

ORIGINAL RESEARCH

Developing a national competency framework for pediatric hospital medicine in Canada using the Delphi method

Peter Vetere,¹ Catharine M Walsh,² Ali Al Maawali,^{3,4} Allan Puran,^{3,5} Tanya N Beran,⁶ Zia Bismilla,³ Suzette Cooke¹

*Author information is provided in the back matter of this manuscript

Abstract

Background: Over the past three decades, the field of Pediatric Hospital Medicine (PHM) has expanded rapidly in North America in response to the increasing complexity and acuity of the pediatric inpatient population. While 78 fellowship programs and a published PHM Core Competencies framework exist in the United States, Canadian fellowship programs lack a national competency framework to guide curriculum and practice. This absence creates uncertainty in defining the scope of practice and training expectations for PHM in Canada. The purpose of this study was to define this scope.

Methods: Using Delphi methodology, a national panel of experts in PHM iteratively rated potential competencies, on a 5-point scale, to determine their priority for inclusion. Responses were analyzed after each round. Competencies that were assigned a rating of three or less by $\geq 80\%$ of the panelists were removed from subsequent rounds. The remaining competencies were re-sent to panelists for further ratings until consensus was reached, defined as Cronbach's $\alpha \geq 0.95$ and after a minimum of two survey rounds. At the conclusion of the Delphi process, competencies where $\geq 80\%$ of the panelists assigned a rating of ≥ 4 were included.

Results: Two rounds of the Delphi process were required to reach consensus. Thirty-five panelists completed both survey rounds. The panelists represented 13 Canadian pediatric tertiary care centers and five community hospitals. Of 176 initial competencies, 109 PHM competencies achieved consensus, spanning the seven CanMEDS roles.

Conclusion: This is the first study to define competencies for PHM in Canada. The competencies identified provide a framework for PHM fellowship program directors to shape local curricula. The results may also be used to inform the development of comprehensive national PHM fellowship curricula.

Élaboration d'un cadre national de compétences pour la médecine hospitalière pédiatrique au Canada à l'aide de la méthode Delphi

Résumé

Contexte : Au cours des trois dernières décennies, le domaine de la médecine hospitalière pédiatrique (MHP) s'est rapidement développé en Amérique du Nord en réponse à la complexité et à le niveau d'acuité croissants de la population pédiatrique hospitalisée. Alors qu'il existe 78 programmes de fellowship et un cadre de compétences de base en MHP publié aux États-Unis, les programmes de fellowship canadiens ne disposent pas d'un cadre national de compétences pour orienter les programmes d'études et la pratique. Cette absence crée une incertitude quant à la définition du champ d'exercice et des attentes en matière de formation pour la MHP au Canada. L'objectif de cette étude était de définir ce champ.

Méthodes : À l'aide de la méthodologie Delphi, un panel national d'experts en MHP a évalué de manière itérative les compétences potentielles, sur une échelle de 5 points, afin de déterminer leur priorité d'inclusion. Les réponses ont été analysées après chaque cycle. Les compétences qui ont reçu une note de trois ou moins par $\geq 80\%$ des membres du panel ont été retirées des cycles suivants. Les compétences restantes ont été renvoyées aux membres du panel pour être réévaluées jusqu'à ce qu'un consensus soit atteint, défini comme un α de Cronbach $\geq 0,95$ et après au moins deux cycles d'enquête. À l'issue du processus Delphi, les compétences auxquelles $\geq 80\%$ des membres du panel ont attribué une note ≥ 4 ont été incluses.

Résultats : Deux cycles du processus Delphi ont été nécessaires pour parvenir à un consensus. Trente-cinq membres du panel ont répondu aux deux cycles d'enquête. Les membres du panel représentaient 13 centres de soins pédiatriques tertiaires canadiens et cinq hôpitaux communautaires. Sur les 176 compétences initiales, 109 compétences en MPH ont fait l'objet d'un consensus, couvrant les sept rôles CanMEDS.

Conclusion : Il s'agit de la première étude visant à définir les compétences en MPH au Canada. Les compétences identifiées fournissent un cadre aux directeurs de fellowship en MPH pour élaborer des programmes d'études locaux. Les résultats peuvent également être utilisés pour éclairer l'élaboration de programmes d'études nationaux complets en MPH.

Introduction

The growth of the field of Pediatric Hospital Medicine (PHM) in North America reflects a consolidated effort to directly address and improve care provided to infants, children and youth requiring admission to hospital. Physicians dedicated to the practice of PHM are referred to as “Hospital Pediatricians” or “Pediatric Hospitalists” to reflect their role as

medical care providers to the inpatient pediatric population.¹

Care by specialists dedicated to pediatric patients requiring hospitalization has been shown to have several advantages. These benefits include lower hospital costs, improved resource utilization and increased adherence to evidenced-informed practice guidelines.² US studies comparing the pediatric

hospitalist model to traditional care models have demonstrated a significant reduction in length of stay.^{3,4} In addition to promoting positive clinical outcomes, research suggests that implementation of pediatric hospitalist training programs demonstrates improvements in the educational experiences of house staff as well as parent and caregiver satisfaction.⁵ The increased clinical acuity and complexity of the pediatric inpatient population has necessitated more sophisticated, integrated care models and coordinated systems.⁶ Hospital pediatricians are now leading initiatives related to quality improvement, patient safety, leadership, management, medical education and research.⁷

The need for additional clinical and academic training to work in pediatric tertiary care hospital settings in the US has been recognized for over two decades. The first PHM fellowships in the US were developed in 2003.⁸ These fellowships were accredited by individual institutions until 2016, when after years of building momentum, the field of PHM received official recognition as a distinct pediatric subspecialty by the American College of Graduate Medical Education.⁹ Following completion of a three-year general pediatric residency, trainees in the US who are pursuing a PHM fellowship must complete a two-year training program. The PHM fellowship curricula are standardized to include eight blocks of prescribed clinical activity, eight blocks of academic endeavors and eight blocks of elective experience.¹⁰ PHM core competencies in the US have been published and recently revised to reflect the changing needs of hospitalized children and their families.¹¹

Canada is following a similar path with recognition that four years of general pediatric training is insufficient to provide the increasing complexity of clinical care, systems coordination and academic rigor required of tertiary care pediatricians. Similar to the US, PHM has gained momentum as an area of focused practice in Canada.¹² The Canadian Pediatric Society (CPS) established a section for Hospital Pediatrics in 2005 dedicated to the clinical care, program management, education and research for hospitalized children.¹³ In an effort to generate new evidence to improve the care and outcomes for

hospitalized children, a Canadian research collaborative known as the Pediatric Inpatient Research Network (PIRN) was launched in 2019.¹⁴ In 2020, the Canadian PHM Training and Education Network (CaPTEN) group was founded with the aim of driving the development of sub-specialty training in PHM with a focus on scholarship, leadership, enhanced health care systems and quality improvement. Given this progress, it is now time to examine the national state of PHM in Canada.

Five Canadian universities have developed PHM fellowship programs to provide additional training following a four-year residency in general pediatrics.¹⁵ These include the University of British Columbia, University of Alberta, University of Calgary, University of Toronto and McGill University.¹⁵ Each of these PHM fellowships has its own training curricula based on perceived needs of trainees (clinical and non-clinical), local drivers (clinical care demands, clinical and academic training priorities, presence of academic mentors and funding model constraints), amount of fellowship elective time, and length of training (one year vs. two year fellowships).

Despite large-scale initiatives in PHM internationally, core competencies for PHM physicians have yet to be established at a national level in Canada. This absence leaves uncertainty about the knowledge, skills and attitudes required for hospital pediatricians to deliver high-quality care and to strengthen the hospital systems that support children and their families. A unique set of competencies for PHM in Canada is important given pediatric trainees complete four years of general pediatric training compared to three years in the US. As pediatric hospitalizations increase, due to population growth and advances in technology, and as post-graduate medical training in Canada transitions from a time-based approach to an outcomes-based model, there is an urgent need for a clearly defined competency framework that aligns with evolving healthcare demands.¹⁶ Therefore, we sought to determine which competencies should define the scope of practice of PHM in Canada.

Methods

Between September of 2022 and June of 2023, hospital pediatricians from pediatric tertiary care centers and community-based hospitals across Canada participated in this Delphi study. We obtained ethics approval from both the University of Calgary and the University of Toronto research ethics boards.

The Delphi method is a research technique that has been utilized to develop competencies for multiple specialties in undergraduate and postgraduate medical education.¹⁷ The process involves asking a panel of experts in a particular field about their ideas and opinions through a series of iterative questions with the ultimate goal of obtaining consensus.¹⁸ It is based on the premise that “pooled intelligence” enhances individual judgement and captures the collective opinion of experts. Benefits of the Delphi approach include anonymity, controlled feedback, flexibility for the choice of statistical analysis, the ability to capture the perspectives of a group of panelists who are geographically dispersed and to address research questions that do not lend themselves to analytic techniques.^{19,20} Studies in political sciences have demonstrated that the Delphi method is advantageous over group discussions, conferences and brainstorming, especially in contexts where the best available information on a topic comes from expert opinion.²¹

Given that PHM is a relatively new area of focus for practice in Canada, we considered the Delphi method—a valuable tool in exploring ideas and perspectives from leaders driving development of the field.

Delphi panel recruitment and sample

Delphi methodology involves a non-random sample of prominent, knowledgeable individuals in a field to form a panel of experts.²⁰ There are no universally accepted guidelines or standards for selecting expert panel members, and “expertise” may be defined using various criteria, such as educational

attainment or years of clinical/practical experience.²⁰ To ensure rigor, expert panelists should be selected according to pre-defined criteria.²²

For this study, we defined expertise in PHM based on several criteria. We identified Canadian experts in PHM practice or education first through members of the executive council of the CPS Hospital Pediatric section and/or members of PIRN. Second, we included pediatricians who had authored at least two research manuscripts related to PHM in peer reviewed journals. Third, we invited recently graduated PHM fellows. Fourth, we included those with formal leadership roles in PHM, defined as: (i) section/division heads or delegates of PHM or equivalent (general pediatric inpatient sections) in tertiary care centers; or (ii) program directors of PHM fellowships. Finally, to enhance representativeness, we invited pediatricians currently practicing inpatient medicine in a community based, non-tertiary urban center. Inclusion criteria required physicians to have been in independent practice for a minimum of seven years, excluding recently graduated fellows. This approach aimed to assemble a heterogeneous expert panel, intentionally composed to capture a broad range of perspectives, experiences and practice contexts within PHM in Canada.

Invitations were sent to prospective panelists via email with the goal of recruiting at least 50 panelists to account for a 20% potential dropout rate between rounds. The target number of respondents for this study was 30, consistent with recommended sample sizes for the Delphi to minimize the influence of any single individual and to ensure reliability of the group’s composite judgement.²³ Panelists interested in participating in our study were asked to sign and submit an online consent form.

Item generation and elimination of data redundancy

Three authors, PV, SC, and ZB, generated an initial list of potential competencies organized into the seven CanMEDS roles from reviewing key resources and articles related to PHM in North America. They accessed four sources: 1) Existing competencies and Entrustable Professional Activities

(EPAs) developed by the five existing PHM fellowship programs in Canada; 2) the 2020 Pediatric Hospital Medicine Core Competencies compendium created in the US¹¹; 3) CPS statements pertaining to care of hospitalized pediatric patients²⁴ and, 4) by completing an in-depth literature review using key words “PHM” and “Competencies.” Once compiled, we reduced the list by combining redundant items. To ensure all competencies generated for rating were specific to the field of PHM in Canada, competencies expected of graduated pediatric residents as outlined by the (RCPSC) in July 2021 were concurrently reviewed.²⁵ Competencies that overlapped with those found in the 2021 Objectives of Training for General Pediatrics were either removed, expanded upon to reflect an advanced skill level required for practice within a pediatric inpatient setting, or in select cases, retained acknowledging more time and practice may be required to develop proficiency. Our team organized competencies by two team members (PV and ZB) under the seven CanMEDs roles including Medical Expert, Communicator, Collaborator, Advocate, Scholar, Leader and Professional.²⁶ Two additional team members (SC and CW) reviewed the categorization and recommended no changes. Given the large number of Medical Expert competencies identified, these were subdivided by four authors (PV, ZB, SC and CW) into the following five categories: Knowledge, Skills, Investigation Interpretations, Managing Uncertainty, and Facilitating Clinical Transitions.

Item reduction

Iterative rounds of Delphi surveys were then used to reduce the list of competencies. REDCapTM (Research Electronic Data Capture) is an online platform that we used for survey distribution, data collection and organization. To maximize response rates, the surveys were designed and distributed in line with principles outlined by Dillman’s tailored design method.²⁸ This design method was conceived in the 1970s as a scientific approach to developing surveys that attempts to reduce four sources of error including coverage, sampling, nonresponse, and measurement.²⁷ For each round, panelists were provided with a link to the online survey and provided clear instructions on how to proceed should they

require troubleshooting or have any questions. Experts were given 12 weeks to respond to each survey round. Research team members piloted the online survey to ensure clarity and to understand approximately how long it would take to complete. Each round was estimated to take approximately 60-90 minutes. If a panelist could not finish the survey at one sitting, we saved the responses so that the survey could be completed at another time.

During Round 1, survey panelists were asked to review each of the proposed competencies to determine how important they perceive it to be “*to the practice of pediatric hospital medicine in Canada.*” Drawing from the definition established by the Association of American Medical Colleges, the American Board of Pediatrics, and the Canadian Pediatric Society Hospital Pediatrics Section, the practice of PHM in Canada was defined as providing care to infants, children and adolescents requiring hospitalization.^{9,13}

Competencies were rated on a five-point Likert scale with anchors as follows: 1 = Not useful to the practice of PHM in Canada, 2 = Somewhat useful for the practice of PHM in Canada, 3 = Moderately useful for the practice of PHM in Canada and, 4 = Very useful for the practice of PHM in Canada and, 5 = Essential for the practice of PHM in Canada. Panelists were asked to provide feedback on the phrasing of potential competencies, clarify content, and/or propose additional competencies if desired.

In the subsequent rounds, panelists re-rated the remaining competencies using the same five-point scale. New competencies suggested by panelists in the preceding round were also included for rating. They were informed of the panel's mean rating and standard deviation (SD) for each competency in the subsequent round. They had the opportunity to offer additional open-ended comments. The Delphi process continued until the expert panel reached consensus based on the specified criteria described below.

Data analysis and determining consensus

Following each Delphi round, the mean rating, standard deviation and proportion of panelists rating an item within each category (1 to 5) were calculated. Four authors (PV, CMW, ZB, SC), blinded to the data source (i.e. panelist identity), reviewed the ratings and qualitative comments.

The criteria for inclusion and exclusion of competencies were defined *a priori* based on published literature using Delphi methodology in the field of medical education, and these were communicated to the panelists for transparency prior to rating.^{28,29,30} Competencies were eliminated from subsequent rounds if 80% or more of respondents assigned a score of 3 (moderately useful) or lower to that item. After each Delphi round, the research team met to review the results, interpret panelist comments and make decisions about combining, reducing and modifying items.

We distributed iterative rounds of Delphi surveys until consensus was achieved. Consensus, which should be defined *a priori* can be measured in varying ways, including percent agreement, measure of central tendency, proportion within a range and dispersion of responses. We defined consensus *a priori* as a Cronbach's α above 0.95 and a minimum of two rounds. It was predetermined that once statistical consensus was achieved, competencies that received a score of 4 or 5 from 80% or more of the panelists would be considered to have met inclusion criteria as a core competency to the practice of PHM in Canada.

Results

Over 300 potential PHM competencies were generated through a literature review. These competencies were cross-referenced with those defined in the RCPSC 2021 Objectives for General Pediatrics to ensure the initial list for rating was specific to PHM.¹⁷ We combined 86 redundant competencies to 43, eliminated 148 due to overlap with competencies expected of graduated general pediatric residents in Canada, expanded 15 general pediatric competencies make them more PHM-specific, and retained seven general pediatric competencies, recognizing that trainees may need more time to develop proficiency. This process resulted in 176 items for panelists to rate in Round 1.

Forty-nine of 65 physicians (75.4%) agreed to be part of the Delphi panel. Of the 49 experts, 38 (78.0%) completed the first Delphi survey, and 35 (71.4%) completed Round 2 (Table 1). Thus, only three experts from Round 1 did not participate in Round 2, resulting in a drop-out rate of 7.9%. Three partially completed (3/176 items rated) surveys were eliminated from the dataset in Round 1.

Following Round 1, eight competencies from the CanMEDS Medical Expert role met exclusion criteria and were eliminated from subsequent rounds. No items from the remaining CanMEDS roles were eliminated in Round 1. Based on respondent feedback, six items were condensed to three to reduce redundancy, two competencies were moved to other CanMEDS sections in the list of competencies, and 19 new competencies were added. These changes resulted in a total of 184 competencies for rating in Round 2. Cronbach's α for Round 1 was 0.97, meeting consensus definition. However, a second Delphi round was undertaken, as it was decided in advance that a minimum of two rounds would be completed and recognizing that new or modified items were generated from Round 1.

Table 1. Number and percentages of participants by geographic region, practice location, years of practice, sex and participant group in rounds 1 and 2 of the delphi process

		Round 1	Round 2
		n = 38	n = 35
Province/Territory, n (%)			
British Columbia		5 (13%)	4 (11%)
Alberta		10 (26%)	10 (28%)
Saskatchewan		1 (3%)	0 (0%)
Manitoba		2 (5%)	2 (6%)
Ontario		12 (32%)	12 (34%)
Quebec		2 (5%)	2 (6%)
Nova Scotia		3 (8%)	2 (6%)
Newfoundland and Labrador		2 (5%)	2 (6%)
Northwest Territories		1 (3%)	1 (3%)
Years of Practice, mean ± SD		13.37 ± 7.77	12.91 ± 7.93
Sex			
Male		10	10
Female		28	25
Participant Group [†] , n (%)			
Tertiary Care Pediatricians	PHM section/division heads	6 (16%)	6 (17%)
	Fellowship director group (CaPTEN)	10 (26%)	10 (29%)
	PIRN	7 (18%)	5 (14%)
	CPS hospital pediatrics executive council	3 (8%)	3 (9%)
	Authors of two research articles related to PHM	2 (5%)	2 (6%)
	Recently graduated fellows	4 (11%)	4 (11%)
Community Pediatricians	Urban Centres	6 (16%)	5 (14%)

Abbreviations: CaPTEN: Canadian PHM Training and Education Network; CPS: Canadian Pediatric Society; PIRN: Pediatric Inpatient Research Network.

[†]All community based centres are considered Urban based on Statistics Canada

Table 2. Number of Pediatric Hospital Medicine Competencies that met inclusion criteria by CanMEDS role at the end of each Delphi round

CanMEDS Role	Round 1 n = 176	Round 2 n = 184	Final Competencies n = 109
Medical Expert	91 (52%)	91 (49%)	58 (53%)
Communicator	10 (6%)	15 (8%)	13 (12%)
Advocate	13 (7%)	13 (7%)	4 (4%)
Collaborator	10 (6%)	9 (5%)	6 (6%)
Leader	18 (10%)	17 (9%)	8 (7%)
Scholar	21 (12%)	27 (15%)	10 (9%)
Professional	13 (7%)	12 (7%)	10 (9%)

n = total number of items in each round

In the second round, we obtained a Cronbach's α of 0.97, meeting the consensus definition. Inclusion criteria were applied, with 109 of 184 competencies meeting the definition for inclusion (Table 2). Figure 1 depicts the number of competencies included and eliminated across Delphi rounds as well as the number of respondents for each iteration of the survey.

The study team reviewed comments provided by panelists in Round 2 and made minor changes to the wording of nine items that met inclusion criteria. One additional competency was suggested by three respondents in Round 2. This individual competency, related to the Leadership role, was subsequently rated by all panelists and did not meet criteria for inclusion. Based on respondent feedback, we combined two competencies in the Professional role into one item.

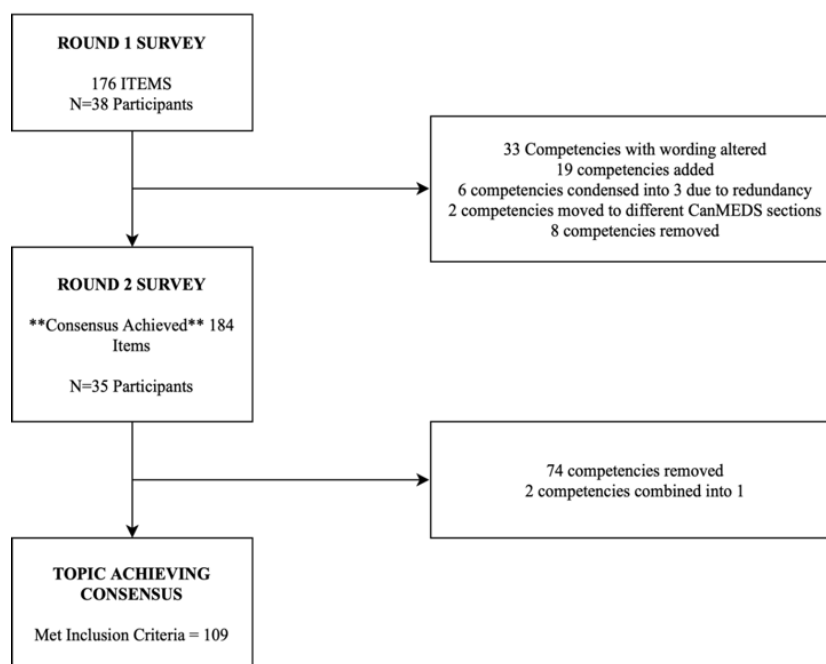


Figure 1. Overview of the Delphi process to identify PHM core competencies.

Discussion

CanMEDS roles where the highest number of competencies met inclusion criteria included two Medical Expert role categories: *Managing Uncertainty* (10 competencies) and *Facilitating Clinical Transitions* (10 competencies), and the Communicator role (13 competencies). CanMEDS roles where the highest number of competencies were eliminated included Medical Expert (*Skills*), Advocate, and Scholar, with 13, 9, and 17 items eliminated, respectively. The number of competencies that met inclusion criteria based on each CanMEDS role is available upon request.

We conducted a sub-analysis by reviewing the data obtained from the 26 panelists who identified as practicing tertiary care hospital pediatricians. No additional competencies met inclusion criteria in this sub-group when compared to the overall group. A table of the eight competencies that were eliminated in Round 1 of the Delphi process, and a table that lists competencies that did not meet the inclusion criteria definition in Round 2 are both available upon request.

This study is the first to define competencies for the practice of PHM in Canada. It advances the work that has occurred at individual Canadian universities and PHM fellowship programs, where curricula have been developed to meet local, institutional and perceived population-based needs. The most notable finding is the widespread agreement by experts in Canada that a physician interested in pursuing a career in PHM must develop and demonstrate field specific competencies. Representation of Delphi panelists from various geographic regions and practice settings helps to ensure these competencies are aligned with current roles and expectations for hospital pediatricians in diverse practice environments.

In Canada, implementation of the CanMEDS competency framework and the recent shift to Competence by Design (CBD) have influenced post graduate medical training.¹⁶ The goal of CBD is to enhance patient care by ensuring trainees are able to demonstrate the skills and behaviours required to meet patient needs. Each specialty has a unique set of ‘units of professional practice’, called Entrustable Professional Activities (EPAs).³¹ Competencies describe the abilities of individuals, whereas EPAs are defined as activities that can be entrusted to a

learner who demonstrates competence.³² The competencies meeting inclusion criteria in this study may subsequently inform a list of EPAs specific to the field of PHM.

Similar to another medical education study using Delphi methodology, the majority of competencies initially generated for rating as well as those meeting inclusion criteria, related to the role of Medical Expert.³³ One possible reason for the prominence of Medical Expert may relate to the variation in payment structures among hospital pediatricians in Canada.³⁴ The majority of hospital pediatricians at tertiary centers and community hospitals are employed under clinical contracts and lack protected time and academic support to engage in scholarly activities including research, medical education scholarship, and/or quality improvement. Consequently, these physicians may not prioritize competencies related to these endeavours.

While the majority of overall medical expert competencies met inclusion criteria, several items addressing medical expert skills were eliminated. Some competencies that were eliminated are considered “core” to Pediatric Emergency Medicine (PEM) and Pediatric Critical Care Medicine (PCCM) residency programs.^{35,36} Panelists may have perceived these items to be not important to PHM. Examples include providing procedural sedation for common medical interventions (e.g., sedation with IN/IV benzodiazepines) being expected of PEM graduates and initiation of mechanical ventilation being core to PCCM graduates. The formal recognition of PCCM as a RCPSC residency (or ‘fellowship’) in 1990 and PEM in 2000 allowed for the development of accredited residency programs with standardized curricula for trainees.³⁷ Leaders in PHM may learn from how these programs developed when paving a future path for PHM in Canada.

Competencies that did not meet inclusion criteria relating to children with medical complexity focused on patients with neurologic impairment and pediatric patients undergoing rehabilitation after brain/spine injury. Differences in practice between pediatric hospitals based on local expertise and resources could help to explain these findings. While

hospital pediatricians at some centers may co-manage neurologically complex patients with Pediatric Neurology or Physiatry, other centers may have the capacity for them to be directly under the care of these subspecialty groups.³⁸ Community-based hospital pediatricians may not have the multi-disciplinary health support required to manage these hospitalized pediatric patients and request a transfer to a tertiary care center. Other variables that might have influenced panelists’ responses when reviewing Medical Expert competencies include the site-specific roles and responsibilities of the Pediatric Intensive Care Unit and Neonatal Intensive Care Unit and whether the PHM physicians are always on-site and/or managing another practice in the community.³⁹

It is not surprising that the majority of items related to the Health Advocate role did not meet inclusion criteria. Similar to other CanMEDS roles, advocacy skills must be learned and practiced. A 2005 article that explored existing barriers in the medical education system pertaining to physician advocacy emphasized constrained time, lack of specific curriculum for health advocacy training, and the lack of gold standard for assessment.⁴⁰ The field of advocacy as it relates to PHM is diverse, encompassing site specific, provincial and national efforts. Given the breadth of potential advocacy activities applicable to PHM, panelists might have experienced difficulty narrowing down which Health Advocate competencies should be considered core to the field. Only four competencies in this study related to Advocacy met inclusion criteria. This contrasts with the US, where 24 competencies are outlined in the 2020 PHM Core Competencies document.¹¹

Almost all of the Scholar competencies related to medical education met inclusion criteria in this Canadian study. This finding aligns with results of a 2009 study exploring the clinical and non-clinical roles of pediatric hospitalists.⁴¹ Ninety-four percent of respondents identified being involved in some form of medical education with almost half holding a medical education leadership role. The same study revealed that pediatric hospitalists spend 16% of their time in hospital providing clinical teaching or supervising residents. Hospital pediatricians

completing our study survey may have perceived the medical education competencies to be essential given the traditional role and reliance on in-patient pediatricians to teach, supervise, coach and assess learners that rotate through the clinical teaching unit. In addition, most respondents in our survey are faculty in nationally accredited residency training programs at their Canadian tertiary care hospital sites, so teaching, coaching and evaluation are expectations of the job. The total number of competencies generated in this study related to medical education is far less than the US, which has 34.¹¹ Two annual PHM related conferences are held in the US each year, The Pediatric Academic Societies conference and The Pediatric Hospital Medicine conference.^{42,43} During these meetings, educational leaders in PHM including program directors and assistant program directors are able to update and add to existing medical education competencies to reflect changing population needs. This ongoing work may be one reason why the US has overall more medical education related competencies.

A large difference in competencies related to scholarly output was observed when comparing those that met inclusion criteria in this Canadian study with the 2020 PHM Core Competencies in the US.¹¹ The competencies achieving consensus in this study contain fewer Scholar competencies, with the exception of medical education. The history of how competencies evolved in the US may help shed light on this difference. The development of the US PHM Core Competencies was a project initiated by the Society of Hospital Medicine Pediatric Core Curriculum task force in 2005.¹ Multiple pediatric hospitalists belonging to the American Academy of Pediatrics, Academic Pediatric Association, and Society for Hospital Medicine met to create a framework for identifying appropriate competency content areas. Experts from both within and outside PHM then collaborated to develop competencies in each area that underwent a formal review from all three national organizations prior to publication in 2010.¹ During that process, academic competencies were infused into the curriculum to satisfy accreditation bodies that expect a sub-specialty field of practice to contain competencies to improve the delivery of care to hospitalized patients through quality

improvement, clinical research and medical education. The two-year US PHM fellowship curricular framework consists of eight clinical blocks, eight academic blocks and eight elective blocks.¹⁰ In contrast, PHM fellowships in Canada have existed for five years or less, are not yet nationally accredited, and only a few offer a balanced clinical, academic and elective experience.¹⁵

In this study, seventy percent of the proposed research related competencies as well as all five competencies pertaining to quality improvement did not meet inclusion criteria. In the updated 2020 US PHM Core Competencies, there are 92 competencies dedicated to research, subdivided into broad categories including: Basic Objectives, Principles of Analysis, Data Management, Critical Appraisal of the Medical Literature, Ethics and Responsible Research Conduct, Dissemination of Research and Professionalism and Leadership.¹¹ Furthermore, 39 competencies have been developed in the US related to Quality Improvement.¹¹ It may be that many panelists in this Canadian study lack exposure to academic training in PHM at their institutions, lack the resources or opportunities to integrate clinical and medical education research and quality improvement initiatives and/or do not transition into academic positions to transition into once they graduate from a PHM fellowship. Additionally, panelists may work in centers where clinical drivers were core to funding and launching their PHM fellowship and, thus, dominate the training curricula. As such, panelists in this study may not have considered the competencies related to research and quality improvement as core competencies for PHM at this time.

Existing literature supports that fellowship training in PHM promotes academic productivity. A US study comparing fellowship-trained hospitalists and non-fellowship-trained hospitalists revealed that a significantly higher proportion of the former were working on and publishing research.⁴⁴ In the same study, fellowship trained graduates also self-reported significantly higher competency scores on research-related tasks such as completing a literature search and applying study results. In a 2020 study, investigators asked PHM fellowship

graduates in the US to complete a web-based survey with the goal of describing positions obtained following training. Of the 143 respondents, 78% reported working at a university affiliated or children's hospital. Panelists reported quality improvement (41%) and medical education (19%) as part of their career description, with 50% having published as first author on at least one peer-reviewed article.⁴⁵ A 2020 Canadian study revealed that final year pediatric residents and recently graduated hospital pediatricians perceived a lack of preparedness to engage in scholarly work, highlighting the need for additional scholarly training in Canadian PHM fellowship training programs.⁵ This paper is the only published study looking specifically at perceived preparedness to practice PHM in Canada following a four-year general pediatrics residency. Recommended strategies include mandating participation in a quality improvement project as a requirement and ensuring trainee involvement in all aspects of a research project (e.g., ethics submission).⁵

Additional competencies recognizing the value of quality improvement, research, and advocacy, may need to be built into the Canadian PHM competencies. Delphi panelists in this study may have based their responses on their current perception of the field in Canada as opposed to how the field has the potential to develop in the future.

For the purposes of this study, the research team used Cronbach's α as the statistical index to quantify consistency of responses among the panel of experts.⁴⁶ A high Cronbach's α of > 0.95 was considered appropriate as the results of this study are "high stakes" for the field of PHM. The Cronbach's α of 0.97 achieved in Round 2 of this study provides strong evidence of the reliability of conclusions drawn from the data. The rigor of this study is also supported by using predetermined values for both inclusion and exclusion of competencies based on published work.⁴⁷

The number of panelist-experts for a study using the Delphi method varies according to the purpose and complexity of the study.²² Several studies employing the Delphi method in health sciences research have commented that increasing the group

size beyond 30 has seldom been found to improve results.⁴⁸ For this study, 35 panelists completed both rounds with a low drop-out rate between rounds. A broad array of key stakeholder groups in pediatrics in Canada was included to ensure a wide range of knowledge, clinical and academic experience, maturity and perspectives. Represented among the panelists were four recently graduated fellows who were well positioned to retrospectively identify gaps in their training after starting independent practice. The study team made it explicit on the survey that the list of competencies generated for ranking were intended for trainees pursuing a PHM fellowship. This instruction was to de-emphasize the physicians' current practice environment (tertiary center vs community-based hospital) and its impact on responses. Rather than rating based on their current professional experience, the intention was for panelists to consider more broadly the future of PHM as a distinct discipline. The demographics of the panel with respect to gender and years in practice are similar to that of general pediatricians certified by the RCPSC, suggesting good generalizability of the findings.⁴⁹

Limitations

This study has limitations. As with any Delphi study, it is possible that responses may have been influenced by the way in which competencies were written or ordered, or by omission of competencies from the preliminary list generated for rating. Respondents, however, were asked after each round to suggest additional competencies they felt should be included and/or to suggest alternate wording. The opinions solicited from the panelists in this study reflect two points in time. As the field of PHM continues to progress in response to the needs of hospitalized pediatric patients, it is possible that perceptions of what competencies should be included or excluded in the discipline may change. Based on the 35 panelists that completed both surveys, only four were recently graduated fellows and five were community-based hospital pediatricians, all of whom work in urban centers. The final set of competencies may not reflect the opinions of these minority groups including hospital pediatricians working in rural community-based hospitals.

Additionally, the consensus data obtained in this study exclude representation from three Canadian provinces (Saskatchewan, New Brunswick, PEI) and two territories (Yukon, Nunavut). Obtaining representation from these provinces was difficult as many sites are facing significant challenges in recruiting and retaining hospital pediatricians. Geographic isolation, high cost of living and limited access to specialized services may be contributory factors. Despite multiple reminder emails, the panelist from Saskatchewan was not able to complete Round 2 due to clinical responsibilities and time required to complete the survey. The results obtained may, therefore, not be fully generalizable to all Canadian jurisdictions. Another limitation was that the surveys were completed within the context of respiratory surges affecting pediatric hospitals across the country. Recognizing the clinical pressures associated with these crises, we were impressed with the response rates but recognize survey completion during this time may have led panelists to place a greater emphasis on clinical competencies.

Conclusion

Using a participatory Delphi method across an array of key stakeholders, our research team was able to engage key informants in a process designed to build consensus on what should be included as core competencies for PHM in Canada. The resulting set of competencies, developed through national collaboration, provides a framework for PHM fellowship directors to consider when designing curricula and related programs of assessment for PHM fellows. The results can also be used to support and inform the initial steps in creating a standardized curricula for PHM fellowships across Canada.

Author information:

1- Alberta Children's Hospital, University of Calgary, Alberta, Canada

2- Division of Gastroenterology, Hepatology and Nutrition and the Research and Learning Institutes, The Hospital for Sick Children, Department of Paediatrics and the Wilson Centre, Temerty Faculty of Medicine, University of Toronto, Ontario, Canada

3- The Hospital for Sick Children, University of Toronto, Ontario, Canada

4- Royal Hospital, Muscat, Oman

5- David Geffen School of Medicine, University of California, California, USA

6- University of Calgary, Community Health Sciences Department, Alberta, Canada

Correspondence to:

Peter Vetere

email: peter.vetere@albertahealthservices.ca

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None of the authors have any conflicts of interest to declare.

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