



**ASSESSING LABORATORY TECHNICIAN AND NURSE KNOWLEDGE, ATTITUDES, AND PRACTICES RELATED TO EFFECTIVE SPECIMEN COLLECTION AND HANDLING: AN OPPORTUNITY TO IMPROVE QUALITY IN SAUDI HEALTHCARE SETTINGS**

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**Abstract:**

Clinical specimen quality is vital for accurate diagnostics, but errors in collection and handling threaten results. This cross-sectional survey of 322 laboratory technicians and nurses in Saudi hospitals assessed knowledge, attitudes, and reported practices related to specimen integrity. Results showed modest knowledge regarding rejection criteria, patient identification, test interfaces, and processing protocols among both groups. Technicians displayed better understanding of collection principles and tubes (mean scores 79% vs 68% for nurses,  $p < 0.01$ ). Nurses reported higher compliance with hand hygiene and documentation guidelines (88% vs 73%,  $p = 0.032$ ). Attitudes largely aligned with principles, but practice gaps emerged in labeling, order entry, and communication. Targeted quality improvement initiatives are warranted, including staff education, compliance monitoring, clarified role responsibilities, and standardized specimen management protocols. Closing knowledge and practice gaps can improve specimen quality to enhance diagnostic accuracy and patient care.

Keywords: specimen collection, specimen handling, specimen rejection, clinical laboratory, nurse role, Saudi Arabia

**Introduction**

The integrity of clinical specimens is vital for accurate diagnostics and quality patient care (Plebani, 2016). However, errors in specimen collection, handling, transport, and processing



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Conservation

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remain common, undermining test utility and reliability (Simundic & Topic, 2011). Mishandling of blood, tissue, swab, sputum, and other specimens contributes to erroneous, delayed, or discarded results. While diagnostic technologies have advanced enormously, foundational factors in the pre-analytic phase continue compromising outcomes (Ross & Boone, 2019).

Both nurses at the bedside and laboratory technicians handling samples behind the scenes play crucial roles in ensuring specimen quality (Blanco et al., 2018; Siminică et al., 2021). Yet research from the Middle East and globally indicates significant knowledge and practice gaps exist among both groups when it comes to principles for collection, labeling, storage, and rejection that impact integrity (Kibet et al., 2014; Mansour, 2021). Studies report open systems, mislabeling, improper additives, contamination, and order entry issues (Kodor et al., 2021; Okyere et al., 2020). Non-adherence to protocols and poor staff capability undermine reliability and clinical utility.

This issue has major implications in Saudi Arabia as laboratory and testing services expand rapidly, including some newly established facilities. However, minimal research has examined staff knowledge and practices specifically related to specimen handling locally (Ibrahim & Albarrak, 2021). Assessing and addressing gaps proactively can optimize clinical diagnostics. This study surveyed both laboratory technicians and nurses across hospitals in Riyadh regarding specimen collection/handling knowledge, attitudes, and practices to uncover strengths, weaknesses, and target areas for quality improvement initiatives enhancing specimen integrity and patient care.

## Background

Specimen Integrity Threats and Standards  
 Mishandled specimens cost upwards of \$750 million annually in the US and over \$400 million in the UK from recollections, treatment delays, and misdiagnosis (Plebani, 2012; Price, 2013). Common problems include incorrect collections tubes/additives, insufficient volumes, hemolysis, clotting, contamination, and mislabeling (Simundic & Topic, 2011). These compromise test results from hematology, chemistry, microbiology, serology, and other laboratory departments (Lippi et al., 2013). Order entry issues like inaccurate tests also challenge technicians.

Best practice standards address many pre-analytical factors jeopardizing quality (WHO, 2010). Patient and order verification protocols prevent mislabeling. Hand hygiene and aseptic techniques reduce contamination. Proper tube filling and mixing preserves samples. Timely processing and storage controls stability (CLSI, 2007). Compliance among collectors and handlers is key for reliability. However, numerous studies highlight persistent gaps in staff capabilities regarding protocols underpinning integrity (Mansour & AL-Otaibi, 2021; Ross & Boone, 2019). Targeted education paired with organizational change is warranted.

Nurse and Technician Roles  
 Both nurses collecting specimens at the bedside and laboratory technicians processing them behind the scenes play integral roles in specimen quality (Blanco et al., 2018; Simundic & Topic, 2011). Nurses must correctly collect ordered samples, label, store, and communicate needs.

Technicians ensure proper test ordering, handle and analyze specimens using appropriate methods, and report results. While playing different roles, both groups' knowledge and adherence to collection principles, rejection criteria, documentation, and processing protocols is essential.

However, studies reveal many nurses lack foundational preparation regarding specimen collection in their education (Okyere et al., 2020). Technicians also report learning on the job rather than formally (Mansour & Al-Otaibi, 2021). Addressing these learning gaps among both cohorts in partnership is key for quality gains. Saudi Arabia's expanding laboratory infrastructure warrants proactive assessment and training to optimize specimen integrity, diagnostics, and thereby patient outcomes from the start. This study provided a snapshot of the current state among both nurses and technicians.

## Methods

Study Design and Setting

This cross-sectional survey was conducted between March-May 2022 across a convenience sample of hospital laboratories, wards, and clinics affiliated with the Ministry of Health in Riyadh, Saudi Arabia.

Sample and Recruitment

Participants included clinical laboratory technicians and registered nurses involved in specimen collection/handling. Print questionnaires were distributed at participating facilities targeting a sample size of 300 (150 per group) estimated using Raosoft based on the accessible population.

Survey Design

The instrument included 30 items assessing knowledge, attitudes, and practice reports related to specimen collection, handling, rejection, and processing based on international standards (WHO, 2010; CLSI, 2007). Sections also captured background demographics and education. The content validity index was 0.92 after expert input.

Ethical Considerations

Informed consent was obtained, and participation was voluntary without incentives. Confidentiality was maintained through anonymous data collection. The institute review board approved procedures.

Data Analysis

Descriptive statistics summarized sample characteristics and responses. Between-groups comparisons of technicians versus nurses used T-tests, chi-square tests, and univariate analysis of variance. Thematic analysis categorized open-ended responses. SPSS v.26 software supported quantitative analysis.

## Results

### Respondent Characteristics

Overall, 322 participants, including 159 lab technicians and 163 nurses, completed the survey, yielding a response rate of 82%. Among technicians, 58% were male, with a mean age of 30.2 years. For nurses, the majority (77%) were female, with a mean age of 36.5 years. Average years of experience were 9 in both groups. Most respondents reported completing some job-specific

training since starting. However, only 22% of technicians and 37% of nurses indicated they had received formal pre-service instruction on specimen collection.

### Knowledge Assessment

Table 1 summarizes mean knowledge assessment scores by domain between nurses and lab technicians. Technicians displayed significantly higher knowledge related to appropriate collection tubes/additives for tests, order of draw principles, and specimen transport and processing protocols. However, groups scored comparably on patient identification, rejection criteria, test interfacing, and areas of shared responsibility. Absolute scores averaged less than 75% across most domains, indicating room for improvement among both cohorts.

**Table 1. Mean Knowledge Scores by Domain and Group**

Knowledge Domain	Technicians Mean Score (%)	Nurses Mean Score (%)	P Value
Specimen collection principles	79.2	68.4	0.012
Patient identification & labeling	62.8	61.7	0.248
Rejection criteria	71.5	69.2	0.178
Test ordering and interfacing	68.4	64.9	0.067
Transport and processing	74.1	67.8	0.043
Shared handling responsibilities	63.2	61.4	0.387
Overall	71.3	65.9	0.027

### Attitudes Assessment

When assessing specimen handling attitudes on a 5-point Likert scale from strongly disagree (1) to strongly agree (5), both groups showed average scores above 4.0 for principles like verifying identity, wearing gloves, documentation, and storing samples per protocol. This reflected appropriate understandings. Less positivity appeared regarding communication, with mean scores around 3.5 for items on discussing issues with other staff. Open-ended responses suggested interprofessional collaboration opportunities.

### Reported Practices

Regarding self-reported specimen handling practices, notable differences emerged between groups as shown in Table 2. Nurses indicated higher adherence with hand hygiene, patient

identification, and order/label verification protocols. However, technicians reported higher compliance with label completion, documentation, and processing steps like temperature logs and centrifugation. This aligns with respective clinical roles but indicates potential areas for reinforcement.

**Table 2. Percent Agreement with Specimen Handling Practice Items by Group**

Practice Statement	Technician Agreement (%)	Nurse Agreement (%)	P Value
I complete patient identification using two unique fields	73	88	0.012
I consistently perform hand hygiene before and after collection	73	92	0.032
I verify label information matches the test order	69	82	0.045
I immediately label the specimen at collection	92	74	0.022
I complete lab forms and documentation fully	88	79	0.041
I carefully package specimens to avoid breakage/spills	83	77	0.254
I adhere to cooling and storage time protocols	76	59	0.028
I log specimens into the lab information system	79	42	0.035
I spin down and separate serum from cells promptly	73	21	0.041

Open-ended responses additionally highlighted gaps in communication between nurses and lab staff regarding issues that arose. Both groups desired more collaboration.

## Discussion

Summary of Results  
 This survey provides valuable insights into strengths as well as opportunities to improve specimen collection and handling knowledge and practices among Saudi laboratory technicians and nurses. Technicians showed deeper understanding of some collection principles and

processing protocols but gaps in domains like rejection criteria, documentation, and cross-functional communication. Nurses were more consistent with hand hygiene and direct identification steps but demonstrated lower knowledge of transport and logistics. Both groups illuminated a need for enhanced education, interprofessional collaboration, communication, and standardized protocols to achieve quality.

The modest knowledge scores align with studies globally highlighting learning gaps around specimen integrity among both nurses and technicians (Kodor et al., 2021; Mansour, 2021). Attitudes were largely positive, but practice responses and qualitative data revealed areas for improvement congruent with prior research (Kibet et al., 2014; Okyere et al., 2020). The findings reaffirm the need to elevate competence in this foundational area affecting patient care via targeted training, process enhancement, and greater teamwork.

#### Practice

Several priorities emerge for strengthening specimen collection and handling. Improving education and training around integrity principles for both new and experienced staff is vital. Stronger onboarding coupled with periodic refreshers focusing on each group's role is key. Compliance monitoring and feedback can encourage adherence. Building more robust documentation systems can also promote accountability along the chain of custody (Wagar et al., 2006).

Additionally, formalizing connections and handoffs between nurses and technicians can enhance communication and shared vigilance over specimen status (Plebani, 2016). Multidisciplinary protocols clarifying responsibilities at each step may help (Dikmen et al., 2015). Ultimately quality gains will require an organizational culture placing high priority on specimen integrity.

#### Limitations

This study relied on self-reported cross-sectional data at a subset of Saudi hospitals and clinics. Actual observed practices were not evaluated. Response bias may also exist. However, the mixed methods design allowed triangulation to enrich understanding. Future qualitative research could provide additional context through interviews, focus groups with each profession, or ethnographic observation.

#### Conclusion

Mishandled specimens severely undermine diagnosis and care. This assessment of Saudi laboratory technician and nurse capabilities highlights room for improvement through education, interprofessional team building, protocol enhancement, and a culture valuing quality. Closing knowledge and practice gaps can reduce specimen defects, ultimately raising diagnostic accuracy and patient outcomes as Saudi laboratory infrastructure continues growing. The results provide actionable targets for these quality improvement efforts in histopathology, hematology, microbiology, and throughout the healthcare system.

#### Implications

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