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Pre-Hospital Emergency Care Council

Community Paramedicine Restricted Review

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Executive summary

Introduction

Community paramedicine is defined as *"a model of care whereby paramedics apply their training and skills in 'non-traditional' community-based environments, often outside the usual emergency response and transportation model. The community paramedic practices within an 'expanded scope', which includes the application of specialised skills and protocols beyond the base paramedic training. The community paramedic engages in an 'expanded role' working in non-traditional roles using existing skills".* Complementing that definition, a community paramedicine programme has been defined as *"a program that uses paramedics to provide immediate or scheduled primary, urgent, and/or specialized healthcare to vulnerable patient populations by focusing on improving equity in healthcare access across the continuum of care."* Together these definitions provide a foundation to guide health services in the development of a community paramedicine framework.

Community paramedicine has evolved from humble beginnings in Nova Scotia and is now widely implemented across much of Australasia, Canada, Finland, Ireland, the United Kingdom (UK), and the United States of America (USA). The main drivers for the community paramedicine model have been the changing paramedic service caseloads that reflect aging populations and declining access to other health services. These community paramedicine models provide an opportunity for community paramedics to more widely be employed across the health system in 'non-traditional' roles that meet the needs of disadvantaged communities who often lack access to high-quality emergency health services or primary health care. However, for health services looking to implement community paramedicine programmes, there can be many factors to navigate, and the siloed nature of healthcare means many programmes are built without consultation with the wider experience base both domestically and internationally. This leads to difficulties for regulatory bodies when looking to define scope of practice and entrance requirements for community paramedicine programmes. This restricted review of the literature provides a collation of evidence to support the introduction of community paramedicine into any jurisdiction for any governing bodies.

Review aims

The aim of this restricted review was to explore and better understand the successes and learnings of community paramedic programmes with a focus on Australasia, Canada, Finland, Ireland, the UK, and the USA context. It includes a review of the published research (both peer-reviewed and grey literature) on the following topics:

- Education;
- Models of delivery including clinical governance, supervision, and other structural supports;
- Scope of community paramedicine roles; and
- Outcomes associated with community paramedic programmes.

Results

The initial search strategy and referencing chaining of the final included peer-reviewed studies yielded 10,130 publications for screening. After elimination of duplicates (2,148) we screened 7,992 studies at the title and abstract level. This led to the exclusion of 7,579 citations. The remaining 405 full-text publications were reviewed (8 were not able to be retrieved) with another 312 publications excluded. We identified an additional five publications through searches of grey literature, resulting in a final yield of 98 publications included in this review. Includes works were published between 2003 and 2021, with the majority published from 2016 onwards (69 of 98 studies). The majority of studies were from the USA (n=37, 38%), followed by Canada (n=29, 30%) and the UK (n=16, 16%). The majority of studies reported on outcomes of community paramedicine programmes (n=50, including quality of life, patient satisfaction, and economic impacts), followed by models of delivery (n=28, including clinical governance, supervision, and other structural supports). A number of studies reported on more than one of the descriptive categories

The findings of this review demonstrate a lack of research and understanding in the areas of education and scope of the role for community paramedics. The findings highlight a need to develop common approaches to education and scope of role while maintaining flexibility in addressing community needs. There was an observable lack of standardisation in the implementation of governance and supervision models, which may prevent community paramedicine from realising its full potential. The outcome measures included in this review show that there is evidence to support the implementation of community paramedicine into healthcare system design. Community paramedicine programmes result in a net reduction in acute healthcare utilisation for enrolled patients, appear to be economically viable for the health service and result in positive patient outcomes with high patient satisfaction with care. There is a developing pool of evidence to many aspects of community paramedicine programmes. However, at this time, gaps in the literature prevent a definitive recommendation on the impact of community paramedicine programmes on healthcare system functionality

Gaps analysis

This review has highlighted that the education required for community paramedics, and the scope of the role they undertake, differs across continents, and across different jurisdictions within each country. Whilst there is a need for community paramedic programmes to be developed in response to specific community needs, a common education requirement, and an indicative scope of the role would be beneficial.

This review found that there was a lack of standardisation in the implementation of governance and supervision models to support community paramedics in both their role and development which should be considered during the establishment of community paramedicine programmes.

Lastly, the inconsistency in outcomes reported in the literature demonstrate a gap in the current evidence. With no consistency in outcome reporting, the standards by which the impact of community paramedic programmes are assessed remains flawed. Quantitative, qualitative, and economic analysis designs should all be considered when evaluating the impact of community paramedicine programmes, as reliance on one method at the exclusion of others may give misleading results. When applied together, these differing study designs could be powerful tools to determine the impact of community paramedicine programmes, and their contribution to the communities within which they serve.

Implications for community paramedicine in Ireland

- Community needs assessments should guide the development of community paramedicine programmes
- Community needs assessments should be dynamic and require ongoing attention
- Community needs assessments should guide the identification of the competencies required of community paramedics to practice effectively and safely
- Educational programmes should be structured to support the development of the predetermined competencies, and should occur at an appropriate academic level (literature would suggest Master's degree with appropriate clinical rotations)
- Links with primary care and public health agencies and professionals should be created
- Challenges such as documentation and data sharing need to be considered and addressed to promote successful programme implementation and delivery
- Existing regulatory structures (e.g., pre-defined or restrictive clinical practice guidelines, registration categories) may limit community paramedicine programmes to respond to meet the needs of communities
- Quantitative, qualitative, and economic analysis designs should all be considered when looking to evaluate the impact of community paramedicine programmes

Introduction

Of all the health disciplines that have progressed in the last decade, none have developed as significantly across the globe as paramedics. Emerging from a clinical environment that necessitated transport to hospital and definitive care, the profession has developed well beyond its initial boundaries of a transportation service. Throughout the world, paramedics are autonomous professionals who make clinical decisions to ensure the patients they attend receive the right care, at the right time, in the right place.

Perhaps one of the interesting things in this development of the profession is that it occurred similarly across the globe. Australasia (1), Canada (2), Finland (3), Ireland (4), the United Kingdom (5), and the United States of America (6) have all faced increasing demand in their respective health services over the last five years. Responding to this demand, services delivered by paramedics have also seen expansion, particularly those that result in treatment for patients in the community without hospital attendance. In the United Kingdom, paramedics with extended skills working for ambulance services have sought to treat and keep patients in the community since 2002 (7). For over a decade there is evidence of rural paramedics adopting a community approach to their care delivery in Australia (8), and in Nova Scotia, there are also examples of community paramedics working alongside nurses and family physicians in a home-visiting model (9). More recently, the community paramedic model has flourished in the United States of America (10).

Community paramedicine is defined as *"a model of care whereby paramedics apply their training and skills in 'non-traditional' community-based environments, often outside the usual emergency response and transportation model. The community paramedic practices within an 'expanded scope', which includes the application of specialised skills and protocols beyond the base paramedic training. The community paramedic engages in an 'expanded role' working in non-traditional roles using existing skills"* (11). Complementing that definition, a community paramedicine programme has been defined as *"a program that uses paramedics to provide immediate or scheduled primary, urgent, and/or specialized healthcare to vulnerable patient populations by focusing on improving equity in healthcare access across the continuum of care."* (12)

Whilst paramedics may not have been an obvious choice for delivering community care due to their association with emergency response, it is their ability to adapt to any situation and patient complaint, that gives them the transferable skills required to assist all in the community at their time of need. With additional education, and increases in paramedic autonomy and scope of role (13), paramedics have excelled in their transition from a transport service to hospital to now assessing and managing patients in the community. Although community paramedic roles are expanding internationally, no review of the literature could be found to guide services in the formation of community paramedicine programmes. For this reason, the aim of this restricted review was to explore and better understand the successes and learnings of community paramedic programmes with a focus on Australasia, Canada, Finland,

Ireland, the UK and the USA context. We sought to review the published research (both peer-reviewed and grey literature) on the following topics:

- Education.
- Models of delivery including clinical governance, supervision, and other structural supports;
- Scope of community paramedicine roles; and
- Outcomes associated with community paramedic programmes.

Methods

A restricted review (sometimes referred to as a rapid review) was deemed appropriate given the lengthy process often required to perform a systematic review, and the need for timely information to inform decision-making and policy creation (14). We used the population, concept, context (PCC) approach to draft research questions for the restricted review in consultation with the commissioning body (Pre-Hospital Emergency Care Council, Ireland). The review protocol was registered on the Open Science Framework in December 2021 (https://osf.io/qxwes/).

Research question

What is the international evidence investigating community paramedicine covering:

- Education including entry-level requirements
- Models of delivery to include clinical governance, supervision, and other structural supports
- Scope of role
- Outcomes from community paramedicine programmes

Search strategy

We performed a systematic literature search in December 2021 for studies that investigated community paramedicine. We utilised an existing validated systematic review search strategy by Eaton et al (15) (see Appendix A). We searched electronic databases CENTRAL, ERIC, EMBASE, MEDLINE, and Google Scholar from 2001 to 2021 for relevant articles. Subject headings were used where appropriate, and keywords and subject headings were adapted as required for individual databases. The CADTH Grey Matters toolkit was used to guide grey literature searches for agency reports, the international organisation reports in national health organisations' websites, and health professional and scientific associations' websites (16). Searching of reference lists and forward reference chaining of final included studies was conducted via the use of "*citationchaser*" software (17).

Eligibility criteria

Articles of any study design that discussed community paramedicine programmes (including mixed-response models whereby paramedics collaborate with or work alongside other healthcare professionals) were included from the peer-reviewed literature. We excluded literature that discussed programmes that did not meet the definition of community paramedicine (e.g., ambulance-based retrieval services, home visits by nursing or general practitioners), and conference abstracts. In addition, we excluded case studies and commentary pieces where no community paramedicine programme was studied, as well as magazine articles and news reports from the grey literature. Papers not available in English were excluded.

Study selection

We imported all search results into Covidence systematic review management software (18) where duplicates were removed. Each title and abstract were screened independently by two reviewers (BS, AB, GE, CL or MN) for exclusion using the eligibility criteria (level 1 screening). This was followed by a full-text review of the remaining articles by two reviewers (BS, GE, GW and MN) using the same eligibility criteria (level 2 screening). Conflicts were resolved by discussion or involvement of a third reviewer (BS, AB or CL). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was used to report on the conduct of the restricted review (19).

Data extraction

We designed and utilised a data extraction form informed by the Cochrane Handbook for Systematic Reviews (20). The form was piloted and updated until the research team reached consensus on the final version. General study characteristics that were extracted included: authorship, year of publication, the status of publication (i.e., grey literature or published), journal, and study design. Study-specific characteristics that were extracted included outcomes measured or issues researched, demographic characteristics of populations, and conclusions. Data were extracted by multiple reviewers (BS, AB, GE, ML, MN, CL, JH, GW). Informed by restricted review methodology (21), a random 20% sample (n=19) was audited for verification by a second author (BS).

Synthesis and analysis

A narrative synthesis was performed. The quantitative aspects of synthesis comprised variables such as patient demographics and reported outcome measures. The qualitative aspects of synthesis involved a content analysis of included studies in line with the research questions requested by the commissioning body, namely: education including entry-level requirements; models of delivery; clinical governance, supervision and other structural supports; scope of role; and outcomes from community paramedicine programmes.

Quality assessment

A risk-of-bias appraisal of included peer-reviewed literature using the Mixed Methods Appraisal Tool (MMAT) was conducted (22). One reviewer assessed the risk-of-bias of the included studies, and this was verified by a random 20% sample audit by a second author (BS). Risk-of-bias appraisal was limited to the primary outcome measure for each study (14).

Results

Search results and study selection

The initial search strategy and referencing chaining of the final included studies yielded 10,130 citations for screening. We identified an additional 5 citations through searches of grey literature. After elimination of duplicates (2,148), we screened 7,992 studies at the title and abstract level (Level 1). This led to the exclusion of 7,579 citations. After performing a full-text review of 410 studies, 98 studies were included for extraction and analysis. See Figure 1 for a PRISMA flow diagram of these findings, and Appendix B for a list of included studies.

Characteristics of included studies

Included studies were published between 2003 and 2021, with the majority published from 2016 onwards (69 of 98 studies). Most were published as peer-reviewed articles (n=93), with the remainder being reports (n=5). The majority of studies were from the United States (n=37, 38%), followed by Canada (n=29, 30%) and the United Kingdom (n=16, 16%) (Figure 2).

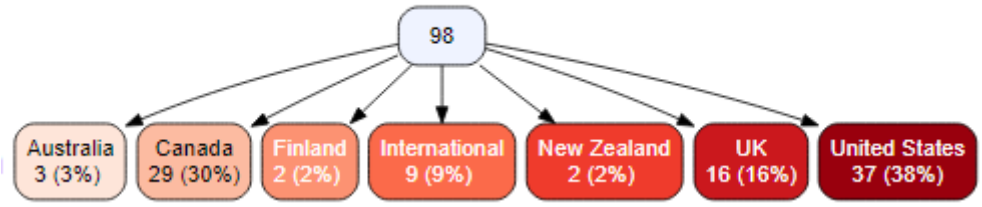
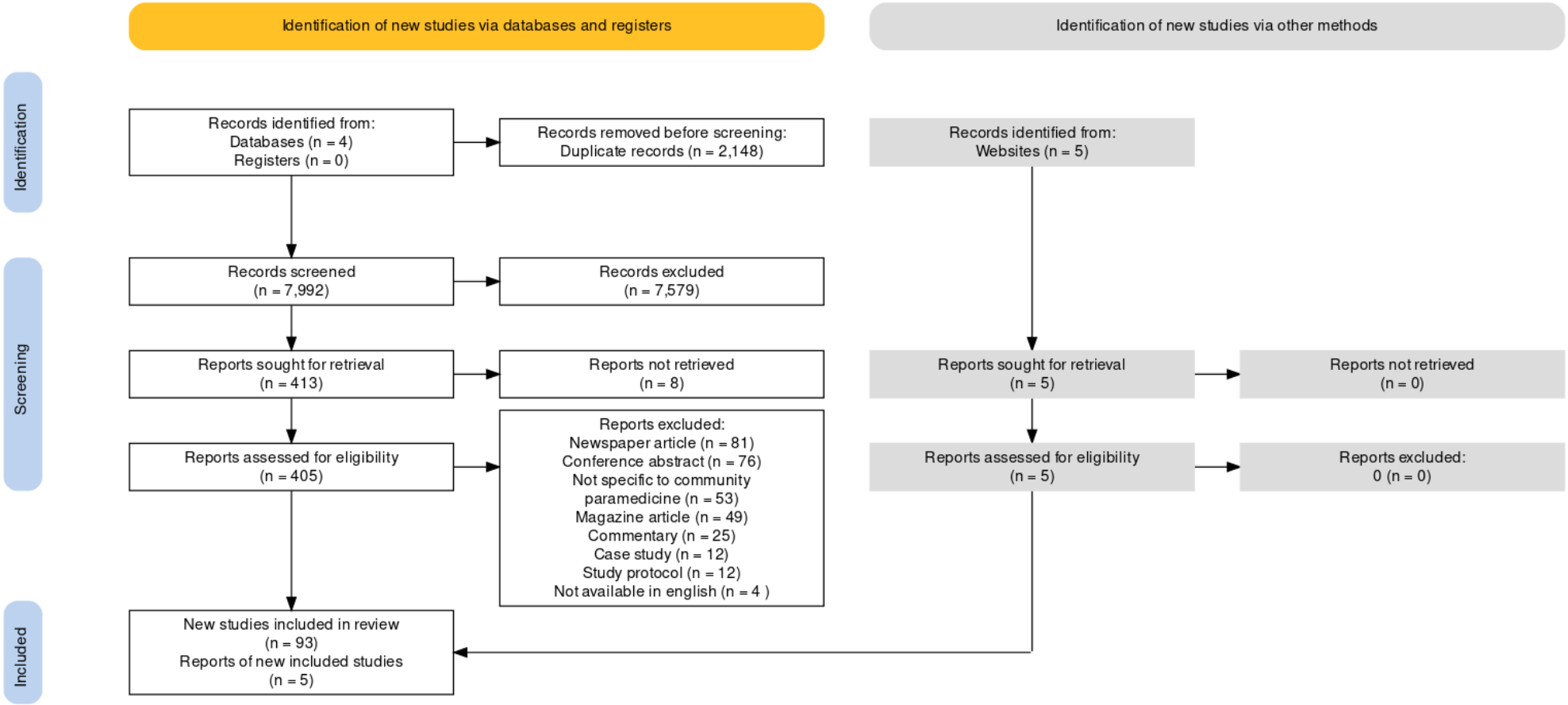


Figure 2. Geographical origin of studies included in this review.

The most common methodologies involved qualitative approaches to data collection and analysis (n=21), followed by systematic reviews (n=13), cohort studies (n=8), and randomised controlled trials (n=6). Populations studied included service users (with varying medical/social needs and histories), paramedics and community paramedics, other healthcare professionals, health system managers, and community members (e.g., relatives and carers). Sample sizes ranged from six (23) to 43,856 (24).

Figure 1. Prisma flow diagram



The majority of studies reported on outcomes of community paramedicine programmes (n=50, including quality of life, patient satisfaction, and economic impacts), followed by models of delivery (n=28, including clinical governance, supervision, and other structural supports). A number of studies reported on more than one of the descriptive categories (Figure 3).

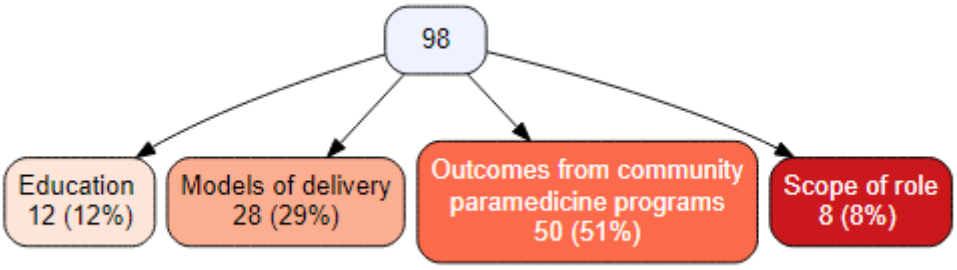


Figure 3. Primary category of evidence investigated by studies included in this review.

Quality assessments results

Quality assessment using the MMAT was possible in 68 of 98 studies. No studies included in the review warranted exclusion based on a significant risk of bias identified in quality assessment; however, lower levels of evidence/study design were most common (25). The most common concern on assessment was due to poorly or vaguely described methods being reported. Of the 30 studies without assessment using the MMAT (where no relevant category exists) there was deemed to be no significant risk of bias in methods, and this most commonly was with systematic or literature reviews. See Tables 1-6 for tabulated quality assessment results.

Education

Twelve studies reported on the education of community paramedics, the competencies required of community paramedics, and/or the gaps that exist in service delivery and the future directions of education to provide such services.

Community paramedicine education

The descriptions of community paramedic education included various forms of in-service education (26, 27), community-college based curricula and programmes (28, 29), and postgraduate level degrees (13, 15, 27, 30). A systematic review by Chan (27) reported a median training time of 240 hours per trainee per programme with a range of 3.5 to 2,080 hours. The National Curriculum and Career Pathway for Community Paramedicine (31) outlines that community paramedics must complete a 300-hour education programme that includes primary care clinical rotations. One implementation of this

curriculum is reported by Boykin (32). A realist review by Eaton (13) reported a master's degree as the most common educational requirement for community paramedics.

Competencies required of community paramedics

Only one study (26) described a process whereby a newly implemented programme evaluated paramedics against a set of desirable competencies (knowledge, skills and attitudes - KSAs) informed by the National Occupational Competency Profile for Paramedics (33). Education gaps relating to the care of older adults were identified and addressed through local training by subject matter experts

Future directions

O'Meara (34) advised that for community paramedicine to be widely accepted and to operate effectively, education and training needs to be available to paramedics, including independent research, and continuing and graduate education. With this (and professional registration) would come support for expanded scopes of practice if required based on population needs assessments. Paramedics reported the need for continuing education to develop within the role (35). Pearson (36) cautioned that further research is needed regarding education and qualifications for community paramedicine, in particular how these roles may impact rural areas that rely on volunteers and/or lower clinical qualifications. The education needs of community paramedics remain under-researched and are not well reported in the studies contained in this review.

Models of service delivery

A total of 28 studies reported on models of service delivery. In addition to outlining the service delivery models, the studies discussed the need for programmes to be designed around community needs, specific innovations in response to COVID-19, challenges facing service delivery, and future directions for research and knowledge sharing.

Service delivery models

A variety of models of service delivery were reported in the literature, and these are broadly described in Table 7, informed by (37). According to Leyenaar et al, 75% of Ontario's municipal paramedic services delivered more than one community paramedicine model of care, serving an estimated population of 56,640, while referring 23,040 service users to other services (37). O'Meara (34, 38) outlined that despite how the model was delivered, community paramedicine differs from other paramedic service delivery by engaging with communities; through its situated practice; collaboration with primary health care; integration with health, aged care and social services; focused governance and leadership; embrace of higher education; and providing treatment and transport options. From a

service delivery perspective, this highlights the importance of integration with the healthcare system. Community paramedics carried out fewer investigations, provided more treatments and were more likely to discharge patients home than the usual providers. In addition, through working in different settings across traditional professional boundaries, community paramedics impacted how services were delivered locally (39).

Table 7. Community paramedicine service delivery models

Model	Description
Community assessment and referral	Community paramedics connect individuals with other care providers, including community care services.
Community paramedic-led clinics	Community paramedics advertise and promote health promotion and preventative care services (including influenza vaccination, chronic disease education, blood pressure checks)
Home visit programmes	Community paramedics work with other healthcare services to maximise “at-home” services for those who repeatedly call or are at risk of frequent 911 utilisation due to medical conditions and/or unmet social needs.
Remote patient monitoring programmes	Community paramedics work with primary care providers to address issues proactively via 24-hour home-based monitoring programmes for chronic health conditions such as COPD, CHF and diabetes.
Community paramedic specialist response	Community paramedics work closely with 911 colleagues in a coordinated and cooperative manner to enable access to other health care providers.
Hospital discharge/transitional care support	Community paramedic programmes partner with hospitals to facilitate improved timeliness of discharge from hospital, with follow-up by community paramedics.
Mental health and addictions support	Community paramedics are part of mental health crisis response teams, provide care in homeless shelter programmes, and assist in medical care provision and oversight at safe consumption and treatment sites.
Palliative care support	Community paramedics provide care for palliative care patients at home aligned with care preferences of those receiving care.

Influenza surge programmes	Community paramedics work with at-risk populations to increase vaccination rates and manage influenza-like presentations in retirement, nursing and other residential environments.
COVID response programmes	Community paramedicine programmes provided COVID response activities including testing, vaccination clinics, and logistical support for public health partners.

Community needs assessment

A key recommendation and lesson reported in the literature across multiple studies was the essential role of understanding the community needs and factors that enabled a sustainable community paramedicine programme (36, 37, 40). O'Meara (41) advised that engaging appropriately with the community can result in more integrated paramedic services, working as part of a less-fragmented system across the health, aged care and social service sectors. This is also important to prevent duplication and overlap of existing service delivery (42).

Service delivery innovations in response to COVID-19

Constantine et al (43) reported on the implementation of COVID-19 drive-through testing by community paramedics in North Carolina, USA. This was achieved through a comprehensive telehealth screening system, combined with screening protocols and integration of documentation across services. This study highlighted the ability of community paramedicine to protect existing emergency resources (e.g., 911 ambulance access and emergency departments) while also improving access to healthcare services.

Other innovations in community paramedicine programmes across Canada in response to service demands and population needs due to COVID-19 (44). Innovations included the delivery of novel community paramedicine services to marginalised populations such as prisoners, immigrant workers, and those experiencing homelessness. In addition, community paramedic programmes implemented virtual visits and telehealth solutions for remote and isolated individuals. This included remote patient monitoring solutions that allowed primary care providers to simultaneously care for large numbers of patients in collaboration with community paramedics. As a result of this increased cooperation and collaboration, community paramedics have further integrated into the primary care system as members of multidisciplinary teams across Canada (44).

From the same study, participants also reported establishing and strengthening links with public health departments as a result of COVID-19 innovations. Batt et al. (44) suggested that the link between public health and paramedicine has often been discussed and that the COVID-19 response illustrated the

ability of community paramedicine to operationalise that link – one example being the ability of community paramedicine programmes to rapidly provide educated personnel, equipment, transport, and logistical support to deploy mass testing and vaccination efforts.

Challenges

Programmes outlined three principal challenges, namely: funding, data-sharing and reporting, and regulatory issues (36, 37, 44, 45). Cooper (46) suggested that further work was required to evaluate the development of practice, the quality of care, and the cost benefits of community paramedicine, which is echoed in other papers (47, 48). Evaluation of community paramedicine programmes has increased in recent years and is explored later in this manuscript. A lack of guidance and inconsistent interpretation regarding programmes and scope of practice was also highlighted (49), while Batt et al. (44) recommended the establishment of appropriate quality indicators for community paramedicine (i.e., not traditional ambulance service quality indicators).

Future research and knowledge sharing

Three papers (44, 50, 51) stressed the importance of conducting and reporting studies when implementing community paramedicine programmes, particularly those of high research quality such as randomised controlled trials. They suggested that doing so would not only assist in guiding the design and delivery of a programme that meets the needs of the community, but it would also serve to create an accessible resource that could be used for replication of study methods for similar initiatives.

Governance and clinical support

Twenty-one studies reported on clinical governance, supervision or medical oversight, and other structural supports, including collaboration with other healthcare staff.

Integrated interdisciplinary collaboration

Several models existed where community paramedics were integrated alongside other professional groups. Whalen (35) reports a combined nurse and paramedic team offering overnight urgent and emergency care, where the unique professional identities of both groups enabled a more holistic patient experience. A more recent model utilised community paramedics as a delegated home visit response from the heart failure specialist (42), to expedite patient access to non-emergency treatment associated with their condition. Similarly, Boykin et al (32) outlined a similar model involving paramedics, pharmacists and advanced practitioners in cardiology responding to patients with heart failure. Other programmes included community paramedics working in Mental Health Crisis Response Teams (24)

providing care in homeless shelter programmes (47) and working within a rapid access team alongside Family Physicians (52).

The need for community paramedics to have effective clinical and managerial links with other health providers was well documented (35, 39, 41, 48, 53). The development of interagency links across different services also enabled the development of patient referral processes (52). However, the key to integration were governance structures to support role implementation and reduce duplication between professional groups (40, 54).

Medical Oversight

Whilst evidence suggested that community paramedics, for the most part, worked without direct medical supervision, 10 studies outlined the provision of remote medical oversight or physician support (35, 40-42, 47, 49, 51, 53-55). In a majority of studies, it was not clear whether medical oversight directed the provision of patient care or was in place as a clinical support to troubleshoot clinical problems. Pearson and Shaler (36) found that in jurisdictions where there was a lack of legislation underpinning professional roles, more robust clinical supervision was required. Leyenaar et al (54), however, in their review found almost exclusively use of clinical on-call support for assistance, rather than permission to treat. There are also arguments that whilst there are valid reasons to support high levels of medical supervision for community paramedics, this should not be at the deficit of developing the professional practice of community paramedics (38, 41).

Standard Operating Procedures

The need for governance structures to support the integration and utilisation of community paramedics was a common occurrence (36, 39, 40, 48, 49, 53). As well as linking legislation to clinical supervision, Pearson and Shaler (36) found that stronger standard operating procedures and protocols existed in jurisdictions with a lack of legislation to support professional conduct. However, there was evidence that whilst protocols existed, they were not always followed as they did not cover all components of the community paramedicine role, such as social assessments (40).

Scope of role

Eight studies reported on the scope of the role of community paramedics. Across the literature reviewed, there was no clear standardisation regarding what an expanded scope of role for community paramedics would include, especially since practice guidelines were still being established as paramedics move to work in these relatively new clinical areas (13, 56). However, three key components that were considered to be a staple requirement of the scope of the role expected of a community paramedic.

General health assessment

All studies (56-62) outlined the importance for community paramedics to be able to undertake a general health assessment. Eight years ago, Evans et al. (58), found that a general health assessment was among one of the most common roles reported in their literature review, with an emphasis on acute minor conditions, rather than complex multi-organ disease. Similar results have been noted more recently (59). In their cross-sectional environmental scan, Leyenaar et al (59) found that all community paramedics undertook a generic health assessment across all organ systems. However, a multisystem assessment was less common, with no community paramedics undertaking an assessment featuring the neuromusculoskeletal system, for example. A more recent literature review outlines that the generalist training given to paramedics prepares them well for the management of a wide spectrum of undifferentiated illnesses, for which a general health assessment would be required (62).

Psychosocial assessment

The assessment and management of behavioural health emergencies as a routine part of ambulance work were considered by Keefe et al (61) to be a transferable trait into community paramedicine. Slightly more recently, a Delphi study in Canada has outlined that the ability for community paramedics to undertake a psychosocial assessment is likely due to the absence of time-sensitive situations in which paramedics conduct their assessments (56). Evans et al (58) outlined that this lack of time-pressure enables community paramedics to undertake safeguarding and risk assessments whilst in patients homes. However, another paper found that whilst assessment for psychosocial needs may be part of the extended role commensurate with community paramedicine, this was one aspect that would not necessarily form part of a paramedics initial training (60). Indeed, Keefe et al (61) also found that experiential learning played a key part in the ability of community paramedics to expand the scope of their role to undertake a more holistic assessment that included biopsychosocial health.

Health promotion

The expanded scope of role for paramedics was also considered to include health assessment and prevention of ill-health (56-58). In rural Australia, an expanded scope of role was found to enable community engagement with local health services (57), where health promotion and illness prevention had a meaningful impact at the community level. Leyenaar et al (56) found that through their engagement and general health assessment, community paramedics were likely to identify medium-term and long- term care needs. Indeed, Evans et al (58) consider that the holistic nature of the assessment may be particularly suited to assess the health requirements of those aged over 60.

Outcomes associated with community paramedicine programmes

Outcomes of community paramedicine programmes were reported in 50 different studies included in the final results. The outcomes associated with community paramedicine programmes were categorised into 5 outcome categories:

- Impact on emergency calls, rates of transportation and hospital admissions
- Economic evaluations
- Patient health outcomes
- Patient satisfaction
- Community paramedic satisfaction and qualitative insights into the role

Emergency calls, transportation and admission outcomes

The most common outcome measure to evaluate community paramedicine programmes was the impact on rates of transportation and presentations to the Emergency Department (ED), impact on rates of Emergency Medical Services (EMS) calls, and admissions to hospital. Twenty studies investigated community paramedicine across these outcome measures, with the impact on ED presentations the most frequently reported outcome measure. See Table 8 for tabulated results.

Impact on ED presentations

Community paramedicine programmes were found to influence the net reduction of ED visits when compared to routine pathways of care. In studies that compared the effect of emergency department visits compared to a control group not receiving community paramedicine intervention the reduction in ED presentations ranged from 21% (63) to 58.7% (64). Comparison control groups were found to have an increase in ED visits while the intervention of community paramedicine programmes provided a net overall reduction. When comparing to control group participants, community paramedicine participants were found to be less likely to attend the ED (relative risk [RR] 0.72, 95% CI = 0.68 to 0.75) (65) and there was also reported to be a reduction in the time spent in ED by patients enrolled in community paramedicine programmes (126.6 vs 211.3 minutes) (66).

Impact on EMS calls

The impact of community paramedicine programmes on request for EMS was reduced. In programmes situated within EMS, there was a 26% reduction in EMS calls. In specific population groups, there was also a reduction in EMS calls. In patients who had suffered a fall there was a reduction in calls and subsequent transports (67) and one study which looked at the impact of community paramedicine programme on patients who frequently utilise the service found there was a mean reduction per patient

from 18 calls on average down to 8 after enrolment (47). A study from Finland found that 82% of the patients assessed and treated by community paramedics did not re-attend EMS (68).

Impact on hospital admissions

Community paramedicine programmes were found to reduce rates of hospital admission. Studies reported a reduction in 30-day readmission rates (69), reduced admissions (70) and improved quality of life. A report from Canada showed a 32% reduction in admissions to a hospital (37) by patients receiving community paramedic intervention and in patients living in long term care receiving community paramedicine intervention they were less likely to be admitted (16.8% vs 39.8%) (71).

Economic outcomes

There were 12 studies that included some form of economic evaluation of community paramedicine programmes included in the results. Results showed that the community paramedicine programmes greatest economic impact was due to a reduction in acute healthcare utilisation through a decrease in the usual pathways of care of emergency call-taking dispatch of paramedics, transport to the ED and ED attendance plus or minus hospital admission. See Table 9 for tabulated results.

Canadian studies showed significantly promising economic advantages associated with the implementation of community paramedicine programmes. In a randomised control trial looking at community paramedicine programmes for low-income seniors in subsidised housing (72) there was a net reduction in EMS calls. This resulted in a cost reduction of C$54-C$243 per resident in the trial with overall cost avoided during 12-months being between C$78,742 to C$355,681.

Despite the costs of implementing a community paramedicine programme not being insignificant, the return on investment was reported to be advantageous. A report on community paramedicine programmes in Ontario Canada (37) showed that a cost avoidance of $29 million in downstream health costs was achieved in a population group of 2,333 patients. It was reported that a net return on investment (being calculated through, cost avoidance – the cost of providing service) to be C$5,842 per patient per year, with a community paramedicine hospital discharge service creating a 50% reduction in health care costs and cost avoidance estimated at C$10,000 per patient.

Studies originating in the US also showed that community paramedicine programmes had an economic advantage over routine pathways of care. Through a reduction in EMS calls, ED presentations and hospital admissions one study found a return on investment of 20% in one year (64). Similarly to Canadian studies the net reduction in costs was associated with diverting patients away from ED presentations, with one pilot study finding that “per patient, savings were US$791 for seven days, US$3,677 for 15 days, and US$538 for 30 days” (73). Another study found a 19% reduction in per-patient costs per month in high-risk patients.

The economic results from community paramedicine programmes were not restricted to the North American context, in the UK paramedic practitioner programmes were found to be cost-effective at £20 000 per Quality Adjusted Life Year (QALY) (66). When discussing mixed models of care a programme that involved a nurse and paramedic team attending to low acuity calls found that the cost of implementation of the programme was offset by the savings from the reduction in ED presentations and hospitalisations. The programme ran over a 15-week period and saved £29 260 (74).

In Australia a community paramedicine programme which was implemented across 6 different sites found that should the programme sites be utilised consistently, annual costs saving per patient seen by the community paramedic equivalent would range from AUD$411 to AUD$998 (75).

Patient health outcomes

Seven studies provided evidence associated with whether community paramedicine programme interventions influenced patient health outcomes. See Table 10 for tabulated results. Three studies specifically reported on the change in both blood pressure and diabetes risk. In patients with hypertension community paramedic intervention showed that both systolic and diastolic blood pressure was decreased significantly (64, 76). Likewise, diabetes risk was decreased in 15% of participants in one Canadian study (76) and one US-based study patients suffering from diabetes saw a decrease in blood glucose measurements on average of 33.7mmol/L (64).

When considering the quality of life measures 3 studies used this as an outcome measure. In a randomised control trial participants receiving the community paramedicine intervention showed significant results in QALYs and were more likely to be able to perform usual daily activities (odds ratio 2.6, 95% CI 1.2 to 5.8) (77). In a similar but separate randomised control trial of community paramedicine an increase in QALYs was also seen (mean difference 0.06, 95%CI: 0.02 to 0.10) (78). A US study that used EQ-5D-3L scores to measure the impact of a community paramedicine programme on patients found that the mean difference between pre and post scores was statistically significant and participants scored nearly 20 points higher on the perceived quality of life (79).

Two studies evaluated the patient safety of community paramedicine programmes, one study found no difference in 28-day mortality rates and a study from New Zealand showed that of only 18 cases where there was a subsequent presentation after a non-transport decision was made, on clinical review all cases at the time the decisions were made were deemed clinically appropriate (80).

Patient satisfaction

Nine studies either primarily investigated or reported on patient satisfaction with care provided by community paramedicine programmes, see Table 11 for tabulated results. All 9 studies reported favourable patient satisfaction results. Patients in the community paramedicine programmes found their experience to be positive (81) and were highly satisfied with the care provided (65). Patients appreciated

the fact that the programmes provided the improved ability for health monitoring, provided primary health care needs at home which increased the sense of security as well as provided increased education on their health issues making patients feel empowered to manage their own health (82). A separate study echoed this result with 99% of participants believing their understanding of their health conditions had improved, leading to increased empowerment in managing their health independently (26). Patient satisfaction was driven by both the professional and personal relationships that the community paramedics were able to develop throughout the community paramedicine programme model of care (83).

One study investigated satisfaction differences between routine EMS models of care compared to a community paramedicine model of care (84). Both models of care were accepted by patients, but a small number of patients still did have a preference to be transported to the ED rather than having care provided in the community or at their place of residence. This was echoed in an Australian report which also found that 2.2% of patients refused to be treated by community paramedics (75).

Community paramedic satisfaction and qualitative insights into the role

Eight studies examined the satisfaction and qualitative experience of community paramedics (or local equivalent) operating in a community paramedicine programme. See Table 12 for tabulated results. Paramedics working in community paramedicine programmes were found to value the role and enjoyed the novel approach to care that impacted positive patient outcomes (35) and they felt accepted to work in non-traditional ambulance roles by other health professionals (85). Paramedics felt that the key to the success of community paramedicine programmes and their role was dependent on interprofessional relationship building (82, 86-88). There were reports of opportunities to improve the experience of community paramedics such as by increasing clinically focussed graduate-level education (45, 46), improving the communication from management staff and better communication about the role of community paramedics with other paramedic staff and allied health partners (45, 88).

Discussion

This review identified 98 studies that explored several aspects of community paramedicine, namely education, programme delivery, the scope of the role, and outcomes. While much of the evidence was of a lower level of evidence (25), taken as a whole the results of this review provide a comprehensive overview of the implementation of community paramedicine around the world in the last twenty years, from the inception of some of the first programmes, to modern-day programme innovations in response to COVID-19.

One of the core tenets of community paramedicine is the design and implementation of programmes that meet the needs of the community (12). While the curriculum outlined by the Paramedic Foundation

(31) provides an introductory module on the conduct of needs assessments, there is a noticeable lack of literature that critically discusses or explores the components of a community needs assessment. Given the acknowledgement that paramedicine is a profession that practises on a health-social care continuum (89, 90) it appears timely for guidance on contemporary approaches to conducting community needs assessments that are holistic and patient-centred, acknowledge the complex barriers to health and social care access in marginalised populations (91) and are co-created with the community, instead of on their behalf.

Central to delivering a service that meets the needs of the community is first educating and supporting community paramedics to do so. Despite the shift towards competency-based education evident in the health professions over the past 10 years (92), only one study in this review (26) identified required competencies to inform education design and delivery. While other educational programmes may have been modelled against identified competencies, the lack of reporting on this aspect of education means there is some uncertainty in the appropriateness of education programmes, and a potential for missed opportunities in addressing community needs. It would appear prudent to first identify the competencies needed of community paramedics in specific contexts (93), and use these findings to design education and assessment strategies.

A natural consequence of such a competency-based approach suggests while standardised or national curricula hold some utility, they should only be used as a foundation for community paramedic education. The unique needs assessment of each community should highlight specific competencies, which can then be used to further guide customised education. Education may take the form of specific clinical rotations (as recommended by the Paramedic Foundation Community Paramedicine curriculum), postgraduate modules or degree programmes, and/or specialised education and qualifications such as independent prescribing. Decisions regarding education design will likely be influenced by the existing educational frameworks for paramedics in these settings. This again highlights the pivotal role of the initial (and ongoing) community needs assessment.

It is obvious that education will therefore influence the scope of the role community paramedics undertake. Evidence in this review demonstrated that the generalist pre-registration education required by paramedics is harnessed to enable the development of community paramedics across different clinical settings and different clinical needs. This pluripotential characteristic of paramedics (13) enables the scope of role to reflect either the environment or community in which they work. Central to the expanded scope of their role for community paramedics was the health promotion and the importance of a holistic biopsychosocial assessment. Community paramedics do not only operate in a response model, but in a proactive approach that focuses on making every contact count.

Supporting the expanded scope of the role is the integration with other healthcare professionals, and the need to have effective administrative links with the wider healthcare system. Such links enable the development of specific care pathways for specific patient groups, creating a smoother patient journey

and improved access to treatment (94). Associated with this integration is consideration of the clinical supervision afforded to community paramedics. Whilst the option for remote physician assistance may undoubtedly be beneficial during complex clinical cases, this should offer supportive advice, rather than direction for treatment. It is vital to the profession and the overall healthcare system that community paramedics work as autonomous clinicians who are capable in their own right (38, 41).

Multiple studies reinforced the importance of links with primary care and integration into the broader healthcare system. These studies reinforce the advice of O'Meara (34) that integrated services are less likely to duplicate work and, by reducing the fragmentation within the healthcare system, may result in improved outcomes. However, such integration is prone to multiple challenges highlighted in the literature. One of the key points of failure for integration appears to be the ability to use shared documentation services, and the sharing of data across multidisciplinary teams. Another challenge faced by community paramedicine programmes is misalignment between existing regulatory structures and new or expanding roles for community paramedics. Revisiting the appropriateness of current regulatory approaches (which were designed to address the regulation of paramedics in one specific context, such as emergency ambulance response) may be necessary to allow community paramedicine programmes to meet the needs of the community.

The response of community paramedicine programmes to COVID-19 was not well reported in the results of this review. However, a publication in press (95) details community paramedics who supported COVID assessment and testing in Renfrew County, Ontario, Canada, thus echoing the previous findings (43, 44). Studies such as these reinforce the unique role of paramedicine, in particular, that of community paramedicine, in supporting primary care and public health service delivery - meeting the needs of the community, even when presented with challenging circumstances such as those presented by COVID-19. By further sharing the experiences and lessons learned from the mobilisation of community paramedicine to support primary care and public health initiatives, programmes can be better placed to serve these evolving community needs going forward.

An important part of community paramedicine program implementation is the robust evaluation used to measure its impact and ability to achieve any pre-set goals. The most-reported outcome measures found in the literature was the impact of community paramedicine programmes on rates of transport by paramedics and rates of ED presentations. There are limitations in using this as a sole outcome measure to evaluate the effectiveness (96) as it has been highlighted that community paramedicine programmes often aim to serve the most vulnerable and complex patients who often require intense healthcare utilisation (97). This is particularly the case in programmes that care for previously identified frequent attenders which have been noted in the literature to not engage in preventative health care measures (98). There is also a natural decrease in ED presentations in some patient groups over time and this may bias results in evaluations solely looking at rates of transport and ED presentations (98). For this reason, the outcomes measure of rates of transportation and presentation to EDs should be

one part of a robust evaluation piece when looking at the impact of community paramedicine programmes on the health system they are integrated within.

Community paramedicine programmes were found to be economically advantageous even when considering the cost of implementation. The importance of consulting with those with expertise in health economics from the development stage of any community paramedicine programme would appear to be important to ensure these results are also applicable. Early involvement with a health economist would enable appropriate prospective data collection and understanding of costs from commencement, rather than attempting to retrospectively evaluate the economics of a programme from a limited dataset (99). Finally, the patient outcomes measured were heterogeneous with many patient outcomes measures showing a positive impact. Quality of life measures appear to show the positive impact of community paramedicine and would be one of the more appropriate outcome measures to be used when considering patient-level outcomes (100). On top of this, patient satisfaction with care provided and qualitative insights provide a well-rounded insight into quantitative outcome measures and were shown in the results to be overwhelmingly positive.

The outcome measure results included in this review show that there is enough evidence to support the implementation of community paramedicine into healthcare system design. Community paramedicine programmes result in a net reduction in acute healthcare utilisation for patients enrolled, appear to be economically viable and result in positive patient outcomes with high patient satisfaction with care.

Gaps analysis

Whilst this review has highlighted programmes across Australasia, Canada, Ireland, the United Kingdom and the United States of America where research has focussed on community paramedicine, this review has also highlighted the significant gaps that exist within each of the topics under consideration.

This review has highlighted that the education required for community paramedics, and the scope of the role they undertake, differs across continents, and across different jurisdictions within each country. Whilst there is a need for community paramedic programmes to be developed in response to specific community needs, this lack of standardisation is problematic in that it has the potential to prevent the professionalisation of this group of practitioners. A common education requirement and an indicative scope of role would be beneficial in the development of paramedics into community paramedics, as well as the movement of community paramedics between jurisdictions and even continents. At the local level, such standardisation will ensure patients and other healthcare providers understand and accept the role of the community paramedic.

Central to the development of community paramedics are governance structures that support their new role. This not only supports their integration with the wider healthcare workforce, but also sets out the requirements to support their development with clinical supervision, and standard operating procedures to support the scope of their role. This review found that there was a lack of standardisation in the

implementation of governance and supervision models to support community paramedics in both their role and development.

Lastly, the inconsistency in outcomes reported in the literature demonstrate a gap in the current evidence. With no consistency in outcome reporting, the standards by which the impact of community paramedic programmes are assessed remains. Standardised reporting outcomes could include the impact on the health workforce (such as reduction in hospital attendance; increased accessibility for patients to specialist services or treatment); patient satisfaction; QALYS; and economic impact within workforces. When applied together, these differing study designs could be powerful tools to determine the impact of community paramedicine programmes, and their contribution to the communities within which they serve.

Implications for community paramedicine in Ireland:

- Community needs assessments should guide the development of community paramedicine programmes
- Community needs assessments should be dynamic and require ongoing attention
- Community needs assessments should guide the identification of the competencies required of community paramedics to practice effectively and safely
- Educational programmes should be structured to support the development of the predetermined competencies, and should occur at an appropriate academic level (literature would suggest Master's degree with appropriate clinical rotations)
- Links with primary care and public health agencies and professionals should be created
- Challenges such as documentation and data sharing need to be considered and addressed to promote successful programme implementation and delivery
- Existing regulatory structures (e.g., pre-defined or restrictive clinical practice guidelines, registration categories) may limit community paramedicine programmes to respond to meet the needs of communities
- Quantitative, qualitative, and economic analysis designs should all be considered when looking to evaluate the impact of community paramedicine programmes

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Summary

This review identified and explored research related to community paramedicine focused on four key areas: education, models of delivery, the scope of the role, and outcomes. Research to date has been published across all four domains from multiple jurisdictions. The findings of this review demonstrate a lack of research and understanding of the education and scope of the role of community paramedics. The findings highlight a need to develop common approaches to education and scope while maintaining flexibility in addressing community needs. There was an observable lack of standardisation in the implementation of governance and supervision models which may prevent community paramedicine from realising its full potential. Finally, while there has been an increased focus on outcomes in the literature, such reporting is inconsistent. This inconsistency, and the gaps evident across the other areas of focus, makes it difficult to articulate what community paramedicine programmes can achieve and their impacts on the healthcare system.

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References

1. Andrew E, Nehme Z, Cameron P, Smith K. Drivers of increasing emergency ambulance demand. Prehospital Emergency Care. 2020;24(3):385.
2. Drennan IR, Blanchard IE, Buick JE. Opportunity for change: is it time to redefine the role of paramedics in healthcare? : Springer; 2021. p. 139-40.
3. Vuorenkoski L, Mladovsky P, Mossialos E, Organization WH. Finland: Health system review. 2008.
4. Cullinan J, Connolly S, Whyte R. The Sustainability of Ireland's Health Care System. The Sustainability of Health Care Systems in Europe: Emerald Publishing Limited; 2021.
5. Claridge F, Parry A. Ambulance service pressures need a whole-system response 2021 [Available from: https://www.nhsconfed.org/articles/ambulance-service-pressures-need-whole-system-response.
6. Mark A, Pencheon D, Elliott R. Demanding healthcare. The International Journal of Health Planning and Management. 2000;15(3):237-53.
7. College of Paramedics. Journey of the College 2021 [Available from: https://www.collegeofparamedics.co.uk/COP/About_us/Journey_of_the_College/COP/About_Us/The_Journey_of_the_College.aspx?hkey=30590e00-f1a4-4fb0-9b03-96ae7062291c.
8. Guo B, Corabian P, Yan C, Tjosvold L. Community paramedicine: program characteristics and evaluation. 2019.
9. Martin-Misener R, Downe-Wamboldt B, Cain E, Girouard M. Cost effectiveness and outcomes of a nurse practitioner–paramedic–family physician model of care: the Long and Brier Islands study. Primary Health Care Research & Development. 2009;10(01):14-25.
10. Iezzoni LI, Dorner SC, Ajayi T. Community paramedicine—addressing questions as programs expand. N Engl J Med. 2016;374(12):1107-9.
11. Wingrove G. International roundtable on community paramedicine. Australasian Journal of Paramedicine. 2011;9(1).
12. CSA Group. Community paramedicine: framework for program development. Toronto: CSA Group. 2017.
13. 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 medicine. 2021;19(1):145.
14. Garritty C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, et al. Cochrane Rapid Reviews Methods Group offers evidence-informed guidance to conduct rapid reviews. Journal of clinical epidemiology. 2021;130:13-22.
15. Eaton G, Wong G, Williams V, Roberts N, Mahtani KR. Contribution of paramedics in primary and urgent care: a systematic review. The British journal of general practice : the journal of the Royal College of General Practitioners. 2020;70(695):e421-e6.
16. Canadian Agency for Drugs Technologies in Health. Grey matters: a practical tool for searching health-related grey literature. Ottawa, ON. 2015.

17. Haddaway N, Grainger M, Gray C. citationchaser: An R package and Shiny app for forward and backward citations chasing in academic searching. 2021.
18. Babineau J. Product review: Covidence (systematic review software). Journal of the Canadian Health Libraries Association/Journal de l'Association des bibliothèques de la santé du Canada. 2014;35(2):68-71.
19. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International Journal of Surgery. 2021;88:105906.
20. Lasserson TJ, Thomas J, Higgins JP. Starting a review. Cochrane handbook for systematic reviews of interventions. 2019:1-12.
21. Plüddemann A, Aronson JK, Onakpoya I, Heneghan C, Mahtani KR. Redefining rapid reviews: a flexible framework for restricted systematic reviews. BMJ evidence-based medicine. 2018;23(6):201-3.
22. Hong QN, Fàbregues S, Bartlett G, Boardman F, Cargo M, Dagenais P, et al. The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. Education for information. 2018;34(4):285-91.
23. Proctor A. Home visits from paramedic practitioners in general practice: patient perceptions. Journal of Paramedic Practice. 2019;11(3):115-21.
24. Leyenaar MS, McLeod B, Jones A, Brousseau A-A, Mercier E, Strum RP, et al. Paramedics assessing patients with complex comorbidities in community settings: results from the CARPE study. CJEM. 2021;23(6):828-36.
25. Burns PB, Rohrich RJ, Chung KC. The levels of evidence and their role in evidence-based medicine. Plastic and reconstructive surgery. 2011;128(1):305.
26. Ruest MR, Ashton CW, Millar J. Community health evaluation completed using paramedic service (CHECUPS): design and implementation of a new community based health program. Journal of Health and Human Services Administration. 2017;40(2):186-218.
27. Chan J, Griffith LE, Costa AP, Leyenaar MS, Agarwal G. Community paramedicine: A systematic review of program descriptions and training. CJEM. 2019;21(6):749-61.
28. Pearson KB, Gale JA, Shaler G. Community paramedicine in rural areas: state and local findings and the role of the State Flex Program. University of Southern Maine; 2014 Feb.
29. Choi BY, Blumberg C, Williams K. Mobile Integrated Health Care and Community Paramedicine: An Emerging Emergency Medical Services Concept. Annals of emergency medicine. 2016;67(3):361-6.
30. Eaton G, Happs I, Tanner R. Designing and implementing an educational framework for advanced paramedic practitioners rotating into primary care in North Wales. Education for primary care : an official publication of the Association of Course Organisers, National Association of GP Tutors, World Organisation of Family Doctors. 2021;32(5):289-95.
31. Paramedic Health Solutions. National Curriculum and Career Pathway for Community Paramedicine https://www.nasemso.org/wp-content/uploads/Communty-Paramedic-Program-

NationalCurrculum-Spring2017.pdf 2016 [Available from: https://www.nasemso.org/wp-content/uploads/Communty-Paramedic-Program-NationalCurrculum-Spring2017.pdf.

32. Boykin A, Wright D, Stevens L, Gardner L. Interprofessional care collaboration for patients with heart failure. American journal of health-system pharmacy : AJHP : official journal of the American Society of Health-System Pharmacists. 2018;75(1):e45-e9.

33. Paramedic Association of Canada. National Occupational Competency Profile for Paramedics. Paramedic Association of Canada Ontario; 2011.

34. O'Meara P, Stirling C, Ruest M, Martin A. Community paramedicine model of care: an observational, ethnographic case study. BMC health services research. 2016;16(101088677):39.

35. Whalen S, Goldstein J, Urquhart R, Carter AJE. The novel role of paramedics in collaborative emergency centres aligns with their professional identity: A qualitative analysis. CJEM. 2018;20(4):518-22.

36. Pearson KB, Shaler G. Community paramedicine pilot programs: lessons from Maine. Journal of Health and Human Services Administration. 2017;40(2):141-85.

37. Leyenaar MS, Strum R, Haque M. Report on the status of community paramedicine in Ontario. Toronto, ON: The Ontario Community Paramedicine Secretariat. 2019.

38. O'Meara P. Would a prehospital practitioner model improve patient care in rural Australia? Emergency medicine journal : EMJ. 2003;20(2):199-203.

39. Mason S, Knowles E, Colwell B, Dixon S, Wardrope J, Gorringe R, et al. Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial. BMJ (Clinical research ed). 2007;335(7626):919.

40. Seidl KL, Gingold DB, Stryckman B, Landi C, Sokan O, Fletcher M, et al. Development of a Logic Model to Guide Implementation and Evaluation of a Mobile Integrated Health Transitional Care Program. Population health management. 2021;24(2):275-81.

41. O'Meara P, Ruest M, Martin A. Integrating a community paramedicine program with local health, aged care and social services: An observational ethnographic study. Australasian Journal of Paramedicine. 2015;12(5).

42. Feldman BA, Nesfeder J, Shah M, Sundlof DW, Rivera OE, Greb CJ, et al. "House Calls" by Mobile Integrated Health Paramedics for Patients with Heart Failure: A Feasibility Study. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2021:1-15.

43. Constantine ST, Callaway D, Driscoll JN, Murphy S. Implementation of Drive-through Testing for COVID-19 with Community Paramedics. Cambridge: Cambridge University Press; 2021.

44. Batt A, Hultink A, Lanos C, Grenier M, Tierney B, Heffern J. Advances in Community Paramedicine in Response to COVID-192021.

45. Martin AC, O'Meara P. Perspectives from the frontline of two North American community paramedicine programs: an observational, ethnographic study. Rural and remote health. 2019;19(1):4888.

46. Cooper S, O'Carroll J, Jenkin A, Badger B. Collaborative practices in unscheduled emergency care: role and impact of the emergency care practitioner--qualitative and summative findings. Emergency medicine journal : EMJ. 2007;24(9):625-9.
47. Tangherlini N, Villar J, Brown J, Rodriguez RM, Yeh C, Friedman BT, et al. The HOME Team: Evaluating the Effect of an EMS-based Outreach Team to Decrease the Frequency of 911 Use Among High Utilizers of EMS. Prehospital and disaster medicine. 2016;31(6):603-7.
48. Rasku T, Kaunonen M, Thyer E, Paavilainen E, Joronen K. The core components of Community Paramedicine - integrated care in primary care setting: a scoping review. Scandinavian journal of caring sciences. 2019;33(3):508-21.
49. Glenn M, Zoph O, Weidenaar K, Barraza L, Greco W, Jenkins K, et al. State Regulation of Community Paramedicine Programs: A National Analysis. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2018;22(2):244-51.
50. Scharf BM. Mobile Integrated Community Health Pilot Program Descriptive Study: Diagnosis Prevalence and Comorbidity among Program Participants. Ann Arbor: University of Maryland, Baltimore County; 2017.
51. Gingold DB, Liang Y, Stryckman B, Marcozzi D. The effect of a mobile integrated health program on health care cost and utilization. Health services research. 2021;56(6):1146-55.
52. Barrett B, Black S, Evans C, Real C, Williams S, Wright B, et al. The emerging role of the emergency care practitioner. Emergency Medicine Journal. 2004;21(5):614-8.
53. Flint DC. The Systemic Impacts of Integrated Mobile Healthcare in a State-wide Emergency Medical Services System. Ann Arbor: University of Baltimore; 2019.
54. Leyenaar M, McLeod B, Chan J, Tavares W, Costa AP, Agarwal G. A scoping study and qualitative assessment of care planning and case management in community paramedicine. Irish Journal of Paramedicine. 2018;3(1):NA-NA.
55. Abrashkin KA, Poku A, Smith KL, Ramjit A, Washko J, Guttenberg M, et al. Community paramedics treat high acuity conditions in the home: a prospective observational study. BMJ supportive & palliative care. 2019((Abrashkin, Poku, Smith) Health Solutions, Northwell Health, New Hyde Park, NY, United States(Ramjit, Washko, Guttenberg) Center for Emergency Medical Services, Northwell Health, Syosset, NY, United States(Zhang) Donald and Barbara Zucker School of Medici).
56. Leyenaar MS, Allana A, Sinha SK, Nolan M, Agarwal G, Tavares W, et al. Relevance of assessment items in community paramedicine home visit programmes: results of a modified Delphi study. BMJ open. 2021;11(11):e048504.
57. Stirling CM, O'Meara P, Pedler D, Tourle V, Walker J. Engaging rural communities in health care through a paramedic expanded scope of practice. Rural and remote health. 2007;7(4):839.
58. Evans R, McGovern R, Birch J, Newbury-Birch D. Which extended paramedic skills are making an impact in emergency care and can be related to the UK paramedic system? A systematic review of the literature. Emergency medicine journal : EMJ. 2014;31(7):594-603.

59. Leyenaar MS, McLeod B, Penhearow S, Strum R, Brydges M, Mercier E, et al. What do community paramedics assess? An environmental scan and content analysis of patient assessment in community paramedicine. CJEM. 2019;21(6):766-75.
60. Ford-Jones PC, Daly T. Filling the gap: Mental health and psychosocial paramedicine programming in Ontario, Canada. Health & social care in the community. 2020((Ford-Jones) Faculty of Health Science and Wellness, Humber Institute of Technology & Advanced Learning, Toronto, Canada(Daly) School of Health Policy and Management, York University Centre for Aging Research and Education, York University, ON, Toronto, C).
61. Keefe B, Carolan K, Wint AJ, Goudreau M, Scott Cluett W, 3rd, Iezzoni LI. Behavioral Health Emergencies Encountered by Community Paramedics: Lessons from the Field and Opportunities for Skills Advancement. The journal of behavioral health services & research. 2020;47(3):365-76.
62. Xi D, McCombe G, Agarwal G, Booker MJ, Cullen W, Bury G, et al. Paramedics working in general practice: a scoping review. HRB Open Research. 2021;4(34):34-NA.
63. Castillo DJ, Myers JB, Mocko J, Beck EH. Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population. Journal of Health Economics and Outcomes Research. 2016;4(2):172-87.
64. Bennett KJ, Yuen MW, Merrell MA. Community Paramedicine Applied in a Rural Community. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association. 2018;34 Suppl 1(jx4, 8508122):s39-s47.
65. Mason S, Knowles E, Freeman J, Snooks H. Safety of paramedics with extended skills. Academic Emergency Medicine. 2008;15(7):607-12.
66. Dixon S, Mason S, Knowles E, Colwell B, Wardrope J, Snooks H, et al. Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial. Emergency medicine journal : EMJ. 2009;26(6):446-51.
67. Quatman-Yates CC, Wisner D, Weade M, Gabriel M, Wiseman JM, Sheridan E, et al. Assessment of Fall-Related Emergency Medical Service Calls and Transports After a Community-Level Fall-Prevention Initiative. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2021:1-14.
68. Hänninen J, Kouvonen A, Sumanen H. Patients Seeking Retreatment after Community Paramedic Assessment and Treatment: Piloting a Community Paramedic Unit Program in Southwest Finland. Nursing Reports. 2020;10(2):66-74.
69. Misra-Hebert AD, Rothberg MB, Fox J, Ji X, Hu B, Milinovich A, et al. Healthcare utilization and patient and provider experience with a home visit program for patients discharged from the hospital at high risk for readmission. Healthcare (Amsterdam, Netherlands). 2021;9(1):100518.
70. Nejtek VA, Talari D, Aryal S, O'Neill L, Wang H. A pilot mobile integrated healthcare program for frequent utilizers of emergency department services. American Journal of Emergency Medicine. 2017;35(11):1702-5.
71. Leduc S, Cantor Z, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting

the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2021;25(4):556-65.
72. 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):e037386.
73. Bradley KW, Esposito D, Romm IK, Loughnane J, Ajayi T. The business case for community paramedicine: lessons from Commonwealth Care Alliance's Pilot Program. Center for Health Care Strategies, Inc. 2016:1-5.
74. Widiatmoko D, Machen I, Dickinson A, Williams J, Kendall S. Developing a new response to non-urgent emergency calls: evaluation of a nurse and paramedic partnership intervention. Primary Health Care Research & Development. 2008;9(3):NA-NA.
75. Thompson C, Williams K, Morris D, Lago L, Kobel C, Quinsey K, et al. HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project. 2014.
76. 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 emergency medicine. 2017;17(1):8.
77. Agarwal G, Angeles R, Pirrie M, McLeod B, Marzanek F, Parascandalo J, et al. Evaluation of a community paramedicine health promotion and lifestyle risk assessment program for older adults who live in social housing: a cluster randomized trial. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2018;190(21):E638-E47.
78. 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 : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2019;23(5):718-29.
79. Ash JR. Quality of Life for Persons with Chronic Disease Utilizing Mobile Integrated Healthcare. Ann Arbor: Walden University; 2020.
80. Hoyle S, Swain A, Fake P, Larsen P. Introduction of an extended care paramedic model in New Zealand. EMA - Emergency Medicine Australasia. 2012;24(6):652-6.
81. Hughes S, Seenan C. Community paramedicine home visits: patient perceptions and experiences. Journal of Paramedic Practice. 2021;13(6):248-57.
82. Martin A, O'Meara P, Farmer J. Consumer perspectives of a community paramedicine program in rural Ontario. The Australian journal of rural health. 2016;24(4):278-83.
83. Brydges M. A Case Study of Older Adult Experiences with a Novel Community Paramedicine Program. 2014

84. Swain AH, Al-Salami M, Hoyle SR, Larsen PD. Patient satisfaction and outcome using emergency care practitioners in New Zealand. Emergency medicine Australasia : EMA. 2012;24(2):175-80.
85. Clarke A. What are the clinical practice experiences of specialist and advanced paramedics working in emergency department roles? A qualitative study. British paramedic journal. 2019;4(3):1-7.
86. Adio OA, Ikuma LH, Dunn S, Nahmens I. Community Paramedics' Perception of Frequent ED Users and the Community Paramedicine Program: A Mixed-Methods Study. Journal of health care for the poor and underserved. 2020;31(3):1134-51.
87. Harvey C, Froggatt S, Lightowler B, Hodge A. The ambulance service advanced practitioner's role in supporting care homes: a qualitative study of care staff experiences. Nursing and Residential Care. 2021;23(10):1-8.
88. Schwab-Reese LM, Renner LM, King H, Miller RP, Forman D, Krumenacker JS, et al. "They're very passionate about making sure that women stay healthy": a qualitative examination of women's experiences participating in a community paramedicine program. BMC health services research. 2021;21(1):1167.
89. Williams B, Beovich B, Olaussen A. The Definition of Paramedicine: An International Delphi Study. Journal of Multidisciplinary Healthcare. 2021;14:3561.
90. Tavares W, Allana A, Beaune L, Weiss D, Blanchard I. Principles to guide the future of paramedicine in Canada. Prehospital Emergency Care. 2021:1-11.
91. Batt AM, Williams B, Brydges M, Leyenaar M, Tavares W. New ways of seeing: supplementing existing competency framework development guidelines with systems thinking. Advances in Health Sciences Education. 2021;26(4):1355-71.
92. Batt AM, Tavares W, Williams B. The development of competency frameworks in healthcare professions: a scoping review. Advances in Health Sciences Education. 2020;25(4):913-87.
93. Batt A, Williams B, Rich J, Tavares W. A six-step model for developing competency frameworks in the healthcare professions. Frontiers in medicine. 2021:2601.
94. Schrijvers G, van Hoorn A, Huiskes N. The care pathway: concepts and theories: an introduction. International journal of integrated care. 2012;12(Special Edition Integrated Care Pathways).
95. Fitzsimon J, Gervais O, Lanos C. COVID-19 Assessment and Testing in Rural Communities During the Pandemic: A Cross Sectional Analysis. JMIR public health and surveillance. 2022.
96. Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Emergency department visits for nonurgent conditions: systematic literature review. The American journal of managed care. 2013;19(1):47-59.
97. Dainty KN, Seaton MB, Drennan IR, Morrison LJ. Home Visit-Based Community Paramedicine and Its Potential Role in Improving Patient-Centered Primary Care: A Grounded Theory Study and Framework. Health services research. 2018;53(5):3455-70.

98. Hudon C, Chouinard M-C, Lambert M, Dufour I, Krieg C. Effectiveness of case management interventions for frequent users of healthcare services: a scoping review. BMJ open. 2016;6(9):e012353.
99. Hunter RM. The Role of the Health Economist in the Evaluation and Development of Complex Interventions in End-of-Life Care. Care at the End of Life: Springer; 2016. p. 31-45.
100. Nolan MJ, Nolan KE, Sinha SK. Community paramedicine is growing in impact and potential. CMAJ. 2018;190(21):E636-E7.

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Tables

Table 1. MMAT Quality assessment results- Qualitative studies

Lead author	Year	Title	Study design	Are there clear research questions?	Do the collected data allow to address the research questions?	Qualitative	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis and interpretation
Brydges	2014	A Case Study of Older Adult Experiences with a Novel Community Paramedicine Program	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Brydges	2016	The CHAP-EMS health promotion program: a qualitative study on participants' views of the role of paramedics.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Clarke	2019	What are the clinical practice experiences of specialist and advanced paramedics working in emergency department roles? A qualitative study.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Dainty	2018	Home Visit-Based Community Paramedicine and Its Potential Role in Improving Patient-Centered Primary Care: A Grounded Theory Study and Framework.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ford-Jones	2020	Filling the gap: Mental health and psychosocial paramedicine programming in Ontario, Canada	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Harvey	2021	The ambulance service advanced practitioner's role in supporting care homes: a qualitative study of care staff experiences	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Hughes	2021	Community paramedicine home visits: patient perceptions and experiences	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Keefe	2020	Behavioural Health Emergencies Encountered by Community Paramedics: Lessons from the Field and Opportunities for Skills Advancement.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Lau	2018	Qualitative Evaluation of the Coach Training within a Community	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes

		Paramedicine Care Transitions Intervention.									
Leyenaar	2021	Paramedics assessing patients with complex comorbidities in community settings: results from the CARPE study.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Martin	2016	Consumer perspectives of a community paramedicine program in rural Ontario.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Martin	2019	Perspectives from the frontline of two North American community paramedicine programs: an observational, ethnographic study.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	No
O'Meara	2015	Would a prehospital practitioner model improve patient care in rural Australia?	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
O'Meara	2016	Integrating a community paramedicine program with local health, aged care and social services: An observational ethnographic study	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Pearson	2014	The Evidence for Community Paramedicine in Rural Areas: State and local findings and the role of the state Flex program	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Proctor	2019	Home visits from paramedic practitioners in general practice: patient perceptions	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ritchie	2020	Readiness of Stakeholders to Adopt Community Paramedicine Programs in Tennessee	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Schwab-Reese	2021	"They're very passionate about making sure that women stay healthy": a qualitative examination of women's experiences participating in a community paramedicine program.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Stirling	2007	Engaging rural communities in health care through a paramedic expanded scope of practice.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Whalen	2018	The novel role of paramedics in collaborative emergency centres aligns with their professional identity: A qualitative analysis.	Qualitative research	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Table 2. MMAT Quality assessment results- Randomised controlled trial

Lead author	Year	Title	Study design	Are there clear research questions?	Do the collected data allow to address the research questions?	Randomised controlled trials	Is randomization appropriately performed?	Are the groups comparable at baseline?	Are there complete outcome data?	Are outcome assessors blinded to the intervention provided?	Did the participants adhere to the assigned intervention
Ashton	2017	Conserving Quality of Life through Community Paramedics.	Economic evaluation/ Randomised controlled trial	Yes	Yes		Can't tell	Can't tell	Yes	Can't tell	Can't tell
Agarwal	2020	Evaluation of a community paramedicine health promotion and lifestyle risk assessment program for older adults who live in social housing: a cluster randomized trial.	Randomised controlled trial	Yes	Yes		Yes	Yes	Yes	No	Yes
Agarwal	2020	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.	Randomised controlled trial	Yes	Yes		Yes	Yes	Yes	No	Yes
Dixon	2008	Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial	Randomised controlled trial	Yes	Yes		Yes	Yes	Yes	No	Yes
Mason	2007	Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial.	Randomised controlled trial	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Mason	2008	Safety of paramedics with extended skills	Randomised controlled trial	Yes	Yes		Yes	Yes	Yes	No	Yes
Shah	2018	Improving the ED-to-Home Transition: The Community Paramedic-Delivered Care Transitions Intervention-Preliminary Findings.	Randomised controlled trial	Yes	Yes		Yes	Can't tell	Yes	Yes	Can't tell

Table 3. MMAT Quality assessment results- non-randomised studies

Lead author	Year	Title	Study design	Non-Randomised studies	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?
Abrashkin	2019	Community paramedics treat high acuity conditions in the home: a prospective observational study	Prospective observational		Yes	Yes	Yes	No	Yes
Agarwal	2017	Cost-effectiveness analysis of a community paramedicine programme for low-income seniors living in subsidised housing: the community paramedicine at clinic programme (CP@clinic).	Economic evaluation		Yes	Yes	Yes	Yes	Yes
Agarwal	2018	Feasibility of implementing a community cardiovascular health promotion program with paramedics and volunteers in a South Asian population.	Non-randomised experimental study		Yes	Yes	Yes	No	Yes
Bennett	2017	Community Paramedicine Applied in a Rural Community.	Non-randomised experimental study		Yes	Yes	Yes	Yes	Yes
Bennett	2020	Community Paramedicine Applied in a Rural Community	Pre/post-test with a comparison group study design		Yes	Yes	Yes	Yes	Yes
Quatman-Yates	2021	Assessment of Fall-Related Emergency Medical Service Calls and Transports After a Community-Level Fall-Prevention Initiative	Prevalence study		Yes	Yes	Yes	Yes	Yes
Xie	2021	Economic Analysis of Mobile Integrated Health Care Delivered by Emergency Medical Services Paramedic Teams.	Economic evaluation		Yes	Yes	Yes	Yes	Yes

Table 4. MMAT Quality assessment results- Quantitative descriptive studies

Lead author	Year	Title	Study design	Are there clear research questions?	Do the collected data allow to address the research questions?	Quantitative descriptive studies	Is the sampling strategy relevant to address the research question?	Is the sample representative of the target population?	Are the measurements appropriate?	Is the risk of nonresponse bias low?	Is the statistical analysis appropriate to answer the research question?
Abrashkin	2016	Providing Acute Care at Home: Community Paramedics Enhance an Advanced Illness Management Program-Preliminary Data.	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ash	2020	Quality of Life for Persons with Chronic Disease Utilizing Mobile Integrated Healthcare	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Boykin	2018	Interprofessional care collaboration for patients with heart failure.	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Castillo	2016	Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Constantine	2021	Implementation of Drive-through Testing for COVID-19 with Community Paramedics	Cohort study	Yes	Yes		Yes	Yes	Yes	Can't tell	Yes
Counts	2017	An Evaluation of the Environmental and Organizational Factors Associated with the Formation of Community Paramedicine Programs	Cross-sectional study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Feldman	2021	"House Calls" by Mobile Integrated Health Paramedics for Patients with Heart Failure: A Feasibility Study	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Gingold	2021	The effect of a mobile integrated health program on health care cost and utilization.	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Hanninen	2020	Patients Seeking Retreatment after Community Paramedic Assessment and Treatment: Piloting a Community Paramedic Unit Program in Southwest Finland	Retrospective analysis	Yes	Yes		Can't tell	Can't tell	Can't tell	Can't tell	Yes

Hoyle	2012	Introduction of an extended care paramedic model in New Zealand	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Jensen	2016	Impact of a Novel Collaborative Long-Term Care EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Kant	2018	Outcomes and provider perspectives on geriatric care by a nurse practitioner-led community paramedicine program.	Case series	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Knowles	2010	An initiative to provide emergency healthcare for older people in the community: the impact on carers.	Cross-sectional study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Mason	2007	Effectiveness of emergency care practitioners working within existing emergency service models of care	Cross-sectional study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Nejtek	2017	A pilot mobile integrated healthcare program for frequent utilizers of emergency department services	Cohort study	Yes	Yes		Yes	Yes	No	Yes	Yes
Nowrouzi-Kia	2021	Quality of work life of paramedics practicing community paramedicine in northern Ontario, Canada: a mixed-methods sequential explanatory study	Cross-sectional study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ruest	2012	Community health evaluation completed using paramedic service (CHECUPS): design and implementation of a new community based health program	Case report	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ruest	2017	Evaluating the impact on 911 calls by an in-home programme with a multidisciplinary team	Case series	Yes	Yes		Yes	Yes	Yes	Can't tell	Yes
Scharf	2017	Mobile Integrated Community Health Pilot Program Descriptive Study: Diagnosis Prevalence and Comorbidity among Program Participants	Prevalence study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Seidl	2021	Development of a Logic Model to Guide Implementation and Evaluation of a Mobile Integrated Health Transitional Care Program.	Retrospective analysis	Yes	Yes		Can't tell	Can't tell	Yes	Can't tell	Can't tell
Siddle	2017	Mobile integrated health to reduce post-discharge acute care visits: A pilot study.	Cohort study	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Swain	2012	Patient satisfaction and outcome using emergency care practitioners in New Zealand.	Cross-sectional study	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Tangherlini	2016	The HOME Team: Evaluating the Effect of an EMS-based Outreach Team to Decrease the Frequency of 911 Use Among High Utilizers of EMS.	Retrospective analysis	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Widiatmoko	2008	Developing a new response to non-urgent emergency calls: evaluation of a nurse and paramedic partnership intervention	Economic evaluation	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Table 5. MMAT Quality assessment results- mixed methods studies

Lead author	Year	Title	Study design	Are there clear research questions?	Do the collected data allow to address the research questions?	Mixed methods studies	Is there an adequate rationale for using a mixed-methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Adio	2020	Community Paramedics' Perception of Frequent ED Users and the Community Paramedicine Program: A Mixed-Methods Study.	Mixed Methods	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Agarwal	2019	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).	Mixed Methods	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Cooper	2007	Collaborative practices in unscheduled emergency care: role and impact of the emergency care practitioner--qualitative and summative findings.	Mixed Methods	No	Yes		Can't tell	No	No	Can't tell	Can't tell
Cooper	2004	The emerging role of the emergency care practitioner	Mixed Methods	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Flint	2019	The Systemic Impacts of Integrated Mobile Healthcare in a State-wide Emergency Medical Services System	Mixed methods	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Leyenaar	2019	Relevance of assessment items in community paramedicine home visit programmes: results of a modified Delphi study.	Delphi	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Leyenaar	2019	Examining consensus for a standardised patient assessment in community paramedicine home visits: a RAND/UCLA-modified Delphi Study.	Delphi	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Lezzoni	2018	Early experiences with the Acute Community Care Program in eastern Massachusetts.	Mixed methods	Yes	Yes		Yes	Yes	Yes	Can't tell	Can't tell
Martin-Misener	2009	Cost effectiveness and outcomes of a nurse, practitioner paramedic, family physician model of care: the Long and Brier Islands study	Economic evaluation	Yes	No		Can't tell	Yes	Yes	No	Can't tell
Misra-Hebert	2021	Healthcare utilization and patient and provider experience with a home visit program for patients discharged from the hospital at high risk for readmission.	Mixed Methods	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Table 6. MMAT Quality assessment results- Studies not included in MMAT

Lead author	Year	Title	Study design	Are there clear research questions?	Do the collected data allow to address the research questions?	Comments
Ball	2005	Setting the scene for the paramedic in primary care: a review of the literature.	Literature review	Yes	No	No MMAT category available- no significant risk of bias noted to warrant exclusion
Batt	2021	Advances in Community Paramedicine in Response to COVID-19	Grey literature	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Bigham	2013	Expanding paramedic scope of practice in the community: a systematic review of the literature.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Bradley	2016	The business case for community paramedicine: lessons from Commonwealth Care Alliances Pilot Program	Grey literature	No	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Chan	2019	Community paramedicine: A systematic review of program descriptions and training.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Choi	2016	Mobile Integrated Health Care and Community Paramedicine: An Emerging Emergency Medical Services Concept.	Systematic review	No	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Eaton	2021	Designing and implementing an educational framework for advanced paramedic practitioners rotating into primary care in North Wales	Literature review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Eaton	2020	Understanding the role of the paramedic in primary care: a realist review.	Literature review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Eaton	2021	Contribution of paramedics in primary and urgent care: a systematic review.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Evans	2012	Which extended paramedic skills are making an impact in emergency care and can be related to the UK paramedic system? A systematic review of the literature.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion

Glenn	2017	State Regulation of Community Paramedicine Programs: A National Analysis.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Goldberg	2014	Mobile integrated healthcare: Using existing out of hospital resources to bridge gaps in healthcare services	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Gregg	2019	Systematic Review of Community Paramedicine and EMS Mobile Integrated Health Care Interventions in the United States.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Halter	2006	Patients' experiences of care provided by emergency care practitioners and traditional ambulance practitioners: A survey from the London Ambulance Service	Survey	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Hill	2013	A systematic review of the activity and impact of emergency care practitioners in the NHS.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Leduc	2020	The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Leyenaar	2021	What do community paramedics assess? An environmental scan and content analysis of patient assessment in community paramedicine.	Environmental scan	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Leyenaar	2019	Report on the status of community paramedicine in Ontario	Grey literature	No	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Leyenaar	2018	A scoping study and qualitative assessment of care planning and case management in community paramedicine	Grey literature	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
O'Meara	2003	Community paramedicine model of care: an observational, ethnographic case study.	Soft systems methodology	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Pang	2019	Limited data to support improved outcomes after community paramedicine intervention: A systematic review.	Systematic review	Yes	No	No MMAT category available- no significant risk of bias noted to warrant exclusion
Pearson	2017	Community Paramedicine pilot programs: lessons from Maine	Survey exercise and literature review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Rasku	2019	The core components of Community Paramedicine - integrated care in primary care setting: a scoping review.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Raynovich	2014	A survey of community paramedicine course offerings and planned offerings	Survey	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Thirumalai	2021	Challenges and Lessons Learned from a Telehealth Community Paramedicine Program for the Prevention of Hypoglycaemia: Pre-Post Pilot Feasibility Study	Single-arm pre/post-test	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Thompson	2014	HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project	Grey literature	No	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Thurman	2021	A scoping review of community paramedicine: evidence and implications for interprofessional practice.	Scoping review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Tohira	2013	The impact of new prehospital practitioners on ambulance transportation to the emergency department: a systematic review and meta-analysis.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
van Vuuren	2021	Reshaping healthcare delivery for elderly patients: the role of community paramedicine; a systematic review.	Systematic review	Yes	Yes	No MMAT category available- no significant risk of bias noted to warrant exclusion
Xi	2021	Paramedics working in general practice: a scoping review	Scoping review	Yes	No	No MMAT category available- no significant risk of bias noted to warrant exclusion

Table 8. Impact on emergency calls, rates of transportation and hospital admissions

Title	Author	Year	Origin	Aim of study	Emergency calls, Transportation and Admission Outcomes
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.	Agarwal	2019	Canada	Evaluate the change in mean EMS calls at the building-level, comparing intervention and control buildings, across multiple community sites.	Intention-to-treat analysis showed no significant difference in EMS calls (mean difference 0.37/100 apartment units/month, 95%CI:0.98 to 0.24). Sensitivity analysis excluding data from 2 building pairs with eligibility changes after intervention initiation revealed a significant difference in EMS calls in favour of the intervention buildings (mean difference 0.90/100 apartment units/month, 95%CI:1.54 to0.26).
Community Paramedicine Applied in a Rural Community	Bennett	2020	United States	The objective of this study was to determine if the CP program reduced ED visits in Abbeville while improving patient outcomes	ED visits among participants decreased by 58.7%, substantially different from the 4% increase in the comparison group (P<.0001). Similarly, inpatient admissions decreased by 68.8% compared to an increase in admissions of 187.5% among the comparison group (P=.045). Length of stay decreased by 15.7% for participants yet increased by 162.5% among the comparison group (P=.03). Among the CP program participants with hospitalisation, there was a 41.2% reduction in 30-day readmissions, compared to a 35.9% increase among the comparison group; this reduction was even higher among those with COPD (75% decrease). It should be noted that the 30-day readmissions rate was significantly impacted by 1 participant, who accounted for 16 visits; without that participant's data, there was an 83.1% decrease in 30-day readmissions, significantly higher than the comparison group (P<.0001).
The business case for community paramedicine: lessons from Commonwealth Care Alliance Pilot Program	Bradley	2016	United States	Summarises acute community care program business case	In the first year of operations, 126 patients received an ACC visit. Out of those patients, 81 percent remained home under the care of ACC paramedics while 19 percent were transported for emergent care needs.
Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population	Castillo	2016	United States	Aims to describe and analyse the initial experience and preliminary impact of an MIH intervention delivered at scale for a high-risk subpopulation.	21% decrease in emergency department utilisation, 37% decrease in inpatient PMPM cost, 40% decrease inpatient utilisation, all measures reached statistical significance.

Mobile Integrated Health Care and Community Paramedicine: An Emerging Emergency Medical Services Concept.	Choi	2016	United States	Literature review of MIH CP	Reduction in ED transports and hospital admissions. Not conclusive on impact
The emerging role of the emergency care practitioner	Cooper	2004	UK	To examine the emerging role of the emergency care practitioner (ECP) with comparisons to paramedic practice.	ECPs were more likely to treat patients on scene than paramedics (p = 0.007); 28% (48 of 170) by ECPs compared with 18% (59 of 331) by paramedics. None of the ECPs or paramedics patients was subsequently conveyed within 24 hours. Patients were conveyed, either by A&E, urgent transfer, patient transfer, rapid response, air ambulance, or ECP vehicles. ECPs arranged conveyance for 50% (85 of 170) of their patients while paramedics conveyed 64% (212 of 331) (p = 0.000)
Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial	Dixon	2008	UK	To assess the cost-effectiveness of the paramedic practitioner (PP) scheme compared with usual emergency care.	Whereas the intervention group received more PP contact time, it reduced the proportion of emergency department (ED) attendances (53.3% vs 84.0%) and time in the ED (126.6 vs 211.3 minutes). There was also some evidence of increased use of health services in the days following the incident for patients in the intervention group. Overall, total costs in the intervention group were £140 lower when routine data were considered (p = 0.63). When the costs and QALY were considered simultaneously, PP had a greater than 95% chance of being cost-effective at £20 000 per QALY.
The effect of a mobile integrated health program on health care cost and utilization.	Gingold	2021	United States	To measure the effect of a mobile integrated health community paramedicine (MIH-CP) transitional care program on hospital utilisation, emergency department visits, and charges.	No significant difference in short-term health care utilisation or charges between patients enrolled in an MIH-CP transitional care program and propensity-matched controls.
Patients' experiences of care provided by emergency care practitioners and traditional ambulance practitioners: A survey from the London Ambulance Service	Halter	2006	UK	To compare patients' experiences of ECP care with that from traditional ambulance practitioners (state-registered paramedic or emergency medical technician).	80.2% of those attended by SRPara or EMTs were conveyed to the emergency department compared with 58.0% of those attended by ECPs (x2= 52.08, df = 1, p,0.001

Patients Seeking Retreatment after Community Paramedic Assessment and Treatment: Piloting a Community Paramedic Unit Program in Southwest Finland	Hanninen	2020	Finland	To categorise CP unit patients seeking retreatment after a CP unit visit and investigate links between CP unit actions and patients seeking retreatment.	The main results show that 82% of the patients assessed and treated by the CP unit did not re-attend
Impact of a Novel Collaborative Long-Term Care EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program	Jensen	2016	Canada	The objective of this study was to measure differences in the delivery of emergency care for LTC residents with acute illnesses or injuries attended by ECP or emergency paramedics, measured primarily with a number of transports to the ED, as well as EMS response and scene time, patient ED length of stay, EMS time in the ED, hospital admission, and relapse back to EMS after calls ending in no transport.	Reduced number of transports, improved measures of time periods.
The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review.	Leduc	2020	Internatio nal	A systematic review of the literature to determine, among long-term care patients, what is the effectiveness and safety of interventions that evaluate and treat patients on-site, avoiding unscheduled transport to the ED.	Two studies, representing one program, utilised extended care paramedics who responded to calls for acute issues in long-term care centres, such as abdominal pain, diabetic problems and traumatic injuries. They found a 29.3% decrease in overall ED transfers after the program was implemented ($p<.001$) and that patients treated by an extended care paramedic were less likely to visit the ED than those treated by an emergency paramedic (45.3% vs 92.7%, $p<.001$). The second paper found patients seen by the extended care paramedic were less likely to be admitted (16.8%) compared to those seen by an emergency paramedic (39.8%)
Report on the status of community paramedicine in Ontario	Leyenaar	2019	Canada	Report summarising community paramedicine in Ontario	The programme overall results showed that for patients enrolled in the program there was a 26% reduction in 9-1-1 calls, a 26% reduction in emergency department visits, a 32% reduction in hospital admissions, and a 41%reduction in hospital readmissions. Findings from Toronto published over the past year have shown that Assessment and Referral Programmes improved access to home care services by 24%, led to an average increase of 17.4 hours in total home care services per person while reducing 9-1-1 calls by 10% and ambulance transports to emergency departments by 7% over the study period

Effectiveness of emergency care practitioners working within existing emergency service models of care	Mason	2007	UK	(1) To evaluate appropriateness, satisfaction and cost of ECPs compared with the usual service available in the same healthcare setting, (2) to increase understanding of what effect, if any, ECPs are having on the delivery of health services locally and (3) to evaluate whether ECP working yields cost savings.	CPs carried out fewer investigations, provided more treatments and were more likely to discharge patients home than the usual providers.
Safety of paramedics with extended skills	Mason	2008	United States	The objectives were to evaluate the safety of clinical decisions made by Paramedic Practitioners operating within the new service.	Overall, patients in the intervention group were less likely to attend the ED (relative risk [RR] 0.72, 95% CI = 0.68 to 0.75) or require hospital admission within 28 days (RR 0.87, 95% CI = 0.81 to 0.94) and experienced a shorter total episode time (235.07 min vs. 277.8 min, 95% CI of difference) 59.5 to -25.0). There was no statistically significant difference in 28-day mortality (RR 0.87, 95% CI = 0.63 to 1.21).
Healthcare utilization and patient and provider experience with a home visit program for patients discharged from the hospital at high risk for readmission.	Misra-Hebert	2021	United States	The goals of this study were to assess the association with health care utilisation and mortality for patients at high risk for readmission who participated in the post-discharge home visit program and to examine provider and patient experience regarding program participation.	Findings supported a lower 30-day readmission association within the intervention groups.
A pilot mobile integrated healthcare program for frequent utilizers of emergency department services	Nejtek	2017	United States	To examine whether or not a mobile integrated health (MIH) program may improve health-related quality of life while reducing emergency department (ED) transports, ED admissions, and inpatient hospital admissions in frequent utilisers of ED services	The results from this small retrospective program evaluation suggest that MIH participation was associated with improved quality of life, fewer ED transports, fewer ED admissions, and reduced inpatient admissions
Assessment of Fall-Related Emergency Medical Service Calls and Transports After a Community-Level Fall-Prevention Initiative	Quatman-Yates	2021	United States	To study the impact of a community paramedic programmes optimization of a fall prevention system entailing a clinical pathway and learning health system (called Community-FIT) on community-level fall-related emergency medical service utilisation rates	The community paramedicine program demonstrated a reduction in fall-related calls and transports.

Evaluating the impact on 911 calls by an in-home programme with a multidisciplinary team	Ruest	2012	Canada	Review whether the use of community paramedics as part of an integrated health care tams can reduce 911 calls	129 patient interactions by community paramedics only 15 incidents resulted in ED visits using 911
The HOME Team: Evaluating the Effect of an EMS-based Outreach Team to Decrease the Frequency of 911 Use Among High Utilizers of EMS.	Tangherlini	2016	United States	examined the effectiveness to reduce repeat use of EMS.	The HOME Team undertook 320 distinct contacts of 59 frequent users during the study period, with an average of 5.42 contacts per patient. The maximum number of contacts was 46. The average use of EMS services by the identified frequent users before first contact was 18.72 (SD=19.40). The average use after first contact was 8.61 (SD=10.84). The mean difference was 10.11; 95% CI, 4.36-15.86; P-value <.001
HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project	Thompson	2014	Australia	Report on the Extended Care Paramedic program in originally developed in South Australia Ambulance Service and implemented within 5 sites in New South Wales	Overall, 62% of eligible patients were treated at a private residence (ranging from 50% at one site to 77% at another site). A high proportion of patients (72.5%, range 65% to 78% at different sites) seen by ECPs did not require transport to hospital.

Table 9. Economic outcomes results

Title	Author	Year	Origin	Aim of study	Economic Outcomes
Cost-effectiveness analysis of a community paramedicine programme for low-income seniors living in subsidised housing: the community paramedicine at clinic programme (CP@clinic).	Agarwal	2020	Canada	To evaluate the cost-effectiveness of the CP@clinic programme compared with usual care for low-income seniors living in subsidised (social) housing	The cost of running the intervention in all five RCT sites for one year was $128462. Due to the reduction of 157.8 EMS calls over the intervention year, the estimated cost avoided during the RCT ranged from $78742 to $355681. This resulted in a cost offset of $54- $243 per resident
Conserving Quality of Life through Community Paramedics.	Ashton	2017	Canada	To determine whether community paramedicine services (the intervention through home visits) would have a positive	The economic impact of CP through conserving the quality of life was monetised through conversion to QALYs and consideration of the cost of the intervention. Per client marginal costs for one year's CP service through this study was calculated to be $5,675 for Renfrew and $5,731

				economic impact through influencing the self-perceived quality of life and determining a monetised value	for Hastings. On that basis, the cost to realise a QALY through this community paramedicine intervention was $67,560 for Renfrew and $76,413 for Hastings.
Community Paramedicine Applied in a Rural Community.	Bennett	2017	United States	The aim was to determine if the CP program reduced ED visits in Abbeville while improving patient outcomes	The Abbeville CP program estimated the cost per visit to be $205.78. This is based upon $4,101.93 in start-up costs; $8,473.20 for equipment purchases; $73,127.56 in personnel costs; and $5,251.55 in travel and maintenance costs, for a total of $90,954.24 for the year of 2015. Since the CP program is part of the existing EMS infrastructure, additional costs for the start-up of the CP program were minimised. Using data supplied by the AAMC cost report, the estimated cost of an average inpatient day was estimated to be $1,531, an ED visit to be $449, and an EMS call to be $312. Given the annualised reduction in ED visits (124), inpatient days (28), and EMS calls (34), a positive marginal benefit to the local health care system was estimated to be at least $18,198, or a return on investment of more than 20%.
The business case for community paramedicine: lessons from Commonwealth Care Alliance Pilot Program	Bradley	2016	United States	Summarises acute community care program business case	Under the pilot program, patients diverted from the ED had lower average costs than those not diverted on a patient-episode basis (per patient savings were $791 for seven days, $3,677 for 15 days, and $538 for 30 days). Accounting for service costs, utilisation, and ED diversion rates, as well as anticipated ACC operating costs and expected ACC patient volume in different geographic regions of Massachusetts, the analysis suggests substantial savings potential
Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population	Castillo	2016	United States	Aims to describe and analyse the initial experience and preliminary impact of an MIH intervention delivered at scale for a high-risk subpopulation.	19% decrease in emergency department per member per month (PMPM) cost
Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial	Dixon	2008	UK	To assess the cost-effectiveness of the paramedic practitioner (PP) scheme compared with usual emergency care.	Overall, total costs in the intervention group were £140 lower when routine data were considered ($p = 0.63$). When the costs and QALY were considered simultaneously, PP had a greater than 95% chance of being cost-effective at £20 000 per QALY.
Report on the status of community paramedicine in Ontario	Leyenaar	2019	Canada	Report summarising community paramedicine in Ontario	Cost avoidance of over $29M in downstream health system costs was achieved amongst the 2,333 patients that participated in this program during the evaluation period. The overall reductions found in health system utilisation generated an estimated $7,279 in cost avoidance for

					the healthcare system per patient per year, with the cost of community paramedic and equipment of $1,455 per patient per year, a net return on investment (cost avoidance - the cost of providing service) $5,842 per patient per year. A community paramedicine enabled hospital discharge program from Sudbury resulted in a 50% reduction in total health care costs per patient and estimated cost avoidance to be $10,000 per patient enrolled.
Cost effectiveness and outcomes of a nurse practitioner paramedic family physician model of care: the Long and Brier Islands study	Martin-Misener R	2009	Canada	Do patients in a collaborative model demonstrate evidence of improved psychosocial adjustment and less expenditure of health care resources over time	The NP paramedic physician model of primary health care services increases access to health care services and is a cost-effective model of health care for rural communities with low emergency call volumes
Effectiveness of emergency care practitioners working within existing emergency service models of care	Mason	2007	UK	(1) To evaluate appropriateness, satisfaction and cost of ECPs compared with the usual service available in the same healthcare setting, (2) to increase understanding of what effect, if any, ECPs are having on the delivery of health services locally and (3) to evaluate whether ECP working yields cost savings.	CPs carried out fewer investigations, provided more treatments and were more likely to discharge patients home than the usual providers. Patients were satisfied with the care received from CPs, and this was consistent across the three different settings. It was found that CPs are working in different settings across traditional professional boundaries and are having an impact on reconfiguring how those services are delivered locally. Costs information (based on deployment within ambulance service) indicated that CP care may be cost effective in that model of CP working.
HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project	Thompson	2014	Australia	Report on the Extended Care Paramedic program in originally developed in South Australia Ambulance Service and implemented within 5 sites in New South Wales	Scenario analysis shows that if all implementation sites saw six ECP patients each shift (that is, six days for each site for 365 days per year) and the same levels of ED avoidance rates seen during implementation were maintained all sites would be highly cost-effective with annual cost savings ranging from $411 per patient at ERP5 to $998 at ERP2.
Developing a new response to non-urgent emergency calls: evaluation of a nurse and paramedic partnership intervention	Widiat-moko	2008	UK	To investigate the cost-effectiveness of a new service development whereby a nurse and a paramedic working in partnership attended non-urgent emergency calls	Conservative estimate of the costs incurred in the A&E department and the subsequent hospitalisation rate; the modelling demonstrated that the project saved £29 260 during its 15 weeks. The cost of providing the pilot service was compensated by the savings made from the reduced use of the A&E department and subsequent hospitalisation

Economic Analysis of Mobile Integrated Health Care Delivered by Emergency Medical Services Paramedic Teams.	Xie F	2021	Canada	"To compare time on task and cost between MIH and ambulance delivered by NEMS from a public payers perspective"	Community paramedicine "was associated with reduced ED transport and saved substantial savings of EMS staff time and resources compared with an ambulance for the matched emergency calls."

Table 10. Patient health outcomes results

Title	Author	Year	Origin	Aim of study	Patient Outcomes
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).	Agarwal	2017	Canada	The aim was to evaluate whether a weekly 8-hour CHAP-EMS program was associated with changes in (1) number of emergency EMS calls (9-1-1) from the seniors' residence building, (2) mean blood pressure (BP) of participants and (3) diabetes risk profile of participants after one year of implementation. Intervention: CHAP-EMS is a low-cost, community paramedicine program designed to assess community-dwelling seniors for lifestyle risk factors that may impact their health and wellbeing and to provide targeted education to address the pertinent risk factors	At baseline, 42% of participants had elevated blood pressure. Systolic blood pressure decreased significantly by the participant's 3rd visit to CHAP-EMS and diastolic by the 5th visit ($p< .05$). At baseline, 19% of participants had diabetes; 67% of those undiagnosed had a moderate or high risk based on the Canadian Diabetes Risk (CANRISK) assessment. 15% of participants dropped one CANRISK category (e.g., high to moderate) during the intervention.
Evaluation of a community paramedicine health promotion and lifestyle risk assessment program for older adults who live in social housing: a cluster randomized trial.	Agarwal	2018	Canada	The aim was to use a randomized controlled trial (RCT) to determine if implementing CP@clinic decreases mean ambulance calls (primary outcome) in the intervention versus control buildings, measured at the building level. Secondary outcomes were improvement in risk-factor profiles and HRQoL among older adults living in subsidised community housing (individual-level measures and analysis)	Residents living in the intervention buildings showed significant improvement compared with those living in control buildings in quality-adjusted life years (QALYs) (mean difference 0.09, 95% CI 0.01 to 0.17) and ability to perform usual activities (odds ratio 2.6, 95% CI 1.2 to 5.8). Those who received the intervention had a significant decrease in systolic (mean change 5.0, 95% CI 1.0 to 9.0) and diastolic (mean change 4.8, 95% CI 1.9 to 7.6) blood pressure.

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.	Agarwal	2019	Canada	Evaluate the change in mean EMS calls at the building-level, comparing intervention and control buildings, across multiple community sites. Intervention: Community paramedic led risk assessment, disease prevention and health promotion sessions weekly in common areas of intervention buildings	At the individual level, there was a significant QALY increase (mean difference 0.06, 95%CI: 0.02 to0.10) and blood pressure decrease (systolic mean change 3.65 mmHg, 95%CI: 2.37 to 4.94; diastolic mean change 2.03 mmHg, 95%CI: 1.00 to 3.06).
Quality of Life for Persons with Chronic Disease Utilizing Mobile Integrated Healthcare	Ash	2020	United States	The study aimed to analyse the relationship between NCD type; age; gender; duration of participation in MIH-CP; hospital readmission; and self-reported, perceived QOL as measured by the EQ-5D-3L for those who received services from the MIH-CP program	No variables were found to be related at statistically significant levels to self-reported, perceived QOL as measured by EQ-5D-3L after completing the MIH program 3. The difference in scores between the pre-test and post-test administration of the EQ-5D-3L was statistically significant (p = .000). The mean difference in the scores was 19.88, which means that the perceived QOL after the intervention increased by nearly 20 points. This difference may indicate an increase in perceived QOL upon graduation from the MIH-CP program
Community Paramedicine Applied in a Rural Community.	Bennett	2017	United States	The aim was to determine if the CP program reduced ED visits in Abbeville while improving patient outcomes	Hypertensive patients decreased an average of 7.2 mmHg (P<.0001) in systolic blood pressure and 4.0 mmHg (p<.0001) in diastolic blood pressure. Diabetic patients decreased blood glucose by an average of 33.7mmol/L (p=.0013).
Introduction of an extended care paramedic model in New Zealand	Hoyle	2012	New Zealand	The study aimed to determine the rate of treatment in the community and to examine any acute hospital presentation within 7 days from ECP presentation.	These 18 cases were reviewed by an emergency medicine specialist (AHS) and in each case, the initial ECP management was considered to be appropriate at the time. The clinical presentation in the ED was either the result of deterioration of the clinical condition despite an appropriate management plan (four cases) or a presentation to the ED that was not warranted based on the severity of the clinical condition (14 cases).
Safety of paramedics with extended skills	Mason	2008	United States	The objectives were to evaluate the safety of clinical decisions made by Paramedic Practitioners operating within the new service.	There was no statistically significant difference in 28-day mortality (RR 0.87, 95% CI = 0.63 to 1.21).

Table 11. Patient satisfaction results

Title	Author	Year	Origin	Aim of study	Outcome result notes
A Case Study of Older Adult Experiences with a Novel Community Paramedicine Program	Brydges	2014	Canada	Aim to understand older adults' experiences with a novel community paramedicine program, the Cardiovascular Health Awareness Program by EMS (CHAP-EMS), operating in a subsidised housing building in Hamilton.	The perceptions and experiences of older adults residing in a building with a community paramedicine program are complex, however, it was clear that distinct themes emerged from these views and experiences. The participants of the program highly valued the program, the paramedics, and the change in social dynamics to the building. The program offered an opportunity for social participation, an increase in access to support and resources, and a trusting avenue to discuss their health. Further, the paramedics provided support, relationships (both professional and personal), a sense of community, and opportunities for participation and engagement amongst building residents
Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population	Castillo	2016	United States	Aims to describe and analyse the initial experience and preliminary impact of an MIH intervention delivered at scale for a high-risk subpopulation.	Member experience satisfaction scores and patient activation measures also showed favourable preliminary trends
Community paramedicine home visits: patient perceptions and experiences	Hughes	2021	UK	To explore patient perceptions and experiences of CP home visits delivered by specialist paramedics (SPs) in a Scottish urban general practice home-visit setting.	Patient perceptions and experience of CP were positive, with patients accepting this model of care. Opportunities to improve healthcare, including better continuity of care and health monitoring found
Consumer perspectives of a community paramedicine program in rural Ontario.	Martin	2016	Canada	The aim was to report on a community paramedicine program in rural Ontario, Canada, through the perceptions and experiences of consumers	Three main interlinked themes were identified: (i)improved health monitoring and primary health care access close to home; (ii) improved sense of security and support for vulnerable residents in the community; and(iii) improved education and empowerment for better health management.

Safety of paramedics with extended skills	Mason	2008	United States	The objectives were to evaluate the safety of clinical decisions made by Paramedic Practitioners operating within the new service.	Patients in the intervention group were more likely to report being highly satisfied with their health care episode (RR 1.16, 95% CI = 1.09 to 1.23).
Community health evaluations completed using paramedic services (CHECUPS): design and implementation of a new community based health program	Ruest	2017	Canada	Overview of design and evaluation of the implementation of CHECUPS program	Approximately 82% felt that their overall health improved, and 99% felt that their understanding of their medical conditions allowed them to better manage their conditions. All patients treated by community paramedics stated that they were either "very satisfied" or "satisfied" with the care provided by those community paramedics
Improving the ED-to-Home Transition: The Community Paramedic-Delivered Care Transitions Intervention-Preliminary Findings.	Shah	2018	United States	To describe an innovative approach to improve the ED-to-home transition.	Participants reported the CTI Program as highly acceptable, with patient and caregiver participants reporting being likely or extremely likely in the future to choose an ED with the CTI Program over one without the program (244 (76.2%); 69 (83.1%) respectively
Patient satisfaction and outcome using emergency care practitioners in New Zealand.	Swain	2012	New Zealand	To determine whether patients found the UCC model of service both acceptable and effective, and to ascertain whether there was any difference in satisfaction with the care provided by the two groups of paramedics, EAS or ECP	From questions put to all patients, it was determined that both paramedic groups arrived promptly and that their clinical assessments were deemed to be appropriate. Satisfaction with the care provided was rated very highly (greater than 9/10). However, ECP assessments and treatment took on average 20 min longer than those of EAS crews (P<0.0001). Five of the 38 ECP patients treated at home would have preferred to be taken to hospital, but the ECPs determined that hospital admission was not required.
HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project	Thompson	2014	Australia	Report on the Extended Care Paramedic program in originally developed in South Australia Ambulance Service and implemented within 5 sites in New South Wales	Evidence from the patient survey confirmed that there was a very high level of consumer satisfaction with the ERP model at all sites. In general, patients reported that the ECP listened and communicated well, examined them thoroughly, provided effective treatment and seemed comfortable dealing with their problems. A small group of patients would have preferred more information regarding recovery and self-care, suggesting a target area for future improvements. Satisfaction ratings were very high. Respondents were highly satisfied with waiting times, the care they received, and their overall experience of the ambulance services involved in the trial. Clear communication and information provision were the main factors that predicted overall

					satisfaction. Overall, 49 consumers refused treatment by an ECP, representing 2.2% of cases.

Table 12. Community paramedic satisfaction and qualitative insights results

Title	Author	Year	Origin	Aim of study	Qualitative outcomes
Community Paramedics' Perception of Frequent ED Users and the Community Paramedicine Program: A Mixed-Methods Study.	Aiyedun	2020	United States	Addresses the following research questions: 1. What are the views of paramedics towards frequent emergency department users and underlying causes? 2. What are the views of paramedics about the community paramedicine program related to its relevance and administration, and their personal experiences and professional competencies?	Community paramedicine provides an opportunity to help underserved frequent attendance populations. With specific training, protocols and screening, goal setting CP are well suited to provide improved care for patients with frequent attendance. Rotation model is not viewed favourably as more than 30 days is needed to make an impact. Programmes need interdisciplinary teams to service frequent attendance
The CHAP-EMS health promotion program: a qualitative study on participants' views of the role of paramedics.	Brydges	2016	Canada	This study sought to understand participants perceptions of paramedic providers to explore their role in this unique practice setting and ultimately create an emerging framework to examine paramedic roles in community paramedicine programmes.	This study found that paramedics had dual roles as advocates for health and wellbeing and as experts in providing emergency care. Results from this study have informed an emerging framework for understanding paramedic roles in community paramedicine settings in multiple contexts: paramedics as trusting health care professionals; paramedics as patient advocates; and lastly, paramedics as emergency experts
What are the clinical practice experiences of specialist and advanced paramedics working in emergency department roles? A qualitative study.	Clarke	2019	UK	This study aimed to explore the lived experiences of paramedics who have made the transition from the ambulance service to specialist/advanced ED roles in the United Kingdom, and to explore how working in this new clinical environment influenced their clinical practice	While role transition to the ED represents a turbulent period for paramedics, elements of paramedic practice transfer directly into new roles and contribute to effective practice. The paramedics in this study found that they were accepted and supported to work in the ED setting and spoke positively of expanding their roles into other areas of the ED in the future. A significant barrier to current clinical practice emerges from a lack of access to medicines which impacts directly on the patient experience. The change in legislation to allow independent prescribing for

					advanced paramedics must be supported by ED managers, and interim improvements are required to extend existing PGDs to include paramedics; ultimately this will improve the quality and safety of the care they can provide, as well as the patient experience
Collaborative practices in unscheduled emergency care: role and impact of the emergency care practitioner--qualitative and summative findings.	Cooper	2007	UK	Through semi-structured interviews focussed on the ECP role and collaborative experiences.	Observational records and interviews showed that ECPs numerous links with other professions were influenced by three major themes as follows. (i) The ECP role: for example, restricted transport codes of communication, focus on reducing admissions, frustrations about patient tasking and conflicting views about leadership and teamwork. (ii) Education and training: drivers for multi-professional clinically focussed graduate-level education, requirements for skill development in minor injury units (MIUs) and general practice, and the need for clinical supervision/mentorship. (iii) Cultural perspectives: a crew room blue-collar view of inter-professional working versus emerging professional white-collar views, power and communication conflicts, and a lack of understanding of the ECPs role.
The ambulance service advanced practitioner's role in supporting care homes: a qualitative study of care staff experiences	Harvey	2021	UK	Investigated the experiences and needs of the care home staff who use the ambulance service, advanced practitioner model.	The most frequently stated benefit of the advanced practitioner service was that it enabled care home residents to be managed within the community and avoid hospital attendance or admission. Care homes are issued with guidance to support decisions about the healthcare of their residents, but most participants preferred to exercise their own judgement in making these choices. While some comments were made regarding the negative attitude of some advanced practitioners responding to the telephone referrals, overall, the positive and constructive relationships between the service and care homes were considered to be of high value. It should also be noted that the care homes that referred residents to the advanced practitioner service less often were more likely to highlight the positive relationships with their GPs and community nursing teams.
Perspectives from the frontline of two North American community paramedicine programmes: an observational, ethnographic study.	Martin	2019	Canada	The purpose of this study was to identify the motivations, job satisfaction and challenges of community paramedics	Transitional challenges facing community paramedics include navigating untraditional roles, managing role boundary barriers and a lack of self-regulation. This study highlighted that scepticism, criticism and misunderstanding caused anxiety for participants transitioning into community paramedic roles, highlighting that improved education and communication from paramedic service management with internal staff and allied health partners might improve this transitional process.

Community paramedicine model of care: an observational, ethnographic case study.	O'Meara	2016	Canada	The study aimed to identify and analyse how community paramedics create and maintain new role boundaries and identities in terms of flexibility and permeability and through this develop and frame a coherent community paramedicine model of care that distinguishes the model from other innovations in paramedic service delivery	Community engagement and situated practice distinguish community paramedicine models of care from other paramedicine and out-of-hospital health care models. Successful community paramedicine programmes are integrated with health, aged care and social services and benefit from strong governance and paramedic leadership.
The novel role of paramedics in collaborative emergency centres aligns with their professional identity: A qualitative analysis.	Whalen	2018	Canada	Ascertain the attitudes, feelings and experiences of paramedics working within the Nova Scotia Collaborative Emergency Centre construct within an interdisciplinary team	Four dominant themes were identified: 1) inter-professional relationships; 2) leadership support; 3) value to the community, and 4) paramedic identity. Paramedics enjoy working in this novel role and believe it aligns with their professional identity. High levels of patient and community satisfaction were reported

Appendix A. Search strategy

This search strategy used was a piloted and validated existing search strategy from Eaton et.al

Medline (Ovidsp) example- (search strategy was adapted to suit idiosyncrasies of each database):

1. Allied Health Personnel/ and emergenc*.mp.
2. Emergency Medical Technicians/
3. (paramedic* or ((emergency or ambulance) adj3 (technician? or practitioner? or staff* or personnel or workforce))).tw.
4. 1 or 2 or 3
5. exp General Practice/
6. general practitioners/ or physicians, family/ or physicians, primary care/
7. Primary Health Care/
8. Community Medicine/ or Community Health Services/ or Rural Health Services/
9. After-Hours Care/
10. Ambulatory Care Facilities/
11. Office Visits/
12. ((family or general) adj3 (practi* or doctor? or physician?)).tw.
13. (primary adj (care or healthcare or "health care")).tw.
14. (community adj2 (care or medicine or service?)).tw.
15. ("out of hours" or ooh or walk in or walk-in).tw.
16. ((health* or medical or ambulatory) adj2 (centre? or center? or clinic?)).tw.
17. *Triage/
18. triage.ti.
19. (Remote Consultation/ or Triage/) and Telephone/
20. exp Call Centers/
21. (helpline? or help line? or hotline? or hot line? or call centre? or call center?).tw.
22. (telephone? adj3 (service? or centre? or center? or triage)).tw.
23. ((enhanc* or expand*) adj3 role?).tw.
24. 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23
25. 4 and 24
26. ((community or primary care or primary health care or primary healthcare) adj3 paramedic*).tw.
27. 25 or 26
28. limit 27 to yr="2001 -Current"

Appendix B. List of included studies

Lead author	Year	Origin	Title	Aim of study	Evidence category under investigation	Study design	Population description	Number of participants
Abrashkin	2016	United States	Providing Acute Care at Home: Community Paramedics Enhance an Advanced Illness Management Program-Preliminary Data.	Explored the feasibility of in-home evaluation and treatment of acute illnesses by paramedics within an Advanced Illness Management (AIM) program.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Two-thirds were female, the median age was 83, and the median number of ADL dependencies was 5 (range 0-6). The study population had high rates of chronic conditions: dementia (44%), decubitus ulcers (29%), diabetes mellitus (26%), congestive heart failure (24%), and chronic obstructive pulmonary disease (15%)	1602
Abrashkin	2019	United States	Community paramedics treat high acuity conditions in the home: a prospective observational study	Explored whether high acuity conditions that would typically result in transport to the ED in a conventional 911 system can be effectively treated at home using a physician extender CP model within advanced illness management (AIM) programme	Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Prospective observational	All individuals enrolled in the AIM programme were eligible to receive care through the CP programme. Enrolment criteria for the AIM programme include being home-bound with two or more chronic conditions.	3137
Adio	2020	United States	Community Paramedics' Perception of Frequent ED Users and the Community Paramedicine Program: A Mixed-Methods Study.	Addresses the following research questions: 1. What are the views of paramedics towards frequent emergency department users and underlying causes? 2. What are the views of paramedics about the community paramedicine program related to its relevance and administration, and their personal experiences and professional competencies?	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Mixed Methods	16 Community Integrated Health Program paramedics	16
Agarwal	2020	Canada	Cost-effectiveness analysis of a community paramedicine	To evaluate the cost-effectiveness of the CP@clinic programme compared with usual care for low-income	Outcomes from community paramedicine programmes (such as quality of life,	Economic evaluation	Aged over 55 years of age, living in mid-and high-rise public housing buildings for low-	678

			programme for low-income seniors living in subsidised housing: the community paramedicine at clinic programme (CP@clinic).	seniors living in subsidised (social) housing	patient satisfaction, and economic impact)		income older adults, where a portion of the rental fees are subsidised by the government	
Agarwal	2017	Canada	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).	The aim was to evaluate whether a weekly 8-hour CHAP-EMS program was associated with changes in (1) number of emergency EMS calls (9-1-1) from the seniors' residence building, (2) mean blood pressure (BP) of participants and (3) diabetes risk profile of participants after one year of implementation	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Non-randomised experimental study	Eligible study participants were apartment building residents over 65 years living in one of 260 apartments units which were identified as having a high volume of ambulance call-outs. Most occupants were assessed as being of low income and, accordingly, were receiving rent subsidies	79
Agarwal	2020	Canada	Feasibility of implementing a community cardiovascular health promotion program with paramedics and volunteers in a South Asian population.	The aim was to assess whether the key components of the CP@clinic program (e.g., paramedic-led sessions, risk assessments, referrals, reports to primary care) can be feasibly implemented in a South Asian community setting. The secondary objective of the study was to describe cardiometabolic risk factors observed in this high-risk population to inform a future full-scale study and health promotion and disease prevention initiatives.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Mixed Methods	Participants consisted of adults visiting a local community recreation centre or a local Sikh Temple. Predominantly North Indian, speaking Hindi, Punjabi and Urdu.	71
Agarwal	2018	Canada	Evaluation of a community paramedicine health promotion and lifestyle risk assessment program for older adults who live in social housing: a cluster randomized trial.	The aim was to use a randomized controlled trial (RCT) to determine if implementing CP@clinic decreases mean ambulance calls (primary outcome) in the intervention versus control buildings, measured at the building level. Secondary outcomes were improvement in risk-factor profiles and HRQoL among older adults living in subsidised community	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	Aged over 55 years of age, living in mid-and high-rise public housing buildings for low-income older adults, where a portion of the rental fees are subsidised by the government	158

				housing (individual-level measures and analysis)				
Agarwal	2019	Canada	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.	Evaluate the change in mean EMS calls at the building-level, comparing intervention and control buildings, across multiple community sites.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	Aged over 55 years of age, living in mid-and high-rise public housing buildings for low-income older adults, where a portion of the rental fees are subsidized by the government	1509
Ash	2020	United States	Quality of Life for Persons with Chronic Disease Utilizing Mobile Integrated Healthcare	The study aimed to analyse the relationship between NCD type; age; gender; duration of participation in MIH-CP; hospital readmission; and self-reported, perceived QOL as measured by the EQ-5D-3L for those who received services from the MIH-CP program	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Patients enrolled in MIH- CP program. Predominantly patients with non-communicable diseases over the age of 18	645
Ashton	2017	Canada	Conserving Quality of Life through Community Paramedics.	To determine whether community paramedicine services (the intervention through home visits) would have a positive economic impact through influencing the self-perceived quality of life and determining a monetised value	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Economic evaluation	Clients who were high users of healthcare services (greater than 3 occasions of service with EMS) and had one or more of five chronic diseases (congestive heart failure, chronic obstructive pulmonary disease, hypertension, stroke, and diabetes) at 2 sites Renfrew and Hastings	200
Ball	2005	International	Setting the scene for the paramedic in primary care: a review of the literature.	The review explores the published evidence which surrounds paramedic practice in an attempt to identify the skills, training, and professional capacity that paramedics of the future will require	Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Literature review	N/A	Not reported

Batt	2021	Canada	Advances in Community Paramedicine in Response to COVID-19	To investigate how have Canadian community paramedicine programmes innovated in response to COVID-19 and how can these innovations inform the future development of community paramedicine?	Scope of role	Grey literature	N/A	N/A
Bennett	2017	United States	Community Paramedicine Applied in a Rural Community.	The aim was to determine if the CP program reduced ED visits in Abbeville while improving patient outcomes	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Non-randomised experimental study	68 participants in the intervention arm, 15 had hypertension, 5 had diabetes, 5 had COPD or asthma, 5 had other diseases (2 depression, 2 posttraumatic stress disorder, and 1 blind), and 39 had some combination of the above. Participants were 60.3% female, 64.7% non-white, with an average age of 57.6 years and were enrolled an average of 355.3days in the program at the time of analysis	193
Bennett	2020	United States	Community Paramedicine Applied in a Rural Community	The objective of this study was to determine if the CP program reduced ED visits in Abbeville while improving patient outcomes	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Pre/post-test with a comparison group study design	CP patients in a rural US county. Eligible for CP program if they have >2 ED visits within a month. Minimum of 1 chronic disease and were frequent users of other health care services.	193 (n=68 enrolled vs. n=125 comparison)
Bigham	2013	Canada	Expanding paramedic scope of practice in the community: a systematic review of the literature.	Review of the international literature to describe existing community paramedic programmes	Models of delivery to include clinical governance, supervision, and other structural supports	Systematic review	N/A	11 studies
Boykin	2018	United States	Interprofessional care collaboration for patients with heart failure.	The aim was to describe the process of collaboration among healthcare professionals during TOC from an institution to the home setting.	Models of delivery to include clinical governance, supervision, and other structural supports; Scope of role	Cohort study	Patients with heart failure	N/A
Bradley	2016	United States	The business case for community paramedicine: lessons	Summarises acute community care program business case	Models of delivery to include clinical governance, supervision, and other	Grey literature	N/A	N/A

			from Commonwealth Care Alliances Pilot Program		structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)			
Brydges	2014	Canada	A Case Study of Older Adult Experiences with a Novel Community Paramedicine Program	Aim to understand older adults' experiences with a novel community paramedicine program, the Cardiovascular Health Awareness Program by EMS (CHAP-EMS), operating in a subsidised housing building in Hamilton.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Older adults living in subsidised housing buildings in Hamilton. Age range 63-89. 12/15 lived alone. All lived with a medical problem	15
Brydges	2016	Canada	The CHAP-EMS health promotion program: a qualitative study on participants' views of the role of paramedics.	This study sought to understand participants' perceptions of paramedic providers to explore their role in this unique practice setting and ultimately create an emerging framework to examine paramedic roles in community paramedicine programmes.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Adults living in the residential building in which CHAP-EMS took place including those who were currently participating in the CHAP-EMS program. Aged 63-89, most living alone 12/15, 6/15 males and all had at least one medical problem	15
Castillo	2016	United States	Mobile Integrated Healthcare: Preliminary Experience and Impact Analysis with a Medicare Advantage Population	Aims to describe and analyse the initial experience and preliminary impact of an MIH intervention delivered at scale for a high-risk subpopulation.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Conducted utilising the experience and data from an MIH care coordination program for the state-wide membership of a Medicare Advantage Preferred Provider Organisation (MAPPO) population in Florida. Consisted of complex and vulnerable patients in the home and alternative settings	1074 (intervention) 1241 (control)
Chan	2019	International	Community paramedicine: A systematic review of program descriptions and training.	A systematic review was conducted to 1) identify the key differences between community paramedicine programmes for program classification, and 2) describe the training required for each program type	Education (including entry-level requirements)	Systematic review	N/A	64 studies

Choi	2016	United States	Mobile Integrated Health Care and Community Paramedicine: An Emerging Emergency Medical Services Concept.	Literature review of MIH CP	Education (including entry-level requirements); Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	Not reported
Clarke	2019	United Kingdom	What are the clinical practice experiences of specialist and advanced paramedics working in emergency department roles? A qualitative study.	This study aimed to explore the lived experiences of paramedics who have made the transition from the ambulance service to specialist/advanced ED roles in the United Kingdom, and to explore how working in this new clinical environment influenced their clinical practice	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Qualified paramedics working within an ED (4-24 months experience)	8
Constantine	2021	United States	Implementation of Drive-through Testing for COVID-19 with Community Paramedics	Aimed to describe the Implementation of Drive-through Testing for COVID-19 with Community Paramedics	Models of delivery to include clinical governance, supervision, and other structural supports	Cohort study	Anyone with concerns about being exposed to, or having the symptoms of, COVID-19 could be screened for testing.	4342
Cooper	2004	United Kingdom	The emerging role of the emergency care practitioner	To examine the emerging role of the emergency care practitioner (ECP) with comparisons to paramedic practice.	Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Mixed Methods	15 paramedics (4 ECP 11 paramedics)	692 cases attended. Paramedics reported on 331 cases while the ECPs reported on 170 cases within the EMS system and 191 MIU cases.
Cooper	2007	United Kingdom	Collaborative practices in unscheduled emergency care: role	Aimed to investigate the ECP role and collaborative experiences.	Outcomes from community paramedicine programmes (such as quality of life,	Mixed Methods	Senior health authority and trust managers, A&E consultants and senior nurses, paramedics, general practitioners (GPs) and	21

			and impact of the emergency care practitioner--qualitative and summative findings.		patient satisfaction, and economic impact)		practice managers, care home managers, social services and Falls group leads.	
Counts	2017	United States	An Evaluation of the Environmental and Organizational Factors Associated with the Formation of Community Paramedicine Programmes	To evaluate the environmental and organisational characteristics that foster the existence of MIHCP programmes and aimed to determine if those counties with programmes see a systematically measurable effect on related EMS call volumes	Models of delivery to include clinical governance, supervision, and other structural supports	Cross sectional study	N/A	N/A
Dainty	2018	Canada	Home Visit-Based Community Paramedicine and Its Potential Role in Improving Patient-Centered Primary Care: A Grounded Theory Study and Framework.	To understand the experiences and perspectives of patients and families involved with the Expanding Paramedicine in the Community (EPIC) randomised trial in Ontario, Canada, as well as how such a model is shaped and enabled according to the needs and interests of programme participants	Education (including entry-level requirements); Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Patients who had received at least three scheduled visits from the EPIC community paramedic	40
Dixon	2008	United Kingdom	Is it cost effective to introduce paramedic practitioners for older people to the ambulance service? Results of a cluster randomised controlled trial	To assess the cost-effectiveness of the paramedic practitioner (PP) scheme compared with usual emergency care.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	Patients >60 years old who presented to ambulance service in an urban setting	3018
Eaton	2021	United Kingdom	Designing and implementing an educational framework for advanced paramedic practitioners rotating into primary care in North Wales	Aimed to evaluate an educational framework to determine how it supported the development of Advanced Paramedic Practitioners in the primary care setting	Education (including entry-level requirements)	Evaluation/ qualitative	Advanced Paramedic Practitioners rotating through primary care, and GPs offering supervision.	11 (7 Advanced Paramedics; 4 GPs)

Eaton	2021	International	Understanding the role of the paramedic in primary care: a realist review.	To understand how paramedics impact (or not) the primary care workforce	Education (including entry-level requirements); Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact); Scope of role	Realist Review	N/A	205 articles
Eaton	2020	United Kingdom	Contribution of paramedics in primary and urgent care: a systematic review.	To describe gaps in the current UK literature regarding the work of paramedics in primary care	Education (including entry-level requirements); Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact); Scope of role	Systematic review	N/A	14 studies
Evans	2012	United Kingdom	Which extended paramedic skills are making an impact in emergency care and can be related to the UK paramedic system? A systematic review of the literature.	To identify evidence of paramedics trained with extra skills and the impact of this on patient care and interrelating services such as General Practices or Emergency Departments	Scope of role	Systematic review	N/A	19 studies
Feldman	2021	United States	"House Calls" by Mobile Integrated Health Paramedics for Patients with Heart Failure: A Feasibility Study	To assess the feasibility of integrating community paramedics into the out-patient management of patients with heart failure with scheduled urgent house calls	Models of delivery to include clinical governance, supervision, and other structural supports	Cohort study	Patients >18 years with acute or acute-on-chronic heart failure, in the geographical boundary of EMS	40

Flint	2019	United States	The Systemic Impacts of Integrated Mobile Healthcare in a State-wide Emergency Medical Services System	To review the impact of IMHC programmes on transport requests, operational surges and fiscal loss of the EMS providing the programme	Models of delivery to include clinical governance, supervision, and other structural supports	Mixed method literature review, retrospective data analysis	N/A	4529 CP calls
Ford-Jones	2020	Canada	Filling the gap: Mental health and psychosocial paramedicine programming in Ontario, Canada	To identify promising programmes for paramedics attending calls for mental health needs in Ontario, Canada.	Scope of role	Qualitative research	N/A	N/A
Gingold	2021	United States	The effect of a mobile integrated health program on health care cost and utilization.	To measure the effect of a mobile integrated health community paramedicine (MIH-CP) transitional care program on hospital utilisation, emergency department visits, and charges	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Patients over 18 years old, discharged to home from internal/family medicine services	464
Glenn	2017	United States	State Regulation of Community Paramedicine Programmes: A National Analysis.	Aimed to examine the current scope of practice related to CP, as defined by state statutes and regulations in the 50 U.S. states	Models of delivery to include clinical governance, supervision, and other structural supports	Systematic review	N/A	N/A
Goldberg	2014	United States	Mobile integrated healthcare: Using existing out of hospital resources to bridge gaps in healthcare services	Aimed to examine how current EMS systems might bridge the gap between at-risk patient populations and health care services through MIH programmes	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	Not reported
Gregg	2019	United States	Systematic Review of Community Paramedicine and EMS Mobile Integrated Health Care	To determine the effectiveness of CP-MIH interventions at addressing the Quadruple Aim (which focuses on controlling health care costs while	Outcomes from community paramedicine programmes (such as quality of life,	Systematic review	N/A	8 studies

			Interventions in the United States.	improving population health and both provider and patient satisfaction)	patient satisfaction, and economic impact)			
Halter	2006	United Kingdom	Patients' experiences of care provided by emergency care practitioners and traditional ambulance practitioners: A survey from the London Ambulance Service	To compare patient experiences of ECP care with that from traditional ambulance practitioners (state-registered paramedic or emergency medical technician).	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Survey	No details given	888
Hanninen	2020	Finland	Patients Seeking Retreatment after Community Paramedic Assessment and Treatment: Piloting a Community Paramedic Unit Program in Southwest Finland	To categorise CP unit patients seeking retreatment after a CP unit visit and investigate links between CP unit actions and patients seeking retreatment.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Retrospective analysis	Not reported	229
Harvey	2021	United Kingdom	The ambulance service advanced practitioner's role in supporting care homes: a qualitative study of care staff experiences	Investigated the experiences and needs of the care home staff who use the ambulance service, advanced practitioner model.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Staff members from 10 different care homes	19
Hill	2013	United Kingdom	A systematic review of the activity and impact of emergency care practitioners in the NHS.	Summarise the impact of ECPs on healthcare delivery and effectiveness as a health service resource	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	5 studies
Hoyle	2012	New Zealand	Introduction of an extended care paramedic model in New Zealand	The study aimed to determine the rate of treatment in the community and to examine any acute hospital presentation within 7 days from ECP presentation.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	The Kapiti population was just under 50 000 people in 2009. The district is a popular retirement area, and as a result, the proportion of residents over the age of 65 is twice the national average. The most common presentations were falls and respiratory	1000

							problems, accounting for 13% and 9.8% of presentations, respectively.	
Hughes	2021	United Kingdom	Community paramedicine home visits: patient perceptions and experiences	To explore patient perceptions and experiences of CP home visits delivered by specialist paramedics (SPs) in a Scottish urban general practice home-visit setting.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Case series	Adults who have mental capacity and have received at least one SP home visit on behalf of their general practice	16
Jensen	2016	Canada	Impact of a Novel Collaborative Long-Term Care EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program	The objective of this study was to measure differences in the delivery of emergency care for LTC residents with acute illnesses or injuries attended by ECP or emergency paramedics, measured primarily with a number of transports to the ED, as well as EMS response and scene time, patient ED length of stay, EMS time in the ED, hospital admission, and relapse back to EMS after calls ending in no transport.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Residents of long-term care	360
Kant	2018	United States	Outcomes and provider perspectives on geriatric care by a nurse practitioner-led community paramedicine program.	The aim was to describe patients, outcomes, and geriatric primary care provider perspectives related to the use of a community paramedicine program.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Case series	Geriatric patients	40
Keefe	2020	United States	Behavioural Health Emergencies Encountered by Community Paramedics: Lessons from the Field and Opportunities for Skills Advancement.	To examine paramedics perceptions and experiences responding to behavioural health crises in the USA	Scope of role	Qualitative research	Paramedics working in the Acute Community Care Programme	23

Knowles	2010	United Kingdom	An initiative to provide emergency healthcare for older people in the community: the impact on carers.	Describe the impact of a new model of service delivery on the carers/support persons for patients that received care.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cross-sectional study	Individuals that provided physical or emotional support to a patient and was present when paramedic practitioners provided care.	569
Lau	2018	United States	Qualitative Evaluation of the Coach Training within a Community Paramedicine Care Transitions Intervention.	Aimed to define community paramedics perceptions regarding their training needs to serve as Care Transitions Intervention (CTI) coaches supporting the ED-to-home transition	Education (including entry-level requirements)	Qualitative research	Participants were identified from a list of active community paramedics currently acting as CTI coaches in Madison, Wisconsin and Rochester, New York. Participants consisted solely of non-Hispanic whites included five women, and had a mean age of 43. Participants had extensive backgrounds in healthcare, primarily as EMS providers, but minimal experience with community paramedicine. All reported some prior geriatrics training.	8
Leduc	2020	International	The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review.	A systematic review of the literature to determine, among long-term care patients, what is the effectiveness and safety of interventions that evaluate and treat patients on-site, avoiding unscheduled transport to the ED.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	22 studies
Leyenaar	2021	Canada	Relevance of assessment items in community paramedicine home visit programmes: results of a modified Delphi study.	To investigate the relevance of assessment items to the practice of community paramedics according to a pre-established clarity-utility matrix	Scope of role	Delphi	The expert panel of community paramedics from one Canadian province	26
Leyenaar	2019	Canada	Examining consensus for a standardised patient assessment in community	Investigate the level of consensus that could be found by a panel of experts regarding appropriate health, social and environmental domains	Education (including entry-level requirements)	Delphi	Patients served by community paramedicine programmes	17

			paramedicine home visits: a RAND/UCLA-modified Delphi Study.	that should be assessed in community paramedicine home visit programme				
Leyenaar	2019	Canada	What do community paramedics assess? An environmental scan and content analysis of patient assessment in community paramedicine.	Aimed to summarise the content of assessment instruments and describe the state of current practice in community paramedicine home visit programmes	Scope of role	Environmental scan	Ontario Community Paramedic programmes	43
Leyenaar	2019	Canada	Report on the status of community paramedicine in Ontario	Report summarising community paramedicine in Ontario	Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact); Scope of role	Grey literature	In 2018-19, 39 (75%) Ontario's municipal paramedic services were delivering more than one community paramedicine model of care. 35 (90%) were offering Home Visit Programmes that served an estimated 3,790 patients, 23 (59%) were offering Community Paramedic-Led Clinics that served an estimated 17,680 patients, 23 (59%) were offering Remote Patient Monitoring programmes that served an estimated 2,300 patients, 10 (26%) were offering Community Paramedic-Specialist Response Programmes that served an estimated 7,840 patients, and 6 (15%) were offering additional programmes that served another 1,990 patients.	N/A
Leyenaar	2018	Canada	A scoping study and qualitative assessment of care planning and case management in community paramedicine	The objective of this study is to contribute to paramedic practice by examining broad areas of care planning in CP, identifying gaps in the evidence, clarifying key concepts, and reporting on the types of evidence that address and inform practice.	Models of delivery to include clinical governance, supervision, and other structural supports; Other	Qualitative research	N/A	10 studies included
Leyenaar	2021	Canada	Paramedics assessing patients with complex comorbidities in community settings:	This study aimed to provide information about how community paramedicine home visit programmes best navigate their role in delivering preventative care to frequent 9-1-1	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Home care clients, community support services clients and community paramedicine clients.	n=43,856 (29,938 home care clients, 13,782

			results from the CARPE study.	users by describing the demographic and clinical characteristics of their patients and comparing them to existing community care populations.				community support services clients, and 136 community paramedicine patients)
Lezzoni	2018	United States	Early experiences with the Acute Community Care Program in eastern Massachusetts.	To describe experiences during the first 2 years of the Acute Community Care Program (ACCP)	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Mixed methods	Socioeconomically disadvantaged adults with complex health needs	601
Martin	2016	Canada	Consumer perspectives of a community paramedicine program in rural Ontario.	The aim was to report on a community paramedicine program in rural Ontario, Canada, through the perceptions and experiences of consumers	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Community members (patients, relatives and carers) referred to as consumers, all were Caucasian Canadians.	14
Martin	2019	Canada	Perspectives from the frontline of two North American community paramedicine programmes: an observational, ethnographic study.	The purpose of this study was to identify the motivations, job satisfaction and challenges of community paramedics	Models of delivery to include clinical governance, supervision, and other structural supports	Qualitative research	Paramedic service managers and community paramedics from two paramedic services.	15
Martin-Misener	2009	Canada	Cost effectiveness and outcomes of a nurse, practitioner paramedic, family physician model of care: the Long and Brier Islands study	To assess if patients in the collaborative model demonstrate evidence of improved psychosocial adjustment and less expenditure of health care resources over time	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Economic evaluation	Adult English-speaking permanent residents of the Islands, age 40 years or more with a diagnosis of at least one chronic illness, aware of their diagnosis and able to provide informed written consent	221
Mason	2007	United Kingdom	Effectiveness of emergency care practitioners working within existing	Aimed to (1) evaluate appropriateness, satisfaction and cost of ECPs compared with the usual service available in the same	Models of delivery to include clinical governance, supervision, and other structural supports	Cross-sectional study	Patients who were seen by an ECP	524

			emergency service models of care	healthcare setting, (2) to increase understanding of what effect, if any, ECPs are having on the delivery of health services locally and (3) to evaluate whether ECP working yields cost savings.				
Mason	2007	United Kingdom	Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial.	To evaluate the benefits of paramedic practitioners assessing and, when possible, treating older people in the community after minor injury or illness. Paramedic practitioners have been trained with extended skills to assess, treat, and discharge older patients with minor acute conditions in the community.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	patients aged over 60 years who called the emergency services within the study period (Sept. 2003-Sept 2004) from a Sheffield postal code, between the hours of 8am-8pm with a presenting complaint that fell within the paramedic practitioner scope of practice	3018 (n=1549 intervention vs. n=1469 control)
Mason	2008	United States	Safety of paramedics with extended skills	Aimed to evaluate the safety of clinical decisions made by Paramedic Practitioners operating within the new service.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	Patients aged >60 years contacting the emergency medical services (EMS) with a minor injury or illness were included in the study.	3,018 (n=1549 intervention vs. n=1469 control)
Misra-Hebert	2021	United States	Healthcare utilization and patient and provider experience with a home visit program for patients discharged from the hospital at high risk for readmission.	Aimed to assess the association with health care utilisation and mortality for patients at high risk for readmission who participated in the post-discharge home visit program and to examine provider and patient experience regarding program participation.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Mixed Methods	Adult patients with a Cleveland Clinic Health System Primary Care Provider following hospital discharge	Varied according to methods of analysis
Nejtek	2017	United States	A pilot mobile integrated healthcare program for frequent utilizers of emergency department services	Aimed to examine whether or not a mobile integrated health (MIH) program may improve health-related quality of life while reducing emergency department (ED) transports, ED admissions, and inpatient hospital admissions in frequent utilisers of ED services	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Participants in a pilot program in North Texas, USA	64

Nowrouzi-Kia	2021	Canada	Quality of work life of paramedics practicing community paramedicine in northern Ontario, Canada: a mixed-methods sequential explanatory study	To evaluate several pilot CP programmes in northern Ontario from the perspectives of paramedics, to gain program recommendations related to both rural and urban settings across northern Ontario	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cross-sectional study	Community Paramedics	75
O'Meara	2003	Australia	Would a prehospital practitioner model improve patient care in rural Australia?	Aimed to develop and critically appraise the prehospital practitioner model as an alternative to existing models in rural Australia	Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Soft systems methodology	N/A	N/A
O'Meara	2015	Canada	Integrating a community paramedicine program with local health, aged care and social services: An observational ethnographic study	To identify and describe the nature of the relationship between public engagement and the integration of CP with local health, aged care and social services	Models of delivery to include clinical governance, supervision, and other structural supports	Qualitative research	Paramedic service managers, paramedics, educators, physicians, nurses, other health professionals, patients and community members. involved with community paramedicine programming in a rural Canadian setting.	Focus groups, interviews, and field observations.
O'Meara	2016	Canada	Community paramedicine model of care: an observational, ethnographic case study.	The study aimed to identify and analyse how community paramedics create and maintain new role boundaries and identities in terms of flexibility and permeability and through this develop and frame a coherent community paramedicine model of care that distinguishes the model from other innovations in paramedic service delivery	Models of delivery to include clinical governance, supervision, and other structural supports	Qualitative research	Community members, including patients, family and carers, Paramedics and paramedic service managers from Renfrew County and the Greater Ottawa area, Paramedicine educators in Ontario, Physicians, nurse practitioners and other health care providers who interact with community paramedics, Health economists and health service managers	up to 94

Pang	2019	International	Limited data to support improved outcomes after community paramedicine intervention: A systematic review.	The objective was to systematically review the literature to describe the outcomes utilised by CP programmes and the extent to which CP programmes improved those outcomes	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	6 studies
Pearson	2014	United States	The Evidence for Community Paramedicine in Rural Areas: State and local findings and the role of the state Flex program	Examined the evidence base for community paramedicine in rural communities, the role of community paramedics in rural healthcare delivery systems, the challenges faced by states in implementing community paramedicine programmes, and the role of the state Flex programmes in supporting the development of community paramedicine programmes.	Education (including entry-level requirements); Models of delivery to include clinical governance, supervision, and other structural supports	Survey exercise and literature review	N/A	N/A
Pearson	2017	United States	Community Paramedicine pilot programmes: lessons from Maine	Aimed to describe the healthcare needs of people living in rural areas and of how community paramedicine can address some of those needs.	Models of delivery to include clinical governance, supervision, and other structural supports	Qualitative research	N/A	N/A
Proctor	2019	United Kingdom	Home visits from paramedic practitioners in general practice: patient perceptions	To explore older patients' perceptions of having PPs, who work in GP surgeries, attend to them on a home visit in place of the GP.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Patients aged 65 or older who had called the GP surgery in hours asking for a GP to visit. The six participants included three females and three males, aged 77-88 years, all of the white British ethnicity.	6
Quatman-Yates	2021	United States	Assessment of Fall-Related Emergency Medical Service Calls and Transports After a Community-Level Fall-Prevention Initiative	Investigated the impact of a community paramedic programmes optimisation of a fall prevention system entailing a clinical pathway and learning health system (called Community-FIT) on community-level fall-related emergency medical service utilisation rates	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Prevalence study	A midwestern suburban city in the USA	892 fall-related call outs

Rasku	2019	Finland	The core components of Community Paramedicine - integrated care in primary care setting: a scoping review.	This scoping review aimed to describe and analyse published empirical studies and program reports describing Community Paramedicine (CP)to find out the core components of CP.	Models of delivery to include clinical governance, supervision, and other structural supports	Systematic review	N/A	21 studies
Raynovich	2014	United States	A survey of community paramedicine course offerings and planned offerings	The feedback received from the respondents has helped to inform the curriculum development group about possible changes that can be made to improve the curriculum.	Education (including entry-level requirements)	Survey	The respondents included administrative and educator representatives of accredited post-secondary educational institutions and Government officials, all of whom had previously requested a copy of the curriculum. As such, this was a population survey and not a sample.	A total of 223 surveys were sent out and 68 (30.49%) responses were received.
Ritchie	2020	United States	Readiness of Stakeholders to Adopt Community Paramedicine Programmes in Tennessee	Aimed to explore opinions, attitudes, and beliefs among key policymakers regarding the adoption of community paramedicine programmes in Tennessee	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	EMS directors or other officials, physicians, county mayors, and home health representatives	21
Ruest	2017	Canada	Community health evaluation completed using paramedic service (CHECUPS): design and implementation of a new community based health program	Overview of design and evaluation of the implementation of CHECUPS program	Education (including entry-level requirements); Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Case report	Patients who "struggle with multiple complex and often interrelated health and social care issues	222
Ruest	2012	Canada	Evaluating the impact on 911 calls by an in-home programme with a multidisciplinary team	Review whether the use of community paramedics as part of integrated health care teams can reduce 911 calls	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Case series	On the waiting list for LTC, able to remain at home until then	27

Scharf	2017	United States	Mobile Integrated Community Health Pilot Program Descriptive Study: Diagnosis Prevalence and Comorbidity among Program Participants	Aimed to evaluate the prevalence of disease among patients in a MIH-CP pilot program	Models of delivery to include clinical governance, supervision, and other structural supports	Prevalence study	Queen Anne's County Mobile Integrated Community Healthcare Pilot Program participants	97
Schwab-Reese	2021	United States	"They're very passionate about making sure that women stay healthy": a qualitative examination of women's experiences participating in a community paramedicine program.	Aimed to evaluate women's experiences in Project Swaddle	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Qualitative research	Pregnant and postpartum women and their infants.	15
Seidl	2021	United States	Development of a Logic Model to Guide Implementation and Evaluation of a Mobile Integrated Health Transitional Care Program.	This paper describes the structured process for developing a logic model.	Models of delivery to include clinical governance, supervision, and other structural supports	Retrospective analysis	Any patient from the inpatient, observation, or ED setting who lives within the 6 eligible zip codes	450 approached, approx. 75% acceptance rate
Shah	2018	United States	Improving the ED-to-Home Transition: The Community Paramedic-Delivered Care Transitions Intervention-Preliminary Findings.	Aimed to describe the community paramedic-delivered care transitions intervention preliminary findings.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Randomised controlled trial	ED patients aged > 60 years receiving discharge home are approached and, if consenting to participate, randomized to the CTI Program or usual car.	853
Siddle	2017	United States	Mobile integrated health to reduce post-discharge acute care visits: A pilot study.	Aimed to evaluate the efficacy of a MIH led transitional care strategy to reduce acute care utilisation.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cohort study	Targeted patients suffering from Chronic Obstructive Pulmonary Disease (COPD), Pneumonia (PNA), Myocardial Infarction (MI) and Heart Failure (HF) before discharge	203

Stirling	2007	Australia	Engaging rural communities in health care through a paramedic expanded scope of practice.	Aims to contribute to understanding how ESP can improve rural health services through successful collaborations	Scope of role	Qualitative research	N/A	17
Swain	2012	New Zealand	Patient satisfaction and outcome using emergency care practitioners in New Zealand.	The purpose of this study was to determine whether patients found the UCC model of service both acceptable and effective and to ascertain whether there was any difference in satisfaction with the care provided by the two groups of paramedics, EAS or ECP.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Cross-sectional study	Patients cared for by ECPs	100
Tangherlini	2016	United States	The HOME Team: Evaluating the Effect of an EMS-based Outreach Team to Decrease the Frequency of 911 Use Among High Utilizers of EMS.	Aimed to examine the effectiveness of the HOME project to reduce repeat use of EMS.	Models of delivery to include clinical governance, supervision, and other structural supports	Retrospective analysis	Patients identified as frequent callers of EMS through a monthly list	508
Thirumalai	2021	United States	Challenges and Lessons Learned from a Telehealth Community Paramedicine Program for the Prevention of Hypoglycaemia: Pre-Post Pilot Feasibility Study	Aimed to describe the results of the feasibility evaluation, implementation challenges, and the lessons learned about the deployment of a hypoglycaemia prevention program in an under-served area	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Single-arm pre/post-test	All patients who called 911 due to hypoglycaemia-related events and met inclusion criteria	40
Thompson	2014	Australia	HWA Expanded Scopes of Practice program evaluation: Extending the Role of Paramedics sub-project	Report on the Extended Care Paramedic program in originally developed in South Australia Ambulance Service and implemented within 5 sites in New South Wales	Education (including entry-level requirements); Models of delivery to include clinical governance, supervision, and other structural supports; Outcomes from community paramedicine	Grey literature	N/A	N/A

					programmes (such as quality of life, patient satisfaction, and economic impact); Scope of role			
Thurman	2021	International	A scoping review of community paramedicine: evidence and implications for interprofessional practice.	The purpose of this scoping review was to understand the evidence base of CP to inform the further evolution of this model of care.	Models of delivery to include clinical governance, supervision, and other structural supports	Scoping review	N/A	29 articles
Tohira	2013	International	The impact of new prehospital practitioners on ambulance transportation to the emergency department: a systematic review and meta-analysis.	To conduct a systematic review and meta-analysis that examined the impact of new prehospital practitioners, including Emergency Care Practitioners (EmCPs), Paramedic Practitioners and Extended Care Paramedics (ECPs) on Emergency Department (ED) services.	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Systematic review	N/A	20 studies
van Vuuren	2021	International	Reshaping healthcare delivery for elderly patients: the role of community paramedicine; a systematic review.	Aimed to identify evidence of the community paramedicine role in care delivery for elderly patients, with an additional focus on palliative care, and the possible impact of this role on the wider healthcare system	Models of delivery to include clinical governance, supervision, and other structural supports	Systematic review	N/A	13 studies
Whalen	2018	Canada	The novel role of paramedics in collaborative emergency centres aligns with their professional identity: A qualitative analysis.	Ascertain the attitudes, feelings and experiences of paramedics working within the Nova Scotia Collaborative Emergency Centre construct within an interdisciplinary team	Models of delivery to include clinical governance, supervision, and other structural supports	Qualitative research	Paramedic clinicians providing care through the Collaborative Emergency Centre (CEC)	14
Widiatmoko	2008	United Kingdom	Developing a new response to non-urgent emergency calls:	To investigate the Fcost-effectiveness of a new service development whereby a nurse and a	Models of delivery to include clinical governance, supervision, and other	Economic evaluation	Patients involved with non-urgent emergency calls	2781

			evaluation of a nurse and paramedic partnership intervention	paramedic working in partnership attended non-urgent emergency calls	structural supports; Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)			
Xi	2021	International	Paramedics working in general practice: a scoping review	Aimed to identify key issues and gaps to inform follow-on research considering paramedics working in general practice in Ireland	Scope of role	Scoping Study	N/A	11 articles
Xie	2021	Canada	Economic Analysis of Mobile Integrated Health Care Delivered by Emergency Medical Services Paramedic Teams.	To compare time on task and cost between MIH and ambulance delivered by NEMS from a public payer's perspective	Outcomes from community paramedicine programmes (such as quality of life, patient satisfaction, and economic impact)	Economic evaluation	Patients accessing paramedic services in Niagara Region, Ontario, Canada	6959 calls

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