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Morbidity and Mortality Associated with Prehospital "Lift-assist" Calls

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Abstract

Introduction: When an individual requires assistance with mobilization, emergency medical services (EMS) may be called. If a patient does not receive treatment on scene and is not transported to hospital, these are referred to as "Lift Assist" (LA) calls. It is possible this need for assistance represents a subtle onset of a disease process or decline in function. Without recognition or treatment, the patient may be at risk for recurrent falls, repeat EMS visits or worsening illness. **Objective**: To examine the 14-day morbidity and mortality associated with LA calls and determine factors that are associated with increased risk of these outcomes. **Methods**: All LA calls from a single EMS agency were collected over a one year study period (January–December 2013). Calls were linked with hospital records to determine if LA patients had a subsequent visit to the emergency department (ED), admission, or death within 14 days of the LA call. Logistic regression analyses were completed to determine factors predicting ED visit or hospital admission within 14 days of the LA call. **Results**: Of 42,055 EMS calls, 804 (1.9%) were LAs. These calls were for 414 individuals; 298 (72%) patients had 1 LA, and 116 (28%) patients had >1 LA call. There were 169 (21%) ED visits, 93 (11.6%) hospital admissions and 9 (1.1%) deaths within 14 days of a LA call. Patient age ($p = 0.025$) significantly predicted ED visit. Patient age ($p = 0.006$) and an Ambulance Call Record missing at least 1 vital sign ($p = 0.038$) significantly predicted hospital admission. **Conclusions**: LA calls are associated with short-term morbidity and mortality. Patient age was found to be associated with these outcomes. These calls may be early indicators of problems requiring comprehensive medical evaluation and thus further factors associated with poor outcomes should be determined. **Key words:** emergency medical services; prehospital emergency care; falls; lift assist

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Introduction

Background

When an individual requires assistance with mobilization, emergency medical services (EMS) may be called to assist. If this individual is assisted up to a more mobile position from the ground by paramedics, but not treated or brought to hospital for further medical attention, then the call is coded as a "lift assist" (LA).[1] Although this code and terminology is used by many different EMS services, there is a paucity of data regarding these calls and patients. Cone et al. examined the number of LA calls for a single EMS agency over a 5-year period and found that 4.8% of their agency's calls were coded as LA[1]. Just over half (55%) of these LA patients were subsequently brought to hospital by EMS within 30 days of their initial LA call. However, the outcomes of these LA patients following their emergency department (ED) visit, is unknown.

It is possible that a proportion of LA cases represent a sentinel event, signifying a covert disease, such as a urinary tract infection, or the LA could represent a marker of deterioration in the patient's functional ability.[2,3] One of the biggest challenges for EMS is to determine the specific nature or cause for the patient's inability to mobilize. Although information on LA calls is sparse, there has been data reporting increased rates of hospital admission and death in non-transported fall-protocol patients in the UK.[4] However, the authors examined only patients who were 65 years of age and greater and in this EMS system, paramedics are able to make disposition decisions for the patients in their care. Given the lack of data on this patient group as a whole, we sought to examine the outcome of all LA patients in our EMS system by examining the 14-day morbidity and mortality of patients following their initial LA call and to determine risk factors associated with these outcomes.

METHODS

Study Design

This was a retrospective chart review of all adult patients (≥18 years) who had a LA call over a one-year period (January–December 2013) from a single EMS service. Patient data was collected from both the prehospital ambulance call report (ACR), as well as the in-hospital patient chart in order to determine morbidity, mortality as well as factors associated with these outcomes. This study was approved by the Health Sciences Research Ethics Board at Western University.

Study Setting

This study was conducted in a single county in the city of London, ON Canada; which has a population of approximately 440 000.[5] The population is served by a single EMS service with an annual call volume of approximately 40,000 calls per year.

Data Collection and Processing

All LA calls were identified via their final problem code of "lift assist," which is determined by the attending paramedic. In the event that a LA call was coded incorrectly, all non-transport calls were manually screened and reviewed to see if they met the definition for a LA, namely: When an individual is assisted up to a more mobile position from the ground by paramedics, but not treated or brought to hospital for further medical attention. These patients were then cross-referenced with local hospital health records to see if they had any of: 1) an Emergency Department (ED) visit, 2) admission to hospital, and 3) death while in hospital, all within 14 days of the original LA call. Cross-referencing was performed using the patient's demographic information including full name, birthdate, address and unique identifier of Ontario Health Insurance Plan (OHIP) card, if available. EMS calls within the specified time-frame (January 1 2013–January 14, 2014) that resulted in a prehospital termination of resuscitation or obviously-dead non-transport calls were also examined. This was done to capture as many prehospital deaths as possible, within the study region.

A study member collected data from electronic and paper charts and data was entered directly into a study-specific Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, Washington). Descriptive statistics were summarized using means and standard deviations (SDs), medians and interquartile ranges (IQRs), or proportional differences, where appropriate. Statistical analysis was conducted using SPSS v 23 (IBM Corporation). Variables for inclusion were determined based on data available on the ACR as well as consensus of 4 EMS medical directors' opinions; and included bradycardia (heart rate <60 beats per minute), tachycardia (heart rate >99 beats per minute), systolic blood pressure <100 mmHg, systolic blood pressure >140 mmHg, systolic blood pressure >180 mmHg, tachypnea (respiratory rate >20 per minute), hypoxemia (SpO2 < 90%), extremes of temperature (>37.9°C or <36°C), hypoglycemia (capillary blood glucose <72 mg/dL [4 mmol/L]), hyperglycemia (capillary blood glucose >360 mg/dL [20 mmol/L]), Glasgow Coma Scale (GCS) <13 points, documented medical history of cardiac disease, respiratory disease, hypertension, diabetes, stroke/TIA, seizure, and psychiatric conditions; as well as patient age and sex. Early in the data collection phase the study group noted a higher than expected number of missing vital sign values. The study group hypothesized that the presence of one or more vital signs might indicate an incomplete assessment and be associated with the regression analysis outcomes. Missing vitals was added to the variable list for regression analysis.

Univariate analysis of each potential risk factor versus both outcomes measures (ED visit or hospital admission within 14 days) was completed. Risk factors with a p-value of <0.10 were considered for inclusion in the multivariable logistic regression model for each outcome measure. Variables with a high proportion of missing values were excluded from the model. Multivariate logistic regression models were used to determine risk factors independently associated with ED visit or hospital admission within 14 days of LA call.

RESULTS

Patient Demographics

There were 42,055 EMS calls in the study period; 804 (1.9%) were LA calls. These calls were for 414 individuals; 298 (72%) patients had 1 LA, and 116 (28%) patients had greater than 1 LA call. The number of multiple LA calls per patient ranged from 2 to 34 with a median of 3 (IQR = 2, 4.25). Mean (SD) age was 74.8 (14.1) years and 45% were male. Age (p = 0.072) and sex (p = 0.396)

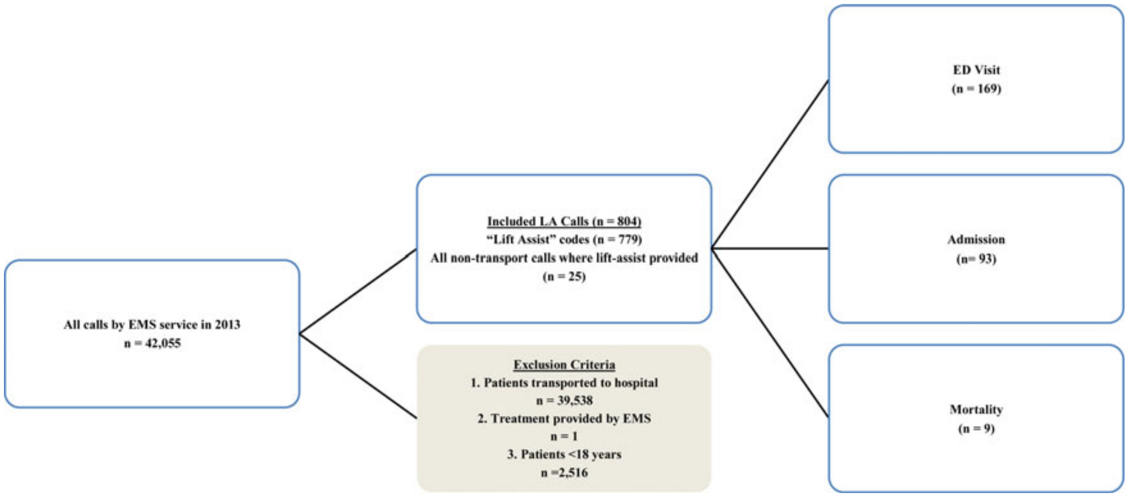

Figure 1. Study flow diagram with morbidity; Emergency Department (ED) Visit, Hospital admission, and in-hospital mortality within 14 days of initial LA call. *LA = *lift assist*; EMS = *Emergency Medical Services*; ED = *Emergency Department*.

did not differ between those who had only 1 LA in the time period, versus those with greater than 1 LA.

Morbidity and Mortality

Of the 804 LA calls, there were 169 ED visits, 93 admissions to hospital and 9 deaths within 14 days of the initial LA. This represents 21%, 11.6%, and 1.1% of all LA calls resulting in ED visit, admission to hospital, and death, respectively, within 14 days of their EMS call (Figure 1).

For those that were admitted, the average length of stay (LOS) was 7 days (IQR = 4, 15.5 days). The most common admitting service was a medical specialty with 85 (91.4%) admissions (Table 1). The most common definitive discharge diagnosis was infection: 31 (33.3%), fractures: 8 (8.6%), cancer 9 (9.7%) (Table 2). Of those admitted to hospital, 18 (19.4%) were discharged to new long-term care homes, 42 (45.2%) were discharged home with new home care supports and 11 (11.8%) patients died during their hospitalization (9 of the 11 died within 14 days of LA call).

No out of hospital deaths of LA-patients were found upon examination of the 75 termination of resuscitation or obviously dead patients in the region from January 14, 2013 to January 14, 2014.

Table 1. Admitting services of patients admitted to hospital: List of admitting services for the 93 patients admitted to hospital within 14 days of initial LA call

Admitting Service	Number (%) of Admissions
Medical	89 (91.4)
Surgical	7 (7.5)
ICU	1 (1.1)
Total	**93**

*LA = *lift assist*; ICU = *intensive care unit*.

Vital Signs

Vital sign documentation was recorded for all 804 calls. The results of the abnormal vitals collected are provided in Table 3. Of the 160 calls for patients with diabetes, 11 (1.4%) calls had documented hypoglycemia (blood glucose <72 mg/dL [4 mmol/L]), and 2 (0.2%) of calls had documented hyperglycemia (blood glucose >360 mg/dL [20mmol/L]). No calls had patients with GCS of less than 13.

Of the ACRs examined, 113 (14.0%) were noted to be missing at least one vital sign. Regarding those charts with missing documentation, 28 (24.8%) were missing more than one vital sign and 44 (27.5%) of 160 calls were missing a blood glucose (BG) in diabetic patients. The most common vital signs missing was temperature, missing from documentation on 105 (13.0%) calls (Table 4). Of these missing vital signs and blood glucose omissions, only 15 (15.4%) and 3 (1.9%) were explained by patient refusal.

Table 2. Discharge diagnosis sub-type of patients admitted to hospital within 14 days of LA call

Discharge Diagnosis	Number (%)
Infection	31 (33.3)
Fall	11 (11.8)
Cancer complication or new diagnosis of cancer	9 (9.7)
Fracture	8 (8.6)
Miscellaneous	34 (36.6)
Total	**93**

Grouped diagnoses based on pathology of patients that were admitted to hospital within 14 days of initial LA. Infection (influenza, sepsis, urinary, pulmonary, and arthrogenic source), falls (mechanical, recurrent, Parkinson's Disease induced and medication induced hypotension causing mechanical fall), cancer related diagnoses (dehydration and a new diagnosis of cancer in 5 of 9 patients), fractures (humerus, hip, pelvic, femur, tibia, and L1 body compression fracture). These were all new diagnoses of fracture at the time of admission. *LA = *lift assist*.

TABLE 3. Vital sign abnormalities in the lift assist population

Vital sign	Number (%) of calls
Bradycardia	14 (1.7)
Tachycardia	86 (10.7)
Hypotension	12 (1.5)
Hypertension	276 (34.3)
Extreme hypertension	16 (2.0)
Hypoxia	1 (0.1)
Extremes of temperature	49 (6.1)

Number and percentage of LA calls wherein abnormal vital signs were documented at end of patient contact. Wherein the following physiologic values were used: bradycardia (heart rate <60 beats per minute), tachycardia (Heart rate >99 beats per minute), hypotension (systolic blood pressure <100 mmHg), hypertension (systolic blood pressure >140 mmHg), extreme hypertension (systolic blood pressure >180 mmHg), tachypnea (respiratory rate >20 per minute), hypoxemia (SpO2 <90%), extremes of temperature (>37.9°C or <36°C). Percentage based on our study population of 804 LA calls. LA = *lift assist*.

Logistic Regression Results

Multivariate logistic regression models were conducted for each outcome. For the outcome of ED visit the model included: age, sex, documented history of cardiac disease on ACR, or blood glucose not documented on the ACR of a patient with reported diabetes. Documented histories of respiratory disease, hypertension, diabetes, stroke/TIA, seizure, and psychiatric conditions were omitted from the model due to a number of missing variables. This was done based on a *post hoc* power calculation. Any variable that did not meet the threshold for the needed number of observations was excluded from analysis. Bradycardia (heart rate <60 beats per minute), systolic blood pressure <100 mmHg, systolic blood pressure >140 mmHg, systolic blood pressure >180 mmHg, tachypnea (respiratory rate >20 per minute), hypoxemia (SpO2 <90%), extremes of temperature (>37.9°C or <36°C), hypoglycemia (capillary blood glucose <72 mg/dL [4 mmol/L]), hyperglycemia (capillary blood glucose >360 mg/dL [20 mmol/L]), GCS <13 points, and missing at least one vital sign on documentation were excluded from the final model. Patient age (OR 1.02, 95% CI 1.01–1.02, p = 0.02) was independently associated with an ED visit within 14-days of original LA call (Table 5). History of cardiac disease, sex, and missing BG were included in the model based on interaction with age but were not predictive of the outcome. The model correctly predicted 81.5% of cases.

TABLE 4. Missing vital signs at LA call by category

Vital Sign	Number (%)
Heart rate	12 (1.5)
Blood pressure	16 (2)
Respiratory rate	18 (2.2)
Oxygen saturation	22 (2.7)
Temperature	107 (13.3)

Number and percentage of vital sign category for those LA calls wherein vital signs were missing. Of the 804 LA calls made, 97 were missing at vital sign documentation. *LA = *lift assist*.

TABLE 5. Variables independently associated with recurrent ED visits for any reason within 14 days of the original LA call as determined by a multivariate logistic regression model

Variable	Odds Ratio	95% Confidence Interval	p-value
Age	1.02	1.00–1.03	0.02
History of Cardiac Disease	0.68	0.45–1.02	0.06
Gender	0.96	0.66–1.39	0.83
Missing BG	0.85	0.39–1.83	0.67

*Wherein, age is represented as a continuous variable and the other variables as binary. LA = lift assist; BG = *capillary blood glucose*.

For the outcome of hospital admission the model included age, sex, documented history of cardiac disease on ACR, tachycardia (heart rate >99 beats per minute), and blood glucose not documented on the ACR of a patient with reported diabetes. Documented history of respiratory disease, hypertension, diabetes, stroke/TIA, seizure, and psychiatric conditions, as well as systolic blood pressure <100 mmHg, systolic blood pressure >140 mmHg, systolic blood pressure >180 mmHg, tachypnea (respiratory rate >20 per minute), hypoxemia (Sp02 <90%), extremes of temperature (>37.9°C or <36°C), hypoglycemia (capillary blood glucose <72 mg/dL [4 mmol/L]), hyperglycemia (capillary blood glucose >360 mg/dL [20 mmol/L]), GCS <13 points and missing at least one vital sign on documentation were excluded from the final model. Patient age (OR 1.02, 95% CI 1.01–1.04, p = 0.004) was independently associated with hospital admission (Table 6). Tachycardia (heart rate >99 beats per minute) was found to be associated with not being admitted to hospital (OR 0.43, 95% CI 0.24–0.78, p = 0.005). History of cardiac disease, sex, and missing BG were included in the model based on interaction with

TABLE 6. Variables independently associated with hospital admission within 14 days of the original LA call as determined by a multivariate logistic regression model

Variable	Odds Ratio	95% Confidence Interval	p-value
Age	1.02	1.01–1.04	0.004
Tachycardia	0.43	0.24–0.78	0.005
Gender	0.76	0.48–1.18	0.221
History Cardiac Disease	0.77	0.47–1.27	0.303
Missing BG	0.55	0.23–1.31	0.175

*Wherein, age is represented as a continuous variable and the other variables as binary. LA = *lift assist*; BG = *capillary blood glucose*.

the risk factor variables but were not predictive of the outcome. The model correctly predicted 88.5% of cases.

The most common missing vital sign was temperature. However, when examined alone, a missing documented temperature was not associated with either repeat ED visit or admission to hospital. There were not enough mortalities within our population to perform a logistic regression on this primary outcome.

Discussion

When an individual cannot mobilize themselves, EMS may be called to attend the patient and provide assistance. Our data show these are not uncommon calls (1.9% of the 42,055 calls for the year in one EMS service); which is consistent with what has been published previously.[1] Thus, there is a significant amount of resources directed toward these individuals during the initial LA. While the crews are performing the LA, they are unable to attend other calls. In rural areas with limited crews and long transport times, this can leave areas without EMS coverage.[6,7]

The results of this study highlight that this is a population of patients that may be covertly unwell and experiences considerable morbidity and mortality. Frequently, these individuals go on to require further medical care in hospital, with 21% of LA calls resulting in subsequent ED visits, 11.5% of LA calls requiring admission to hospital and 1.1% of LA calls resulted in mortality in the hospital, all within 14 days of the LA call. Subsequent care of these patients is responsible for sizeable EMS and hospital resources as reflected in the mean length of stay of 7 days. We believe these calls may be early indicators of problems that require comprehensive medical evaluation and treatment. Assessment at this junction in a patient's illness may avoid the morbidity and mortality found in our study.

However, in today's healthcare climate, there is increased demand to reduce ED overcrowding and overburdening of resources. This is a global phenomenon with a variety of solutions being proposed. One way of reducing the demand and burden is to decrease the input of patients through the ED. Proposed methods include ambulance diversion to other hospitals, alternate care facilities, or avoiding ambulance transport altogether.[4,6–13]

Non-transport by paramedics, or refusal-of-care protocols have been studied with identified safety concerns.[14–17] Paramedics have been shown to be unable to consistently identify low-acuity patients in several studies.[18–24] Under-triage of patients was reported at 8–11%. In the study by Silvestri et al., 11/27 (40.7%) of the patients who were under-triaged to non-transport by the paramedics and went on to be admitted to hospital had covert symptoms similar to our LA population of generalized illness: anorexia, fatigue, and weakness.[19] As highlighted by the authors, paramedics are taught to assess, provide initial treatment and transport patients. An expectation for paramedics to diagnose and definitively manage less acute complaints is not fair given their training in this area and lack of diagnostic tests available in a clinic or hospital setting. Thus, although non-transport of LA patients may seem appealing to help decrease the burden on EDs, we argue these covertly unwell patients may require a full assessment in hospital with a full complement of diagnostic testing. In our own LA patient population, the diagnoses of infection, fracture, and new oncologic discoveries were only possible with laboratory and diagnostic imaging tools.

Aside from the medical diagnoses that were made 71 (76.3%) of admitted patients in our study population were transferred to an alternate living disposition upon discharge from hospital, including retirement home or nursing home (18, 19.4%), or home with nursing care (42, 45.2%). This increase in assistance may not have been initiated so timely if they had not been transported to hospital. Notably, not all disposition results were available, so this represents a conservative estimate.

Our patient population was elderly, with a mean age of 74.8. Age was found to be a predictor of both ED visit and admission to hospital in 14 days from our logistic regression analyses. These elderly patients' inability to mobilize may be due to a steady decline in function. This is supported by the fact that 76.3% of those who went on to be admitted required further care than what they were receiving at home prior to their inability to mobilize and subsequent LA call. Given our aging population, research is underway on how best identify these patients that require extra supports to avoid morbidity and mortality. One way of predicting admission and re-admission to hospital is by use of frailty measures. These include measurements of instrumental activities of daily living (IADLs), and activities of daily living (ADLs), such as mobilization; which is highlighted in a LA call. Kahlon et al., performed a prospective cohort study of medicine patients discharged from hospital.[25] Patient report of their IADL and ADL status the week before requiring hospital admission was used to give a score of no frailty, mild, moderate or severe frailty. Those patients that scored moderate or higher on the Clinical Frailty Scale were independently associated with re-admission to hospital or death within 30-days. Similar to our LA cohort, these patients were also significantly more likely than non-frail patients to be discharged to an assisted-living facility or home with home care supports. Their study also highlights the fact that the patient's inability to perform ADLs, such as mobilization, is independently associated with morbidity and mortality. This is in keeping with our findings of morbidity and mortality with LA calls.

These frail patients are often covertly unwell. This, combined with a dispatch code for "lift assist" leads to risk of cognitive bias surrounding the patient's level of acuity. This is reflected in our study by the number of incomplete charts with regards to vital sign documentation. Of the ACRs examined, 113 (14.0%) were noted to be missing at least one vital sign, and 44 (27.5%) of 160 calls were missing blood glucose documentation in diabetic patients. Of these missing vital signs and blood glucose omissions, only 15 (15.5%) and 3 (1.9%) were explained by patient refusal, respectively. In our system, a full set of vital signs is required for all patient encounters and blood glucose should be assessed in diabetic patients that are not able to mobilize. Thus, there is a discrepancy in what is required for standard care and what is being performed. There is a potential bias to these covertly unwell patients not requiring the same level of attention as those that are overtly unwell. As our study shows, LA patients are at risk of morbidity and mortality and we hope the results of our study will help highlight the degree of suspicion that prehospital care providers must have for potentially significant pathology that may co-exist.

Surprisingly, we found that tachycardia (heart rate >99 beats per minute) at time of LA was negatively associated with hospital admission within 14 days. This could reflect the patient's ability to compensate to whatever insult caused the immobility. Additionally, this may be a marker of patients who are not on certain medications that could contribute to orthostasis (e.g., beta blocker, calcium channel blocker), which is a known risk factor for falls. Alternate explanations include response to the stressor of requiring aid in mobilizing and signs of exertion from attempts to mobilize. However, each represents compensation and thus appropriate response to stress. In the absence of appropriate compensation, supportive care, including potential hospital admission, may be required.

Limitations and Future Directions

We found an association in 14-day morbidity and mortality in patients who require a LA call; however, this does not show causality that the subsequent ED visit, admission or mortality was directly related to the LA call. A consensus of 4 EMS medical directors felt that this time frame would give sufficient confidence to at least suggest that the LA and subsequent morbidity and mortality were temporally correlated. However, our results are based on association alone, not causation and there are many factors at play. There may have been another insult following the LA that resulted in the hospital admission. Unfortunately, there is no easy way to prove causation and thus, this important limitation must be stated and the overarching fact our data is based on association highlighted.

Patients could only be enrolled in this study, if their call was documented on the ACR as a LA. It is foreseeable that some patient's charts may be labeled as something other than this. In order to try to overcome this issue, all non-transport chart code ACRs were reviewed to ensure all LA calls were identified. There is the possibility that ACRs are not be generated by the paramedics when no care is delivered. However, this would result in a more conservative estimation of patient morbidity and mortality. Thus, we were willing to accept this potential shortcoming.

Patients were only recognized as returning to hospital if they presented to our center. If they sought care elsewhere within 14-days of LA, these potential visits were not captured. However, this is a theoretical risk and it would be expected to represent only a small proportion of our patients. As this would again result in a more conservative estimate, we are accepting of this consequence.

Another point worth mentioning is that the presence of abnormal vitals does not mandate that the patient is experiencing a pathologic process. These normal values are based on population-based cut-offs. Thus, it is entirely possible to have for example, a systolic blood pressure of <90 mmHg and be physiologically fully-functioning. We chose to use these cut-offs as they are well-recognized parameters. But, it should bear mentioning that abnormal vitals do not require a pathologic process and are an indirect screen for pathology.

Our patient sample was from a single-EMS provider service and from only one-year of data. As such, the results may not be generalizable to all populations. A larger sample size could potentially allow for examination of mortality, for which our event rate was too small to comment on.

Since the study was undertaken in a one-payer government covered-health system, there are minimal financial consequences to taking an ambulance to hospital. Although we cannot say for certain that patients would refuse transportation after a LA and then take a private vehicle to the ED right afterwards, it would be highly unlikely. Thus, we believe that a very small, if any at all, of the outcomes would have been based on this potential scenario.

It should be noted that variables with a high proportion of missing observations were excluded from the logistic regression model. Had missing observations not been an issue and these variables included in the analysis, it is possible that these factors may have been identified as having an association with ED visit and/or hospital admission within 14 days.

We found a discrepancy in the documentation of vital signs in our LA patients and are unaware of how this compares to the rate of missing vital sign documentation in patients with similar acuity (ex. CTAS) scores that are transported to hospital. We are also unaware of what the baseline rate of morbidity and mortality in transported patients of similar low acuity is with respect to our LA cohort. This data would help put our initial findings in perspective to the general population, as this is currently unknown. A follow-up study for similar patients that activate 9-1-1 is ongoing. Similarly, the morbidity and mortality rates for a similar cohort in the general population that do not activate 9-1-1 are unknown and this should be explored with a follow-up study.

Conclusion

LA calls are correlated with morbidity and mortality within 14 days of a LA call. Age was associated with an ED visit within 14 days of LA call as well as admission to hospital within 14 days. This information may help underscore the importance in knowing the cause for required assistance with mobilization. This patient population should be assessed with the same level of care as those who call for objective medical complaints, as LA may represent covert pathology or increased risk for future injury.. Further research, including a larger more varied study population and comparison to a similar cohort of patients that do and do not activate 9-1-1, is needed to help paramedics identify high risk patients at their initial LA call.

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