Impact of the Use of Regional Poison Control Centers in an Urban EMS Dispatch System

Michael Levine¹ · John Flores² · Seth A. Seabury³ · Stephen Sanko^{2,4} · Marc Eckstein^{2,4}

Received: 7 April 2016 / Revised: 5 September 2016 / Accepted: 6 September 2016 / Published online: 7 October 2016
© American College of Medical Toxicology 2016

Abstract

Background The public commonly calls 911 for unintentional ingestions, rather than calling the local poison center. By utilizing a series of scripted questions, 911 dispatchers in Los Angeles determine if an ingestion meets “*omega-1*” classification. Under such circumstances, the regional poison center is contacted prior to dispatch of paramedics. If the poison center advises that the patient can remain at home, EMS is not dispatched and the patient is followed at home by the poison center. The primary objective is to determine the number of averted transports through involvement of a poison center. A secondary objective is to determine the potential costs and charges saved with the use of such a strategy.

Methods A retrospective review of all overdose calls with an “*omega-1*” classification to a single EMS system between 1/2008–6/2012. Each call culminating in an EMS dispatch was subsequently reviewed by two additional reviewers. The cost savings was determined by utilizing data from the Medical Expenditure Panel Survey (MEPS) from 2000 to 2010. Monetary values were adjusted to 2012 dollars.

Results Three hundred eighteen cases received “*omega-1*” dispatch classification. EMS was dispatched 19 times (5.98 %), and 11 patients (3.46 %) were ultimately transported. The most common reasons for transport were ambiguity over the ingested agent or amount, and caller insistence. Using these estimates, routine consultation of a regional poison center as part of EMS dispatch averted \$486,595 in charges, and \$183,279 in payments.

Conclusions Routine consultation of a poison center by emergency medical dispatchers can reduce unnecessary dispatches, ambulance transports, and ED visits with significant associated cost savings.

Keywords EMS · Poison control center · Dispatch · Paramedic · Cost

Introduction

The volume of emergency medicine services (EMS) 911 calls and ambulance transports has increased markedly over the past few years [1]. This high call volume has led to efforts among several EMS provider agencies to identify low-acuity calls and seek alternative mechanisms to provide patients with the care that they need outside of the traditional model of ambulance response and transport to an emergency department (ED). Various studies have demonstrated low acuity patients can be accurately predicted at the time of dispatch [2, 3]. For example, implementation of a nurse-advice line by EMS dispatch for low-acuity patients has been demonstrated to reduce unnecessary EMS transports [4]. Another strategy that has been used by several EMS provider agencies to reduce unnecessary ambulance dispatches and subsequent ED transports is to routinely involve the regional poison center as part

✉ Michael Levine
mdlevine@usc.edu

¹ Department of Emergency Medicine, Division of Medical Toxicology, University of Southern California, Los Angeles, CA, USA

² Los Angeles City Fire Department, Los Angeles, CA, USA

³ Department of Emergency Medicine and the Leonard D. Schaeffer Center for Health Policy and Economics, University of Southern California, Los Angeles, CA, USA

⁴ Department of Emergency Medicine, Division of Emergency Medical Services, University of Southern California, Los Angeles, CA, USA

of the EMS dispatch process for calls involving overdoses or exposure to potentially toxic substances [5].

Incorporating a poison center into an emergency dispatch system has the potential to reduce EMS volume, and lower costs by preventing unnecessary ambulance transports ED work-ups. The primary aim of this study was to determine the number of transports avoided by use of such an approach. The secondary aim of this study was to estimate the cost-savings associated with this strategy.

Methods

Design and Settings

During the study period, LAFD 911 call takers, when confronted with cases of potential exposure, use a series of scripted questions to determine if a medical emergency exists. Specifically, the following parameters were established: if the ingestion was unintentional; if the patient was awake with normal mental status; if the skin color and breathing pattern appeared normal; and if the patient is at least 3 years of age. If the answers to all these questions are “yes” and if there was no exposure to caustics, cocaine, methamphetamine, narcotics, or tricyclic antidepressants, the incident receives an “*omega-1*” classification. In such circumstances, the 911 operator called the California Poison Control System prior to dispatching an ambulance. If the specialist in poison information (SPI) advises that the patient can be kept at home and the caller is agreeable, then no EMS resources are dispatched and the patient is followed at home by the poison center.

This IRB-approved study was a retrospective study of all 911 calls in the city of Los Angeles which were assigned an “*omega-1*” classification between the January 1, 2008 and June 30, 2012. Patients were identified via a search of computerized records of EMS dispatches by the LAFD. The LAFD is the second largest municipal EMS provider in the United States, providing tiered-dispatch response for a city of 3.94 million people over a geographical area spanning 471 mile². All 911 calls for poisonings or overdoses in which EMS is ultimately dispatched automatically generate a paramedic level response.

The EMS computer records were reviewed by a single investigator (JF). The abstractor was blinded to the study hypothesis and received a brief instructional overview on data abstraction prior to performing any data abstraction. This investigator performed a computer-based search to identify all patients meeting “*omega 1*” classification. Data were collected on a pre-designed data abstraction sheet by a second investigator (SS). Ten percent of the charts were randomly selected and reviewed for accuracy of abstraction by a second investigator (ML). A kappa statistic was performed to assess interrater reliability. All “*omega-1*” classifications which were ultimately transported were reviewed independently by two

investigators (ML, ME), and a consensus was reached as to the reason for transport.

Cost Determination

To estimate the cost savings associated with any reduction in the number of visits, data from the Emergency Room Visits file (ERV) of the Medical Expenditure Panel Survey (MEPS) from 2000 to 2010 was examined. The MEPS is a nationally representative survey of families in the US designed to provide comprehensive information about the cost and use of health care. The MEPS surveys about 30,000 individuals from 12,000 families each year, and includes event-level data on episodes of care. The ERV is a subset of the MEPS that provides visit-level information for trips to the ED, including information on the reason for the visit and any associated costs. The MEPS captures two different measures of costs: paid amounts and charges, both of which are broken down by facility costs and doctor costs. We use both paid amounts and charges because charges likely overestimate the cost of care (it is essentially a “list price” for care), while paid amounts might understate costs (particularly for emergency department visits) if patients are uninsured or otherwise fail to pay for their care. Thus, using both charges and paid amounts provides upper and lower bounds on the potential cost savings.

From the ERV, all visits from 2000 to 2010 involving poisoning by non-specified drugs or medical substances using the ICD-9-CM diagnosis code of 977 were identified. The MEPS includes up to three codes per visit—we included any visit with 977 in any of the three codes. The total charges, which is a sum of the facility charge, the physician charge, and the out-of-pocket charges, along with the amount paid was determined. The monetary values were adjusted to 2012 dollars using the medical component of the Consumer Price Index published by the Bureau of Labor Statistics (BLS). The cost and charges associated with the transport itself are not included in the MEPS data. In Los Angeles, all overdose or poisoning calls generate an advanced life support (ALS) level response, which is associated with a base charge of \$1750 for paramedic transport to an ED. In the fiscal year 2015–2016, the LAFD collected 50 % of its ambulance charges, or 75 million dollars.

Descriptive statistics was utilized.

Results

During the study span, the LAFD responded to an average of 314,000 EMS incidents per year. Included in these responses are more than 10,000 annual poisoning-related calls resulting in more than 7000 poisoning-related transports annually. In the 54 months, 318 cases received an “*omega-1*” dispatch classification. Of these 318 patients, EMS was dispatched 19

times (5.98 %). Incorrect use of the protocol in which the poison center contact occurred *after* dispatch occurred twice. In both of these times, EMS was canceled prior to arrival. Thus, 17 patient evaluations occurred, of which 11 (3.46 %) were ultimately transported (Fig. 1). Most of the cases where patient transport occurred were the result of caller insistence. There were six cases in which EMS evaluation occurred, but transport did not occur. In most of these cases, the agent ingested was unknown at the time the 911 call was placed, but this ambiguity was resolved by paramedics on scene. None of these six patients subsequently called 911 within the following 24 h.

The kappa statistic for inter-rater reliability was greater than 0.8 for each variable analyzed.

On review of the MEPS data, the average total charges were \$1585 per patient encounter, resulting in an average payment of \$597. Applying the MEPS data to these 307 subjects, and assuming all would have been transported to the ED prior to protocol adoption, the involvement of the regional poison center prior to dispatch averted \$486,595 in charges, and \$183,279 in payments. If the transport itself was included, the additional savings would be \$537,250.

Limitations

The study has several potential limitations. First, the study was retrospective in design and thus is limited to the completeness and accuracy of medical records. We opted to include dichotomous data (e.g., transported or not), which is subject

to little interpretation, and thus, likely reduced some of the bias of retrospective studies [6].

Overall, the number of patients who received an “omega 1” classification was quite low, especially in proportion to the total number of calls. Currently, Los Angeles County EMS guidelines indicate mandatory transport of any patient under the age of 3 years with a potential poisoning. Thus, in order to be eligible for an “omega 1” classification, patients had to be at least 3 years of age. Young children represent a disproportionate number of unintentional ingestions. Thus, perhaps one of the largest groups of patients who benefit from such a protocol was excluded. This study demonstrates the feasibility of incorporating a regional poison center into the EMS dispatch system. Had younger children been eligible for inclusion, we anticipate the numbers being much greater.

We were also unable to determine whether patients ultimately sought, and received, emergency care on their own after consulting with the poison center. The 911 call takers typically do not ask for the patient’s name. Thus, given that the patient’s name is not known, it would be nearly impossible to determine from the California Poison Control System records if a given patient ultimately presented to the hospital. However, given that poison centers tend to be conservative in their referral guidelines, and the caller still had the option to insist on transport by EMS during the 911 call, we feel it is unlikely that many patients initially had a plan for home management, but ultimately sought care on their own in a medical facility. Historically, of patients recommended for home management by the California Poison Control System, approximately 1 % ultimately seek

Fig. 1 Flow diagram outlining the destinations for patients meeting “Omega 1” classifications

care despite the advice of the poison center [7]. Nonetheless, it is possible some patients ultimately did seek care on their own, which would reduce the magnitude of these findings. However, we feel that because this would be a rare occurrence, it is unlikely to result in a significant alteration in the paper's conclusions. In a similar study involving the city of San Diego in which the poison center was contacted prior to EMS dispatch, in cases in which the poison center recommended home management, 161/168 (95.8 %) did not ultimately seek medical care in an ED [8]. Of those who did seek medical care, all patients remained asymptomatic or were classified as having "minor" toxicity per the American Association of Poison Control Centers outcome classification. Such a classification corresponds to either minimal or no treatment provided [8]. Conversely, all patients in the Anderson study who did have moderate or severe symptoms were assessed in a timely fashion by the poison center staff, and transport was recommended. Thus, local results and literature consensus support our notion that relatively few patients would have ultimately presented to an ED for care.

During the economic analysis of this study, we assumed all patients would have been transported prior to the protocol. It is certainly possible some patients would have signed out against medical advice and/or refused transport. If this was the case, the financial impact would have lessened.

One potentially significant adverse effect that could result is if consulting poison center led to a patient not being transported to the ED when he or she had a life-threatening condition, and this could have resulted in a worse patient outcome (even death). Given the conservative tendencies of poison centers in terms of EMS referrals, we feel this is unlikely. Nonetheless, because 911 call takers ask for the name of the caller, but not the patient, we were unable to provide definitive follow up through the poison center for these patients.

Discussion

This study examined the impact of having 911 call takers consult a regional poison center prior to EMS dispatch, in terms of resource utilization and potential cost savings. Consulting the poison center resulted in a marked decrease in EMS transports as well as patient charges and healthcare expenditures. While charges reflect the amount that hospitals bill for their services, these are not always reflective of the actual costs of services and are generally much higher than what is actually paid. However, it is possible that average payments in the ED, with a higher portion of uninsured

patients who pay nothing at all, actually understate the true costs of services. We report the savings from reduced visits in terms of both charges and paid amounts to serve as upper and lower bounds, respectively, on the actual savings associated with the program. In addition, this study did not include the costs of the ambulance transport itself, which is clearly not negligible. The true costs associated with transport are highly debatable, but we included the charges to determine the potential cost savings. Our findings suggest that the estimated cost averted from involving the poison center prior to dispatch ranged from \$720,529 to \$1,023,845 during our 4.5 year study.

Our findings provide new insight into the potential cost savings from consulting a poison center prior to dispatch for resources for 911 calls. In the Austin, Texas, prehospital providers can opt to contact the regional poison center, but such contact is not routinely performed by 911 dispatchers. Bier and colleagues performed a retrospective chart review of unintentional ingestions called into poison centers by EMS providers in the field between 2004 and 2006, and determined that transport occurred in only 16 % of patients in whom contact with a regional poison center was made [5]. Both the current study and Bier's study are limited by selection bias. Unlike the current study, however, the selection bias in Bier's study occurred at the level of the prehospital provider, as contact with the poison center was not required. Consequently, pre-hospital providers likely referred only low-acuity, well-appearing patients to the poison center. The current study differs from that of Bier and colleagues, in that the point of contact with the poison center was prior to the time of dispatch, rather than in the field prior to the time of transport. Nonetheless, Bier and colleagues felt such an approach was associated with a cost savings of \$68,333 per year, or \$634 per patient in transport costs.

An important contribution of our study is to consider the costs associated with the unnecessary use ambulance transport and ED services for patients when paramedics are dispatched without contacting poison center. Lovecchio and colleagues surveyed 12 EDs to determine both institutional and physician level charges for conservative management of a hypothetical patient who would have been advised to stay home and not seek care in an ED [9]. All respondents indicated the hypothetical patient who would have been advised to stay home would generate a level 4 or 5 facility and professional service charge. Of note, the MEPS data do not include other potential costs, such as the impact on ED crowding. This indicates that a failure to consider the costs associated with an ED visit substantially understates the potential savings.

Conclusions

The Los Angeles Fire Department protocol for consulting the regional poison center prior to the initial dispatch for selected cases of unintentional ingestions was associated with reduced resource deployments, reduced transports, and saves costs.

Compliance with Ethical Standards

Conflicts of Interest None

Sources of Funding None

References

1. Burt CW, McCaig LF, Valverde RH. Analysis of ambulance transports and diversions among US emergency departments. *Ann Emerg Med.* 2006;47:317–26.
2. Hinchey P, Myers B, Zalkin J, et al. Low acuity EMS dispatch criteria can reliably identify patients without high-acuity illness or injury. *Prehosp Emerg Care.* 2007;11:42–8.
3. Studnek JR, Thestrup L, Blackwell T, et al. Utilization of prehospital dispatch protocols to identify low-acuity patients. *Prehosp Emerg Care.* 2012;16:204–9.
4. Infinger A, Studnek JR, Hawkins E, et al. Implementation of prehospital dispatch protocols that triage low-acuity patients to advise-line nurses. *Prehosp Emerg Care.* 2013;17:481–5.
5. Bier SA, Borys DJ. Emergency medical services' use of poison control centers for unintentional drug ingestions. *Am J Emerg Med.* 2010;28:911–4.
6. Gilbert EH, Lowenstein SR, Koziol-McLain J, et al. chart reviews in emergency medicine research: what are the methods? *Ann Emerg Med.* 1996;27:305–8.
7. Personal communication. California Poison Control System
8. Anderson BD, Manoguerra SM, Haynes BE. Diversion of 911 poisoning calls to a poison center. *Prehosp Emerg Care.* 1998;2:176–9.
9. Lovecchio F, Curry SC, Waszolek K, et al. Poison control centers decrease emergency healthcare utilization costs. *J Med Toxicol.* 2008;4:221–4.