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A qualitative RE-AIM evaluation of an embedded community paramedicine program in an Ontario Family Health Team

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Abstract

Background In 2014, a rural Family Health Team (FHT) in Ontario, Canada embedded a community paramedicine program into their primary care practice to improve care for their complex patients. Community paramedics are health care professionals who extend their role beyond emergency services to provide primary care in home and community settings. The study aims to evaluate the utility of having community paramedics embedded in a rural FHT.

Methods In this qualitative study, we conducted 12 semi-structured interviews with the community paramedicine team (*n*=4) and other staff from the FHT (*n*=8), including physicians, nurse practitioners, allied health professionals (AHPs), and the program director. We conducted a deductive and thematic analysis using the RE-AIM framework. This allowed us to examine the strengths and challenges of incorporating community paramedics in a primary care model for providers and coordinating patient care in a rural setting.

Results *Reach:* The community paramedicine program is primarily used by physicians to target older patients with multiple chronic conditions, frequent health care use, and limited social support. *Effectiveness:* In-home visits by community paramedics yield a detailed picture of patients' health-related behaviours, such as medication adherence and dietary habits, improving the FHT's understanding of patient needs and informing care strategies. *Adoption:* Community paramedics value the opportunity to build long-lasting patient relationships. *Implementation:* The FHT's rural location is a significant external barrier limiting the paramedic program's ability to serve a larger patient caseload. *Maintenance:* The program aligns with the FHT's mission to improve access to care for vulnerable patients.

Conclusions Our findings highlight community paramedics' role in supporting high-needs patients, particularly in rural settings. The average age of patients in the program is 78, and they often have multiple comorbidities, including prevalent dementia. Such health conditions necessitate home visits to gather accurate health information often masked in clinic settings. Embedding community paramedics in a primary care model improves access to care and provides more support for patients with complex needs. Using these findings, we developed a "how to" blueprint for embedding community paramedics in primary care settings to address the care needs of high-risk older adults.

Clinical trial number Not applicable.

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Background

Community paramedicine

Traditionally, paramedics are seen as emergency responders; they drive ambulances and bring people to the hospital. However, in response to the growing demands of an aging population and their escalating health care needs, the paramedic role has expanded to include a subset of providers called community paramedics [1–3]. The scope of practice of community paramedics includes preventive care and primary health care in home and community settings [4]. They take a proactive approach to addressing the needs of complex, high-risk patients [1, 5] by providing care directly in patients' homes and performing activities such as health assessments, chronic disease management, medication administration, and monitoring [6]. In Canada, most community paramedicine programs operate independently of typical primary care settings, such as physician- or nurse-led clinics. When needed, they consult with external primary care physicians or refer to other health care providers [3]. Guo et al. [7] conducted a review of various community paramedicine programs in Canada, Australia, England, and the United States, highlighting the diversity in program implementation and goals. Some programs primarily targeted older adults, while others focused on patients with complex chronic diseases. Regarding effectiveness, their review found that community paramedicine programs have been associated with reductions in emergency calls, emergency department visits, hospital admissions, and emergency transport charges [7]. In Ontario, a community paramedic-led primary care clinic improved health outcomes for older adults living in subsidized housing [8, 9] by decreasing blood pressure levels and improving quality-adjusted life years. It also reduced 911 calls lessening the strain on the health care system [7]. Further evaluation is needed to establish the long-term impact and effectiveness of community paramedicine programs [7]. With increasing pressure on the Canadian health care system from an aging population [10, 11], federal ministers, including the Minister of Health, have highlighted the pressing need for health care systems to evolve and explore new ways to adapt resource allocation to improve patient care and system efficiency [12].

An embedded community paramedicine program

In 2014, a rural Family Health Team (FHT) in the West Ottawa region of Ontario piloted a community paramedicine program embedded in their clinical practice, which is not a commonly seen model in Canada. Ontario FHTs consist of interdisciplinary health professionals, such as family physicians, nurses, and allied health professionals (AHPs), who collaborate to deliver more comprehensive primary care in a single-payer health care system [13]. By expanding their team to include community paramedics, the FHT improved access to care for their most complex patients. This initiative involved directing patients with multiple comorbidities, limited social support, and high emergency department (ED) visits for non-emergency issues to the paramedicine program, with the goal of reducing health provider workload and improving patient reach and care, especially for high-risk patients living in rural settings. The FHT gave the paramedic team full access to their electronic medical records (EMR), medical supplies, and organizational supports. Currently, this stands as one of the few FHTs in Ontario that has successfully implemented and sustained a community paramedicine program embedded within their clinic. This allowed for a unique opportunity for the study to evaluate the utility of having community paramedics embedded in a rural FHT.

Methods

Study design

The study follows a qualitative descriptive design [14], commonly used in applied health research, including evaluations such as this RE-AIM framework-based study. This approach provides straightforward descriptions of participants' experiences and program outcomes [14]. Moreover, the study follows a community-based research approach [15], emphasizing collaboration between researchers and community partners to address issues relevant to the community and improve the application of findings to real-world contexts. This study team includes community paramedics and staff from the FHT who actively participated in the research process.

Framework

We used the RE-AIM framework to evaluate the aims, strengths, and challenges of the FHT-embedded program. This framework has been used for over two decades to provide in-depth assessments of the successes and limitations of public health interventions across five dimensions: reach, effectiveness, adoption, implementation, and maintenance [16, 17]. The framework's strength lies in its comprehensive and flexible approach

to tailoring evaluations to suit smaller communities and clinical settings [16], and it has been used to evaluate other community paramedicine programs [18]. Using qualitative methods (e.g., staff interviews) within the RE-AIM framework provided more holistic insights into the program's adoption and implementation [19].

Study team

The study team includes researchers, community paramedics, and clinic staff from the FHT. Our community researchers assisted with recruitment, governance, and the co-development of outputs, such as the program blueprint. They were not involved in conducting interviews or analyzing the evaluation results, ensuring objectivity in the data collection and analysis phases.

Data collection

Recruitment

The community paramedic team (G.B., K.H., T.I., K.S.) contacted FHT staff to gauge interest in participating in the study. The research team contacted interested participants for further information and to schedule interviews. L.K., K.K.M., and S.P. conducted interviews over Microsoft Teams or in person at the clinic based on participant preference. Interview details are included in Appendix A.

Interviews

The interview guide used in this study was developed by the research team and informed by the RE-AIM framework (Supplementary Material 1). The interviewers obtained verbal consent from participants and conducted interviews lasting 30 to 70 minutes, which were transcribed verbatim. To support rigour, interviewers engaged in reflexive journaling and memo writing during the interview process [20]. Journal notes on key codes and reflections during/after the interview were discussed during bi-weekly research meetings with the multidisciplinary research team (K.K.M, S.P., L.K., S.T.).

Documents

To obtain a fulsome description of the program, the research team collected and analyzed documents on the community paramedicine program's organizational structure, including training protocols and referral resources.

De-identified descriptive patient data

The research team collaborated with the FHT's Health Informatic specialist (M.F.) to obtain de-identified data regarding the characteristics of patients who were or are enrolled in the program from its inception in 2014 to 2022. The dataset of 335 patients described age, sex, comorbidities and types of referrals made by the FHT.

Data analysis

RE-AIM qualitative analysis

Content analysis of documents and analysis of interviews were guided by the RE-AIM framework and managed using the qualitative software package MAXQDA. This approach combined deductive and inductive thematic analysis. Deductive analysis was applied to most RE-AIM domains, ensuring alignment with the framework's established evaluation criteria. However, for the " Effectiveness" domain of RE-AIM, an inductive approach was used to allow themes to emerge directly from the data, following Braun and Clarke's approach for thematic analysis [21]. Since health administrative data was unavailable at the time of the study, this inductive approach allowed the study to focus on capturing the perspectives of FHT staff and community paramedics and identify areas they viewed as contributing to its success. This combination of deductive and inductive analysis allowed for an evaluation of the program that highlighted key factors that made it effective from the perspective of its implementers.

Our approach to qualitative content analysis aligns with established methods [22] and our deductive analysis follows the same RE-AIM methods as other studies that have used this framework for qualitative evaluations [19, 23]. A codebook based on the RE-AIM framework was created by S.P. and distributed to the research team for input (Appendix B). The first two transcripts were group coded by three research team members (L.K., S.P., S.T.). The next two transcripts were consensus-coded by two members of the team (S.P., S.T.), with any unresolved discrepancies being resolved by a third coder (L.K.). The remaining transcripts were divided and double-coded (S.P., S.T.). The codes were consolidated, and the research team identified content and themes relevant to the RE-AIM framework domains. Key quotes were identified as evidence of dominant themes and reviewed with the broader research team (C.B., G.B., K.F., K.H., T.I., K.S., K.K.M.).

Descriptive statistical analysis

The de-identified patient data was analyzed in RStudio (S.P.), focusing on descriptive statistics, including mean age, gender proportions, and the prevalence of co-morbidities and referral types.

Ethics approval

Ethical approval for the current study was approved by the Bruyère Health Research Ethics Board (M16-23-023).

Results

Study population

We interviewed 12 participants: the community paramedicine team (n=4), which includes three community paramedics and their patient care coordinator, and other staff from the FHT working in adjacent positions (*n*=8), including physicians, nurse practitioners, allied health professionals (AHPs), and the program director.

Program description

The program consisted of two full-time community paramedics, a patient care coordinator who was a paramedic on modified duties, and a clinical consultant who was a physician who provided guidance for the program's medical directives. These paramedics visited patients' homes on the FHT rosters to conduct clinical assessments and deliver treatments where possible. The paramedics managed around 100 patients (50 each) in coordination with the FHT clinic staff, conducting 3-5 home visits daily, each lasting 45-75 minutes. In addition to these visits, the paramedics and their patient care coordinator performed phone check-ins and triaged incoming patient calls as part of their daily responsibilities. About 70% of their patients were from the FHT roster, while the remaining 30% were referred by hospitals or home care. This program was funded by Ontario Health and a local hospital, with costs representing $100,000 per paramedic.

The FHT was not responsible for recruiting community paramedics, as these staff were hired from an external paramedicine service, including both Primary Care Paramedics (PCPs) and Advanced Care Paramedics (ACPs). PCPs provide essential emergency medical care, including basic life support and patient stabilization, while ACPs have additional training in advanced medical procedures [24]. To support both certification levels, the FHT's training program was designed to accommodate their varying skill sets, offering supplementary training as needed. Once selected to be part of the FHT's embedded community paramedic program, staff were trained by the lead community paramedic. Training included shadowing a community paramedic and FHT staff, e-learning, and workshops. This continued until the hired paramedic felt equipped to conduct home visits independently.

Reach

Target population

The initial criteria for recruiting patients for the community paramedic program were patients with multiple chronic diseases, such as congestive heart failure, chronic obstructive pulmonary disease, Parkinson's disease, as well as mental health conditions (e.g., dementia, bipolar disorder). They also included patients with limited social support and those with higher health care usage. These criteria established an initial pilot group of 155 patients for the program, identified through their EMR. As understanding of the program's service criteria grew, the referral process shifted to an ongoing basis where physicians referred patients with complex health issues. Occasionally, patients would request a referral to the paramedicine program themselves after hearing about the program from other patients.

Table 1 describes the baseline characteristics of the community paramedicine program's participants (*n*=335) from 2014 to 2022. Due to limited data availability, the table does not represent the 30% (*n*=100-150) of external patients the program serves. Based on the clinic staff's responses and the demographic profiles of the paramedics' patients, the program was recruiting and serving the FHT's most complex and high-needs patients. These patients had an average age of 78 and typically presented with 2.7 of the top 10 prioritized comorbidities from the FHT, with dementia and mental health diagnoses being the most common (Table 1).

Mitigating fear

The community paramedic team and FHT physicians shared that the primary barrier to patient recruitment into the community paramedicine program was that patients feared accepting care from the paramedicine team could lead to an undesired placement in long-term care. These concerns were primarily addressed through initial phone conversations and first visits with the community paramedic, during which the program's goals and patient concerns were discussed. This strategy fostered rapport among patients and paramedics, as patients began to see these visits as supportive measures that enabled them to age in their homes longer.

> *And it's going to take a few visits to figure it out because that first visit or two, they're doing to us what they do to the physicians. They're just making everything sound wonderful. And they're often really suspicious when the doctors send a paramedic into their home. They think that we're there to get them placed into long-term care or senior living. That's huge for these people. So, to really allay those fears early on, that we're just there to support them at home is really important. - Community Paramedic Team 2*

Effectiveness

Home visits offer deeper insights into patients' health circumstances

A recurring theme was that in-home visits facilitate a deeper understanding of each patient's health situation.

Table 1 Baseline characters of Community Paramedicine Program Population from 2014-2022

Baseline characteristic	n	%
Average Age	78	
Gender		
Male	148	44.2
Female	187	55.8
Average Diagnoses Counts per Patient[a]	2.69	
Diagnosis Type[b]		
Mental Health[c]	118	35.2
Dementia	115	34.3
Diabetes	107	31.9
Palliative Care	106	31.6
Chronic Heart Failure	99	29.6
Falls/Frailty	93	27.8
COPD	89	26.6
Cerebrovascular accident (CVA) /Stroke	58	17.3
Chronic Pain	39	11.6
Neurologic (not CVA)	33	9.85
Average Number of Referrals per Patient	13.38	
Range of Referral Counts per Patient	1-63	
Referral Types[c]		
Gastroenterologist	208	
Cardiologist	171	
Geriatric Assessment	157	
E-Consult[d]	137	
Neurologist	137	
Home and Community Care Support Services	128	
Urologist	123	
ENT	98	
Rheumatologist	87	
Orthopedic Surgeon	85	
Dermatologist	74	
General Surgeon	57	
Pain and Symptom Management	57	
Hematologist	53	
Diabetes Education	51	
Total Number of Patients Assessed for Cognitive Function		
Montreal Cognitive Assessment	190	

[a] This average count only includes the counts for the specific diagnosis types listed in the table, not all possible diagnoses.

[b] The diagnosis types selected for recruitment in the community paramedic program do not cover all morbidities in this population. However, these 10 specific diagnoses were chosen because they generally require a higher level of care and impose greater costs on the system. Additionally, patients can have more than one of the diseases listed.

[c] This category includes depression, anxiety, schizophrenia, bipolar disorder, and other psychotic disorders.

[d] Referral counts are only for 2015 and onwards. Physiotherapy, chiropractic, acupuncture, medical equipment, and massage therapy categories have been excluded due to higher counts resulting from billing purposes and renewal requirements. This is not an exhaustive list of referral types but only the top 15. These referrals were completed either by community paramedics or FHT staff.

[e] An E-Consult in primary care in Ontario is a digital communication platform that enables primary care providers to seek advice from specialists on patient care.

Table 1 (continued)

[f] The Montreal Cognitive Assessment (MoCA) is a brief screening tool used to assess mild cognitive impairment by evaluating different cognitive functions such as memory, attention, language, visuospatial ability, and executive function. It is commonly used to detect early signs of dementia and other cognitive impairments.

These visits highlighted aspects such as medication adherence, dietary practices, home safety, and hygiene, which are often difficult to determine in a clinical setting but contribute to the success of treatment plans and health outcomes.

> *I think it's a lot of question asking. But it's also, visual cues of looking at their environments, looking at how things are maintained. If you find ways to check their insulin in the fridge, look at sort of their situation with respect to food, look at all the different mobility aids they have. - Community Paramedic Team 4*

For physicians who had uncertainties regarding a patient's living conditions or suspected an element of their health is unaccounted for, paramedic home visits provided an opportunity to gain a more holistic view of something that can be masked or missed in a clinic setting. FHT staff have noted that patients with cognitive impairment or dementia can have difficulty accurately conveying their health needs, and these visits allow for a better understanding of their care requirements.

> *It's been very useful to have someone go into the home to sort of just see how safe they are at home […]. Also, medication-wise it can be useful to have because they can kind of go over the pill bottles and see if the patient seems to be taking them or not, and if they seem to have an organized system for it. - Physician 2*

Moreover, by scanning and engaging with patients in their homes, community paramedics can better identify and address potential health risks, as they are often the first to detect these issues. "*It may be that the paramedic is the first person to detect that things are not going all that well cognitively. Detection and assessment are probably one thing that they can do"* (Physician 1).

Patient care coordination with physicians

Most of the patients on the current community paramedicine roster were referred by their family physicians. This emphasized one of the guiding aims of the community paramedicine program: fostering collaboration between community paramedics and physicians to offer additional and more tailored care. *"I think that one of the things that's really valuable is we are the eyes and ears for the physicians at home"* (Community Paramedic Team 4).

Additionally, the program's integrated nature fostered seamless and quick exchanges between physicians and community paramedics, either through their EMR channels or in the office, enabling more coordinated and effective care. *"We can see everything. We can see their charting. We can see when they have an upcoming appointment with the doctor. So usually if they have an upcoming appointment with the doctor within this month, I would not schedule a paramedic to go out and see them, because it's like duplicating the work."* (Community Paramedic Team 3).

This contrasted with communication gaps often observed with external health services.

> *I don't hear from [Personal Support Worker] PSWs. They don't call me and say, did you know that he's had a fall, and he's got a sore on his leg, and he's been eating rotting bananas for a week? Like, I don't get that feedback from the PSW. Whereas with the paramedic, I get frequent updates if they're not doing well. - Physician 3*

Finally, community paramedics played a crucial role in advocating for patients on their roster, helping them obtain resources or additional care from their FHT team and/or external health and social care services. "*I'm just here to support you [patient], to stay in your home and stay safe any way I can do that and help communicate back to the physician because maybe you can't get to the clinic very easily*" (Community Paramedic Team 2).

Patient care coordination with nurses and allied health professionals (AHPs)

An embedded community paramedicine program in an FHT offered access to a diverse pool of expertise, including nurse practitioners, pharmacists, and social workers. *"Often, it's just so nice to be able to walk upstairs and just pick the brain of any one of these experts in their fields when we're really hitting a brick wall with people"* (Community Paramedic Team 2).

In the pilot phase of the program, nurses and AHPs collaborated with the community paramedics to increase their scope of practice to better serve complex patients at home. This included performing medication reconciliation, providing wound care, conducting blood work analysis, and facilitating cognitive assessments at the patient's home.

Following onboarding, community paramedics have collaborated with nurses and AHPs as needed. For example, nurses and AHPs could request that the community paramedic conduct follow-ups or check-in on specific concerns for shared patients. "*I might say, 'While you're there, can you check on their insulin injections? Can you teach them how to inject Ozempic?'*" (Clinic Staff 3).

Additionally, community paramedics helped persuade hesitant patients of the benefits of accepting an AHP referral. Increased collaboration was occasionally hindered by two main challenges: limited overlap in patient rosters, with paramedics often focusing on a smaller subset of highly complex cases, and operational limitations inherent in a rural FHT context, where AHP roles are often limited and subject to frequent turnover.

Patient care coordination with social services

It was repeatedly mentioned that community paramedics were well-versed in community resources, often being the first to identify and facilitate referrals with physician approval. "*They are very knowledgeable, or they have become very knowledgeable, about the other services available in the community*" (Physician 1).

However, the FHT and community paramedic team encountered significant challenges when collaborating with social services, primarily due to issues with service accessibility, reliability and communication. These challenges were particularly acute in rural settings where services are sparse, resulting in extended wait times or complete unavailability of services. Additionally, such issues disproportionately impacted patients who have minimal social support or transportation options.

> *Especially with [our] area, even things like transport have been issues in the past, to get to day programs, to get to food banks, to get into for appointments. So I think a lot of the frustration is around what resources are available. And, even if they are available, are they serviced and what are the wait times like - Community Paramedic Team 4*

As a result, community paramedics filled this role to the best of their ability while patients waited for services.

> *It would be easier if the social services were able to step up more, right? I think we're gap fillers right now, so a lot of the work we do is not even what we set out to do, but we're just trying to keep these patients afloat until the right care kicks in. - Community Paramedic Team 2*

Patient care coordination with external health services

Community paramedics worked in conjunction with various other external health services, including geriatric teams, hospitals, and home care services. This collaboration was especially valuable for patients recently discharged from the hospital who needed temporary support to ensure a safe transition back to their homes. Knowing that community paramedics can provide follow-up care enables hospitals to reduce the length of patient stays without compromising patient safety.

Community paramedics also aided in increasing capacity in the home care sector, as they worked in tandem with personal support workers (PSWs) and care coordinators to offer more frequent monitoring of patients.

> *So I feel like I increase their [home care] capacity quite a bit, because some people when they are in crisis, I can see them every 2-3 weeks or every two months depending what they need. Which the care coordinator will never be able to do, their caseload is just too big. - Community Paramedic Team 2*

However, community paramedics in rural settings struggled with long wait times for allied health referrals such as occupational therapy, PSW, and physiotherapy. This often resulted in an increased workload for the paramedics, requiring more frequent visits and making it difficult to deliver care promptly.

Adoption

Community paramedicine – staff level

Community paramedics embedded in the FHT valued the opportunity to engage with patients as part of the clinic, as it fostered strong and long-lasting patient-paramedic relationships. *"I like the idea of working with not just the patient themselves, but their entire care team, their family members, that sort of thing, getting rapport. Having time on scene is huge"* (Community Paramedic Team 2).

The community paramedic role offered a more multidisciplinary and preventive approach to care for their patients compared to working in a traditional paramedic role. Integration into the FHT empowered community paramedics to broaden their scope of practice, allowing them to provide care that traditionally falls beyond the purview of paramedicine.

One of the main reasons they preferred an embedded practice setting over operating in a standalone community paramedicine clinic was that being part of the FHT guaranteed easy collaboration with physicians. "*You have the buy-in from the docs, so that is so crucial in doing care planning*" (Community Paramedic Team 1).

Moreover, the embedded community paramedicine model served to dismantle the traditional barriers that often segregate and silo health care services. This was facilitated through direct communication in the clinic, via the EMR system or through shared access to patient charts. It was particularly beneficial during initial home visits because paramedics had access to patient histories, enabling more informed care planning.

However, it took the program several years to achieve its current state of care integration due to unsecured funding in its pilot phase. Presently, a significant challenge arose from the community paramedic role not being formally recognized as a funded position within FHTs at a systems level. Consequently, community paramedics still relied on alternative funding sources from different financial streams within Ontario Health, distinct from typical FHT positions. Furthermore, they had to report to an external paramedic service, which complicated their scope of practice and duties. For example, the paramedics began and ended their day at the external paramedic service and borrowed their vehicles.

> *I always wear multiple hats. It's difficult because when I work in the clinic, I can take orders from the doctors here, but if I'm driving to the clinic in a paramedic vehicle, then I'm also liable. let's say if there's an accident in front of me, I'm expected to stop and provide care but I'm under a different medical director - Community Paramedic Team 1*

Family Health Team on community paramedics - staff level & setting level

Clinic staff expressed appreciation for having access to embedded community paramedics who conducted home visits, particularly for patients who have difficulty attending clinic appointments. This service not only enriched patient care by ensuring continuous care but also offered staff reassurance about patients' ability to manage their health in their own environment. "*Having eyes and ears in that patient's direct environment can allow us, as health care providers, to make better decisions about their health*" (Clinic Staff 1).

Moreover, the lead community paramedic who joined the pilot program in 2014 has stayed with the team, building long-term relationships and trust with the staff. The FHT staff expressed that all paramedic team members consistently demonstrated a willingness to engage and offer additional support when requested, showing their commitment to the team and the broader healthcare mission. *"I've never had any issues communicating with any of my [community paramedic] colleagues. I've never had a hard time getting ahold of them. They're always really onboard and willing to help"* (Physician 3).

Implementation

Staff training

All paramedics in the program expressed confidence in their training and highlighted that the program was designed to give them the flexibility to expand their scope of practice to better meet patient needs, with support from their clinical consultant and FHT director. "*We just keep adding training as we learn more about our patients and their needs, so we're really open to whatever makes sense for that population*" (Community Paramedic Team 2).

Internal barriers and adaptions

The key to sustaining the embedded community paramedicine program following the first two years of the pilot phase was developing funding partnerships with the local hospital and Ontario Health. They advocated for baseline funding by highlighting the impact of community paramedics in reducing hospital stay length for complex patients. However, while this funding has been critical, limitations remain as it does not fully support scaling up the program's services.

A critical evolution to the program was granting community paramedics access to the FHT's EMR. This allowed them to consult and update patient charts directly, eliminating the need for a separate documentation process.

> *Without the record, you're really relying on those notes that they have from their previous visit[...] Before if there was something urgent that they had to do that with, they'd have to pick up the phone, call the admin person, and the admin person would have to go into the patient record share whatever they could. - Clinic Staff 2*

Community paramedics continued to face challenges in patient engagement, particularly in conducting assessments for conditions such as cognitive impairments using tools like the Montreal Cognitive Assessment. Patient hesitancy was often rooted in fear of potential consequences, such as long-term care placement or loss of driving privileges. Additionally, this reluctance extended to accessing social services due to pride or perceived stigma. This can impact their ability to provide appropriately tailored care. "*There's sort of a stigma around asking for help. […] It's hard, sometimes, to have them agree to go down that route*" (Community Paramedic Team 4).

External barriers

A significant external barrier that impacted the community paramedicine program's implementation capacity was its operation in a rural setting. The geographical spread of patients limited the number of visits community paramedics could conduct daily, with travel time consuming a considerable portion of their schedule. This challenge was partially mitigated by phone check-ins and optimizing visit routes based on geography. *"Some days, I feel that I really didn't see that many people, but I drove 250 km"* (Community Paramedic Team 1).

Maintenance

Program' sustainability

The sustainability of the community paramedicine program was closely tied to its alignment with the FHT's mission. Assessing the program's cost-saving impact was challenging due to the paramedics' focus on upstream preventive care. However, it should be noted that any potential cost-savings would likely benefit hospitals and emergency services, not the FHT. While the FHT's increased investment in primary care may not directly reflect cost savings for them, it could reduce the burden on downstream hospital services. "*It's theoretical cost-saving. It's an improved patient condition, it's an improved patient experience, and probably an improved provider experience, but maybe in the end doesn't actually save any money. But it may use our money more wisely*" (Clinic Staff 5).

The FHT placed significant value on the program's ability to expand service capacity, thereby better serving their most vulnerable populations and reducing the need for in-person clinic visits.

> *I see it as two pieces to it, somebody who needs to be seen but won't come in, or somebody who needs to be seen and would come in, but maybe not frequently enough to identify that they're going to end up in the hospital if they're not otherwise checked in on. - Clinic Staff 5*

Recommendation for growth

FHT clinic staff suggested expanding the scope of practice for community paramedics to allow more assessments to be conducted directly in patients' homes, thereby improving accessibility and efficiency of care.

To support the sustainability and scalability of an embedded community paramedicine model across the province, it would be important to secure dedicated funding for this role in the primary care setting. "*To make it easy, community paramedicine should be its own thing in whatever area. Whether I'm at headquarters or at the clinic or I'm somewhere else. I should be able to do the same things*" (Community Paramedic Team 1).

Discussion

Reach

The program served the FHT's most complex and high-needs patients, with an average age of 78 and typically presenting with 2.7 of the top 10 prioritized comorbidities identified by the FHT. Dementia and mental health diagnoses are the most common conditions among these patients. This patient profile aligned with other community paramedicine programs in Canada and globally, which focused on providing care for complex older populations with multiple morbidities and those in precarious housing situations [25]. A systematic review [25] demonstrated that community paramedics support older adults by aiding in chronic disease

management, health assessment, and education, positively impacting the health of older patients.

Although being a rural-based program limits the reach and capacity of the community paramedicine program, it is important to recognize that the rural aspect makes home visits especially important, particularly given how costly and time-consuming they can be for physicians and nurse practitioners to conduct. This research builds on existing literature demonstrating that community paramedicine programs in rural settings have the potential to significantly increase the accessibility of care in remote areas [26, 27].

Effectiveness

From the perspective of FHT staff, community paramedics' ability to conduct home visits and assessments was instrumental in providing a holistic view of patients' health behaviours. This understanding allowed community paramedics, physicians, and AHPs to glean more accurate information, often unattainable or missed in clinical settings. This corresponds with findings from previous research on the importance of home visits conducted by physicians [28, 29] or nurses [28, 30] in providing person-centred and context-driven care.

Furthermore, these home visits enabled paramedics to conduct assessments, administer vaccines, and collect blood and urine samples at the patient's home. This reduced physical strain for patients with decreased mobility and transportation challenges, who would otherwise struggle to visit the clinic. A systematic review [31] similarly highlights the important role of home care in supporting older adults aging in place. The review demonstrated that home care can reduce hospitalization by better managing chronic conditions, reducing emergency visits, and minimizing the length of hospital stays. This underscored the value of embedding community paramedic programs to improve primary care capacity and provide care at home for older adults.

Access and reliability issues in social and health services remain a major challenge in many rural areas in Canada. Patients and primary care staff encounter shortages in mental health services [32, 33] and social services [34, 35], which is compounded by labour shortages in primary care and home care staff, such as PSWs, occupational therapists, and physiotherapists [36]. This stresses the value of leveraging other forms of primary care to increase the capacity for health and social services in these rural environments. Expanding the role of paramedics to support primary health care can provide additional capacity to areas with limited service availability, helping patients who are waiting for care.

Adoption

As traditional paramedics increasingly seek to expand their roles beyond emergency response, there is a growing desire for their role to include preventive care and health promotion [3, 37]. Community paramedicine has emerged as an avenue for paramedics to be more involved in patient care. Embedding a community paramedicine program into an FHT can increase learning opportunities for paramedics while also facilitating a multidisciplinary approach to health care.

Implementation

Since the program was small and training was facilitated by the same paramedic, implementation of their duties was consistent across the paramedics who had been part of the program to date. This process will likely need to be adapted to work in a larger clinical setting. Embedded within an FHT, community paramedics benefited from increased access to patients' charts and notes and expanded their scope of practice with training from FHT physicians, nurses, and AHPs. This integration represented a key advantage of the embedded community program model over separate community paramedicine programs. Separate programs lack rostered physicians for their patients, have limited access to patient histories, and offer fewer opportunities for collaboration with other healthcare professionals.

Second, although our study was unable to investigate the potential cost-saving impact of the program on avoidable emergency department visits and hospital admissions, prior research has demonstrated that primary care community paramedic clinics do alleviate the burden and costs on hospital services [38, 39]. Future research could explore these cost-saving effects in greater detail.

Maintenance and future directions

Integrating community paramedics into a primary health care team exemplifies a more holistic care model, reflecting a shift towards preventive and comprehensive health care strategies that align with Ontario's Ministry of Health and Long-Term Care priorities. As part of its plan for connected and convenient care [40], this approach supports the goals of improving access to care at home, and increasing the number of primary care providers and expertise available to family physicians and nurse practitioners.

Our findings demonstrate the potential for community paramedic roles to integrate seamlessly into the primary care model, increasing their scope of practice while supporting the workload of physicians. With Ontario and Canada overall facing a shortage of family physicians [41, 42] and ongoing staff issues, expanding the role of

traditional paramedics presents an opportunity to forge beneficial relationships with primary care providers. As shown in our findings, embedded community paramedics can help physicians manage large caseloads while also improving health care access for rural and high-needs patients. Moreover, it creates opportunities to better support older adults as they age in place. This additional support is especially needed in rural areas where travel time [43, 44], and factors such as mobility issues [45], cognitive decline and dementia [46] may prevent regular clinic visits.

Limitations

This evaluation has a few limitations. First, the evaluation did not include interviews with patients using the community paramedicine program, thereby missing the patient perspective. As a result, the RE-AIM evaluation does not fully capture the program's effectiveness from the patients' point of view. While provider anecdotes suggest improvements in patient care and experience, such as better care coordination and access, this evidence is indirect and insufficient to speak to patient experiences or outcomes. The study instead focused on how the program supports primary care teams and physicians by increasing primary care service capacity, informing care strategies, and improving access for high-risk, rural older adults. Future research should include patient perspectives to better assess the program's impact on patient outcomes and experiences. Second, a limitation of this evaluation is the limited generalizability of the findings due to the program's small scale and rural setting. As a novel program in Ontario operating within a specific context, the results and the role of community paramedics may not fully translate to larger or urban healthcare settings with different patient populations or resource availability. Our co-developed blueprint (Supplementary Material 2) aims to improve generalizability by providing initial steps for different primary care practices to consider when embedding community paramedics into their practice.

Conclusion

As the population in Ontario and Canada overall ages, the demand for accessible and effective health care is increasing. Profiling this innovative FHT-embedded community paramedicine model offers valuable insights not only for other FHTs and primary care settings in Ontario but also for international health systems seeking to manage the needs of complex patient populations. By collaborating with community paramedics, health care systems can alleviate the strain on emergency departments, hospitals, and primary care providers while improving patient access to timely care. This model could be adapted to meet the needs of aging populations in other regions with strained emergency services and limited primary care access. The next steps for this research involve disseminating a "how to" blueprint (Supplementary Material 2) for embedding the community paramedic role in primary care across various FHT and primary care settings throughout Ontario and Canada.

Appendix A

Research Team

The following two individuals conducted the interviews[a]. Their characteristics reflect those at the time of the interviews.

Name	Credentials	Position	Gender	Previous Experience
Sarisha Philip[b]	MPH	Master of Public Health student at the University of Ottawa	Female	Sarisha had minimal experience with qualitative work. She was trained by Dr. Kehoe MacLeod.
Krystal Kehoe MacLeod	PhD	Postdoctoral Fellow at Bruyère Research Institute and University of Ottawa	Female	Dr. Kehoe MacLeod has a PhD in in Public Policy & Administration from Carleton University. She is a CIHR-funded postdoctoral fellow at Bruyère Research Institute with expertise in qualitative, mixed methods, and community-based research. She completed 118 interviews for her doctoral work on older adults aging in place.

[a] L.K. attended three interviews (two with K.K.M leading and one with S.P. leading) with minimal participation. S.T. attended one interview (S.P. leading) with minimal participation.

[b] S.P attended all interviews. She attended two with K.K.M. leading before completing the rest by herself.

Appendix B

RE-AIM Codebook

FHT: Family Health Team

Code	Key Characteristics and Rules	Example Quote
REACH		
Recruitment of target population	Describes the intended population the program is hoping to serve. This includes criteria used to identify and recruit patients to refer to the program. Also includes how referrals are made to the program.	"Hospitalizations, numbers of mediation, and numbers of conditions. We had Encode-FM, and we utilized what were called problem lists. So if a person had a long problem list, just the sheer length and number of problems were relevant."
Patient population	Describes the patient population the program serves.	"I would say the majority of the ones I have had are people who live alone. There have been some who live with a spouse or another family member, but the ones where we might feel like we're not getting any information from anyone else other than the patient are ones where it can be helpful to have the paramedics checking in. So those are the ones we're worried about safety at home, so typically they tend to be the medically more complex patients. More often seniors. I mean, I don't think they're all seniors, but I think a lot of them are seniors"
Barriers to reach	Describes difficulties in recruiting patients to join the program or community paramedics being unable to include FHT-referred patients in their program for internal reasons. **Exclude:** Patients who are not part of the FHT (external references).	"Sometimes they'll say, "Well, why did my doctor refer me? Like, why?" And so that's where that delicate fine line comes in, and you have to be like, "Well, they just feel that maybe you might want some more help at home." Or we can also offer to set up cleaning services, and then they're like, "Oh, okay, I could use some help." And so you have to be very – like I said, it's a fine line, and you don't want them to think you're taking their independence away."
Strategies for enhancing reach	Strategies program usings to improve the reach of the program. **Includes:** Examples of how they interact with patients in the first couple of visits.	"Sometimes they'll say, "Well, why did my doctor refer me? Like, why?" And so that's where that delicate fine line comes in, and you have to be like, "Well, they just feel that maybe you might want some more help at home." Or we can also offer to set up cleaning services, and then they're like, "Oh, okay, I could use some help." And so you have to be very – like I said, it's a fine line, and you don't want them to think you're taking their independence away."
EFFECTIVENESS		
E1. Patient satisfaction/dissatisfaction with the program	Code for when FHT or community paramedic staff discuss the patient experience being part of the program. Only include patient experience and sentiments about the program.	"Honestly, very rare, very, very rare. Usually, it's the opposite. Usually, they only want to see the paramedic. Like, you know, some of [the community paramedic's] patients, like, they only want to see [the community paramedics] because they feel comfortable with them. They feel safe with them. So I find it's the opposite, it's they want to see the paramedic, and they feel safe, rather than a PSW coming to their house"
E2. Home visits provide a better understanding of patient's health circumstance	Describes how community paramedics visiting the patient's home improves understanding of patient's health circumstance and, could impact patients care.	"So, the benefit for us and our patients, I think, is that there are some patients who we feel the picture we see in the office may be only a small part of what we need to know."

Code	Key Characteristics and Rules	Example Quote
E3. Patient care coordination with physicians	Explores how the relationship with community paramedics and FHT physicians impacts patient care. This involves capturing if physicians believe the program helps improve or hinders their patient care. **Include:** Descriptions of FHT staff describing coordination in terms of system flow.	"So with us, we have direct contact with the doctors. So there, there are patients at the clinic. We can see everything. We can see their charting. We can see when they have an upcoming appointment with the doctor. So usually if they have an upcoming appointment with the doctor within this month, I would not schedule a paramedic to go out and see them, because it's like duplicating the work. So we see the patient when the doctor can't, and there's like, you know, a huge interval in between
E4. Patient care coordination with nurses/allied health professionals	Explores how the relationship with community paramedics and nurses/allied health professionals at FHT impacts patient care. **Include:** Descriptions of FHT staff describing coordination in terms of system flow.	"Sometimes, we do collaborate with the physician assistants or the NP. So we see a lot of the same faces. And, sometimes, they're also able to prescribe things or help us out with a patient. I'd say it's a little less, overall. Because sort of its kind of not one or the other. But, if we go visit a patient, we might kind of alternate that with them, just coming in to see a nurse practitioner or a physician's assistant, the same as we try to space out visits between, you know, if they were just there to see the doctor or not maybe going to go see them the next week, we kind of try to space them."
E5. Patient care coordination with external social services	Explores how the relationship with community paramedic staff and social services in the local community impacts patient care.	"I think it would be easier if the social services were able to step up more, right? I think we're gap fillers right now, so a lot of the work we do is not even what we set out to do, but we're just trying to keep these patients afloat until the right care kicks in for them. That can be beyond frustrating when you put in that referral and you know there's a desperate need, and then you're told the waitlist is a year long or something, or they can't come at all, right? So that's really time-consuming."
E6. Patient care coordination with external healthcare organizations	Explores how the relationship with community paramedics and external healthcare organizations (LHIN/HCCSS/ diagnostic imaging/ laboratory/ hospitals).	"So I guess our main go-to right now will be the home and community care folks for personal support, occupational therapy, and physical therapy" "Sometimes you'll have nursing, but nursing is fairly rare to get in the community unless it's for a specific thing. So whenever you refer to home and community care, maybe assign, let's say, a care coordinator, the care coordinator does 1-2 assessments per year. Their mandate is 6-12 months to interact with patients. Given that I see the most vulnerable and complex people that's not nearly enough. So I feel like I increase their capacity quite a bit, because some people when they are in crisis, I can see them every 2-3 weeks or two months"
ADOPTION		

Code	Key Characteristics and Rules	Example Quote
A1. Recruitment of community paramedic staff to the program	Explores how community paramedics learned about the job position and why it interested them. Only code for preconceived reasons for interest in the position. Also, include the characteristics and experience required of someone hired for the community paramedic position.	"I really enjoyed the multidisciplinary approach. I knew of the community paramedics that worked at [location]. Then after that about a year ago, that my colleague [Community paramedic] was on leave for a bit, so then I asked if I could backfill his position"
A2. Community paramedic staff satisfaction with their position/responsibilities	Do community paramedics enjoy their work and responsibilities of the community paramedic position, and why? Do they feel equipped to perform their position?	"I like the idea of working with not just the patient themselves, but their entire care team, their family members, that sort of thing, getting rapport."
A3. Community paramedic/FHT staff satisfaction in an FHT setting	Explores the benefits of community paramedic working in an FHT compared to an independent community paramedic program. Explores the benefits of FHT using an embedded community paramedic program vs external community paramedic programs.	"And often it's just so nice to be able to walk upstairs and just pick the brain of any one of these experts in their fields when we're really hitting a brick wall with people." "Being with the [X] family health removes my biggest barrier. Cause I find when I was at headquarters, my biggest barrier was the silos that we were operating in and not knowing what other care is going on with this person. Whereas being the [X] family health, you have the buy-in from the docs, so that is so crucial in doing care planning"
A4. Community paramedic /FHT staff dissatisfaction in an FHT setting	Explores the disadvantages community paramedics state about working in an FHT compared to an independent community paramedic program	"It's difficult because I work in the clinic, so I can take orders from the doctors, but if I'm driving to the clinic in a paramedic vehicle when I'm also liable, let's say if there's an accident in front of me, I'm under a different medical director."
A5. Community paramedic staff dissatisfaction with their position	Explores the negatives community paramedics experiences working in their position.	"And my understanding is we're only funded for 1.5 paramedics. So the second one is precarious and always has been, so that always leaves an unsettled feeling in our team."
A6. FHT staff satisfaction with using the community paramedic program	FHT staff describe why they use the program. This includes describing their personal relationship with community paramedic staff. Also includes how it impacts their position and workload.	"So I find, yeah, in terms of care coordination, it's hard for family doctors with all the hats we wear and how busy we are to be able to do all of those things, but the paramedics do a phenomenal job in connecting patients with those resources and then informing us so we're in the loop and we know what's going on." "Yes, very much so. I mean I'm quite impressed with the program and the fact that they can kind of go into people's homes and have eyes on people and help them where they're at. It seems like a great model, from my perspective."
A7. FHT staff dissatisfaction with using the community paramedic program	Includes • FHT staff describe why they don't want to use the program. • Describing their personal relationship with community paramedic staff. • How it impacts their position, workload and how it could be improved for FHT staff use.	"I mean, I think there are some improvements that could be made there. Like, they do an excellent assessment, but the note can be quite long. And, so, sometimes from our perspective, the most relevant information doesn't immediately stand out."
IMPLEMENTATION		
I1. Staff recruitment and engagement	Explores whether the community paramedic program has the required staff to run the program, both pre-pilot and post-pilot. **Include:** How the clinic advertises/recruits' staff	"The candidate for this position should possess some of these key assets, which are crucial to the important and supportive role they play as part of the Community Paramedic Program team"

Code	Key Characteristics and Rules	Example Quote
I2. Staff Training	Describes how staff are trained.	"So it could – it's so many different ways. It's e-learning, it's in-class, it's workshops, it's conferences, it's just one-on-one training with people already doing that in the job, doing some – some work upstairs with the staff there, shadowing them. Yeah, it's been all over the map. And we just keep adding training as we learn more about our patients and their needs, so we're really open to whatever makes sense for that population"
I3. Program implementation	Describes how the community paramedic program is implemented and conducted. **Include:** Description of FHT staff experience coordinating with community paramedic team. Here, coordination doesn't directly mean its impacting patient care but more system flow. **Exclude:** Descriptions of care coordination with FHT staff that help with improving patient care.	"So the referral isn't too onerous. We just kind of write a note to them and say what we're concerned about specifically, and then they will contact the patient and arrange a visit, and then they'll send us a note, which I can go into in more detail, sort of letting us know what happened" "If the referral comes from outside the physician, then I have to ask the physician's permission first. So I usually send an email to the doctor, whoever's patient it is, and I ask their permission. "Are you okay with us seeing this patient and enrolling them in our program?" They'll either say, "You know, I don't know if they can benefit from it. Let me talk to the patient first." Or they'll say, "Absolutely." Like yesterday I had a referral, and it came from outside, not for the doctor. And so I messaged him, and he's like, "Absolutely, that would be amazing. This patient could use your care." "At home, no one's telling me how long I need to be there. I'm there as long as it takes."
I4. Scope of Practice & Adaption	The skills and controlled medical acts that a FHT community paramedic is required and permitted to perform in their role	"…enhanced skill sets such as urine dips, vaccinations …" "we just keep adding training as we learn more about our patients and their needs, so we're really open to whatever makes sense for that population …"
I5. Barriers to implementation (internal)	Explores difficulties and challenges encountered in implementing the community paramedic program. Internally affecting their implementation (e.g., staff, funding, patient reluctancy to use services)	"Without the record, you're really relying on those notes that they have from their previous visit[...] Before if there was something urgent that they had to do that with, they'd have to pick up the phone, call the admin person, and the admin person would have to go into the patient record share whatever they could."
I6. Implementation strategies	Discuss strategies employed to resolve challenges and improve program implementation.	"I think that, in that situation, you have to respect what they're saying. If they don't want you to – if they say like, "No. That's fine. I don't want that," you know, what we can do is try again over time, not immediately. You know, we don't have to immediately get to the root of everything on the first visit. Like I said, you really need to build rapport. And, over time, they might say, "Oh, yeah. Okay. Fine. If you want to do that, go ahead." Or you can, you know, if there's other ways to – like it depends what the situation is to go about it or, you know, say, "Do you mind if we" – you know, on the next visit, "Do you mind if we go in the kitchen today and do our interview?" Like just subtle things like that. "Can we sit at the kitchen table?" if you want to, you know, see a different part of their house or environment."

Code	Key Characteristics and Rules	Example Quote
I7. Barriers to implementation (External)	Explores difficulties and challenges encountered in implementing the community paramedic program. External affecting their implementation (e.g. social services, health services)	"The constraints – a lot of the times, the constraints are really on like what resources are available in the community. You might identify, you know, gaps and this patient could really use, you know, or wait times or you could really use, for example, social work or physio or whatever. And it might be, you know, oh, it's a nine-month wait or you're not able to access this particular program based on where you live. Especially with the [location] area, even things like transport have been issues in the past, to get to day programs, to get to food banks, to get into for appointments. So I think a lot of the frustration is around what resources are available. And, even if they are available, are they serviced and what are the wait times like."
MAINTENANCE		
M1. FHT's organization support of the community paramedic program	Explores the level of support FHT Exec provides for the program. Only include responses from FHT Exec.	"I see it as two pieces to it, somebody who needs to be seen but won't come in, or somebody who needs to be seen and would come in, but maybe not frequently enough to identify that they're going to end up in the hospital if they're not otherwise checked in on."
M2. FHT's mission goals align with community paramedic program	Explores how the aims and goals of the community paramedic program align with FHT's mission goals.	"Yeah, they very much do in that they can improve care for some of the most vulnerable patients, who are ones who could more easily fall through the cracks in the healthcare system. You know, especially ones who might be living alone and who might be having some dementia. So, yeah, so they do align with our goals of improving patient care. And for hopefully keeping patients out of the hospital and emergency department, unless it's needed."
M3. Changes made to the community paramedic program	Explores how the program has changed over time. This includes any direct changes made to improve sustainability. Includes: external changes that may impact how the program operates. Include references to maintaining the same practices/ aims over time.	"I think time was a big factor for sure, and just them seeing my notes and having informal conversations with them, you know, and being respectful of their time. I would wander up to talk to them, but always ask first, do you have five minutes? How about if not now, later? I think them getting feedback from our patients as well was probably helpful." "So we just got a bucket of money to get the program up and running, and then we had to validate it. But we got base funding, I think, two years ago, so now it's permanent. And it's from the province and it funnels through the Family Health team, is my understanding, but not my forte"

Code	Key Characteristics and Rules	Example Quote
M4. Barriers to sustainability	Explores past and current challenges in the program that can impact long-term sustainability.	"Oh, it's always been, absolutely. It's always weighing over our heads, especially before we had the base funding. It was year to year. We never knew if we were going to get renewed, so it was really stressful. And it was always just funding for one person, and we managed to get creative to stretch it to 1.5, but now it's really stressful for that second person, that second spot."
M5. Recommendations for changes	Describes how the FHT staff envisions the program changing or expanding. This is mainly referring to suggestions that are currently not part of the community paramedic team's scope of practice. **Exclude:** Suggestions outside of the FHT role that would improve the community paramedic program (e.g., improving external social services).	"I think one of the things that's often difficult when we're monitoring medications is doing blood work, and at this point, the paramedics aren't able to do blood work. They can do things like the six monthly osteoporosis injection, or the B12 injections, or flu shots in the home. COVID shots in the home they were doing as well at one point. So those things are really useful" "Well, one little kind of image that popped into my mind when I was reading that this was partly about food security and community paramedicine was, you know – and, again, this might be a lot on the community paramedics – but, for those very isolated individuals who maybe have trouble accessing or don't have those supports, I almost wondered whether there's room for them to get a few things from a local food bank, to be able to deliver or that kind of thing."

Abbreviations

AHP Allied Health Professional
EMR Electronic Medical Records
FHT Family Health Team
RE-AIM Reach, effectiveness, adoption, implementation, and maintenance
PCP Primary Care Paramedics
ACP Advanced Care Paramedics
PSW Personal Support Worker

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions
K.K.M. is the principal researcher of the study and is leading the research project. S.P. is the study's research coordinator involved in the recruitment, data collection, analysis, dissemination, and drafted the manuscript paper. L.K., research coordinator, oversaw and was involved in recruitment, data collection, analysis, and dissemination activities. S.T., student research assistant, contributed to data collection and analysis. T.I., K.S., and B.B. focused on the recruitment of participants, while M.F. aided in data collection for patient aggregate data. The initial grant proposal was developed by K.K.M., L.K., T.I., B.B., K.F., K.S., K.H., G.B., and C.M.. All authors collectively contributed to the study's conception and design, participated in manuscript editing and approval, and will be involved in sharing the project's findings. All authors read and approved the final manuscript.

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Availability of data and materials
Due to privacy and participant confidentiality considerations, the data supporting this study is not publicly available. Readers who wish to access de-identified data may contact the corresponding author, subject to appropriate ethical approvals and data-sharing agreements.

Declarations

Ethics approval and consent to participate
Verbal informed consent to participate and be audio-recorded was obtained from all participants. Ethical approval for the current study was approved by the Bruyère Research Ethics Board (M16-23-023). This research involving human participants was conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki, which sets forth guidelines for research involving human subjects to ensure their rights, safety, and well-being are protected throughout the study.

Consent to publication
Verbal informed consent to have their de-identified interview data published was obtained from all participants. Ethical approval for the current study was approved by the Bruyère Research Ethics Board (M16-23-023).

Competing interests
T.I., K.S., G.B., K.H., B.B., M.F., K.F., and C.B. were or are currently members of the Family Health Team and part of the research team. This could potentially influence the data collected from them in the interviews relating to the evaluation of the community paramedicine program. All other authors declare that they have no competing interests.

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References

1. Shannon B, Eaton G, Lanos C, Leyenaar M, Nolan M, Bowles KA, et al. The development of community paramedicine; a restricted review. Health Soc Care Community. 2022;30(6):e3547-61.
2. Shannon B, Baldry S, O'Meara P, Foster N, Martin A, Cook M, et al. The definition of a community paramedic: An international consensus. Paramedicine. 2023;20(1):4–22.
3. Agarwal G, Keenan A, Pirrie M, Marzanek-Lefebvre F. Integrating community paramedicine with primary health care: a qualitative study of community paramedic views. CMAJ Open. 2022;10(2):E331-7.
4. Allana A, Pinto AD. Paramedics Have Untapped Potential to Address Social Determinants of Health in Canada. Healthcare Policy [Internet]. 2021 Feb 1 [cited 2025 Jan 29];16(3):67. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7957353/
5. Nolan MJ, Nolan KE, Sinha SK. Community paramedicine is growing in impact and potential. Cmaj. 2018;190(21):E636-7.
6. Eastern Ontario Community Paramedic Programs [Internet]. [cited 2025 Jan 24]. About the Eastern Ontario Community Paramedic Programs. Available from: https://www.communityparamedics.ca/about
7. Guo B, Corabian P, Yan C, Tjosvold L. Community Paramedicine [Internet]. Community Paramedicine: Program Characteristics and Evaluation. Edmonton: Institute of Health Economics; 2017 [cited 2025 Jan 24]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK549096/
8. Agarwal G, Angeles R, Pirrie M, Marzanek F, McLeod B, Parascandalo J, et al. Effectiveness of a community paramedic-led health assessment and education initiative in a seniors' residence building: The Community Health Assessment Program through Emergency Medical Services (CHAP-EMS). BMC Emerg Med. 2017;17(1):1–8.
9. Agarwal G, Angeles R, Pirrie M, McLeod B, Marzanek F, Parascandalo J, et al. Reducing 9-1-1 Emergency Medical Service Calls By Implementing A Community Paramedicine Program For Vulnerable Older Adults In Public Housing In Canada: A Multi-Site Cluster Randomized Controlled Trial. Prehospital Emergency Care [Internet]. 2019;23(5):718–29. Available from: https://doi.org/10.1080/10903127.2019.1566421
10. Hallman, S., LeVasseur, S., Berard-Chagnon, J., & Martel, L. (2022). A portrait of Canada's growing population aged 85 and older from the 2021 Census: Census of population, 2021. In Statistics Canada. Report No.: 98-200-X. https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-X/2021004/98-200-X2021004-eng.pdf.
11. Information CI for H. Canada's seniors population outlook: Uncharted territory [Internet]. 2017 [cited 2024 Apr 14]. Available from: https://www.cihi.ca/en/infographic-canadas-seniors-population-outlook-uncharted-territory
12. National Seniors Council. Supporting Canadians Aging at Home: Ensuring Quality of Life as We Age. Government of Canada = Gouvernement du Canada; 2024.
13. Ontario Ministry of Health and Long-Term Care. Family Health Teams [Internet]. 2022. Available from: https://www.health.gov.on.ca/en/pro/programs/fht/
14. Sandelowski M. Whatever happened to qualitative description? Res Nurs Health. 2000;23(4):334–40.
15. Israel BA, Eng E, Schulz AJ, Parker EA. Methods for community-based participatory research for health [Internet]. 2nd ed. Jossey-Bass; 2013 [cited 2025 Jan 27]. Available from: https://www.wiley.com/en-hk/Methods+for+Community-Based+Participatory+Research+for+Health%2C+2nd+Edition-p-9781118021866
16. Russell E, Thomas M, Shawn M. Evaluating the public health impact of health promotion interventions: The RE-AIM framework. Am J Public Health. 1999;89(9):1322–7.
17. Gaglio B, Shoup JA, Glasgow RE. The RE-AIM framework: a systematic review of use over time. Am J Public Health. 2013;103(6):e38–46. https://doi.org/10.2105/AJPH.2013.301299.
18. Ridgeway JL, Gerdes EOW, Dodge A, Liedl CP, Juntunen MB, Sundt WJS, et al. Community paramedic hospital reduction and mitigation program: study protocol for a randomized pragmatic clinical trial. Trials [Internet]. 2023 Dec 1 [cited 2025 Jan 24];24(1):122. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9940335/
19. Holtrop JS, Rabin BA, Glasgow RE. Qualitative approaches to use of the RE-AIM framework: Rationale and methods. BMC Health Serv Res. 2018;18(1):1–10.
20. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. Med Teach [Internet]. 2023;45(3):241–51. Available from: https://doi.org/10.1080/0142159X.2022.2057287
21. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101.
22. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs [Internet]. 2008 Apr [cited 2025 Jan 24];62(1):107–15. Available from: https://pubmed.ncbi.nlm.nih.gov/18352969/
23. Oelschlägel L, Moen A, Dihle A, Christensen VL, Heggdal K, Österlind J, et al. Implementation of remote home care: assessment guided by the RE-AIM framework. BMC Health Serv Res [Internet]. 2024 Dec 1 [cited 2025 Jan 24];24(1):1–12. Available from: https://bmchealthservres.biomedcentral.com/articles/https://doi.org/10.1186/s12913-024-10625-9
24. Ontario Paramedic. Ontario Paramedic Scope of Practice [Internet]. [cited 2025 Jan 29]. Available from: https://www.ontarioparamedic.ca/scope-of-practice/
25. van Vuuren J, Thomas B, Agarwal G, MacDermott S, Kinsman L, O'Meara P, et al. Reshaping healthcare delivery for elderly patients: the role of community paramedicine; a systematic review. BMC Health Serv Res. 2021;21(1):1–15.
26. McAuslan C, Roll J, McAuslan M. Goals, Services, and Target Patient Populations of Community Paramedicine in Rural United States. International Journal of Paramedicine. 2023;3:22–33.
27. Patterson DG, Coulthard C, Garberson LA, Wingrove G, Larson EH. What is the potential of community paramedicine to fill rural health care gaps? J Health Care Poor Underserved. 2016;27(4):144–58.
28. Scott M, Ramzy A, Isenberg SR, Webber C, Eddeen AB, Murmann M, Mahdavi R, Howard M, Kendall CE, Klinger C, Marshall D, Sinnarajah A, Ponka D, Buchman S, Bennett C, Tanuseputro P, Dahrouge S, May K, Heer C, Hsu AT. Nurse practitioner and physician end-of-life home visits and end-of-life outcomes. BMJ Support Palliat Care. 2023;14(e3):1–9. https://doi.org/10.1136/spcare-2023-004392.
29. Salahub C, Kiran T, Na Y, Sinha SK, Stall NM, Ivers NM, et al. Characteristics and practice patterns of family physicians who provide home visits in Ontario, Canada: a cross-sectional study. CMAJ Open. 2023;11(2):E282-90.
30. Markle-Reid M, Browne G, Gafni A. Nurse-led health promotion interventions improve quality of life in frail older home care clients: Lessons learned from three randomized trials in Ontario. Canada J Eval Clin Pract. 2013;19(1):118–31.
31. Johnson S, Bacsu J, Abeykoon H, McIntosh T, Jeffery B, Novik N. No Place Like Home: A Systematic Review of Home Care for Older Adults in Canada. Canadian Journal on Aging. 2018;37(4):400–19.
32. Friesen E. The landscape of mental health services in rural Canada. Univ Toronto Med J. 2019;96(2):47–52.
33. Canadian Mental Health Association. Rural and Northern Community Issues in Mental Health [Internet]. 2009. Available from: http://ontario.cmha.ca/public_policy/rural-and-northern-community-issues-in-mental-health/#.V_kDT_krLIW
34. Lamanna M, Klinger CA, Liu A, Mirza RM. The Association between Public Transportation and Social Isolation in Older Adults: A Scoping Review of the Literature. Canadian Journal on Aging. 2020;39(3):393–405.
35. Keating N, Swindle J, Fletcher S. Aging in rural Canada: A retrospective and review. Canadian Journal on Aging. 2011;30(3):323–38.
36. Association ROM. Fill the Gaps Closer to Home Improving Access to Health Services for Rural Ontario. 2024;0–11. Available from: www.roma.on.ca/advocacy.

37. Eaton G, Wong G, Tierney S, Roberts N, Williams V, Mahtani KR. Understanding the role of the paramedic in primary care: a realist review. BMC Med. 2021;19(1):1–14.
38. Agarwal G, Pirrie M, Angeles R, Marzanek F, Thabane L, O'Reilly D. Cost-effectiveness analysis of a community paramedicine programme for low-income seniors living in subsidised housing: The community paramedicine at clinic programme (CP@clinic). BMJ Open. 2020;10(10):1–10.
39. Elden OE, Uleberg O, Lysne M, Haugdahl HS. Community paramedicine: cost-benefit analysis and safety evaluation in paramedical emergency services in rural areas - a scoping review. BMJ Open. 2022;12(6):1–7.
40. Ontario Ministry of Health and Long-Term Care. Your Health: A Plan for Connected and Convenient Care [Internet]. 2023. Available from: https://www.ontario.ca/page/your-health-plan-connected-and-convenient-care
41. Physicians OC of F. More Than Four Million Ontarians Will Be Without a Family Doctor by 2026 [Internet]. 2023 [cited 2024 Apr 14]. Available from: https://ontariofamilyphysicians.ca/news/more-than-four-million-ontarians-will-be-without-a-family-doctor-by-2026/
42. Ontario College of Family Physicians. A Profession in Crisis: The survival of family medicine in Ontario. 2023; Available from: file:///C:/Users/User/Documents/Practicum/PSI Grant/References/ocfp_member_survey_report_2023_05.pdf
43. Wong S, Regan S. Patient perspectives on primary health care in rural communities: effects of geography on access, continuity and efficiency. Rural Remote Health [Internet]. 2009 Mar 19;(9). Available from: http://www.rrh.org.au
44. Shah TI, Clark AF, Seabrook JA, Sibbald S, Gilliland JA. Geographic accessibility to primary care providers: Comparing rural and urban areas in Southwestern Ontario. Canadian Geographer. 2020;64(1):65–78.
45. McMillan C, Lee J, Milligan J, Hillier LM, Bauman C. Physician perspectives on care of individuals with severe mobility impairments in primary care in Southwestern Ontario, Canada. Health Soc Care Community. 2016 Jul 1 [cited 2025 Jan 30];24(4):463–72. Available from: https://onlinelibrary.wiley.com/doi/full/https://doi.org/10.1111/hsc.12228
46. Parmar J, Coe MB, Dobbs B, Mckay R, Kirwan MC, Cooper T, Marin A, Ccfp MD, Coe D, Gupta N, Bs MB. Diagnosis and management of dementia in primary care: exploratory study. Can Fam Phys. 2014;60(5):457–65.

Publisher's Note

Krystal Kehoe MacLeod is a Postdoctoral Fellow at Bruyere Research Institute and the Director of the Centre for Care Access and Equity Research (CCAER). At CCAER, our aim is to improve access to culturally informed health and social care with a focus on challenging the social, structural, and systemic inequities faced by underserved communities. We use intersectionality, health equity, organizational management, and feminist political economy theoretical frameworks and specialize in mixed methods studies that combine qualitative methods with population-level health administrative data. We prioritize community-based research approaches and integrated knowledge mobilization to involve our community partners across the entire research process. Our work is funded through grants from Health Canada, the Canadian Institutes of Health Research (CIHR), the Social Sciences and Humanities Research Council of Canada (SSHRC), the Centre for Aging + Brain Health Innovation at Baycrest, the New Brunswick Research Foundation, l'Association Médicale Universitaire Montfort, and the University of Ottawa.