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EDUCATION AND PRACTICE

IMPACT OF A NOVEL COLLABORATIVE LONG-TERM CARE – EMS MODEL: A BEFORE-AND-AFTER COHORT ANALYSIS OF AN EXTENDED CARE PARAMEDIC PROGRAM

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ABSTRACT

To compare system and clinical outcomes before and after an extended care paramedic (ECP) program was implemented to better address the emergency needs of long-term care (LTC) residents. Data were collected from emergency medical services (EMS), hospital, and ten LTC facility charts for two five-month time periods, before and after ECP implementation. Outcomes include: number of EMS patients transported to emergency department (ED) and several clinical, safety, and system secondary outcomes. Statistics included descriptive, chi-squared, t-tests, and ANOVA; $\alpha < 0.05$. 413 cases were included (before: $n = 136$, 33%; after $n = 277$, 67%). Median patient age was 85 years (IQR 77–91 years) and 292/413 (70.7%) were female. The number of transports to ED before implementation was 129/136 (94.9%), with 147/224 (65.6%) after, $p < 0.001$. In the after period, fewer patients seen by ECP were transported: 58/128 (45.3%) vs. 89/96 (92.7%) of those not seen by ECP, $p < 0.001$. Hospital admissions were similar between phases: 39/120 (32.5%) vs. 56/213 (29.4%), $p = \text{NS}$, but in the after phase, fewer ECP patients were admitted vs. non-ECP: 21/125 (16.8%) vs. 35/88 (39.8%), $p < 0.001$. Mean EMS call time (dispatch to arrive ED or clear scene) was shorter before than after: 25 minutes vs. 57 minutes, $p < 0.001$. In the after

period, calls with ECP were longer than without ECP: 1 hour, 35 minutes vs. 30 minutes, $p < 0.001$. The mean patient ED length-of-stay was similar before and after: 7 hours, 29 minutes compared to 8 hours, 11 minutes; $p = \text{NS}$. In the after phase, ED length-of-stay was somewhat shorter with ECPs vs. no ECPs: 7 hours, 5 minutes vs. 9 hours, $p = \text{NS}$. There were zero relapses after no-transport in the before phase and three relapses from 77 calls not transported in the after phase (3/77, 3.9%); two involved ECP (2/70, 2.8%). Reductions were observed in the number of LTC patients transported to the ED when the ECP program was introduced, with fewer patients admitted to the hospital. EMS calls take longer with ECP involved. The addition of ECP to the LTC model of care appears to be beneficial and safe, with few relapse calls identified. **Key words:** emergency medical services; long term care; mobile integrated health care

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INTRODUCTION

It has been identified that, in general, older adults use emergency medical services (EMS) frequently.^{1–3} Long-term care (LTC) residents are an especially complex and vulnerable population attended to by EMS⁴ They are often elderly and have high levels of frailty, functional impairment, and comorbidities, including cognitive impairment.⁵ EMS calls for LTC residents frequently result in transport to emergency departments (EDs).^{6,7} A recent study has identified that in the absence of specialized programs to address acute needs, one in four residents of LTC will require EMS and transport to the ED.⁸ Transporting these patients to busy EDs can contribute to confusion and anxiety, as well as exposure to illness and adverse events.⁹

The transitions between LTC, EMS, and EDs provide opportunity for improvements in the delivery of acute care at the bedside.^{10,11} Expanded scope paramedic programs have been implemented around the world.

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These programs are often designed to address the needs of specific patient populations, such as those with chronic diseases, in an effort to meet their needs and reduce urgent use of EMS or the ED. These practices are supported by a small number of trials.^{12–14} To date, only one expanded scope paramedic program developed specifically for LTC residents has been reported¹⁵; however, this study was a small pilot study that did not include the outcomes of patients who were transported to hospital, leaving important questions unanswered. The potential benefit of this program is improving the continuity of care, better addressing the goals of care, and giving LTC patients the option of receiving care within their place of residence.

In our setting, Emergency Health Services (EHS) is a provincially organized EMS system and the sole provider of emergency and transfer services in Nova Scotia. EHS provides oversight for licensing of personnel, standards for education, and ensures single access to the EMS system, centralized computer aided dispatch, standards for response times, and medical oversight. Ground ambulances are staffed with primary, intermediate, and advanced care paramedics. EHS attends to 38,000 emergency calls a year in the capital region (2010–2011) where the Extended Care Paramedic (ECP) program was implemented. The ECP program is a collaboration with the district health authority and “Care by Design,” a new model of long-term care, which includes dedicated physician staffing, on-call LTC physician coverage, and interdisciplinary care.¹⁶ Ten of twelve “Care by Design” LTC facilities were included in the study sample (two facilities were excluded as they had different models of primary care [one was a teaching facility, the other had one full-time family physician on staff]).

As previously described, ECP staff includes approximately fifteen advanced care paramedics with additional specialized training work in conjunction with LTC and EHS online medical oversight physicians.¹⁵ The ECP scope of practice includes assessment and treatment interventions above the current advanced care paramedic scope of practice,¹⁷ including: wound management (suturing and skin adhesive), consultation with LTC physicians to develop specialized care plans, and facilitation of referrals to hospital for quicker access to diagnostic imaging and emergency department beds. “End of life” care is also in this scope and is not limited to those registered with a palliative program, but includes all in the dying process. End of life care is focused on helping to facilitate high quality of death.¹⁸ ECPs respond to LTC facilities from 0900–2100 h on a daily basis, whereas emergency paramedics are available to LTC facilities on a 24/7 basis. ECPs work alone, in a nontransport-capable vehicle, and do not respond to calls in emergency mode (i.e., they do not use lights-and-sirens). Dispatch indications for ECP are listed in Table 1. Con-

current medical oversight to ECP is provided by online EMS physicians and established evidence-based written EMS protocols. All patients seen by the ECP are discussed with the online medical oversight physician and the LTC physician on call. ECPs were trained for two weeks in January 2011.

The objective of this study was to measure differences in delivery of emergency care for LTC residents with acute illnesses or injuries attended by ECP or emergency paramedics, measured primarily with number of transports to the ED, as well as EMS response and scene time, patient ED length of stay, EMS time in the ED, hospital admission, and relapse back to EMS after calls ending in no transport. The hypothesis was there would be differences in the number of transports to the ED for LTC patients seen by ECP compared to emergency paramedics.

METHODS

This analysis is a retrospective cohort study and is part of a larger time series study, the methods of which have been described in detail elsewhere.¹⁶ In this analysis, two five-month periods are compared: before (September 1, 2010–January 31, 2011) and after (September 1, 2011–January 31, 2012) implementation of the ECP program. A subgroup analysis of the after period responses was conducted, based on type of paramedic response (ECP vs emergency paramedic).

Sampling

All consecutive eligible calls were included. In the before period, all LTC residents who had a 911 call made for them were attended by emergency paramedics. The before study period ended before ECP training began. In the after period, patients were attended to by either ECPs or emergency paramedics, based on a pre-selected list of dispatch determinants or at the request of the LTC facility. ECPs were dispatched to a LTC facility if the call is triaged as one of the low acuity dispatch determinants pre-identified as most appropriate for ECP response, or if the LTC staff specifically request the ECP, which could include patients of any acuity level. If the ECP is occupied with a call when another request is made, the closest emergency ambulance is dispatched.

This study was approved by the Capital District Health Authority Research Ethics Board, Halifax Nova Scotia, Canada (2011-123).

Outcomes

The primary outcome measure was the number of EMS calls that resulted in transport to the ED. Secondary outcomes were: EMS response and scene time, patient ED length of stay [defined as the time EMS arrived at

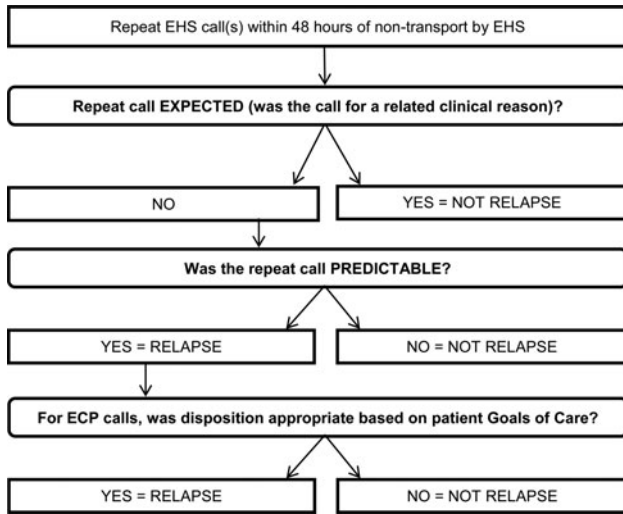


FIGURE 1. Determination of “Relapse Call.”

ED to time patient left ED (admitted or discharged)], EMS time in the ED (defined as time EMS arrived at ED to time patient placed in ED bed), hospital admission, and relapse back to EMS after calls ending in no transport. Relapse was considered a proxy measure for safety.

Data Collection

Data collection began with a query of the EHS electronic patient care database. Deterministic data linkage was used to match EHS records with hospital charts and LTC charts.¹⁹ EHS data was transferred into a study-specific database (Microsoft Access, Redwood CA USA). Trained research nurses abstracted data on study patients from LTC and hospital charts, and from the narrative sections of EHS charts. For relapse, for each patient not transported, the EHS database was forward searched by identifiers, and repeat calls were identified. A committee of paramedics and physicians (*n* = 9) reviewed all calls for the same patient and determined by consensus whether the repeat call was a “relapse.” For each call in which there was a repeat call within 48 hours, the committee discussed if the clinical reason for each call was related to each other, following an algorithm (Figure 1).

Data Analysis

Data were exported into SPSS 21.0 statistical analysis software (IBM, Armonk NY). Patient characteristics and relapses were analyzed and reported descriptively. Comparisons were made with chi-squared tests, two-tailed independent t-tests and ANOVA as appropriate, with significance set at 0.05 (corrections made for multiple comparisons).

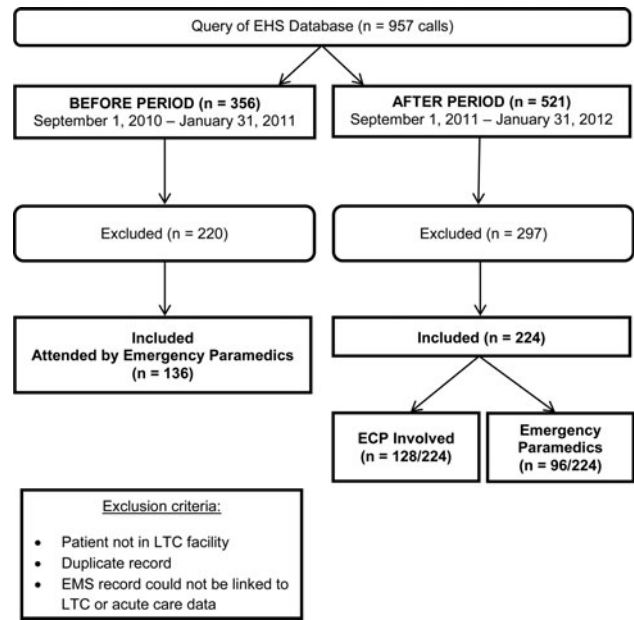


FIGURE 2. Patient inclusion flow diagram.

RESULTS

There were 360 LTC residents who had a 911 call made for them during the two study periods: 136 in the before period and 224 in the after period. In the after period, 128/224 were exposed to ECPs and 96/224 received care from emergency paramedics only (i.e., ECPs were not involved in the call) (Figure 2). There were several differences in patient characteristics between the before and after period. In the after period, patients attended by ECP or by emergency paramedics were similar, except for Canadian Triage Acuity Score (CTAS) distribution (Table 2).

There was a decrease in the number of patients transported to the ED between the before (94.9%) and after

TABLE 1. Indications for dispatching ECP to LTC patient (15)

Dispatch Complaint	Dispatch Determinant Level (MPDS)
Abdominal pain	Alpha
Allergies	Alpha
Assault	Alpha
Back pain	Alpha
Choking	Alpha
Diabetic problem	Alpha
Eye injuries	Alpha
Falls	Alpha
Headache	Alpha
Hemorrhage/lacerations	Alpha
Poisoning	Omega
Sick person	Alpha and Omega
Traumatic injuries	Alpha
Any specific request from LTC requesting ECP	All levels

TABLE 2. Patient characteristics

	Before Period	After Period	p-value	After Period: ECP Involved	After Period: Emergency Paramedics	p-value
n	136	224		128	96	
Age median (IQR)	86(13)	84(16)	0.001	85(14.5)	84(18)	NS
Female n (%)	110(80.1%)	147(65.6%)	0.001	90(70.3%)	57(59.4%)	NS
Comfort Care Directives n (%)	121(91.0%)	219(97.8%)	0.001	127(99.2%)	92(95.8%)	NS
CTAS 1 n (%)	0	2(0.9%)	<0.001	0	2(2.1%)	<0.001
CTAS 2 n (%)	26(19.7%)	32(16.8%)		11(8.6%)	21(21.9%)	
CTAS 3 n (%)	80(60.6%)	76(40.8%)		26(20.3%)	50(52.1%)	
CTAS 4 n (%)	22(16.7%)	44 (24.4%)		33(25.8%)	11(11.5%)	
CTAS 5 n (%)	4(2.9%)	37(16.5%)		30(23.4%)	7(7.3%)	
CTAS score missing	4(2.9%)	33(14.7%)		28(21.9%)	5(5.2%)	

CTAS = Canadian Triage and Acuity Score.

periods (65.6%), and in the after period there was a decrease when ECP was involved in the call (45.3%) compared to when ECP was not involved (92.7%) (Table 3). The overall number of patients who were admitted to the hospital was not different between study periods; however, in the after period fewer patients who received care from ECP were admitted as compared to those patients attended to by emergency paramedics.

In the after phase, response and scene times were statistically significantly longer when ECP was involved in the call compared to emergency paramedics. Patients spent 40 minutes longer in the ED in the after period than the before period, and in the after period, ECP calls took almost two hours longer than emergency paramedic calls, neither difference statistically significant. Differences were not observed in the length of time EMS crews spent in the EDs in the before or after periods, or in the subgroup analysis of the after period.

There were few calls identified as relapses in either study period (Figure 3): 0 in the before period and three in the after period; two with ECP involved and one with emergency paramedics. There were zero relapses after no-transport in the before phase and three relapses from 77 calls not transported in the after phase (3/77, 3.9%); two involved ECP (2/70, 2.8%).

DISCUSSION

This cohort analysis examined the impact of this novel delivery of coordinated emergency care for LTC residents by ECPs, with a focus on system and safety outcomes.²⁰ These findings complement previously published qualitative analysis of the delivery of ECP care to this vulnerable population.²¹ This current study found that 29% fewer LTC patients were transported to the ED after the ECP program was implemented than before. In the after period, there were 47% fewer transports when ECP was involved than emergency paramedics only. This large decrease is similar to other mobile integrated health programs, such as the. Gray et al. observed that 73% of transports for elderly pa-

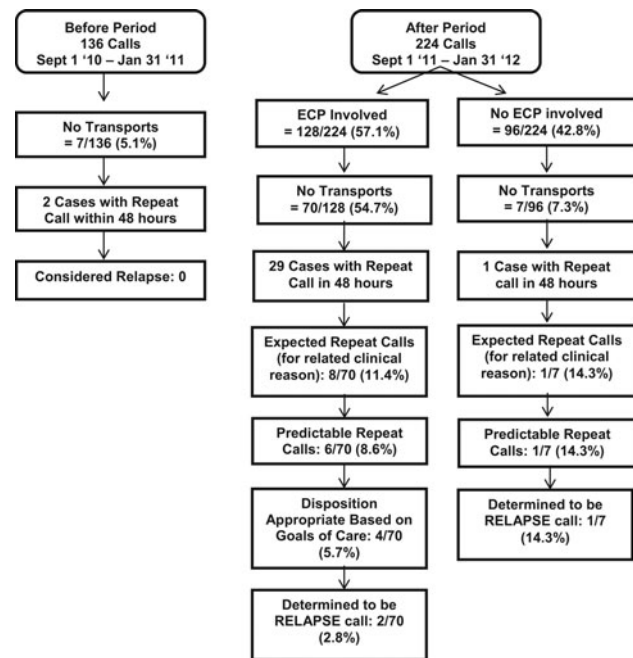


FIGURE 3. Relapse calls.

tients with a fall were avoided with UK emergency care practitioners.²²

Given that it was common for ECP calls to end in no transport, it is important to examine safety. Other mobile integrated health programs have evaluated safety by searching for unexpected calls back to the EMS system, unexpected visits to the ED, or hospital admissions. Gray et al. found that within 72 hours of the ECP visit, 21/171 patients presented to the ED or were admitted (12.9%).²² In their cluster randomized trial comparing ECP to standard EMS service, Mason et al found patients seen by ECP were more likely to have repeat contact with the health system within 28 days than patients seen by emergency paramedics (21% vs. 18%, $p < 0.01$).¹² In our examination for relapse calls after 48 hours, we found the opposite; those seen by ECP relapsed back to EMS less (3% vs. 14%). This may be because ECPs develop care plans in consultation with

the LTC physician, EMS physician, nursing staff, and family.

The EMS call “flow” is substantially different from the traditional EMS response, evident by the longer call duration when ECPs are involved. The time it takes for ECPs to develop a care plan, consult with physicians and the ED, deliver treatment, and communicate with staff and families contributes to increased scene times.

This ECP program is a strong example of how EMS can be an important collaborator in the delivery of care for LTC residents. The findings of this study and previous qualitative research on this program indicate integration of EMS into the model of care facilitates collaboration and communication.²¹ Integration is an important element of improving quality and efficiency of care; such efforts are enhanced when multidisciplinary cooperation and a focus on the continuity of care is included.²³ A call has been made for such demonstration projects this to be reported.²⁴ These are important to inform EMS planning as the population continues to age and providing high quality care at end of life is a focus for policy makers and healthcare providers.

Limitations

This study has some limitations inherent in this uncontrolled observational design. Patients in the two time periods differed in age, gender, presence of a comfort care directive, and acuity score. We do not believe the age difference of two years observed between the before and after period was clinically significant. There were fewer women in the after period. The effect of this difference between groups on the results is unknown. In the after period, charac-

teristics of ECP and emergency paramedic-attended patients were similar except for triage acuity; this is not surprising, given that ECPs were usually dispatched to lower acuity calls, as well as the higher acuity calls in which the LTC specifically requested ECP. The ECP shift times may also have contributed to the acuity differences between groups. During overnight hours (2100–0900), LTC facilities likely called 911 for high acuity patients, but would wait until morning to call for ECP for low acuity patients. The higher rate of comfort care directives and lower acuity complaints may have had an effect on reducing the non-transport rate, and other outcomes such as admission rate. In addition, we did not control for external variables that may have confounded these results, such as ED overcrowding. Timestamps were unable to be obtained in some cases. We do not believe that there is a difference in the calls with all timestamps compared to those missing times; however, the effect of this is unknown. The standard deviation for the mean times was fairly wide, reflecting the variance in duration of LTC EMS calls in our system, especially when ECP is involved. Time differences between groups were underpowered to reach significance. Finally, in our study, the relapse time period was 48 hours, which is shorter than some previously published studies which used relapse periods as long as 28 days.¹² We believe the 48-hour time period to be most important to identify patients whose condition was not improving or becoming worse, and that extending beyond that would include many patients with repeat calls for unrelated reasons. Our definition of “relapse” excluded repeat calls made for an unrelated clinical condition, making our estimates less conservative.

TABLE 3. Outcomes

	Before Period	After Period	p-value	After Period: ECP Involved	After Period: Emergency Paramedics	p-value
<i>n</i>	136	224		128	96	
Transported to ED <i>n</i> (%)	129 (94.9%)	147 (65.6%)	<0.001	58 (45.3%)	89 (92.7%)	<0.001
Hospital Admissions* <i>n</i> (%)	39/120 (32.5%)	56/213 (29.4%)	NS	21/125 (16.8%)	35/88 (39.8%)	<0.001
Mean EMS response and scene time** (min:sec) (SD)	25:16 (07:20) <i>n</i> = 128	57:15 (54:00) <i>n</i> = 151	<0.001	1:35:18 (1:06:40) <i>n</i> = 62	30:45 (12:36) <i>n</i> = 89	<0.001
Mean Patient ED LoS*** (hh:mm:sec) (SD)	7:29:49 (4:58:04) <i>n</i> = 115	8:11:22 (5:30:56) <i>n</i> = 139	NS	7:05:15 (4:51:05) <i>n</i> = 57	8:57:19 (5:50:25) <i>n</i> = 82	NS
Mean EMS Time in ED**** (hh:mm:ss) (SD)	1:49:46 (1:55:06) <i>n</i> = 114	1:54:33 (3:41:41) <i>n</i> = 139	NS	1:53:03 (3:36:11) <i>n</i> = 57	1:55:36 (3:46:44) <i>n</i> = 82	NS

*In some cases admission was unknown. Reported here are the patients in which admission status was found. In the before period, admission was missing for nine patients who were transported (7% missing). In the after period, admission was missing for 11 patients who were transported (7.5%).

**EMS response and scene time defined as *dispatch time to time EMS departed scene*. In the before period, there were 0 records missing the *dispatch time* and eight records missing the *depart scene time* (5.9%). In the after period, three were missing the *dispatch time* (all ECP) (1.3%) and 73 were missing the *depart scene time* (32.6%) (66 were ECP, none of which transported to ED).

***Patient ED LoS defined as *time EMS arrived ED to time patient left ED* (admitted or discharged, reported for those cases in which patient was transported to ED). In the before period, 14 records were missing *time patient left ED* (10.8%). In the after period, eight records were missing *time patient left ED* (5.4%) (one was ECP).

****EMS Time in ED defined as *time EMS arrived at ED to time patient placed in ED bed* (reported for those cases in which patient was transported to ED). In the before period, 15 records were missing *time patient in ED bed* (11.6%). In the after period, 8 records were missing *time patient placed in ED bed* (5.4%) (one was ECP).

CONCLUSION

In this cohort analysis, it was found that the addition of the ECP program significantly reduces the number of patient transported to the ED and number of admissions, without any significant risk to patient safety.

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