

Technical Report Written Examination™ 2017

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Introduction

Organizations who administer high-stakes examinations must be concerned with validity reliability and fairness because these measures are required in making pass/fail decisions affecting candidates for licensure or certification. Fairness to examinees and protection of the public are the foremost concerns for the NDEB and the NDEB has an obligation to provide the highest quality examination program possible.

This Technical Report is a summary of the processes followed by the NDEB to develop, administer, and score the Written Examination administered in 2017. It provides a summary of the information needed to support the validity and reliability of the assessment. For additional detailed information, key references are included in Appendix A.

This report serves as a reference for the members of the NDEB Examinations Committee, NDEB Board, and Provincial Dental Regulatory Authorities (DRAs). The processes described in this report may differ from those used in other years.

Part A – NDEB Examinations and Assessments

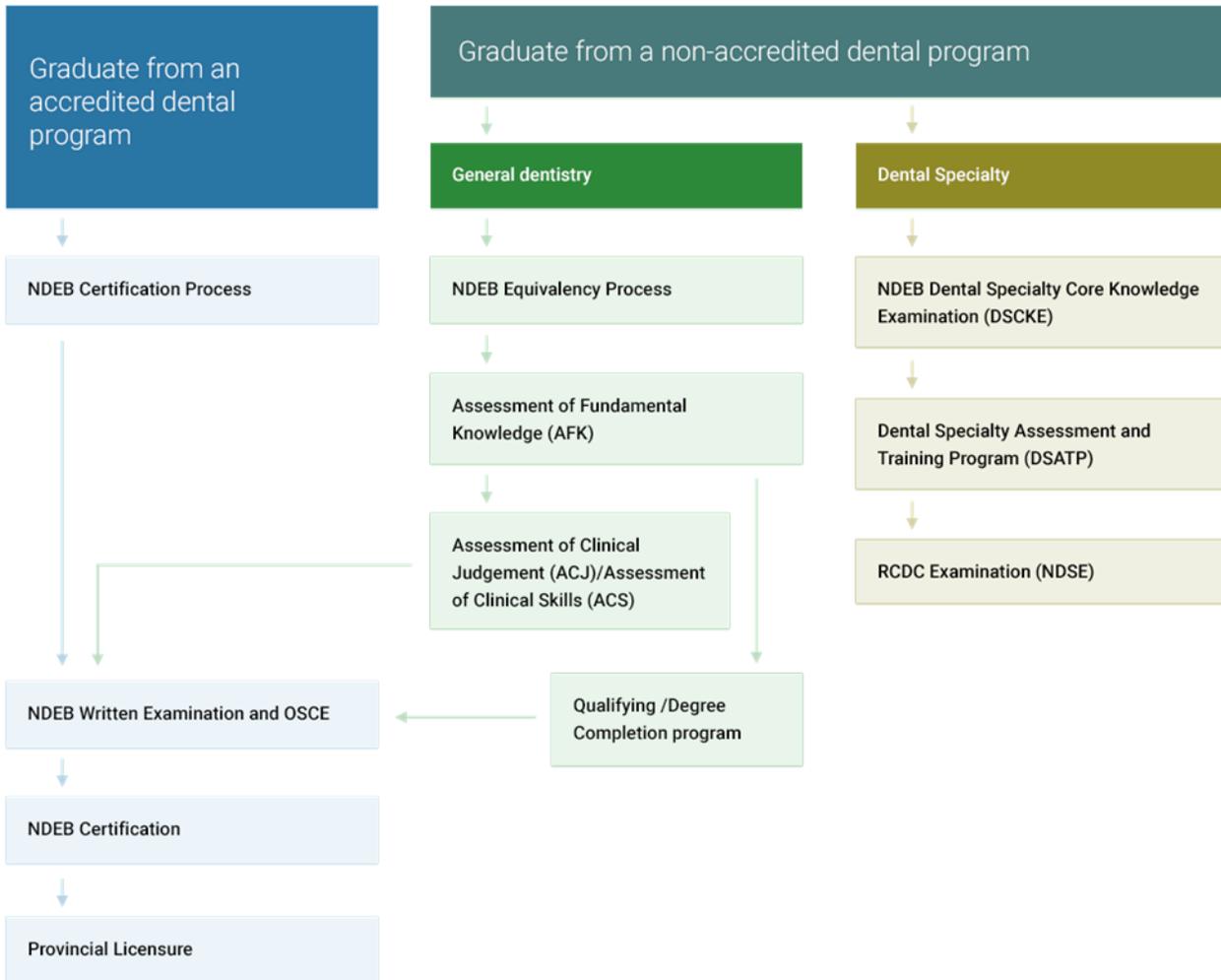
This section of the Technical Report outlines the full examination and assessment processes to demonstrate all of the aspects needed to obtain an NDEB certificate.

Conditions for Receiving a Certificate

Successful completion of the NDEB's Written Examination and Objective Structured Clinical Examinations (OSCE) is one of the conditions for receiving a licence to practice dentistry in Canada. A candidate, as defined under NDEB's published By-Laws, is granted a certificate upon presentation of the following documentation:

- evidence of graduation from an Accredited Program or successful completion of a Qualifying Program or NDEB Equivalency Process, and
- evidence that the candidate has passed the Written Examination and OSCE.

The following diagram illustrates the pathways to obtaining NDEB certification and licensure as a dentist in Canada.



Current Examinations for Graduates of Accredited Programs

Written Examination

The purpose of the Written Examination is to assess the Competencies for a Beginning Dental Practitioner in Canada that can be evaluated through multiple-choice formats. The content categories that form the blueprint for the Written Examination are based on the 47 competencies. The Written Examination assesses the following constructs: basic science knowledge and applied clinical science knowledge and judgement, including diagnosis, treatment planning, prognosis, treatment methods, and clinical decision making.

The Written Examination consists of two books, each with 150 single answer multiple-choice questions. Each book is given in a 2.5 hour (150-minute) examination session. The sessions are held in the morning and afternoon of one day at established examination centres. Generally, the Written Examination is completed with time remaining. Consequently, there is no evidence that the Written Examination is a speeded test.

The NDEB website displays the examination blueprint, a list of reference texts commonly used in Canadian dental programs, and all necessary logistical details. Approximately 3,500 questions, including many used on past examinations are also available on the NDEB website (www.ndeb-bned.ca). These released questions are updated annually.

Objective Structured Clinical Examination (OSCE)

The OSCE is a one-day station-type examination administered the day after the Written Examination. It is designed to test aspects of clinical judgement. OSCE stations generally have two questions and require the examinee to review the information supplied (e.g. patient history, photographs, radiographic images, casts, models) and answer multiple response type questions. Each question has up to 15 answer options and one or more correct answer(s). Some stations may require the examinee to review the information supplied and write an acceptable prescription for a medication commonly prescribed by general dentists in Canada. Examinees have five minutes at each station to answer the questions. After five minutes, the candidates move to the next station.

Current Assessments for Graduates of Non-Accredited Programs (NDEB Equivalency Process)

Graduates of non-accredited dental programs are required to complete the NDEB Equivalency Process or a two-year Degree Completion Program prior to being eligible to participate in the Certification Process.

Self-Assessment

Prior to applying for the Equivalency Process, individuals are advised to complete a 100-item single-answer multiple-choice question self-assessment available on the NDEB website. Guidance is provided to individuals based on their self-assessment results.

Credential Verification

The NDEB performs an in-depth credential verification procedure for each individual applicant prior to approving the applicant as a participant in the NDEB Equivalency Process.

Assessment of Fundamental Knowledge (AFK)

The AFK consists of two books, each with 150 multiple-choice questions. Each book is given in a three-hour session (180-minute). The sessions are held in the morning and afternoon of one day.

The AFK tests biomedical science knowledge and applied clinical science knowledge. Prior to the assessment, examinees are advised to go on the NDEB website to look at the blueprint and a list of reference texts commonly used in Canadian dental programs.

Assessment of Clinical Skills (ACS)

During the two-day ACS, participants perform simulated dental procedures on manikins in a clinical setting.

Each day participants receive:

- a typodont mounted in a manikin on a dental chair.
- a detailed list of requirements specifying tooth numbers and surfaces.

Participants are required to perform 12 requirements over the two days. Calibrated Examiners evaluate the requirements anonymously.

Assessment of Clinical Judgement (ACJ)

The ACJ consists of two books given in a single day.

Book 1 A and B - Diagnosis, Treatment Planning and Clinical Decision Making

These components contain single and multi-answer multiple-choice questions and evaluate ability to formulate a diagnosis and to make clinical decisions. Patient histories, dental charts, and photographs may be provided for patients of all ages, including those with special needs.

Book 2 - Radiographic Interpretation

This component contains multi-answer multiple-choice questions and evaluates knowledge in oral radiology and ability to make a radiographic interpretation and diagnosis using radiographic images.

Part B – Development

Test Construction Process and Validity Evidence

Examinations Committee

The Examinations Committee of the Board consists of nine members appointed by the Board. One of these members may be the Public Representative. No more than two persons can be recommended to be members by each of the Ordre des dentistes du Québec and the ACFD. Staff support for the Committee includes the Executive Director, Managers, and the Chief Examiners for all assessments and examinations.

Examinations Committee members must abide by a terms of reference document that forms part of the NDEB By-Laws. According to the terms of reference, the Examinations Committee members must be elected by the NDEB Board. Term limits and other administrative processes are also outlined in the terms of reference.

The Examinations Committee ensures the examinations and assessments are conducted in a fair and equitable manner for all concerned. The Committee:

- reviews the standards and procedures of all examinations and assessments and makes recommendations to the Board on all matters concerning the examinations and assessments.
- reviews the passing standard for each examination and assessment and makes a recommendation to the Board.
- recommends to the Board, Chief Examiners for each of the Board's examinations and assessments.
- reviews the protocols for each of the Board's examinations and assessments and submits the protocols to the Board for approval. Suggestions for changes to the protocols are initiated by staff and the Chief Examiners.
- recommends to the Board future changes to the structure or format of the examinations and assessments.
- reviews the names of individuals recommended for appointment as Examiners by the DRAs, the Deans and Directors of the dental programs in Canada, and the Canadian Forces Dental Services and recommends Examiners to the Board for appointment. This appointment process ensures that Examiners represent various areas of practice and come from across Canada.
- recommends the appointment of consultants who are recognized for their expertise and/or experience in examination and assessment development to the Board.
- reviews results of the examinations and assessments to ensure consistency of the examinations and assessments over each administration. This is to confirm that the performance required to

meet the standardized passing score is the same for each version and that examinee results from different versions are comparable.

- contributes to maintaining the examination and assessment integrity by reviewing summaries of reports from Test Administrators, Presiding Examiners and Assessment Supervisors on irregularities identified during an administration. If an examinee is reported to have compromised the process by cheating or violating the regulations, the Committee has the authority to void the results of that examinee's examination and to prohibit the examinee from taking future examinations.

Staff Support

The Director of Examinations, who reports to the Executive Director and Registrar, is responsible for staff supervision and the implementation of all policies approved by the Board to ensure the process operates efficiently and effectively.

The Chief Examiner is responsible for the development of the examination or assessment including coordination of question development, question selection, monitoring the item bank and results within the guidelines and parameters established by the NDEB as stipulated in the protocol (NDEB, 2017).

The Examinations and Assessments Managers, in consultation with the Director of Examinations, prepare and administer the examinations/assessments and manage the operational delivery, including arrangements with staff, preparing protocols and instructions for Test Administrators, correspondence with Examiners, production and translation of the examinations/assessments, and the maintenance of the question bank. The Managers are supported by coordinators and an assistant.

The Manager-Credential Verification and Program Services (CVPS) makes arrangements with hosting institutions and with specific individuals who are trained to administer the examinations/assessments at test centres. These arrangements are made annually.

All staff is responsible for carrying out directives from the Examinations Committee as approved by the Board.

Item Development and Selection

The examination/assessment development process follows the NDEB's development plan that is contained in the Examiner's Manual and contains high level information on the processes used to support the creation of defensible examination content. Specific elements of that plan are detailed below.

Examiners who are dental specialists/content experts at Canadian Faculties of Dentistry are sent copies of the Examiner's Manual and other preparatory material for review prior to a question development workshop. During the workshop, Examiners are trained in question construction, then construct, and criticize potential new items in their discipline. Examiners are directed to write items that assess higher cognitive processes such as application and problem solving. They are further instructed to avoid recall questions whenever possible. Examiners are also asked to avoid trivial questions. New items are reviewed

and revised by a group of subject matter experts prior to being eligible for use on an examination/assessment. In addition, all new items are reviewed and, if required, edited by the Chief Examiner and senior staff.

Examiners who are practicing general dentists recommended by the Provincial Dental Regulatory Authorities select all the items for every examination/assessment in accordance with a blueprint. The results of past item analyses are used as a guide in the item selection process. Items are selected based on several criteria including consistency with the blueprint, taxonomy of cognitive levels, the need for anchor items, and statistical properties of the items.

The NDEB collects and retains information on Examiners involved in the development and approval of the examination/assessment, including demographic characteristics and practice areas.

Item Review, Verification, and Translation

All examination and assessments are available in English and French. This includes all forms and preparation materials.

After test items have been selected and a draft examination/assessment form is built, the items are reviewed and translated using a multi-stage process. This first draft is reviewed and validated by groups of trained Examiners who verify the technical accuracy of the items. They may also consult with additional subject matter experts when required. This includes identifying item enemies and verifying the representativeness of the content domain and the significance of the content being tested (NDEB, 2010). During this review, questions are subjected to intensive review to verify the wording and the correct answer. Should a question need to be reworded, it is either revised for the examination or replaced. The review focuses on three things. First, the technical content of the question is verified to ensure that it is consistent with best practices and supported by the literature. Second, a sensitivity review is done to ensure that the question content is not offensive and does not discriminate against examinee subgroups. Third, a language review is done to ensure that the content does not exceed the language level needed to practice dentistry safely and effectively in Canada.

Items are then translated by dentists familiar with the vocabulary used on the examinations/assessments. The questions and the translations are then reviewed by a group including bilingual subject matter experts who are approved by the Ordre des dentistes du Québec (ODQ). In addition, the NDEB has developed a detailed glossary of translated terms. This glossary is updated annually. This process ensures that examinees writing in either official language have equal opportunity to demonstrate their competence. The translation process ensures consistency between English and French versions of the questions.

Following the first review, NDEB staff members input required revisions and build a second draft examination/assessment. During a second review, trained Examiners including bilingual Examiners approved by the ODQ verify that all the changes have been made to the questions and that the French translation is accurate. NDEB staff members input the changes and produce revised copies of items so that all items are finalized during the review.

Following the second review, NDEB staff members produce the examination/assessment in the final format that will be used. During a final review, trained Examiners, including bilingual Examiners approved by the ODQ, verify that all questions are correct in both languages and that the formatting of the document is correct. NDEB staff members input any additional changes and produce revised copies so that the examination/assessment can be approved at the end of the review session.

Examination/Assessment Production

Following the final review, NDEB staff members produce four versions of the examination/assessment using an automated process that produces a random pattern of questions in each of the four versions. These books contain identical items but are presented in a different order to limit potential cheating. The Chief Examiner, and a bilingual Examiner approved by the ODQ, review each version to ensure that the format and numbering of questions and distractors in each version is correct. The Chief Examiner and a bilingual Examiner approve the final versions by initialing each page of each version.

Prior to printing, the appropriate cover page and instruction pages are added to the documents. All printing is done on site. Documents that have been finalized are saved as .PDF files in a specific directory. The originals of the finalized documents, which include Examiner initials, are copied on a specific on-site printer. After printing the batches of books, a random check of documents is performed by two staff members to verify that no errors have been made during the printing process.

Computer generated labels indicating names, NDEB identification numbers, and assigned seat numbers are affixed to the front of each book.

Test Validity and Reliability

The primary purpose of establishing content validity of credentialing examinations is to show that the process and results underlying their development are a valid reflection of that part of professional competence that the examinations purport to assess. That is, construct validity is about the relationships between the construct of professional competence and the examination instrument. The examination and assessment content categories reflect both educational programs and the requirements of practice, and general practitioners select the content for the examinations and assessments. In addition, each form is built to match the blueprint approved annually by the Board and contained in the protocols.

In addition to the logical basis for asserting construct validity, the NDEB has carried out several studies, both internal and published, that support validity claims (Appendix B).

Test reliability refers to the degree to which examination/assessment scores for a group of examinees are consistent over repeated administration of the test and are therefore considered to be dependable and consistent for an individual examinee. Reliability is estimated using a reliability coefficient, which is a unit-free indicator that reflects the degree to which scores are free of random measurement error. Based on the data provided in the results section of this Technical Report, the NDEB examinations and assessments display evidence of continued strong reliability.

Documentation

Evidence of test validity is collected through multiple means, one of which is the documentation of development and administration procedures. The NDEB makes these documents publicly available. Only confidential material or material that could jeopardize the integrity of the examination/assessment is retained internally. These documents are also updated frequently (generally on an annual basis) to reflect the most recent information. References for these documents can be found in Appendix A.

To support the various sources of validity evidence, NDEB produces the following documents:

NDEB By-Laws

The NDEB By-laws contain a number of sections related to the NDEB's examination and assessment programs. Examples of relevant information include:

- Certification eligibility
- The Board's certification and equivalency processes
- Examinations and assessments
- Conduct and appeals policies
- Terms of Reference for various examination-related committees
- Test Accommodations
- Misconduct

The By-Laws are available free of charge on NDEB's website (www.ndeb-bned.ca).

Competencies for a Beginning Dental Practitioner in Canada (Appendix C)

This document outlines the body of knowledge that is assessed by the NDEB's examinations and assessments. A clearly outlined body of knowledge is key to establishing the content validity of examinations/assessments by providing a link between practice and the examination/assessment. This document is available in English and French on NDEB's website (www.ndeb-bned.ca).

Written Examination Protocol

Updated annually, the Written Examination Protocol contains all of the information the candidate needs in order to prepare to write the Written Examination. In addition to providing logistical information, this document is meant to reduce construct irrelevant variance related to testing. The document details the purpose and intended use of the examination. Candidates acquire advance information on examination content, instructions and other procedures. At a high level, the Written Examination Protocol contains the following information:

- Content and format
- Schedule
- Validation of registration
- Instructions

- Sample questions
- Reference texts
- Examination regulations
- Passing standard
- Results
- Appeals and rescores
- Repeats

This document is available in English and French free of charge on NDEB's website (www.ndeb-bned.ca) and is posted in every candidate's online profile once the candidate has registered for the Written Examination.

Written Examination: Chief Examiner's Manual

Reviewed and updated annually, the Written Examination: Chief Examiner's Manual is an internal document that describes the various stages in examination development and production. This document also ensures that the Written Examination development process remains similar from year to year. This document contains:

- examination assembly guidelines and information on blueprint adherence.
- guidelines to producing examination forms.
- procedures and protocols for examination development meeting.

Examiner's Manual Written and AFK

Reviewed and updated annually, the Examiner's Manual for the Written and AFK is an internal document provided to examiners and outlines the question writing philosophy and guidelines for question format and style.

Instructions and Regulations for Test Administrators – Written Examination

The purpose of this document is to describe, in detail, the procedures to follow before, during and after the administration of the Written Examination. This document ensures that examinees have a similar experience when completing the examination, regardless of where they write. The document also enhances examination security by providing a detailed quality assurance protocol. Examinees are also reminded on numerous occasions that having someone else take the examination for them, disclosure of confidential examination material, or engagement in any other form of cheating is unacceptable and that such behavior may result in sanctions. This document contains:

- instructions prior to the examination.
- instructions for examination day (which include verbal candidate instructions).
- procedures to follow during the administration of the examination.
- procedures to follow at the end of the examination.
- instructions following the examination.

Part C - Administration

Locations and Procedures

The Written Examination and OSCE are administered three times a year (March, May and November) as established by Board policy. With the exception of some approved testing accommodations, for each administration, the examinations are taken over two days. All examinations are written in a distraction-free and comfortable environment where candidates are optimally able to demonstrate their competence on the examinations.

The March examination session is held across Canada with centres established in each of the ten dental schools. May and November examination sessions may be established in Canada in several locations provided that a minimum of ten candidates apply in a location. Examination centres may also be established outside of Canada with an expectation that a minimum of 50 candidates will apply for a centre and that an examination location with acceptable security can be established.

The NDEB tries to accommodate location preferences but may have to offer alternative locations due to space limitation at some examination sites. In these cases, candidates are assigned to the centre closest to the candidate's indicated address.

Test Administrators

Each examination centre has one or more designated Test Administrator appointed by the NDEB.

The Test Administrator's primary responsibilities include securing appropriate space at the examination centre, receiving the exam material and ensuring the security of examination materials before, during, and after the examination, appointing invigilators to assist in monitoring the examination, and ensuring the examinations are administered according to NDEB procedures.

When a new centre is established, or a new Test Administrator is appointed, NDEB staff visit the centre and meet with the individual who will be the designated Test Administrator to review the roles and responsibilities. All Test Administrators are required to adhere to the NDEB's instructions and regulations for Test Administrators. These documents clearly outline the responsibility of the Test Administrator and examination day procedures allowing for standardized administration across all centres. Test Administrators are encouraged to communicate with NDEB staff with questions or concerns regarding the administration or their responsibilities.

Prior to the administration, NDEB staff communicates with the Test Administrators to review any new NDEB policies or procedures in relation to the administration of the examination.

Administration Procedures

The NDEB has developed standard administration procedures for each of the examinations/assessments. The documentation includes uniform directions for Test Administrators, invigilators and examinees, the schedule for the examination/assessment, and the security protocols that should be undertaken during the examination.

Standard check-in procedures are in place for all examinees at each examination centre. A set of standardized instructions is read to all examinees in their language of choice prior to the commencement of the examination/assessment. Examinees are reminded of the rules of conduct and provided the opportunity to remove prohibited items from the examination room before the examination starts. No variation from the administration is allowed unless a test accommodation has been granted by the NDEB.

Reporting

The Test Administrator is responsible for completing a report of the administration of the examination/assessment. The report will include any irregularities that occurred that may have disrupted the administration of the examination/assessment. The report will also include details regarding any misconduct that occurred prior, during, or after the administration.

Testing Accommodations

In the case of testing accommodations approved by the NDEB pursuant to its published By-Laws (NDEB, 2017) and procedures, test forms or administration conditions may be modified in order to accommodate examinees requiring testing accommodations. The purpose of testing accommodations is to remove construct-irrelevant barriers that would interfere with an examinee's ability to demonstrate their competence. Accommodations may be provided for a disability, medical condition, or religious reason. Examinees must submit a written request prior to the registration deadline and are required to provide supporting documentation. Accommodations may include an alternate writing date, separate examination room, large print booklets, special coloured paper, or longer examination times. The number of requests for these types of accommodations is small, and as such, the NDEB is unable to establish the validity of these modified examination forms for this specific population. Testing accommodations represent the only allowable variations in administration conditions, and these variations are documented in detail. In recent years, the number of examination accommodations has been increasing, and most accommodations involve no modifications to examination materials.

Part D - Scoring

Standards for Pass/Fail

It is the NDEB's statutory obligation to certify only those who are qualified to enter the dental profession in Canada. In the interest of public health, the NDEB establishes standards necessary to ensure competency.

Standard Setting

The Written Examination is scored as percent correct. Passing standards were originally established through an in-depth standard setting process that utilizes both the Angoff and Bookmarking methods for recommending a passing standard. The passing standard is approved by the Board annually.

Passing Score

Based on the recommendation of an expert committee, in January 2015, the NDEB introduced a standardized passing score of 75 for all of its examinations and assessments. This change brought the NDEB in line with international standards. The new passing score has no impact on the difficulty or reliability of the NDEB's examinations or assessments.

Scoring

Each of the three hundred multiple-choice items is scored as correct (1) or incorrect (0). All answer sheets are scored centrally at NDEB offices using a scanning program. Several quality assurance steps are taken to ensure that the scoring is done accurately. For example, high and low scores are manually verified to ensure accuracy. In addition, a sample of answer sheets is also selected for manual verification. Questions that are flagged as not answered by an examinee are reviewed manually if there are more than two occurrences per book. All these processes are contained in a detailed procedures manual. Item analyses are carried out to flag potentially problematic items. Flagged items are reviewed by experts, and if necessary, eliminated or rekeyed. A raw examination score is then re-calculated for each examinee.

Equating and Re-scaling

In addition to the passing score, examinee scores are also re-scaled using the procedure described in detail in Maguire (2004) which is provided in Appendix E. To ensure fairness, a number of data quality assurance steps are taken to ensure that the equating and re-scaling is done in a fair manner while respecting the statistical assumptions that underlie these mathematical procedures.

Given that the Written Examination is a high-stakes linear examination that produces a single final score, the reliability/precision metrics are appropriate for this type of examination. Graduates of Canadian dental programs are used as the standard reference group. The passing rates are calculated for all examinees: those from Canadian universities, those from accredited universities outside of Canada, and those who have successfully completed the Equivalency Process.

Sub-scores are not included on candidate score reports but grouped sub-scores are included in school reports. These sub-scores are for diagnostic and information purposes only. Individual pass/fail decisions are not made on the basis of sub-score performance. As a result, reliability estimates are not provided for sub-scores.

Subgroup Differences

There have historically been small differences at the item and test level between examinees taking the Written Examination in English and in French. In order to investigate if these differences are due to differential item functioning (DIF) and/or bias, in 2012, the NDEB conducted an in-depth study. Although a handful of items were shown to behave differently between English and French cohorts, no systematic bias was evident toward either language (Smith & Buckendahl, 2012). The NDEB conducts a DIF analysis annually to investigate differences between examinees writing in English and French.

Review Procedures and Policy Following the Statistical Analysis of NDEB Examinations and Assessments

After verification and scanning of answer score sheets and reviewing any procedural abnormalities, an initial statistical analysis is performed. Reports generated from the initial statistical analysis are provided to the Chief Examiner and other attendees at a statistics review meeting. During this meeting, the following reports are reviewed:

- Candidate Performance by Exam Summary
- Question Performance by Exam Summary
- Exam Performance Detail
- Question Performance – Top/Low/Biserial Distribution (Condensed) (required for examinations/assessments which include multi-answer test items)

During the review, the correctness of all answer keys is verified and non-performing or compromised items are eliminated from the examination/assessment. A final statistical analysis is then performed and results calculated with those items removed.

Review

- Using information provided in the Question Performance by Exam Summary report, questions identified by a colour prompt are printed for in-depth review.
- Colour highlights within the report are triggered by the following criteria:
 - Difficulty: Less than .3
 - Biserial: Less than .05 (unless the Difficulty is greater than .95)
 - a Language Fairness Assessment
- Chief Examiners review the identified questions to:
 - confirm the accuracy of the answer key to identify potential ambiguities, including the possibility of multiple correct answers.
 - identify potential “trick” items or unclear wording.
 - identify a possible English – French translation issue.
 - establish consistency between images and/or models.
 - identify item decay as evidenced by an unusual increase in percent correct. If significant decay in a test item is noted, staff will conduct an internet search to ascertain whether the item has been released to the web in any form, or whether there is evidence of item reconstruction.
- Workshop attendees use their expert judgement to determine if:
 - A question will be voided (i.e. will no longer be used on examinations/assessments) if it is unclear, ambiguous, tricky or if it presents a translation issue.
 - a revision to the answer key is required.

Excluding a Question from the Test Equating Process

A question will be excluded from the test-equating process if:

- there is evidence of test reconstruction, coupled with significant decay.
- it is released between the date it was used in the reference examination/assessment and the date of the current examination/assessment.

The reason for excluding an item from the test equating process will be documented in writing and stored in the examination/assessment file.

Pilot Testing

As part of an additional quality control step, the NDEB embeds new questions into examinations/assessments as pilot test items. These items are new and have not been properly evaluated by the examinee population. Pilot items that perform well from a statistical perspective count toward the examinee's score, while those items that do not perform well are not counted. Items are generally voided for the following reasons:

- The item difficulty index is very low, indicating that on average, examinees were unable to respond to the question or that the question was written unclearly.
- The item has negative item discrimination indicating that poorly-performing examinees responded correctly to the item more frequently than highly-performing examinees.
- The analysis of response patterns for the distractors provides strong evidence that the item is unclear or ambiguous.

In addition, item statistics are used to improve items for future use. Due to the NDEB's pilot testing methodology, items are exposed to a live examinee population, which includes all relevant subgroups.

Reporting

The results of the Written Examination are posted on a secure website within six weeks of the administration date. Examinees access their results by logging in to their online profile. Email notification is sent when results are posted. If there is an anticipated delay in the release of results, examinees are notified by email. Results are reported as Pass/Fail. Examinees who fail also receive their test equated, re-scaled score and the pass mark for the examination. This allows examinees to determine how close they were to passing. They are also provided with instructions on how to appeal their score.

Canadian Faculties of Dentistry are normally sent reports of the Faculty's student results for the March administration and school performance versus Canadian performance annually. On request, other accredited dental programs that have a sufficient number of examinees (more than 10) participating in a session can receive the same information. For the Written Examination, the following information is provided:

- National (Canadian) level means and standard deviations of scores broken down by blueprint category;
- School level means and standard deviations of scores broken down by major blueprint category; and
- Individual student pass/fail results.

Instructions for proper score interpretation are included with the report. Specifically, schools are informed that data is provided "for information purposes only." Individual student numerical results are generally not provided to schools unless the school makes a request to the NDEB and demonstrates a valid research or academic need for the data.

A general statistical performance report for each examination is prepared for the Board. DRAs get a list of candidates who have been certified (i.e., they passed both the Written Examination and OSCE and graduated from a dental program).

Examinee results and records are kept pursuant to the NDEB's internal document retention policies and procedures. In addition, all information related to the Written Examination (e.g., test protocol, reports) is retained.

Appeals

Within three months of the release of results, examinees who have failed may apply to the Board to have their answer score sheets manually rescored. Two NDEB Staff members perform a manual rescore by comparing the answers on the answer score sheet with the master score sheet. The Examinations/Assessments Manager then verifies the mark. The mark produced by the manual rescore will be the final mark.

Applications for manual rescoring must be accompanied by a filing fee.

Petitions

Within a specified timeframe, examinees may petition the Board or Executive Committee in writing, with an accompanying filing fee, regarding the following:

- Examination or assessment results have been voided
- Examinee has been denied the privilege of repeating an examination or assessment
- Compassionate grounds

Part E - Security

The NDEB takes several measures to ensure the security of its processes.

Credential Verification

Credential verification of applicants is performed to ensure that applicants to all processes are eligible for participation. While the credential verification process differs depending on the process applied for, each process includes source verification with the university to confirm the applicant's graduation.

Examinee Information

The NDEB uses a third-party web tool called BrightTrac for its registration application. BrightTrac accounts are password protected, and the data is stored on Amazon servers.

In house, the NDEB has examinee information in MS Access databases and various documents are stored on NDEB servers. This information is only accessible to staff with valid network accounts and drive permissions.

Administration

The NDEB is in regular communication with on-site staff to keep them apprised of changes to administration processes and emphasize the importance of security measures such as standardized check-in procedures and restricted items. Test Administrators and invigilators are trained to identify, manage, and report misconduct.

On-site Security

The Test Administrator stores all examination/assessment material in a secure, locked area. After the completion of the examination/assessment, all materials are returned to the NDEB office by courier. NDEB staff verifies the return of all materials including individually labeled books, identification cards, and, answer score sheets. These security measures help maintain the integrity of the examination/assessment by limiting exposure to assessment items before and after the administration.

Exam Security

The NDEB's examination/assessment metadata and statistics are stored in a SQL Server database on a separate secure server that is only accessible via the database's user interface. Individuals who do not have permissions to access the NDEB network are restricted.

The questions themselves are also restricted to only those users who need to access them via their network group policy rules.

The NDEB has a policy that questions in progress are never sent via email. Rather, they are uploaded to password-protected SharePoint or Basecamp sites for sharing and collaboration.

All NDEB portable devices are encrypted using BitLocker so no one can access anything without the proper credentials.

Security Analysis

During exam processing, a test analysis program is applied to the item results of all examinees. Those with extreme values are flagged for attention. In rare cases, examinees are informed that results of the examination/assessment will be delayed pending a review.

Copyright

NDEB staff regularly monitors online forums for examination/assessment content that is shared and follows up with legal action as needed.

Part F - Outcomes Summary

Introduction

This report provides summary information on the structure of the Written Examination, as well as statistical summaries at the item and test levels. The yearly results are based on the March administration only since May and November administrations use instruments from other years.

This sample of examinees is also largely comprised of Canadian-educated first-time examinees. This cohort homogeneity allows for better year-to-year comparisons. Historical data is also presented that demonstrates that, in general, the Written Examination performance from this cohort of examinees is similar to previous years.

Table of Examination Items by Category – Written Examination

Root Category	WMarch2014	WMarch2015	WMarch2016	WMarch2017
Dental Anatomy/Occlusion/Operative	17	17	16	17
Endodontics/Dental Emergencies	25	25	25	22
Foundation Science	59	59	60	60
Oral Medicine/Pathology/Oral Facial Pain	38	39	37	38
Oral Surgery/Trauma	22	22	22	21
Orthodontics/Pediatrics	23	24	23	23
Periodontics	29	27	28	27
Pharmacology/Therapeutics/Local Anesthesia	19	19	19	19
Prosthodontics/Implants	32	33	32	31
Miscellaneous**	31	31	32	31
Total Scored	295	296	294	289
Rejected	5	4	6	11
Total	300	300	300	300

**Miscellaneous: "Abuse and Neglect", "Anxious Patient", "Ethics and Jurisprudence", "Geriatrics", "Infection Control", "Informed Consent", "Occupational Hazards", "Prevention", "Radiology", "Records", "Relationship general/oral health", "Scientific Literature", "Special Needs"

Written Analysis Report

	Attempt	WMarch2014	WMarch2015	WMarch2016	WMarch2017
Number of Candidates	1	782	846	801	778
	2	16	13	13	20
	3	3	4	4	2
	Total	801	863	818	800
Pass (#)	1	716	768	713	687
	2	11	9	9	12
	3	2	3	3	1
	Total	729	780	725	700
Pass (%)	1	91.6	90.8	89.0	88.3
	2	68.8	69.2	69.2	60.0
	3	66.7	75.0	75.0	50.0
	Overall	91.0	90.4	88.6	87.5
Passing Raw Score (%)		68.5	69.0	67.0	63.8
Mean Raw Score (%)	1	78.5	79.5	77.3	74.5
	2	71.2	72.3	70.2	63.9
	3	70.7	70.7	70.9	64.2
	Overall	78.3	79.3	77.2	74.2
Range Rescaled	1	51 - 89	32 - 98	60 - 96	56 - 100
	2	60 - 76	70 - 86	65 - 87	66 - 85
	3	61 - 72	69 - 79	73 - 84	73 - 77
	Overall	51 - 89	32 - 98	60 - 96	56 - 100
Mean Rescaled Score	1	74.6	83.7	83.3	85.5
	2	67.3	77.4	77.2	74.6
	3	66.8	76.0	77.8	74.9
	Overall	74.4	83.5	83.2	85.2
Cronbach's Alpha		0.90	0.92	0.92	0.92

Part G - Glossary

AADE	American Association of Dental Examinations
ACFD	Association of Canadian Faculties of Dentistry
ADA	American Dental Association
ADAC	American Dental Association Commission on Dental Accreditation
ADC	Australian Dental Council
AERA	American Educational Research Association
APA	American Psychological Association
CDA	Canadian Dental Association
CDAC	Commission on Dental Accreditation of Canada
CDRAF	Canadian Dental Regulatory Authorities Federation
DRA	Provincial Dental Regulatory Authorities
NCME	National Council on Measurement in Education
NDEB	National Dental Examining Board of Canada
ODQ	Ordre des dentistes du Québec
RCDC	Royal College of Dentists of Canada

Part H – Appendices

Appendix A – Key Supporting References

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Appendix C – Competencies for a Beginning Dental Practitioner in Canada

A competent beginning dental practitioner in Canada must be able to provide oral health care for the benefit of individual patients and communities in a culturally sensitive manner.

Competency assumes that all behaviours are supported by foundation knowledge and skills in biomedical, behavioural and clinical dental science and by professional behaviour. Beginning dental practitioners in Canada must be able to apply foundation knowledge and skills to justify their decisions and actions and to evaluate outcomes. Therefore, foundation knowledge, skills and professional behaviour are understood to be a part of every competency.

Competency also assumes that all behaviours are performed to an acceptable level and that the practitioner can evaluate their quality and effectiveness. Competency cannot be achieved without the ability to self-evaluate. Moreover, there are no degrees of competence: a dentist is either competent or not competent. The competencies below refer to general dental practice and include the management of patients of all ages including those with special needs. It is assumed that all oral health care is provided in an ethical manner, in accordance with legal requirements at the national and provincial level.

A beginning dental practitioner in Canada must be competent to:

1. recognize the determinants of oral health in individuals and populations and the role of dentists in health promotion, including the disadvantaged.
2. recognize the relationship between general health and oral health.
3. evaluate the scientific literature and justify management recommendations based on the level of evidence available.
4. communicate effectively with patients, parents or guardians, staff, peers, other health professionals and the public.
5. identify the patient's chief complaint/concern and obtain the associated history.
6. obtain and interpret a medical, dental and psychosocial history, including a review of systems as necessary, and evaluate physical or psychosocial conditions that may affect dental management.
7. maintain accurate and complete patient records in a confidential manner.
8. prevent the transmission of infectious diseases by following current infection control guidelines.
9. perform a clinical examination.
10. differentiate between normal and abnormal hard and soft tissues of the maxillofacial complex.
11. prescribe and obtain the required diagnostic tests, considering their risks and benefits.
12. perform a radiographic examination.
13. interpret the findings from a patient's history, clinical examination, radiographic examination and from other diagnostic tests and procedures.
14. recognize and manage the anxious or fearful dental patient.
15. recognize signs of abuse and/or neglect and make appropriate reports.
16. assess patient risk (including, but not limited to, diet and tobacco use) for oral disease or injuries.
17. develop a problem list and establish diagnoses.

18. determine the level of expertise required for treatment and formulate a written request for consultation and/or referral when appropriate.
19. develop treatment options based on the evaluation of all relevant data.
20. discuss the findings, diagnoses, etiology, risks, benefits and prognoses of the treatment options, with a view to patient participation in oral health management.
21. develop an appropriate comprehensive, prioritized and sequenced treatment plan.
22. present and discuss the sequence of treatment, estimated fees, payment arrangements, time requirements and the patient's responsibilities for treatment.
23. obtain informed consent including the patient's written acceptance of the treatment plan and any modifications.
24. modify the treatment plan as required during the course of treatment.
25. provide education regarding the risks and prevention of oral disease and injury to encourage the adoption of healthy behaviors.
26. provide therapies for the prevention of oral disease and injury.
27. recognize and institute procedures to minimize occupational hazards related to the practice of dentistry.
28. achieve local anesthesia for dental procedures and manage related complications.
29. determine the indications and contraindications for the use of drugs used in dental practice, their dosages and routes of administration and write prescriptions for drugs used in dentistry.
30. manage dental emergencies.
31. recognize and manage systemic emergencies which may occur in dental practice.
32. manage conditions and diseases of the periodontium, provide periodontal treatment when indicated and monitor treatment outcomes.
33. assess the risk, extent and activity of caries and recommend appropriate non-surgical and surgical therapy.
34. manage dental caries, tooth defects and esthetic problems and, when restoration is warranted, use techniques that conserve tooth structure and preserve pulp vitality to restore form and function.
35. manage patients with orofacial pain and/or dysfunction.
36. manage surgical procedures related to oral soft and hard tissues and their complications
37. manage trauma to the orofacial complex.
38. manage conditions and pathology of the pulp and provide endodontic treatment when indicated.
39. manage abnormalities of orofacial growth and development and treat minor orthodontic problems.
40. recognize and manage functional and non-functional occlusion.
41. select and, where indicated, prescribe appropriate biomaterials for patient treatment.
42. manage partially and completely edentulous patients with prosthodontic needs including the provision of fixed, removable and implant prostheses.
43. make records required for use in the laboratory fabrication of dental prostheses and appliances.
44. design a dental prosthesis or appliance, write a laboratory prescription and evaluate laboratory products.

45. apply accepted principles of ethics and jurisprudence to maintain standards and advance knowledge and skills.
46. apply basic principles of practice administration, financial and personnel management to a dental practice.
47. demonstrate professional behaviour that is ethical, supercedes self-interest, strives for excellence, is committed to continued professional development and is accountable to individual patients, society and the profession.

Definition

To “manage” the oral health care needs of a patient is assumed to include all actions performed by a health care provider that are designed to alter the course of a patient’s condition. Such actions may include providing education, advice, treatment by the dentist, treatment by the dentist after consultation with another health care professional, referral of a patient to another health care professional, monitoring treatment provided, but also may include providing no treatment or observation. “Manage” assumes the use of the least invasive therapy necessary to gain a successful outcome in accordance with patient wishes.

Appendix D – Equating Procedure

Excerpts from Maguire (2004)

Each year, the National Dental Examining Board of Canada administers examinations to graduating students from Canadian Faculties of Dentistry. The results of the examinations are used as part of the credentialing process. In addition, the examination program plays a role in maintaining a national standard of competence for dentists entering practice in Canada. Consistent with the second purpose, it is of interest to trace the performance of candidate cohorts over successive years. Direct comparison of candidates' average performance in successive years could be made but if differences were observed, they could be due to differences in the candidates themselves, to differences between the two examinations (one may be more difficult than the other), or to a combination of both. The process of examination equating attempts to make the examination scores equivalent so that differences between equated scores can be attributed to the difference between cohorts of candidates. In effect, the equating process attempts to answer the question, how would candidates who wrote in 2013 have performed on the 2012 examination?

The equating procedure to be presented below is taken from Angoff (1971, pp579-583). It is based on an examination design in which instruments in successive years consist of two components: a common component (a set of items that appear in both years) and a unique component (sets of items that appear in one year, but not the other). Consider for example the examinations administered in 2012 (year 1) and 2013 (year 2). In 2012 a candidate's score can be thought of as:

$Y_1 = V_1 + U_1$ where V is the score on the common items and U is the score on the unique items. In 2013, a candidate's score would be:

$X_2 = V_2 + W_2$ where V is the score on the common items and W is the score on the unique items.

The goal of the equating process is to find a mathematical function that projects X onto Y or Y onto X . Unlike a regression equation, this function should yield consistent results regardless of the direction in which scores are to be equated, that is, projecting from 2012 to 2013 or from 2013 to 2012.

The general form of the equation for equating scores from 2013 to scores from 2012 is:

$$Y'_2 = bX_2 + a \quad (1)$$

or, if the direction were reversed, the equation would be:

$$X'_1 = \frac{1}{b}(Y_1 - a) \quad (2)$$

For simplicity, we will assume that 2012 will be treated as the base year, and we want to equate the 2012 score to it.

The details of the algebra can be found in Angoff's 1971 chapter, but essentially the functions are based on the supposition of a single combined sample of candidates, i.e. the 2012 group combined with the 2013 group. We will refer to this hypothetical sample as the 'total' group. There are two variables:

1. the scores on Y for all candidates (i.e. the scores on the 2012 examination).
2. the scores on X for all candidates (i.e. the scores on the 2013 examination).

Of course we only have Y scores for the 2012 candidates, and X scores for the 2013 candidates, but if all candidates had taken both examinations, the equating formula for mapping scores from 2013 to 2012 would be:

$$Y' = \frac{sd(Y_T)}{sd(X_T)}(X - mean(X_T) + mean(Y_T)) \quad (3)$$

where:

- $sd(Y_T)$ is the standard deviation of Y scores for the total sample,
- $sd(X_T)$ is the standard deviation of X scores for the total sample,
- $mean(Y_T)$ is the mean Y score for the total sample,
- $mean(X_T)$ is the mean X score for the total sample.

In terms of equation 1,

$$b = \frac{sd(Y_T)}{sd(X_T)} \quad \text{and} \quad a = mean(Y_T) - b(mean(X_T)) \quad (4)$$

The four values required for equation (3) are estimated using the common portions of the exams. The procedure, referred to in the literature as 'common item linear equating,' will be presented below. In this case the equating (common) portion of the examination forms part of the total score. The procedure is identical for situations in which the equating part of the examination is treated as a separate entity.

Equating Formulas – Common Item Equating

The actual procedure begins with the calculation of two scores in each of the two samples:

Y_1 = the score for 2001 candidates on the entire examination (300 items)

V_1 = the score for 2001 candidates on the common portion (110 items)

X_2 = the score for 2002 candidates on the entire examination (300 items)

V_2 = the score for 2002 candidates on the common portion (110) items.

To find the values needed for equation 3, four intermediate statistics must be estimated:

$$\text{var}(Y_T) = .5 \text{var}(Y_1) + .5 \text{var}(Y_2) + .25[\text{mean}(Y_1) - \text{mean}(Y_2)]^2 \quad (5)$$

$$\text{var}(X_T) = .5 \text{var}(X_1) + .5 \text{var}(X_2) + .25[\text{mean}(X_1) - \text{mean}(X_2)]^2 \quad (6)$$

$$\text{mean}(Y_T) = .5\text{mean}(Y_1) + .5(\text{mean}(Y_2)) \quad (7)$$

$$\text{mean}(X_T) = .5\text{mean}(X_1) + .5\text{mean}(X_2) \quad (8)$$

Four of the values that appear in equations 5 through 8 must be estimated under the assumption that the regression slopes of Y_1 on V_1 in Group 1 and X_2 on V_2 in Group 2 are the same. The four estimates are:

$$\text{var}(Y_2) = \text{var}(Y_1) - \left\{ \frac{\text{cov}(Y_1 V_1)}{\text{var}(V_1)} \right\}^2 [\text{var}(V_1) - \text{var}(V_2)] \quad (9)$$

$$\text{var}(X_1) = \text{var}(X_2) + \left\{ \frac{\text{cov}(X_2 V_2)}{\text{var}(V_2)} \right\}^2 [\text{var}(V_1) - \text{var}(V_2)] \quad (10)$$

$$\text{mean}(Y_2) = \text{mean}(Y_1) - \frac{\text{cov}(Y_1 V_1)}{\text{var}(V_1)} [\text{mean}(V_1) - \text{mean}(V_2)] \quad (11)$$

$$\text{mean}(X_1) = \text{mean}(X_2) + \frac{\text{cov}(X_2 V_2)}{\text{var}(V_2)} [\text{mean}(V_1) - \text{mean}(V_2)] \quad (12)$$

Calculation of the Equating Expressions:

Step 1. From the data, calculate the following values:

- (a) Group 1 (2012): means and standard deviations of Y and V , also the covariance between Y and V .
- (b) Group 2 (2013): Means and standard deviations of X and V , also the covariance between X and V .

Step 2. Substitute the values from Step 1 into equations (9) through (12).

Step 3. Substitute the values from Steps 1 and 2 into equations (5) through (8).

Step 4. Substitute the results of Step 3 into equations (3) and (4).

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