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ORIGINAL RESEARCH

Emergency Medical Services

Community paramedicine in Central Oregon: A promising model to reduce non-urgent emergency department utilization among medically complex Medicaid beneficiaries

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Abstract

Background: Community paramedicine has emerged as a promising model to redirect persons with nonmedically emergent conditions to more appropriate and less expensive community-based health care settings. Outreach through community paramedicine to patients with a history of high hospital emergency department (ED) use and chronic health conditions has been found to reduce ED use. This study examined the effect of community paramedicine implemented in 2 rural counties in reducing nonemergent ED use among a sample of Medicaid beneficiaries with complex medical conditions and a history of high ED utilization.

Methods: A cluster randomized trial approach with a stepped wedge design was used to test the effect of the community paramedicine intervention. ED utilization for non-urgent care was measured by emergency medicine ED visits and avoidable ED visits.

Results: The community paramedicine intervention reduced ED utilization among a sample of 102 medically complex Medicaid beneficiaries with a history of high ED utilization. In the unadjusted models, emergency medical ED visits decreased by 13.9% (incidence rate ratio [IRR], 0.86; 95% confidence interval [CI], 0.76–0.98) or 6.1 visits saved for every 100 people. Avoidable emergency department visits decreased by 38.9% (IRR, 0.61; 95% CI, 0.44–0.84) or 2.3 visits saved for every 100 people.

Conclusion: Our results suggest community paramedicine is a promising model to achieve a reduction in ED utilization among medically complex patients by managing complex health conditions in a home-based setting.

KEYWORDS
community paramedicine, comorbidities, emergency department utilization, non-urgent care

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1 | INTRODUCTION

1.1 | Background

In 2017, there were a total of 144.8 million emergency department (ED) visits in the United States.[1] A large proportion of those visits were for non-urgent conditions defined as: (1) immediate medical care that is not required within 12 hours based on the patient's initial complaint, presenting symptoms, vital signs, medical history, and age; and (2) care that did not require any diagnostic or screening services, procedures or medications, and patients were discharged home.[2] ED use for a medically nonemergent condition is neither a new nor a minor phenomenon. Authors of a systematic review of literature on non-urgent ED use between 1980 and 2008 found a median percentage of 32% of ED visits were nonurgent.[3]

ED use for medically nonemergent conditions can lead to unintended consequences such as higher healthcare spending, avoidable use of scarce hospital ED resources, and disconnected relationships between primary care physicians and their patients.[4] Redirecting medically nonemergent care to other more appropriate primary care settings is estimated to save $4.4 billion annually in health care spending in the United States.[5] Importantly, continuity of care is often lacking when primary care is delivered in an ED, as the emergency physician may not be aware of a patient's medical history, prognosis, and current treatments.[6] Effective community-based health care models are needed to divert patients who do not have a medically urgent condition to health care destinations that are more appropriate than a hospital emergency department.

1.2 | Importance

Community paramedicine (CP) has emerged as a promising model to redirect patients with nonemergent medical conditions to less resource intensive primary care settings, thereby increasing the availability of ED resources for emergency response.[7] Implemented in 1992, CP has gained international and national recognition as an innovative approach to health system reform.[8] In a CP program, trained paramedics operate beyond their role of traditional emergency medicine response and transport of ill or injured persons to and between hospitals.[7] The community paramedic practices within an "expanded scope," which includes the application of specialized skills and protocols beyond the base paramedic training such as: assessment (vital signs, blood pressure), labs (glucose levels, medication compliance), treatment (wound care, medication reconciliation), prevention (immunizations, fall assessment), and referral (medical, mental/behavioral and social services).[9] Community paramedicine has been credited with improving patient outcomes and patient satisfaction among frequent ED users, encouraging more appropriate use of emergency care services, and reducing health care costs.[7,10]

The Bottom Line

Frequently avoidable emergency department (ED) utilization has many negative downstream consequences. In this study of 2 rural counties, a community paramedicine program was used to target ED use for non-emergent conditions among a sample of 102 Medicaid beneficiaries. The intervention substantially reduced avoidable ED visits (2.3 visits saved for every 100 people).

1.3 | Goals of this investigation

The objective of this study was to determine if a CP intervention implemented in 2 rural Oregon counties reduced frequent emergency department utilization among a sample of Medicaid beneficiaries who had a history of high ED utilization. This study contributes addresses a gap in our current knowledge about the efficacy and safety of community paramedicine, particularly among a rural, Medicaid population.

2 | METHODS

2.1 | Study design and setting

The CP intervention was implemented in 2 rural Oregon counties with a combined population of 42,698 (Rural-Urban Continuum Code 6).[11] Residents in both counties have access to an emergency department operated by a regional health system. We worked with PacificSource Coordinated Care Organization (CCO) to identify and recruit primary care clinics to participate in the study. Our target recruitment goal was 4 clinics, 2 from each county. The primary care clinics were part of a private, not-for-profit health system operating in Central Oregon. Clinics receive payment for health care service delivery from private health insurers, Medicaid, Medicare, and patient out-of-pocket payments and provide primary care for local residents who reflect the population demographics of the 2 counties.

We conducted a cluster randomized trial in rural Oregon and applied a stepwedge design to investigate the effect of community paramedicine on ED use among a sample of Medicaid beneficiaries with a history of high ED utilization. Study activities were conducted in partnership with PacificSource Coordinated Care Organization, Redmond Fire and Rescue, and Crook County Fire and Rescue. This manuscript describes findings from the CP intervention that was implemented from July 2017 to March 2019. This project was funded by Central Oregon Health Resource Council. Our study was approved by the Oregon Health & Science University institutional review board (00018861).

2.2 | Selection of participants

Study participants met the following inclusion criteria: aged 18 years or older, discharged from the hospital within the last 24 hours, a current

Medicaid beneficiary, and a member of the PacificSource CCO. Patients currently enrolled in a home health or hospice program were excluded from the study.

2.3 | Study enrollment

Using these inclusion criteria, PacificSource CCO compiled a list of eligible patients using PacificSource Member Insight reports and clinic complexity reports which were then reviewed by the primary care clinics who led study recruitment activities. A member of the primary care team at each of the 4 clinics then reached out to eligible patients and invited them to participate in the study. Patients were provided information about the study verbally and in writing and were informed that participation was optional. Patients gave their verbal consent to participate in the study, either over the phone or in person during a primary care appointment, and could opt out of participating at any time during the study. Consent was obtained before the release of personal health information from their electronic health record. All participants were enrolled during the recruitment phase and followed longitudinally for 20 months.

2.4 | Intervention

The CP intervention intentionally complemented and extended the existing Patient Centered Primary Care Medical Home model[12] adopted at the 4 primary care clinics. The intervention involved 2 community paramedics. The paramedics worked alone and were assigned a group of study participants. Each paramedic provided care in a home-based, non-urgent setting to 51 patients. The paramedics were supervised by an ordering physician who was the medical director of the Fire and Rescue District in each county.

Each study participant received 5 home visits with a paramedic over a 3-month period. The home visits were scheduled at a frequency determined most appropriate by the ED discharge coordinator and the study participant's primary care team. The first home visit involved the community paramedic and a clinic-based community health educator/worker. Together, they discussed hospital discharge instructions and follow-up care with the study participant, including dosage instructions for prescribed medications. The initial home visit also included an environmental safety assessment, social assessment, basic health and wellness assessment, and a nutrition assessment. The four subsequent home visits were conducted by the paramedic alone and involved checking and recording patient vitals (ie, weight, heart rate, temperature, blood sugar, blood pressure, and oxygen saturation; helping patients with medication adherence, assisting with scheduling follow-up appointments with primary care and/or specialty care. When necessary, community paramedics also coordinated social service support, such as food assistance.

2.5 | Randomization

A cluster randomized trial, using a stepped-wedge approach, was used to test the effect of the intervention.[13] Patients were clustered at the clinic level; the unit of randomization was the clinic. The sequence order of the 4 clinics' transition from control to intervention was determined pragmatically based on clinic readiness to assume new workflow processes associated with the intervention.[13] Clinic crossover was unidirectional from the control to the intervention condition. By the conclusion of the final sequence, all of the clinics received the CP intervention (Figure 1). Clinic sequence order determined the duration each clinic was in the control and intervention condition. The study design included a 15-day washout period between the control and intervention to account for ED use that was unrelated to the CP intervention. The model's design enables a staggered introduction of the CP intervention over time, multiple data collection time points for each clinic in both the control and intervention conditions, and the ability to control for time trends, as there is a contemporaneous comparison across the clinics.

2.6 | Data collection

PacificSource CCO compiled and provided the dataset to study investigators. PacificSource compiled the dataset by extracting data from the All Payers All Claims Reporting Program Oregon database[14] using a prescribed variable list for patients in the sample population. All ED visits from patients in the sample were recorded in the electronic health record and included in the dataset. The clinics and the 2 hospital EDs in the counties use the same electronic health record software platform, enabling complete capture of all ED encounters and primary care visits of the study population during the data collection phase of the study.

The health plan retrospectively collected data for 20 months (July 1, 2017 to March 2019). Data were collected for a minimum of 12 months during the control period and for a maximum of 8 months during the intervention period. Baseline data were obtained when all clinics were in the control condition, before initiation of each clinic's staggered exposure to the CP intervention. Data collection occurred at 5 intervals: baseline: 13 months, T1: 5 months, T2: 3 months, T3: 7 months, and T4: 5 months. While the study investigators planned for data collection to occur at 4-month intervals, this was a pragmatic research study testing the CP intervention in a real-life setting. The different data collection time blocks, (ie, baseline: 13 months for baseline, T1: 5 months, T2: 3 months, T3: 7 months, and T4: 5 months) were the result of staffing issues at the primary care clinics and health system.

2.7 | Outcome measures

The effectiveness of the CP intervention in facilitating a reduction of ED use was assessed through the outcome measures emergency medicine ED use and avoidable ED use. We define emergency medicine as the "diagnosis and treatment of unforeseen illness or injury provided in a hospital emergency department setting."[15] Emergency medicine use is the sum of ED visits per member per month. Avoidable ED visit is defined as "not requiring any diagnostic tests, procedures or medication"[2] and visits to the ED that could have been more appropriately managed by a physician in an office or clinic setting.[16] Avoidable

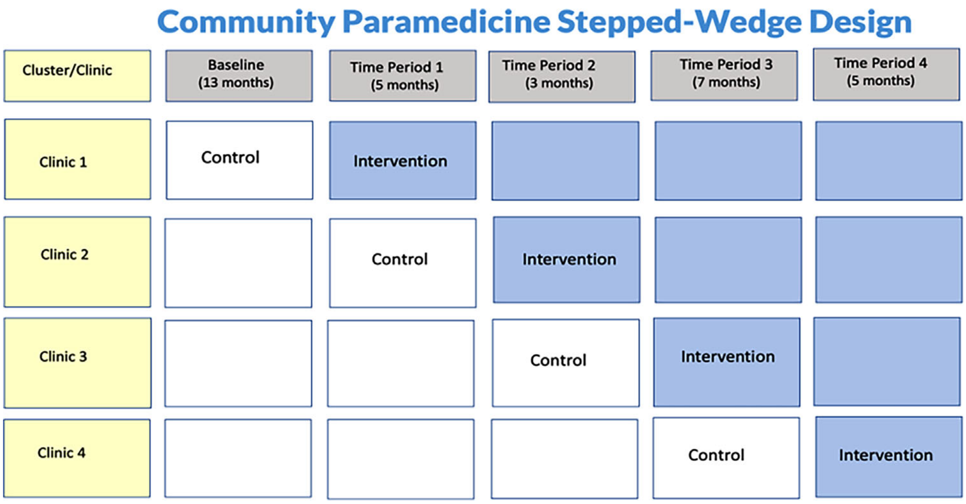

FIGURE 1 Community paramedicine stepped-wedge design sequence.

ED visits were calculated per member per month using the Medi-Cal method of avoidable ED identification.[17,18] The two outcome measures were analyzed separately.

2.8 | Independent variables

Patient level covariates included a Charlson Comorbidity Index variable and 6 health risk stratification variables. The Charlson Comorbidity Index was used to predict the 10-year survival in patients with multiple comorbidities.[19] Consisting of 19 conditions, it is an average comorbidity score for a patient. The patient health risk was defined using 6 health risk stratification variables ranging in the following order from low to high risk: healthy, stable, struggling, at-risk, in crisis, to unknown. PacificSource CCO assigned a risk score for each patient using a proprietary model that combines diagnosis types, complexity, and member utilization patterns. The health plan calculated the average risk score for a member, with a reference comparison population being 100.

2.9 | Statistical analysis

Descriptive statistics were calculated across the 4 clinics for emergency and avoidable ED utilization for both the control and intervention time-periods to explore distribution of the data. The unit of analysis was member months of ED use. A mixed effects Poisson regression with fixed clinic and random time effects was estimated to determine the effect of the intervention with and without patient-level covariates. The incident rate ratios are reported. We used the margins post-estimation command to identify and report linear trends of the CP intervention. The percent decrease in ED and avoidable ED use was calculated as the difference of the incidence rate ratio (IRR) coefficient from 1 multiplied by 100. Linear trend effects were reported as visit number change per hundred patients or the linear trend coefficient multiplied by 100. A P value of <0.05 was used to determine significance. Analyses were performed using Stata version 16 software.

The CP intervention coefficient was the estimated effect of the intervention on the prevalence of ED and avoidable ED use during the control compared with the intervention periods. Models 1 and 2 included the 4 clinics in both the control and intervention conditions and the CP intervention as a predictor of ED utilization (model 1) and avoidable ED use (model 2). Models 3 and 4 included the same predictors and outcomes, but also controlled for patient age, health risk level indicators ranging from 1 (at-risk) to 6 (unknown), and the Charlson Comorbidity Index ranking. Comparison of models 1 and 2 informed if and to what extent the intervention's effect had on general or avoidable ED use. Models 3 and 4 examined if changes in patient characteristics over time affected results.

3 | RESULTS

3.1 | Participants/sample

A total of 102 patients from 4 primary care clinics were included in this study. Patients in the sample were assigned to 1 of 4 clinics based on where they received primary care (Figure 2).

The study population ranged in age from 19 to 92 years old, with a median age of 45 years (interquartile range [IQR], 34–56 years). The sample reflected Oregon's population demographics, with the majority self-reporting as White, non-Hispanic (87%; 89/102), followed by Hispanic or Latino (11%; 11/102), and then Black or African American (2%; 2/102). The number of ED visits ranged from 1 to 29 over a rolling 12-month period from baseline, with a median of 4 ED visits per patient (IQR, 2–7). The Charlson Comorbidity Index ranged from 0 to 16, with a median comorbidity score of 0 (IQR, 0–2). Approximately 25% (24/102) of the sample had multiple comorbidities. Chronic obstructive pulmonary disease was the most common medical condition in the past 12 months followed by depression and diabetes. Sample

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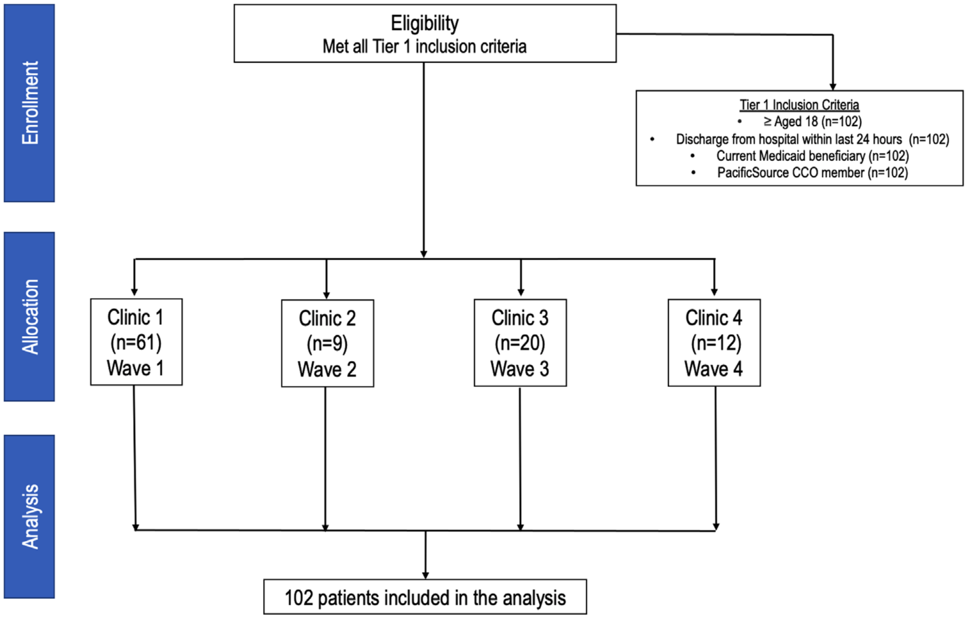

FIGURE 2 Study enrollment, allocation, and analysis consort diagram.

TABLE 1 Sample demographic characteristics.

Characteristic	No.	Range	Median	IQR
Age, years	101	18–92	45	34–56
Persons 18–64 years, %	88.1, (89 of 101)			
Persons >64 years, %	11.9, (12 of 101)			
Race/ethnicity				
White, %	84.2, (85 of 101)		–	–
Black/African American, %	1.98, (2 of 101)		–	–
Hispanic/Latino, %	10.9, (11 of 101)		–	–
Unknown, %	2.97, (3 of 101)		–	–

TABLE 2 Health characteristics.

Health characteristic	Range	Median	IQR
ED visits over 12 months	1–29	4	2–7
Charlson Comorbidity Index	0–16	0	0–2
Inpatient hospital admission	0–42	0	0–0
Emergency medical services transports over 12 months	0–268	4	1–10

demographic characteristics are shown in Table 1 and health characteristics are shown in Table 2.

The mean number of emergency medical and avoidable ED visits for the study population decreased from the control to the intervention time periods. Emergency medical ED visits declined per person from 0.51 (95% confidence interval [CI], 0.43–0.59; median, 0; IQR, 0–1 visits) in the control period to 0.41 (95% CI, 0.37–0.44; median, 0; IQR, 0–1 visits) per person in the CP intervention period. Avoidable ED visits also declined from 0.06 (95% CI, 0.04–0.07; median, 0; IQR, 0–0 visits) to 0.05 (CI, 0.03–0.07; median, 0; IQR, 0–0 visits) per person from the control to intervention time periods (Figure 3).

In the unadjusted model 1 (emergency medicine ED use), we found that the CP intervention resulted in a 13.9% decrease (IRR, 0.86; 95% CI, 0.76–0.98) in emergency medicine ED use. The linear effect of the CP intervention was a –0.061 (95% CI, –0.11 to –0.01) decrease in ED visits. That is, for every 100 people, there was a reduction of 6.1 ED visits per 100 people. In the unadjusted model 2, (avoidable ED visits), we found a 38.9% decrease (IRR, 0.61; 95% CI, 0.44–0.84) in avoidable ED visits. The linear effect of this decrease was –0.023 (95% CI, –0.04 to –0.01) visits, or a reduction in 2.3 avoidable ED visits for every 100 people.

Model 3 introduced 3 confounding variables and the CP intervention as a predictor of ED utilization. We found that age, health risk stratification score, and the Charlson Comorbidity Index were correlated with emergency ED use among patients in the sample. After accounting for these controls, emergency medicine ED visits decreased by 16.1% (IRR, 0.84; 95% CI, 0.73–0.96). The linear effect of this

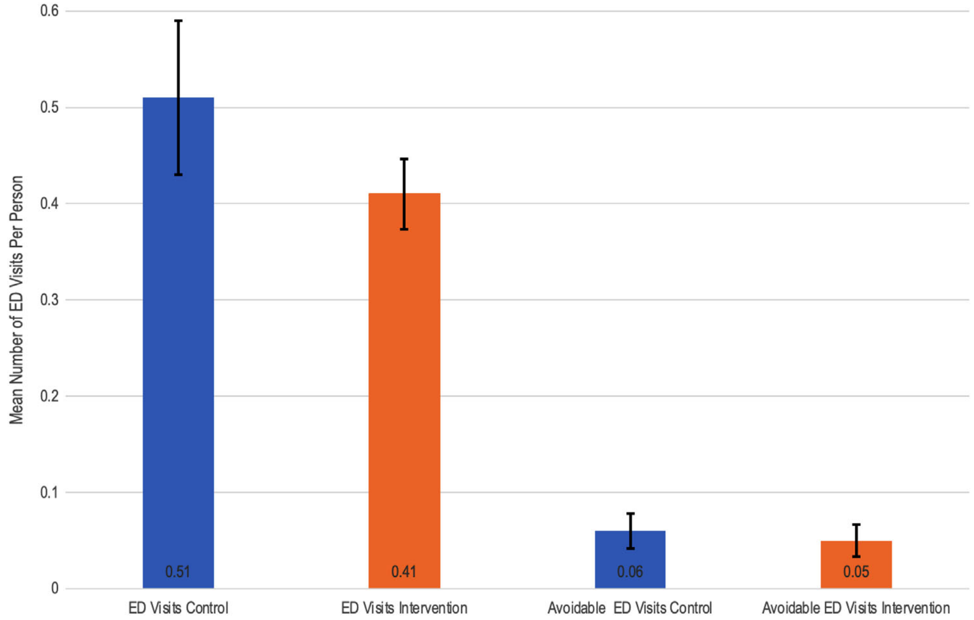

FIGURE 3 Average per person emergency medicine and avoidable ED visits.

TABLE 3 Overall and avoidable ED Poisson regression results.

	Model 1 emergency medicine ED use		Model 2 avoidable ED use		Model 3 emergency medicine ED use		Model 4 avoidable ED use	
	Coefficient (95% CI)	*P*-value	Coefficient (95% CI)	*P*-value	Coefficient (95% CI)	*P*-value	Coefficient (95% CI)	*P*-value
CP intervention	0.86 (0.76–0.98)	0.022	0.61 (0.44–0.84)	0.003	0.84 (0.73–0.96)	0.013	0.69 (0.47–0.98)	0.038
Clinic 1	Ref 0.30 (0.26–0.33)	Ref 0.000	Ref 0.03 (0.03–0.05)	0.000	Ref0.014 (0.00–0.04)	0.000	Ref 0.003 (0.00–0.03)	0.000
Clinic 2	1.70 (1.46–1.99)	0.000	1.81 (1.14–2.87)	0.012	1.54 (1.32–1.81)	0.000	1.63 (1.02–2.60)	0.042
Clinic 3	1.58 (1.37–1.82)	0.000	1.94 (1.29–2.91)	0.001	1.47 (1.27–1.70)	0.000	1.68 (1.11–2.55)	0.014
Clinic 4	1.88 (1.62–2.19)	0.000	2.27 (1.47–3.51)	0.000	1.70 (1.47–1.98)	0.000	2.09 (1.35–3.23)	0.001

Note: Models 3 and 4 adjusted for age, Health Risk Stratification Score, and the Charlson Comorbidity Index.

decrease was −0.071 (95% CI, −0.13 to −0.02), or 7.1 visits saved per 100 people. We included the same controls in model 4 (avoidable ED visits). We found that avoidable ED visits decreased by 32% (IRR, 0.68; 95% CI, 0.47–0.98). The linear effect of this decrease was −0.018 (95% CI, −0.03 to −0.00), or a reduction of 1.8 avoidable ED visits for every 100 people. The need to control for member age, health risk stratification score, and Charlson Comorbidity Index suggests that the characteristics of the patients in the sample were not consistent over time. A summary of regression analysis for the unadjusted models 1 and 2 and adjusted models 3 and 4 with patient controls are shown in Table 3. The marginal predictive means for models 1–4 are shown in Table 4.

3.2 | Limitations

Our results need to be considered with the following limitations. This was a pragmatic study implemented in a real-life setting. Primary care and 2 community paramedics maintained the program. While this approach greatly enhances the likelihood of sustainability and allows us to confirm that the program is feasible, it inherently resulted in some loss of fidelity to study data collection. Specifically, while the clinic clusters transitioned from control to receiving the CP intervention in a sequential manner, there was variation in the duration of the 4 time periods that each clinic remained as an intervention or control site. This resulted in a baseline period of 13 months, while the duration of the intervention time period varied from 3, 5, and 7 months. Finally, although a step wedge design is equitable in that an entire sample receives the intervention, a limitation of this design is the absence of a real-time comparator in the control condition in the last time period when all clusters have transitioned to receiving the intervention.

4 | DISCUSSION

The objective of this study was to determine if a CP intervention implemented in 2 rural Oregon counties reduced frequent emergency department utilization among a sample of Medicaid beneficiaries who

TABLE 4 Marginal predictive means.

	Model 1	Model 2	Model 3	Model 4
Margin	−0.061	−0.023	−0.071	−0.018
Delta-method Std. Err.	0.026	0.007	0.028	0.008
z	−2.32	−3.07	−2.52	−2.14
P-value	0.020	0.002	0.012	0.033
95% CI	−0.11 to −0.01	−0.04 to −0.01	−0.13 to −0.02	−0.03 to −0.00

Abbreviation: Delta-method Std. Err., Delta Method Standard Error.

had a history of high ED utilization. We found that the CP intervention reduced ED utilization among patients in our sample. Our results align with published literature suggesting that community paramedics can reduce ED use through assuming an expanded scope of practice in the field.[7,9,10] The results of this study suggest that CP is a promising approach to foster more appropriate ED use among Medicaid beneficiaries who have a history of high (ED) utilization by managing medically complex patients in a home-based setting, thereby redirecting nonmedically urgent care to less resource intensive environments.

Community paramedics enhanced access to primary, preventive, and health promotion care for the study's participants by delivering and managing chronic health conditions in their homes. Through weekly home visits, the paramedics monitored their patients' health. They communicated with their patient's primary care physician, and helped them to follow hospital discharge and medication dosing instructions. In some cases, the paramedics assisted with scheduling follow-up primary and specialty care appointments and coordinating social services such as assisting with applications for food assistance.

Through weekly home visits, the community paramedics got to know their patients by observing them in their home environments. When necessary, the paramedics responded to situations that could lead to medical emergencies. For example, a community paramedic working with a recently widowed 84-year-old man with Type I diabetes identified medication management and nutrition as significant challenges. The community paramedic observed that the man did not know how to cook for himself and listened as he expressed confusion over which prescribed medications to take. The community paramedic taught the gentleman how to administer insulin to himself, and created a chart with numbers to help the patient know how much insulin to take in relation to his blood sugar. The patient posted the chart on his door and it "revolutionized his care." The community paramedic working with this patient commented the key was "getting to know him, getting him comfortable with me so that he could tell me what was going on. We really changed his life quite a bit, so he was self-sufficient." By developing trust in order to be welcomed inside patients' homes, community paramedics learned about patient attributes that may have been hidden from their primary care physician. These hidden attributes included illiteracy, a significant barrier in adhering to dosage instructions for prescribed medications, inability to meet basic needs, and an inability to pay for utilities, which keeps people comfortably in their own homes.

Our findings support a body of literature that community paramedicine is an effective approach to redirect nonmedically urgent care from hospital EDs. Community paramedics possess the training and knowledge to effectively manage chronic conditions, and if needed, help with case management in a home-based setting. As a member of a patient's care team, community paramedics have the ability to interact with the patient's primary care physician and other members of their care team for advice and support. Currently, a notable limitation of the model is payment for care that does not involve transport. For the CP model to effectively facilitate more appropriate ED use long-term, reimbursement policies and regulations need to be amended to enable paramedics to bill public and private health insurance providers for the care they provide to patients in their homes.

4.1 | Implications for policy and practice

This study offers policy makers and health care stakeholders empirical evidence about the clinical and economic benefits of CP as an innovative, patient-centered model of care. By assuming an expanded role, community paramedics improved patient well-being by providing cost-effective, preventive health care. Decreases in emergency medicine and avoidable ED utilization were achieved, reducing health care costs among this sample of Medicaid beneficiaries. Furthermore, scare hospital ED resources were preserved to provide acute medical care for patients who need it.

4.2 | Future research

The literature suggests more research on the efficacy of CP is needed to support the clinical and economic benefit of this model of care.[10] We agree with this assertion and add the caveat that future research investigating CP should focus on specific populations with a propensity for, or history of, high ED utilization. Future research may want to explore CP as an intervention for socially isolated older adults with comorbid conditions. This area of inquiry could contribute valuable information about the potential of home visiting health care service delivery models in redirecting non-urgent care to more appropriate settings, while addressing the well-being of medically complex patients through creating social connections.

The CP intervention reduced ED utilization among a sample of medically complex Medicaid beneficiaries with a history of high ED use. Through a series of home visits, community paramedics managed complex medical conditions by observing and responding to patient needs in their homes. Our results suggest community paramedicine is a promising model to achieve a reduction in ED utilization among medically complex patients by managing complex health conditions in a home-based setting.

AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. JS obtained research funding; PF conducted project management. KB and MO supervised recruitment and data collection. KB managed the data. JC and NW provided statistical advice on the study design and analyzed the data. JC drafted the manuscript, and all authors contributed substantially to its revisions. JC takes responsibility for the article.

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REFERENCES

1. Moore BJ, Liang L. Costs of emergency department visits in the United States. Agency for healthcare research and quality. 2020. [cited 2022 June 21]. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb268-ED-Costs-2017.pdf
2. Hsia RY, Niedzwiecki M. Avoidable emergency department visits: a starting point. *Int J Qual Health Care*. 2017;29(5):642-645.
3. Durand AC, Gentile S, Devictor B, et al. ED patients: how nonurgent are they? Systematic review of the emergency medicine literature. *Am J Emerg Med*. 2011;29(3):333-345.
4. Uscher-Pine Lori, s, Pines J, Kellermann A, Gillen E, Mehrotra AP. Emergency department visits for nonurgent conditions: systematic literature review. *Am J Manag Care*. 2013;19(1), 47-59.
5. Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Aff (Millwood)*. 2010;29(9):1630-1636.
6. Sprivulis PC, Da Silva JA, Jacobs IG, Frazer AR, Jelinek GA. The association between hospital overcrowding and mortality among. *Med J Aust*. 2006;184(12):208-212.
7. Kizer K, Shore K, Moulin A. Community paramedicine: A promising model for integrating emergency and primary care. California HealthCare Foundation and California Emergency medical Services Authority. 2013. 1-25.
8. Peter O'Meara MR, Stirling Christine. Community paramedice_higher education as an enabling factor. *Australas J Paramed*. 2014;11(2):1-10.
9. Bigham BL, Kennedy SM, Drennan I, Morrison LJ. Expanding paramedic scope of practice in the community: a systematic review of the literature. *Prehosp Emerg Care*. 2013;17(3):361-372.
10. Choi BY, Blumberg C, Williams K. Mobile integrated health care and community paramedicine: an emerging emergency medical services concept. *Ann Emerg Med*. 2016;67(3):361-366.
11. Health O.O.o.R. *About rural and frontier data: Oregon Office of Rural Health Geographic Definitions*. 2021. [cited 2021 August 3, 2022]. https://www.ohsu.edu/oregon-office-of-rural-health/about-rural-and-frontier-data2021
12. Stange KC, Nutting PA, Miller WL, et al. Defining and measuring the patient-centered medical home. *J Gen Intern Med*. 2010;25:601-612.
13. Hussey M, Hughes J. Design and analysis of stepped wedge cluster randomized trials. *Contemp Clin Trials*. 2007;28:182-191.
14. Analytics O.H.A.O.o.H. All payer all claims reporting program. Oregon Health Authority; 2019.
15. Physicians A.C.o.E. Definition of Emergency Medicine. 2021. [cited 2022 August 9]; Available from. https://www.acep.org/patient-care/policy-statements/definition-of-emergency-medicine/
16. Division M.-C.M.C. 2010 Statewide Collaborative QIP ER Remeasurement Report. 2012.
17. Division C.D.o.H.C.S.M.-C.M.C. Ambulatory care: avoidable emergency department visits. CCO State Quality Measure Specification Sheet for 2018 Measurement Year 2018 [cited 2022 June 27]. https://www.oregon.gov/oha/HPA/ANALYTICS/CCOMetrics/Ambulatory-Care-Avoidable-ED-visits-2018.pdf
18. *PacificSource Claims Data [dataset]* PacificSource Coordinated Care Organization. 2019.
19. Glasheen WP, Cordier T, Gumpina R, Haugh G, Davis J, Renda A. Charlson Comorbidity Index: ICD-9 update and ICD-10 translation. *Am Health Drug Benefits*. 2019;12(4):188-197.

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