Community Paramedic Pilot Program Operational Metrics and Impact on Patient Emergency Medical Services Utilization

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ABSTRACT

Introduction: Community paramedicine (CP) is an expanding area of interest within the field of emergency medical services. Few studies have established operational metrics and outcome measures for CP programs. We aimed to evaluate change in 911 use and operational metrics among patients enrolled in a pilot, fire department-based, CP program.

Objective: The purpose of this study was to determine if the ongoing CP program decreased unscheduled emergency health care utilization among high utilizers. It was hypothesized that the implementation of community paramedicine visits would reduce 911 calls among this cohort.

Methods: A retrospective cohort study of adults enrolled in a CP program during 2016 to 2020 was performed. Patients were enrolled in the CP program if they frequently used a community emergency department or 911 services. This was defined as greater than 4 uses in the past 12 months. A select group of experienced paramedics received targeted training in relevant concepts. Paramedics frequently contacted patients via both in-home visits and phone calls based on perceived clinical need. Through a review of electronic medical records, we collected patient demographic and clinical information and program operational metrics. The primary outcome of interest was the change in 911 use after enrollment. These 2 groups were compared using a paired *t* test.

Results: Of 33 patients who met inclusion criteria, 29 were successfully enrolled. Pre-enrollment 911 calls averaged 31.8 calls per month. Post-enrollment 911 calls averaged 14.2 calls per month. Average calls per month decreased by 54.2% ($P = .003$) post-enrollment, a reduction of 207 calls per year across the cohort. Length of program enrollment also was found to have a greater impact on 911 call reduction.

Conclusions: A fire-department based CP program effectively reduced 911 calls for high utilizer emergency medical services and emergency department patients by 54.2%. Program participation for 6 months or longer was associated with greater reductions in 911 calls, regardless of the number of existing comorbidities.

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INTRODUCTION

There are approximately 37.6 million emergency medical services (EMS) responses annually in the United States, including 23.6 million that result in transport.[1] A significant portion of these EMS responses in the US are nonemergent, and it is estimated that nonemergent calls can account for 20% to 40% of all 911 calls.[2] This overutilization has been shown to contribute to resource strain, increased cost, provider burnout, and system inefficiency.[2] New prehospital delivery methods are being explored to reduce avoidable EMS utilization. Recently, this has led to the innovative concept of community paramedicine (CP), also commonly referred to as mobile integrated health care.

CP is an evolving practice, and programs typically are designed to address specific local issues affecting the health care system. However, programs vary widely in their scope and design. Most rely on collaborations between EMS and other health care and social service providers.[3] Interest in CP has grown substantially in recent years to improve access to and quality of care. Some of the delivery system problems targeted by CP programs include the overuse of the 911 system, the need for alternative means to manage patients who do not require transport to an emergency department (ED), repeat ED visits, and hospital readmissions. As these programs become more prevalent across the country,

evaluation of their effect on patient care and system utilization has become paramount.

Prior studies have suggested the benefits of CP programs to reduce the utilization of unnecessary emergency services; however, detailed analysis of program demographics and operational data is not well described.[4-8] Therefore, we sought to evaluate our newly implemented CP program's effect on 911 utilization in addition to the program's operational metrics. The results of this study will be used to assess the program's efficacy and to guide the development of future CP programs.

METHODS

Program Description

This is a descriptive analysis and retrospective chart review of a fire department-based paramedic EMS service CP program in a midsized Midwestern city. Program participants were identified as high utilizers of the ED and/or EMS service who reside within the response jurisdiction. A high utilizer was defined as a patient who had initiated EMS services with a 911 call 4 or more times in the prior 12 months or a patient who had 4 or more visits to the ED within the prior 12 months. Eligibility included providing a valid address for home consultation. The CP program identified and contacted eligible candidates for participation. Upon providing their consent, candidates then enrolled in the program. Providers were paramedic level trained and completed additional targeted training and instruction on motivational interviewing. Patient contact from CP providers was conducted through both in-person home visits and telemedicine visits. The first visit was a community health consultation and assessment of the patient's overall health, which included the development of a personalized plan for future visits. After initial evaluation, the frequency of future visits was determined between the patient and paramedic according to each individual patient's primary health goals and perceived need. Visits were conducted in the patient's home or an agreed upon community meeting place. Community paramedics attempted to reach patients by phone and scheduled structured time for visits. Unscheduled visits occurred occasionally if patients could not be contacted by phone. After each patient contact, community paramedics documented a summary of the visits through the electronic reporting software. Each home visit also was entered into the computer-aided dispatch system in real time for provider safety and community paramedic tracking purposes.

Data Collection

Data were obtained through retrospective chart reviews using the prehospital electronic medical record (ImageTrend, Lakeville, Minnesota) during May 2016 to February 2020. This study was deemed to be Institutional Review Board (IRB) exempt by the University of Wisconsin's online IRB evaluation tool. Specific data obtained from ImageTrend included EMS calls, community health home visits, and telehealth contacts, as well as patient demographic data and past medical history. A summary of each community health visit or 911 call also was available through a free text option completed by the community paramedics.

Community paramedic home health visits began in May 2016, identifying 33 patients and ultimately enrolling 29 into the program through February 2020. Participants remained in the program until they either reached their specific goals and were determined to no longer require services, moved out of department jurisdiction, dropped out of the program, or died. The primary outcome of 911 calls among patients enrolled were analyzed both pre- and post-enrollment. In addition to 911 call

Table 1. Enrolled Patient Demographics in the Community Paramedicine Program

	N	%
Race		
White	17	58.6
African American	11	37.9
Other	1	3.4
Sex		
Male	4	13.8
Female	25	86.2
Age		
18 – 24	0	0
25 – 34	1	3.4
35 – 44	4	13.8
45 – 54	5	17.2
55 – 64	8	27.6
65 – 74	5	17.2
75+	3	10.3
Missing age	3	10.3
Chronic disease		
Hypertension	6	20.7
Diabetes	7	24.1
Pulmonary disease	10	34.5
Chronic kidney disease	1	3.4
Rheumatologic disease	3	10.3
Mental health	13	44.8
Substance abuse	9	31.0
Single comorbidity	11	37.9
Multiple comorbidities	18	62.1

Table 2. Number of Patient Contacts and Contact Modality Utilized in the Community Paramedicine Program

	N	%
Total community paramedicine contacts	1371	100
Home visits	742	54.1
Telehealth contacts	629	45.9
Home visits 1 provider	425	57.3
Home visits 2 providers	317	42.7
	Cohort Total	**Average**
Patient-months	503	13.0/patient
Home visits	742	1.5 / patient / month
Telehealth contacts	629	1.2 / patient / month

data, operational matrix data were collected, including the total number of in-person visits, total number of telephone communications, and number of paramedics utilized for each visit. A 1-year retrospective chart review was done to establish baseline 911 call utilization for each participant. As participants engaged in the program, their 911 calls were tracked and calculated as a rate of 911 calls per month. If a participant died or became unenrolled in the program prior to 1 year post-intervention, the total number of months they were actively enrolled in the program was used for the final calculations. Independent t tests were performed to compare in group differences in baseline and subsequent measurements. A summative analysis of program operation metrics also was performed by retrospective review of ImageTrend reports for each encounter.

Table 3. 911 Calls per Month Pre-enrollment vs Post-enrollment in the Community Paramedicine Program

Length Enrolled	N	911 Calls/Month Pre-enrollment	911 Calls/Month Post-enrollment	911 Calls/Month Difference	*P* value
Entire cohort	29	31.85	14.61	17.24 (54.2% reduction)	0.003
0–6 months	9	7.66	5.97	1.69 (22.1% reduction)	0.314
7–12 months	11	13.56	5.65	7.91 (58.4% reduction)	0.072
13+ months	9	10.62	2.97	7.65 (72.3% reduction)	0.018
Single comorbidity	11	11.55	5.06	6.49 (56% reduction)	0.084
Multiple comorbidities	18	20.34	9.54	10.80 (53.4% reduction)	0.027

RESULTS

Of the 29 participants who were successfully enrolled in the CP program, 11 remained enrolled in the program at the end of the study period. Five successfully graduated from the program and no longer needed services. Six patients moved outside of the fire department's jurisdiction while actively enrolled, 4 participants dropped out of the program, and 3 participants died while enrolled in the program. Table 1 describes the patient cohort.

A total of 1371 community paramedic patient contacts were made over a 46-month period. Each participant remained enrolled in the program for a varying degree of time. Operation metric data related to community paramedicine visits performed can be seen in Table 2.

Prior to enrolling in the program, participants in the cohort averaged 31.85 calls per month. This resulted in an average of 1.10 (+/- .20) calls per month per participant. After enrollment, the cohort averaged 14.16 calls per month, or .504 (+/- .13) calls per month per participant. Overall, this represents a 54.2% ($P = 0.003$) reduction in 911 calls after program enrollment (Table 3). On average, each patient reduced their utilization of 911 services by 7 calls per year, resulting in a potential reduction of 207 calls per year collectively for the program participants.

The average participant was enrolled in the program for 405 days. Nine patients were enrolled in zero to 6 months, 11 were enrolled 7 to 12 months, and 9 were enrolled for 13 months or more. Table 3 shows sub-analysis of participants 911 call reduction related to length of program enrollment.

Of the 29 patients in the pilot program cohort, 11 had only 1 identifiable medical comorbidity, and 18 had multiple comorbid conditions. Table 3 shows the average 911 call reduction when the cohort is analyzed based on initial chronic comorbidities at the time of enrollment. Table 3 shows a summary of the sub-analysis in EMS utilization pre-enrollment compared to post-enrollment in the pilot program.

DISCUSSION

While enrolled in a fire department-based CP program, participants with high EMS utilization had a significant reduction in 911 calls. These findings suggest that CP programs may be effective in reducing 911 utilization among high utilizer patients and add to the literature supported in prior studies.[4-8] In addition, the demographic data and operational metrics of this program provide new insight into the sustainability and the resources required to replicate this type of program.

Surprisingly, the number of comorbidities did not affect the reduction in 911 calls when enrolled in the program. Prior studies have suggested that repeated ambulance use is highly correlated to medical comorbidities such as chronic obstructive pulmonary disease, chronic alcohol use, and mental illness.[9] For this reason, it was postulated that the more medical comorbidities a patient has, the more they could benefit from a community paramedic program. However, when the patient cohort was separated by number of preexisting medical conditions, a similar reduction in 911calls per month between the single comorbidity cohort and multiple comorbidity cohort (56.0% and 53.4%, respectively) was found, although this was insignificant for the single comorbidity cohort. A trend that was established suggests a similar reduction in 911 calls across both groups regardless of the number of comorbid health conditions and is likely insignificant as a result of being underpowered in this analysis. This suggests that patients with single and multiple comorbidities can both benefit from CP programs. Interestingly, a high percentage of participants had mental health as a comorbidity. This subgroup was not analyzed separately, however is an area of interest for future programs within our system. These demographic data suggest a benefit to a wide variety of patient populations.

There is limited previous analysis regarding patient characteristics and length of patient program enrollment in relation to reduction in 911 call volume. When participants were analyzed further according to their length of program enrollment, a clear trend developed linking length of enrollment to 911 call reduction. The longer patients were enrolled in the CP program, the greater their reduction in 911 calls per month. While these findings were not

statistically significant, a strong trend was established suggesting that outcomes would become significant with additional participants over time. A review of existing literature did not yield any current studies that quantified the benefits of CP programs based on length of enrollment. It appears that program participation for at least 6 months correlated with a significant decrease in 911 utilization, while participation for shorter time frames showed a less significant reduction. Given the reduction seen with longer enrollment, we suggest that an anticipated enrollment duration of greater than 6 months may need to be considered by programs prior to participant enrollment. This longer duration needed for maximum benefit was not anticipated during the early stages of our program development and would have aided in appropriate personnel and resource planning. It also suggests that the longitudinal relationships CP providers develop with their patients may be beneficial in reducing EMS utilization.

The secondary outcomes of interest were specific to the program's operational metrics. This is a novel description that is scarcely represented in the current literature. This analysis found that most patient contacts were in-person home visits supplemented with telephone communications. We also found that most home visits were completed by a single paramedic, although many required 2 providers to address concerns for provider safety. These benchmark data can be beneficial in the creation and replication of similar CP programs. Specifically, this may drive decisions regarding personnel staffing models and the number of providers required to complete to the program's anticipated workload. Time spent during each encounter may vary and was not captured in this analysis; however, having baseline knowledge of the number and types of contact anticipated may again be of benefit for resource planning.

A limitation of this study is the small number of patients enrolled (n=29). An additional limitation to this study is the lack of a true control arm. Future analysis of programs would benefit from an increased number of participants as well as a control group consisting of patients who qualified for the program but did not enroll. Further analysis of CP programs also could correlate any reduction in 911 utilization to ED visits, hospital admissions, and readmission rates. Cost analysis was not performed for this study.

CONCLUSIONS

A fire-department based CP program effectively reduced 911 calls for high utilizer EMS and ED patients by 54.2%. Participation in the program for 6 months or longer was associated with greater reductions in 911 calls. Most contacts were home visits requiring a single EMS provider. These findings can be utilized to inform the development of future CP programs.

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