Canadian National EMS Research Agenda

www.emscc.ca/nra


COMMUNICATIONS
EHS
NOVA SCOTIA

Canadian National EMS Research Agenda

EMS Research Agenda Study Team

Jan L Jensen ACP MAHSR
Halifax NS CANADA

Ian E Blanchard EMT-P MSc
Calgary AB CANADA

Blair L Bigham ACP MSc
Toronto ON CANADA

Katie N Dainty PhD
Toronto ON CANADA

Doug Socha PCP BSc
Hastings Quinte EMS ON CANADA

Alix Carter MD MPH FRCPC
Halifax NS CANADA

Lawrence H. Brown MPH&TM
AUSTRALIA

Andrew H Travers MD MSc FRCPC
Halifax NS CANADA

Alan Craig ACP MScPL
Toronto ON CANADA

Ryan Brown PCP BSc
Sydney NS CANADA (Research Assistant)

Laurie J Morrison MD MSc FRCPC
Toronto ON CANADA

Acknowledgements

The Canadian National EMS Research Agenda is a project of the EMS Chiefs of Canada.

This research project is generously funded by the Paramedic Association of Canada, the Calgary EMS Foundation, the Canadian Institutes of Health Research, Defense Research and Development Canada, and the Nova Scotia Health Research Foundation.

The research was conducted at the Dalhousie University Division of EMS and the University of Toronto Li Ka Shing Knowledge Institute (RESCU).

The following people made important contributions to the work of this project: Lisa Young, Dalhousie University (administrative support); Corinne Demone, Dalhousie University (research management support); Jane Heuller, Heuller and Associates (roundtable facilitation), Mary Ann Martell, Dalhousie University (transcription); Wayne Voutour, Medavie EMS NS (IT support), Kelly Nash, EMS Chiefs of Canada (project management support), and Carrie Anderson, EMS Chiefs of Canada (web design). Thank you to Dr. Ed Cain (Dalhousie University) and Dr. Andy Anton (University of Calgary) for their contributions to study design

PARTICIPANTS:

Dug Andrusiek	BC
John Ash	ON
Bud Avery	NS
Emmanuelle Bourdon	QC
Ron Bowles	BC
Dr. Ed Cain	NS
Dr. Jim Christenson	BC
Michel Courtois	QC
Jaclyn Day	ON
Claude Desrosiers	QC
Ingrid Devries	ON
Zach Dewar	NS
Gerard Dinn	YT
Dr. Steve Donaldson	AB
Becky Donelon	AB
Dr. Shaun Dowling	AB
Susan Dugas	NB
Greg Furlong	ON
Ralph Hofmann	ON
Chris Hood	NB
Siobian Kennedy	ON
Trevor Lang	ON
Ron Laverty	ON
Ryan Lee	AB
Michael Longeway	ON
Ken Luciak	SK
Dr. Russell MacDonald	ON
Alexander MacQuarrie	NB
Dr. Jennifer McVey	NS
Dr. Rose Mengual	NL
Dr. David Petrie	NS
Pierre Poirier	ON
Richard Poon	AB
Jodi Possia	MB
Michel Ruest	ON
Dr. Eli Segal	QC
Kristy Smaggus	ON
Dr. Sunil Sookram	AB
Dr. Ian Stiell	ON
Walter Tavares	ON
John Trickett	ON
Dr. Christian Vaillancourt	ON
Mark Walker	NS
Dr. Karen Wanger	BC
Dr. Michelle Welsford	ON

Contents

Presidents' Address

EMSCC:

The Emergency Medical Services Chiefs of Canada is proud to have partnered with the Paramedic Association of Canada in the creation of this Canadian National Emergency Medical Services Research Agenda.

This foundational work is an essential artifact as we continue to support the ongoing need to gather reliable data, promote research education for Paramedics, foster research partnerships and ultimately promote a research culture with the Canadian Emergency Medical Services community.

Many thanks to Chief Socha, Chair of the Emergency Medical Services Chiefs of Canada / Paramedic Association of Canada Research Committee, committee members and the Emergency Medical Services community who have tirelessly worked to make the Canadian National Emergency Medical Services Research Agenda a reality.

Many thanks,

Chief Michael Nolan

President, Emergency Medical Services Chiefs of Canada

PAC:

On behalf of the Paramedic Association of Canada, I would like to congratulate Chief Doug Socha and his team on the completion of the Canadian National Emergency Medical Services Research Agenda.

The ongoing collaboration between the EMS Chiefs of Canada and the Paramedic Association of Canada on projects such as this, show what can be accomplished when we work together in areas of common interest. It is an exciting time in the paramedic profession, and the natural next steps of taking this agenda and turning it into additional research projects will help guide us now and into the future.

The Paramedic Association of Canada continues to support this and other projects which will move this profession forward. Thank you for the opportunity.

Chris Hood

President

Paramedic Association of Canada

1. Executive Summary

Research is essential for the development of evidence-based Emergency Medical Services (EMS) systems of care. While EMS research efforts in Canada are on the rise, coordinated advancement of the EMS research enterprise requires further development. When resources are scarce and gaps in evidence large, a national agenda may inform the growth of EMS research. To derive this agenda for Canadian EMS research, a mixed-methods study was designed, consisting of three phases:

1. ***Interviews of EMS stakeholders;***
2. An in-person ***roundtable session;***
3. A ***consensus survey.***

Several countries have undertaken the development of national research agendas, with the goal of advancing EMS research. Advances in EMS research in those countries have been credited towards EMS research agendas. Deriving an agenda unique to the Canadian landscape is likely to stimulate similar progress.

Thirteen stakeholders from various roles in EMS research and from across the country participated in telephone ***interviews***. The key issues identified include:

- ***the need for further education and training in research, expanding existing opportunities,***
- ***the importance of leadership to drive the agenda, and considerations for a National Research Agenda.***

The results from these interviews helped guide the discussion at the subsequent roundtable session.

At the ***Newfoundland Roundtable,*** 47 stakeholders from across the country participated at the professionally facilitated session. The following topics were discussed during small group sessions:

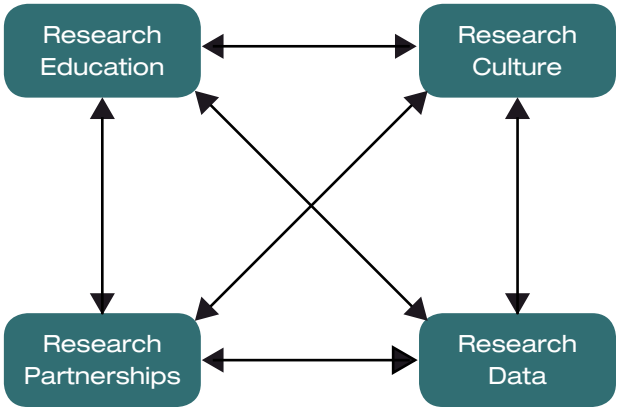
1. **Barriers** to Canadian EMS research;
2. Current **strengths** that exists or **potential opportunities**;
3. **Recommendations** for the future; and
4. **Suggested topics** for future study.

Two hundred and thirty nine unique statements were made at the Newfoundland Roundtable and were categorized into:

- Time
- Opportunities and funding
- Education and mentorship
- Culture of research and collaboration
- Structure, process and outcome
- EMS and paramedic practice
- The future of the EMS research agenda

The statements from the Newfoundland Roundtable formed the subsequent ***consensus survey.*** All participants were invited to take part in the three-round online survey, during which they scored the importance of each statement to Canadian EMS research. Statements in which the majority of participants scored as 'important' or 'extremely important' were retained.

Four themes emerged from the statements found to be important in the Delphi consensus survey. It was identified that ***education*** is needed for providers, physicians, administrators, and educators on how to conduct and interpret research. This education should start during entry-to-practice training and continue throughout the career. A ***culture*** of research was identified as lacking in many EMS systems. Participants suggested that EMS systems must continue to support the creation and use of research. Participants identified that EMS system ***data*** is essential for research; that data should be uniformly collected across Canada, and that EMS systems should have access to patient outcome data. Finally, the importance of ***partnerships*** between EMS systems and researchers was identified as being important for research productivity and quality.



Nineteen recommendations were found to be important for the future of Canadian EMS research:

Time, opportunities, and funding	**1.**	Strategically market the importance of EMS research to other agencies, health groups and the public.
	2.	Strengthen research partnerships between EMS academic centres, systems, regulators, educators and national associations.
	3.	Increase funding opportunities for EMS research infrastructure and studies.
	4.	Universities should consider EMS providers with graduate training for academic appointments, so they can engage in academic EMS research.
	5.	Create opportunities for EMS providers to work in research positions. Review collective agreements if necessary.
Education and mentorship	**6.**	Integrate research literacy and research competencies into EMS providers', managers' and EMS physicians' foundational and continuing education.
	7.	Provide scholarships for EMS providers, managers and physicians to take research-based graduate degrees.
	8.	Information should be purposefully disseminated to EMS providers about EMS research activities occurring in Canada.
Culture of Research and Research Collaboration in EMS	**9.**	Increase multidisciplinary strategic partnerships to broaden the topics studied in EMS research.
	10.	Engage EMS providers and managers early in the research process and include them on study teams.
	11.	EMS systems administrators should budget for research projects during annual strategic planning.
	12.	EMS researchers must undertake comprehensive knowledge translation initiatives, including delivering research results to EMS providers and administrators.
	13.	Evidence-based decision-making should be encouraged in EMS systems. If evidence is lacking, further research should be undertaken.
	14.	The network of Canadians interested in EMS research should be formalized, possibly as a national EMS research organization or conferences.
Structure, Process and Outcome	**15.**	EMS researchers and administrators should better inform research ethics boards about the nature of EMS research and request EMS experts participate on review committees.
	16.	Highlight EMS research in special issues or sections of the *Canadian Journal of Emergency Medicine.*
	17.	EMS data should be linked with hospital and other datasets.
	18.	Create a national EMS data dictionary of operational and clinical terms.
Future Directions for the EMS Research Agenda	**19.**	The EMS Research Agenda needs to be viewed as an ongoing project. An implementation, evaluation and renewal plan should be designed and this process should include mapping gaps in EMS research.

To achieve changes suggested by the participants, strong leadership from national organizations that are stakeholders in Canadian EMS research is required. Developing national strategies will take careful planning and organization. While this agenda may provide important recommendations, the next step is to determine how best to implement the national level recommendations, and what support structures are needed to promote the implementation of local level recommendations. In local settings, EMS stakeholders and researchers should together review the recommendations in this agenda, determine which are most important for their setting, and strategize actions to effect change.

2. Creating a National EMS Research Agenda

Figure 1 Editorial published in the Canadian Medical Association Journal *(16)*

Paramedic-driven research

In every medical specialty, and most aspects of health care, research drives improvements in care and systems.[1] Paramedicine is an emerging health profession. Paramedics have become increasingly involved in conducting important emergency medical services (EMS) research. This has led to publication of scholarly articles changing clinical and operational practice. In Canada, paramedic researchers have struggled to find the right home base to pursue EMS research. It is time to establish a national framework to propel paramedic-driven research forward. Formal training, mentorship, protected time and funding opportunities are essential to the success of paramedic researchers. EMS services must work collaboratively with governments, base hospitals, universities, and other stakeholders to fund paramedic clinician-researchers; this infusion of support will result in a burst of scholarly work specific to paramedic practice that will inform and improve clinical practice and operational performance.

Blair L. Bigham MSc ACPf
St. Michael's Hospital, RESCU York Region Emergency Medical Services, Toronto, Ont.
Jan L. Jensen MSc ACP
Dalhousie University, Division of EMS Emergency Health Services, Halifax, NS
Ian E. Blanchard MSc, EMT-P
Alberta Health Services, Emergency Medical Services, Calgary, Alta.

Evidence based medicine is the "…conscientious, explicit, and judicious use of current best evidence in making decisions…"(1). The practice of evidence based medicine combines individual and organizational experience and expertise with the best available evidence to guide clinical care and system design. Emergency Medical Services (EMS) systems have developed from basic transport services to systems of advanced out-of-hospital clinical care (2,3). The challenge for many health disciplines, including EMS, is the scarcity of research from which best evidence can be derived and practice based on (4,5).

While some EMS physicians and managers strive to apply existing research evidence to care provided in their system, many aspects of EMS continue to have little empirical data available (6). Moreover, some of the research which has been done has not been effectively translated into practice (4,7-10). In response, EMS organizations across Canada, including the EMS Chiefs of Canada, have identified the development of research as a priority (5).

2.1 EMS IN CANADA

EMS has traditionally focused on emergency response to the sick and injured in the prehospital environment, and inter-facility transport. The last three decades have seen considerable expansion of the scope of practice of EMS personnel and the sophistication of EMS operations. EMS systems and paramedics are now integral parts of the health care system, with their roles expanding to include not only emergency response and transport, but injury prevention and control, community health, public education, and emergency preparedness (5). This expansion has occurred, for the most part, independent of any formal measurement and evaluation of outcome.

EMS regulation, operation and clinical care delivery is somewhat varied across Canada, but to a lesser extent than other countries, such as the United States. EMS systems in each Canadian province and territory have evolved independent of each other. Generally, services are regulated by provincial departments or ministries of health, and are operated by municipalities, private companies, or health authorities (5). While there is some variability in standards of care in each jurisdiction, this has decreased in the last decade as services strive to meet accreditation standards (11-13) and with the introduction of the *National Occupational Competency Profile* by the Paramedic Association of Canada (2). This guiding document has allowed for increasing standardization in the levels of paramedic practice, and the scope of each recognized level. In addition, there is a trend towards more EMS regulation by either provincial governments or regional health authorities, as opposed to individual services (5). As an example, Alberta has recently transitioned EMS from municipal to provincial jurisdiction, including the transfer of governance and funding of EMS services and the consolidation of dispatch services (14). This move seems to have increased EMS integration within the health care system. This increasing uniformity could propel some aspects of EMS forward that would be beneficial to conducting research, such as data sharing, and to generalizing research findings, such as having standard practices. Although Canada is a geographically vast country, many of the barriers and opportunities experienced in any one service are shared experiences by many.

2.2 EMS RESEARCH IN CANADA

Reliable evidence is important to drive decision-making of all types in healthcare, including clinical care and system-wide policy decisions. A foundation of research is required to support an evidence-based approach to the traditional role that EMS has had in the community, as well as its new roles (5).

The research enterprise in EMS, like other health disciplines, is fraught with challenges (15,16). Studies are most often conducted by investigators employed by universities or hospitals. The research process is often slow; rigorously derived evidence often requires more time than is available when system decisions need to be made.

While challenges exist, there is progress occurring in EMS research in several locations. EMS research enterprises – active collaborations between researchers, EMS decision-makers and providers – exist which regularly produce high quality studies. While it is unusual for researchers to be employed directly by EMS systems in Canada, there has been increasing collaboration between research institutes and EMS systems to conduct studies, and EMS physicians and paramedics are increasingly taking the role of lead investigators in EMS studies. Similarly, in some locations local EMS research review committees have been implemented, as have some provincial research consortiums and a national EMS research committee of the EMS Chiefs of Canada. Much can be learned through sharing experiences and lessons learned from these success stories.

This is not the first time work has been done to develop a large-scale research agenda to guide EMS research (15,17), nor is creating a national research agenda unique to EMS (18-20). Research agendas can serve as roadmaps to guiding change to improve the quality and quantity of studies that are conducted, and foster the use of research evidence more effectively.

2.3 EMS RESEARCH AGENDAS FROM OTHER COUNTRIES

A scoping review was conducted to inform participants of the Canadian EMS Research Agenda on work done in other countries. Research agendas were found from Australia (17), the United Kingdom (21), the United States (7,8,15,22-24), and Ireland (25).

In 2002, the **Council of Ambulance Authorities (CAA)** in Australia hosted a national symposium to discuss the development of a national research agenda for EMS. The aims of the symposium were to: "identify gaps in the current research effort, discuss targets for future research, and describe mechanisms for encouraging industry cooperation and fostering the research effort" (p. 1). EMS stakeholders, which included state ambulance authorities and academics among others, convened for a two day symposium (17).

In 2005, the **Department of Health for England (DH)** commissioned a programme of work to build the evidence base for the provision of prehospital care in England. To undertake this work the DH engaged the 999 EMS Research Forum to undertake a study that will review the current evidence in prehospital care, identify gaps in the current evidence, and to prioritize topics for future study (21).

The **US National Research Agenda** was undertaken as a result of recommendations made in the EMS Agenda for the Future (26). The goals of the US National Research Agenda were to identify the impediments to scientific investigation in EMS and make recommendations to improve both the quality and quantity of EMS research (15,22,23,27). **The Pediatric Emergency Care Applied Research Network (PECARN)** is a national research network that performs pediatric emergency care research including prehospital care in the US. They report on the results of a **Pediatric Prehospital Research Agenda**, whose objective was to develop a pediatric-specific prehospital research agenda (24). The **Emergency Medical Services Outcomes Project (EMSOP)** was a US based project tasked with prioritizing conditions for outcomes study in EMS (7). Finally a summary of a workshop session from the ***2007 Academic Emergency Medicine*** consensus conference: "Knowledge Translation in Emergency Medicine: Establishing a Research Agenda and Guide Map for Evidence Uptake", provides recommendations for future avenues to narrow the "gap between knowledge and practice in the delivery of emergency medical care in the prehospital setting" (p. 1052) (8).

The **Centre for Prehospital Research** created a **National Prehospital Research Strategy** for the **Prehospital Emergency Care Council (PHECC)** in Ireland. The goals of this strategy were to: gauge current levels of prehospital research activity in Ireland, ascertain the research strengths that exist in the Irish prehospital community, pinpoint the obstacles to high quality research in the prehospital arena, determine the building blocks for a national prehospital research culture, outline an implementation plan

> "...there are very few EMS research labs and they are geographically disperse. So there's not great opportunities to mentor individuals that might be interested... So if there were a specific [funding] stream focused on EMS, I would strongly advocate that that needs to be a mentoring package."
>
> Interview Participant

> "...is it important for Canada to move towards a national research agenda?... Yes, yes, absolutely... I mean if there are universal questions that need to be answered, and we can pool ideas and resources and expertise, we will get better science and better answers"
>
> Interview Participant

for the strategy, and identify expected and measurable short and long-term outcomes of implementing this research strategy (25).

While these agendas have numerous commonalities, especially in the barriers to and recommendations for developing EMS research, generalizing results of a research agenda from another country to the Canadian setting requires interpretive caution.

2.4 THE NEED FOR A NATIONAL AGENDA

The identified international agendas described barriers to EMS research, identified opportunities, and made recommendations for the future. Several advances in EMS research in those countries have been credited towards an EMS research agenda. Deriving an agenda unique to the Canadian landscape is likely to stimulate similar advances.

While EMS research efforts in Canada are on the rise, both the quantity and rigour of research varies by region and coordinated advancement of the Canadian EMS research enterprise has been slow. Little is known about barriers and unique enablers that may impact on the growth and development of Canadian EMS research.

2.5 OBJECTIVES OF THE CANADIAN NATIONAL EMS RESEARCH AGENDA STUDY

The purpose of this study is to support and guide Canadian EMS research growth through the exploration of four study objectives:

1. Determine the existing barriers to Canadian EMS research;
2. Identify current strengths and opportunities to conduct and use research in Canadian EMS;
3. Make recommendations to facilitate the development of EMS research in Canada;
4. Identify suggestions of topics for future study.

2.6 MIXED-METHODS METHODOLOGY

To derive this agenda, a mixed-methods research project was employed. This study consisted of three phases:

1. Qualitative interviews of EMS stakeholders;
2. A roundtable session of participants from across the country and;
3. An online, multi-round consensus survey.

This approach of collecting both qualitative and quantitative data to answer one research question is growing in popularity among researchers and funding agencies (28). An essential component of mixed methods studies is effective integration of data; otherwise the project is essentially two independent studies of the same topic (29). In this project, each phase of the study will inform the next stage, and the results will be integrated using triangulation, a process that contributes to the validity of the results (30). During the design phase of this study, the study team established that the topic must be explored qualitatively, to learn more about the barriers and opportunities to Canadian EMS research - a previously unstudied topic. The qualitative data was analyzed, and the results informed the roundtable discussion. The topics discussed during the roundtable were subsequently entered into the Delphi consensus survey, which the participants quantitatively scored for importance to Canadian EMS research. This step-wise approach improves the rigour and trustworthiness of the data, compared to other study designs that could have been chosen.

2.7 STAKEHOLDER SAMPLING STRATEGY

Purposeful sampling was employed to recruit three to four EMS research stakeholders from *a priori* identified key categories from professional roles, organizations and geographical regions. Stakeholder categories based on professional roles were: paramedic researchers, EMS educators, EMS providers, EMS managers, EMS regulators, EMS physicians, and EMS physician researchers (Table 1).

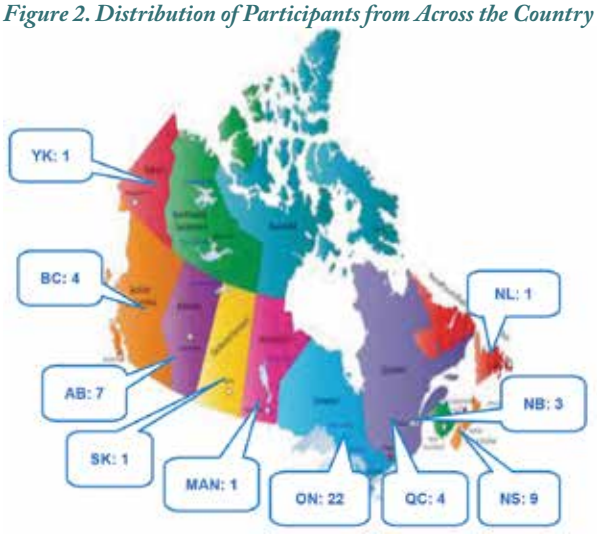
Table 1 Key Stakeholder Groups Recruited to Participate

Stakeholder Group	Definition
Paramedic researchers	paramedics who have dedicated time for research, or are regularly involved in conducting research studies
Paramedic educators	paramedics who are employed by colleges, universities or EMS systems as educators of paramedic students or practicing paramedics
EMS providers	field paramedics/communication officers/flight staff or others who primarily work in the ambulance, air medical transport or other EMS clinical settings
EMS managers	those who supervise or manage the operations of an EMS system
EMS regulators	those who primarily work within a government organization that regulates an EMS system
EMS physicians	physicians who work in the role of medical director, overseeing clinical care in an EMS system
EMS physician researchers	physicians who have dedicated time for research, and their research focus is EMS research
One representative from each of the following organizations: • The Paramedic Association Of Canada (PAC), The Society For Pre-hospital Educators Of Canada (SPEC) • The Emergency Medical Services Chiefs Of Canada (EMSCC) • The Canadian Organization Of Paramedic Regulators (COPR) • The Canadian Association Of Emergency Physicians – EMS Committee (CAEP-EMS) • The National Association Of EMS Physicians – Canadian Relations Committee (NAEMSP-Can)	

The term 'paramedic' in this research agenda is inclusive of all levels of practicing paramedics in Canada (i.e., basic and advanced life support). Where the term 'EMS administrators' is used, it is referring collectively to managers and regulators (i.e., EMS system decision-makers). 'EMS system' refers to a one or more than one paramedic service/EMS operations that delivers EMS response to a community or region.

One representative was recruited from each of the relevant national EMS organizations.

Figure 2. Distribution of Participants from Across the Country



In February 2011, all potential participants were emailed a letter from the EMSCC and PAC, explaining the EMS Research Agenda project, and the upcoming opportunity to participate. Subsequent to that, all potential participants received a recruitment letter and were invited to participate in the Newfoundland Roundtable and consensus survey. Participants were recruited to participate in the interviews separately.

2.8 RESEARCH ETHICS APPROVAL

The Capital District Health Authority research ethics board (Halifax, NS) approved the Newfoundland Roundtable session and Delphi consensus survey phases of the study. Written informed consent was obtained at the Newfoundland Roundtable session or via telephone and email for those who did not attend the roundtable. The St. Michael's Hospital research ethics board (Toronto, ON) approved the key informant interview phase of the study, and the sub-sample who participated in this phase provided verbal informed consent prior to the start of the interview. The methods have been published previously (31).

3. Key Informant Interviews

3.1 OBJECTIVE

The purpose of this phase of the study was to gain the opinions and perspectives of participants on EMS research in Canada.

3.2 METHODS

3.2.1 Sample

For this phase, a random purposeful sample of three to four participants from each key stakeholder group were invited (32). Random selection within stakeholder groups was further subjected to partitioning by geographic location and relevant national organization representation to ensure a national and representative group of participants (Table 1).

In February 2011, those who were selected for interviews were sent an email which explained this study phase in greater detail. Of that sub-sample, those that were interested replied to the lead investigator (KND) and received an information package after scheduling the interview.

3.2.2 Data Collection

Interviews were conducted over the telephone in a private office and all sessions were audio recorded for transcription purposes. A semi-structured interview guide was developed, based on a literature synthesis and the investigator knowledge of this topic (Table 2).

Table 2 Semi-structured Interview Guide Used for Telephone Interviews

	Question	Possible Probes
1	You have been asked to be part of this project because of your involvement with EMS research in Canada – can you tell me about how you are involved?	• Current role • Organization • How they got involved in the first place • Amount of time spent on research
2	Can you tell me more about the type of pre-hospital research you do?	Looking for drivers here
3	What do you enjoy about doing EMS research?	
4	How do you find it to conduct EMS research in Canada? (i.e. easy, difficult)	• Probe recognition of EMS/pre-hospital research in Canada • Do you think it is different in other countries?
5	What types of things facilitate your research?	i.e. good collaboration, good databases, good funding?
6	Do you encounter any difficulties in doing your research here in Canada?	Probe reasons for each "barrier" - system issues, financial etc.
7	What are your thoughts on funding for EMS research here in Canada?	
8	Do you think it's important to focus on building a Canadian EMS Research Agenda?	
9	If this group was going to work to improve EMS research in Canada what do you think their top 3 areas of focus should be?	
10	Is there anything else you would like to tell me about EMS research in Canada?	

Each interview recording was professionally transcribed and the lead investigator (KND) checked all for accuracy. During transcription, all potential identifying information was removed from the transcripts; participant identities were never directly linked to interview data. Interviews were conducted until thematic saturation was reached. Saturation is the ongoing collection and analysis of data until no new information was obtained and there was a 'redundancy' in the theme categories in subsequent interviews (33).

3.2.3 Data Analysis

Two investigators conducted the qualitative data analysis (KND and BLB). Both investigators independently read through each transcript as they were completed, in order to gain an understanding of the issues discussed, and to develop a preliminary coding scheme. New codes were added to the coding scheme as additional transcripts were reviewed and this approach resulted in a final coding scheme. All transcripts were then read a second time, and coded according to the final scheme. The two investigators compared their independent coding for the first four transcripts, and discussed and resolved any areas of divergence in their coding assignments. After this, each investigator coded half of the remaining transcripts. Encoding the information allows investigators to organize the data to identify and develop themes from within it (34).

Thematic analysis is a search for themes that appear to be important to the description of the phenomenon (35). Connecting or clustering of codes is the process of discovering patterns in the data (36), which then become identified as themes. After all transcripts were coded, the two investigators analyzed the data using descriptive thematic analysis methods and identified the major emergent themes (37).

3.3 RESULTS

Thirteen interviews were conducted between March and May of 2011. No further interviews were done, as thematic saturation had been reached and it was unlikely new information would be learned from additional interviews.

Participants included four EMS physician researchers, four EMS providers, two EMS physicians and three EMS educators with an average of 14 years of experience (range 7-29) in EMS and/or EMS research (APPENDIX A).

Four major themes emerged from the analysis.

3.3.1 Need for Education & Training in Research

Participants frequently expressed concern about the lack of a formalized system of research training for EMS providers and managers. Training in research methods and skills such as critical appraisal, are not topics which are covered in standard paramedic curricula so there is a lack of appreciation for the pursuit of research and inadequate preparation to conduct research within the ranks of EMS staff.

In addition, there is an assumption that EMS physicians have research experience or training, however participants suggested this might not in fact be the case. As EMS physicians are usually in leadership positions, this may contribute to a lack of appreciation or support for conducting and using research in EMS services, or for building it into the role of EMS front-line providers and managers. Participants felt that a key component of capacity building is formal education and training and capability at all levels.

3.3.2 Expanding Existing Opportunities

Participants identified that several "excellent shops" (referring to research programs) exist in Canada, which are known to conduct high quality EMS research. However, they perceived there are few formal connections with those programs to leverage research mentorship opportunities for EMS staff.

Theme #1:

NEED FOR EDUCATION AND TRAINING IN RESEARCH

"I think part of it [a research agenda] needs to be not just education in school but education on research as part of a paramedic system, as part of an EMS system.

And that needs to include education for the medical directors. Because the assumption that the physicians have a grounding in research, coming through and coming into a service, is absolutely wrong."

Interview Participant

Theme #2:
EXPANDING EXISTING OPPORTUNTIES

"I would say there are pockets of the country that are doing some really good research. But most of the country, I would say, still is in its infancy."

"And right from the beginning as well, we felt that the paramedics not only should be involved with research but should start to be the drivers of the research so they sort of take ownership of that"

Interview Participants

Theme #3:
DRIVING THE AGENDA

"I mean one is collaborations are important… we need to keep that collaboration side of things going and that needs someone to drive it. I mean if there are universal questions that need to be answered, and we need a way to pool ideas and resources and expertise, we will get better science and better answers."

Interview Participant

Theme #4:

CONSIDERATIONS FOR THE AGENDA

"I live and work in an urban setting in relatively southern Canada. But what about the more rural Canadian EMS centres and what challenges they are facing?... because it's a Canadian research agenda that we should be examining and asking our colleagues who work in a more northern and rural environment."

"so essentially we need a bunch of people that come together to think about all the issues that we are faced with in the EMS system. List them and try to see what kind of quick impact we can have and start to make some small victories"

Interview Participant

The need was expressed for researchers to involve EMS providers and managers in studies at early stages, such as during hypothesis generation and study design, rather than just in "worker bee" roles like data collection and study operationalization. However, some participants discussed that it can be complicated to formally involve EMS providers in a study, identifying issues related to contracts, time, compensation and accountability expectations. This perhaps draws attention to how EMS strategic mandates should include research to give the EMS services a way to engage providers in research as part of service delivery without violating any contractual agreements.

3.3.3 Importance of Leadership to Drive the Agenda

The need for and importance of a formal, centralized body to drive EMS research was identified as a key enabler for moving a national research agenda forward. True pan-Canadian collaboration was identified as a requirement and national EMS research-oriented meetings and/or conferences, access to research resources for those working in EMS and an "engine to drive the work" were commonly mentioned. Linking such a centralized group with an existing national organization/association, or collaboration of organizations, seemed to resonate with the stakeholders.

Participants felt that one of the functions of this centralized group could be to improve the research-to-practice process through targeted knowledge translation activities, including increased spread of information about ongoing work and completed research, and guidance and discussion on evaluating and implementing evidence-based guidelines.

3.3.4 Considerations for a National Research Agenda

Participants expressed that establishing a research agenda specific to Canada is necessary to improve the conduct and use of EMS research in this country. Some felt issues unique to the Canadian setting are often not well represented in resources, such as textbooks and training materials. Participants often mentioned how diverse the EMS care and delivery is in Canada, including urban versus rural considerations and the varied patient population.

Participants strongly expressed the importance of ensuring true national representation as the research agenda is developed. They also emphasized how important it is to ensure that recommendations for change collected through this process are actually acted upon to improve Canadian EMS research. Some discussed that certain issues will be important nationally, while others will be more or less vital to local systems. Participants also suggested that the research agenda should not prioritize specific research questions, but rather identify more general topics that should be studied further.

3.4 DISCUSSION ON THE KEY INFORMANT INTERVIEWS

We conducted interviews with various stakeholders to provide a framework for the issues that will be important for the development of an agenda for Canadian EMS research. This baseline study was designed as a starting point for the larger consensus-driven methodology and provided important direction for a subsequent roundtable discussion and Delphi survey.

In the Canadian setting, EMS research has been conducted in pockets throughout the country, so the investigators felt the use of a qualitative methodology to explore perceptions and experiences was an important first step to building a comprehensive EMS research agenda for Canada. To our

knowledge, other EMS research agendas have not used such a mixed methods approach. Other strengths of this study phase include the rigorous approach to conducting the qualitative data collection, including the interviews and analysis being conducted by a non-participant researcher and the focus on analyzing emerging themes grounded in the data as opposed to following a pre-defined framework. The sample size for this study is small, however it was clear that thematic saturation was reached and therefore we are confident that it can be considered representative of the stakeholder population targeted for the purposes of defining initial directional cues. The sub-sample was selected from a larger group of individuals identified as being involved in EMS research and therefore the opinion of EMS providers/administrators who are not currently involved in EMS research would not have been captured. This was not felt to significantly influence the findings of the study phase as the latter group would likely not be able contribute effectively to the specific subject of the current state of EMS research in Canada.

Our findings were underscored by the identification of several key realities about the EMS research enterprise in Canada, which held true across all of the stakeholder groups. First, there is a very strong belief in the need for improved research training. Participants believe strategic supports are required for EMS research in Canada, and research is important to creating knowledge specific to the Canadian context. It appears that the service agreements that exist with the EMS service, their providers or the physicians providing the medical oversight, may not standardly include research as part of the mandate and this limits a paramedic's ability to regularly participate in research or for EMS services to expend part of their operating budget to evaluate their provision of care. Making research part of the mandate for EMS services, providers and medical directors may provide opportunities for growth and training in EMS research across the nation. Additionally, a lack of collaborative and centralized research infrastructure is seen as a key barrier to ensuring the paramedic field and others who are eager to contribute to EMS science are given support from employers, learning institutions, and senior EMS researchers. Mentorship of budding EMS researchers is required from all levels of the EMS research community.

4. Newfoundland Roundtable

4.1 OBJECTIVE

The objective of the Newfoundland Roundtable was to conduct a face-to-face with all participants, to engage them in active discussion and consideration of the study objectives, prior to the start of the consensus survey. The data generated from the roundtable were evaluated quantitatively in the survey.

4.2 METHODS

June 2011 presented a unique opportunity in which many EMS research stakeholders would be gathering in St. John's NL for three conferences held in collaboration with each other: the ***Canadian Association of Emergency Physicians annual conference***, the ***EMS Chiefs of Canada*** annual conference and the ***Horizon Newfoundland and Labrador Transport Medicine*** annual conference. An eight hour session was hosted, in which invited study participants gathered. Forty-seven (89% of all study participants) attended the roundtable (APPENDIX A).

Prior to the roundtable, participants received study information, which informed them of the four study objectives that would be discussed:

1. Determine the existing barriers to Canadian EMS research;
2. Identify current strengths and opportunities to conduct and use research in Canadian EMS;
3. Make recommendations to facilitate the development of EMS research in Canada; and to
4. Identify suggestions of topics for future study.

At the Newfoundland Roundtable, these objectives were discussed in small facilitated groups, followed by large group discussion, all moderated by a professional facilitator. Participants were purposefully placed into small groups so each had a mix of stakeholders and geographical regions (Table 3). Small groups were facilitated by members of the study team and by two invited international EMS researchers, Dr. Peter O'Meara (Australia) and Mr. Gary Wingrove (USA).

Table 3. Roundtable session Schedule

Time	Topic
1030 - 1100	**Registration**
1100 - 1110	**Welcome and Introductions** Jane Helleur *Session Facilitator*
1110 - 1125	**Setting the Context and Greetings** Jan Jensen *Canadian National EMS Research Agenda Principal Investigator* Mike Nolan *President, EMS Chiefs of Canada* Chris Hood *President, Paramedic Association of Canada* Dr. Alix Carter *Chair, Canadian Association of Emergency Physicians, EMS Committee*
1125 - 1150	Working Lunch: **Experiences from the US EMS Research Agenda** Lawrence Brown, *Investigator, US EMS Research Agenda* **Results of Qualitative Interviews** *Dr.* Katie Dainty, *Qualitative Interviews Lead Investigator*
1150 - 1200	Small Group Instructions
1200- 1320	Group Session: **EMS Research Barriers** In small groups, participants will identify the barriers to the development of Canadian EMS Research. Small groups reported back to large group.
1320 - 1440	Group Session: **Strengths and Opportunities** In small groups, participants will identify the strengths and opportunities that currently or potentially exist in the development of Canadian EMS Research. Small groups reported back to large group.
1440- 1455	Break

Table 3. Roundtable session Schedule (continued)

Time	Topic
1455 - 1615	Small Group Session: **Recommendations for the Future** In small groups, participants will formulate recommendations to overcome barriers and capitalize on strengths and opportunities. Small groups reported back to large group.
1615 - 1735	Small Group Session: **Suggested Topics for Future Study** In small groups, participants will suggest topics for future study in the following 6 research domains: Clinical, health services, health systems, education, professional development and safety. Small groups reported back to large group.
1735- 1815	**Full Group Debrief** As a large group, we will assess all group reports and identify topics & themes that have emerged. We will also discuss cautions and concerns that must be noted as work on achieving consensus on barriers, strengths and opportunities, recommendations and research priorities proceeds.
1815 - 1830	Session Wrap-up, Delphi Consensus Survey Instructions and Concluding Comments

Each participant was provided a binder that contained study materials, including informed consent forms and worksheets for each small group session. Participants were instructed to document statements they felt were important to each study objective on their worksheets. Small group facilitators recorded statements discussed by their group on flipcharts, and reported this back to the large group at the conclusion of each small group session.

Investigators collected worksheets from every roundtable participant and the flipcharts. Statements were recorded verbatim within each study objective. Duplications were removed. At the roundtable, 280 unique statements were generated (Table 4).

These statements formed the first round of the Delphi consensus survey.

Table 4 statements generated from Newfoundland Roundtable

Study Objective	Content Area	Number of Statements
BARRIERS	Time, opportunities and funding	10
	Education and mentorship	19
	Culture of research and collaboration	18
	Structure, process and outcome of research	14
	EMS and provider practice	8
	Other	4
	Total number of Barriers statements	73
STRENGTHS AND OPPORTUNTIES	Time, opportunities and funding	13
	Education and mentorship	10
	Culture of research and collaboration	1
	Structure, process and outcome of research	23
	EMS and provider practice	14
	Other	1
	Total number of Strengths and Opportunities statements	62
RECOMMENDATIONS	Time, opportunities and funding	4
	Education and mentorship	9
	Culture of research and collaboration	17
	Structure, process and outcome of research	7
	EMS and provider practice	0
	Other	0
	Total number of Recommendations statements	37
SUGGESTED TOPICS FOR FUTURE STUDY	Clinical	19
	Health services/system	23
	Education	20
	Professional development	18
	Safety	19
	Other	9
	Total number of Suggested Topics for Future Study statements	108

5. The Delphi Consensus Survey

5.1 OBJECTIVE

The objective of the Delphi consensus survey was to quantitatively measure participants' opinion of the importance of each statement to Canadian EMS. During this phase, new statements could be suggested and also scored for importance.

5.2 METHODS

5.2.1 Derivation of the Quantitative Delphi Survey Tool

The statements collected and collated from the Newfoundland Roundtable were organized within each study objective (barriers, strengths/opportunities, recommendations and suggested topics), and were then categorized by best fit by two investigators (IEB and LHB) to 6 content areas:

1. time, opportunities and funding
2. education and mentorship
3. culture of research and collaboration
4. structure, process and outcome of research
5. EMS and provider practice
6. other

When there was disagreement on the assignment, a third investigator served as adjudicator (AHT). The purpose of this categorization was to better organize the statements within each study objective into similar groups, to improve ease of use of the survey. The survey tool was pilot-tested by five researchers not associated with the study.

5.2.2 Scoring the Quantitative Delphi Survey Tool

Participants scored the importance of each statement to Canadian EMS research. Scoring was done on a 5-point Likert scale (Table 5).

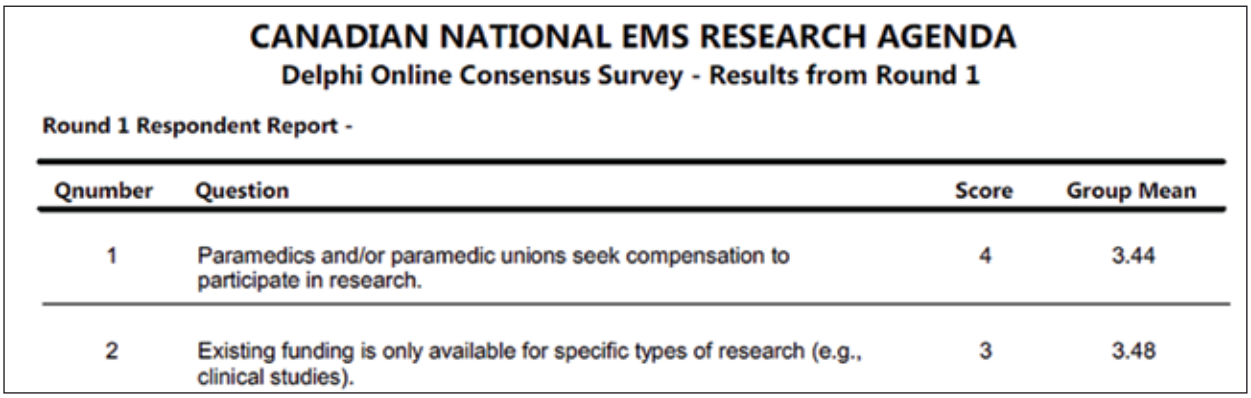
Table 5 Delphi Survey Likert Scale

1	2	3	4	5
not important	not very important	possibly important	important	extremely important

Participants were also encouraged to suggest new statements and provide comments.

It was determined *a priori* that a statement would be declared "important" if it was rated as "important" or "extremely important" by at least 80% of participants who answered the question. Similarly, a statement was defined as "unimportant" if 80% of participants rated it as "not important" or "not very important" (38,39).Statements that achieved consensus were removed from the Delphi survey for subsequent rounds. For the second and third rounds, a Microsoft Access (2010, Redwood, CA, USA) report was generated for each participant showing the mean scores and the participant's own score for each statement from the previous round (Figure 3). Participants were then able to consider their scoring within the context of others' score and re-score each statement, or keep the score they originally assigned (40-42).

Figure 3 Example of respondent report



CANADIAN NATIONAL EMS RESEARCH AGENDA

Delphi Online Consensus Survey - Results from Round 1

Round 1 Respondent Report -

Qnumber	Question	Score	Group Mean
1	Paramedics and/or paramedic unions seek compensation to participate in research.	4	3.44
2	Existing funding is only available for specific types of research (e.g., clinical studies).	3	3.48

Conducting the Survey

An electronic survey tool (Opinio Version 6.5.1 © 1998-2012, Objectplanet, Oslo, Norway) was used to deliver the survey. The first round of the survey opened August 1, 2011. Each survey was open for two weeks, with reminder emails sent to non-responders every four days, with a two-week gap between rounds to permit data analysis. The Delphi survey was designed to have a maximum of 4 rounds. Stopping rules were established *a priori:* evidence of respondent fatigue and a substantial decrease in new statements reaching consensus (38).

5.2.3 Data Management

Data was exported into Microsoft Excel (Redwood, CA, USA), and participant characteristics, free text coding, mean scores and percent consensus were calculated after each round of circulation to all respondents.

5.2.4 Data Triangulation

We employed methodological triangulation, which refers to the application and combination of multiple research methodologies in the study of the same phenomenon (30). Triangulation facilitates validation of data through cross verification from more than two sources. We applied this approach to data derived from the baseline qualitative interviews, the roundtable discussion and the Delphi consensus results. (JLJ, KND, IEB) (29,30).

5.3 RESULTS

5.3.1 Sample and response rate

Fifty-three participants from across Canada took part, representing 10/13 Canadian provinces and territories. Each self-identified his/her professional designation as: 36 EMS providers, 16 physicians, and one nurse. The participants represented a cross section of roles, including 20 researchers, 11 physicians and EMS providers (that is, identified their primary role as clinical care), nine educators, two EMS managers, two regulators, and one government emergency management administrator (APPENDIX A). The group had a mean of 19 years of EMS experience (SD 8.9).

Participation was good in all Delphi rounds: 50 (94%) people participated in round one 47 (89%) in round two, and 40 (75%) in round three.

5.3.2 Quantitative results

At the roundtable, 280 unique statements were generated. The Delphi rounds contained 280, 238 and 212 statements respectively; statements in which consensus was achieved were removed from subsequent rounds. Each round also included 9 free-text questions, in which additional statements could be suggested by participants. In round 1, participants provided 78 free text comments, from which 18 new statements were added to the Delphi. In round 2, participants made 53 comments, which resulted in 13 new statements being added to the Delphi. The Delphi consensus survey was terminated after three rounds after assessment of stopping rules.

Triangulation of qualitative interview, roundtable and Delphi phases revealed high data convergence between the initial qualitative findings and the subsequent data gathered during the roundtable and Delphi. Additional themes that were not identified during the baseline interviews arose during the roundtable discussion. These were found to be convergent with the consensus results, indicating high consistency across the data set as a whole.

One hundred and forty one statements achieved consensus as 'important': 20 barriers; 54 strengths/opportunities; 31 recommendations; and 36 suggested topics for future study. No statements achieved consensus as 'unimportant'. All individual statements that achieved consensus are presented in Appen

6. Barriers to Canadian EMS Research

> "I think that a formidable barrier is one of culture and the reluctance to change.
>
> To endorse a research agenda means that you have to accept that research may validate practice or change it. For many paramedics and paramedic services, this represents a large leap in thinking."
>
> Survey Participant

Twenty statements pertaining to barriers to Canadian EMS research were found to be important. These were consolidated into 10 barriers (Table 6).

Two barriers were focused on ***time, opportunities and funding;*** specifically regarding a lack of research funding for EMS studies and few EMS research jobs. Three barriers on research ***education and mentorship*** addressed the lack of education on research in three different points in the career pathway of all those who work in EMS: foundational (entry-to-practice) education, graduate education, and mentorship to conduct research. Three barriers focused on the ***culture of research and collaboration in EMS.*** A lack of collaboration and effective relationships was found to be important, as was the prioritization EMS research receives. Finally, two barriers regarding the ***structure, process and outcome*** of EMS research were about obtaining consent from patients in the EMS setting, and the use of EMS and hospital data for research.

Table 6 Identified Important Barriers to Canadian EMS Research

Content Area	Delphi Statement Identifier*	Barriers
Time, Opportunities, and Funding	B-1 B-3	**1.** There are few funding sources for EMS research projects or for EMS systems to conduct research.
	B-2 B-4	**2.** There are very few EMS research jobs or research salary support, and there is a lack of dedicated time for EMS providers who are interested to conduct or assist in research.
Education and Mentorship	B-5 B-7 B-8	**3.** There is a lack of baseline research knowledge among people who work in EMS (providers, physicians and others). Entry-to-practice paramedic programs often do not include an introduction to research course, and research and evidence based literacy have not been part of the NOCPs.
	B-6	**4.** There are few opportunities for research mentorships, outside of fellowship programs for physicians.
	B-9	**5.** EMS services often do not support EMS providers to take graduate education in research related degrees.
Culture of Research and Research Collaboration in EMS	B-11 B-16	**6.** There is little or no relationship between EMS services and academia, and governments, hospitals, universities and EMS services often don't work together to conduct studies.
	B-10 B-12 B-13	**7.** EMS research studies compete with operational and other priorities within the system, but a clear strategic direction for EMS research doesn't exist, and EMS services do not include EMS research in their strategic planning.
	B-14 B-15	**8.** EMS providers and managers are often not part of the design and planning phases of research studies. EMS providers often don't understand the importance of studies, which can impact accurate data collection process.
Structure, Process and Outcome	B-17	**9.** It can be difficult to obtain informed consent in clinical studies in the EMS setting.
	B-18 B-19 B-20	**10.** EMS data is sometimes not clean (e.g., data points not well defined, not all users understand what information to enter, etc.), and there are inconsistencies between how different services measure, collect and analyze their data. EMS datasets are difficult to link with hospital data to obtain outcome data and to conduct population/epidemiologic studies.

* The Delphi statements that achieved consensus can be found in Appendix B; NOCPs = National Occupational Competency Profile (participants were referring to the 2002 version)

7. Strengths and Opportunities for EMS Research

Fifty-four statements pertaining to strengths and opportunities were found to be important by participants. These were consolidated into 24 (Table 7).

Six strengths and opportunities focused on ***time, opportunities and funding,*** including that there are opportunities and successes for EMS research to be funded, including by government, there are many questions to ask in EMS and great opportunities for increased partnerships. Five strengths and opportunities were about ***education and mentorship***, which, like the barriers, also focus on research education at different points in the career pathway. Three strengths and opportunities regarding ***culture and collaborations*** focus on the beneficial experiences and relationships that can be generated from involvement in research. Six strengths and opportunities on the ***structure, process and outcome*** of conducting EMS research largely focused on opportunities to improve data quality and availability, as well as identified some research structure successes, such as the implementation of local EMS research review committees. Four strengths and opportunities were identified about ***EMS and paramedic practice.***

> "My perception is that there is an appetite for change amongst the practitioners and a huge patient population on which no formal research has been done."
>
> Survey Participant

Table 7 Existing Strengths or Potential Opportunities for Canadian EMS Research

Content Area	Delphi Statement Identifier*	Strengths and Opportunities
Time, Opportunities and Funding to Conduct Research	S/O-2 S/O-3	**1.** Large EMS systems can leverage government support for EMS research. Regulators can include incentives and performance measures in operator contracts related to research.
	S/O-4	**2.** Large EMS research studies have acquired stable research funding.
	S/O-5 S/O-10	**3.** The field of health services research is growing; there is funding available to conduct research on health systems and policy. Existing partnerships can be capitalized on to do this type of research in EMS.
	S/O-1 S/O-6 S/O-7 S/O-8	**4.** There are many research questions to ask in EMS: the EMS patient population is quite varied (such as age, location, illness or injuries), certain aspects of EMS have not been well studied (such as EMS communications centres), and the health system is under pressure, leading to re-evaluation of service delivery.
	S/O-9	**5.** In some locations, partnerships between EMS services and universities have been established to conduct research.
	S/O-11	**6.** Some EMS systems have a researcher on staff.
Education and Mentorship	S/O-14 S/O-16 S/O-17 S/O-23	**7.** A national standard for paramedic education exists, and an opportunity exists to leverage more research competencies in the NOCP and future national exam. EMS educators can be trained on the fundamentals of research, which they can teach their students. Colleges and paramedic training schools have the opportunity to encourage research.
	S/O-18 S/O-20	**8.** Paramedic training programs are increasingly collaborating with universities, and more degree programs are under development. Research programs and courses specializing in EMS exist in Canada.
	S/O-15 S/O-22	**9.** EMS providers are obtaining more training and higher education than ever before.
	S/O-12 S/O-19	**10.** High quality graduate research degrees are offered at Canadian universities, and student research grants are available.
	S/O-13 S/O-21	**11.** There are established EMS research leaders who provide an opportunity for research mentorship for EMS providers, managers, physicians and others (such as by obtaining grant funding to hire EMS providers to work on studies).

Table 7 Existing Strengths or Potential Opportunities for Canadian EMS Research (continued)

Content Area	Delphi Statement Identifier*	Strengths and Opportunities
Culture of Research and Research Collaboration in EMS	S/O-24 S/O-25 S/O-26	**12.** EMS research provides opportunities to collaborate with other disciplines (such as business, engineering and social sciences) and among existing EMS research centres and national organizations/associations.
	S/O-27	**13.** Positive experiences with one research study leads to other research studies.
	S/O-28	**14.** EMS providers and physicians already have good interdisciplinary collaboration.
Structure, Process and Outcome	S/O-31 S/O-32 S/O-42	**15.** There have been milestones in Canadian EMS research that have helped to move EMS research forward, such as success changing legislation restrictive to EMS and EMS research, large studies, and international EMS research consortiums.
	S/O-34	**16.** EMS research committees that evaluate and coordinate EMS research projects are becoming more prevalent.
	S/O-35 S/O-40 S/O-45 S/O-36 S/O-37	**17.** Some EMS systems collect data in the same way, including how data is defined and analyzed, and there is a movement to create a national set of standard data definitions. This allows for EMS datasets to be consolidated and stored in research registries to increase the statistical power of studies. Some EMS systems already have linkages with hospitals for some outcome data (such as ST-elevation myocardial infarction).
	S/O-30 S/O-33 S/O-38 S/O-39 S/O-41 S/O-44	**18.** Many EMS services use electronic charting including computer aided dispatching, patient care charting, and biometric monitoring, which can allow for real-time data analysis and reporting. Performance-based EMS contracts require EMS operators to collect data.
	S/O-29	**19.** EMS researchers can use existing uniform data sets (such as the Canadian Institute for Health Information).
	S/O-43 S/O-46	**20.** EMS-specific evidence repositories exist and research articles can be found online through web-based databases.
EMS and Paramedic Practice	S/O-47	**21.** In many locations in Canada, EMS regulation is moving to a provincial or regional level, which increases standardization.
	S/O-48	**22.** EMS providers generally comply with protocols and can quickly adopt clinical research protocols.
	S/O-49 S/O-53	**23.** The EMS setting is unique: paramedics are some of the few health care providers that have direct access to patients in their home environments. The public generally considers EMS providers to be trusted professionals.
	S/O-50 S/O-51 S/O-52 S/O-54	**24.** As the identity of EMS providers evolves, evidence is needed to guide the development of EMS protocols and guidelines especially for new and alternative EMS programs and scopes of practice, such as community/extended care paramedic programs.

* The Delphi Statements that achieved consensus can be found in Appendix B; S/O = strengths and opportunities; NOCPs = National Occupational Competency Profile (participants were referring to the 2002 version)


PARAMEDIC
EHS

8. Recommendations for the Future of Canadian EMS Research

Thirty-one important statements were consolidated into 19 specific recommendations for the future (Table 8).

Five were on ***time, opportunities and funding***. They focused on raising awareness of EMS research, developing relationships for research, creating opportunities for those interested to work in research and called for increased funding. Three recommendations were about ***education and mentorship***, stating more education should be available for all in EMS on conducting and using research, as well as the importance of funding for research education and providing the results of studies to those working in the field. Six recommendations on ***culture and collaborations,*** call for increased focus on research by EMS systems, and for researchers to include EMS in their study plans earlier, as well as strengthening of the EMS research network in Canada. The research ***structure, process and outcome*** recommendations focus on improving the quality of and access to data, EMS engagement of research ethics boards and dissemination strategy. Finally, one recommendation focuses on future direction for the ***EMS Research Agenda***.

Table 8 Recommendations for the Future

Content Area	Delphi Statement Identifier*	Recommendations
Time, opportunities, and funding	R-1	**1.** Strategically market the importance of EMS research to other agencies, health groups and the public.
	R-2	**2.** Strengthen research partnerships between EMS academic centres, systems, regulators, educators and national associations.
	R-3 R-4	**3.** Increase funding opportunities for EMS research infrastructure and studies.
	R-5	**4.** Universities should consider EMS providers with graduate training for academic appointments, so they can engage in academic EMS research.
	R-6 R-7	**5.** Create opportunities for EMS providers to work in research positions. Review collective agreements if necessary.
Education and mentorship	R-8 R-9 R-10 R-11 R-12	**6.** Integrate research literacy and research competencies into EMS providers', managers' and EMS physicians' foundational and continuing education.
	R-13 R-14	**7.** Provide scholarships for EMS providers, managers and physicians to take research-based graduate degrees.
	R-15	**8.** Information should be purposefully disseminated to EMS providers about EMS research activities occurring in Canada.
Culture of Research and Research Collaboration in EMS	R-16	**9.** Increase multidisciplinary strategic partnerships to broaden the topics studied in EMS research.
	R-17 R-18	**10.** Engage EMS providers and managers early in the research process and include them on study teams.
	R-19	**11.** EMS systems administrators should budget for research projects during annual strategic planning.
	R-20	**12.** EMS researchers must undertake comprehensive knowledge translation initiatives, including delivering research results to EMS providers and administrators.
	R-21	**13.** Evidence-based decision-making should be encouraged in EMS systems. If evidence is lacking, further research should be undertaken.
	R-22 R-23 R-24	**14.** The network of Canadians interested in EMS research should be formalized, possibly as a national EMS research organization or conferences.
Structure, Process and Outcome	R-25	**15.** EMS researchers and administrators should better inform research ethics boards about the nature of EMS research and request EMS experts participate on review committees.
	R-26	**16.** Highlight EMS research in special issues or sections of the *Canadian Journal of Emergency Medicine.*
	R-27	**17.** EMS data should be linked with hospital and other datasets.
	R-28	**18.** Create a national EMS data dictionary of operational and clinical terms.
Future Directions for the EMS Research Agenda	R-29 R-30 R-31	**19.** The EMS Research Agenda needs to be viewed as an ongoing project. An implementation, evaluation and renewal plan should be designed and this process should include mapping gaps in EMS research.

* The Delphi Statements that achieved consensus can be found in Appendix B

9. Suggested Topics for Future Study

> "This window of opportunity extends from pure clinical based research to more performance based as well."
>
> Survey Participant

Participants achieved consensus on the importance of 36 topics that require increased research efforts (see Appendix B), in the following content areas:

- **Clinical topics** **n = 11**
- **Health Services/Systems topics** **n = 10**
- **Education topics** **n = 6**
- **Safety topics** **n = 6**
- **Professional Development topics** **n = 3**

These topics were broad, including the study of time-sensitive interventions, resource utilization best practices, measuring competency, and improving both patient and provider safety through system engineering and cultural shifts.

Importantly, the list of suggested topics should not be viewed as exclusive: the absence of something from the list does not mean that it is unimportant or low priority. The list of suggested topics identifies areas of EMS in need of *additional* or *increased* research attention. It does not suggest that those areas of EMS already receiving research attention should receive less (or no) future attention.

10. Study Limitations

At the roundtable session, there were more participants with a primary role as EMS provider or administrator compared to physicians and researchers, which may have overrepresented those perspectives. This may have been compensated for in the Delphi process, which had improved physician representation and allowed participants to add statements. Certain provinces appear to be overrepresented (Ontario and Nova Scotia), likely a result of sampling bias on the part of investigators identifying potential participants. We suggest that the effect overrepresentation had on the conclusions of the agenda were small, and given how comprehensive the methods were the breadth of EMS research in Canada was likely addressed.

Some participants had difficulty applying the Likert scale to statements they felt were untrue in their local setting. Participants were reminded that the statement may be true somewhere in Canada, and were instructed to score the item as unimportant if they believed it was not true or possible. This approach might have limited the ability of local issues to achieve consensus. While this Agenda focuses on issues that are shared by many in the country, it does not suggest that local issues that did not achieve consensus are unimportant.

Finally, while every effort was made to select a purposeful sample of Canadian EMS research stakeholders, it is unknown how the conclusions were affected by the few participants who chose not to participate. It is possible that certain groups within the sample were more prone to favour the face-to-face discussion, whereas others may be more inclined to complete the survey, which may have influenced the final results of the study.

11. Summary of Findings

> "...having Canadian-based research in EMS would actually be very valuable since as a Canadian educated paramedic, all we ever see from textbooks, it all comes out of the US...So having Canadian-based research would actually benefit Canadians themselves because it would be more tailored to our reality."
>
> Interview Participant

11.1 SUMMARY OF CONTENT AREAS

In terms of *time, opportunities and funding*, participants perceive research education and EMS-specific funding opportunities are limited, as are research positions and opportunities for providers to develop their own research ideas. In some locations, strong collaborations between EMS systems and universities specializing in prehospital research exist, and there are some examples of success, such as obtaining funding for large studies and building incentives into EMS operations contracts to conduct research. The limited availability of EMS literature and the emphasis in Canada on evidence-based medicine and efficient health care resource utilization may create research opportunities for providers, systems and researchers.

For *education and mentorship,* participants identified that EMS providers often lack foundational knowledge on research and critical appraisal, which has not typically been taught in entry-to-practice paramedic programs. This has been addressed in the 2011 version of the National Occupational Competency Profile (2), with a specific competency on evidence-based practice (1.2c), which should lead to the delivery of research curriculum in standard EMS provider training. However the NOCPs only address EMS provider education, and do not apply to managers, physicians or others. Few EMS providers or EMS physicians pursue specific research training or graduate studies, possibly in part because of a perceived lack of opportunities. However, participants identified that more providers are obtaining undergraduate degrees, and that some education institutions offer undergraduate paramedic degrees, which are accepted for entry to graduate programs. Participants also identified several universities with strong prehospital research programs and mentors, have led to several EMS researchers achieving university appointments, research grants and peer-reviewed publications. In some EMS systems, research mentorship has started at the individual project level, by hiring providers into research assistant or coordinator roles, and guiding them through the research process, essentially providing on-the-job training in research.

Related to the *culture of research and collaborations*, participants expressed the need for value to be placed on research when competing with other system pressures. A culture of appreciation for research is needed to ensure EMS operations strategic planning and funding includes resources and willingness to do research, and partnerships to pursue and facilitate high quality research. This type of culture may lead to improved research participation by providers, including enrolment, protocol compliance, and data quality and faster translation of evidence into practice.

EMS data was identified as important to *structure, process and outcome* yet was viewed to be of variable quality and be difficult to link to other datasets to measure outcomes. Data quality was seen as improving, with an increase in computerized dispatch and electronic charting systems, many of which can include biometric data uploaded from defibrillators. The challenge of obtaining consent in emergency settings was also identified. In several locations, EMS research committees that evaluate and coordinate EMS research projects are becoming more prevalent, which may help improve EMS research strategic planning, better study designs, reduce the time it takes to start projects and coordination of timing of similar studies, and foster collaborations.

Participants didn't identify any specific barriers or recommendations related to *EMS and paramedic practice*, but did identify several opportunities and current strengths that could foster Canadian EMS research. Participants felt the EMS setting is unique, and the fact that EMS providers access patients in their home environments can provide interesting research opportunities. EMS care is evolving, including movement from structured protocols to evidence-based guidelines. EMS providers are also working in new roles, such as community paramedicine, and in multi-disciplinary teams, the advancement of which requires research. Other items that were identified as strengths in conducting research included: in many Canadian locations, EMS delivery is regulated at a regional or provincial level, which increases standardization; EMS providers are generally trusted by the public, and EMS providers can quickly adapt to research protocols because they are good at complying with clinical protocols.

11.2 RECOMMENDATIONS FOR THE FUTURE

The most important output from the results of the Canadian National EMS Research Agenda study is the recommendations for the future. These recommendations can be acted on locally, regionally and nationally to improve Canadian EMS research.

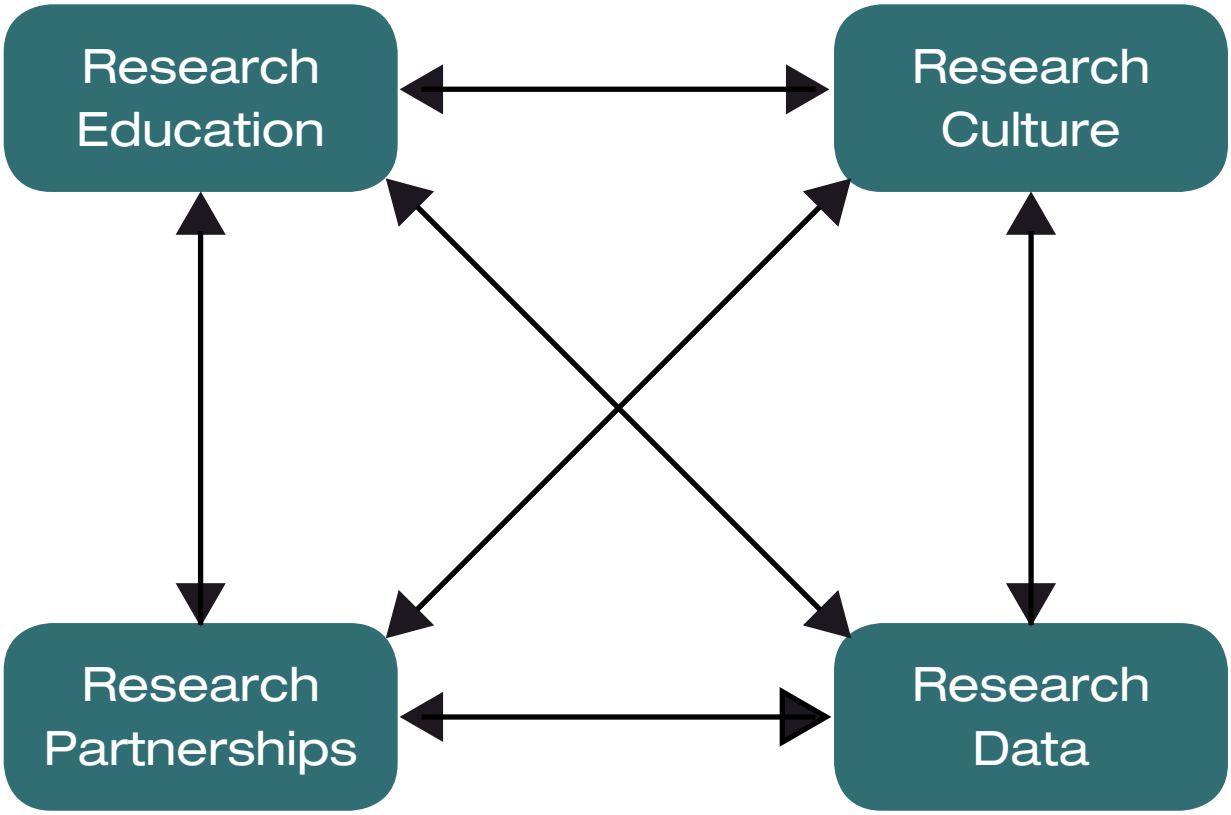
> "Paramedics don't have a clear direction... a lot of paramedics have excellent, excellent research ideas but they don't know where to go with them."
>
> Interview Participant

Participants strongly supported evidence-based clinical practice and operations in EMS. While great advances have been made in Canadian EMS research, there is little evidence available to support or refute most established EMS practices, not to mention newly implemented interventions and evolving EMS programs. To improve this, participants outlined recommendations to increase the amount and rigor of Canadian EMS research. An important message that emerged from recommendations in the *time, opportunities, and funding* content area was the importance of **partnerships** in developing the EMS research enterprise. All recommendations arising from this content area involve fostering partnerships, or increasing the opportunity for linkages and teamwork across the spectrum of EMS research stakeholders (e.g., academic centres, systems, regulators, education institutions and national associations, etc). Another clear message, outlined from the *education and mentorship* recommendations, was the need for further research **education** for those that work in EMS. Providers, physicians, administrators and educators were identified as requiring more education on research literacy and process, starting at the entry-to-practice level and continuing throughout all career pathways. The importance of partnerships between EMS and academic institutions to design and conduct research was underscored in recommendations made from the culture of research and research collaboration in EMS content area. It was recognized that EMS systems and their staff are essential for study planning and implementation, and also as users of research results; participants recognized that EMS systems need to embed research within the organizational culture. Finally, the importance of EMS data was delineated in the *structure, process and outcome* content area. EMS data must be valid, reliable within individual systems and between areas of Canada, and linkages to patient outcome data must be routinely available to EMS administrators and researchers to enable data driven decisions.

These improvements are likely intertwined within EMS systems; as one area of EMS develops, it stands to reason that others would evolve as well (Figure 4). For example, if research education for providers, EMS physicians, and EMS administrators was improved, this knowledge might lead to a change in organizational culture, through which research is supported and participation becomes the norm. This change in culture may lead to a focused emphasis on fostering research partnerships, which may subsequently result in the strengthening of data collection and linkage processes.

The key messages arising from the recommendations made in this Canadian study echo many of the recommendations made from the US, Australian, and Irish research agendas (15,17,21,25,31). Specifically, improving EMS data was listed in both the US and Irish agendas, enhancing research education was listed in the US, Australian, and Irish agendas, building a research culture was listed in the Irish agenda, and finally fostering partnerships to enhance the research enterprise, although not explicitly listed in the US, Australian and Irish agendas, would likely occur as a result of implementing recommendations.

Figure 4. Major Themes for Canadian EMS Research



12. The Future

> "But really, I think that we can overcome the fragmentation. There's enough information and enough people, sort of a critical mass now to bring it together nationally and say, okay, here's what we have, here's how we should do business, here's what we need, here's what we think."
>
> Interview Participant

12.1 NATIONAL IMPLEMENTATION

To achieve changes suggested by the participants will require strong leadership from national organizations that are stakeholders in the EMS research process. Developing national strategies to strengthen the EMS research enterprise will take careful planning and organization. While this agenda may provide important recommendations, the next step is to determine how best to implement the national level recommendations, and what support structures are needed to promote the implementation of local level recommendations. This can only occur with a strong commitment from, and partnership between, national EMS research stakeholder groups.

12.2 LOCAL IMPLEMENTATION

Continued advancement of EMS research will depend on the actions of individuals and groups in response to these recommendations. No one group can enact all the recommendations set forth in this agenda; a coordinated and collaborative approach is necessary, both on a national and local level. Those who make up local EMS research enterprises across the country, which include regulators, managers, medical leadership, academics, educators and providers should review the recommendations in this agenda, determine which are most important for their setting, and strategize priorities for action.

Figure 5. Suggestion for how to determine action for each Recommendation

Recommendation #15.				
EMS researchers and administrators should better inform research ethics boards about the nature of EMS research and request EMS experts participate on review committees.				
Is this important to our system/institution/association? Consider if this recommendation is relevant to your setting				
1	2	3	4	5
How feasible is it to put this in place? Consider resources, time and collaborations required.				
1	2	3	4	5

Each recommendation should be discussed relative to the local context, and scored first for importance (consider if the recommendation is relevant and if it is an issue that needs to be addressed or improved), and then for feasibility (consider resources required) (Figure 5).

12.3 PERFORMANCE OF THE RESEARCH AGENDA

Participants urged measurement of the implementation and effect of the recommendations, and suggested the agenda itself be revisited in five or ten years. Of the EMS research agendas reviewed from around the world, documents reporting measurement of the effect of the agenda on increasing EMS research were not located.

13. Conclusion

The purpose of this study was to identify current ***barriers, strengths and opportunities*** to the conduct and use research in Canadian EMS, in order to ***make recommendations*** to enhance the development of EMS research in Canada. The resultant consensus-based key messages should inform strategic direction locally, regionally and nationally to further advance Canadian EMS research.

14. References

1. Sackett DL, Rosenberg WM, Gray JA,et al. Evidence-based medicine: What it is and what it isn't [editorial]. BMJ 1996;312:71-72.

2. Paramedic Association of Canada. National Occupational Competency Profile. 2011; Available at: http://paramedic.ca/nocp/.

3. Shah MN. The formation of the Emergency Medical Services system. Am J Public Health 2006 Mar;96(3):414-423.

4. Callaham M. Quantifying the Scanty Science of Prehospital Emergency Care. Ann Emerg Med 1997;30(6):791-796.

5. Emergency Medical Services Chiefs of Canada. The Future of EMS in Canada: Defining the New Road Ahead. 2006.

6. Myers JB, Slovis CM, Eckstein M, Goodloe JM, Isaacs SM, Loflin JR, et al. Evidence-Based Performance Measures for Emergency Medical Services Systems: A Model for Expanded EMS Benchmarking. A Statement Developed by the 2007 Consortium U.S. Metropolitan Municipalities' EMS Medical Directors. Prehosp Emerg Care 2008;12(2):141-151.

7. Maio RF, Garrison H, Spaite DW. Emergency Medical Services Outcomes Project I (EMSOP I): Prioritizing Conditions for Outcomes Research. Ann Emerg Med 1999;33:423-432.

8. Cone DC. Knowledge translation in the Emergency Medical Services: A research agenda for advancing prehospital care. Acad Emerg Med 2007;14(11):1052-1057.

9. Bigham BL, Aufderheide TP, Davis DP, Powell J, Donn S, Suffoletto B, et al. Knowledge translation in Emergency Medical Services: A qualitative survey of barriers to guideline implementation. Resuscitation 2010 /;81(7):836-840.

10. Dalhousie University Division of Emergency Medical Services. Canadian Prehospital Evidence Based Protocols Project. Available at: http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm. Accessed 7/16/2008, 2008.

11. Accreditation Canada. Emergency Medical Services. Available at: http://www.accreditation.ca/accreditation-programs/qmentum/standards/emergency-medical-services/.

12. Commission on Accreditation of Ambulance Services. Home Page. 2012; Available at: http://www.caas.org/.

13. Commission on the Accreditation of Medical Transport Systems. International Services. 2012; Available at: http://www.camts.org/.

14. Alberta Health Services. On the Move. An Update on the EMS Transition in Alberta. 2009 April 2009.

15. Sayre MR, White LJ, Brown LH, Armacost M, Dean JM, Frame SB, et al. National EMS research agenda. Prehosp Emerg Care 2002 2002/;6(3 SUPPL.):S1; S43.

16. Bigham BL, Jensen JL, Blanchard IE. Uncharted Waters: Paramedic Researchers Struggle to Navigate Rough Seas. Canadian Medical Association Journal e-letters 2010.

17. Tippett V, Clark M, Woods S, Fitzgerald G. Towards a national research agenda for the ambulance and pre-hospital sector in Australia. JEPHC 2003;1(1-2).

18. Valiga TM, Ironside PM. Crafting a national agenda for nursing education research. J Nurs Educ 2012 Jan;51(1):3,6-20111213-01.

19. Lenaway D, Halverson P, Sotnikov S, Tilson H, Corso L, Millington W. Public health systems research: setting a national agenda. Am J Public Health 2006 Mar;96(3):410-413.

20. Schroedel JG, Watson D, Ashmore DH. A national research agenda for the postsecondary education of deaf and hard of hearing students: a road map for the future. Am Ann Deaf 2003;148(2):67-73.

21. Snooks H, Evans A, Wells B, Peconi J, Thomas M, Woollard M, et al. What are the highest priorities for research in emergency prehospital care? Emerg Med J 2009;26(8):549-550.

22. Sayre MR, White LJ, Brown LH, McHenry SD. National EMS research agenda: Proceedings of the implementation symposium. Acad Emerg Med 2003/10;10(10):1100-1108.

23. Sayre MR, White LJ, Brown LH, McHenry SD. The National EMS Research Strategic Plan. Prehosp Emerg Care 2005 2005;9(3):255-266.

24. Foltin GL, Dayan P, Tunik M, Marr M, Leonard J, Brown K, et al. Priorities for pediatric prehospital research. Pediatr Emerg Care 2010 Oct;26(10):773-777.

25. A National Prehospital Research Strategy. 2008.

26. National Highway Safety Traffic Administration. EMS Agenda for the Future. 1996; Available at: http://www.nhtsa.gov/people/injury/ems/agenda/emsman.html.

27. National EMS research agenda. Prehosp Emerg Care 2002;6(3):S1-43.

28. Clark VLP. The Adoption and Practice of Mixed Methods: U.S. Trends in Federally Funded Health-Related Research. Qualitative Inquiry 2010 07/01;16(6):428-440.

29. O'Cathain A, Murphy E, Nicholl J, O'Cathain A. Research Methods and Reporting: Three techniques for integrating data in mixed methods studies. BMJ: British Medical Journal 2010 11/27;341(7783):1147-1150.

30. Farmer T, Robinson K, Elliott SJ, Eyles J. Developing and implementing a triangulation protocol for qualitative health research. Qual Health Res 2006 Mar;16(3):377-394.

31. Jensen JL, Blanchard IE, Bigham BL, Dainty KN, Socha D, Carter A, et al. Methodology for the development of a Canadian National EMS Research Agenda. BMC Emerg Med 2011 Sep 30;11:15.

32. Greenhalgh T, Russell J, Swinglehurst D. Narrative methods in quality improvement research. Qual Saf Health Care 2005 Dec;14(6):443-449.

33. Glaser BG, Strauss AL. The discovery of grounded theory: strategies for qualitative research. Chicago, Aldine Pub. Co. 196; 1967.

34. Daly J, Kellehear A, Gilksman M. The public health researcher. A methodological approach. Melbourne, Australia: Oxford University Press; 1997.

35. Crabtree B, Miller W. A template approach to text analysis: Developing and using codebooks. In: Crabtree B, Miller W, editors. Doing qualitative research. Newbury Park, CA: Sage; 1999. p. 163-177.

36. Fereday J, Muir-Cochrane E. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. International Journal of Qualitative Methods 2006;5(1):80-92.

37. Sandelowski M. Whatever happened to qualitative description? Res Nurs Health 2000 Aug;23(4):334-340.

38. Powell C. The Delphi technique: myths and realities. J Adv Nurs 2003 Feb;41(4):376-382.

39. Beattie E, Mackway-Jones K. A Delphi study to identify performance indicators for emergency medicine. Emerg Med J 2004 Jan;21(1):47-50.

40. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. J Adv Nurs 2000;32(4):1008-1015.

41. Boulkedid R, Abdoul H, Loustau M, Sibony O, Alberti C. Using and reporting the Delphi method for selecting healthcare quality indicators: a systematic review. PLoS ONE 2011;6(6):e20476-e20476.

42. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the Delphi technique in nursing research. J Adv Nurs 2006;53(2):205-212.

15. Appendices

APPENDIX A. Participant Demographics in Each Study Phase

	All Participants (n=53)	Interviews (n=13, 25%)	Roundtable (n=47, 89%)	Delphi round 1 (n=50, 94%)	Delphi round 2 (n=47, 89%)	Delphi round 3 (n=40, 75%)
Primary Professional Type	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Paramedic	35 (66.0)	7 (53.8)	35 (74.5)	35 (70.0)	30 (63.8)	27 (67.5)
Physician	16 (30.2)	6 (46.2)	10 (21.3)	13 (26.0)	15 (31.9)	11 (27.5)
Paramedic & Nurse	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	1 (2.1)	1 (2.5)
Nurse	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	1 (2.1)	1 (2.5)
Role	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**
Researcher	17 (32.0)	4 (30.1)	14 (29.8)	16 (32.0)	16 (34.0)	13 (32.5)
Educator	9 (17.0)	3 (23.0)	9 (19.1)	9 (18.0)	9 (19.1)	7 (17.5)
Researcher & Educator	3 (5.7)	0 (0)	3 (6.4)	2 (4.0)	3 (6.4)	1 (2.5)
EMS Manager	10 (18.9)	2 (15.4)	10 (21.3)	10 (20.0)	10 (21.3)	8 (20.0)
EMS Regulator	2 (3.8)	0 (0)	2 (4.2)	2 (4.0)	2 (4.2)	2 (5.0)
Paramedic only	5 (9.4)	4 (30.8)	5 (10.6)	5 (10.0)	2 (4.2)	3 (7.5)
Physician only	6 (11.3)	0 (0)	3 (6.4)	5 (10.0)	5 (10.6)	5 (12.5)
Emergency Management Administrator	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	0 (0)	1 (2.5)
Province or Territory	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Alberta	7 (13.2)	2 (15.4)	5 (10.6)	6 (12.0)	7 (14.9)	7 (17.5)
British Columbia	4 (7.5)	1 (7.7)	4 (8.5)	3 (6.0)	4 (8.5)	2 (5.0)
Manitoba	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	1 (2.1)	1 (2.5)
New Brunswick	3 (5.7)	0 (0)	3 (6.4)	3 (6.0)	3 (6.4)	3 (7.5)
Newfoundland and Labrador	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	1 (2.1)	0 (0)
Nova Scotia	9 (17.0)	2 (15.4)	8 (17.0)	8 (16.0)	8 (17.0)	7 (17.5)
North West Territories	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Nunavut Territory	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ontario	22 (41.5)	5 (38.5)	20 (42.5)	22 (44.0)	18 (38.3)	16 (40.0)
Prince Edward Island	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Quebec	4 (7.5)	2 (15.4)	3 (6.4)	4 (8.0)	3 (6.4)	3 (7.5)
Saskatchewan	1 (1.9)	1 (7.7)	1 (2.1)	1 (2.0)	1 (2.1)	1 (2.5)
Yukon Territory	1 (1.9)	0 (0)	1 (2.1)	1 (2.0)	1 (2.1)	0 (0)

APPENDIX B. Included Consensus Items from Delphi Surveys

Content Area	Delphi Statement Identifier	Statement
BARRIERS		
Time, Opportunities and Funding to Conduct Research	B-1	There are few funding sources for EMS research (both salary support and grants for projects).
	B-2	There is a lack of dedicated time for EMS providers interested in pursuing their own research, or to assist in research projects.
	B-3	Government/regulators don't give EMS services funding to conduct EMS research.
	B-4	There are very few EMS research jobs.
Education and Mentorship	B-5	There is a lack of baseline research knowledge among people who work in EMS (providers, physicians and others).
	B-6	There are few opportunities for research mentorships, outside of fellowship programs for physicians.
	B-7	Entry-to-practice paramedic programs often do not include an introduction to research course.
	B-8	Research is not well covered in the current NOCPs, especially important skills such as critical appraisal of the peer reviewed literature (evidence based literacy).
	B-9	EMS services often do not support EMS providers to take graduate education in research related degrees.
Culture of Research and Research Collaboration in EMS	B-10	EMS research studies compete with operational and other priorities within the system.
	B-11	There is little or no relationship between EMS services and academia (including universities, research ethics boards, methodologists, etc).
	B-12	A clear strategic direction for EMS research doesn't exist.
	B-13	EMS services do not include conducting EMS research as a part of their strategic planning.
	B-14	EMS providers often don't understand the importance of research studies, which can impact accurate data collection process.
	B-15	EMS providers are often not part of the design and planning phases of research.
	B-16	Governments, EMS services, hospitals and universities don't work together to conduct EMS research.
Structure, Process and Outcome of EMS Research	B-17	It can be difficult to obtain informed consent in clinical studies in the EMS setting.
	B-18	EMS datasets are difficult to link with hospital data to obtain outcome data and to conduct population/ epidemiologic studies.
	B-19	EMS data is sometimes not clean (e.g., data points not well defined, not all users understand what information to enter, etc).
	B-20	EMS services measure, collect and analyze their data inconsistently.
STRENGTHS AND OPPORTUNITIES		
Time, Opportunities and Funding to Conduct Research	S/O-1	In Canada, the health care system is under pressure and re-evaluation is taking place (such as the upcoming 2014 Health Accord), which provides an opportunity for EMS research.
	S/O-2	Large EMS systems can leverage government support for EMS research.
	S/O-3	Regulators can include incentives and performance measures in operator contracts related to research.
	S/O-4	Large EMS research studies have acquired stable research funding.
	S/O-5	Funding/grants exist for research on policy and health systems, and partnerships between researchers and decision makers.
	S/O-6	An opportunity exists to increase the amount of research done in and on EMS communications centres.
	S/O-7	There are many research questions to ask in EMS.
	S/O-8	The EMS patient population is quite varied (such as age, location, illness or injuries).
	S/O-9	There are existing partnerships between EMS services and universities to conduct research.
	S/O-10	Health services research is growing as an important aspect of research.
	S/O-11	Some EMS systems have a researcher on staff.

Content Area	Delphi Statement Identifier	Statement
Education and Mentorship	S/O-12	High quality graduate research degrees are offered at Canadian universities.
	S/O-13	There are established EMS research leaders who provide an opportunity for mentorship.
	S/O-14	EMS educators can be trained on the fundamentals of research, which they can teach their students.
	S/O-15	EMS providers receive more training and continuing education than ever before.
	S/O-16	A national standard for paramedic education exists (the National Occupational Competency Profile).
	S/O-17	The opportunity exists to leverage more research competencies in the NOCP and future national exam.
	S/O-18	Paramedic training programs are increasingly collaborating with universities, and more paramedic degree programs are under development.
	S/O-19	Some grants exist that support research/graduate training.
	S/O-20	Research programs and courses specializing in EMS exist in Canada.
	S/O-21	Researchers have the opportunity to incorporate mentorship into their grant funding by hiring EMS providers as research assistants.
	S/O-22	More EMS providers are returning to school for higher education.
	S/O-23	Colleges and paramedic training schools have the opportunity to encourage research.
Culture of Research and Research Collaboration in EMS	S/O-24	EMS research provides opportunities to collaborate with other non-health sciences professions such as business, engineering and social sciences.
	S/O-25	Partnerships exist between EMS research centers.
	S/O-26	An opportunity exists for national organizations/associations to collaborate to conduct and support EMS research.
	S/O-27	Positive experiences with one research study leads to other research studies.
	S/O-28	EMS providers and physicians already have good interdisciplinary collaboration.
Structure, Process and Outcome	S/O-29	EMS researchers can use existing uniform data sets (such as the Canadian Institute for Health Information).
	S/O-30	Biometric monitoring is used more often in EMS systems (such as CPR monitoring).
	S/O-31	Some provinces have had success changing legislation that was restrictive to EMS and EMS research.
	S/O-32	There have been milestones in Canadian EMS research that have helped to move EMS research forward (such as the Ontario Prehospital ALS Study).
	S/O-33	Real-time data analysis and reporting is possible.
	S/O-34	EMS research committees that evaluate and coordinate EMS research projects are becoming more prevalent.
	S/O-35	There is a movement to create a national standard EMS data set.
	S/O-36	EMS datasets can be consolidated and stored in research registries to increase the statistical power of studies.
	S/O-37	Some EMS systems already have linkages with hospitals for some outcome data (such as ST-elevation myocardial infarction).
	S/O-38	Most EMS systems use computer-aided dispatching, so all dispatch data is collected electronically.
	S/O-39	A wealth of EMS data exists (dispatch data, patient records, etc).
	S/O-40	Some EMS systems collect data in the same way, including how data is defined and analyzed.
	S/O-41	Many EMS services use electronic charting.
	S/O-42	There have been multi-centre international EMS studies, and an ongoing EMS research consortium (the Resuscitation Outcomes Consortium).
	S/O-43	EMS-specific evidence repositories exist (such as the Dalhousie University Prehospital Evidence-based Protocols project).
	S/O-44	Performance-based EMS contracts require EMS operators to collect data.
	S/O-45	Many leaders in EMS are aware of the need for common data definitions across services.
	S/O-46	Research articles can be found online through web-based databases.

Content Area	Delphi Statement Identifier	Statement
EMS and Paramedic Practice	S/O-47	In many locations in Canada, EMS regulation is moving to a provincial or regional level, which increases standardization.
	S/O-48	EMS providers generally comply with protocols and can quickly adopt clinical research protocols.
	S/O-49	The public generally considers EMS providers to be trusted professionals.
	S/O-50	There is some movement in EMS practice from protocols to more evidence-based guidelines.
	S/O-51	EMS providers are increasingly working in interdisciplinary teams to provide non-traditional care.
	S/O-52	The evolving identity of EMS providers creates a role for research.
	S/O-53	The EMS setting is unique: paramedics are some of the few health care providers that have direct access to patients in their home environments.
	S/O-54	Evidence is needed to guide the development of new EMS programs, such as community/extended care paramedic programs.
RECOMMENDATIONS		
Time, Opportunities and Funding	R-1	National associations, EMS systems and EMS research centres must strategically market the importance of EMS research to other agencies, health groups and the public.
	R-2	Partnerships between EMS academic centres, systems, regulators, schools and national associations should be strengthened to increase support for EMS research.
	R-3	National and provincial health granting agencies should have a special call for EMS research studies.
	R-4	EMS leaders and researchers should lobby provincial and federal governments for financial support to conduct EMS research.
	R-5	Universities should consider EMS providers with graduate training for academic appointments, so they can access university services (such as research grant accounts).
	R-6	EMS provider collective agreements should permit paramedics to take alternate positions so they can work in research, but remain part of the union.
	R-7	EMS systems should have an EMS researcher position on their staff.
Education and Mentorship	R-8	EMS systems should integrate research evidence into paramedic continuing medical education.
	R-9	Integrate research evidence into all aspects of EMS provider and physician training.
	R-10	Researchers should offer EMS providers, physicians, administrators and others workshops on conducting research and using research evidence.
	R-11	As paramedics progress through career training (PCP, ACP, CCP, management or other specialized roles), increasingly complex research competencies should be introduced.
	R-12	Upper level EMS administrators should increase their knowledge of research and critical appraisal.
	R-13	EMS research centres should create fellowship and graduate student opportunities focused on EMS research.
	R-14	EMS systems should provide scholarships for EMS providers, physicians, administrators to undertake graduate education.
	R-15	Information on existing EMS research groups in Canada should be disseminated to front-line paramedics
Culture of Research and Research Collaboration in EMS	R-16	EMS administrators and researchers should increase strategic partnerships with non-EMS groups to conduct research.
	R-17	EMS researchers should engage EMS providers and managers early in the research process (such as at the design phase).
	R-18	All EMS research study teams should include an EMS provider.
	R-19	EMS systems (regulators and operators) should budget for research projects during annual strategic planning.
	R-20	EMS researchers must take a more comprehensive approach to knowledge translation, including delivering the results of research to front-line staff.
	R-21	EMS physicians, managers and providers must encourage the use of evidence-based decision making in implementing a new program, device or drug in their system. If sufficient evidence is not available, a study should be conducted.
	R-22	National EMS associations should have a regular conference together.

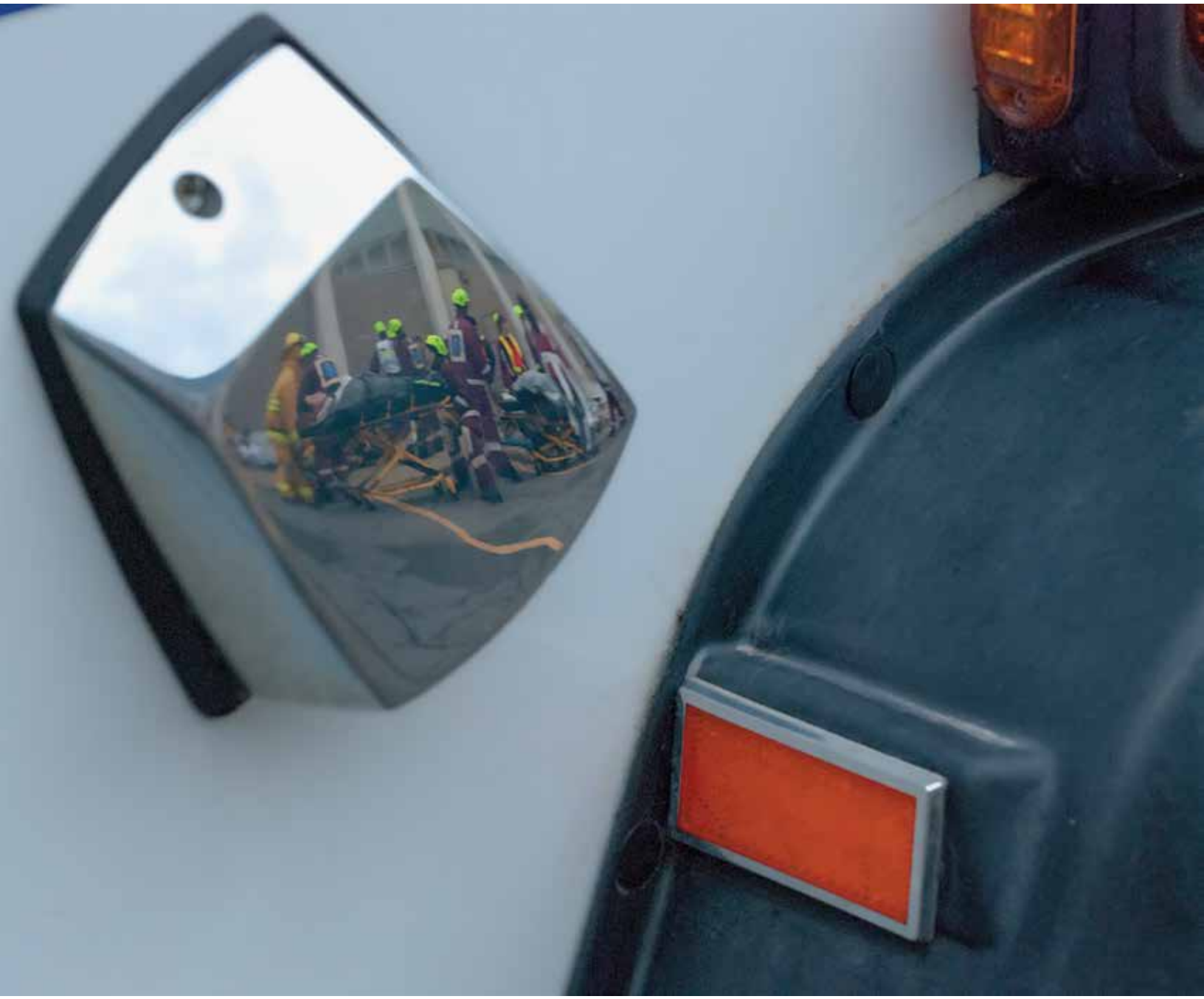
Content Area	Delphi Statement Identifier	Statement
Culture of Research and Research Collaboration in EMS	R-23	Establish a national research conference for EMS research.
	R-24	The existing (somewhat informal) network of EMS researchers/people interested in EMS research should be strengthened and built upon, to increase collaboration and idea-sharing.
Structure, Process and Outcome	R-25	EMS researchers and EMS administrators should engage research ethics boards to educate them on the unique nature of EMS research, and ask them to have EMS experts on their review committees.
	R-26	The *Canadian Journal of Emergency Medicine* should have an annual special edition on EMS, or special section in each issue.
	R-27	EMS administrators and researchers should lobby provincial governments and health authorities to provide funding and expertise to link EMS, hospital and other datasets.
	R-28	A national EMS data dictionary must be completed and universally utilized.
Future Directions for the EMS Research Agenda	R-29	The gaps that exist in EMS knowledge should be systematically mapped out, to identify research priorities.
	R-30	A plan to renew the EMS Research Agenda in 5 or 10 years needs to be designed.
	R-31	A plan to implement the Canadian National EMS Research Agenda needs to be designed, along with an evaluation method to measure its effects.
SUGGESTED TOPICS FOR FUTURE STUDY		
Clinical	P-1	Links to clinical outcome data (including hospital, medical examiner).
	P-2	Implementation of evidence-based protocols (such as Canadian C-spine Rule).
	P-3	Clinical errors.
	P-4	Use of research evidence to create clinical protocols/guidelines.
	P-5	Clinical outcomes survival and other outcome measures.
	P-6	Sepsis
	P-7	Clinical prediction rules/decision rules.
	P-8	Paramedic clinical decision-making.
	P-9	Geriatric care.
	P-10	Respiratory distress (interventions such as continuous positive airway pressure).
	P-11	Data collection and definitions
Health Services/ Systems	P-12	Destination decisions non-transport and alternate referrals by EMS providers.
	P-13	Regionalization of care for specific conditions in Canada (e.g., stroke, ST elevation myocardial infarction, sepsis, trauma).
	P-14	Role of EMS in health protection and promotion.
	P-15	Cost effectiveness of specific EMS programs (such as helicopter EMS, community paramedicine, etc).
	P-16	Deployment/System Status Management.
	P-17	ED overcrowding and ambulance offload delay time interval standards, interventions.
	P-18	Extended scope/community paramedicine programs.
	P-19	Triage by EMS providers.
	P-20	Best placement of advanced/basic crews (rural vs urban).
	P-21	The role of the paramedic in various health settings.
Education	P-22	Advanced decision-making training.
	P-23	Evidence-based practice/critical analysis training.
	P-24	Knowledge translation in EMS.
	P-25	Communication skills training.
	P-26	High fidelity simulation.
	P-27	Competency assessment/testing.

Content Area	Delphi Statement Identifier	Statement
Safety	P-28	Most common errors, errors with biggest impact on safety & clinical outcome.
	P-29	Error, adverse event reporting (including never events that should never occur).
	P-30	Transfer of care/information loss in hand-over.
	P-31	System interventions to improve patient & provider safety.
	P-32	Ergonomics, lifting, equipment design.
	P-33	Paramedic injury (including injury prevention programs).
Professional Development	P-34	Maintenance of competence.
	P-35	How to conduct high quality research in EMS.
	P-36	Using research to inform policy and non-clinical decisions.

For more information, please contact:

Jan L Jensen,
Principal Investigator
Dalhousie University Division of EMS
QEII Health Sciences Centre
1796 Summer Street, Room 3021
Halifax Nova Scotia B3H3A7
jljensen@dal.ca

Doug Socha,
Research Committee Chair
EMS Chiefs of Canada
201-4 Florence Street
Ottawa Ontario K2P 0W7
sochad@hastingscounty.com



www.emscc.ca/nra

www.emscc.ca/nra