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PARAMEDIC-INITIATED HOME CARE REFERRALS AND USE OF HOME CARE AND EMERGENCY MEDICAL SERVICES

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ABSTRACT

Objective: We examined the association between paramedic-initiated home care referrals and utilization of home care, 9-1-1, and Emergency Department (ED) services. **Methods:** This was a retrospective cohort study of individuals who received a paramedic-initiated home care referral after a 9-1-1 call between January 1, 2011 and December 31, 2012 in Toronto, Ontario, Canada. Home care, 9-1-1, and ED utilization were compared in the 6 months before and after home care referral. Nonparametric longitudinal regression was performed to assess changes in hours of home care service use and zero-inflated Poisson regression was performed to assess changes in the number of 9-1-1 calls and ambulance transports

to ED. **Results:** During the 24-month study period, 2,382 individuals received a paramedic-initiated home care referral. After excluding individuals who died, were hospitalized, or were admitted to a nursing home, the final study cohort was 1,851. The proportion of the study population receiving home care services increased from 18.2% to 42.5% after referral, representing 450 additional people receiving services. In longitudinal regression analysis, there was an increase of 17.4 hours in total services per person in the six months after referral (95% CI: 1.7–33.1, $p = 0.03$). The mean number of 9-1-1 calls per person was 1.44 (SD 9.58) before home care referral and 1.20 (SD 7.04) after home care referral in the overall study cohort. This represented a 10% reduction in 9-1-1 calls (95% CI: 7–13%, $p < 0.001$) in Poisson regression analysis. The mean number of ambulance transports to ED per person was 0.91 (SD 8.90) before home care referral and 0.79 (SD 6.27) after home care referral, representing a 7% reduction (95% CI: 3–11%, $p < 0.001$) in Poisson regression analysis. When only the participants with complete paramedic and home care records were included in the analysis, the reductions in 9-1-1 calls and ambulance transports to ED were attenuated but remained statistically significant. **Conclusions:** Paramedic-initiated home care referrals in Toronto were associated with improved access to and use of home care services and may have been associated with reduced 9-1-1 calls and ambulance transports to ED. **Key words:** community paramedicine; home care services; emergency medical services

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A. A. Verma, J. Klich, A. Thurston, J. Scantlebury, and S. K. Sinha conceived and designed the study. J. Klich, A. Thurston, and J. Scantlebury coordinated data collection from Toronto Emergency Medical Services and G. Seddon coordinated data collection from Community Care Access Centres. A. Kiss provided statistical expertise and performed the analyses. A. A. Verma and S. K. Sinha drafted the manuscript and all authors contributed substantially to its revision. A. A. Verma and S. K. Sinha take responsibility for the paper as a whole.

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INTRODUCTION

Paramedics are uniquely positioned to support sustainable and high quality healthcare delivery because they initiate care for people in their own homes and communities. Paramedics are thus well-positioned to recognize unmet needs of community-dwelling individuals and participate in efforts to avoid unnecessary Emergency Department (ED) visits. The umbrella term, “community paramedicine,” describes an increasing number of programs that deploy paramedics in expanded roles (1). For example, paramedics conduct home visits to improve chronic disease management in rural and remote regions of Canada and Australia (2). In programs in the United States and United Kingdom, paramedics deliver acute medical care or triage and refer patients to other services in order to avoid unnecessary ED transports (3, 4).

Thus, community paramedicine programs could potentially improve care for community-dwelling individuals and reduce unnecessary use of costly hospital-based services. However, research about this novel area of practice remains limited. Two recent systematic reviews identified only 11 studies evaluating community paramedicine and concluded that although these programs appear promising, further research about their effectiveness is needed (5, 6). Our study contributes empiric evidence about the impact of a large community paramedicine program on utilization of 9-1-1, ED, and home care services in Toronto, Ontario, Canada.

Beginning in 2006, Toronto Emergency Medical Services (EMS) developed its Community Referrals by EMS (CREMS) program. CREMS enables paramedics to link patients who call 9-1-1 with local Community Care Access Centres (CCACs) to address possible unmet home care needs. CCACs are government-funded community agencies in Ontario that assess client needs and coordinate the delivery of home care and community services including case management, nursing, physical and occupational therapy, and personal support services. Referrals to CCACs can occur through hospitals, primary care practices, or individuals contacting CCACs themselves. The CREMS program represents a new method of accessing CCAC services that takes advantage of the paramedic's unique perspective.

The purpose of this study was to assess the association between paramedic-initiated home care referrals in Toronto and utilization of home care, 9-1-1, and ED services.

METHODS

Study Design and Setting

We conducted a retrospective cohort study of individuals who received a CREMS referral by Toronto EMS paramedics after a 9-1-1 call between January 1, 2011 and December 31, 2012 in the Greater Toronto Area, Canada. Ethics approval for this project was obtained from the research ethics board of the Toronto Central CCAC.

Participants

All individuals who received a CREMS referral by Toronto EMS paramedics during the study period were included in the study. We excluded individuals who were hospitalized, admitted to a nursing home, or died within 6 months after their CREMS referral. These individuals would have shorter time in the follow-up period to receive home care services or to make a 9-1-1 call and this could bias the pre- and post-referral comparison. Furthermore, individuals who were hospitalized may have been referred to home

care from the hospital and thus changes in their use of home care services may not have been related to the paramedic-initiated referral.

Intervention

Through CREMS, paramedics responding to a 9-1-1 call could directly refer individuals for home care services through their local CCAC. Paramedics were informed about the CREMS process through annual education sessions and a pocket reference card, which carried information about what services were accessible through CCACs. There were no formal CREMS referral criteria and paramedics were instructed to refer individuals who they felt might benefit from additional home care services. During the study period, paramedics made CREMS referrals by telephone call to the CCAC. Individuals referred through CREMS were then contacted by a CCAC Care Coordinator to determine their needs and eligibility for home care services. Individuals could refuse CCAC assessments or services at any time.

Data Collection

Data for this study were electronically extracted from patient care records of Toronto EMS and the five Greater Toronto Area CCACs. Data from Toronto EMS and the CCACs were linked using provincial health insurance number or name and date of birth. Toronto EMS paramedics documented the details of 9-1-1 patient encounters in an electronic patient record. From these records, we collected the number of 9-1-1 calls per patient, patient demographics, reason for 9-1-1 call, and whether the patient was transported to ED. Data pertaining to home care services were obtained from the electronic client records of the CCACs, which document the assessments and services provided to each client. From these records, we collected the date and amount of all home care services provided and the date of discharge from CCAC services as well as the reason for discharge, for example, death or transfer to a nursing home. In cases where no CCAC records were available, data were unavailable about death, hospitalization, or nursing home admission during the follow-up period.

Outcome Measures

The primary measure of home care utilization was the total combined hours of CCAC services provided, which included care coordination, nursing, physical and occupational therapy, social work, dietician, and personal support services. Total hours of care coordination, nursing, physical and occupational therapy, and personal support services were also examined separately as secondary outcomes.

TABLE 1. Change in utilization of home care services after a CREMS referral

	Receiving Services Before <i>N</i> (%)	Receiving Services After <i>N</i> (%)	Adjusted Change in Services Hours per Person (95% CI)
Total Home Care Services	336 (18.2)	786 (42.5)	17.40 (1.74, 33.09)
Care Coordination	322 (17.4)	771 (41.7)	15.01 (−23.30, 53.30)
Physiotherapy	60 (3.2)	178 (9.6)	0.12 (−1.12, 1.36)
Occupational Therapy	171 (9.2)	510 (27.6)	−0.47 (−1.05, 0.11)
Personal Support	188 (10.2)	487 (26.3)	28.40 (10.60, 46.30)
Nursing	137 (7.4)	305 (16.5)	−1.20 (−10.80, 8.40)

The number and proportion of the study population ($N = 1851$) who used this service at least once in the six months before or after a CREMS referral is presented. Adjusted change is the estimated difference in the number of service hours in the six months after a CREMS referral compared with the six months prior for individuals who received services in both periods using nonparametric longitudinal regression.

The primary measure of EMS utilization was the number of 9-1-1 calls made per person. The number of ambulance transports to the ED per person was a secondary outcome.

All outcomes were measured in the 6 months before and after a CREMS referral was initiated.

Analysis

Descriptive statistics were calculated for all variables of interest. A nonparametric longitudinal regression analysis was performed using the methods of Brunner et al. to assess change in utilization home care services in the 6 months after CREMS referral compared with the 6 months before (7). These models offer conservative estimates of change over time as they include only individuals who used services in both time periods and they adjust for the correlation among observations taken on the same patient. A zero-inflated Poisson model was run to assess change in 9-1-1 calls and ambulance transports to the ED in the 6 months before and after CREMS referral. This approach models the count nature of the data and accounts for the large number of non-users in the follow-up period. All analyses were carried out using SAS Version 9.3 (SAS Institute, Cary, NC, USA).

Our primary analysis was performed using an “intention-to-treat” approach, in which the total study cohort referred through CREMS was included. Because a proportion of individuals who received a CREMS referral did not have any CCAC records, a sensitivity analysis using a “per-protocol” approach was also performed, in which only clients who received a CREMS referral and had available CCAC records were included.

Results

In total, 2,382 individuals received a CREMS referral over the two-year study period. After excluding individuals who died ($N = 144$), were hospitalized ($N = 370$) or were admitted to a nursing home ($N = 102$) in the 6-month follow-up period, the final study cohort numbered 1,851 (the “intention-to-treat” population). Of the 1,851 individuals referred by CREMS,

the CCACs had available records for 1,100 (the “per-protocol” population).

The mean age was 79.0 years (SD 13.6). The reason for the index 9-1-1 EMS call was documented in 1,442 of 1,851 cases and the most common reasons for calls to EMS based on their Medical Priority Dispatch System were “falls” ($N = 513$, 27.7%), “sick person” ($N = 327$, 17.7%), and “breathing problems” ($N = 104$, 5.6%).

Home Care Services

CREMS referral was associated with a significant increase in utilization of home care services. The proportion of the overall population receiving CCAC services increased from 18.2% to 42.5% after CREMS referral (Table 1), representing 450 additional people receiving services. In the 6 months prior to the CREMS referral, the study population received a total of 28,828 hours of home care services compared with 53,900 hours in the 6 months afterward. Among the individuals who received services in both time periods, the unadjusted median number of hours of home care services per person was 15.0 (IQR 3.0–63.8) in the 6 months before their CREMS referral and 23.0 (IQR 4.0–64.0) in the 6 months after. After adjusting for correlation between observations taken on the same patient, there was an increase of 17.4 hours in total services per person in the six months after CREMS referral (95% CI: 1.7–33.1, $p = 0.03$, Table 1).

The number of individuals receiving home care services increased for all types of home care services after CREMS referral (Table 1). Among individuals who received services in both time periods, the only significant change in the average number of hours per person after CREMS referral was for personal support services, with an adjusted increase of 28.4 hours per person (95% CI 10.6–46.3, $p = 0.002$, Table 1).

Emergency Medical Services

In the ‘intention-to-treat’ population the unadjusted mean 9-1-1 calls per person was 1.44 (SD 9.58) in the six months prior to CREMS referral and 1.20 (SD 7.04) in the six months after CREMS referral. Using zero-inflated Poisson regression, the incidence rate ratio

TABLE 2. Change in EMS and ED utilization after a CREMS referral

	9-1-1 Calls to EMS		Ambulance Transports to ED	
	Unadjusted Mean (SD)	Incidence Rate Ratio (95% CI)	Unadjusted Mean (SD)	Incidence Rate Ratio (95% CI)
Intention-to-Treat (N = 1851)				
Before Referral	1.44 (9.58)		0.91 (8.90)	
After Referral	1.20 (7.04)	0.89 (0.87–0.93)	0.79 (6.27)	0.93 (0.89–0.97)
Per-Protocol (N = 1100)				
Before Referral	0.98 (7.69)		0.70 (7.30)	
After Referral	0.96 (5.70)	0.95 (0.91–1.00)	0.65 (4.93)	0.90 (0.85–0.95)

EMS = *Emergency Medical Service*; ED = *Emergency Department*. Incidence Rate Ratio is reported from zero-inflated Poisson regression analysis comparing the 6 months after CREMS referral with six months before referral. The intention-to-treat population was the total study population and the per-protocol population included only the individuals with both EMS and CCAC records available for analysis.

(IRR) for 9-1-1 calls after CREMS referral was 0.90 (95% CI: 0.87–0.93, $p < 0.001$) representing a 10% reduction in 9-1-1 calls after CREMS referral (Table 2).

In the “intention-to-treat” population the unadjusted mean ambulance transports to ED per person was 0.91 (SD 8.90) in the 6 months prior to CREMS referral and 0.79 (SD 6.27) in the 6 months after CREMS referral. Using zero-inflated Poisson regression, there was a 7% reduction in ambulance transports to ED (IRR 0.93, 95% CI: 0.89–0.97, $p < 0.001$).

Sensitivity Analysis

There were 1,100 individuals with records in both the CCAC and EMS datasets. In this “per-protocol” population, the IRR for 9-1-1 calls after CREMS referral was 0.95 (95% CI: 0.91–1.00, $p = 0.045$) and the IRR for ambulance transports to ED was 0.90 (95% CI: 0.85–0.95, $p < 0.001$).

DISCUSSION

Our study provides empiric evidence about the association between paramedic-initiated home care referrals and the utilization of home care, 9-1-1, and ED services by a population of mainly older adults in a major metropolitan city. CREMS referral was associated with a 24.3% increase in the number of people receiving home care services, with large increases in care coordination (24.3%), occupational therapy (18.4%), and personal support (16.1%). It was also associated with a modest increase in the hours of home care services used among individuals who were previously receiving services, predominantly due to increased personal support. This suggests that CREMS referral increased both access to and use of home care services. CREMS referral may also have been associated with reduced utilization of 9-1-1 and ED services, with a 10% reduction in 9-1-1 calls in the “intention-to-treat” population and a 5% reduction in the “per-protocol” population.

In the absence of a control group, it is not possible to make a causal inference about the effect of a CREMS referral. Nevertheless, it is reasonable to attribute

the substantial increase in utilization of home care services to the CREMS referral. Home care services, such as occupational therapy, have been shown to reduce events like falls (8), which may trigger 9-1-1 calls and ED utilization. Thus, the improved access to home care services that we report may have plausibly reduced 9-1-1 and ED utilization. However, observations regarding EMS and ED utilization may be confounded by secular trends, regression to the mean or missing data. For example, in the “intention-to-treat” analysis, the reduced 9-1-1 calls and ED transports may have been due to undetected deaths among those with no CCAC records. This might explain why the reduction in 9-1-1 calls was attenuated in the “per-protocol” analysis, where there were no missing records. Given these limitations, it is reasonable to conclude that CREMS referral may be associated with reduced 9-1-1 and ED utilization and further research is needed to confirm this finding.

Our findings are consistent with the small number of previously published studies. Shah and colleagues found that paramedics were able to feasibly refer older adults to case managers for home care services in a rural setting (9). Heinelt and colleagues report that community paramedics can integrate with primary care physicians to identify patients at risk for serious medical events and intervene upstream (10). One systematic review identified 11 case reports about eight community paramedicine programs in rural settings in Canada and the United States (6). Another systematic review using the Cochrane methodology identified 11 articles and one randomized controlled trial about community paramedicine initiatives (5). These studies reported that community paramedicine may be associated with improved health outcomes or reduced healthcare utilization but the quality of evidence to support these conclusions was poor (6). In the one randomized trial, which was conducted in an urban area in England, paramedics with expanded scope of practice when attending emergency calls were able to reduce ED visits and hospitalizations (11). An analysis of 3,000 patients transported to ED after 9-1-1 calls in Ontario found that 77% of patients with age

greater than 65 years were discharged directly from the ED, suggesting that expanded paramedic roles could reduce ED utilization (12). The primary conclusion from both systematic reviews was that there is a paucity of research about community paramedicine, and our study adds to this body of literature.

Our study may inform efforts to further develop community paramedicine programs. The proportion of individuals who received CCAC services after CREMS referral was only 42.5%. This suggests that there may be an opportunity to improve the patient selection criteria for paramedic-initiated home care referrals, for example through the development of screening tools (13) and enhanced paramedic training. This relates to interviews with paramedics across Ontario, which found that there are opportunities to improve role clarity and knowledge about CREMS programs (4). We also found that individuals made an average of 1.44 calls to 9-1-1 in the six months before CREMS referral. It is possible that community paramedicine programs could have a greater effect by targeting more intensive users of EMS services.

Our study has several limitations. First, there was no control group and thus we were unable to account for secular trends or regression to the mean. To address this, we employed a statistical approach for use of home care services that used each individual as their own control and included an adjustment for repeated measures over time. We also excluded individuals with reduced follow-up time due to death, hospitalization, or nursing home admission. This improves the validity of the pre-post comparison but limits the generalizability of our findings among more seriously ill individuals. Second, only 59% of CREMS referrals recorded by Toronto EMS had corresponding CCAC client care records. The most likely explanation for this is that the CCACs did not maintain records about individuals who either could not be contacted or declined further assessment. This compares favorably with the study by Shah and colleagues, in which 73% of individuals refused their case management referral (9). There may also have been errors reporting or recording personal identifying data during the 9-1-1 paramedic visit, which could affect data linkage between EMS and CCAC records. Data about study exclusion criteria were derived primarily from CCAC client records. These data may have been incomplete in the group with no CCAC records. Therefore, we performed both an "intention-to-treat" analysis involving the entire study population and a "per-protocol" analysis restricted to only those with CCAC records. Third, we measured ambulance transports to ED but did not measure ED utilization through other means of access. Finally, there were no formal criteria given to paramedics for making a CREMS referral. Thus, paramedics used their judgment to determine whether individuals might benefit from a CREMS referral,

which reflects real-world practice but may limit the reproducibility of our findings or generalizability to other practice settings.

CONCLUSION

In conclusion, the Toronto CREMS program was associated with increased access to and use of home care services for a population of mainly older adults and may have been associated with reduced 9-1-1 calls and ambulance ED transports. Our findings add to the growing literature that highlights the promise of community paramedicine and reinforces the need for further prospective studies and randomized controlled trials in this area.

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