Practice Indicators of Suboptimal Care and Avoidable Adverse Events: A Content Analysis of a National Qualifying Examination

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Supplemental digital content for this article is available at [LWW INSERT LINK].

Abstract

Purpose

To (1) compile an initial list of physician-related practice indicators (PRINDs) that contribute to causing or preventing suboptimal care (SOCR) and adverse events (AEs) and (2) determine the extent to which one national exam assessed these PRINDs.

Method

In 2009-2010, the authors searched the literature and surveyed 17 physician experts to compile a list of PRINDs of SOCR and avoidable AEs. They then conducted a content analysis of the 2008 and 2009 Medical Council of Canada (MCC) Qualifying Examinations (QEs).

Results

The authors identified 92 unique PRINDs, of which 59 were behaviors or decisions expected of all physicians and suitable for assessment on a general medical examination. Of these, 36 (61%) were tested on the 2008 and 2009 MCC QEs. The mean number of PRINDs tested per exam was highest for Part I knowledge (32.2), followed by Part I clinical decision making (CDM) (18.4) and Part II clinical performance (objective structured clinical examination [OSCE]) (9.8). The percentage of questions or cases per exam testing a PRIND (e.g., 14/36; 39% for CDM and 5.26/12; 44% for OSCE) differed from the percentage of the total test score attributed to PRINDs (e.g., 10.8/36; 30% for CDM and 68.5/1,522.3; 5% for OSCE).

Conclusions

PRINDs represent candidates' abilities to avoid SOCR and AEs and constitute an important aspect of medical practice to be assessed on licensing or certifying examinations to best protect the public. The different scoring methods used to measure such knowledge and skills warrant further consideration.

Adverse events (AEs) represent unintentional actions by health care professionals that result in substantial losses in patient health status, complications, prolonged recovery, disability, or even death.[1-3] As many as one third of patients admitted to a hospital experience at least one AE either while receiving care or after their discharge.[4-6] AEs that occur during a patient's hospitalization alone represent a significant financial burden to health care systems, with an average estimated cost of over $9 billion per year in the United States.[7,8] Close to half of these AEs are considered preventable, as they are the direct result of errors in diagnosis, delays in the detection or management of complications, breakdowns in communication, equipment failures, mislabeled drugs, or procedural problems.[9-11] The convergence of increasingly complex care plans, an aging patient population, and multiple transfers between health care delivery sites further increases the risk of practitioners providing suboptimal care (SOCR) and preventable AEs occurring.[12] A central mission of medical licensing authorities is to protect the public against unsafe health care practices by assessing physicians' ability to provide optimal care and avoid AEs. This goal raises a key design question for licensure examinations, namely to what extent does the content of their examinations assess physicians' knowledge, decision making, and actions as they contribute to SOCR and AEs?

Medical competence is a multidimensional construct that can be assessed in a number of ways depending on the practice model used.[13] One element of competence is a physician's ability to practice safely and avoid SOCR and AEs. The purpose of our study was twofold: (1) to compile a list of physician-related practice indicators (PRINDs) that contribute to either causing or preventing SOCR and AEs, and (2) to determine the extent to which one national exam, the Medical Council of Canada (MCC) Qualifying Examination (QE), required for licensure in

Canada, assessed these PRINDs. For the purpose of our study, we defined the PRINDs of SOCR and avoidable AEs as either a physician's failure to act (errors of omission) or his or her inappropriate actions (errors of commission), which could produce a clinically relevant loss in health status and would occur with sufficient frequency to be considered a priority at the population level. Examples of such PRINDs (stated positively) range from prescribing influenza vaccinations to high-risk patients, providing heart failure patients written instructions on activity, diet, medications, and what to do if symptoms worsen, and recognizing an abdominal aortic aneurysm or an ectopic pregnancy. Some PRINDs represent specific events, such as prescribing medications that produce central nervous system side effects in patients who are at risk for falling, while others are more general, such as intervening rapidly when a complication arises.

From an assessment perspective, this type of research is part of the process of gathering ongoing evidence for the validity of exams.[14] Our overarching goal with this study was to begin to establish a framework for identifying important indicators of safe medical practices and prevalent practice problems and errors, and to determine how these indicators might relate to exam content. In our study, we addressed three aspects of validity evidence, of the five sources of construct validity evidence described in *The Standards for Educational and Psychological Testing*[15]: (1) content as it relates to practice analysis and blueprinting, (2) response process regarding scoring procedures, and (3) consequences for medical schools and candidates taking national exams.

Method

We conducted our study in two parts. First, we compiled a list of PRINDs of SOCR and avoidable AEs. We then conducted a content analysis of the 2008 and 2009 MCC QEs.

PRINDs identification

To date, no one has systematically compiled a unique list of the knowledge and skills physicians need to avoid clinically-relevant errors related to SOCR and preventable AEs, nor have they identified corresponding methods for assessing these skills. The purpose of this part of our study was threefold: (1) to compile a list of PRINDs that health care agencies and authorities judge to play a significant role in either causing or preventing SOCR and avoidable AEs, (2) to determine the extent to which physicians are responsible for practicing the behaviors associated with PRINDs, and (3) to estimate when during training and the method by which these PRINDs could be assessed.

To identify the relevant PRINDs, we searched, during the fall 2009 and winter 2010, PubMed and Goggle for reviews of important practice errors that experts already had judged to play a role in either causing or preventing SOCR and avoidable AEs. We did not limit our searches by date or type, and our sources included reviews of AE studies,[16] medical litigation insurance case report advisories,[17] patient safety institutes,[18,19] recommended safe practices,[20] health care quality and accreditation agencies,[21-31] pay-for-performance analyses,[32] and quality improvement initiatives.[33-35] We collapsed the PRINDs that we identified from multiple sources into a single indicator. To improve coherence, we then standardized each PRIND to capture the problem (e.g., deterioration or death in asthma patients having an acute exacerbation) and the expected behavior needed to avoid the problem (e.g., prescribe fast-acting bronchodilators and/or systemic

corticosteroids).

Then, in March 2010, we surveyed an expert panel of 17 physicians from the MCC test committees to determine the level of physician responsibility in avoiding these events and the appropriate method to assess their relevant skills. From the list of test committee members and in consultation with MCC exam officials, we selected physician-experts from a broad spectrum of specialties, with direct involvement in training programs and assessment methods, and able to make informed judgments about the appropriateness, timing, and method of assessing PRINDs.

We used a web-based survey to independently gather each expert's ratings of each PRIND concerning three issues: (1) the extent to which the PRIND was under the direct control of the physician; (2) whether the PRIND should be assessed on a general medical examination, such as the MCC QE, a specialty certification examination, or both; and (3) the extent to which the PRIND could be assessed by a written examination, a performance-based examination, and an in-training evaluation during supervised practice. We obtained ethics approval for our survey from the internal review board at McGill University.

We used Likert scales to measure the extent of physician control and the suitability of each assessment method. We classified a PRIND as predominantly under the control of the physician when two thirds or more of the experts rated it as ≥ 5 on a 7-point scale, where 1 represented no control and 7 represented complete control. We used the same two-thirds majority rule to determine if the PRIND should be assessed on a general medical or specialty only examination. We classified a specific assessment method as suitable for testing a PRIND if 70% or more of

the experts rated the PRIND as likely or definitely to be tested by the method.

MCC QE content analysis

The purpose of this part of our study was to determine the extent to which one national licensing examination, the MCC QE, assessed the PRINDs. The MCC QE is required for licensure in Canada and consists of two parts (taken on two separate occasions) and six components.[36] See List 1 for details.

We analyzed the content of the fall 2008 and 2009 administrations of the MCC QE I and II. We based our analysis on the PRINDs that the experts identified as being appropriate for testing on a general medical examination. We analyzed the content of each multiple choice question (MCQ) and clinical decision making (CDM) and objective structured clinical examination (OSCE) case using a 4-point rating scale representing the extent to which a PRIND was tested: 0 indicated not at all; 1, the question or case included a PRIND topic but did not test the PRIND; 2, the question or case partially tested a PRIND; and 3, the question or case completely tested a PRIND. We also tallied the number of total and distinct PRINDs and the number and percentage of exam points attributed to each PRIND in each question or case.

For the purpose of our study and the ease of interpreting our findings, we used raw, unweighted scores for the compilations and analyses. The MCC however uses more complex, weighted, and scaled scoring procedures (e.g., the knowledge component of Part I is worth 75% while the CDM component is worth 25%).[36] Thus our findings are not scaled and represent a simple sum of item scores.

We analyzed the exam contents from more to less complex scoring procedures, starting with the Part II OSCE checklists (all 48 cases used), followed by the Part I CDM key features[37] scoring keys (all 158 cases used) and the Part I MCQ scores (810 five-option MCQs used from 5 random exams with 162 questions per exam, with an equal number of questions across 6 clinical disciplines). For the Part II OSCE exams, two raters (GB, RT) independently analyzed the content of the cases, with an overall 89.1% (545/612 PRINDs) agreement rate; they resolved discrepancies by consensus. They disagreed not in identifying the PRINDs tested on the exams but rather in identifying instances where PRINDs could potentially be tested, that is, going from a code of 0 (not at all tested) to a code of 1 (PRIND included but not tested). Given the high degree of agreement between the two raters and the consensus reached, one rater (GB) completed the analysis of the Part I components.

Results

PRINDs identification

Overall, we identified 92 unique PRINDs, related to 76 health care problems. The MCC experts judged only two PRINDs to be out of the control of the physician (85.7% rater agreement, intraclass correlation [ICC] = 0.342): one related to nursing activities regarding central line infections and the other related to hospital procedures for blood cross-matches.

Of the remaining 90 PRINDs, 59 (66%) were behaviors or decisions expected of all physicians and suitable for assessment on a general medical examination (64.2% rater agreement, ICC = 0.456). These 59 PRINDs were related to 46 health care problems. A detailed list of the health

care problems and PRINDs expected (1) of all physicians entering or in practice is available in Supplemental Digital Appendix 1 and (2) of physicians entering or in specialty practice in Supplemental Digital Appendix 2, [LWW INSERT LINK]. Examples of the latter include: ensuring proper administration route for chemotherapy, assessing readiness to extubate, and managing wound dehiscence.

Experts considered written examinations to be effective assessment methods for 34 PRINDs (of 59, 58%), performance examinations for 36 PRINDs (of 59, 61%), and in-training evaluations during supervised practice for 54 PRINDs (of 59, 92%).

MCC QE content analysis

Of the 59 PRINDs, 36 (61%) were tested on the 2008 and 2009 MCC QEs. When a PRIND was tested, most often it was assessed completely: 99% for Part I Knowledge (31.8/32), 92% for Part I CDM (16.9/18.4), and 85% for Part II (8.3/9.8). Of the 36 PRINDs tested, 19 (53%) were tested only on one of the three main parts of the MCC QEs (5 unique to Part I Knowledge, 10 to Part I CDM, and 4 to Part II OSCE), 9 (25%) were tested on two of the three parts, and 8 (22%) were tested on all three parts.

The mean number of PRINDs tested per exam was highest for Part I Knowledge (32.2 PRINDs), followed by Part I CDM (18.4 PRINDs) and Part II OSCE (9.8 PRINDs) (see Row 1, Table 1). However, Part I Knowledge included the smallest percentage of questions per exam testing PRINDs (32/162, 20%), compared to Part I CDM (14/36, 39%) and Part II OSCE (5.25/12, 44%) (see Row 2, Table 1). The Part I CDM total test scores contained the largest percentage of points

related to PRINDs (10.8/36, 30%) compared to Part I Knowledge (32/162, 20%) and Part II OSCE (68.5/1522.3, 5%) (see Row 3, Table 1). Finally, the percentage of points attributed to PRINDs, when a PRIND was tested, for both Part I CDM and Knowledge was 78% (8.5/10.9) and 99% (31.8/32), respectively, compared to Part II OSCE with 10% (6.64/68.5) (see Row 4, Table 1).

Discussion

Our list of PRINDs provides a framework for structuring case-based learning opportunities during undergraduate, graduate, and continuous professional development programs, and for selecting the content for licensing and certification examinations. Our findings also augment existing efforts to define the content of a patient safety curriculum for medicine.[38-42]

The behaviors that we identified in this study needed to reduce the risk of SOCR and avoidable AEs reflect predominantly problems in hospital-based, specialty care. Studies of medical errors have generally been conducted in these settings. As studies of medical errors expand to assess patient safety problems in the community, home, and long-term care, different types of problems and PRINDs likely will emerge. For example, we did not identify any problems related to mental health, and few related to maternal-child issues. The extensive health informatics infrastructure currently being developed will allow for the more accurate and timely detection of medical errors and the risk factors for such events across the health care continuum.[43]

Overall, about three fifths of the PRINDs that we identified in this study were assessed on the 2008 and 2009 administrations of the MCC QE. Given the key role that licensure exams play in

testing PRINDs related to causing and preventing SOCR and avoidable AEs, one could argue that such examinations need to test more PRINDs to better protect the public against suboptimal medical care. We also found a certain redundancy in the PRINDs tested across the different parts of the MCC QEs (e.g., 9 were tested on two of the three parts, and 8 were tested on all three), while certain PRINDs (23 in all) were never tested. Alternative blueprinting approaches could be used to reduce these redundancies, thus increasing the number of distinct PRINDs tested.

Our results from this study raise interesting issues about response processes regarding scoring procedures. For example, while the percentage of cases testing one or more PRINDs per exam was relatively similar between CDM and OSCE cases, the methods used to score these cases produced a vast difference in the percentage of points attributed to PRINDs in these two components--30% vs. 5%, a six-fold difference, even when one accounts for the fact that the CDM cases tested on average about twice as many PRINDs (18.4 vs. 9.8). In other words, CDM scores better represented candidates' abilities to avoid SOCR and AEs than OSCE or Knowledge scores. This discrepancy in scoring is similar to that of patient management problems (PMPs) decades ago, which eventually led to their demise. For the PMPs, thoroughness masked the essential or key feature elements in the resolution of the cases.[37] For PRINDs, the multidimensional aspects of the OSCE checklists (i.e., assessing data gathering, problem solving, communication, and cultural, ethical, and organizational aspects of practice) and its scoring procedures mask our critical elements of interest, that is, a candidate's ability to avoid SOCR or AEs. More focused scoring rubrics, like those in the study by Yudkowsky and colleagues[44], which included only clinically discriminating physical exam findings on the checklist, make the scoring more precise and reliable.

For cases testing a PRIND, vastly different scoring procedures guided the development of the scoring keys. The MCQs, by virtue of their limited focus, yielded an almost perfect match between a PRIND and the number of points attributed to it (99%). The CDM cases, by virtue of their key features approach, also had a high level of concordance between PRINDs and scores (78%). The scoring keys for CDM cases specifically focused on and exclusively rewarded the critical steps or actions in the resolution of the problem[37], namely the PRINDs. Illustrating this point is a case of respiratory failure, where all three key features tested a PRIND: (1) respond to lab results in a timely fashion; (2) prescribe fast-acting β-agonists for asthma patients having an acute exacerbation; and (3) prescribe influenza vaccination for high risk patients. Consequently, all the points candidates could earn for that case were directly related to avoiding SOCR or AEs. In other cases, the PRIND is captured, not by the candidate accumulating points but by him or her losing points. For example, in a case of abdominal pain (as in an ectopic pregnancy or aortic aneurism), failure to intervene rapidly will result in a zero score for the case overall, even if other appropriate actions were taken. Despite such positive actions, the patient will deteriorate unless swift action is taken, that is, the patient will experience an avoidable AE. The zero score in this case directly reflects the nature and importance of the PRIND.

Finally, in a 2007 predictive validity study, Tamblyn and colleagues[45] found a positive relationship between the complaints retained by regulatory authorities for both CDM scores (51% increase in the relative rate of complaints retained per two standard deviation reduction in score) and OSCE communication scores (38% increase). The number of PRINDs alone, in our study, does not explain the higher predictive rates of complaints retained in practice found in the

Tamblyn study for CDM and communication scores. However, while both Part I CDM and Part II OSCE had relatively similar percentages of cases testing PRINDs (39% and 44% respectively), the much higher percentage of total test points attributed to PRINDs in Part I CDM (30%) compared to that in Part II OSCE (5%) might have contributed to the highest relative rate of complaints associated with lower scores for that component. The Part II communication score, with only half a point out of 100 (0.5%) related to PRINDs, is measuring something completely different than the PRINDs we analyzed in our study.

Conclusions

The results from our study shed light on three aspects of validity related to assessing the PRINDs of SOCR and avoidable AEs as one of the multidimensional components of a candidate's readiness to practice safely and independently. These aspects of validity include: (1) content as it relates to practice analysis and blueprinting, (2) response process regarding scoring procedures, and (3) consequences for medical schools and candidates taking national exams. The set of PRINDs that we compiled represents a first step in defining competencies for safe medical practice. Yet, we need to conduct a more comprehensive practice analysis to fully capture that domain, including, for example, patient safety problems and medical errors in the community, home, and long-term care. Depending on the candidates to assess and the practice analysis procedures used for criterion-referenced licensing examinations[46,47], we must decide what omissions and commissions occur frequently enough in practice and with sufficient health consequences to be considered essential competencies for a national exam intended for supervised or unsupervised practice. We then can incorporate such analyses and decisions into a broader, more comprehensive practice model for blueprinting that can guide the content selection

for the entire exam.[13] The data sources that we used in our study were mostly from Canada and the United States. Broadening these sources could foster the development of a more global practice model. In addition, the blueprinting strategy should also guide the selection of exam formats (e.g., MCQs, key features cases, or OSCEs) that are best suited for the competencies tested. According to our experts, all but one PRIND could be assessed using a written, performance, or in-training examination format. In addition, of the 23 PRINDs not tested on the 2008 and 2009 MCC QEs, only 6 could not be assessed using a written or performance examination. The main reason we found for not testing a PRIND was not because of test format limitations but because of the absence of a blueprinting strategy for PRINDs.

In addition, we need to address the fact that different scoring procedures led to different representations of the content. The key features approach, with its focus on critical steps and actions, offers a mechanism whereby a physician's mastery of the decisions or behaviors needed to avoid SOCR and AEs is clearly captured and conveyed.[38] Scoring issues are crucial both in terms of how scores are scaled and reported and how different sub-scores are used in predictive studies, as Tamblyn and colleagues used in their study of CDM and OSCE communication scores. Further complicating the issue is the fact that criterion-referenced licensing examinations focus on pass-fail cut-score decisions (vs. norm-referenced examinations that use the whole range of the measurement scale) and the fact that different components of the examination may have different weights (e.g., CDM contributes 25% to a compensatory score while Knowledge contributes 75%).[36]

Finally, the consequences of overtly testing candidates' ability to avoid SOCR and AEs will undoubtedly prompt medical schools, program directors, and candidates taking the exams, as well as professional development and revalidation agencies, to pay closer attention to this important aspect of medical practice, much like OSCEs did for clinical exam skills two decades ago.[48] As George Miller used to say, "Assessment drives the curriculum." His statement is especially true when that call to avoid SOCR and AEs comes from the licensing authorities.

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