Rapid Review

An International Review of Emergency Care Clinical Networks

Prepared for the
BC AHSN & BC EMN

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About NAO

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Executive Summary

Clinical networks have become increasingly widespread as mechanisms to promote innovation, knowledge creation and exchange, and collaboration. They have been established internationally in emergency care (EC) to strengthen care delivery and address fragmentation across settings and providers. Clinical networks have the potential to improve quality of care and health outcomes, and enable system-wide change, but there has been limited research to date on structures and functions to guide the development and strengthening of clinical networks. Further, little is known about the prevalence of EC clinical networks (ECCNs) internationally, how they function, and what role they play in the broader efforts to strengthen health systems.

This rapid review explores the prevalence and characteristics of existing ECCNs throughout the world. Drawing on survey data and targeted web searches, we describe the structure, stated objectives, and activities of 32 ECCNs globally to identify and share promising practices that may ultimately enhance the effectiveness of these networks to improve care delivery and strengthen health systems.

The included networks share many similarities regarding their goals, target audiences, membership profiles, and communication methods. Most networks have a formal governance structure in place with defined roles for leadership, support, and decision making. The networks are also engaged in a variety of different activities, most commonly related to continuing professional development and creating or providing resources. Although all networks included physicians amongst their membership, other clinical and non-clinical stakeholders were sometimes represented within the membership profiles.

Many of the networks had encountered challenges throughout their development and expansion. Despite describing a diversity of funding sources, financial sustainability was frequently cited as a key challenge. Due to the voluntary nature of the majority of networks, active membership fluctuated over time, resulting in difficulties with member engagement. Further, limited formal evaluations of the networks' effectiveness and outcomes were available, even for networks with a longstanding presence. Further research is needed to fully understand the impact of these networks and whether they have successfully achieved their stated purposes.

Significant heterogeneity was observed across the 32 identified ECCNs, likely due to the broad inclusion employed during recruitment phases and the varied interpretation by participants regarding what constituted an "emergency care clinical network" in their jurisdiction. Future research should consider the broader context in which the networks operate in order to better understand the supporting structures and factors that contribute to their success. As well, focusing on exemplar networks to learn more about the mechanisms through which they aspire to contribute to a learning health system, whether and how they have been evaluated, and what lessons may be transferable to other networks and jurisdictions, could be useful to develop a more standardized approach to evaluating and developing clinical networks, grounded in proven strategies for success.

Introduction & Background

Clinical networks have become increasingly widespread as mechanisms to promote innovation, knowledge creation and exchange, and collaboration (1,2). Though clinical networks vary widely in their structure, purpose, and focus (3), they generally provide "a structure for clinicians to work more closely across institutional and professional boundaries, and allow for continuous working relationships and flow of knowledge about best practice between individuals and organisations" (4). By supporting the adoption of evidence-based practice, and by improving information flow among clinicians and other organizations and actors, clinical networks can help strengthen quality and appropriateness of care, improve efficiency-of-care delivery, and achieve more integrated and seamless care for patients across multiple services and providers (5,6).

In emergency care (EC), clinical networks have been established internationally to strengthen care delivery and address fragmentation across settings and providers. EC can be defined as urgent health services that cuts across "traditional disease-focused disciplines and provides prompt interventions for many disease-specific emergencies … [W]ell organized emergency care appropriately distributed across a country allows for timely coordination of services and resources, and optimum efficiency and efficacy in treating a range of acute conditions, from out-of-hospital care at the scene of an injury or illness to treatment and stabilization in the emergency unit, and early operative and intensive care" (7). Thus, EC encompasses a wide breadth of practice and care provider range, making EC providers proficient in a variety of fields (8). Further, EC providers are often tasked with executing operations in isolation from professionals in other areas of the health care system (research, policy, etc.), creating challenges in developing optimal administrative and organizational strategies within emergency departments (8,9). In response to these challenges, clinical networks such as the British Columbia Emergency Medicine Network (BC EMN) and the Alberta Emergency Strategic Clinical Network (ESCN), have been developed to generate new practice-relevant knowledge and research related to EC provision, disseminate knowledge to practice, improve uniformity-of-care practices, and provide necessary structural or academic support to EC facilities and practitioners (8,10).

Recent evaluations and systematic reviews have identified several benefits of clinical networks, including their potential to improve quality of care and health outcomes and enable system-wide change (4,5,8,9). However, there has been limited research to date on structures and functions to guide the development and strengthening of clinical networks (1,4,8,11). Also, little is known about the prevalence of EC clinical networks (ECCN) internationally, how they function, and what role they play in the broader efforts to strengthen health systems.

This rapid review explores the prevalence and characteristics of existing ECCNs throughout the world. Using a variety of international examples, this review describes the structure, stated objectives, and activities of ECCNs globally in order to identify opportunities for sharing promising practices that ultimately enhance the effectiveness of these networks to improve care delivery and strengthen health systems.

Methods

Data Collection

Data collection occurred in two phases: (i) identification of potential ECCNs, and (ii) acquisition of self-described characteristics of identified networks. All procedural materials were co-created with collaborators at the BC EMN and approved by the Office of Research Ethics at the University of British Columbia (REB #H20-02477).

We utilized the following operational definitions:

(a) Emergency Care: an urgent health service that cross cuts traditional disease-focused disciplines and provides prompt interventions for many disease-specific emergencies. Well-organized emergency care appropriately distributed across a country allows for timely coordination of services and resources, and optimum efficiency and efficacy in treating a range of acute conditions, from out-of-hospital care at the scene of an injury or illness to treatment and stabilization in the emergency unit, and early operative and intensive care (7).

(b) Clinical Network: a structure for clinicians to work more closely across institutional and professional boundaries and allow for continuous working relationships and flow of knowledge about best practices between individuals and organisations (3).

We first undertook a rapid environmental scan of grey and academic literature to identify publications relating to ECCNs and any specific networks these identified. The targeted, rapid environmental scan involved iterative searches of academic and grey literature in bibliographic databases/search engines (PubMed, Google Scholar) and websites of key organizations. A combination of broad and specific key terms related to ECCNs helped to ensure comprehensiveness (**Appendix A**).

The study population for Phase 1 consisted of all countries affiliated with the International Federation of Emergency Medicine (IFEM), categorized and studied nationally or, when appropriate, at the province/state level (see **Appendix B** for a list of IFEM members). IFEM was founded in 1991 and is an association composed of national and regional emergency medicine organizations (12). The IFEM head office supported Phase 1 both through provision of its mailing list and by participating in our email reminder process. We contacted all 68 IFEM General Assembly members and 53 state chapters of the American College of Emergency Physicians (ACEP) by email and asked them to participate in a short survey available through a REDCap link, to indicate whether or not ECCNs existed in their jurisdictions based on our operational definitions. If the member contact (physician lead or administrator) believed one or more networks existed in their jurisdiction, they were asked to provide the network name(s) and contact information (see **Appendix C**). A series of follow-up emails were sent to the network contacts who had not replied following a modified Dillman approach (13). This involved following up with network contacts 10 days from the initial invitation to participate, for a total of four times, twice by the research team and twice by the IFEM head office.

The response rates for IFEM and ACEP members in Phase 1 were 75% and 21% respectively, for a total of 60 surveys completed. This resulted in a list of 62 potential networks identified. The NAO reviewed the list of identified networks for adherence to the operational definitions and made independent inclusion/exclusion decisions in cases deemed obvious. We also excluded networks whose only focus or activity was research, and networks without contact information. Potential networks whose allocation was

not obvious were referred to the BC EMN Management Committee for adjudication, resulting in a total of 40 networks identified for inclusion in Phase 2 (**Appendix D**).

We developed a survey for Phase 2 to capture participating networks' self-reported information about their network's purpose, activities, members, organizational structure, impacts, and evaluation (see **Appendix C**). This survey, also hosted on REDCap, was first reviewed and pilot tested by the BC EMN Management Committee and the Scientific Director of the Alberta ESCN. The 40 networks identified through the Phase 1 process were invited to complete the Phase 2 survey via email. Participants could save their responses and return to complete the survey at another time. Responses were tracked and we applied a modified Dillman approach (13) to follow-up with non-respondents in an approach similar to that described for Phase 1 but only by the research team and without the direct assistance of the IFEM Head Office (i.e., following up with network contacts 10 days from the initial invitation to participate, and a total of four follow-up attempts by the research team). Two networks that were referred by another network in Phase 1 indicated that they did not complete the survey because they did not meet the criteria. Web searches were conducted for networks that did not complete the survey to determine their eligibility and, where possible, to gather the information asked in the survey. Ten networks that did not reply to the survey were included in the final dataset because the networks' websites provided sufficient information to determine eligibility and extract data.

Data Analysis

We received 24 survey responses and excluded two that did not match the eligibility requirements based on our operational definitions and criteria, resulting in a final study population for the Phase 2 survey of 22 networks (response rate 60%). Closed-ended question responses were analyzed using descriptive statistics (counts and proportions), and open-ended question responses were grouped thematically where possible. We also reviewed resources sent from network contacts in the survey such as website and journal article links, or comments referring to published work, and searched network websites to gather further information about network activities, publications, and structures.

Limitations

The sample of ECCNs included in this review should not be assumed to be comprehensive, as we relied on IFEM members and ACEP chapters to voluntarily identify ECCNs and complete a survey, and publicly available information on network websites. While many IFEM members responded in the first phase of data collection, there was a low response rate from ACEP state chapters. Terminology used to define clinical networks is inconsistent (4,14), which may have impacted the identification of networks in Phase 1 of data collection. Recruitment activities were performed in English during the COVID-19 pandemic. As such, language barriers and responding to rapidly evolving health system needs may have impacted network participation in Phase 2. Additionally, in many cases there were limited or no responses to the open-ended questions of the survey. Some networks were excluded because websites were non-existent/unknown, unavailable to the public, or could not be sufficiently translated into English. Finally, this review focused on assessing the global prevalence of clinical networks focused on EC, producing a high-level summary of their characteristics, and did not explore network processes in depth or evaluate their effectiveness.

Analytic Overview

Description and Activities

We identified and gathered information for 32 ECCNs (22 from completed surveys and 10 from website searches). **Figure 1** displays the widespread distribution of these networks worldwide, including those at the multi-national,[1] national and sub-national levels. An overview of the networks is found in **Appendix E**.
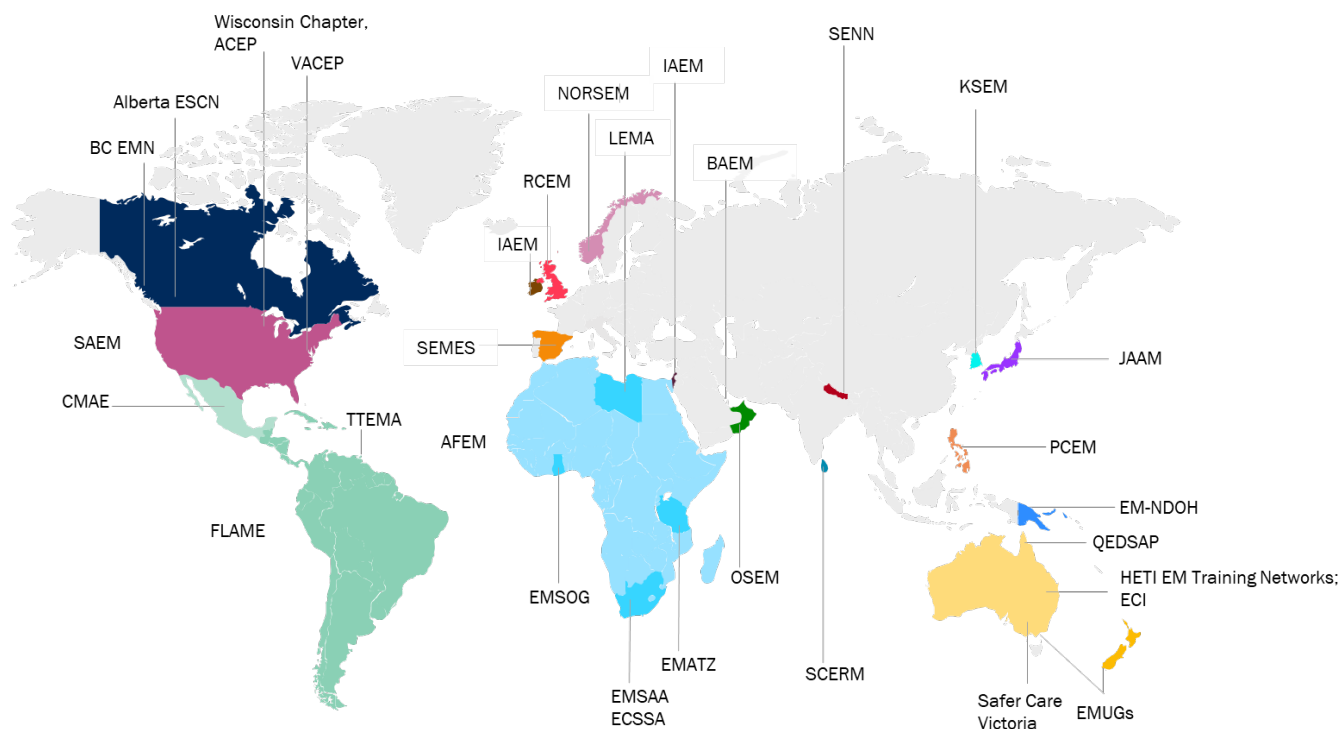

Figure 1. *Map of the included ECCNs*

These ECCNs are primarily focused on strengthening the emergency health care system by connecting emergency providers to one another, providing resources and supports, and seeking to improve patient outcomes. In line with these goals, many ECCNs provide network members with continuing education and training while simultaneously supporting the creation and dissemination of research evidence. Several networks have also adopted advisory and advocacy roles in order to further support their members and the EC profession. Limited details on the networks' advocacy efforts were available in survey responses or on network websites. However, as one concrete example, the Society for Academic Emergency Medicine's Association of Academic Chairs of Emergency Medicine (AACEM) had created a designated Member Advocacy Workgroup focused on developing strategies to "... enhance AACEM's role in unifying emergency medicine organizations [... and] maximize AACEM's involvement in legislative, regulatory, and legal issues impacting academic emergency medicine" (15). More commonly, advocacy appeared within the networks' mission statements, which articulated a goal to advocate on behalf of the profession at a global level (16,17).

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[1] The European Society for Emergency Medicine (ESEM) represents network organizations at the multi-national level. While other multi-national networks are included (FLAME and AFEM), ESEM did not identify their networks as meeting our operational definitions or respond to our surveys.

Survey respondents and network websites indicate that the most common network activities were creating and providing clinical resources and continuing professional development (**Figure 2**). Clinical resources included toolkits, rapid assessment protocols, and resource pages to assist emergency practitioners in their roles and to promote evidence-based practice. These resources often provide guidance on commonly encountered EC patient presentations. Continuing professional development included a wide range of activities, with many networks offering annual conferences, e-learning webinars, or short courses online and in-person. Further professional development activities offered by some networks included mentorship programs, and assistance in navigating academia for EC scholars (18). Some networks have established academic research journals. For example, the *South African Journal of Pre-hospital Emergency Care* (SAJPEC) is the official journal of the Emergency Care Society of South Africa (19), the Korean Society of Emergency Medicine (KSEM) established the *Journal of the Korean Society of Emergency Medicine* (20), and the Society of Academic Emergency Medicine established the *Journal Academic Emergency Medicine*.

Another activity is the provision of real-time support services to network members, which was identified in 15 (48%) of the included networks. For example, the BC EMN recently piloted and received positive feedback on a real-time virtual support service for some of its network members (8). Such services are often designed to provide 24/7 consultation services to emergency care providers to support patient care (21). Network activities also include professional rights advocacy, supporting and contributing to quality improvement and innovation, events (e.g., conferences, symposiums), public relations and awareness, and efforts to influence policy. Other activities reported by survey respondents included: opportunities for discussion between care providers, and accreditation of training programs and specialization in emergency medicine. One network (Alberta ESCN) reported engaging in "special projects" among their activities. Although details on these special projects were not provided in the survey, the network's website described a series of projects related to initiating new treatments, standardizing knowledge, education, and policies, and engaging stakeholders in research activities (22).

Network activities

Activities	
Continuing professional development	28 (90%)
Creating or providing clinical resources	28 (90%)
Research	23 (74%)
Real-time support	15 (48%)
Other	15 (48%)

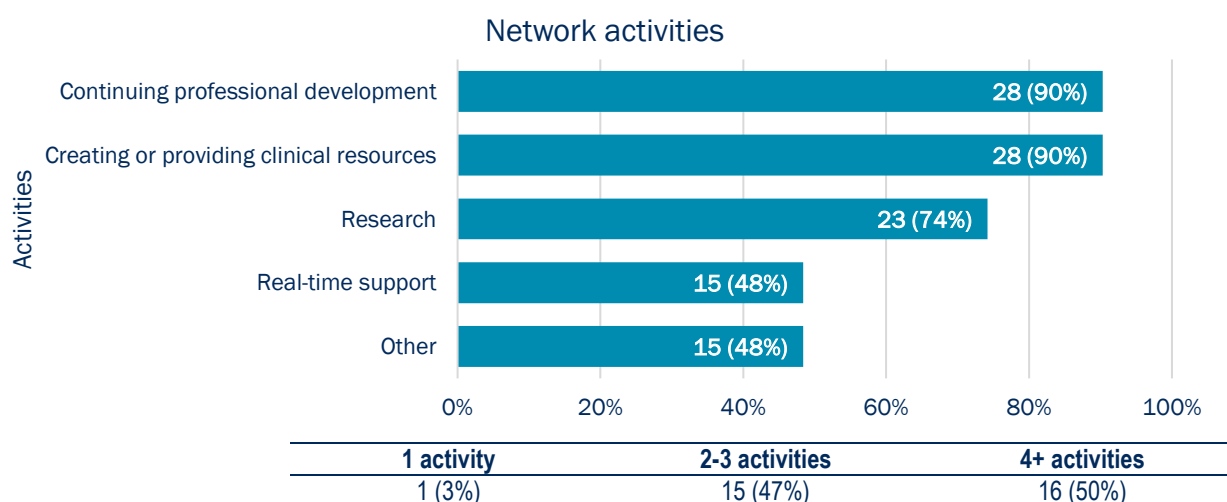| 1 activity	2-3 activities	4+ activities
1 (3%)	15 (47%)	16 (50%)

Figure 2. Network activities in the 32 ECCNs

Note. Most networks reported in the survey or indicated on their website more than one activity. "Other" activities include quality improvement initiatives, public relations, awareness and input, policy shaping, advocacy, providing opportunities for discussion by care providers, events (conferences, symposiums), and accreditation.

The primary audience for all included networks was EC providers and support staff. This is reflected by the network membership composition, all of which include physicians (n=32, 100%), nearly two-thirds include nurses (n=20, 63%), and over half include other clinical staff (n=19, 59%). By contrast, only 25% include system managers (n=8) and 16% include patient representatives and family advisors (n=5) as members (**Figure 3**). One network (Japanese Association for Acute Medicine [JAAM]) reported in the survey that patient representatives are included in their governance structure, but not as network members.
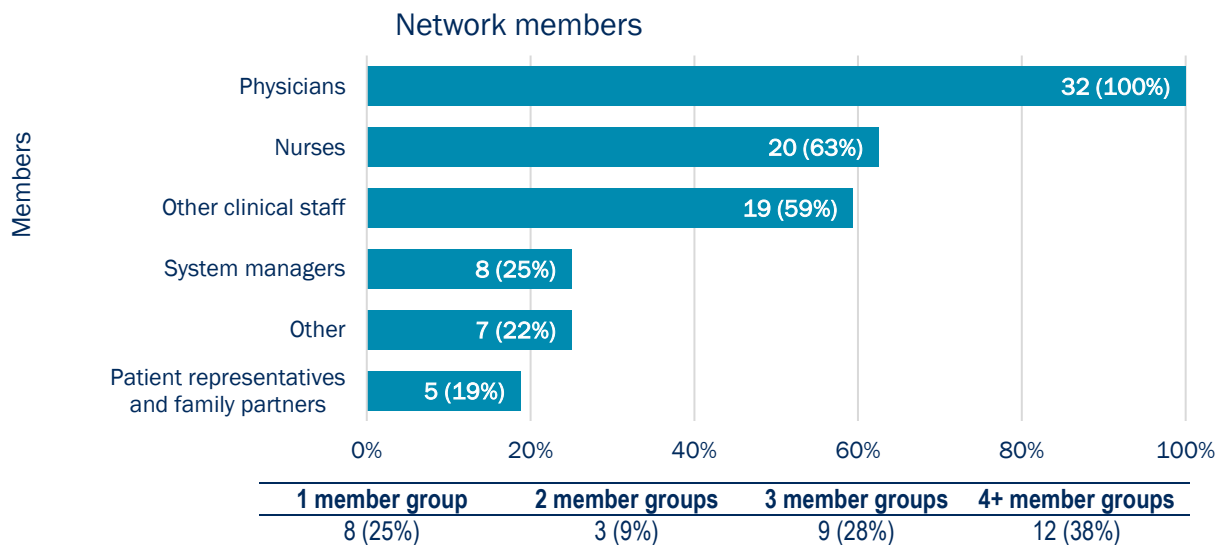
Network members

Members	%
Physicians	32 (100%)
Nurses	20 (63%)
Other clinical staff	19 (59%)
System managers	8 (25%)
Other	7 (22%)
Patient representatives and family partners	5 (19%)

1 member group	2 member groups	3 member groups	4+ member groups
8 (25%)	3 (9%)	9 (28%)	12 (38%)

Figure 3. *Network members for the 32 ECCNs*

Note. Most networks reported in the survey or indicated on their website multiple member groups by profession. "Other" network members include researchers and professors, project managers, trainees, "honorary and life members," and other "interested persons."

Organizational Structure and Learning

Networks like the Spanish Society for Emergency Medicine (SEMES) (1988) and the Royal College of Emergency Medicine in the United Kingdom (UK) are long established (1967), while other networks like the Israeli Society for Emergency Medicine and the Society of Emergency Nurses for Nepal (SENN) were launched as recently as 2019. **Table 1** shows that most networks were developed by EC providers/network members. The BC EMN respondent added that academic physicians aided in the network's development. In the case of the Society for Academic Emergency Medicine in the United States, this group emerged from the amalgamation of providers and members of the University Association for Emergency Medicine and the Society of Teachers and Emergency Medicine. Details about who developed the ECCN could not be found for 8 of the 10 networks for which we relied on website information.

Table 1. Who developed the emergency care clinical network?

Response	Count (%)
Providers/network members	14 (44%)
Health system managers/administrators	4 (13%)
Providers/network members AND health system managers/administrators	5 (16%)
Not reported/available	8 (25%)
Providers/network members AND academic physicians	1 (3%)
Total	32 (100%)

Nearly all of the networks have a formal governance structure in place (n=28, 88%). The networks often adopt a traditional organizational structure, comprised of network members, leaders, and boards. Coordinators, directors, board members, or an executive director/committee are often responsible for network activities and operations. It was seen that the networks utilized different committees and working groups to support the network's objectives and plans. For example, the Royal College of Emergency Medicine (RCEM) in the UK includes committees focused on corporate management, education, international/global health, professional affairs, quality in emergency medicine, research and publications, training standards, and also a public advisory group (23). Networks often partnered with other organizations aligned with their perspectives and shared objectives in order to facilitate the achievement of mutual goals. These partners included national medical associations, governmental and non-governmental organizations, other research and clinical networks, and universities or colleges.

Website searches found that some networks describe their membership categories based on the qualifications, background, and interests of the stakeholder. For example, the Emergency Medicine Association of Tanzania offers a full membership category for persons "involved in education, research and/or patient care in the field of emergency medicine" and an affiliate member category for any persons "with an interest in emergency medicine" (24). Depending on the network, membership may come with a variety of benefits including voting rights, reduced fees for educational resources and conferences, and opportunities to contribute on network committees. Membership fees may also vary based on the membership categories, but details about membership fees and member benefits were not asked in the survey.

Networks reported varied membership sizes and proportions of active members. The two smallest networks both reported 25 network members (Queensland [Australia] Emergency Department Strategic Advisory Panel; Christus Muguerza Alta in Mexico), whereas the larger networks had memberships of around 10,000 (JAAM; RCEM). The percentage of active members within the networks ranged from roughly 10% to over 90%. In some cases, membership included organizations and emergency departments. **Figure 4** displays the distribution of member size and proportion of active members.
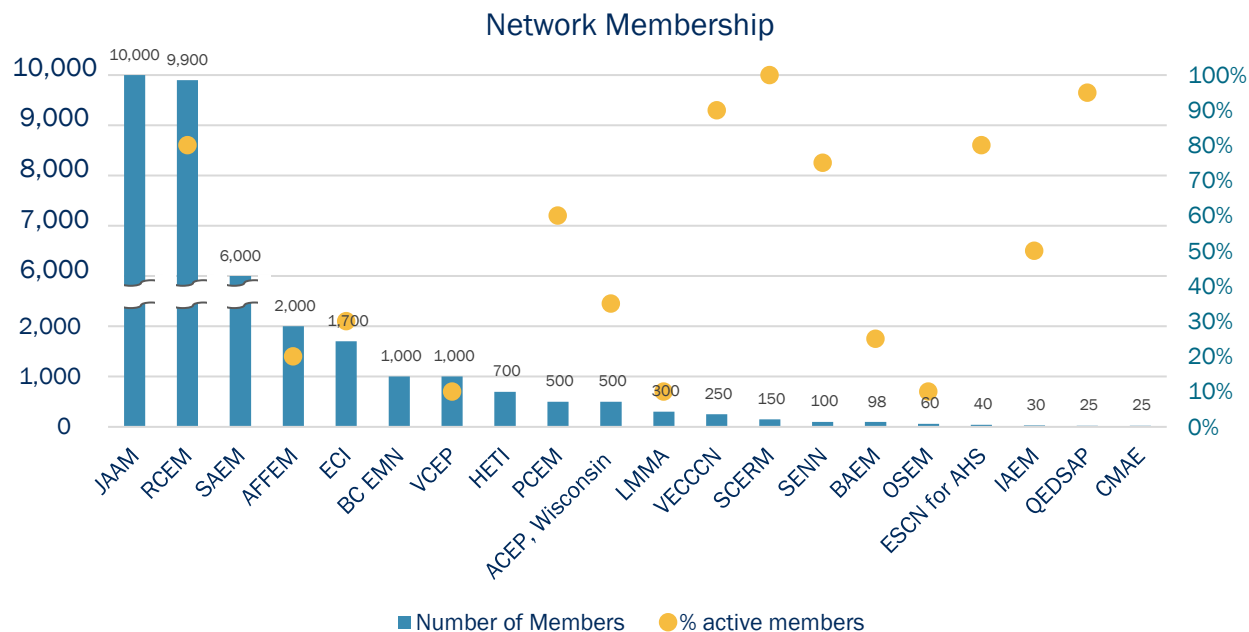
Figure 4. *Network membership size and active members*

Note. The number of network members was not reported by all of the survey respondents and unavailable on network websites. The proportion of active members was not reported for JAAM, SAEM, BC EMN, and HETI.

Funding

Over half (n=20, 63%) of the networks reported receiving some type of funding, most of which is ongoing rather than fixed term (**Table 2**). Funding sources for the networks are diverse and commonly include funding from governmental and non-governmental organizations (n=8), conferences and events (n=3), and grants (n=2). Some networks also receive funding through membership or subscription fees (n=11), and two networks noted fundraising, donations, and book publication royalties as funding sources. Survey participants from 10 networks reported that their network does not receive any funding, and funding information was not reported or available for two networks.

Table 2. Network funding

Question	Count (%)
Do you have any sources of funding?	
Yes	20 (63%)
No	10 (31%)
Not reported/available	2 (6%)
Total	32 (100%)
If yes (n=20): What is the funding period?	
Ongoing	17 (85%)
Fixed term	2 (10%)
Variable	1 (5%)
Total	20 (100%)

Network engagement and communication

According to survey respondents, participation in the networks is largely voluntary (n=21, 66% of networks studied). Two networks mandate participation among eligible stakeholders (Society of Emergency Nurses for Nepal; Papua New Guinea National Department of Health). However, further details about how participation is mandated, and for which members, are unknown.

Technology is widely used by the networks to facilitate information exchange, such as through social media (e.g., Facebook, Twitter), web-based applications (e.g., SharePoint), and email-listservs. Survey respondents indicated that some networks also utilize direct letter communication, messaging applications (e.g., WhatsApp), in-person meetings or events, and newsletters (**Figure 5**). Network websites are often central to the networks' communication strategies, acting as a hub to access information and resources as well as connect network members. Some websites offer private discussion and feedback forums for their network members (8).
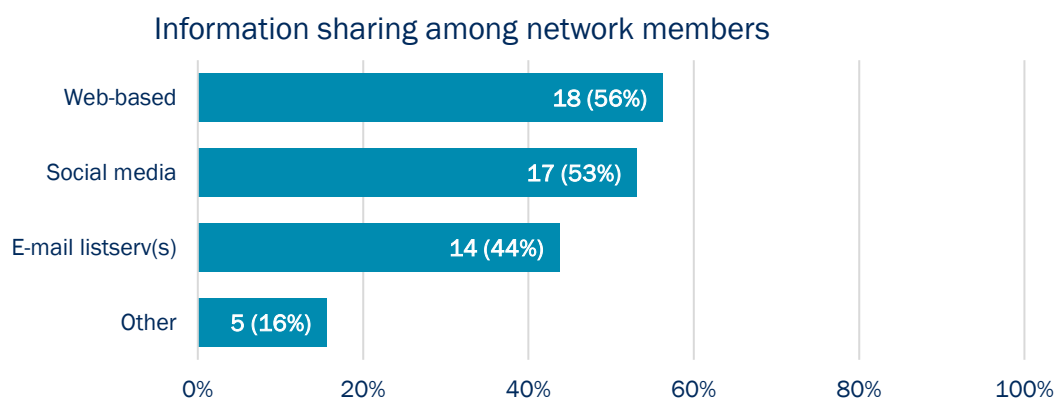
Information sharing among network members

Category	Value
Web-based	18 (56%)
Social media	17 (53%)
E-mail listserv(s)	14 (44%)
Other	5 (16%)

Figure 5. Information sharing among network members (survey respondents, n=22)

Note. "Other" information sharing includes face-to-face interaction, WhatsApp mobile application, letters, and newsletters.

Challenges

12 networks (55%) reported that they encountered challenges in establishing their network, though few details and examples were provided in the survey responses. The challenges described relate to resources and funding, membership engagement, sustainability, ongoing governance, and role definition. One network in Australia cited an "initial resistance to sharing resources between sites."

> Getting a critical mass in the early days was difficult, however [it] was the key to success.

> Many challenges, and still going. Mostly it's volunteer work, no income, change is always difficult for other organizations, we lack authority and power, and above all funding.

Five networks also described unanticipated outcomes or consequences of the network that were similar to the initial challenges noted above, such as membership fluctuations and insufficient funding. Structural challenges for decision making (e.g., lack of representation from certain stakeholders), planning conferences and other events, and the impact of COVID-19 cancelling events were also acknowledged. The Alberta ESCN noted research "wins" through the Partnership for Research and Innovation in the Health System (PRIHS) program that promotes health research collaboration between academic institutions, researchers, patients, and Alberta Health Services (25).

Impacts and Evaluation

As shown in **Table 3**, only one-third of survey respondents reported that their network measured impacts (n=8), and even fewer had established a formal evaluation of their network (n=3, 10%). Of the three networks with established formal network evaluation, two performed their evaluation internally and published their findings in academic journals (1,10,11,26). The other network utilized an external evaluation, and the formal report was not available online. **Appendix F** summarizes the key findings from these published network evaluations. Details about how other networks have measured impacts and utilized their findings were not offered in the survey and limited public information is available on their websites.

Table 3. Impacts and evaluation

Question	Count (%)
Do you measure any impacts of your network?	
Yes	8 (25%)
No	14 (44%)
Not available/reported	10 (31%)
Total	32 (100%)
Has your network been formally evaluated?	
Yes	3 (9%)
No	19 (59%)
Not available/reported	10 (31%)
Total	32 (100%)

Conclusion and Future Directions for Research

This review identified and described 32 ECCNs that have been established across the world at multi-national, national, and sub-national levels. These networks share many similarities regarding their goals, target audiences, membership profiles, and methods for sharing information and engaging with members. In addition, nearly all of the included networks have a formal governance structure in place with defined roles for leadership, support, and decision making. Despite the many similarities, the networks also demonstrated differences in their network activities, membership requirements, and funding models, reflecting the fact that our operational definitions were broad and relied on the interpretation of those surveyed in Phase 1 to identify potential networks.

Many of the networks had encountered challenges throughout their development and expansion. Notably, although the networks reported a diversity of funding sources, financial sustainability was frequently cited as a key challenge. Due to the voluntary nature of the majority of networks, active membership can also fluctuate over time, resulting in difficulties with member engagement.

Despite the longstanding presence of many of the networks, limited formal evaluations of their effectiveness and outcomes were available. For the BC EMN, network evaluations led to an improved understanding of its members' perceptions and the identification of success factors, contributing to a change in the network's design (1). Common measures evaluated by the networks included online engagement, and survey and interview data. However, further research is needed to fully understand the impact of these networks and whether they have successfully achieved their stated purposes. Formal evaluations that demonstrate the performance and outcomes associated with these networks may also help to secure more sustainable financial support from governments and donors.

Future Work and Learning Health Systems

Significant heterogeneity was observed across the 32 identified networks, likely due to the broad inclusivity of the definitions we employed, and the resultingly varied interpretations by participating IFEM members regarding what constituted an "emergency care clinical network" in their jurisdiction. Future research should consider the broader context in which networks operate in order to gain a better understanding of the supporting structures and factors that contribute to their success. Detailed information on the networks' implementation processes, governance, and decision making is warranted. In addition, the networks' strategies for engaging their membership in these administrative processes would provide valuable insight towards their long-term potential, as a recent review suggested that a combined "bottom-up" and "top-down" approach should be implemented in clinical networks to maintain engagement and allow for decentralized decision making (4).

As illustrated by the BC EMN in Canada, some ECCNs appear to have aligned their objectives and functions with the goals of a "learning health system." Learning health systems depend on routine evidence generation and application to drive improvements in care; they are systems "in which progress in science, informatics and care culture align to generate new knowledge as an ongoing natural by-product of the care experience and seamlessly refines and delivers best practices for continuous learning in health and healthcare" (27). Moreover, learning health systems "require vision, leadership and infrastructure to flourish" (28). In order to identify a subset of EC networks globally that may contribute to a learning health system, we propose two broad criteria: 1) EC networks that support the timely collection, analysis, and dissemination of comprehensive data across the system; and 2) EC networks that leverage these data and

analytics to support practice-level and system-level change. While there is limited detail about the timeliness and comprehensiveness of data across the system, 11 of the ECCNs in this study appear to demonstrate stronger evidence that their network supports the goals of a learning health system (**Box 1**).

An in-depth case study of exemplar ECCNs from across the globe would help to provide greater insights on their function, utility, and feasibility for adoption in other jurisdictions. Moreover, a larger body of literature already exists to evaluate the impact of clinical *research* networks, and the data collection strategies used in these evaluations are likely highly transferrable to this work. Exemplar cases could include networks that function or aspire to function as a learning health system, combine "bottom-up" and "top-down" processes for engagement and decision making, have been formally evaluated, those that engaged unique stakeholder groups, those that offer a unique combination of services, or those with similar goals and structures. Such a case study could incorporate data from both network members and leaders to obtain a comprehensive understanding the network's dynamics and evolution over time.

Future work may consider focusing on exemplar networks to learn more about the mechanisms through which they aspire to contribute to a learning health system, whether and how they have been evaluated, and what lessons may be transferable to other networks and jurisdictions. This information could be used in turn to develop a more standardized approach to evaluating and developing clinical networks, grounded in proven strategies for success.

Box 1. ECCNs that may support goals of a learning health system

- BC Emergency Medicine Network (BC EMN)
- Emergency Care Institute
- Emergency Care Society of South Africa (ECSSA)
- Emergency Medicine Association of Tanzania (EMAT)
- Emergency Medicine Society of South Africa (EMSSA)
- Emergency Strategic Clinical Network for Alberta Health Services (ESCN for AHS)
- HETI Emergency Medicine Training Networks
- Irish Association for Emergency Medicine (IAEM)
- Korean Society of Emergency Medicine (KSEM)
- Society for Academic Emergency Medicine (SAEM)
- Spanish Society for Emergency Medicine (SEMES)

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Appendix A. Environmental Scan

We performed targeted and iterative searches of academic and grey literature in the bibliographic databases/search engines PubMed and Google Scholar, as well as websites of key organizations (ML). Separate searches were carried out for each selected jurisdiction and used both broad and specific terms related to emergency care networks, to ensure comprehensiveness.

The environmental scan focuses on managed and non-managed clinical networks defined as: *"voluntary clinician groupings that aim to improve clinical care and service delivery using a collegial approach to identify and implement a range of quality improvement strategies"* (4).

Academic Literature Search

Search term(s)	Results	Included
PubMed		
"emergency care clinical network"	0	
"emergency medicine clinical network"	0	
Emergency AND "clinical network"	115	1 reviewed & included: McLane et al., 2019
"emergency network"	60	0
"emergency care network"	20	0
"emergency medicine network"	61	6 reviewed: Abu-Laban et al., 2018; Abu-Laban et al., 2019; Blumberg et al., 2017 (excluded - research network study); Chun, 2014 (excluded - research network); Horner et al., 2013 (excluded - assessment of a guideline); New Zealand Emergency Medicine Network, 2015
Google Scholar		
"emergency care clinical network"	9	2 reviewed: Bamert, 2009; Kelly et al., 2017 (not available/accessible)
"emergency medicine clinical network"	0	
emergency AND "clinical network"	3500	
"emergency network"	6320	
"emergency care network"	479	2 reviewed & included: Drebit et al., 2020*; Turner et al., 2007
"emergency medicine network"	716	2 reviewed & included: Christenson, 2014; Johnston et al., 2019

* checked "related articles" for Drebit 2020 = 32 results; 1 included (Mork et al., 2019)

Grey Literature Search

Website/Search term(s)	Included
American College of Emergency Physicians website	PDF of 53 Chapter Offices contact information
IFEM website	Pediatric Emergency Medicine Special Interest Group (International)
Google search "emergency care network" "emergency medicine network" "emergency clinical network"	BC Emergency Medicine Network (BC, Canada) Emergency Strategic Clinical Network (AB, Canada) Emergency Care Institute (NSW, Australia) Emergency Care Clinical Network (Victoria, Australia)

Appendix B. List of IFEM Members

IFEM Member		Website
AAEM	American Academy of Emergency Medicine	https://www.aaem.org/
ABRAMEDE	Brazilian Association for Emergency Medicine	https://www.abramede.com.br/
ACEM	Asociación Colombiana de Especialistas en Medicina de Urgencias y Emergencias	https://www.acemcolombia.com/
ACEM	Australasian College for Emergency Medicine	https://acem.org.au/
ACEP	American College of Emergency Physicians	https://www.acep.org/
ACOEP	American College of Osteopathic Emergency Physicians	https://osteopathic.org/
AFEM	African Federation for Emergency Medicine (AFEM)	https://afem.africa/
ASEM	Asian Society for Emergency Medicine	http://www.asiansem.org/
ASOCOME	Asociación Costarricense de Medicos Emergenciólogos	https://www.asocome.com/
ASPAME	Asociación Panamena de Medicina de Emergencias	n/a
BAEM	Bahrain Association of Emergency Medicine	http://www.bemc-bh.com/index1#intro
CAEP	Canadian Association of Emergency Physicians	https://caep.ca/
CEPAMM	College of Emergency Physicians, Academy of Medicine Malaysia	https://www.mycep.org/
DASEM	Danish Society for Emergency Medicine	http://www.dasem.dk/en/danish-society-for-emergency-medicine/
DGINA	German Association for Emergency Medicine GAfEM/DGINA	https://www.dgina.de/
EMAT	Emergency Medicine Association of Turkey	https://www.tatd.org.tr/
EMATZ	Emergency Medicine Association of Tanzania	http://www.emat.or.tz/
EMSOG	Emergency Medicine Society of Ghana	https://emsog.org/
EMSSA	Emergency Medicine Society of South Africa	https://emssa.org.za/
ESEM	Emirates Society of Emergency Medicine	https://esem.ae/
EUSEM	European Society for Emergency Medicine	https://eusem.org/
FLAME	Federación Latinoamericana de Medicina de Emergencias	flameoficial.com
FSEM	Finnish Society of Emergency Medicine	https://www.akuuttilaaketiede.fi/
GEMPA	Georgian Emergency Medicine Physicians Association	n/a
GFEM	Gulf Federation of Emergency Medicine	https://www.gfem2020.com/
HKCEM	Hong Kong College of Emergency Medicine	https://hkcem.org.hk/
IAEM	Irish Association for Emergency Medicine	http://www.iaem.ie/
Icelandic SEM	Icelandic Society for Emergency Medicine	https://emc-hmfp.org/project/icelandic-emergency-medicine-initiative-iemi/
Iraqi SEM	Iraqi Society for Emergency Medicine	n/a
ISEM	Iranian Society of Emergency Medicine	https://www.isem.ir/
Israeli AEM	Israeli Association for Emergency Medicine	n/a
JAAM	Japanese Association for Acute Medicine	https://www.jaam.jp/english/english-top.html
KSEM	Korean Society of Emergency Medicine	https://emergency.or.kr/

LEMA	Libyan Emergency Medicine Association	https://lema.org.ly/
MASTEM	Malaysian Society for Traumatology and Emergency Medicine	n/a
MSOTKE	Hungarian Association for Emergency Medicine	http://msotke.hu/
NORSEM	Norwegian Society for Emergency Physicians	https://www.norsem.org/
NSEP	Nepalese Society of Emergency Physicians	https://www.facebook.com/pages/category/Community-Organization/Nepalese-Society-of-Emergency-Physicians-129960014380349/
NVSHA	Dutch Society of Emergency Physicians	https://www.nvsha.nl/
OSEM	Oman Society of Emergency Medicine	Omanemergency.org
PaSEM	Pakistan Society of Emergency Medicine	https://www.psem.com.pk/
PACEMD	Pan American Collaborative Emergency Medicine Development Program	https://www.pacemd.org/
PNGSEM	Papua New Guinea Society for Emergency Medicine	n/a
PCEM	Philippine College of Emergency Medicine	https://pcem.ph
PSEM	Polish Society for Emergency Medicine	https://medycynaratunkowa.com.pl/
RCEM	Royal College of Emergency Medicine	https://www.rcem.ac.uk/
RECA	Rwanda Emergency Care Association	https://www.recaonline.org/
SAE	Sociedad Argentina de Emergencias	https://sae-emergencias.org.ar/
SAEM	Society for Academic Emergency Medicine	https://www.saem.org/
SASEM	Saudi Society of Emergency Medicine	n/a
SEMES	Spanish Society of Urgency and Emergency Medicine	https://www.semes.org/
SEMI	Society for Emergency Medicine, India	https://www.semi.org.in/
SEMPON	Society of Emergency Medicine Practitioners of Nigeria	https://sempon.org.ng/
SEMS	Society for Emergency Medicine in Singapore	https://www.semes.org/
SEPA	Sudanese Emergency Physicians Association	https://www.facebook.com/semssudan/
SGNOR	Swiss Society of Emergency and Rescue Medicine	https://www.sgnor.ch/index.php?id=36
SMME	Sociedad Mexicana de Medicina de Emergencia	n/a
SOCHIMU	Sociedad Chilena de Medicina de Urgencias	https://www.sochimu.cl/
SODOEM	Sociedad Dominicana de Emergenciología	n/a
SPEM	Sociedad Paraguaya de Emergencias Medicas	https://spem.org.py/
SPMED	Sociedad Peruana de Medicina de Emergencias y Desastres	https://www.spmed.org.pe/
SSCCEM	Sri Lankan Society of Critical Care and Emergency Medicine	n/a
SWESEM	Swedish Society for Emergency Medicine	http://swesem.org/
TCEP	Thai College of Emergency Physicians	https://www.taem.or.th/
TSEM	Taiwan Society of Emergency Medicine	https://www.sem.org.tw/
TTEMA	Trinidad and Tobago Emergency Medicine Association	https://www.ttema.org/
VSEM	Vietnamese Society of Emergency Medicine	n/a
YAEMD	Yemeni Association of Emergency Medicine and Disaster	n/a

n/a = not available or broken weblink

Appendix C. Recruitment Materials

C1. Identifying Networks Survey

The North American Observatory on Health Systems and Policies (NAO) is conducting a review to identify and characterize emergency care clinical networks throughout the world. This project is being conducted by the NAO in partnership with the British Columbia Emergency Medicine Network, and with funding from the British Columbia Academic Health Science Network.

1) Your Name: _____

2) What IFEM Member, Country, or State do you represent? _____

We would like to know whether you are aware of any emergency care clinical networks based on the following definitions:

(a) Emergency Care: an urgent health service that cross cuts traditional disease-focused disciplines and provides prompt interventions for many disease-specific emergencies. Well-organized emergency care appropriately distributed across a country allows for timely coordination of services and resources, and optimum efficiency and efficacy in treating a range of acute conditions, from out-of-hospital care at the scene of an injury or illness to treatment and stabilization in the emergency unit, and early operative and intensive care.

(b) Clinical Network: a structure for clinicians to work more closely across institutional and professional boundaries and allow for continuous working relationships and flow of knowledge about best practice between individuals and organisations.

3) Are there any networks or groups that could be considered an emergency care clinical network in your jurisdiction?

Yes or Maybe _____

No _____

If "Yes" or "Maybe", please provide us with the name of the emergency care clinical network(s) and if possible, contact information for someone who might be able to answer a brief 15-minute survey about the network.

Emergency care clinical network name(s): _____

Emergency care clinical network contact(s) (email): _____

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C2. Network Survey Questions

In the survey, when we use the terms "emergency care" and "clinical network" this is based on the following definitions:

- *Emergency Care:* an urgent health service that cross cuts traditional disease-focused disciplines and provides prompt interventions for many disease-specific emergencies. Well-organized emergency care appropriately distributed across a country allows for timely coordination of services and resources, and optimum efficiency and efficacy in treating a range of acute conditions, from out-of-hospital care at the scene of an injury or illness to treatment and stabilization in the emergency unit, and early operative and intensive care.

- *Clinical Network*: a structure for clinicians to work more closely across institutional and professional boundaries and allow for continuous working relationships and flow of knowledge about best practice between individuals and organizations.

Name of your emergency care clinical network:

The state/province, region, country, or organization covered by your network:

Website link to your emergency care clinical network (if applicable):

Email address of a contact person for your emergency care clinical network:

Description and Activities of Emergency Care Clinical Network

1) What are the primary goals and target audience of your network? _____

2) What activities are part of your network? *Please check all that apply*
    i. creating or providing clinical resources
    ii. research
    iii. continuing professional development
    iv. real-time support
    v. other (please describe) _____

3) Who are the members of your network? *Please check all that apply*
    i. physicians
    ii. nurses
    iii. other clinical staff
    iv. system managers
    v. patient representatives (e.g., senior executives of health authorities)
    vi. other (please describe) _____

4) How many members are in your network (if applicable)? _____
    a. Out of these members, can you give an approximate percentage of members who actively engage and participate in your network? _____

5) If your network represents organizations (e.g., hospital emergency departments), please list the nature of these organizations _____
    a. Out of these organizations, can you give an approximate percentage of organizations who actively engage and participate in your network? _____

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6) Does your network have sources of funding?
If YES, what is (are) the funding source(s)? _____
If YES, what time period does this funding cover?
    i) fixed term ii) ongoing iii) other (please specify) _____

Organizational Structure and Learning in Emergency Care Clinical Network

1) What year was your network launched?

2) Was the network developed by health system managers/administrators and/or by providers/network members?

3) Who is responsible for network activities and operations? (e.g., coordinator)

4) Does your network have a formal governance structure? YES __ NO __
If YES: Do you include patients or members of the public in your formal structure? YES __ NO __

5) Is membership voluntary or mandated in your network? YES __ NO __

6) How do members of your network engage with one another? _____

7) How does your network share information among members? *Please check all that apply*

8) Have you encountered any challenges in establishing your network? YES __ NO __
If YES, please describe: _____

Impacts and Evaluation of Emergency Care Clinical Network

1) Do you measure any impacts of your network? (e.g., impact on patient outcomes or sharing between members or organizations) YES __ NO __

2) Has your network been formally evaluated? YES __ NO __
If YES,
    i.   Do you have a formal evaluation framework? YES __ NO __
    ii.   Please describe what indicators are included: _____

3) Have there been any unanticipated outcomes or consequences of your network?
Please describe: _____

4) Do you share information you have learned through your network with those outside the network? YES __ NO __   If YES, please describe: _____

Additional Comments and Consent

1) Do you have any additional resources on your network you could share with us? _____

2) Do you consent to be contacted by email for follow-up if we require further information?
YES __ NO __

3) Would you like to receive a link to the study report by email? YES __ NO __
If YES to 2) or 3), please enter your email address here: _____

4) I have read and understand the survey information and submission of this survey indicates my consent to participate in the study: YES __ NO __

Please click "submit" to submit your responses.
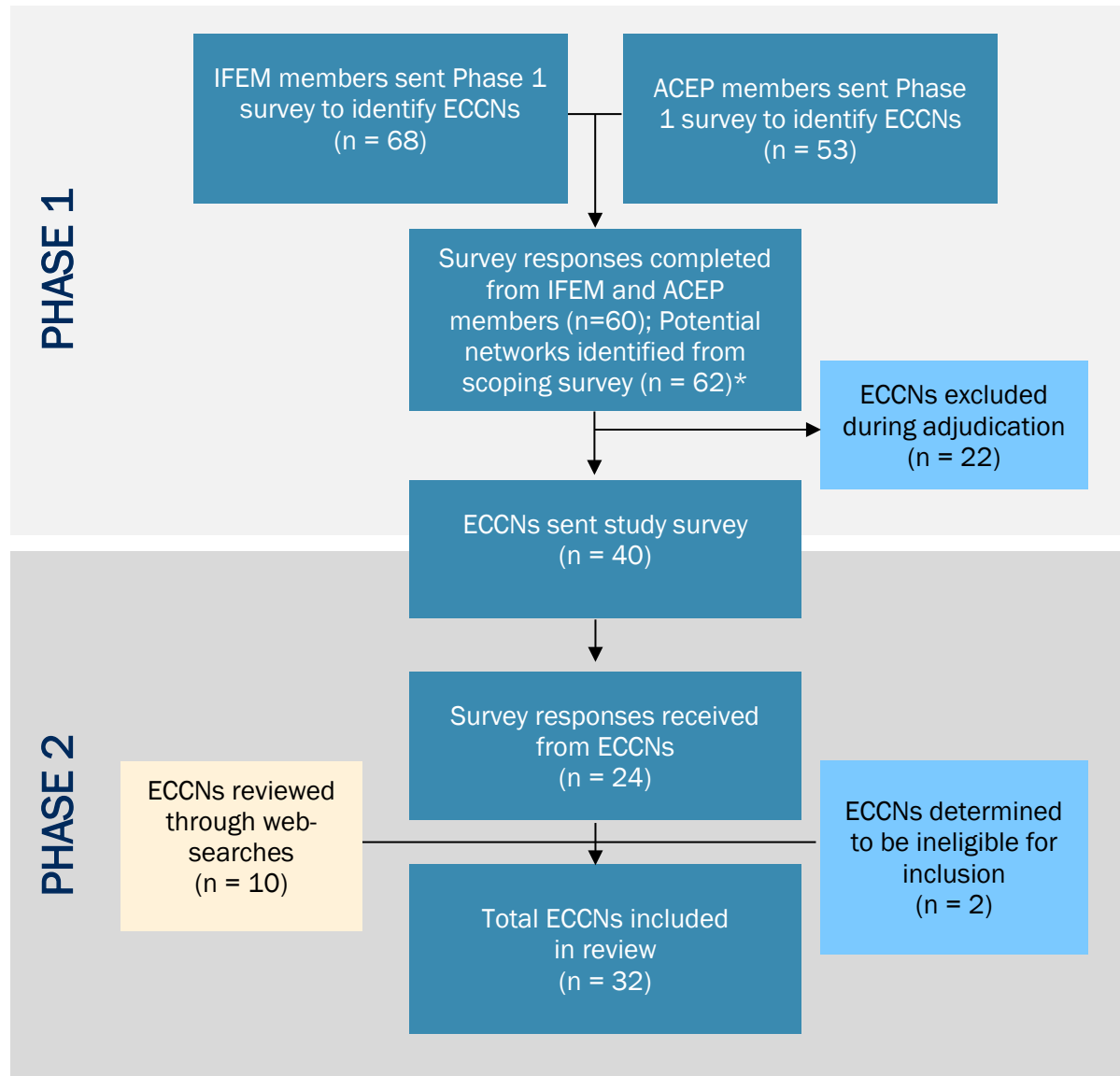
Appendix D. Study sample

Figure D1. Flow diagram depicting network identification and inclusion

Some survey respondents indicated more than one potential network.

Appendix E. Overview of Emergency Care Clinical Networks

Table E1. List of ECCNs included in the study

Network Name	Jurisdiction	Year established	Approx. # of members	Voluntary or mandated	Formal evaluation
African Federation for Emergency Medicine (AFEM)	Africa	2009	2,000+	Voluntary	✗
Emergency Medicine Ultrasound Group (EMUGs)	Australia & New Zealand	2015	n/a	Voluntary	✗
Health Education and Training Institute (HETI), Emergency Medicine Training Networks	Australia (New South Wales)	2009	700	Voluntary	✓
Emergency Care Institute (ECI)	Australia (New South Wales)	2009	1.700	Voluntary	✗
Queensland Emergency Department Strategic Advisory Panel (QEDSAP)	Australia (Queensland)	2006	25	Voluntary	✗
Victorian Emergency Care Clinical Network (Safer Care Victoria)	Australia (Victoria)	2017	250+	Voluntary	✗
Emergency Strategic Clinical Network (ESCN)	Canada (Alberta)	2011	40	Voluntary	✓
BC Emergency Medicine Network (BCEMN)	Canada (British Columbia)	2017	1,000	Voluntary	✓
Emergency Medicine Society of Ghana (EMSOG)	Ghana	n/a	n/a	n/a	n/a
Irish Association for Emergency Medicine (IAEM)	Ireland	1989	n/a	n/a	n/a
Israeli Association for Emergency Medicine (IAEM)	Israel	2019	30	Voluntary	✗
Japanese Association for Acute Medicine (JAAM)	Japan	1973	10,000	Voluntary	✗
Bahrain Association of Emergency Medicine (BAEM)	Kingdom of Bahrain	2014	98	Voluntary	✗
Korean Society of Emergency Medicine (KSEM)	Korea	1973	n/a	Voluntary	n/a
Federación Latinoamericana de Medicina de Emergencias (FLAME)	Latin America	2019	13[2]	Voluntary	✗
Libyan Emergency Medicine Association (LEMA)	Libya	2013	300	n/a	n/a
Christus Muguerza Alta Especialidad (CMAE)	Mexico	2010	25	Voluntary	✗
Society of Emergency Nurses for Nepal (SENN)	Nepal	2019	100+	Mandated	✗
Norwegian Society for Emergency Medicine (NORSEM)	Norway	2010	n/a	Voluntary	n/a

[2] FLAME's membership consists of 13 Latin American Societies.

Oman Society of Emergency Medicine (OSEM)	Oman	2013	60	Voluntary	✕
Emergency Medicine – National Department of Health (EM-NDOH)	Papua New Guinea	2010	n/a	Mandated	✕
Philippine College of Emergency Medicine (PCEM)	Philippines	2009	500	Voluntary	✕
Emergency Medicine Society of South Africa (EMSSA)	South Africa	n/a	n/a	n/a	n/a
Emergency Care Society of South Africa (ECSSA)	South Africa	2011	n/a	n/a	n/a
Spanish Society for Emergency Medicine (SEMES)	Spain	1988	n/a	n/a	n/a
Sri Lankan College for Emergency and Retrieval Medicine (SCERM)	Sri Lanka	2019	150	Voluntary	✕
Emergency Medicine Association of Tanzania (EMAT)	Tanzania	2011	n/a	Voluntary	✕
Trinidad and Tobago Emergency Medicine Association (TTEMA)	Trinidad and Tobago	n/a	n/a	n/a	n/a
The Royal College of Emergency Medicine (RCEM)	United Kingdom	1967	9,900	Voluntary	✕
Society for Academic Emergency Medicine (SAEM)	USA	1989	n/a	n/a	n/a
Virginia College of Emergency Physicians	USA (Virginia)	1978	1,000	Voluntary	✕
Wisconsin Chapter – American College of Emergency Physicians (ACEP)	USA (Wisconsin)	1971	500	Voluntary	✕

Appendix F. Summary of Emergency Care Clinical Network Evaluations

Table F1. Summary of ECCN evaluations

Author/Year	Network/Jurisdiction	Methods	Key Findings
Abu-Laban, 2019	BC EMN British Columbia, Canada	Description of the process undertaken to inform the development of the BC EM Network: (1) a scoping literature review, (2) a survey of BC emergency practitioners and EM residents (n=208), (3) key informant interviews, (4) focus groups in sites across BC, and (5) establishment of a brand identity.	• Survey results: 84% reported consulting internet resources once or more per emergency department shift; however, 26% reported feeling neutral, somewhat unsatisfied, or very unsatisfied with searching for information on the Internet to support their practice. • Enthusiasm was expressed for envisioned BC EM Network resources, and the key informant interviews and focus group results helped identify and refine key desired components of the BC EM Network. • Success factors included: hiring an external consulting and creative firm, hiring a manager, advocacy for a distributed leadership model. • Identifying early challenges and gathering feedback from their broad EM network community led to changes in the design and evolution of the BCEMN.
Drebit, 2020	BC EMN British Columbia, Canada	A patient evaluation framework was developed internally using literature and BC EM Network patient partner input to answer the following key questions regarding patient engagement (PE): 1. Is the appropriate structure in place to support PE activities? 2. Are patient partners actively engaged in the EM Network? 3. Does the EM Network have a participatory/collaborative culture such that patients are true partners? 4. How have patient partners influenced/impacted the EM Network?	• The Organizational Questionnaire was distributed to 43 nonpatient partners leads within the EM Network, 16 (37%) of whom completed the survey. • Participants indicated the level of PE was appropriate but still at an early stage. • They had good awareness of PE activities but indicated more communication was needed to inform the broader BC EM Network membership. It was also noted that as the BC EM Network expands, its PE efforts should also expand and that such expansion should include the requisite resources.
Marsden, 2019	BC EMN British Columbia, Canada	The overall function of the BC EM Network after 1 year of operation was evaluated by: (1) analyzing membership and online engagement data and by conducting an online quantitative	• During the study period, the BC EM Network consisted of 622 of 1400 eligible members (44%) from 79 of 108 emergency care sites in BC (73%). Each month an average of 999 active users visited the website.

		survey: and (2) through subsequent qualitative interviews to obtain member feedback. Google Maps, Google Analytics, and Twitter Analytics were used, as well as PARTNER (Program to Analyze, Record, and Track Networks to Enhance Relationships), a validated social network analysis tool.	• Survey respondents perceived the network to be credible and respected, but more attention is required to clearly communicate and establish its purpose and offerings. • Averaged scores for the perceptions of survey respondents regarding three network values (power/influence, involvement, resource contribution) ranged from 2.36 to 2.52, with 3.00 being considered good. • The majority of interview participants said they felt "supported" or "somewhat supported" in their work by the Network.
McLane, 2019	ESCN Alberta, Canada	Description of Alberta Emergency Strategic Clinical Network (ESCN), including commentary on successes and challenges.	• Since 2012, the ESCN has engaged in projects such as standardized training, integrated care pathways and research to improve care for vulnerable populations. • Challenges encountered so far include time and resource pressures within emergency departments, change fatigue at the front lines, lack of authority to change clinician practice, and ensuring the network's relevance to local contexts.