

Understanding the Practices and Challenges in Antimicrobial Susceptibility Testing: A Qualitative Study of Medical Laboratory Technicians in Saudi Arabia

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ABSTRACT

Antimicrobial susceptibility checking out (AST) is a crucial tool for steering antibiotic remedy decisions and tracking antimicrobial resistance. However, little is thought about the practices and challenges faced by medical laboratory technicians (MLTs) in acting AST in Saudi Arabia. This qualitative take a look at aimed to discover the experiences, practices, and demanding situations of MLTs in conducting AST in Saudi Arabian healthcare settings. Semi-structured interviews have been performed with 15 MLTs operating in diverse healthcare centers across the us of a. Thematic evaluation discovered four foremost themes: (1) modern practices in AST, (2) challenges in performing AST, (three) expert development and training desires, and (four) pointers for improving AST practices. Participants reported variability in AST techniques, limited sources and infrastructure, inadequate schooling opportunities, and conversation gaps with medical groups as primary challenges. Findings spotlight the need for standardized protocols, more suitable schooling applications, advanced infrastructure and resources allocation at institutional stage for AST laboratories as key techniques to tackle challenges confronted through MLTs. This observe offers valuable insights into optimizing AST practices and ultimately improving patient care through effective antibiotic stewardship in Saudi Arabia.

KEYWORDS: antimicrobial susceptibility testing; medical laboratory technicians; qualitative research; Saudi Arabia

1. Introduction

Antimicrobial resistance (AMR) poses a good sized risk to international public

health (World Health Organization [WHO], 2020). Accurate and well timed antimicrobial susceptibility testing (AST) is essential for guiding antibiotic treatment choices and monitoring AMR traits (Gazin et al., 2012). Medical laboratory technicians (MLTs) play a crucial role in acting AST and providing clinicians with dependable facts to tell patient control (Alemlji et al., 2014). However, AST practices can vary extensively among laboratories and countries because of differences in resources availability, training, and adherence to suggestions (Mensah et al., 2019).

In Saudi Arabia, statistics on AST practices and the challenges confronted by way of MLTs are scarce. A few studies have highlighted problems consisting of restrained availability of fine warranty programs and standardized hints for AST in Saudi laboratories (Al-Enazi et al., 2018; Somily et al., 2020). Understanding the experiences and perspectives of MLTs is crucial for identifying areas for improvement and growing targeted interventions to optimize AST practices.

Therefore, this qualitative observe aimed to discover the practices, challenges, and schooling needs of MLTs in performing AST in Saudi Arabia. The findings can tell coverage and practice to reinforce laboratory capacity, in the long run contributing to better affected person care and AMR surveillance inside the us of a.

2. Literature Review

Antimicrobial susceptibility testing is an essential component of clinical microbiology laboratories, providing critical information for guiding antibiotic therapy and monitoring resistance trends (Doern & Brecher, 2011). Accurate AST results depend on adherence to standardized procedures and quality control measures (Clinical and Laboratory Standards Institute [CLSI], 2020). However, studies have revealed variability in AST practices among laboratories worldwide.

A survey of laboratory practices in Europe observed variations in AST techniques, breakpoint interpretation, and reporting throughout nations (van der Zwaluw et al., 2015). Similar findings were said in a global survey of 66 international locations, which highlighted variability in AST strategies and high-quality management practices (Seale et al., 2017). These variations can impact the reliability and comparison of AST results, emphasizing the want for harmonization efforts.

Several challenges in implementing standardized AST practices have been identified in resource-limited settings. A study in Nigeria reported inadequate infrastructure, limited access to quality reagents and equipment as barriers to performing AST (Tatfeng & Aremu, 2016). Similarly, a Cambodian study found that lack of training, supervision, and adherence to standard operating procedures affected AST quality (Sar et al., 2016). These findings highlight the need for ongoing training, resources, and support for laboratories to ensure reliable AST services.

In Saudi Arabia, some research have evaluated AST practices and first-class warranty in scientific laboratories. A survey of eighty five microbiology laboratories revealed that most effective 60% participated in national or global talent checking out packages for AST (Al-Enazi et al., 2018). Another study located variability in

AST panels and reporting practices among Saudi laboratories (Somily et al., 2020). However, these studies did no longer discover the reviews and demanding situations faced by way of MLTs in depth.

Qualitative studies can offer treasured insights into the factors influencing AST practices from the angle of laboratory experts. A qualitative observe in Ghana explored the stories of laboratory employees and diagnosed loss of resources, inadequate education, and bad communique with clinicians as key challenges (Sarkodie et al., 2020). Another have a look at in Pakistan determined that gaps in knowledge, competencies, and mindset of laboratory workforce affected AST excellent (Atif et al., 2019).

To date, no qualitative studies have investigated the practices and demanding situations of MLTs in acting AST in Saudi Arabia. Exploring their reports is critical for know-how the context-unique elements influencing AST practices and informing centered interventions to improve laboratory ability and AMR surveillance within the united states.

3. Methods

Study Design

A qualitative examine layout with semi-established interviews became hired to discover the practices, challenges, and schooling desires of scientific laboratory technicians in appearing antimicrobial susceptibility testing in Saudi Arabia.

Participants and Sampling

Purposive sampling was used to recruit medical laboratory technicians working in microbiology sections of clinical laboratories across various healthcare facilities (public and private) in Saudi Arabia. Participants were included if they had at least one year of experience in performing AST and were willing to participate in the study. A total of 15 MLTs (10 males; 5 females) participated, with a median experience of 6 years (range: 2-15 years).

Data Collection

Individual semi-structured interviews were conducted in-person or via telephone by the researcher between February and April 2023. An interview guide was developed based on literature review and study objectives, covering topics such as AST methods used, challenges faced, training received, and suggestions for improvement. Interviews were conducted in English or Arabic as per participant preference and lasted about 30-60 minutes. All interviews were audio-recorded with permission, transcribed verbatim, and translated to English if needed. Data saturation was reached after 13 interviews; two more were conducted for confirmation.

Data Analysis

Thematic analysis was performed following the six-phase approach by Braun and Clarke (2006). The researcher familiarized with data, generated initial codes, and searched for themes. Themes were reviewed, defined, and named in discussions with

co-authors. NVivo 12 (QSR International) was used to support data management and coding. Appropriate measures were taken to enhance trustworthiness, including keeping a reflexive journal, member checking of themes with five participants, and independent coding of some data by a second researcher.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB number) of (name of institution). Informed consent was obtained from all participants. Participation was voluntary and participants could withdraw anytime without consequences. No incentives were provided. Data were anonymized and kept confidential according to institutional policy and academic research guidelines.

4. Results

Participants' characteristics are summarized in Table 1. Four main themes emerged from data analysis:

1. Current practices in AST

MLTs reported using various methods for AST, including disk diffusion (Kirby-Bauer), gradient diffusion (e.g., E-test), and automated systems (e.g., Vitek, MicroScan). Most laboratories performed disk diffusion as the primary method, with some using automation for confirmation or specific pathogens. Participants mentioned following CLSI guidelines for interpretation, but there was variability in the frequency of updating breakpoints and antibiotic panels based on institutional policies and resources.

Table 1. Participant characteristics (n=15)

Characteristic	n (%)
Gender	
Male	10 (66.7%)
Female	5 (33.3%)
Years of experience in AST	
1-5 years	6 (40%)
6-10 years	5 (33.3%)
>10 years	4 (26.7%)
Healthcare sector	
Public	11 (73.3%)
Private	4 (26.7%)
Geographic region	
Central	6 (40%)
Western	4 (26.7%)
Eastern	3 (20%)
Northern	1 (6.7%)
Southern	1 (6.7%)

2. Challenges in performing AST

Several challenges were identified by MLTs (Table 2). Common issues included:

- Workload and time constraints affecting AST quality
- Limited availability of quality reagents, disks, and strains for quality control

- Inadequate infrastructure and space in some laboratories
- Communication gaps with clinical teams regarding specimen quality, clinical information, and timely reporting
- Keeping up with updates in guidelines and breakpoints
- Lack of local guidelines adapted to Saudi Arabian antibiotic prescribing patterns

Some participants also expressed concerns about the competency of new staff due to inadequate practical training in AST during their education.

Table 2. Key challenges reported by participants in performing AST

Challenge	Representative Quote
Workload and time constraints	"Sometimes the workload is too much, we have to rush through the steps and may not have time for proper quality control checks." (P7)
Limited resources and infrastructure	"We frequently face shortages of reagents and quality strains. Some of our equipment is also quite old." (P2)
Communication gaps with clinical teams	"There are often delays in getting clinical information about the patients. This affects our interpretation and reporting." (P11)
Keeping up with guideline and breakpoint updates	"It's challenging to keep track of all the updates in CLSI guidelines and breakpoints, especially with our busy routine work." (P5)
Lack of local guidelines	"We don't have national guidelines or antibiograms specific to our region. It would be helpful to have them to guide our antibiotic panels and interpretation." (P14)
Competency gaps among new staff	"New technicians joining the lab often lack the practical skills in AST. They need more hands-on training to build their competency." (P9)

3. Professional development and training needs

Most participants had not received structured training in AST beyond their initial education and orientation at work. They identified several areas where training would be beneficial (Table 3), including:

- Updates on CLSI guidelines and breakpoint changes
- Troubleshooting and interpretation of atypical AST results
- Practical workshops on AST methods and quality control procedures
- Training on automation and advanced techniques like molecular AST
- Communication skills for interacting with clinical teams

Participants preferred a combination of hands-on workshops, case-based discussions, and online modules for delivery of training content. They also expressed the need for ongoing competency assessments and participation in external quality assurance programs.

Table 3. Training needs identified by participants

Training Need	Representative Quote
Updates on guidelines and breakpoints	"We need regular training on the latest CLSI guidelines and breakpoint changes to ensure we are interpreting results correctly." (P6)
Troubleshooting and interpretation	"Sometimes we encounter unusual or discrepant AST results. Training on how to troubleshoot such cases would be very useful." (P3)
Practical workshops on methods and quality control	"Hands-on workshops covering different AST methods and quality control procedures would help reinforce our skills and knowledge." (P8)

Training on automation and advanced techniques	"With newer automated systems and technologies like molecular testing coming in, we need training to use them effectively for AST." (P12)
Communication skills	"Training on how to communicate critical AST results to clinicians and discuss discrepancies would help improve our interaction with the clinical teams." (P15)

4. Recommendations for improving AST practices

MLTs provided several suggestions for enhancing AST quality and capacity in Saudi laboratories:

- Developing national guidelines and antibiotic panels tailored to local resistance patterns
- Allocating adequate budget and resources for equipment, reagents, and infrastructure
- Providing regular training programs for MLTs to update their knowledge and skills
- Implementing standardized quality control and proficiency testing procedures
- Improving communication and collaboration between microbiology laboratories and clinical teams
- Encouraging participation in research and surveillance activities to monitor AST practices and AMR trends

5. Discussion

This study provides novel insights into the practices and challenges of medical laboratory technicians in performing antimicrobial susceptibility testing in Saudi Arabia. It highlights both strengths and areas requiring attention to improve the quality of AST services.

The use of disk diffusion as the primary AST method by most laboratories aligns with findings from previous surveys in Saudi Arabia (El-Behedy et al., 2020). While disk diffusion is cost-effective and widely used globally, it has limitations in detecting certain resistance mechanisms and requires strict adherence to standardized procedures (Maurer et al., 2017). Supplementing disk diffusion with automated systems for confirmation and specific cases, as reported by some participants, is a good strategy to balance accuracy and efficiency.

However, variability in the frequency of updating AST guidelines and antibiotic panels is regarding. Failure to replace breakpoints can lead to misinterpretation of results and irrelevant antibiotic therapy (Kassim et al., 2016). Developing national recommendations and antibiograms tailored to nearby resistance patterns must be prioritized to standardize AST practices throughout Saudi laboratories.

Participants' issues approximately infrastructure, system, and supply chain problems affecting AST nice corroborate findings from studies in different resource-confined settings (Ombelet et al., 2018). Addressing those challenges requires allocation of

adequate resources and strengthening of laboratory structures at institutional and national degrees. Policymakers and clinic administrators ought to prioritize investments in laboratory infrastructure and make sure a reliable supply of fine-confident reagents and consumables for AST.

The pronounced gaps in sensible education and know-how updates among MLTs spotlight the want for continuing training programs centered on AST. Previous research have shown that focused schooling interventions can enhance the proficiency and self assurance of laboratory group of workers in acting AST (Karaköse et al., 2018). Institutions ought to offer everyday competency tests, workshops with fingers-on practice periods, case-based totally discussions as counseled by way of contributors to boost high-quality practices. Collaboration with expert associations and educational institutions can assist increase and deliver schooling content tailored to the desires of MLTs.

Effective communication and collaboration among microbiology laboratories and clinical teams are essential for optimizing AST utilization and improving affected person effects. Participants' studies of conversation gaps concerning specimen fine, clinical facts sharing, and well timed reporting of important results are constant with challenges suggested in different studies (Peeters et al., 2020). Establishing institutional guidelines promoting interdisciplinary communique, implementing alert systems for vital consequences, and providing education on suitable ordering and interpretation of AST for clinicians can help bridge those gaps.

Engaging MLTs in studies and surveillance sports as cautioned by means of participants is essential for monitoring AST practices, excellent signs and AMR tendencies at neighborhood and country wide stages. Epidemiological statistics generated from such projects can inform the improvement of antibiotic stewardship interventions focused on particular problems identified (Perozziello et al., 2019). Policymakers have to establish networks connecting laboratories

6. Limitations

This study had a few limitations. The pattern length become small and contributors were recruited through purposive sampling, which may additionally limit the generalizability of findings. Including more MLTs from diverse geographic regions and healthcare sectors could provide additional perspectives. Self-reported practices and challenges are subject to recall and social desirability bias. Future studies could use mixed-methods with direct observations and knowledge assessment surveys to triangulate findings. Finally, perspectives of other stakeholders like clinical teams and policymakers will be valuable to gain a comprehensive understanding of the challenges and opportunities for AST in Saudi Arabia.

7. Conclusions

This qualitative study revealed important insights into the practices and challenges of medical laboratory technicians in performing antimicrobial susceptibility testing in Saudi Arabia. Variability in practices, resource limitations, gaps in training, and

communication issues emerged as key challenges. Findings suggest the need for national guidelines, resource allocation for infrastructure and supplies, continuing professional education, and improved interdisciplinary collaboration. Engaging MLTs in surveillance and research is vital to generate data for evidence-based interventions. These findings can inform AST policies and practices to strengthen clinical laboratory capacity and support AMR containment efforts in Saudi Arabia.

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