Canadian Midwifery Registration Examination

Summary Technical Report 2020

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For the Canadian Midwifery Regulators Council

April 2021

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Introduction

Each province and territory is responsible for ensuring that all applicants for registration as midwives meet an acceptable level of competence before they begin to practise midwifery in Canada. This level of competence is measured, in part, by the Canadian Midwifery Registration Examination (CMRE).

The CMRE is a national written examination designed to assess Canadian-educated and internationally-educated applicants for midwifery registration to ensure they meet entry-level competency standards set out in the *Canadian Competencies for Midwives*. Its goal is to ensure that midwives gaining registration are competent and safe practitioners providing a consistent standard of care across Canada.

The examination consists of between 210-230 multiple-choice questions. The majority of questions on the exam are case-based. Exam questions come from the CMRE exam databank according to the CMRE Blueprint and the examination content is based on the *Canadian Competencies for Midwives*. In order to represent the range of care a Canadian midwife is expected to provide, slightly more than half of the questions are set in an out-of-hospital setting with the remainder in a hospital setting. Slightly more than half of the questions represent normal midwifery situations and the remainder, abnormal situations.

This technical report begins with a brief overview of the history of the examination development, written primarily by previous psychometric consultants for the CMRE, including Raman K. Grover, Ph.D. and Sharon Mendes-Barnett, Ph.D. The remaining sections describe exam maintenance and development activities during the 2020 calendar year and the construction and administration of the October 2020 CMRE. These sections of the report were written primarily by Dallie Sandilands, Ph.D. of EMP Educational Measurement Professionals ("EMP"), current psychometric consultant for the CMRE.

History of the Examination Development

In 2003, the Canadian Midwifery Regulators Consortium launched the HRSDC-funded National Midwifery Assessment Strategy (NAS) project, an initiative designed to determine the best strategy for assessing the skills and abilities of internationally-educated midwives applying for registration in Canada. NAS research involved consultation with a wide variety of stakeholders. One of its results was a clear directive to create a national registration exam to ensure a consistent evaluation of midwives' competence to practise in Canada. The initial development of the examination took place in 2005 and 2006. More than 45 content experts (mostly practicing midwives) participated in the development activities. The CMRE is now required for midwifery registration in Canada for Canadian graduates of baccalaureate midwifery education programs and internationally-educated applicants in all jurisdictions where legislation permits.

Exam Committee

The Exam Committee was launched initially as the NAS Steering Committee. Committee members are nominated by their provincial regulatory authority. What is now known as the CMRE Committee reports to the Canadian Midwifery Regulators Council (CMRC) and provides guidance to the CMRE Administrator.

Examination Standards

The CMRE development was guided by research into exam standards and the resulting exam adheres as much as is feasible to generally accepted examination standards.

Development of a Valid, Defensible Examination

Standards dictate that a credentialing examination must be based on clearly defined competencies that fit the purpose of the exam. In keeping with this, the exam committee started exam development in 2004 with the creation of a document that detailed the knowledge and skills expected of an entry-level midwife in Canada.

The first step in that process was a comparative analysis of provincial competency documents resulting in a spreadsheet providing a detailed comparison competency-by-competency. The first draft of the *Canadian Competencies for Midwives* document was then created based on common competencies. A final document was approved in May 2005. In 2019, CMRC engaged Yardstick Assessment Strategies to update the competencies for the CMRE. Separate reports on the competency review process and results will be provided separately by Yardstick Assessment Strategies.

CMRE Blueprint

It is critical that a credentialing exam be standardized in format and content. Assessment Strategies Inc. (ASI), a high stakes exam development consulting firm, was contracted to coordinate the initial exam development, including the development of the CMRE blueprint. A written survey sent to exam committee members enabled ASI to identify the relative importance of each competency so that the blueprint could define the number of questions on each competency. Several teleconferences with the exam committee were held to discuss and refine survey results and to make decisions regarding the exam structure. The resulting exam blueprint approved in June 2005 provides a detailed description of the CMRE.

Developing the Initial Item Bank

In order to create as many test items as possible for the CMRE bank, regulators and educators were asked if they would contribute questions from provincial examinations that the CMRE would be replacing. The College of Midwives of BC, the College of Midwives of Ontario, and the Alberta MHDC contributed their PLEA written examinations to the process. ASI facilitated the process of revising and creating items in two item-writing workshops in 2005 (one English and one French). The English workshop resulted in 128 potential items for the CMRE, and the French workshop produced 47 items.

Pilot

Due to the small numbers of potential participants in a pilot administration of the CMRE, a qualitative, rather than quantitative, pilot of the exam was conducted in 2005 with approximately 20 registered midwives with a range of midwifery experience. Each participant reviewed half of

the more than 250 items that were available to the CMRE. Participants were asked to answer each item without reference to the answer key, and then to review the answer key and provide written feedback on each item regarding its clarity, currency, and accuracy.

Validation of Initial Bank Items

A four-day in-person exam committee meeting was held in English in November 2005 to review the feedback from the exam pilot and to confirm the exam items. Validation involved reviewing each item and revising them as appropriate. A validation process in March 2007 was held with committee members to ensure that each of the new questions was appropriate for all Canadian jurisdictions, that it was relevant to the competency selected, and that it read clearly. Each item was reviewed and discussed. Revisions were made, as required, to the items and to references.

Translation of Initial Bank Items

ASI's professional translation team translated the items into French, and a session was held in April 2007 to review the final translation.

Initial Cut-Score Setting

It is critical that the cut score set for a credentialing exam be done through careful analysis to determine the level of skills and knowledge needed for safe, entry-level practice. To accomplish this, a standard setting procedure was used to determine an administration specific cut-score (pass score). Based on a recommendation from ASI and further research, the Angoff method was used.

In 2005, six participants (exam committee members and midwives) from four jurisdictions participated in a four-day workshop. Participants reviewed all aspects of each exam item to estimate the probability that an entry-level candidate would get it correct. A provisional cut-score resulted from this workshop. The group also confirmed that cut-scores for the CMRE will range from 70-80%.

The Angoff method was used again in March 2007, when a session was held to identify a standard score for each new item in the bank. All new items were successfully reviewed and assigned an Angoff score.

Since then, all newly-written items and any substantially revised items have undergone a standard setting procedure to determine their Angoff scores.

Policies & Procedures

The NAS Project Coordinator engaged in research to determine the policies and procedures that would best protect the security of the exam, ensure the effectiveness of the exam, and be most fair to exam candidates. The Coordinator drafted policies, procedures, manuals, and forms for review by exam committee members and other relevant stakeholders. This process resulted in the following documents available in both English and French:

- Candidate information sheets posted to the website;
- Proctor Manual, and associated forms;
- Marker Manual, and associated form (not required after 2007).

Confidentiality and Security

The CMRE and all associated materials are protected by copyright law. Stringent measures were in place throughout examination development to protect the examination before, during, and after the administration. All those with access to examination materials sign affidavits of non-disclosure. Examination materials are kept locked and/or password protected when not in use. A USB drive back up of examination materials is also kept in a locked cabinet.

Ongoing Item Bank Maintenance and Development

Having a robust bank of examination items for the CMRE enables midwifery regulators to follow accepted standards for examination construction as outlined in the CMRE blueprint. It allows for the construction of new examination forms that bolster security with enough items to allow for the construction of comparable examination forms. This in turn contributes to fair and more effective decisions over time.

Item writing or item review workshops are held once every year, if possible. The item writing group typically contains registered, practicing midwives from across Canada, with a range of practice experience as well as experience with CMRE item writing. The item writing workshops

are facilitated by the CMRE Psychometrician who provides training on how to write items in an effective manner based on evidence-based practice. Once trained, the item writers independently write new items. Newly-written items are discussed and reviewed by other members of the item writing team. After this, they are submitted to a separate group of registered, practicing midwives for validation. Validation involves a thorough review of the items (i.e. editing for grammar/spelling errors, fairness reviews, and extensive content-related reviews to ensure: each item measures the intended competency it has been designed to measure, the correct response is clearly correct and the incorrect response options are clearly incorrect and the items do not contain terminology that may be unfamiliar to English language learners).

Beginning in 2018, item writing and item validation activities were conducted simultaneously in English and French whenever possible. Validated items are then submitted to a translation company for full translation or verification of translations prepared by the midwife item writers and validators. A bilingual member of the item writing or item validation group reviews the translation company's translation to ensure correct translation of midwifery-related content. Upon completion of translation or translation verification, the items undergo standard setting where, after receiving training from a psychometrician, a different group of midwives set a cut-score for each item that indicates the probability of correct response by a minimally qualified, entry-level midwife.

Item bank maintenance and development activities that occurred during previous years are described in the respective CMRE Technical Report for each year. Item bank maintenance and development activities that occurred in the current year are briefly described in the following sections of this report.

The Canadian Midwifery Registration Examination 2020

The following sections of the CMRE Technical Report pertain to 2020 CMRE exam activities carried out or facilitated by Dr. Dallie Sandilands of EMP Educational Measurement Professionals.

Exam Development Activities in 2020

The main CMRE exam development activities facilitated by Dr. Sandilands in 2020 were a review and update of the CMRE practice exam and a series of online item reviews, translation and standard setting.

CMRE Practice Exam – PESA

A review of the CMRE practice exam (the Midwifery Pre Exam Self Assessment, PESA) was completed in 2020. The PESA was reviewed, updated, and translated during the period from July 2019 through to May of 2020. After EMP facilitated an initial workshop that provided training in item writing and item review, a team of 13 midwife subject matter experts ("SMEs") worked in pairs or small groups in an online environment. The goals of their review were to: ensure the PESA content was up to date and questions were properly referenced; improve the psychometric quality of the questions by adhering to CMRE item writing and review guidelines; and achieve a better match to the existing CMRE blueprint. Throughout the review period, occasional large group meetings were held to enable the SMEs to discuss specific questions or concerns and to receive additional feedback from the larger group of SMEs. Once the pairs or small groups were satisfied with the results of their review, items were reviewed one additional time by a highly experienced midwife item reviewer. Then the entire PESA content was translated from English to French by certified translator at *Mosaic Interpretation and Translation Services* of Vancouver, BC. Mosaic's translation was reviewed and validated by a French-speaking bilingual midwife with considerable experience in reviewing and translating CMRE items. Following this, the updated PESA was made available as practice material for CMRE candidates.

Item Review and Validation Activities

Ongoing item review and validation activities occurred in an online meeting environment beginning in November of 2019 through to July of 2020. Six experienced CMRE item validators took part, working in pairs. Their work was supported by the CMRE Administrator who provided administrative and technical support, and by the CMRE psychometrician who provided support documents, reference materials and psychometric support as required. The validators reviewed

19 cases containing 59 case-based and 29 independent items identified as requiring review for midwifery currency or accuracy (including updating item references) or psychometric quality. A further 6 cases containing 22 case-based items and 4 independent items were reviewed by one experienced CMRE item validator. These 26 items had been identified by the psychometrician as items mentioning "effacement". The purpose of the review was to standardize the presentation of cervical length and corresponding effacement in all CMRE questions that mention effacement [for example, "cervical length of 1 centimeter (75% effaced)", or "cervical length of 0.5 centimeters (90% effaced)"]. Changes were made in English and then updated in French by a French-speaking midwife.

Translation and Translation Validation Activities

Translation activities began while item reviews were proceeding and continued afterwards. Items requiring either full or partial translation were provided to *Mosaic Interpretation and Translation Services* in a secure online environment. Following the MOSAIC translations, the translations were reviewed and verified by a French-speaking CMRE item validator. In all, 60 items and 10 case texts were translated and verified.

Standard Setting Activity

A 9 hour standard setting meeting was held on March 26, 2020 via technology-enabled "Webex" services. Nine midwife subject matter panelists set the standard for 42 items using a modified Angoff procedure. A report describing details of the method used and the results has been provided to CMRE separately.

Exam Form Construction and Composition in 2020

All CMRE exam forms are based on the CMRE blueprint. To maintain security, the CMRE examination forms are changed after each sitting to the extent allowed by the availability of items in the item bank while still allowing for adequate coverage of the blueprint categories.

To ensure comparability of exam forms over time, an effort is made to keep all aspects of the item balance on the CMRE as consistent as possible. Comparability of the examination forms across administration is essential for fairness. Adherence to the examination blueprint ensures, as much as is reasonably possible, that the examination forms measure the same construct (midwifery proficiency) in the same way (across specified competencies of a specified weight and across specified conditions within specific proportions). Further, comparability is achieved by

ensuring that the examination is administered by proctors in a consistent manner and that settings conform to identified standards.

Due to the Covid-19 pandemic no CMRE administration was held in May of 2020. Candidates who had registered for the May 2020 exam were offered the opportunity to sit the CMRE in October 2020.

Examination form construction and the administration of the October 2020 CMRE are outlined here.

Exam Form Creation

The October 2020 exam form was automatically generated using a computerized algorithm designed to select cases and items to match the required blueprint categories. The October 2020 form was carefully reviewed by the psychometrician to ensure its overall quality and appropriate mapping to the blueprint prior to forwarding it to two midwife subject matter experts ("SMEs") for review prior to finalizing and printing.

Pre-Exam Review

The October 2020 exam was administered in English and French. The English and French versions of the exam were sent for review by an English-speaking and a French-speaking SME respectively. The SMEs reviewed the exam independently, then the SMEs and psychometrician met via videoconference to determine what the final content should be. The SME reviewers provided feedback for improving the exam as well as suggestions for reviewing specific items in the future. Subsequently, the SMEs' comments were taken into consideration by the psychometrician when preparing the final version of the exam, and the item bank was updated accordingly.

Final Version of the October 2020 Exam

The following section provides details of the final version of the October 2020 exam, as it was presented to the candidates.

The October 2020 CMRE exam was composed of two parts: Part 1 was administered before the lunch break and Part 2 was administered after the lunch break. Both parts consist of case-based items and independent items. The composition of each part of the exam is shown in Table 3:

Table 3: October 2020 CMRE composition

Part	Case Study	Independent	Total
1	66	44	110
2	67	43	110
Total	133	87	220

The October CMRE met the requirements of tau equivalence with previous CMRE exam forms. Tau equivalence is achieved in the CMRE by ensuring that all examination forms are constructed from the same blueprint and that items contributing to the content are generated using a common model across item writing sessions. Adherence to the CMRE blueprint competencies for administrations between 2016 and 2020 is shown in Table 4.

Table 4: Adherence to Blueprint Competencies May 2016 to Oct. 2020 Administrations

Competency	Blueprint %	Administration								
		Oct-20	Oct-19	May-19	Oct-18	May-18	Oct-17	May-17	Oct-16	May-16
General	5 to 10	10.5%	10.50%	9.33%	11.50%	11.01%	8.72%	8.26%	8.84%	7.34%
Education and Counseling	5 to 10	5.9%	5.02%	8.89%	5.75%	5.50%	5.50%	7.80%	6.98%	6.42%
Antepartum	25 to 30	25.0%	25.11%	23.56%	23.45%	24.77%	22.94%	25.69%	26.51%	27.52%
Intrapartum	25 to 30	28.2%	25.57%	25.33%	26.11%	25.23%	25.23%	27.52%	29.30%	25.69%
Postpartum	10 to 15	10.5%	11.42%	12.00%	13.27%	14.22%	14.22%	12.39%	12.09%	13.30%
Newborn	10 to 15	10.9%	11.87%	12.00%	12.39%	12.39%	14.22%	11.93%	11.63%	12.84%
Well Woman	1 to 5	4.5%	4.57%	4.00%	3.54%	3.67%	4.13%	2.75%	2.33%	3.67%
Legal	1 to 3	2.3%	3.20%	2.67%	2.21%	1.83%	2.29%	1.38%	1.40%	1.83%
Professional Development	1 to 3	2.3%	2.74%	2.22%	1.77%	1.38%	2.75%	2.29%	0.93%	1.38%

To promote fairness through form comparability, items are selected to maximize consistency in item difficulty (as estimated using the Angoff standard setting method) across administrations and over time. The Angoff score for each of the major competencies and the overall Angoff score is considered in the examination construction. The Angoff scores from October 2011 through to October 2020 are given in Table 5.

Table 5. Angoff scores for major Blueprint competencies, 2011 to 2020 (%)

Administration	General	Antepartum	Intrapartum	Postpartum	Newborn
Oct 2011	78.87	77.61	78.13	76.31	75.89
May 2012	78.49	76.95	79.08	76.85	75.86
Aug 2012	78.49	76.95	79.08	76.85	75.86
Oct 2012	78.84	76.64	79.93	77.40	76.74
May 2013	79.60	77.23	79.84	77.94	76.66
Sep 2013	78.56	77.56	79.33	78.10	76.79
May 2014	78.14	77.45	79.08	77.59	76.60
Sep 2014	78.95	77.84	79.43	78.22	76.43
May 2015	78.64	76.89	79.63	77.57	75.90
Oct 2015	79.07	76.89	79.63	77.57	75.90
May 2016	78.56	77.83	80.83	76.75	77.35
Oct 2016	78.52	76.74	80.34	77.79	78.15
May 2017	79.56	76.69	78.83	78.65	77.93
Oct 2017	79.72	78.48	79.87	77.58	78.56
May 2018	78.97	79.33	80.26	77.49	78.68
Oct 2018	78.38	79.31	80.79	77.34	78.10
May 2019	77.31	77.93	77.39	76.73	77.16
Oct 2019	76.59	77.68	77.58	77.35	76.41
Oct 2020	76.68	75.31	77.61	76.68	75.34

Administration 2020

A total of 100 candidates completed the CMRE in 2020. Due to the ongoing COVID-19 pandemic and provincial regulations limiting the size of group gatherings, the exam was held at various locations and various types of venues. These extraordinary administration arrangements allowed the exam to be held in compliance with all provincial COVID-19 regulations. Table 6 summarizes the number of candidates and type of venue at each exam location:

Table 6. Candidates and Locations

Location	Number of Candidates	Type of Exam Location
AB: Calgary	9	Hotel meeting room
BC: Vancouver	23	University exam room
MB: Winnipeg	3	Regulator's office
NL: St John's	1	Regulator's office
NS: Halifax	3	Regulator's office
ON: Hamilton	19	Individual hotel rooms
ON: Ottawa	9	Hotel meeting room
ON: Thunder Bay	3	Hotel meeting room
ON: Toronto	29	Individual hotel rooms
QC: Montreal	1	Regulator's office
Total	**100**	

Exam administration tasks included the printing and distribution of the CMRE; the updating, printing and distribution of administration/data collection materials; and the printing of score package materials. Given a set of site requirements and guidelines, provincial registrars arranged for the examination sites and identified exam proctors. To ensure consistency (and comparability) across site locations and administrations over time, the CMRE Administrator held teleconferences with proctors to review the written protocols outlined in the Proctor Manual, as well as the proctor script.

Scoring and Quality Assurance for Scoring

The CMRE Administrator sent all candidate optical answer ("bubble sheet") responses to EMP via courier. All bubble sheets received by EMP were scanned by Verita Strategy Group, Inc. and saved to a *Microsoft Excel* file. Verita Strategy Group verified the accuracy of the data records before providing them to EMP for scoring. As a further quality control step, EMP also did random checks of the contents of the data files against the contents of the bubble sheets before undertaking scoring activities.

Data Analysis and Review

Scoring, item analyses and reliability analyses were conducted using the *CTT classical test theory* package (Willse 2018), the *psych* package (Revelle, 2018) and the *betafunctions* package (Haakon Haakstad, 2020) of the *R Language and Environment for Statistical Computing* (R Core Team, 2019) as follows:

- Total and subscale (competency) number correct scores and percentages.

- Item-Level total and subscale (competency) Cronbach's alpha reliability statistics.

- Combined case- and item-level total Cronbach's alpha reliability statistics.

- The Standard Error of Measurement for total scores.

- Classification Consistency and Accuracy (Livingston and Lewis 1995 approach based on observed test scores and test reliability, as implemented in the *betafunctions* R package (Haakon Haakstad, 2020)

- Total and subscale (competency) Angoff scores (cut scores used to set pass/fail standard).

- Observed item statistics (response option frequencies, mean item difficulty (p) values, standard deviation, item discrimination (point biserial statistic) and test reliability if item deleted).

In addition to the initial quality control step noted above, the responses of two candidates whose preliminary scores were below the cut score were carefully reviewed. First, these candidates' bubble sheet responses were compared to the response data file received from Verita Strategy Group, Inc. (which was used to create candidates' scores). The response data file was verified to be correct for these candidates. As an additional quality control step, these candidates' bubble sheet responses were hand-entered in an Excel spreadsheet, and their scores were verified by calculating them in Excel. No errors or anomalies in scoring were identified. No other candidates' scores required individual verification as there were no other candidates whose preliminary scores were near or below the cut score.

Key Validation and Item Review Process

The psychometrician met with SMEs after the exam had been scored to review items with unexpected response patterns/item statistics, items identified by the SMEs during the pre-exam review as potentially requiring review after the exam had been held, and items with potentially significant candidate comments, as follows:

Items with unexpected response patterns (such as when a large proportion of candidates selected a single incorrect response option) or negative point biserial statistics (negative item discrimination) were identified and reviewed by the psychometrician. Item statistics of items considered to require further investigation were compared to past performance and information about the item in the item bank if available.

After each CMRE sitting, the candidates are asked to provide feedback on their examination experience and to comment on specific items on the exam. Candidate comments were summarized by the CMRE Administrator and presented to the psychometrician to consider and identify any items that should be reviewed at the key validation and item review meeting.

Following the October 2020 administration, the psychometrician met with 4 SMEs to review 34 items flagged for review. The SMEs were a subgroup of the CMRE validation team and included the two subject matter experts who had conducted the pre-exam review. The reviewers' recommendations were as follows:

- 3 items: Do not change scoring for October 2020 exam; flag each item to be reviewed/revised or provide references before future use;
- 24 items: Do not change scoring for October 2020 exam; no future action necessary;
- 2 items: Accept two correct responses for October 2020 exam; flag the items to be reviewed and revised so there is only one correct response; provide references before future use;
- 3 items: Remove the items from the exam; flag the items to be reviewed and revised prior to future use or discard the items from the item bank;
- 2 items: Do not change scoring for October 2020 exam; very minor changes made to item in the item bank during the meeting;

Final Scoring and Report to Exam Committee

After the key validation activity, EMP re-scored the data as per the SMEs' recommendations. EMP and the CMRE Administrator prepared an Examination Report containing psychometric details (EMP) and summaries of candidate feedback (CMRE Administrator) for the CMRE Committee. EMP's psychometric report includes details of the exam preparation, administration, key validation and item review procedure and results, scoring, reliability statistics (Cronbach alpha, SEM, classification accuracy and classification consistency) and candidate exam results.

A secure CMRE Committee web/teleconference was held to review the Examination Report and the candidate results. The CMRE Committee accepted the key validation and item review recommendations and ratified the score results.

CMRE score results were then reported to provincial regulators by the CMRE Administrator. Regulators received information regarding their candidates' pass/fail status and general weak areas, as well as summary comparisons with other candidates at this sitting (without

candidate names). All score-related correspondence with candidates was via the CMRE Administrator. Candidates received reports with their pass/fail status; failing candidates also received general feedback of strong and weak areas vis-à-vis the competency categories (ex. intrapartum, newborn, etc.).

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