.3)
Male	13,056 (42.6)
Location	n (%)
Rural	8,193 (29.5)
Urban	13,229 (47.9)
Not Indicated	6,903 (22.5)
*Common Co-morbidities	n (%)
Cardiac (MI, CHF)	8,475 (27.7)
Diabetes	7,818 (25.5)
Respiratory (COPD, asthma)	6,477 (21.1)
Stroke or TIA	4,252 (13.9)
Co-morbidities	mean (SD) 4.1 (3.1) median 3
Medications	mean (SD) 6.4 (4.5) median 6
CTAS**	n (%)
1 (Resuscitation)	523 (1.7)
2 (Emergent)	3,079 (10)
3 (Urgent)	12,180 (39.7)
4 or 5 (Less Urgent)	7,070 (23.1)
Clinical Impression	n (%)
Cardiovascular	3,579 (11.7)
Gastrointestinal	4,342 (14.2)
Neurological	2,836 (9.3)
Nonspecific/Wellness Check	6,157 (20.7)
Respiratory	3,718 (12.1)
Trauma	4,436 (14.5)
Interventions	n (%)
No Intervention	13,646 (44.5)
One Intervention	4,335 (14.1)
Two to Four Interventions	11,300 (36.9)
Five or more	1,372 (4.5)

*MI = myocardial infarction, TIA = transient ischemic attack, CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease.
**CTAS = Canadian Triage and Acuity Score.

In this Canadian provincial EMS system, the EMS utilization rate for older adults was found to be comparable to other developed countries: 202.8 responses per 1,000 population versus 167 per 1,000 (United States data)⁴ and 211.2 per 1,000 (Australia data)⁷. Also, age has been noted to be the major determinant of EMS use⁹ and EMS use is the highest in the oldest of the old with transport rates greater than 470 per 1,000^{5,7}, which we also confirmed in our study, with a transport rate 4.5 times higher for older adults compared to younger adults.

Category	16–64 years*	≥ 65–84 years*	≥ 85 years*
Responses per 1,000	49.7	158.5	482.8
Transports per 1,000	37.2	134.7	427.8
Non-transport rate per 1,000	11.9	20.7	47.9

*The denominators were derived from Canada population estimates (2010)¹²: 651,475 (16–64 years), 130,507 (65–84 years), 20,653 (≥85 years).

Characteristic*	Transports (n = 26,420) (87.7%)	Non-transports (n = 3,693) (12.3%)	p-value
Age (± SD)	80.15 (8.42)	78.32 (8.51)	p = 0.042
Female, n (%)	15,545 (57.3)	2,027 (54.9)	p < 0.001
Rural, n (%)	8,351 (38.4%)	701 (35%)	p = 0.003
CTAS, mode (n)	3 (12,008)	5 (1,750)	p < 0.001
Co-morbidities	4.2 (3.2)	3.3 (2.6)	p < 0.001
Medications	6.6 (4.5)	5.2 (3.9)	p < 0.001
Total Time	82.8 (249.1)	32.6 (52.5)	p < 0.001
Scene Time	24.2 (188.5)	32.6 (52.5)	p = 0.008
Interventions, n (%)			
No Intervention	10,363 (38.4)	3,283 (88.9)	p = 0.001
2 or more	12,466 (46.2)	206 (5.6)	

*Values indicate mean and standard deviation unless indicated otherwise.

Given that the aging population will place a greater demand on EMS systems and that it is unlikely that EMS budgets will increase at the same rate to meet those demands, there is a growing need to improve EMS system efficiency and effectiveness, or to better define alternatives to EMS transport. To that end, our study extends the knowledge of previous work by quantifying the non-transport rate, a measure often missed in other analyses.⁴ We showed that non-transports accounted for 12% of the older adult call volume. This represents a significant utilization of EMS resources, as these calls had a 30% longer on-scene time than transport, during which EMS availability is reduced to the service area without any obvious benefit to the patient. We also found that 23% of our study population were triaged by EMS as CTAS 4 or 5, i.e., seemingly minor complaints, and that EMS provided no interventions for 38.4% of transported patients. While we did not follow these lower acuity CTAS 4 and 5 patients to determine if they needed ED

management, all three groups (lower acuity CTAS 4, 5 and the no intervention group) might be more effectively managed by modified or even non-EMS systems.

In NS, provincial emergency care is aiming to provide better care for older adults through improved assessment and efficient care that is congruent with the patient's care goals^{14,15} and also to align EMS with integrated networks of emergency care to improve care continuity.¹⁶ There is a movement towards expanded-scope EMS, where increased emergency or primary care is delivered onsite, thereby avoiding transport to the ED.¹⁷⁻¹⁹ Other innovative ideas of managing low-priority EMS calls include secondary telephone triage²⁰, paramedic referral services²¹, and community paramedic models¹⁷. Either individually or in combinations, the implementation of such innovative programs can allow for EMS services to adapt to the changing health care needs of the population.

LIMITATIONS

There are limitations associated with the use of administrative data. Even so, there were no missing data for age (it is a mandatory field for paramedics to complete). There were a few cases where sex (n = 25, <0.1%) or the transport decision (n = 106 cases, <0.1%) were missing. The accuracy of the paramedic-documented CTAS was not validated, so it is possible that severity was under-estimated. Whether CTAS is a valid measure of illness severity in the non-transported patient should be evaluated further. Unfortunately, postal codes were missing for 6,903 cases (22.5%), precluding analysis. The ePCR data are not linked to hospital records, so patient outcomes were not known. This analysis looked at one calendar year of EMS use, so it is possible that the results may have been affected by conditions that were unique to that year, but to our knowledge this was not the case.

CONCLUSIONS

We confirmed that older adults use EMS services at higher rates than younger populations, and that this increases with age and is consistent with other industrialized populations. We also found that the low-priority and non-transport calls by older adults consumed considerable resources in this provincial system. Hence, these might be the areas most malleable

to the innovative changes that are needed to meet the challenges facing EMS systems.

Acknowledgments: We would like to express our gratitude to the EHS Operations Management IT services for data query.

Competing Interests: J. Goldstein was supported by a student research award from the Nova Scotia Health Research Foundation and funding from the Atlantic Regional Training Center. No other competing interests were reported.

REFERENCES

1. Milan A. Age and sex structure: Canada, provinces and territories, 2010. No. 91-209-X. Ottawa, ON: Statistics Canada; 2011.
2. Aminzadeh F, Dalziel WB. Older adults in the emergency department: A systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann of Emerg Med* 2002;39(3):238-47.
3. McConnell CE, Wilson RW. The demand for prehospital emergency services in an aging society. *Soc Sci and Med* 1998;46(8):1027-31.
4. Shah MN, Bazarian JJ, Lerner B, et al. The epidemiology of emergency medical services use by older adults: an analysis of the national hospital ambulatory medical care survey. *Acad Emerg Med* 2007;14(5):441-8.
5. Clark MJ, FitzGerald G. Older people's use of ambulance services: a population based analysis. *J Acad Emerg Med* 1999;16(2):108-11.
6. Keskinoglu P, Sofuoglu T, Ozmen O, et al. Older people's use of pre-hospital emergency medical services in Izmir, Turkey. *Arch Geront Geriatr* 2010;50(3):356-60.
7. Lowthian JA, Jolley DJ, Curtis AJ, et al. The challenges of population ageing: accelerating demand for emergency ambulance services by older patients, 1995-2015. *Med J Aust* 2011;194(11):574-8.
8. Meisel ZF, Pines JM, Polsky D, et al. Variations in ambulance use in the United States: the role of health insurance. *Acad Emerg Med* 2011;18(10):1036-44.
9. Svenson JE. Patterns of use of emergency medical transport: A population based study. *Am J Emerg Med* 2000;18(2):130-4.
10. Tangherlini N, Pletcher MJ, Covec MA, et al. Frequent use of emergency medical services by the elderly: a case-control study using paramedic records. *Prehosp Dis Med* 2010;25(3):258-64.
11. Moss ST, Chan TC, Buchanan J, et al. Outcome study of prehospital patients signed out against medical advice by field paramedics. *Ann Emerg Med* 1998;31(2):247-50.
12. Statistics Canada. Table 051-0001 Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database). Available at: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0510001&tabMode=dataTable&srchLan=-1&p1=-1&p2=9#customizeTab> (accessed September 8, 2012).

13. Emergency Health Services Nova Scotia. Annual report 2010/11. Available at: <http://www.gov.ns.ca/health/ehs/> (accessed January 25, 2012).
14. Ross J. The patient journey through emergency care in Nova Scotia: a prescription for new medicine. Nova Scotia Department of Health and Wellness; 2010. Available at: <http://novascotia.ca/DHW/publications/Dr-Ross-The-Patient-Journey-Through-Emergency-Care-in-Nova-Scotia.pdf>.
15. Jensen JL, Travers AH, Bardua DJ, et al. Transport outcomes and dispatch determinants in a paramedic long-term care program: a pilot study. *CJEM* 2013;15(4):206-13.
16. Martinez R, Carr B. Creating integrated networks of emergency care: from vision to value. *Health Aff* 2013; 32(12):2082-90.
17. Mason S, Knowles E, Colwell B, et al. Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial. *BMJ* 2007;335(7626):919.
18. Gray JT, Walker A. Avoiding admissions from the ambulance service: a review of elderly patients with falls and patients with breathing difficulties seen by emergency care practitioners in South Yorkshire. *Emerg Med J* 2008; 25(3):168-71.
19. Arendts GM, Sim Johnston S, et al. ParaMED Home: a protocol for a randomised controlled trial of paramedic assessment and referral to access medical care at home. *BMC Emerg Med* 2011;11:7, doi: [10.1186/1471-227X-11-7](https://doi.org/10.1186/1471-227X-11-7).
20. Eastwood K, Morgans A, Smith K, et al. Secondary triage in prehospital emergency ambulance services: a systematic review. *Emerg Med J* 2014; epub, doi: [10.1136/emered-2913-203120](https://doi.org/10.1136/emered-2913-203120).
21. Newton M, Tunn E, Moses I, et al. Clinical navigation for beginners: the clinical utility and safety of the paramedic pathfinder. *Emerg Med J* 2014;31:e29-34, doi:[10.1136/emered-2012-202033](https://doi.org/10.1136/emered-2012-202033).