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Brief Report

Operation care: a pilot case management intervention for frequent emergency medical system users

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Abstract

Objectives: This study aims to determine if a prehospital case management intervention reduces transport and nontransport emergency medical system (EMS) responses to frequent EMS users.

Methods: The 25 most frequent EMS users in a major metropolitan area were identified, and 10 were enrolled in the intervention. These patients received linkage to psychosocial and medical resources through weekly case management visits for 5 to 12 weeks between May and August 2008. Main outcome measures were the number of transport and nontransport EMS responses to patients during the intervention as compared with predicted EMS responses based on each patient's previous year's EMS use. Transport data were available for all patients, but nontransport data were unavailable for 1 patient who was homeless and 6 patients living in apartment buildings. Secondary outcome measures included cost savings to the entire health care system and the Baltimore City Fire Department.

Results: Transport responses decreased 32% over the 76 predicted transport responses during the intervention, and nontransport responses decreased 79% over the 24 predicted nontransport responses during the intervention. Including the dedicated case manager's salary, this represented a cost savings to the entire health care system and to the Baltimore City Fire Department of $14 461 and $6311, respectively, over 12 weeks.

Conclusions: Prehospital case management may reduce EMS use in high-frequency EMS users and create significant cost savings to municipalities and the health care system. Additional large-scale studies are needed to validate these findings.

1. Introduction

Emergency medical system (EMS) overuse creates a significant burden on an already-taxed prehospital medical delivery system [1-6]. Because individuals 65 years or older are significantly more likely than younger individuals to use EMS services, this problem will increase as the population ages [1,3,5,7]. Repeat users of EMS services compound this

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burden, tying up large amounts of prehospital responders' time, local governments' fiscal resources, and hospital emergency departments' (EDs') workloads [5,6,8-13]. As municipalities are forced to close fire departments because of budget shortfalls, the impetus to reduce frequent EMS use takes on a greater urgency [14].

Multiple studies have identified inhospital case management strategies to reduce resources devoted to frequent ED users [15,16]. One study investigated prehospital case management for frequent EMS users and found a paradoxical increase in EMS use after the intervention and multiple obstacles in locating patients and in improving their social and medical needs [6].

Given the recruitment difficulties, small sample size, and limited intervention described in this previous study, we hypothesized that a novel prehospital case management intervention with more intensive case manager involvement and improved recruitment would decrease frequent EMS use in a major metropolitan area.

2. Methods

This study was conducted in Baltimore City (population, 637 418) [17]. The Baltimore City Fire Department operates 24 advanced life support transport units 24 hours a day, with 4 additional units during peak hours. In addition, during periods of high call demand, the fire department is able to add 12 transport units that are advanced life support or basic life support units. There are 220 field medics, EMS officers, and administrative staff employed under this EMS umbrella. The fire department averages about 148 000 responses per year and transports approximately 67% of patients [18].

Participants were identified by the Baltimore City Fire Department, which provided a list of the 25 individuals who most often activated EMS during fiscal year 2007, regardless of whether or not the calls required transport. Of the 25 individuals who most often activated EMS, 5 were deceased, 2 were incarcerated, 2 resided outside the city limits, 4 were unable to be located, and 2 were hospitalized. The remaining 10 patients were selected for the project, and all agreed to participate. All patients were informed of the project's purpose and the interventions offered and were given an opportunity to refuse participation.

Baltimore HealthCare Access, a quasi-public agency of the Baltimore City Health Department, assigned a dedicated case manager to work with the patients during the intervention period from May 12, 2008, to August 1, 2008. The length of intervention varied from 5 to 12 weeks for each patient because of patient difficulties in scheduling the initial case manager assessment. The case manager had a bachelor's degree and 2½ years of experience as a short-term case manager for another city organization and could contact nurse liaisons as needed.

After conducting an initial home-based assessment of each patient's medical, psychosocial, and insurance needs, the case manager developed a plan of care for each patient. She provided at least weekly visits to patients, arranged care with primary and subspecialty medical providers, referred patients to relevant psychosocial services, and issued Baltimore HealthCare Access' telephone number if patients had questions or problems. She confirmed patient attendance at all referrals listed. All patients were educated on the proper use of EMS. Weekly meetings were held with clinical and outreach staff at Baltimore HealthCare Access to review the case manager's plans and share ideas about challenging patients.

Transport data came from the Baltimore City Fire Department's billing service. Nontransport data came from the dispatch system, which records the street addresses to which ambulances are dispatched, not the names of patients who received onsite services. For this reason, nontransport response data were only available for 3 patients; these data were not available for homeless patients or patients living in apartment buildings. In addition, nontransport response data do not include frequent users who summoned ambulances from different addresses. Data analyses were performed as if all nontransport calls to a specific address were for the patient involved in the study. Predicted transport and nontransport EMS responses were calculated by multiplying the patient's average number of EMS responses per week from the previous year by the number of weeks the patient was in the intervention.

Cost estimates are based on a Baltimore City Fire Department comprehensive fee study conducted by an independent firm [18]. Nontransport responses cost the fire department $460 on average, and transport responses cost $762 on average. The fire department bills insurance companies and uninsured patients $377 on average for transport responses. Medicare/Medicaid reimburses 80% of the billed costs, private insurance companies reimburse 100% of the billed costs, and the fire department collects 3% of billed costs from uninsured patients on average. The Primary Adult Care Insurance Program does not reimburse for ambulance transports, and the fire department does not bill for nontransport responses. The direct cost of the project to Baltimore City was approximately $12 577 in salary and fringe benefits to the dedicated case manager.

Health care system costs were determined by adding each patient's total costs for transport or nontransport responses based on predicted or actual call volume. Baltimore City Fire Department costs were determined by subtracting each patient's average insurance reimbursements from the expected or actual health care system costs. Cost savings were determined by subtracting actual costs from expected costs and further subtracting the cost of the case manager's salary.

This study was approved by the Johns Hopkins Medicine Institutional Review Board.

3. Results

The average patient age was 60 years, 40% were male, 90% were enrolled in a health insurance plan at the time of intervention, 70% had a mental health and/or substance abuse diagnosis, and all patients had 2 or more chronic diseases (Table 1). Patient 9 was homeless, but all other patients had permanent addresses. All participants received 8 to 12 weeks of intervention except patient 4 who received only 5 weeks. Over the course of the intervention, the case manager provided a total of 97 weeks of care.

The case manager made 32 referrals to 22 separate agencies for these 10 patients (Table 1). There were 8 referrals to medically related agencies; 5 referrals to adult care groups; 5 referrals to food procurement services; and 3 referrals each to substance abuse programs, adult protective services, and psychiatric evaluations. Two additional referrals were made regarding health insurance issues; and 3 referrals were for other services such as energy assistance, transportation, and photographic identification. The compliance rate for these referrals was at or close to 100%, as our case manager confirmed attendance at all referrals.

Transport responses decreased 32% over predicted transport responses during the intervention period. Nontransport responses decreased 79% over predicted nontransport responses during the intervention period (Table 2). Two patients had greater than predicted transport responses during the intervention. There were no obvious differences between patients with increased transport responses and those with decreased transport responses with regard to age, diagnoses, types of referrals made, or insurance type in this small pilot study sample. There was no appreciable correlation between increasing number of patient weeks in the intervention and decreased total number of EMS responses. No adverse events due to decreased activation of EMS were noted by patient self-report after the intervention period.

The predicted cost of EMS services for these 10 patients to the entire health care system was $68 965. Based on actual use, the cost to the health care system was only $41 927. Including insurance reimbursements, the predicted cost to the Baltimore City Fire Department was $47 919, whereas actual costs were only $29 031. Accounting for the case manager's salary, the net savings to the health care

Table 1 Patient demographic information and referrals made

Patient	Age (y)	Sex	Insurance status before intervention	Diagnoses	Programs and services to which patient was referred	Weeks in intervention
1	61	Female	Private	Diabetes, hypertension, depression	Psychiatric evaluation, nutritional consultation, diabetes management, adult protective services, domestic violence program	12
2	65	Female	Medicare	Congestive heart failure, seizure disorder, depression	Adult evaluation services, specialty care (ophthalmology), adult day care, food stamps	11
3	61	Female	Medicaid	Hypertension, osteoporosis	Adult day care, Meals on Wheels, durable medical equipment (wheelchair)	9
4	83	Female	Medicare	Diabetes, asthma, dementia	Adult and geriatric services, specialty care (ophthalmology), medicine compliance	5
5	39	Female	Uninsured	Drug/alcohol abuse, cardiac disease	Health insurance, drug treatment	8
6	89	Female	Medicare	Hypertension, depression	Baltimore City Health Department's Personal Care Program, specialty services (ophthalmology/podiatry), energy assistance	11
7	52	Male	Medicare	Throat cancer, paralysis	Substance abuse treatment, assistance with photo identification/birth certificate	11
8	53	Male	Medicare	Congestive heart failure, chronic obstructive pulmonary disorder, kidney failure	Kidney disease program, transportation, adult protective services, Meals on Wheels, assisted living	10
9	47	Male	Medicaid	Drug/alcohol abuse, seizure disorder, hepatitis, manic-depressive	Long-term drug treatment, psychiatric evaluation	11
10	52	Male	Primary Adult Care Program	Drug/alcohol abuse, seizure disorder	Food stamps, Medicaid [a]	9

[a] This patient was admitted to a hospital during the intervention period, and operation care team worked with hospital social workers to secure referrals for substance abuse treatment. These referrals were not included in the listed tallies.

Table 2 Preintervention and postintervention transport and nontransport emergency medical system responses

Patient	Transport responses May 2007-May 2008	Predicted [a] transport responses intervention	Actual transport responses intervention	Nontransport responses [b] May 2007-May 2008	Predicted [a] nontransport responses intervention	Actual nontransport responses intervention
1	6	1	0	103	23	4
2	54	11	12	NA	NA	NA
3	63	11	2	5	1	1
4	55	6	1	NA	NA	NA
5	7	1	0	NA	NA	NA
6	11	2	0	NA	NA	NA
7	23	5	0	0	0	0
8	30	6	1	NA	NA	NA
9	130	27	26	NA	NA	NA
10	33	6	10	NA	NA	NA
Total	412	76	52	108	24	5

NA indicates not applicable.

[a] Predicted response equals number of weeks in intervention multiplied by the average number of responses per week from the previous year.

[b] Nontransport response data gathered from EMS dispatch system using street addresses to which ambulances were dispatched. Data were unavailable for homeless patient and patients living in apartment complexes.

system and to the fire department was $14 461 and $6311, respectively.

For the 7 patients who showed at least an 80% decline in transport responses, the predicted total cost of transport responses to the health care system and the fire department was $24 384 and $14 936, respectively. The actual cost of transport services for these patients to the health care system and the fire department was only $3048 and $1842, respectively. Nontransport cost savings for the 3 patients with this type of data available was $8750. Decreased nontransport call frequency was only seen in 1 of the 3 patients.

4. Discussion

This article describes an intensive, prehospital case management strategy for high-frequency EMS users that reduced transport EMS responses by 32% and saved the entire health care system and the Baltimore City Fire Department $14 461 and $6311, respectively, over 12 weeks. Lack of health insurance was not a primary barrier to non-EMS medical care, as 90% of patients had health insurance at the beginning of the intervention. This finding echoes previous studies of frequent ED users [19,20]. Instead, the involvement of a dedicated case manager helping to navigate and coordinate the health care system presumably lessened the systemic burden for these high-frequency EMS users. These high-frequency EMS users had multiple unmet medical and psychosocial needs and required personalized interventions and referrals. Anecdotal reports from patients suggest that simple interventions, such as insuring the continuous availability of glucometer strips for a diabetic, were the chief drivers behind decreased call frequencies.

Municipal psychosocial support organizations may need to increase outreach efforts based on this study, as 69% of the referrals made by our case manager were to nonmedical agencies. This study also suggests that high EMS use is a possible predictor of life-threatening illness, as 20% of the high-frequency EMS users initially identified by the Baltimore City Fire Department were deceased. This figure is comparable to previous studies of mortality in high-frequency ED users but appreciably higher than the 6% rate identified in the other prehospital case management study [6,19,20]. Furthermore, no appreciable adverse events, such as a patient not calling EMS when needed, resulted from this intervention. We do recognize that our study was not designed to definitively investigate this outcome.

The savings noted during the intervention period were significant but do not include other potential benefits, including fewer patient ED visits, a possible decrease in ED costs, and freedom for ambulance crews to attend other medical emergencies. For this reason, this study likely underestimates the true cost savings to the health care system and Baltimore City created by this intervention.

It is unclear why certain patients benefited significantly from this type of intervention, whereas 2 patients paradoxically increased their EMS call frequency. Anecdotally, patient 2 had a high level of anxiety regarding her cardiac disease, leading to multiple EMS calls for chest pain. Continued involvement with the operation care team led to her admission to an assisted living facility after the intervention period, decreasing her call frequency significantly. A previous prehospital case management study found increased EMS call frequency in its entire 5-person intervention group and concluded that social service interventions are not effective at reducing EMS call frequency [6]. Their intervention spanned only 4 weeks and included an initial assessment of patient problems and case manager

referrals to support services. It is unclear whether their case managers had repeated contact with the patients or if patients attended referrals made by the case manager. It is possible that our more positive results came from the dedicated responsibilities of our case manager to these patients, the repeated contact she had with them over 12 weeks, and her confirmation of patient attendance at all referrals. In addition, the study of Weiss et al [6] was unable to enroll 88% of high-frequency EMS users in their intervention, with 13% refusing. We enlisted 40% of our target group, and all accessible patients agreed to participate. This improved participation and consent rate could be due to our dedicated case manager's experience with this vulnerable population. Follow-up research should focus on patient characteristics that predict increased or decreased EMS call frequency after this type of intervention.

When longitudinal data after the study period were retrospectively examined for this patient population, analysis was impeded by inconsistent data collection and patient admissions to long-term care facilities. Additional patients were enrolled in the program after the study period (data not shown), with inconsistent results, inconsistent data collection, and a minimal decrease in EMS use when analyzed as a group. Unfortunately, no additional case managers were hired; and a single case manager was responsible for all patients as well as data collection. For this reason, larger-scale projects with intervention and control groups and more sustained data collection efforts are needed to confirm this preliminary analysis.

There are several limitations to this analysis. Only 10 patients were enrolled in this pilot project, and they are not necessarily representative of all frequent EMS users' behaviors or demographics. Six additional patients were unable to be located or were hospitalized during the intervention period, and it is unclear how their participation would have changed the results. Although 100% of locatable, qualified, high-frequency EMS users agreed to participate in this study, our 40% overall enrollment rate may have created a selection bias toward those participants likely to respond to the intervention. If this study is representative of all users, this implies that 60% of high-frequency EMS users may not be impacted by this type of intervention in other cities. We used the prior year's EMS use as a baseline and did not adjust for seasonal trends or for the possibility that these patients' EMS calls would have regressed toward the mean without intervention. We were unable to fully explore the nontransport responses in our study because of data limitations. We cannot comment on how our intervention changed nontransport responses for 7 patients or nontransport responses outside a patient's home and how these data would alter the apparent effectiveness of our intervention. Because our primary outcome measures were transport and nontransport EMS responses, we are unable to fully assess if these high-frequency EMS users had real or perceived improvements in their health status or health outcomes as a result of the intervention. In addition, longitudinal data on the sustainability of decreased EMS use after the intervention were not available. Finally, the financial analysis did not control for differences in cost based on the exact services provided by the ambulance crew; and the direct cost of the project to Baltimore City does not include the salaries of participants in the weekly case management conferences.

Prehospital case management may reduce EMS use by frequent EMS users. This pilot project decreased EMS use and resulted in significant cost reduction to an urban EMS system, with minimal initial investment and resource allocation. Further investigation of this type of intervention is warranted.

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