Contemporary evidence-based practice in Canadian emergency medical services: a vision for integrating evidence into clinical and policy decision-making

Jan L. Jensen, MAHSR*†; Andrew H. Travers, MD, MSc*†

ABSTRACT

Nationally, emphasis on the importance of evidence-based practice (EBP) in emergency medicine and emergency medical services (EMS) has continuously increased. However, meaningful incorporation of effective and sustainable EBP into clinical and administrative decision-making remains a challenge. We propose a vision for EBP in EMS: *Canadian EMS clinicians and leaders will understand and use the best available evidence for clinical and administrative decision-making, to improve patient health outcomes, the capability and quality of EMS systems of care, and safety of patients and EMS professionals.* This vision can be implemented with the use of a structure, process, system, and outcome taxonomy to identify current barriers to true EBP, to recognize the opportunities that exist, and propose corresponding recommended strategies for local EMS agencies and at the national level. Framing local and national discussions with this approach will be useful for developing a cohesive and collaborative Canadian EBP strategy.

RÉSUMÉ

On n'a cessé d'insister, à l'échelle nationale, sur l'importance de la pratique fondée sur des données probantes (PFDP) en médecine d'urgence et dans les services médicaux d'urgence (SMU). Toutefois, la véritable incorporation d'une PFDP efficace et durable dans les prises de décision cliniques et administratives pose toujours des problèmes. Aussi nous, les auteurs, proposons-nous la vision suivante de la PFDP dans les SMU : *les cliniciens et les dirigeants en matière de SMU au Canada comprendront les meilleures données probantes qui soient et les appliqueront dans les prises de décision cliniques et administratives afin d'améliorer les résultats cliniques chez les patients, la capacité et la qualité des systèmes de soins des SMU, la sécurité des patients et la compétence des professionnels des SMU*. Il serait possible de concrétiser cette vision à l'aide d'une taxinomie des structures, des processus, des systèmes et des résultats afin de cerner les obstacles actuels à la véritable PFDP, de discerner les possibilités existantes et de proposer des stratégies recommandées, adaptées aux besoins, aux agences locales de SMU ainsi qu'à des organisations nationales. Ainsi, le fait de dresser un cadre de discussion à l'échelle locale et nationale reposant sur cette approche facilitera l'élaboration d'une stratégie cohérente et collaborative de la PFDP au pays.

Keywords: emergency medical services, paramedic, evidence based practice

INTRODUCTION

The terms, *evidence-based medicine (EBM)*, *evidence-based practice (EBP)*, and *knowledge translation (KT)*, are familiar to most emergency medicine (EM) and emergency medical services (EMS) clinicians and leaders. There have been calls for meaningful incorporation of these principles into EM and EMS. Several EMS research agendas from around the world have made

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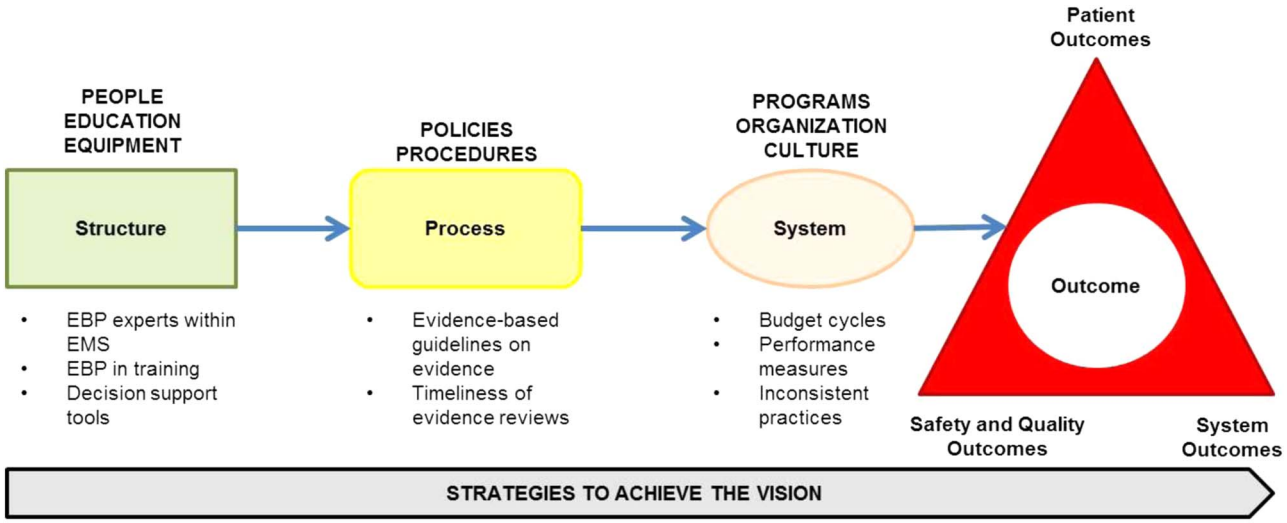
clear recommendations about the importance of prioritizing and adequately resourcing to enable evidence-based decision-making,[1-8] with similar calls having been made in EM.[9] The notion of EBM/EBP/KT is easily appreciated and agreed to; however, meaningful incorporation into clinical and administrative practice in Canadian EMS remains a challenge nationally and at the local EMS system level. This article will propose a vision for Canadian EMS EBP that we can collectively strive to achieve. This vision can be implemented with the use of the structure, process, system, and outcome (SPSO) taxonomy (Figure 1) to identify current barriers and strengths, with corresponding recommended strategies for local EMS agencies and at the national level (Table 1).[10]

THE VISION OF EMS EBP

Vision statements are used by organizations to describe their long-term objectives; specifically what it is they are aiming for. They describe the future and are stable.[11] Such an exercise is important for EBP in EMS to increase understanding and engagement among all stakeholders. We propose that the vision is: *Canadian EMS clinicians and leaders will understand and use the best available evidence for clinical and administrative decision-making, to improve patient health outcomes, the capability and quality of EMS systems of care, and safety of patients and EMS professionals.* With this vision set, barriers to achieving it can be identified, current strengths that will propel the vision forward, recognized and effective strategies established (Table 1).[12]



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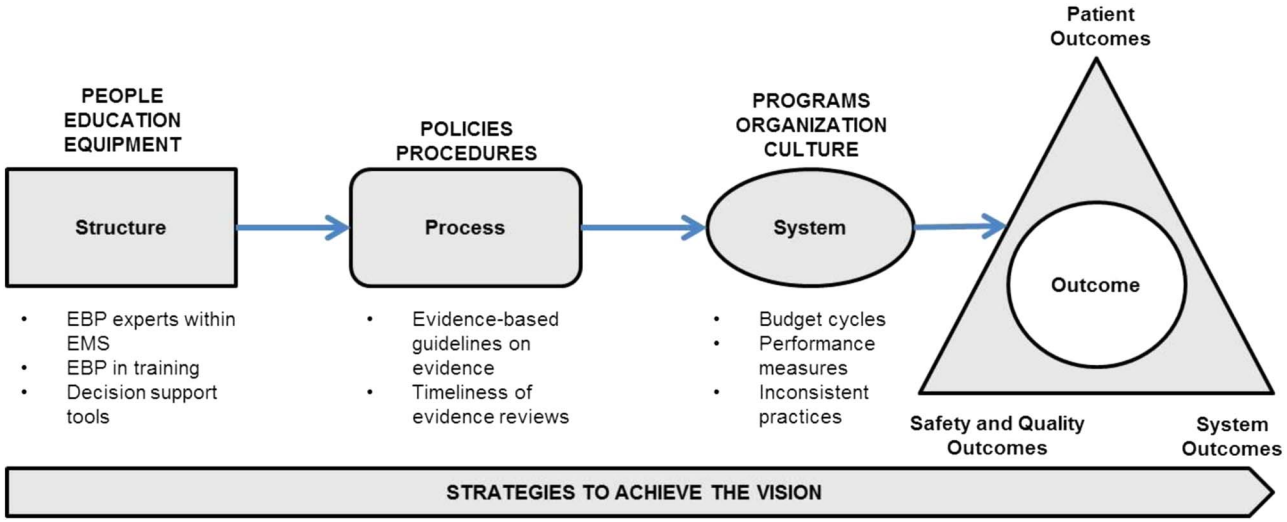

Figure 1. SPSO Strategies to Achieve the Canadian EMS EBP Vision.

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Table 1. Identified barriers and opportunities for incorporating EBP into EMS clinical and policy decision-making

Category	Barrier	Existing strengths	National EMS implementation strategy	Local EMS implementation strategy
Structures	Few EBP experts in EMS	Targeted EMS training programs on EBP and for EMS professionals, including leadership roles. Some institutions offer EBP services which EMS could access.[33,34] Some EMS agencies employ researchers/research coordinators/research medical directors.	Optimize development of leadership training that includes EBP. Develop ongoing expertise and maintain active participation in the ILCOR evidence evaluation process.[23,43]	Fund EBP training for key staff. Seek local (non-EMS) expertise and services to assist with evidence evaluation. Develop relationship between EMS and academia for this. Implement scholarships for graduate (masters and PhD) training for paramedics.[44] Establish collaborations between EMS services and universities for advanced research training.
	Lack of EBP in foundational and continuing training	Research is a competency at all paramedic training levels in Paramedic Association of Canada NOCPs.[16] Centennial College paramedic program includes research course).[45] Evidence-based practice is included in a Canadian paramedic textbook.[46] Training in EBP for paramedics exists (e.g., Dalhousie University Division of EMS Paramedic Evidence Based Practice[47]) and in some settings is required for practicing EMS clinicians (e.g., Alberta College of Paramedics literature review module[48]).	National organizations to host EBP training sessions. Foster discussion on effective education strategies to meet and exceed NOCP requirements for EBP in foundational training.	Incorporate journal clubs, evidence reviews and research into paramedic continuing training as core curriculum. Incorporate "journal clubs" and similar scholarly activities into local EMS medical director deliverables. Regulators/colleges to provide registration credits for EBP continuing education.
	Lack of effective and efficient evidence-based decision support tools.	Mobile apps and key websites increasingly available and desired by clinicians.	National availability of effective tools.	Provide updated list of recommended EBP and research apps and websites to EMS clinicians. Provide local EMS guidelines/protocols/policies on an app for EMS clinician use, with links to EBP resources.
Processes	EMS protocols/guidelines/ policies are not based on evidence.	GRADE method is well accepted and established.[49] Evidence reviews are required for protocol and policy change suggestion submissions and is integrated in the process.[50,51]	Establish a working group to development national evidence-based EMS clinical practice guidelines/ protocols, using established methodology. Translate known national and international guidelines (e.g., resuscitation guidelines) to local and national practice.	Refer to available evidence review sources during EMS guideline/protocol/policy update process. Medical Directors and EMS leadership to lead and support incorporation of evidence reviews into policy and protocol changes. Require evidence reviews as part of protocol/policy change suggestion process. Develop local EMS expertise on GRADE or similar guideline development processes.
	Non-research evidence (e.g., quality improvement, program evaluation data/ findings) are not included in EMS EBP.		Showcase programs that effectively include research and non-research evidence in decision-making processes.	Review non-research data alongside research evidence during EBP process.

Table 1. (Continued)

Category	Barrier	Existing strengths	National EMS implementation strategy	Local EMS implementation strategy
	Locating and reviewing evidence is time consuming and labour intensive.	Some EMS systems have access to peer reviewed journals. Studies are becoming increasingly open access. Canadian PEP Project[20] Cochrane Prehospital and Emergency Care systematic reviews.[52] Rapid review methods are becoming more established. Evidence review services are available in some sites (e.g., Ottawa and Hamilton.[33,34]	Effective dissemination of EMS-specific evidence resources, such as PEP.	Incorporate targeted rapid evidence reviews into guideline/protocol/policy update cycles. Limit evidence reviews to questions not covered in existing evidence review sources.
Systems	Mismatch of evidence review cycles and EMS business cycles.	The timing for release of some EB-guidelines is predictable; EMS systems can prepare in advance (e.g., ILCOR/Resuscitation guidelines released every five years).[53]		During business planning, predict funding requirements for incorporating evidence-based changes into practice for upcoming cycle. Budget for cost of EBP (e.g., evidence review services).
	Few effective partnerships between academia and EMS service delivery exist.	Use effective partnerships as a model to implement in other Canadian sites.	Foster collaboration between EMS and academia across the country through networks, such as the Canadian EMS Research Network.[54]	EMS agencies, universities and research centres can partner to build the EMS local research enterprise through: collaborative graduate programs, industry grant applications, and joint projects.
	Difficult to measure the impact of EBP in EMS clinical care/service delivery.	Evidence-based performance measures established in the US.[40] Benchmarks for specific indicators available in published guidelines (e.g., time to intervention for STEMI care).[55,56]	Continue national/inter-agency discussion to develop standards for evidence-based EMS performance measures.	Incorporate evidence-based performance measures into local quality improvement processes.
	Inconsistency in EBP across Canadian EMS.	Paramedic Association of Canada NOCPs – research included as a competency at all paramedic training levels. Increasing number of EMS clinicians with research training. EBP tools, such as Canadian PEP project. Structured protocols guide paramedic clinical care in most EMS systems.	Discussion and projects at national level, though partnerships and collaboration. Capitalize on the strengths in the current widespread use of standardized protocols in Canadian EMS. Develop national, evidence based guidelines and protocols that are implemented at the local level.	Prioritize EBP within local services.

EBP = evidence-based practice; EMS = emergency medical services; GRADE = Grading of Recommendations, Assessment, Development and Evaluation; ILCOR = International Liaison Committee on Resuscitation; NOCPs = National Occupational Competency Profiles; PEP = Prehospital Evidence-based Practice Project; STEMI = ST-elevation myocardial infarction.

EMS EBP STRUCTURE

Structure: barriers

Structural elements include, but are not limited to, people, equipment, and education. Several structural barriers to the effective incorporation of EBP into EMS practices and clinical care have been identified. The predominant barriers are 1) lack of EBP and research expertise within EMS systems, 2) little or inconsistent training in EBP for clinicians and leaders, and 3) few effective clinical decision support tools that are evidence-based.

To foster the development of EBP expertise among those who work in EMS, foundational training programs for paramedics, physicians, and EMS administration and leadership must include EBP. As in EM, instilling these principles in new graduates enables effective KT. In a recent survey of the Royal College of Physicians and Surgeons of Canada residency directors, key areas of improvement were found to be increasing the number of EBM experts available at sites, incorporating EBM principles into regular learner journal clubs, and nationalization of EBM resources.[13] Correspondingly, paramedic training needs to incorporate the same principles of EBP throughout the continuum of each program. EMS clinicians (paramedics, physicians, and others) should graduate prepared to locate and use reliable EBP resources. Further work is required to effectively integrate EBP at the EMS point of care with patients. During EMS calls, paramedics and online medical oversight physicians (where applicable) require reliable resources that are simple to navigate and apply. There has been little published on how best to include EBP within clinical decision support tools, and whether they improve clinical care, particularly in the EMS setting.[14] EMS administrative leaders require EBP skills to incorporate evidence into policy decision-making, an area that requires further specific training and resources.[15]

Structure: strengths and implementation strategies

Several strengths exist in Canada to improve structures to enable EBP. Some Canadian EMS systems have dedicated research positions, which often provide local EBP expertise. The EBP function can also be embedded into other key positions, such as clinical quality positions, particularly if these staff members receive specific training in this area. Staff members in these positions develop expertise through experience, if their system requires a structured EBP process for updates to protocols, policies, procedures, and practices (PPPP) to be updated. Research has become a requirement for training at all levels in the Paramedic Association of Canada's National Occupational Competency Profile (NOCP), which helps drive this standard forward[16] (http://www.paramedic.ca/site/nocp?nav=02). Significant variation in the amount of time and resources invested in EBM likely exists across training programs, but this may continue to improve with national discussions and growing expectations for emphasis to be placed on EBP. Clinical decision support tools are promising. These have the potential to provide evidence-based resources and tools in a concise, easily accessible format. Some Canadian EMS systems have disseminated their local PPPP to staff via smartphone apps. The success of these is a platform to build upon to get EBP tools into the hands of those who need them at the right time. EMS stakeholders must be proactive to make incremental improvements in EBP structure, including expertise, training, and tools. Resources must be allocated in these areas to build a sustainable structure in which EBPs can thrive.

PROCESSES FOR EMS EBP

Process: barriers

Process elements include, but are not limited to, PPPP. The leading process barrier is that, in many systems, EMS PPPP are not based on research evidence. This is likely for three main reasons. First, the tendency has been to extrapolate EM knowledge into the EMS realm of practice.[17] Recently, the evidence flow has been in the inverse direction: high-quality EMS research data have been generalized to the in-hospital setting.[18] Adapting research findings from the EMS to the EM setting (or vice versa) may work well for some clinical constructs (e.g., stroke, STEMI care in urban locations), and opportunities to do this are limited for others (e.g., rural management of abdominal pain). This is because of a lack of research evidence in some conditions, and also clinical presentation and care differ enough between the settings that generalizing must be done carefully. EMS must continue to work with EM stakeholders in identifying common areas in which EBP/KT efforts can be optimized. Likewise, EM stakeholders must continue to appreciate the nuances of EMS practices.

The second process barrier is the relative lack of research evidence available for EMS care, like the EM

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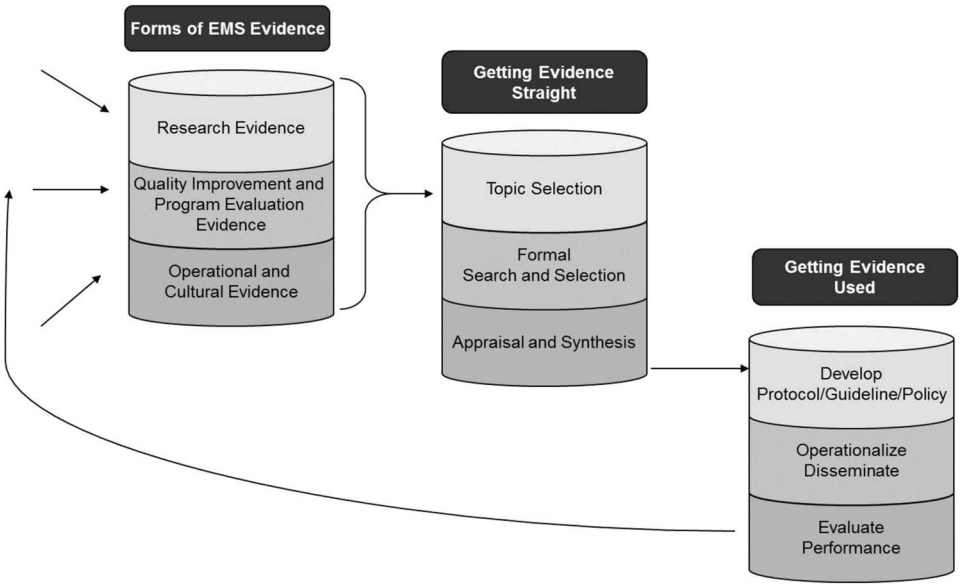

Figure 2. Evidence Evaluation Process in EMS. Adapted from <1>.

body of research that is in relative youth compared to hospital-based practices.[19] This concern is continuously decreasing as the quality and quantity of the EMS evidence base expands rapidly. Of note, much EMS knowledge resides in quality improvement and program evaluation programs. The information derived from these processes should be incorporated into the evidence-based decision-making processes, rather than in separate silos (Figure 2).

The third process barrier is the effort required to identify the evidence and incorporate it into practice. This has been previously well described in the EMS landmark article by Cone; we must first "get the evidence straight" and then "get the evidence used" (see Figure 2). Both parts of this equation can be perplexing to implement and maintain in a meaningful way within Canadian EMS systems.[1] Translation of evidence from EM to EMS must be done carefully,[17] because loosely generalized research findings can lead to practices that are no longer evidence-based. The effort required to conduct literature searches, select relevant studies (consciously excluding those that are not), analyse, synthesize, and apply to the breadth of EMS care is immense.

Process: strengths and implementation strategies

There are a few well established Canadian EMS-specific evidence resources available, including the Canadian Prehospital Evidence-based Practice (PEP) project (https://emspep.cdha.nshealth.ca/Default.aspx).[20] Similar programs exist or are in development in Australia[21] and Ireland[22] (http://www.ul.ie/cpr/node/661). Perhaps the most well-known example of an EBP activity is the resuscitation recommendations that stem from the evidence reviews of the International Liaison Committee on Resuscitation.[23] Incorporating these resources into EMS guideline development and updating processes is efficient – saving the steps of literature searching, selection, and appraisal. In the United States, a large national project to develop national EMS evidence-based guidelines is underway,[24,25] and, similarly, the U.S. PEGASUS project is establishing evidence-based guidelines for pediatric EMS.[26] On a smaller scale, this was explored several years ago in Canada through a small pilot EMS evidence-based guidelines project.[27]

Methodology for conducting evidence reviews is continuously becoming more streamlined and timely. One of the leading approaches for the development of evidence-based guidelines is the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology, which has been used in several projects, including the U.S. National Evidence-Based Guidelines Project,[24] the ILCOR evidence review process,[28] and the development of the Surviving Sepsis International Guidelines.[29] The AGREE II tool is a robust methodological approach for developing

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evidence-based guidelines.[30] Efficiently targeting the evidence for specific questions is improving with rapid evidence reviews.[31,32] Some institutions even offer rapid reviews as a service, such as the Ottawa Hospital Research Institute[33] and McMaster University Health Forum.[34] Rapid reviews are often helpful for specific policy and system-level decisions, which may not be addressed through the evidence reviews completed for clinical guidelines. For example, recently, the Nova Scotia provincial government funded a rapid evidence review on collaborative emergency centres to inform decision-making for this program.[35]

EMS stakeholders can use existing EBP processes established within Canada, as well as International EMS systems to advance their local systems. EM and EMS physicians who are in the position of developing and overseeing local practice guidelines need not feel they are alone in their venture. There are several EM and EMS leaders in the country who have gained significant expertise and experience in guideline development using these methods. Using a common and shared framework at the national level for "getting the evidence" and "getting the evidence straight" propels potentially limited local resources for "getting the evidence used." It is essential to incorporate local evidence generated from quality improvement and program evaluation data into EBP. Methods used to generate these findings can be evaluated, and this evidence should be translated to practice and readily available for the end user to consider and use. Finally, EMS systems are grounded in a protocol-driven culture. Traditionally, EMS care and processes have been directive and specific. Although there is a movement towards more open guidelines, the benefit of protocols must not be dismissed. Protocols provide a structured vehicle for many people to perform in the same way, which can enable consistent application of EBPs. EMS must strike a healthy balance between the use of guidelines and protocols. This should be guided through national discussion and identification of best practices.

SYSTEMS FOR EMS EBP

System: barriers

System barriers include programs, resources, and the current EMS culture. A recent literature review identified seven publications describing evidence-based approaches and frameworks for EMS clinical policy decision-making.[36] The summary from this scant literature found that EBP for decision-making is challenging and unlikely to be successful if the efforts were not adequately resourced, which includes funding, expertise, time, and high-level support. A culture that promotes (even demands) EBP and sufficient funding are required to build sustainable programs within EMS systems. This can be challenging because of the asynchronous timing of research (notoriously long), guideline release dates (e.g., resuscitation guidelines released every 5 years in the fall), and operational budget cycles (e.g., usually beginning in the spring). Purposeful inclusion of research, EBP, and anticipated changes to guidelines in business planning strategies would ensure that funding decisions for this are considered. Investment in resources, including developing local EBP expertise and time for EBP activities, can minimize the "knowledge to action" (K2A) gap.[37] Once evidence is translated or codified into EMS PPPP, efforts must be focused on factors that will enable evidence to be used[38] and evaluated in an ongoing culture and system of quality (Figure 3).

System: opportunities and implementation strategies

Effective EMS (and EM) EBP systems are developed and maintained by integrating EBP structure elements (e.g., people trained in EBP with appropriate resources) with EBP process elements (e.g., evidence review of PPPP). Because resources available to EMS for EBP may be limited, it is important for local EMS systems not to "re-invent the wheel" (see Figure 3). If a published high-quality EMS guideline informs the user on "what to do" and "how to do it," which includes the provision of high quality, effective KT tools (e.g., slide sets, pocket guides), the focus should be the development and execution of an effective implementation strategy. If a quality published guideline informs the user on "what to do" but lacks any "how-to" tools, then the priority is to determine how to effectively operationalize the information in the local system in the most meaningful way. There is opportunity here for sharing best practices across EMS systems. If no guideline exists, or the guideline is of low quality, then the focus should be on conducting in-depth evidence appraisal. An effective Canadian EMS EBP system would clearly catalogue the various bodies of knowledge (i.e., clear what/how clinical practice guidelines [CPG]

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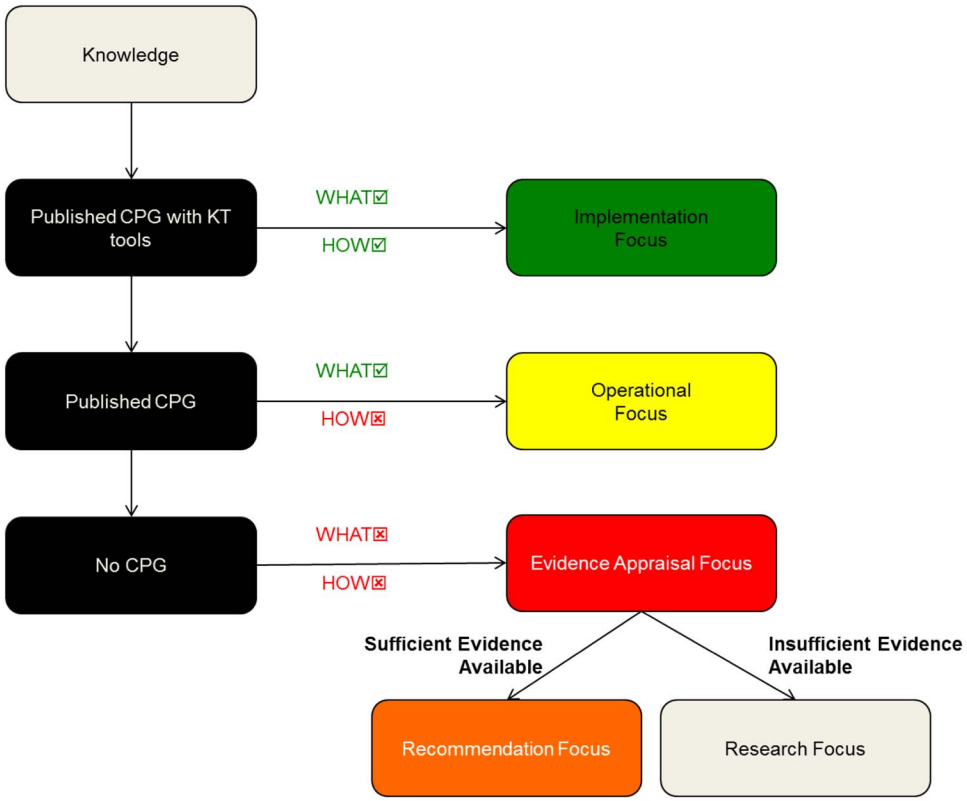

Figure 3. Focus for Action with Availability of Various CPGs.

v. what only CPG, etc.), increasing efficiency for end users when searching for CPG and KT tools.

It is challenging to measure the effect of specific EBP initiatives. Does integrating evidence with clinical and policy decision-making make a difference to important outcomes? Importantly, previous work from the United States proposed EMS performance measures that were grounded in research evidence,[39] which has been expanded in the recent COMPASS project.[40] This shifts reliance from traditional performance indicators, such as response times, to indicators that reflect important outcomes, including clinical patient care and safety outcomes. Further research is needed to demonstrate the value of EBP. One study from the United States demonstrated an increase in protocol compliance for appropriate analgesia dosing with the introduction of an evidence-based EMS guideline.[41] Similar work is needed to demonstrate the effect on other important structure, process, system, and outcomes (SPSOs).[10,26] As in the process strategies, sharing limited resources at a national/international level to establish the evidence and get it straight with acceptable evidence evaluation tools enables local EMS agencies to optimize resources for "getting it used."[42]

CONCLUSION

The vision for EBP in Canadian EMS is to use the best available evidence to improve outcomes, including clinical, system, safety, and quality. Achieving meaningful, sustainable practices that incorporate evidence into clinical and policy decision-making can be challenging. Identification of barriers at the structure, process, and system levels enables current opportunities to become clear and targeted implementation strategies to be developed. This approach to improving EBP may be effective at the local EMS level, and the model is also applicable to EM departments and systems. Framing national discussions with this approach will be useful for developing a cohesive and collaborative Canadian strategy.

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