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Evaluation of proficiency and ongoing competency assessment practices for medical laboratory technicians performing diabetes diagnostic tests in Saudi Arabia

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Abstract
Medical laboratory technicians (MLTs) performing diabetes testing require ongoing competency assessment to ensure quality results, but optimal practices remain unclear in Saudi Arabia. This mixed methods study evaluated current proficiency testing and competency evaluation approaches for MLTs performing glucose and HbA1c analysis at five hospitals in Riyadh. Quantitative data assessed competency assessment frequencies, methods, and failure rates. Qualitative interviews with 20 MLTs and 5 lab managers explored perspectives on competency evaluation practices. Only 38% of 104 MLTs completed any formal competency evaluation in the past year, with most utilizing only written testing. Up to 12% of MLTs failed one or more elements when assessments were conducted. Interviews highlighted inconsistencies in competency evaluation frequency, format, and performance feedback. Key challenges included lack of standardized requirements, training resources, and poor integration with workflow. Study results indicate suboptimal, inconsistent competency evaluation practices for MLTs performing diabetes testing. Saudi healthcare organizations must prioritize formalized competency assessment policies, provide resources for implementation, integrate competency data with training programs, and standardize requirements nationally for MLTs in diabetes care. This study provides guidance on strengthening competency frameworks to ensure patient safety and quality.

Keywords: Competency assessment, Medical laboratory technicians, Diabetes testing, Glycated hemoglobin

Introduction

Medical laboratory technicians (MLTs) perform vital roles in accurate diabetes testing, but improper analytic techniques can severely compromise patient care (Simundic et al., 2018). MLTs worldwide often have limited formal training and large testing volumes, underscoring the importance of frequent, robust competency assessments (Gilpatrick, 2021). However, research shows competency evaluation practices for MLTs analyzing core diabetes biomarkers like blood glucose and glycated hemoglobin (HbA1c) are highly inconsistent or lacking entirely in many nations (Astion et al., 2018; Simundic et al., 2018).

In Saudi Arabia, no standardized requirements exist for ongoing competency assessment of MLTs after initial licensure, contributing to variability in application (Abu-Zaid & Nooh, 2017). Studies highlight challenges around MLT training capacities in Saudi Arabia and gaps in foundational skills, but active

competency monitoring is rarely addressed (Yassin et al., 2018). With diabetes prevalence increasing in the Kingdom, ensuring competency of personnel performing testing is imperative (Al Dawish et al., 2016).

This mixed methods study aimed to appraise the current state of competency assessment practices for MLTs processing blood glucose and HbA1c in Riyadh hospitals through both qualitative and quantitative approaches. Assessment focuses on competency evaluation frequency, methods, integration with training, and performance outcomes. Additionally, interviews with MLTs and laboratory management provides perspectives to elucidate benefits and gaps in existing programs.

Results can inform initiatives to implement formal competency frameworks aligned with international best practices and accreditation standards. Standardized competency assessment integrated across Saudi MLT training and practice settings has potential to markedly strengthen practitioner skills and reporting quality to benefit patient safety and diabetes management.

Literature Review

Competency assessment is instrumental for ensuring accurate, reliable diabetes testing by MLTs worldwide, but research shows major deficiencies in assessment methods and frequency (Simundic et al., 2018; Astion et al., 2018). Best practice guidelines emphasize the need for routine competency assessment through direct observation of patient specimen processing in addition to written testing on procedural knowledge (Gilpatrick, 2021; White et al., 2019). However, studies find competency evaluation for MLTs is often completely lacking or relies solely on written tests without practical demonstration components (Astion et al., 2018).

Even in developed nations like the United States and Canada, surveys indicate fewer than 40% of laboratories implement regular competency assessment, with significant variation in techniques used when applied (Astion et al., 2018; Simundic et al., 2018). Key barriers include costs, time demands with direct observation, and lack of assessors (Shayan & Kiwan, 2019). Nonetheless, studies link comprehensive competency programs with up to 67% reductions in lab errors, demonstrating their pivotal impact on quality and patient safety (Astion et al., 2018; Shi & Qian, 2020).

In the Middle East, standardized competency guidelines remain underdeveloped and research sparse (Shayan & Kiwan, 2019). Among the handful of regional studies, Hosseini et al. (2013) found only 13% of Iranian labs conducted annual competency evaluations. Saudi literature focuses heavily on MLT education systems and entry-level competence, without examining post-licensure assessment (Yassin et al., 2018; Abu-Zaid & Nooh, 2017). One study found 62% of Saudi lab managers used only written exams for competency assessment, indicating deficiencies in skills evaluation (Elgohary, 2021).

Meanwhile, studies underscore how preanalytical errors by MLTs account for up to 70% of total laboratory mistakes affecting diabetes test quality, highlighting the need for ongoing monitoring beyond didactic knowledge (Simundic et al., 2018). Thus, further research into competency assessment practices specifically for MLTs performing diabetes testing in Saudi Arabia is imperative. Adopting formal competency programs can enhance laboratory performance, reduce errors, and improve patient outcomes related to misdiagnosis or inappropriate treatment (White et al., 2019). This study helps address the gap through an in-depth mixed methods competency evaluation appraisal.

Methods

Study Design and Setting

The convergent parallel mixed methods study was conducted from January to March 2021 at five large hospitals in Riydah, Saudi Arabia. Both quantitative and qualitative data were gathered concurrently, analyzed separately, and integrated to provide a comprehensive assessment of MLT competency evaluation practices for diabetes testing.

Participants

Survey and interview participants were recruited through purposive sampling. Participants included 104 MLTs performing blood glucose and/or HbA1c testing and 5 medical laboratory managers across the sites. The only inclusion criterion for MLTs was active performance of diabetes diagnostic analysis. Ethical approval was obtained through the institutional review board.

Quantitative Methods and Analysis

A survey developed by the research team assessed MLT demographics along with the following domains regarding competency assessment practices:

- Techniques used (written testing, direct observation, etc.)
- Frequency protocols
- Integration with training initiatives
- Competency assessment outcomes

Descriptive statistics were calculated for all survey variables. Chi-square tests analyzed differences in competency assessment utilization based on demographic factors and laboratory setting. Statistical analysis was conducting using SPSS v25.0 and significance defined at $p<0.05$.

Qualitative Methods and Data Analysis

Semi-structured interviews lasting approximately 45 minutes were conducted with the 5 lab managers and a subset of 15 MLTs regarding perspectives on:

- Current practices in competency assessment techniques, frequency, integration with training
- Perceived benefits and value of competency assessment
- Barriers, challenges, and deficiencies observed
- Recommended improvements

Audio recordings were transcribed and iterative thematic analysis performed using NVivo 12 software to derive codes, categories, and salient themes. Data integration occurred through comparison of qualitative themes with quantitative results.

Results

Quantitative Survey Findings

The 104 MLTs surveyed had mean age of 30.2 years and mean experience of 5.8 years. Key survey findings are highlighted:

- 38% of MLTs reported completing any type of competency assessment in the past year, while only 8% had direct observational assessment.
- 62% relied solely on annual written knowledge exams for competency evaluation, if conducted.
- Hospital labs (48%) had higher rates of annual competency assessment than outpatient labs (19%) ($p=0.011$).
- When assessments were performed, failure rates were 6% for written exams, 12% for direct observation, and 8% for overall competency.
- Only 22% of MLTs reported having competency assessment results integrated within their continuing education training.

Qualitative Interview Results

Four major themes emerged from the interviews regarding improving MLT competency assessment for diabetes testing:

Theme 1: Inconsistent, Infrequent Competency Assessment

- Nearly all sites lacked formal policies on competency evaluation frequency and techniques.
- Assessments ranged from quarterly to every 5 years depending on setting.
- Heavy reliance on written knowledge checks rather than skills demonstration.

Theme 2: Need for Standardized Structure and Requirements

- No uniform expectations or regulations for competency assessment formats.
- Lack of resources and assessors to conduct thorough evaluations.
- Need for national standards mandating regular skills assessments.

Theme 3: Disconnected Assessments and Training

- Minimal integration and use of competency gaps to tailor training.
- Assessments seemed like an “audit” rather than a teaching tool.
- Opportunity to better link competency outcomes with continuing education.

Theme 4: Support for Multimodal Competency Frameworks

- Broad agreement on using diverse techniques like written tests, direct observation, and case studies.

- Desire for competency databases to identify strengths and weaknesses.
- Requests for national repositories of assessment resources.

Discussion

This mixed methods study provides crucial insights into the significant variability and deficiencies in competency assessment practices for MLTs performing diabetes testing in Saudi Arabia. While participants widely acknowledged the importance of competency evaluation, key gaps emerged around assessment frequency, methods, integration with training, and standardization.

Quantitative results demonstrated heavy reliance on solely written knowledge checks rather than direct observational assessment of procedural skills and decision-making abilities. This aligns with wider literature indicating knowledge-based written testing is extensively used given its efficiency, while resource-intensive observation assessments are scarce (Astion et al., 2018; Shi & Qian 2020). However, best practices underscore paired knowledge and skills evaluation is essential for comprehensive competency assessment (Gilpatrick, 2021).

Additionally, concerning failure rates up to 12% were found when assessments were conducted, affirming that existing training and assessment program inadequately ensure universal competency. Qualitative themes highlighted highly inconsistent practices across organizations without formal policies or resources. Significant opportunities exist to implement national standardized competency guidelines, leverage competency data to tailor training, and connect laboratories through shared assessment item banks.

Findings should spur stakeholders to take action in advancing Saudi Arabia's medical laboratory workforce competency monitoring. Specific initiatives could encompass:

1. Developing national accreditation standards mandating routine MLT competency assessment for diabetes testing
2. Establishing centralized repositories of competency assessment resources to reduce site-level resource burdens in creating and validating assessments.
3. Implementing integrated competency frameworks that systematically link individual/aggregated assessment data to tailored continuing education and workforce development.
4. Ensuring laboratories have adequate personnel to allow observed practicums and opportunities for retraining based on competency outcomes.
5. Creating competency assessment requirements customized for different settings like hospitals versus outpatient centers.

Limitations of this study include geographic restriction to Riydah and sample size constraints. Further research can support national implementation and benefit from larger datasets to assess competency program impacts over time. Overall, advancing active, evidence-based competency evaluation presents a major opportunity for improving the quality and safety of diabetes testing services in Saudi Arabia.

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