



Original Article

Ambulance Use, Health Outcomes, and Costs for Emergency Department Visits for Primary Diagnosis of Syncope in Canada

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ABSTRACT

Background: Syncope is a common presentation to the emergency department (ED), yet little is known regarding patient mode of arrival.

Methods: We identified patients ≥ 20 years old who presented to the ED with a primary diagnosis of syncope in Alberta and Ontario, Canada, between 2010 and 2016. Outcomes included 30-day in-hospital mortality, ED revisits, and rehospitalizations according to mode of arrival and discharge status. The estimated cost for ambulance use was calculated based on the provincial rates (Alberta CAD\$385 and Ontario \$240).

Results: A total of 271,601 syncope presentations to the ED were identified and 60.7% arrived by ambulance. A total of 76.3% ($n = 125,793$) of ambulance users and 87.0% of self-presenters ($n = 92,845$) were discharged from the ED. Regardless of mode of arrival, discharged patients were younger with fewer comorbidities.

RÉSUMÉ

Contexte : La syncope est une manifestation courante chez les patients qui se présentent au service des urgences; pourtant, on en sait peu sur la façon dont ces patients arrivent à l'hôpital.

Méthodologie : Nous avons examiné les dossiers de patients âgés de 20 ans ou plus qui se sont présentés au service des urgences d'hôpitaux de l'Alberta et de l'Ontario, au Canada, et qui ont reçu un diagnostic de syncope entre 2010 et 2016. Les issues évaluées comprenaient la mortalité hospitalière à 30 jours, les nouvelles visites au service des urgences et les réadmissions à l'hôpital en fonction du mode d'arrivée et du statut au moment de la sortie de l'hôpital. Le coût estimatif des services d'ambulance a été calculé à partir des tarifs provinciaux (385 \$ en Alberta et 240 \$ en Ontario).

Résultats : En tout, 271 601 cas de syncope ont été recensés dans les services des urgences; dans 60,7 % des cas, le patient est arrivé en

Syncope is a frequent presentation to the emergency department (ED), accounting for up to 1% of total ED visits and nearly 2% of all hospital admissions.¹ In Canada, over CAD\$530 million was spent over 8 years for syncope-related costs, with the highest proportion (\$317 million) attributed to patients who presented to the ED and were directly discharged.² These costs factored hospital expenditures only and did not include ambulance transportation. Limited studies have examined mode of arrival (ambulance vs self-presentation) for syncope patients presenting to the ED, outcomes according to

the mode of arrival, and discharge status and costs. Therefore, the objectives of this study were to examine the rate of ambulance use, 30-day in-hospital mortality, ED visits, and rehospitalizations, and to estimate costs associated with ambulance use. These data may help to identify low-risk patients arriving by ambulance where targeted strategies may reduce unnecessary use, resulting in cost savings.

Methods

All patients ≥ 20 years of age presenting to the ED with a primary diagnosis of syncope were identified using International Classification of Diseases, 10th Revision code R55 in Canadian provinces of Alberta (AB) and Ontario (ON) between April 2010 and March 2016. The data sources included the National Ambulatory Care Reporting System, which captures ED visits, of which AB and ON have 100% mandatory reporting, and the Canadian Institute of Health Information discharge abstract database, which records all admissions to acute care facilities in Canada except Québec. Patients were

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Ethics Statement: This study was approved by the Research Ethics Board at the University of Alberta.

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See page 368 for disclosure information.

Compared with ambulance users admitted, those discharged had lower in-hospital mortality (0.2% vs 3.5%, $P < 0.001$), ED revisits (4.4% vs 10.4%, $P < 0.001$), and rehospitalizations (3.6% vs 10.7%, $P < 0.001$). Discharged self-presenters also had significantly lower outcomes ($P < 0.001$, for each outcome) compared with admitted self-presenters. The estimated cost for ambulance use among patients discharged from the ED was \$33,137,735.

Conclusion: A majority of syncope patients arrived to the ED by ambulance, and over 3 quarters were directly discharged home. Although discharged patients had a favourable short-term prognosis, they incurred high transportation costs. Strategies aimed at preventing unnecessary ambulance use are needed.

excluded from the study for the following reasons: (1) residing outside of AB or ON at the time of the ED visit, (2) missing identification, (3) arriving by air or transfer from another facility, and (4) discharged dead from the ED visit.

Patients were categorized based on mode of arrival (ambulance user or self-presenter) and based on ED discharge status. The ED discharge status was defined as hospitalized if the patient was hospitalized within 48 hours from the ED visit, or discharged home. Outcomes included 30-day in-hospital mortality, ED revisits, and rehospitalization. All 30-day outcomes were evaluated within 30 days from the index ED visit for patients with complete follow-up time. For hospitalized patients, the 30-day rehospitalization outcome excluded the hospitalization after the ED visit resulting from their presentation. Cost was calculated based on ambulance transportation fees (\$385 in AB³ and \$240 in ON⁴). The length of stay in the ED was also calculated for ambulance users discharged directly from the ED based on arrival and discharge times recorded on the chart. Patient comorbidities and Charlson comorbidity score (0, 1-2, 3-4, ≥ 5) were calculated based on all diagnosis fields in all hospitalizations identified within 2 years before the ED visit.

Statistical analysis

Patient characteristics (age, sex, urban residence, and comorbidities) were compared between 4 groups: ambulance users discharged home, ambulance users admitted, self-presenters discharged home, and self-presenters admitted. Categorical variables were presented using counts and percentages. Continuous variables were presented using mean and standard deviation. The unit of the comparison analysis was the ED visit, and patients with multiple visits were included multiple times.

Outcomes were compared between ambulance users and self-presenters, and between the 4 groups using the χ^2 test. In

ambulance. Au total, 76,3 % ($n = 125\,793$) des patients arrivés en ambulance et 87,0 % des patients qui se sont présentés d'eux-mêmes ($n = 92\,845$) ont reçu leur congé du service des urgences. Quel que soit leur mode d'arrivée, les patients qui ont reçu leur congé étaient plus jeunes et présentaient moins d'affections concomitantes. Chez les patients arrivés en ambulance, ceux qui ont reçu leur congé ont affiché des résultats inférieurs à ceux qui ont été admis à l'hôpital quant à la mortalité hospitalière (0,2 % vs 3,5 %, $p < 0,001$), aux nouvelles visites au service des urgences (4,4 % vs 10,4 %, $p < 0,001$) et aux réadmissions à l'hôpital (3,6 % vs 10,7 %, $p < 0,001$). Dans le cas des patients qui se sont présentés d'eux-mêmes, l'incidence des issues évaluées était aussi plus faible chez ceux qui ont reçu leur congé ($p < 0,001$ pour chaque issue) que chez ceux qui ont été admis à l'hôpital. Le coût estimatif du recours aux services d'ambulance par les patients qui ont reçu leur congé du service des urgences se chiffrait à 33 137 735 \$.

Conclusion : La majorité des patients subissant une syncope sont arrivés au service des urgences en ambulance, et plus des trois quarts ont reçu directement leur congé à la maison. Bien que le pronostic à court terme des patients ayant reçu leur congé du service des urgences ait été favorable, ces patients ont dû payer des frais de transport élevés. Des stratégies visant à prévenir le recours inutile aux services d'ambulance s'imposent.

multivariate analyses, we compared ambulance users admitted, ambulance users discharged home, and self-presenters admitted with self-presenters discharged home using logistic regression, adjusting for baseline demographic variables (age, gender, urban residency, and comorbidities). For this analysis, only 1 syncope ED visit per patient was selected, the earliest ED visits identified during the study period. Data analysis was generated using SAS software, Version 9.4 of the SAS system for Windows x64 based system.

Results

A total of 281,308 syncope presentations were identified (54,130 in AB and 226,998 in ON). After exclusions, the final study cohort consisted of a total of 271,601: 51,512 ED visits for syncope in AB and 220,089 ED visits for syncope in ON (Supplemental Fig. S1).

Overall, the 30-day outcomes, based on the index ED visit, revealed a 0.7% ($n = 1546$) in-hospital mortality, 5.6% ($n = 13,238$) ED revisit rate, and 4.6% ($n = 10,744$) rehospitalization rate.

Baseline characteristics according to mode of arrival and discharge status

Over the study period, 60.7% ($n = 164,831$) of 271,601 syncope presentations to the ED arrived by ambulance. Table 1 demonstrates baseline characteristics according to mode of arrival and discharge status. A total of 76.3% of ambulance users and 87.0% ($n = 92,845$) of self-presenters were discharged home directly from the ED. Compared with self-presenters, ambulance users were older (mean age, 63.8 vs 50.8 years), more often male sex (47.0% vs 44.6%), more frequently resided in urban locations (86.9% vs 82.8%), and had a higher comorbidity burden. Compared with admitted ambulance users, discharged ambulance users were

Table 1. Baseline characteristics according to mode of arrival

| Characteristic | Ambulance user (n = 164,831) | | Self-presenter (n = 106,770) | |
|-----------------------------|------------------------------|---------------------------|------------------------------|---------------------------|
| | Discharged (n = 125,793) | Hospitalized (n = 39,038) | Discharged (n = 92,845) | Hospitalized (n = 13,925) |
| Mean age (y) (SD) | 60.4 (21.3) | 74.8 (14.6) | 48.2 (20.2) | 67.8 (17.0) |
| Male gender (%) | 45.3 | 52.3 | 43.1 | 53.6 |
| Urban residency (%) | 87.2 | 85.9 | 82.8 | 82.2 |
| Comorbidities, n (%) | | | | |
| Myocardial infarct | 3115 (2.5) | 2523 (6.5) | 1275 (1.4) | 722 (5.2) |
| Congestive heart failure | 3371 (2.7) | 3629 (9.3) | 1180 (1.3) | 1008 (7.2) |
| Peripheral vascular disease | 1121 (0.9) | 925 (2.4) | 469 (0.5) | 263 (1.9) |
| Cerebrovascular disease | 3175 (2.5) | 2010 (5.1) | 990 (1.1) | 459 (3.3) |
| Dementia | 3353 (2.7) | 1866 (4.8) | 397 (0.4) | 256 (1.8) |
| Chronic pulmonary disease | 3046 (2.4) | 2615 (6.7) | 1422 (1.5) | 774 (5.6) |
| Renal disease | 2001 (1.6) | 1829 (4.7) | 836 (0.9) | 538 (3.9) |
| Liver disease | 589 (0.5) | 432 (1.1) | 273 (0.3) | 121 (0.9) |
| Diabetes | 6871 (5.5) | 5416 (13.9) | 2986 (3.2) | 1669 (12.0) |
| Cancer | 3198 (2.5) | 2168 (5.6) | 1585 (1.7) | 739 (5.3) |
| Charlson score (%) | | | | |
| 0 | 85.1 | 66.4 | 91.9 | 73.0 |
| 1, 2 | 9.2 | 18.3 | 5.0 | 14.7 |
| 3, 4 | 3.6 | 9.3 | 1.8 | 6.9 |
| ≥ 5 | 2.1 | 6.0 | 1.2 | 5.4 |

SD, standard deviation.

younger, more frequently male, more frequently resided in an urban location, and had lower comorbidity burden. Similar baseline characteristics were observed from self-presenters who were discharged home compared with those self-presenters admitted to the hospital.

Outcomes according to mode of arrival

Ambulance users had higher rates of 30-day in-hospital mortality (0.9% vs 0.3%, $P > 0.001$) and 30-day rehospitalization (7.7% vs 3.5%, $P < 0.001$) compared with self-presenters. Compared with those admitted, discharged ambulance users had lower rates of 30-day in-hospital mortality (0.2% vs 3.5%, $P < 0.001$), ED revisits (4.4% vs 10.4%), and rehospitalization (3.6% vs 10.7%, $P < 0.001$, Fig. 1). Discharged self-presenters had significantly lower rates of all 3 outcomes when compared with admitted self-presenters.

After multivariate logistic regression, admitted ambulance and self-presenters had a higher chance of dying (odds ratio [OR]: 19.5 and 11.24, $P < 0.001$, respectively), requiring the ED revisit (OR: 1.55 and 2.21, $P < 0.001$), and rehospitalization (OR: 2.19 and 2.45, $P < 0.001$). Discharged ambulance users were independently associated with increased mortality (OR: 1.52, $P = 0.0065$) and rehospitalization (OR: 1.06, $P = 0.0315$), and with decreased ED revisit (OR: 0.88, $P < 0.001$) (Supplemental Table S1).

Costs

The estimated cost of ambulance transportation (based on provincial ambulance fees) for patients discharged from the ED was \$33,137,735. The estimated cost for ambulance transportation for admitted patients was \$10,173,000. Discharged ambulance users spent a mean of 5.2 (± 3.6) hours in

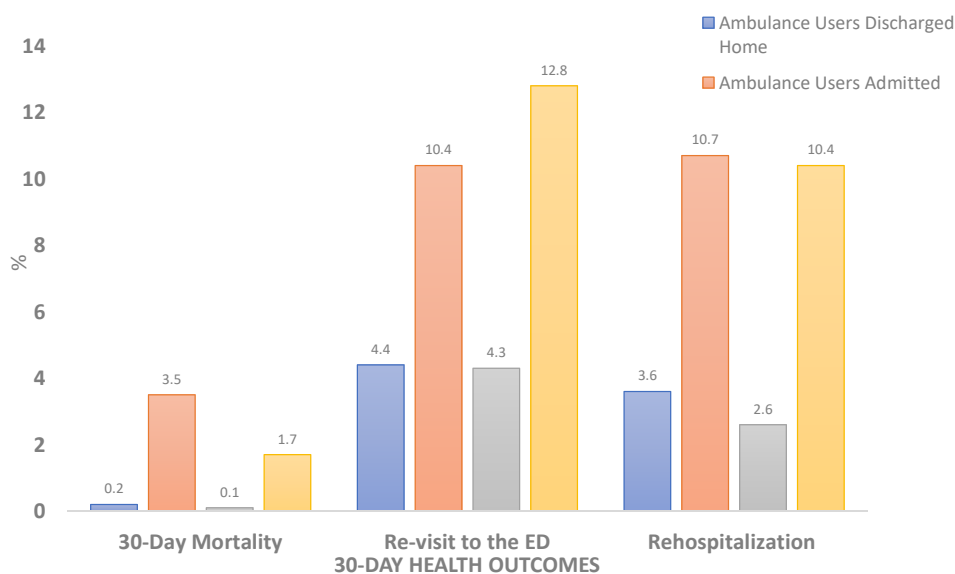


Figure 1. Thirty-day health outcomes for syncope patients presenting to the emergency department (ED) according to mode of arrival.

the ED. Discharged self-presenters spent a mean of 14.5 (± 13.5) hours in the ED.

Discussion

In this large cohort of patients presenting to the ED with a primary diagnosis of syncope, we found that nearly two-thirds of all syncope presentations arrived by ambulance and over 75% were discharged home directly from the ED. Discharged patients arriving by ambulance had a favourable short-term prognosis; however, they incurred high transportation costs.

A previous nationwide study⁵ demonstrated that nearly 64% of patients hospitalized with a primary diagnosis of syncope arrived by ambulance and ambulance use rate increased by nearly 8% over 12 years. This study found nearly the same percentage of syncope patients presenting to the ED present via ambulance; however, only a small fraction are admitted to the hospital. Regardless of mode of arrival, hospitalized syncope patients represent an older population with a higher comorbidity burden as compared with those discharged home directly from the ED. As previous research has demonstrated⁵⁻⁷ for both syncope and other cardiovascular conditions, older patients frequently have more comorbidities and potentially more experience with the health care system and therefore may call the ambulance more often for rapid evaluation when presenting with syncope. This may be a possible explanation for the higher mean ages and comorbidity burden seen amongst ambulance users and self-presenters. Furthermore, urban residence has previously been shown to be an independent predictor of ambulance use in syncope;⁵ our data are consistent with these findings.

The vast majority of syncope patients presenting to the ED were discharged directly from the ED and were found to be low risk with favourable 30-day outcomes. Previous data have shown that the vast majority of hospitalized syncope patients are low risk;^{5,8} however, our study is novel in demonstrating that the majority of patients presenting to the ED via ambulance are also low risk and safe to be discharged home. These data would suggest that risk stratification in the ED is appropriately identifying high- and low-risk patients with favourable outcomes for discharged patients compared with hospitalized syncope patients. This is further supported by multivariate analysis demonstrating that admitted patients (ambulance and self-presenters) are higher risk, whereas ambulance users discharged home are lower risk. Interestingly, there was a substantial rehospitalization rate for both discharged ambulance users and self-presenters. There are several possibilities for this; this may reflect that patients discharged are more likely to be admitted if they present a second time. Another possibility is the paucity of outpatient syncope-care pathways/resources, which may influence the decision to admit for inpatient workup vs outpatient workup.

From a cost perspective, ambulance utilization and subsequent ED stay account for significant resource utilization. Specifically, the patient cost for ambulance use alone for patients who were discharged directly from the ED was over \$12 million. Ambulance users discharged from the ED also spent over 5 hours in the ED, and therefore, when factoring in the ambulance crew's stay with the patient in the ED until a bed is available, the cost to the health care system is even higher. Significant costs are incurred with syncope ED

presentations; previous data² have demonstrated that costs for syncope patients discharged directly from the ED were over \$300 million and those admitted over \$530 million over an 8-year period. Although this study looked at 2 provinces, there was a large range of potential cost savings as the cost for ambulance transportation varied to up to \$530.

Given that the majority of ambulance users for syncope presentations are low risk, significant cost-savings opportunities exist if unnecessary transportation to the ED can be avoided. This may be achieved by having ambulance crews apply a risk-assessment score in the field to determine if a patient should be transported. Another strategy may involve risk stratification done via a phone helpline with low-risk patients advised to follow up with their family physician or referred to an outpatient syncope clinic. In addition, the development of syncope-care pathways such as the Syncope Unit in Europe⁹ have demonstrated substantial reductions in syncope-related presentations, hospitalizations, and unnecessary diagnostic testing, resulting in significant cost savings. Finally, population-based education strategies may be employed to help patients better understand when to activate emergency medical services.

Study limitations

This study has several limitations. First, the study data were obtained from administrative datasets and are therefore may be subject to misclassification. Second, the Charlson comorbidity score was calculated using the secondary diagnosis fields of the hospitalization record that relies on accuracy of completion of the chart. Third, generalizability to other provinces is limited given each province has a different copay system. Fourth, patient mortality was only available from hospital discharges.

Conclusion

Over a 6-year period, nearly two-thirds of all syncope presentations to the ED arrived by ambulance, and regardless of mode of arrival, the majority are discharged home directly from the ED with favourable short-term prognosis. Significant cost-saving opportunities exist by reducing unnecessary ambulance and ED utilization among low-risk syncope patients.

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Disclosures

The authors have no conflicts of interest to disclose.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.04.012>.