Validation of a Canadian curriculum in obstetric medicine

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Summary: A comprehensive curriculum for obstetric medicine was created through review and synthesis of several existing sources including a recent textbook, published curricula and a review of cases seen in a specialized clinical setting. The preliminary curriculum document then underwent local validation and reformulation of educational objectives with reference to the CanMEDS framework promoted by the Royal College of Physicians and Surgeons of Canada. This draft 'Canadian' Curriculum Content Validation Instrument, covering 34 medical conditions, was then distributed to a cohort of 29 Canadian obstetric internists (the study group) for review. All responders gave feedback on each of the 402 curricular items, with a high level of inter-rater agreement. A subgroup was subsequently convened ($n = 15$) and Delphi methodology was used to review the major recommendations from the group, as well as nine additional problematic items, achieving a consensus on 38/43 survey items (88%). The final validated document was presented at the North American Society of Obstetric Medicine meeting in April 2010 in Toronto, Canada and distributed to study group members for local adaptation and implementation. Wider dissemination is planned in the near future.

Keywords: obstetric medicine, curriculum development, validity evidence, competencies and skills, pregnancy

INTRODUCTION

Obstetric medicine (OM) is a relatively new and growing domain in the specialty of internal medicine, denoting expertise in the care of women with medical disorders in pregnancy. In the past 10–20 years, women with medical conditions that once would have precluded them from childbearing are surviving into adulthood and are choosing to undertake pregnancies. In addition, the average age at the time of first pregnancy has continued to rise over recent decades.¹ Along with a dramatic increase in the use of assisted reproductive technology by older women, this has led to an obstetric population at higher risk for medical complications during their pregnancies. As a result of these trends, as well as advances in obstetrical care, the causes of maternal mortality in countries with advanced medical care have shifted from surgical to medical causes.^{2–4} For instance, maternal mortality in England and Wales is now primarily a result of medical causes (such as venous thromboembolism and hypertensive disorders) in 81% of cases, compared with 47% in the 1950s.⁵

Recognition of the changing pattern in maternal morbidity and mortality, and the preventable nature of the majority of these deaths, has resulted in the creation of a relatively new discipline, obstetric or maternal medicine. OM focuses on the care of women with medical disorders in pregnancy. A specialist in

OM provides comprehensive consultative care for pregnant women with medical disorders, and may also serve to 'bridge the gap' between the specialist obstetricians and other medical specialists – who may be uncomfortable in addressing the pharmacological and physiological changes that occur during pregnancy.^{6–8}

Medical disorders in pregnancy are an important component of the body of knowledge that a specialist in general internal medicine (GIM) in Canada is expected to master, being an expectation of training of the Royal College of Physicians and Surgeons of Canada (RCPSC). Internal medicine residents, in general, have limited exposure to women with medical disorders in pregnancy during their training and may not have been systematically instructed about the approach to medical problems in pregnant women. This leads to a failure to link the curriculum to certification requirements and health-care needs, as advocated by experts in curriculum design.^{9,10} A survey of recent graduates from GIM residencies across Canada identified medical problems of pregnancy as one of the areas within CanMEDS competencies which showed the greatest gap between importance and preparation, with respondents typically feeling their residency training in this domain was inadequate.¹¹ In response to similar concerns, the International Society of Obstetric Medicine (ISOM) has elaborated a standardized curriculum in OM to outline the body of knowledge in internal medicine of particular relevance to pregnancy, to outline the specifics of conditions unique to pregnancy, to define the context in which training should occur and to serve as a model for local curricula (Powrie R, 2009, unpublished communication). The creation of a unique Canadian curriculum document is needed in

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order to properly serve the style and focus of residency training and to reflect the practice style (specialist, consultative) of Canadian internists.

OBJECTIVE

The purpose of this project was to validate the content of a Canadian curriculum in OM, reflecting the particular training focus and practice style of Canadian internists, via creation of a national curriculum consensus group. Such a curriculum can serve as a blueprint for the creation of curricular objectives, the selection of appropriate instructional strategies and the development of assessment methods supported by significant validity evidence. This may be done on an individualized basis by particular centres or regions, reflecting their unique needs and populations. The use of Delphi methodology, in addition to the nation-wide survey validation, will ensure a high level of consensus. The strength of the accumulated validity evidence will thereafter be helpful in supporting future uses of the curriculum. The completed curriculum document will be made available to all internal medicine training programmes in Canada, and more widely for local educational adaptation and research.

METHODS

OM physician sample

The sampling for all steps was purposive and homogeneous. The goal was to invite in the consensus group all internal medicine physicians currently involved in the teaching and practice of OM in Canada. This group was identified via review of prior Canadian attendees at the North American Society of Obstetric Medicine and ISOM Annual Meetings; established national academic relationships of the authors and participants; review of authors of recent publications in *Obstetric Medicine*; and 'word of mouth'. Each identified subject was asked for their voluntary participation in a curriculum development consensus group. The eligible subjects who consented to participate made up the study group.

Curriculum validation instrument

The CanCOM curriculum validation instrument (CVI) was constructed by one of the authors (AC) based on several sources including (a) a document analysis of a recent OM textbook, *Medical Care of the Pregnant Patient* (edited by RV Lee);¹² (b) triangulation with cases seen in a specialized OM clinical setting in Montreal, Quebec over a six-month period; (c) content included in two existing curricula – the Brown Curriculum, developed and utilized at Women & Infants' Hospital in Providence, Rhode Island¹³ and the curriculum recently developed by ISOM; and (d) local validation by five OM subject-matter experts. Finally, the educational objectives were reviewed and formulated in reference to the framework of core competencies disseminated by the RCPSC as the 'CanMEDS roles'.¹⁴ These include medical expert (the central role), communicator, collaborator, health advocate, manager, scholar and professional. The result of these preliminary efforts was a 28-page document containing 402 separate items divided into 12 disciplines: hypertension, cardiology, endocrinology, respiratory, haematology, gastroenterology, neurology,

nephrology, infectious diseases, immunological disorders, dermatology and psychiatric disorders. The number of items per discipline reflected the perceived relative importance of the subject in OM and ranged from eight (dermatology) to 51 (hypertension). The individual line items each reflected an item of expected knowledge in OM; for instance, 'Demonstrates applied knowledge of the definition of proteinuria in pregnancy and how to measure it.' The document was referred to as the CVI.

Validation of curriculum

In fall 2009, the study group members were provided with the CVI and asked to indicate for each of the 420 items whether it should be included, modified or deleted. Members were also asked to justify any suggested changes and were invited to suggest additional content. After collection, these qualitative data were analysed using a Grounded Theory approach with development of themes by constant comparison to previous coding.^{15,16} Revision of the themes was made as necessary during the process of coding.¹⁷ To increase validity evidence, a second coder (PG) recoded the entire data-set using the same table of codes. Adjustments were made to the coding schema, by consensus, following this second coding.

Delphi consensus

The Delphi methodology was used to obtain consensus on the more controversial modifications of the curriculum, identified mainly by a lack of consensus (80% or less agreement) on curriculum line items as well as by comments provided during the study group review. Delphi methodology allows for subjective input from a larger group, in an efficient manner across several time zones, and with potentially less influence by dominant personalities than a face-to-face meeting.¹⁸ Participants were requested to be available over the subsequent three-week interval for rapid response to each round of the Delphi survey.

Each Delphi survey participant received instructions to rate on a Likert scale of 1–5 their level of agreement with proposed modifications to the curriculum document summarized by the co-leaders. A space was provided to justify their rating, if desired. Several rounds were planned, and after each round the surveys were returned to each participant with their rating, the group's mean, standard deviation, bar histogram and a list of anonymous comments for each item. In the interest of transparency, any item that obtained consensus remained in the survey with comments, means, standard deviations and bar histograms along with the label, 'consensus achieved'.

RESULTS

Consensus group

Thirty-five eligible physicians were identified as internal medicine specialists having an active interest in the education and practice of OM in Canada. Of these, six physicians had already participated either in the initial elaboration (AC) or the local review of the curriculum outline. The remainder ($N = 29$) were invited to join the Canadian Consensus for a Curriculum in Obstetric Medicine group. Twenty-seven (93%) accepted the invitation to join the consensus group (Figure 1). The final

Figure 1 Outline of recruitment process for both curriculum validation and Delphi survey

composition of the CanCOM group included 33 members – including both CanCOM co-leaders (AC and PG) – from six of Canada's 10 provinces, with the largest proportion (39%) practising in Quebec.

Validation of curriculum

Twenty-five OM physicians completed the survey (92.5% response rate), with a varied demographic and practice background (Table 1). The length of time in practice and teaching in OM varied from less than one year to 27 years with an average of eight years. Three distinct subgroups were apparent: a small group of four senior OM physicians, the 'pioneers'; a second generation of 10 mid-career physicians; and a third generation of junior consultants, having recently entered independent clinical practice. The 'pioneers' are largely self-taught and dedicate most of their time to the teaching and practice of OM. The majority of the second generation of OM specialists

(in practice for an average of 10 years, range 9–13 years) have a background in GIM (80%) along with some specialized OM training (70%). The third generation is the largest, with 14 recent graduates having been in practice an average of three years. These subjects are engaged in varied clinical and academic activities: while only 30% of their time is dedicated to OM, most have substantial specific training in OM (i.e. completed fellowship programmes).

Twenty-four out of 25 (24/25) participants (96%) provided explanations for any line item they felt should be deleted from the document. Overall, 73% of the curriculum blueprint items were selected for inclusion (unmodified) by 24 or more of the 25 respondents. Ninety of the items (22%) reached a complete consensus (25/25) for unmodified inclusion. On the other hand, 28 items (7%) were identified as potentially or obviously problematic, due to achieving 80% or less agreement to include (range 20–80%, with a mean of 73%, a mode of 80% and a median of 80%) (Figure 2). None of the curriculum items were selected for deletion by a majority (50% or more) of the respondents.

Overall, the inter-rater level of agreement was high. The free-marginal *kappa* (a measure of agreement that exceeds chance levels) ranged from 76% (haematology) to 92% (dermatology) with the lowest level of agreement well within the zone of substantial agreement proposed by the literature (Table 2).^{19,20} In general, the level of agreement and the free-marginal *kappa* were inversely related to the number of items and thus the relative importance of the discipline in OM, as indicated by a correlation coefficient of -0.72 between the free-marginal *kappa* and the number of items in a given discipline. This inverse association might reflect either a greater interest in or a greater comfort with items pertaining to the 'core' of clinical OM. The correlation between the percent of items selected for deletion (by one respondent or more) and the number of line items was present but to a lesser degree, with a coefficient of 0.60.

Qualitative analysis

Unprompted responses to the invitation to form a consensus group were very positive, consistent with the high participation rate. Participants welcomed the initiative, for example with one

Table 1 Demographic data

	CANCOM group	Curriculum validation	Delphi group
Number of participants	33	27	15
Geographic location	Alberta: 7 British Columbia: 3 Manitoba: 1 Maritimes: 1 Ontario: 6 Quebec: 13 Saskatchewan: 2 Nunavut: 0 Territories: 0	Alberta: 7 British Columbia: 3 Manitoba: 1 Maritimes: 1 Ontario: 6 Quebec: 7 Saskatchewan: 2 Nunavut: 0 Territories: 0	Alberta: 4 British Columbia: 1 Manitoba: 1 Maritimes: 0 Ontario: 2 Quebec: 7 Saskatchewan: 2 Nunavut: 0 Territories: 0
Number of years of practice in OM	8.5	6.4	8.3
Number of years of teaching in OM	8.3	6.1	7.5
% time spent in OM teaching or practice	42	34	37
Specialty	80% GIM; 7% endocrinology; 13% other	77% GIM; 7% endocrinology; 16% other	80% GIM; 6% endocrinology; 14% other
% with specific training in OM	73	70	73

OM = obstetric medicine; GIM = general internal medicine

Figure 2 Number of items selected for inclusion for each level of agreement

participant commenting, 'wonderful initiative and great idea', and voiced their interest in taking part in the validation process (e.g. 'I am thrilled to participate') and in the result (e.g. 'very interesting, and looking forward to the outcome').

Comments collected from all correspondence, subsequent to the distribution and collection of the validation instrument, were classified into three categories: (1) general comments; (2) suggestions for improvement in format or style and (3) suggestions for content. General comments were subdivided into reactions to the document (10), reflections on CanMEDS roles (4) and issues relating to the target audience (2). Some participants, in general comments, commended the document as a 'great start', a 'wonderful document', 'representative of what we see in our clinical practice' and expressed gratitude for the work done: 'thanks, it looks great'. Comments relating to the CanMEDS roles were also common in the CVI, highlighting a common issue regarding the way in which roles other than Medical Expert were dealt with in the document. With regard to the style and format, one participant questioned the initial level of detail, stating 'the text comes across as too didactic. This is not a course but a guide to knowledge and skills to be acquired ... in certain sections there is much emphasis on details relating to certain diseases and not others of equal importance.'

Suggestions for additional content resulted in consideration of nine new sections and 23 other medical conditions. Regarding suggestions related to content, a total of 768

comments justifying the selection to 'modify' or 'delete' content were analysed. Disciplines such as hypertension, endocrinology and haematology – which are key features of OM – were the sections with the greatest number of comments (relative to the number of line items). Conversely, less robust sections such as respirology, dermatology and psychiatry elicited the fewest comments per item.

Six themes emerged from the suggestions in the qualitative analysis: (1) clarify meaning, (2) improve classification, (3) improve level of detail, (4) improve relevance, (5) improve exactitude and (6) suggestions for additional content. The most frequent suggestions were to improve clarity and level of detail, followed by suggestions for additional content.

Delphi consensus

Qualitative and quantitative analysis of the responders' feedback about the OM curriculum led to three main observations. First, while the inter-rater agreement on a majority of items was high, a minority of items had a percent level of agreement of 80% or below. These items required modification. Some of them were straightforward and others, as reflected in the variety of comments, were potentially more controversial. Second, although the 'include' option was selected for many items in the survey, with a high level of inter-rater agreement, many such items were also accompanied by useful suggestions for improvement. Finally, qualitative analysis highlighted an interest in (a) increasing the scope of the OM curriculum and (b) in changing how the CanMEDS roles other than Medical Expert were integrated. Based on this preliminary analysis it was decided that the use of a Delphi methodology to seek further consensus with regard to the more important or controversial modifications of the curriculum would enhance validity, rather than having the authors unilaterally determine these changes.

Of the 32 CanCOM members (excluding author AC), 16 were available to participate in the Delphi consensus process and returned the first-round survey within the time allotted. The participants in the Delphi survey were a representative sample of the larger study group, with representation from six of the seven provinces. Three rounds of the Delphi survey took place over five weeks. The interval of time to receive all the surveys increased from round to round, from seven to 19 days, although a majority of respondents (66%) returned their

Table 2 Level of agreement per discipline (in increasing order)

Discipline	# of items	% of items with 100% agreement to include	% of items selected for deletion by one respondent or more	% overall agreement	Free-marginal Kappa
Haematology	44	11	27	84	76
Neurology	31	13	29	84	77
Hypertension	51	24	25	85	78
Cardiology	39	21	49	85	78
Endocrinology	60	25	25	86	79
Nephrology	22	14	18	86	79
Gastroenterology	52	19	17	87	80
Infectious diseases	27	30	44	88	82
Immunological disorders	34	35	35	90	85
Psychiatric disorders	17	18	47	91	86
Respirology	17	41	12	94	91
Dermatology	8	38	13	95	92

surveys within the prescribed one week interval. Of note, the survey coincided with the second wave of the 2009 H1N1 pandemic, which likely impacted on response time.

Of the initial 43 items in the Delphi survey, 38 items (89%) achieved consensus by the end of Round 3. Of these items, a consensus to accept the proposed modification was obtained for 36 items, with an average mean and standard deviation of 4.18 and 0.63 (Table 3). Conversely, two suggestions for additional content were excluded, based on a consensus of Delphi survey participants, with an average mean of 2.13 (with 2 on the Likert scale representing disagreement with inclusion) (standard deviation of 0.39). The five items without consensus were reviewed and modified as best possible by the authors while taking into consideration the comments expressed.

DISCUSSION

This curriculum has several strengths resulting from the substantial validity evidence cumulated at each step of the research. According to many measurement experts, content-related validity is the fundamental source of validity evidence when seeking to measure academic proficiency.^{21–23} At every stage of development and review, validity evidence was therefore sought and documented.

First, the instrument which served as basis for the external validation was based on a blueprint created from several high-quality sources of reference: published or to-be published curricula, a recent textbook in OM, and actual clinical cases. This approach provided content-related validity evidence. This blueprint was initially reviewed by local subject-matter experts and then validated by a survey of a large representative sample of physicians practising OM across Canada. Finally, consensus on major alterations to the original working document was achieved by Delphi methodology, which represented a further source of validity evidence.

The validity of the curriculum content was confirmed by a high level of inter-rater agreement. Many items were kept 'unmodified' in the final curriculum, while only a small percentage of items elicited a low enough proportion of agreement to require review and revision. The additional use of qualitative analysis of the comments was critical in revealing the nature of problematic items, adding constructive insights to items

that were not problematic but could be improved, and eliciting opinions regarding additional content that could be included. Indeed, the objective of data collection in grounded theory is to obtain as many relevant perspectives as possible to address the research objective.²⁴ We are confident that this purpose was achieved, with the result that many improvements were made in curriculum goals and objectives, based on this source of extensive and constructive input.

This curriculum blueprint will serve as the basis for future research. First, it should have immediate use as a tool to evaluate current curricular objectives, instructional methods and assessment strategies. Second, the pedagogical value of distributing the curriculum blueprint to the learners could be ascertained. Indeed, publication of an examination blueprint is viewed by some as an effective way to direct the students in their learning.²⁵ In contrast to curricular objectives, a well constructed blueprint will provide more precision as to the essential elements of the curriculum and set expectations as to what will be evaluated thereafter.²⁶ This educational intervention would alert learners to the expectations of their rotation in OM and start the process of learners' retrieval of prior knowledge, thus satisfying basic principles of adult learning theory including Gagne's first conditions of learning (attending, expectancy and retrieval).²⁷ This document also provides the basis for reflection, an important phase in the cycle of learning to start before experience takes place.²⁸

Third, such a document could be used to define competencies that are considered essential objectives for any clinical rotation in OM. In other words, the group could delineate the knowledge, skills and attitudes that all trainees should minimally acquire during a typical one- or two-month clinical rotation by a trainee in Canada. Such a list could then serve as a tool to evaluate the effectiveness of the given rotation. With input from trainees, the average level of competency upon entering a rotation and the average level of competency at the end of the rotation could be ascertained. This evaluation would serve to revise and improve instructional strategies to meet this challenge. For example, one of the authors (AC) is developing a clinical case databank targeted at reducing the gap between what is taught by the usual clinical exposure and teaching and what should optimally be taught (Cumyn A, Morin F, in preparation, 2010).

Table 3 Details on the consensus achieved through Delphi survey

	Number of items	% for which a consensus was achieved	Average mean and (SD) of items accepted by consensus	Average mean and (SD) of items that were rejected by consensus	Average mean and (SD) on round 3 of items without consensus	Average number of comments
Changes to format	2	100	4.11 (0.66)	NA ^a	NA	9.5
Additional new sections	9	89	4.2 (0.66)	NA	2.87 (1.19)	10.3
Additional items of content	23	83	3.96 (0.73)	2.13 (0.39)	3.28 (1.01)	7.2
Modifications to problematic items	9	100	4.37 (0.69)	NA	NA	4.2
Total	43	88	4.18 (0.63)	2.13 (0.39)	3.20 (1.05)	7.35

NA = not available; SD = standard deviation

Furthermore, this curriculum blueprint may be useful in defining a standard certificate or diploma in OM. At this time, OM is an informal 'subdivision' of GIM with no established standards for training. This is likely to change in time as the demand for training in OM increases across Canada.

CONCLUSION

This national validation of a curriculum in OM resulted in the creation of a comprehensive document outlining the competencies required by internists in Canada to care for patients with medical disorders in pregnancy. These competencies are based on the RCPSC's framework of CanMEDs competencies. In this format, this curriculum will set a Canadian standard for this relatively new domain of knowledge. It is available to all the Canadian physicians involved in teaching and research in OM. This project is, to our knowledge, the first published study to delineate a content domain in this knowledge area, to validate a curriculum blueprint, and to use both qualitative and quantitative analysis to develop a Delphi survey and finalize major changes by consensus.

It is our most sincere hope that this curriculum will help with the ongoing efforts across Canada to assist residents in GIM in developing their competency to care for patients with medical conditions in pregnancy. We expect that the burden of disease will increase over the next decade, given women's decisions to embark on a pregnancy despite pre-existing medical conditions or a more advanced age. We hope that the next generation of physicians will be adequately equipped to face this challenge. We would like to express our gratitude to all colleagues across Canada who generously participated in this important medical education undertaking.

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