NBME®
CLINICAL SCIENCE SUBJECT EXAMINATIONS

A CLOSE COLLABORATION BETWEEN MEDICAL EDUCATORS & NBME

Clerkship years are a critical period in medical education. To help ensure that students are learning throughout their clerkships and moving on to their internships with all the knowledge and skills they'll need, medical school faculty rely on NBME Clinical Subject Examinations. In an NBME February 2019 survey of nearly 150 clerkship directors from over 70 universities, **97%** of respondents reported that they use Clinical Science Subject Examinations to assess student performance after a clerkship (NBME, 2019).

With that kind of responsibility, NBME understands how important it is for Subject Examinations to be relevant to what is being taught in today's classrooms and clinical settings and we can't do that alone. Clerkship faculty and directors aren't just passively using NBME Subject Examinations as capstones to their clerkship curricula. They're also actively contributing to their development.

This collaborative process creates assessments that are meaningful and reflective of students' best interests, and grounded in the following principles and applications:

- **Facilitated collaboration**
- **Rigorous and, at times, reimagined content development processes**
- **Meaningful feedback for, from, and about students and their performances**

Continue reading to learn about how we collaborate at each step of the process.

NBME®

FACILITATED COLLABORATION

We know that the medical education community best serves current and future students when assessments and curricula are developed together. That's why NBME Clinical Science Subject Examinations are the result of collaborative partnerships between NBME and subject matter experts (SMEs) who are current clerkship directors and/or heavily involved with development of the national curriculum for the clinical clerkships.

Designing a Process to Learn From Each Other

We combine our test development specialty knowledge, provide editorial guidance and scoring/psychometric capabilities with medical educators' content expertise, curriculum objectives, and detailed feedback.

But NBME is not just looking to medical professionals for their knowledge. We're also here to listen. Yolanda Reyes-Iglesias, MD, Associate Professor of Neurology and Vice-Chair for Undergraduate Medical Education in the Department of Neurology at the Miller School of Medicine of the University of Miami, saw this when she worked with NBME on the Clinical Neurology Subject Examination's development.

While Dr. Reyes-Iglesias worked on the Neuroscience Task Force for USMLE® Steps 1, 2, and 3 exam content, she simultaneously served on the education sub-committee for the American Academy of Neurology (AAN). She and the sub-committee's other clerkship directors agreed that the content on the Clinical Neurology Subject Examination needed to be aligned with the AAN Core Clerkship Curriculum.

"Was what the clerkship directors were teaching being assessed and covered in the NBME Subject Examination?" she asked. Dr. Reyes-Iglesias put NBME staff in contact with the education sub-committee of AAN, and a task force of clerkship directors was formed to review the content with NBME.

"NBME and the education sub-committee were speaking the same language," she said. According to Dr. Reyes-Iglesias, the AAN sub-committee was satisfied with the work of the task force in bringing the Subject Examination into better alignment with the curricula.

AAN is not alone in this. For example, 81% of clerkship directors have ranked "relevance of content" as an important factor when deciding to administer NBME Subject Examinations to their students (NBME, 2019).

Not only was the alignment of the exam's content what Dr. Reyes-Iglesias hoped to achieve, the collaboration was so successful she now believes that "every clerkship director and teacher should have the experience of working with NBME."

Aligning to a National Curriculum

In recent years, several clinical science clerkship director groups have relayed to NBME that alignment between respective Subject Examinations and the national (or core) curricula is critical. Learn about how NBME collaborated with medical practitioners to improve the Surgery Subject Examination.

When Amy Morales, Director of Test Materials Development at NBME, and Carly Daniels, Managing Editor, Test Development, attended a meeting of the Committee on Clerkship Directors of the Association for Surgical Education (ASE) in April 2017 in San Diego, they learned that the content of the Surgery Subject Examination could benefit from greater alignment with the core (national) curriculum for surgery.

Listening to the clerkship directors' concerns sparked the reimagining of how to better align the Surgery Subject Examination with the curriculum: by including surgeons who best understood the subject matter in the curating of exam questions.

NBME's team learned more about the national surgery curriculum from the American College of Surgeons (ACS)/ASE Medical Student Core Curriculum Steering Committee. Then came the item-writing workshops. Carly Daniels and Miranda Gipe, Senior Editor of Test Development, sat down with 13 surgery clerkship directors to teach them best practices for writing multiple-choice questions. The group of surgeons then wrote new Surgery Subject Examination content and vetted existing content. Typically, clerkship directors review new Subject Examination content remotely and independently, so this was a different approach. Many of the writers noted that it was helpful to review the content together simultaneously, because the conversations that took place provided new perspectives.

> "When you have a group of people working together at the same time, that collective voice is helpful. It creates an environment that enables editorial staff to interact with subject matter experts and ask questions. There is learning on both sides.
>
> **— AMY MORALES**

This collaboration has now evolved into an NBME task force that develops and reviews new exam content. Jesse Moore, MD, an Associate Professor of Surgery at the Larner College of Medicine at the University of Vermont, chairs the Surgery Task Force. He underscored the richness of this collaboration.

"It has been a fantastic collaboration. NBME's openness to improving the Surgery Subject Examination has been impressive," he said. "Working with NBME has been a personal pleasure. I've learned a great deal."

End-of-exam Examinee Survey

Students, too, are a part of NBME's exam creation process. Implemented in May 2021, the **end-of-exam examinee survey** has been administered continuously since. The survey, which is available to examinees directly after the exam ends, asks about the following areas: usage of the exam; alignment of exam content to curriculum and expectation; exam security; experience with the exam administration software; study time and tools used.

On a periodic basis, NBME analysts gather this feedback, organize the data, and direct the findings to appropriate assessment expert areas including Test Development, Product Management, Psychometrics, or even the Office of Research Strategy for discussion and consideration in future versions of Subject Examinations.

RIGOROUS—AND AT TIMES—REIMAGINED CONTENT DEVELOPMENT PROCESSES

In the past, creating a Clinical Science Subject Examination involved repurposing content from retired United States Medical Licensing Examination® (USMLE) Step 2 Clinical Knowledge (CK) forms. However, through its collaboration with clerkship director groups, NBME has gained helpful feedback that this process could be enhanced for certain clinical science disciplines and their respective Subject Examinations; the process of content development needs to evolve as the Subject Examination program grows.

More recently, NBME Clinical Science Subject Examinations have been created using not only content retired from USMLE Step 2 CK that reflects current medical practice and aligns with the clerkship curriculum for that clinical science discipline, but also content developed specifically for the Subject Examination. Our current processes encourage collaboration and ensure rigorous review of content so that each exam contains content that is aligned with national curricula and best practices.

Task Force Formation, Blueprinting, and Item Writing Co-Creation

Once a clerkship group relays to us that their students could benefit from the development of new content and a revised blueprint of the exam, a series of iterative, meticulous steps occur:

- NBME Test Development staff convenes a meeting with a task force of clerkship directors and/or curriculum developers from the clerkship group. The goal is to show the new task force what is already in the content pool and to listen to what they are looking to change, and what the content area balance should be for the future.
- Test Development, Psychometrics, and Test Construction staff at NBME determine what the new blueprint will look like, and how to shift to it over time. (This shift has to happen gradually to allow for the comparison of data associated with different forms across years.) This step helps ensure that pretested exam content is looking ahead to the future goal of, for example, substantially increasing the GI content and reducing other content areas. This part of exam development is captured with coding of test items by organ system and physician task/competencies.
- From there, NBME and the newly developed task force participate in an item-writing workshop where the editorial expertise of test development staff can guide the task force through writing clinically sound vignettes that fit their new blueprint.

Pretesting New Content (or Newly Revised Content) and Obtaining Performance Data

Before adding any new content, NBME collaborates with the relevant Subject Examination task force and pretests all newly written or newly revised content. Pretesting is when newly written or newly revised content is added to the respective Subject Examinations (in alignment with the blueprint) for examinees to see and answer without the test questions counting for credit. They are used to gather performance data. After an item is pre-tested for one year and performance data have been collected and analyzed, NBME and the respective task force determine if these test questions should count for credit.

Since 2015, pretesting newly written or newly revised content on various Subject Examinations has been critical in fulfilling the desired exam content blueprinting and content alignment goals of our task forces.

MEANINGFUL FEEDBACK FOR, FROM, AND ABOUT STUDENTS AND THEIR PERFORMANCES

Psychometrics: Key Validation and Reliability

Input from experts and pretesting practices create best-in-class content, but to help ensure such content stays relevant, we continue to validate our exams over time. Quality assurance for NBME Subject Examinations relies on sound psychometric and measurement practices. In a process called key validation, NBME scoring staff provide item statistics for all questions and also identify any test questions that do not perform to a certain level on an examination. Subject matter experts review these items and, while uncommon, delete questions from scoring if necessary or determine to revise and re-pretest that question. NBME also monitors the reliability of Subject Examination scores on a regular basis as part of our quality assurance checks. We've found that reliability coefficient estimates are stable across exam forms and over time.

Informative Correlations and Alternative Uses of Students' Subject Examination Scores

The use of NBME Clinical Science Subject Examinations is widespread at medical schools. While assessing a student's overall clinical science knowledge relative to a national comparison group is a major reason why NBME Clinical Science Subject Examinations are so widely used, there are other ways Subject Examination scores can be helpful to faculty.

One example of an alternative use of Subject Examination scores involves reviewing the correlation between an individual score and performance on USMLE. There is a moderate positive relationship between performance on *individual* Clinical Science Subject Examinations and performance on USMLE Step 1, Step 2 Clinical Knowledge (CK), and Step 3 (Morrison, et al., 2020, p. 263).

This study further used a large national sample to investigate the relationship between Clinical Science Subject Examination *composite* scores and other clinical knowledge outcome measures–specifically scores on USMLE Step 2 CK and Step 3 (Morrison, et al., 2020, p. 264). A moderate to high positive correlation of the clinical science composite scores with USMLE Step 2 CK and Step 3 scores was found. In summary, medical schools could use these composite scores alone or in conjunction with Step 1 to identify students who are at risk of failing Step 2 CK and/or Step 3 so that remediation can be provided (Morrison, et al., 2020, p. 268).

Score Reporting: Key to Students and Medical Educators

While the isolated exam experience serves as a summative means of assessment of a student's knowledge obtained or cultivated in a clerkship, **Score Reports** enable examinees to see their strengths and areas for improvement. Such data are not only useful for examinees, but also for faculty; according to a survey conducted by NBME, 61% of clerkship directors said performance feedback provided to students is important (NBME, 2019).

In addition to score report feedback, clerkship directors have access to **comparative data** that tells them how their students performed on the exam in comparison to the rest of the medical students who sat for the same Subject Examination in the United States. This feature, according to 83% of clerkship directors, was "very important" when determining whether to administer an NBME Subject Examination to their students (NBME, 2019).

Finally, **Grading Guidelines** are provided to help clerkship directors select minimum passing scores on the Subject Examinations. Grading Guidelines are developed for each Clinical Science Subject Examination based on recommendations from panels of medical school faculty that participate in content-based standard setting training via Zoom. The results of the grading guidelines studies are summarized in reports that are provided to medical schools.

Short-Answer Questions

To provide a more holistic view of students' knowledge, NBME has begun to incorporate short-answer questions within the Medicine Subject Examination. These open-text items are designed to solicit examinee-generated answers to exam questions. This exam modality mirrors a physician's thought process, which often requires the development of multiple hypotheses (including differential diagnoses) to determine how best to treat patients. We are looking forward to introducing these types of questions on other exams in the future to continue to enhance Subject Examinations.

NBME Clinical Science Subject Examinations measure and support the education of medical students in applying their clinical science knowledge in everyday practice. This positive outcome is the result of collaboration between NBME and expert educators from across the medical profession, and includes facilitated collaboration; rigorous and, at times, reimagined content development processes; and meaningful feedback and exploration.

Morrison, C., Barone, M., Baker, G., Ross, L., Pak, S. (2020). "Investigating the Relationship Between a Clinical Science Composite Score and USMLE Step 2 Clinical Knowledge and Step 3 Performance." *Medical Science Educator*, 30, 263-269. Access here.

NBME. (2019). "Clerkship Director Survey," in *Subject Exams Market Research Background* (2021.)

For more information or to discuss future content collaboration with NBME, get in touch at nbme.org/contact

NBME / 3750 MARKET STREET, PHILADELPHIA, PA 19104, USA