

EVALUATING THE PSYCHOMETRIC CHARACTERISTICS OF A WRITTEN ASSESSMENT DESIGNED TO MEASURE KNOWLEDGE AND PRACTICES RELATED TO SAFE DENTAL CARE.

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Abstract

Ensuring patient safety is a critical aspect of dental practice, requiring continuous evaluation and training of dental professionals. Written tests are widely used to assess knowledge and understanding of patient safety principles, but their effectiveness depends on robust psychometric properties, including validity, reliability, item quality, and fairness. This article explores the process of determining the psychometric properties of a written test designed to assess safe dental practices. Key patient safety domains, such as prescribing practices, infection control, and management of procedural complications, are discussed as foundational components of the test. Principles of psychometric evaluation, including content and construct validity, internal consistency, item difficulty, discrimination indices, and fairness, are outlined. The article details the development, piloting, and refinement of the test, emphasizing the importance of expert review and statistical analysis in validating the tool. By rigorously evaluating and refining written assessments, dental educators can enhance the measurement of safety knowledge, identify training needs, and contribute to fostering a culture of patient safety in dentistry. This work highlights the implications of psychometrically sound tests for improving dental education and ensuring safer practices in clinical settings.

Introduction

Patient safety is a critical component of healthcare, including dental practice. The implementation of safe practices in dentistry is essential to minimize risks, prevent harm, and ensure optimal patient outcomes (Yamalík & Perea Pérez, 2012). To evaluate the competency of dental professionals in adhering to safety standards, reliable and valid assessment tools are necessary. Written tests are commonly used to assess knowledge and understanding of patient safety principles. However, to ensure the effectiveness of such tools, their psychometric properties—validity, reliability, item analysis, and fairness—must be rigorously evaluated (Downing, Juul, & Park, 2019).

This article explores the process of determining the psychometric properties of a written test designed to assess safe dental practices, with a focus on the essential aspects of patient safety in dentistry. It provides an in-depth discussion on the principles of psychometric evaluation, the importance of robust testing tools, and the methodologies used to validate and refine assessments.

Patient Safety in Dental Practice

Patient safety in dentistry encompasses a wide range of practices aimed at minimizing risks associated with treatment and procedures. Key areas include proper drug prescribing practices, infection control, prevention of nerve injuries, and management of complications associated with dental materials or procedures (Jadhav et al., 2016; Nabilou et al., 2015). Effective training and evaluation of dental professionals in these areas are vital.

Key Safety Concerns in Dentistry

1. Prescribing Errors: Errors in prescribing medications are a significant safety issue in dentistry. Studies have shown that such errors can result from inadequate knowledge or poor prescribing habits and can have severe consequences for patients (Araghi et al., 2016; Ross et al., 2013).
2. Infection Control: Cross-infection control remains a fundamental aspect of patient safety in dental practice. Proper protocols for sterilization, handling dental impressions, and managing percutaneous injuries are critical (Vázquez-Rodríguez et al., 2018; Das et al., 2019).
3. Local Anesthesia Complications: Adverse events related to local anesthesia, such as paresthesias or hypersensitivity reactions, are not uncommon and can have lasting impacts on patients (Rosenberg, 2017; Pemberton & Gibson, 2012).
4. Nerve Injuries: Dental procedures, particularly those involving the inferior alveolar nerve, can lead to temporary or permanent nerve damage. Prevention and management of such injuries are essential competencies for dental professionals (Greenstein et al., 2015; Alhassani & AlGhamdi, 2010).

Given these safety concerns, the development of a written test to assess knowledge and understanding of safety practices is a critical step toward improving patient outcomes.

Principles of Psychometric Evaluation

Psychometric evaluation refers to the process of assessing the reliability and validity of a test. This ensures that the test measures what it is intended to measure and produces consistent results across different administrations and populations. The key principles of psychometric evaluation include validity, reliability, item analysis, and fairness.

Validity

Validity refers to the extent to which a test measures what it claims to measure. For a written test on safe dental practices, ensuring content validity is crucial. This involves aligning test items with the key domains of patient safety, such as prescribing practices, infection control, and management

of complications (Walton et al., 2010). Construct validity, which examines whether the test reflects the theoretical constructs of safe dental practice, is also essential (Farley et al., 2015).

Reliability

Reliability assesses the consistency of test results. A reliable test produces stable and reproducible results across different administrations and populations. Methods to evaluate reliability include internal consistency, test-retest reliability, and inter-rater reliability (Axelson & Kreiter, 2019).

Item Analysis

Item analysis examines the quality of individual test items. Metrics such as difficulty index, discrimination index, and distractor analysis are used to evaluate the effectiveness of each question in distinguishing between high-performing and low-performing test-takers (Burud et al., 2019; Mehta & Mokhasi, 2014).

Fairness

Fairness ensures that the test does not disadvantage any group of test-takers. Bias in test design or administration can affect validity and reliability. Efforts must be made to ensure that the test is culturally and linguistically appropriate for all participants (Doubova et al., 2020).

Developing the Written Test

The development of a written test to assess safe dental practices involves several steps, including identifying test objectives, creating test items, and piloting the test.

Identifying Test Objectives

The primary objective of the test is to evaluate dental professionals' knowledge and understanding of patient safety principles. Specific objectives may include assessing:

- Knowledge of drug prescribing practices and prevention of errors (Ross et al., 2013; Guzmán-Álvarez et al., 2012).
- Awareness and implementation of infection control protocols (Thomas et al., 2008; Das et al., 2019).
- Ability to recognize and manage complications associated with dental procedures (Bains et al., 2014; Greenstein et al., 2015).

Creating Test Items

Test items should be developed based on the identified objectives. The National Board of Medical Examiners (NBME) item-writing guide provides valuable recommendations for creating high-quality test items, such as avoiding ambiguous language and ensuring that distractors are plausible (NBME, 2020). Multiple-choice questions (MCQs) are commonly used due to their efficiency and objectivity.

Piloting the Test

Before administering the test on a larger scale, a pilot study should be conducted to evaluate its initial psychometric properties. Feedback from participants can help identify issues with question clarity, content coverage, and test length.

Evaluating the Psychometric Properties

The psychometric properties of the test can be evaluated using the following methods:

- Validity Assessment

Content validity can be established through expert review. A panel of dental educators and patient safety experts can evaluate whether the test items adequately cover the domains of safe dental practice. Construct validity can be assessed using statistical methods, such as factor analysis, to determine whether the test items align with the theoretical framework of patient safety (Downing et al., 2019).

- Reliability Analysis

Reliability can be evaluated using statistical measures such as Cronbach's alpha, which assesses internal consistency. A Cronbach's alpha value of 0.7 or higher indicates acceptable reliability (Axelson & Kreiter, 2019). Test-retest reliability can be measured by administering the test to the same group of participants at two different time points and comparing the results.

- Item Analysis

Item analysis involves calculating the difficulty index, discrimination index, and distractor efficiency for each test item. The difficulty index indicates the proportion of test-takers who answered the item correctly, while the discrimination index measures the ability of the item to differentiate between high-performing and low-performing participants (Burud et al., 2019; Rao et al., 2016).

- Fairness Evaluation

Fairness can be evaluated by analyzing test performance across different demographic groups. Differential item functioning (DIF) analysis can identify items that may be biased against specific groups (Doubova et al., 2020).

Refining the Test

Based on the results of the psychometric evaluation, the test can be refined to improve its validity, reliability, and fairness. Items with low discrimination indices or high DIF values should be revised or replaced. The test blueprint may also be adjusted to ensure comprehensive coverage of patient safety domains.

Implications for Dental Education

A well-designed written test with robust psychometric properties can serve as a valuable tool for assessing and improving knowledge of patient safety in dental education. It can also be used to identify areas where additional training is needed, ultimately contributing to safer dental practices and better patient outcomes.

Conclusion

Determining the psychometric properties of a written test to assess safe dental practice is a critical step in ensuring its effectiveness as an assessment tool. Validity, reliability, item analysis, and fairness must be rigorously evaluated to create a test that accurately measures knowledge and understanding of patient safety principles. By refining and validating such tests, dental educators can enhance the training and evaluation of dental professionals, fostering a culture of safety in dental practice.

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