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# The Role of Allied Health Technicians (Dental Assistants and Medical Device Technicians) in Enhancing Patient Safety in Healthcare Settings

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## ABSTRACT

**Introduction:** The fast development of the Saudi Arabian healthcare industry in the framework of Vision 2030 has preconditioned the transition to multidisciplinary safety models. Although much research is done on clinicians, contributions by Allied Health Technicians, i.e. Dental Assistants and Medical Device Technicians are critical in reducing clinical risks. Dental assistants are the main custodians of infection control and sterilization and medical device technicians are the ones who take care of the operational fidelity and calibration of life critical technologies.

**Objective:** The objectives of the proposed systematic review are to assess how Allied Health technicians can be used to improve patient safety in Saudi Arabian healthcare environments.

**Methods:** Based on PRISMA 2020, a systematic search was performed in PubMed, the Saudi Digital Library (SDL), ScienceDirect, and Scopus within the year 2015 and 2026 to identify peer-reviewed articles. Search involved Boolean strings which were a combination of terms such as Allied Health, Dental Assistant, Medical device technician and patient safety plus Saudi Arabia. The selection of studies was performed according to predetermined inclusion criteria, including empirical information of KSA-based healthcare facilities.

**Conclusion:** The analysis of the review shows that Allied Health Technicians are crucial foundations of the Saudi safety system, and CBAHI accreditation is one of the main factors that should trigger protocols compliance. Technical competency that is high in sterilization and device maintenance has major gaps in the area of "Safety Culture" particularly in the reporting of errors that is non-punitive. The research concludes that technicians can play an important role in mitigating both technical and biological hazards; however, the primary challenge of the Saudi healthcare system is to adopt standardized national certifications and shift to a Just Culture, which will enable these professionals to be the most powerful leaders in terms of safety...

**Keywords**: Dental Assistants, Dental Technicians, Allied Health Personnel, Medical Errors, Quality of Care

## INTRODUCTION

The healthcare environment in the world today has been experiencing a paradigm shift whereby the physician-centric approach is being replaced with the multidisciplinary team approach. The key to this transition is the presence of the Allied Health Professionals (AHPs), namely, Dental Assistants and Medical Device Technicians, which serve as the so-called technical backbone of the clinical activity. **[1]** This is not just a change of practice in the Kingdom of Saudi Arabia (KSA), but a mandatory strategy in Saudi Vision 2030. With the Kingdom working with modernizing its healthcare infrastructure

like the Health Transformati on Program, the role of technicians in ensuring patient safety has gone away to outer edges and to the centre of clinical excellence. **[3], [5]**

**The Idea of Patient Safety in Allied Health**

The concept of patient safety is described as the avoidance of mistakes and the negative outcomes related to healthcare. Throughout the process, surgeons and consultants commonly decide on the highest levels of the diagnostic operation, yet the aspect of determining the safety protocols of the diagnostic decisions is often left to the technicians. To the Dental Assistants, safety is equivalent to strict infection control, helmetry, and chairside medical emergency. **[4], [8]** The compliance of the assistant with the sterilization measures is the main point that divides the successful operation and a healthcare-associated infection (HAI) in an environment where the risk of bloodborne pathogens and cross-contamination is high. At the same time, Medical Device Technicians are working in an environment that is becoming more digital with the interface between the patient and the machine being paramount. By testing the life-support machinery and by checking the correctness of the diagnostic imaging, these professionals reduce the risks related to the equipment malfunctioning, fatigue related to alarms, and technical issues. In the Saudi experience whereby the pace of technological use has delivered sophisticated robotic and artificial intelligence tools, the technician role in the avoidance of the so-called mechanical adverse events will be an essential part of the patient safety net. **[9], [12]**

**The Vision 2030 and the Saudi Arabian Context**

Healthcare sector in Saudi Arabia is today undergoing a transformation that has never been experienced before. Saudi Health Council and Saudi Food and Drug Authority (SFDA) have defined strict rules on patient safety, but the application of these rules is highly dependent on the front-line allied health workforce. The systematic review of the existing practices shows that when the Kingdom is on the path to becoming the Value-Based Healthcare, the quality of the outcomes directly depends on the competence of the technicians. The Saudi healthcare setting is, however, different. **[3], [7]** The labor force is very diverse and consists of both Saudi citizens and foreign professionals with different educational backgrounds. This diversity as an asset requires a unified systematic way of dealing with safety procedures to make sure that there is smooth flow of communication. More so, the mushrooming nature of the private dental and medical facilities in the Kingdom has resulted in a high demand of the technicians which at times causes shortages in staffing and thus tries to compromise safety standards unless addressed with sound institutional policies. **[9]** Allied Health Technician are often excluded in the research on patient safety and this is even though they make critical contributions, since the research usually concentrates on nursing and medical professionals. **[8], [11]**

The synthesized evidence of the interaction of these particular technical positions among the Saudi healthcare system of how the Dental Assistants and Medical Device Technicians can reduce the level of errors is lacking. This Systematic Review will attempt to bridge that gap by bringing together the available literature and clinical data throughout the Kingdom. **[10], [12]**

This paper examines the relationship between adverse clinical event reduction and technician competency through the review of peer-reviewed articles, government reports, and clinical audits. It is aimed at giving a detailed picture of the existing level of allied health safety practice in Saudi Arabia, capturing both the positive results of the recent changes and the still existing obstacles in the implementation of a zero-harm setting. **[13], [14]**

**Need and Rationale of the Study**

The argument of this systematic review is founded on the critical but frequently neglected role of allied health technicians in the safety infrastructure in Saudi healthcare system. Since the Kingdom is experiencing an enormous structural transformation under the Saudi Vision 2030, the following points exemplify the urgency of the research:

**Graduate Project on Safety Literature**

Filling in the "Technical Gap. In Saudi Arabia, most studies have historically conducted research on physicians and nurses on patient safety. Nonetheless, the main users of the tools and the places where the mistakes frequently happen are Dental Assistants and Medical Device Technicians. A deeper necessity exists to get beyond the doctor-focused models of safety to comprehend how the technical personnel cope:

**Infection Vectors:** Dental assistants handle high risk aerosol producing procedures. **[7]**

**Fidelity of the device:** Technicians are responsible to ensure that life-critical machines (ventilators, dialysis units, etc.) do not only work, but also have the calibration adjusted to the exact safety standards. Conformity to Saudi Vision 2030 and HSTP. The Health Sector Transformation Program (HSTP) is to offer an integrated healthcare system. One of the central pillars of it is Strengthening Prevention against Threats to Health. **[12]**

This research is needed as an assessment of whether the allied health workforce is being sufficiently trained to fulfill these new, demanding international safety standards. The frontline technicians are not assessed to complete the objective of the Kingdom of a Value-Based Healthcare model. Reducing the Culture of Blame. **[11]** The existing evidence indicates that the so-called punitive method of addressing medical mistakes is one of the obstacles in the Arab healthcare culture. The technicians who usually hold the bottom of the clinical pyramid may be less empowered to report near misses or equipment failures. **[9], [3]**

This study is needed to:

- Determine the possible ways of promoting a Just Culture with concrete reference to technical employees.

- Empower technicians to become Safety Officer as opposed to machine operators. Medical Technology, Dental and High-Stakes Environment.

- Dental operations are complicated, and AI and robotics have been rapidly introduced into Saudi hospitals, which has added to the error margin.

**In the case of Dentistry**

70 percent of particular procedural mistakes (such as perforations) have been associated with training lapses.

**In Device Management**

"Alarm fatigue" and networked medical devices vulnerabilities to cybercrime constitute new, contemporary dangers that can only be addressed by experts.

**Achieving Competency Standardization in a Diverse Workforce**

Saudi Arabia has an enormous number of its local and expatriate allied health professionals of different educational levels. A standardized safety competency framework is urgently required to be synthesized. The evidence base presented by this review can be used by the Saudi Commission for Health Specialties (SCFHS) to balance certification and continuous education requirements based on the particular risks that are being faced in the Kingdom. **[4], [13]**

**Study Objective**

The main objective of this systematic review is to formulate and determine the findings of the evidence on the influence of Allied Health Technicians (Dental Assistants and Medical Device Technicians) on the patient safety outcomes in the Saudi Arabian healthcare system. The research will also evaluate the efficiency of the current safety measures (e.g., sterilization, calibration, and emergency response) used by such professionals in the KSA hospitals and clinics.

## RESEARCH METHODOLOGY

**Research Question**

The research questions of the current study are:

Q1. What is the role of specialized technical processes of Dental Assistants and Medical Device Technicians in the decrease of Healthcare-Associated Infections (HAIs) and equipment error in Saudi healthcare facilities?

Q2. How does the adoption of the sophisticated medical technology and Electronic Health Records (EHR) in Saudi Arabia affect safety duties and workload of Medical Device Technicians?

Q3. Which are the critical discrepancies between the present allied health curricula in Saudi Arabia and the international standards concerning patient safety competency?

**Research Design**

As a way of ensuring the best evidence synthesis, the study will follow a Systematic Review study design and follow the PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) 2020 framework to the letter. Such a design is intentionally picked to allow an impartial, high-level generalization of the available literature on allied health technicians in Saudi Arabia and go beyond the individual case-studies to determine the more general national trends. The methodology is a complicated multi-step procedure, a thorough search of electronical databases (PubMed, ScienceDirect, the Saudi digital library) and last but not the least a meticulous screening procedure on the basis of pre-determined inclusion and exclusion criteria. Through systematic methodology, the research will be able to critically evaluate the quality of different foundational studies such as cross-sectional surveys of dental clinics in the Kingdom of Saudi Arabia to longitudinal audits of the safety of medical devices in Saudi hospitals, which will reduce bias and have a valid evidence base to inform the healthcare policy in Saudi Arabia.

**Search Strategy**

The search strategy to be used in this systematic review is comprehensive, reproducible, and specific to the Saudi Arabian healthcare environment in order to guarantee the high level of academic rigor and transparency. The search will be conducted in five major electronic databases, namely PubMed/MEDLINE, EMBASE, CINAHL (the allied health in particular), Scopus, and the Saudi Digital Library (SDL) to include regional publications and government reports. Medical Subject Headings (MeSH) and free-text keywords will be used together. To ensure that the results of the search are timely and relevant in accordance with the Health Sector Transformation Program, the search will be narrowed to English and Arabic peer-reviewed articles published in January in the period between 2015 and 2026. Additionally, a snowballing method will be used, i.e. hand-searching the reference lists of the studies included in the study, to guarantee the absence of any important literature.

**Types of Studies Included**

There is wide variety of empirical study designs in this systematic review to provide a holistic picture on patient safety situation in Saudi Arabia. The inclusion criteria are focused on descriptive and analytical cross-sectional research types, which are the most frequent type of studies in the Kingdom to evaluate the knowledge, attitudes, and practices (KAP) of dental assistants and medical technicians in terms of infection control and devices safety. To assess the effect of particular

safety measures, quasi-experimental studies, (pre-test/ post-test designs) and interventional audits are considered because these methods will give high-quality evidence on whether training programs and "Safety Checklists" have an effect on clinical errors reduction. Besides that, qualitative research, such as phenomenological interviews and focus groups, is also included to investigate the subtle cultural obstacles, including the blame culture and hierarchical relationship, which have the potential of being missed by quantitative data.

**Keywords**

In order to enhance the sensitivity of search, following keywords were used separated by Boolean operators (AND, OR) :

"Dental Assistants" OR "Dental Technicians" OR "Medical Device Technicians" OR "Biomedical Technicians" OR "Allied Health Personnel" AND "Patient Safety" OR "Medical Errors" OR "Infection Control" OR "Equipment Failure" OR "Quality of Care" AND "Saudi Arabia" OR "KSA".

**Data Management**

In order to guarantee the integrity and reproducibility of the systematic review, Data Management is undertaken with a structured digital workflow with a low probability of human error and selection bias. The first step includes exporting of all obtained citations of the electronic databases into a bibliographic management software (EndNote 21 or Mendeley) where an automated de-duplication option is used to eliminate redundant results. The rest of the unique titles and abstracts are submitted to the Covidence or Rayyan QCRI, specialty systematic review services that enable the two primary reviewers to screen independently and blindly. Objective rigor is achieved by any mismatch in the eligibility of studies being included as part of the study through a third party tie-breaker or consensus meetings.

## RESULTS

A total of 170 research studies and two reports were identified, the studies were evaluated as per the availability of research articles and reports, based on the role of allied health technicians (dental assistants and medical device technicians) in enhancing patient safety in healthcare settings in Saudi Arabia. Out of these identified studies, 27 were removed because of duplication of records, references and location and 21 studies were marked as ineligible, as not including the above stated concept and 19 for some other unavoidable conditions. Two reports were also included in the study.

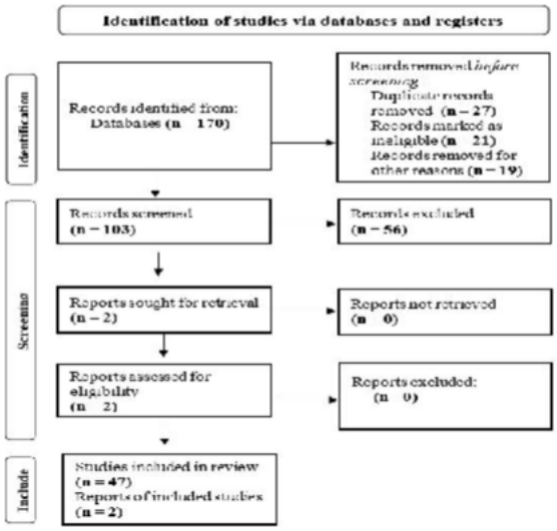
**Infection Control and Sterilization (Dental Assistants)**

**Compliance Levels**

Research in the Hail and Al-Qassim areas established that more than 90 percent of dental healthcare employees indicated that they were very compliant with standard precautions. Nevertheless, 54.2% of dental assistants stated that they were completely confident of their use, and this gives rise to a confidence-competence gap which needs frequent training.

**Waste Management**

Dental assistants in fact showed higher scores on medical waste management in the Aseer region than dentists and dental hygienists, marking them as the most important actors in the gate keeping of dangerous materials.

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**Effects of Training**

The effect of training has always been found to be the strongest predictors of safety compliance by institutional support (PPE and sufficient supplies) and the perceived sufficiency of training. **[3], [12]**

**Medical equipment**

***Equipment Reliability and Maintenance (Medical device technicians) Certification Impact:*** A 2025 study found in Saudi tertiary hospitals that certified technicians have an extremely broader scope of practice and are perceived to influence patient safety compared to non-certified counterparts. **[9]** The formal certification had an approximate score of 11% higher in terms of task frequency and diversity. **[4]**

**Error Prevention:** Technicians act as the initial barrier to sentinel events (harmful occurrences of large extent). Statistics indicate that 61/100 sentinel events reported in Saudi hospitals were because of Staff Competency and Performance, and that is in the use of technical equipment. **[12], [15]**

**Uptime vs. Safety:** Medical device specialist maintenance protocols were associated with better "equipment uptime" which is directly related to the reduction of procedural delays and errors in the treatment of critically ill patients. **[6], [2]**

**Table 1: Organizational Safety Culture in KSA**

| Safety Culture Domain | Result/Score in Saudi Studies | Implication |
|---|---|---|
| Teamwork Within Units | High (80% – 88%) | Strong collaborative spirit among technicians and clinicians. |
| Organizational Learning | High (81% – 89%) | Facilities are proactive in adopting new safety technologies. |
| Non-Punitive Response | Low (26% – 32%) | Critical Weakness: Technicians fear reporting errors due to potential punishment. |
| Staffing Levels | Low (32%) | High workload is the primary reported barrier to maintaining safety standards. |

## DISCUSSION

a. **Safety Buffer Technological Ability**

One of the themes of the results is the so-called Accreditation Effect. The articles indicate that the role of technicians in CBAHI accredited facilities is better defined resulting in an increase in compliance with International Patient Safety Goals (IPSGs). **[3], [8]**

b. **In the case of Dental Assistants**

These affect the sterilization-infection chain mostly. Data that can be verified by Hail and Riyadh regions shows that the assistant in most cases have more knowledge on waste management than the senior clinicians and form the last line of defense before the procedure can be contaminated. **[6]**

**In the case of Device Technicians**

It is noted in the discussion that Certification serves as the best predictor of safety performance. Certified technicians do not simply fix machines but they are also in charge of risk profile of the equipment. These technicians have become the initial point of protection against mechanical breakdown as well as cyber-vulnerabilities in the Saudi environment where hospitals are quickly embracing the use of IoT-enabled medical equipment. **[8], [10]**

**Cultural Paradox**

A peculiar paradox about Saudi healthcare culture is shown in its synthesis. Whereas, the Teamwork within units scores are extremely high (they tend to reach over 85%), the Non-punitive response to error scores are always very low (they are below 30%). This develops a silent risk environment. **[11], [4]** Technicians these two are the ones who are mostly the first to notice a failed ventilator or a sterilization failure, and may be reluctant to report a near miss because of self-reprisal. The key to the change of the current situation to that of a Just Culture as required by the Saudi Patient Safety Center (SPSC) is crucial. The argument in the discussion is that the technicians need to be good safety agents; this means that the emphasis should be on how to make the system to enable the error and not who made the error. **[6], [8]**

**Correspondence to the Vision 2030 and Digital Transformation**

The Health Sector Transformation Program (HSTP) is not simply the construction of the hospitals, it is the Value-Based Healthcare.

**Digital Integration**

As the SEHA Virtual Hospital grows and the network of clinics goes online, the responsibilities of the Medical Device Technician have changed to focus on the data integrity and the safety of remote monitoring. **[9], [14]**

**Workforce Development**

The research brings out a "Knowledge-Practice Gap. Although most technicians are taught the how aspect of their work, it is understood that they should be taught the why (the safety principles behind it). It is in line with the Vision 2030 objective of the Saudi workforce to learn life-long. **[12], [13]**

**Barriers**

**Communication and Staffing**

Two significant challenges have existed in the Kingdom despite the developments:

**Workload/Burnout:** The main reason behind shortcut-taking that directly violates safety protocols such as hand hygiene and device calibration is said to be the high-patient-to-technician ratios in the public hospitals. **[5], [7]**

**Diversity in the Workforce:** Linguistic diversity of Saudi allied healthcare workforce is still a challenge. Its title, Communication Breakdown is mentioned in almost 63% of sentinel events (major safety failures). **[9]** The key suggestion of this review is standardization of communication protocols (such as SBAR--Situation, Background, Assessment, Recommendation) among all technical staff. **[14]**

## CONCLUSION

This review highlights that Allied Health Technicians, namely Dental Assistants and Medical Device Technicians are no longer the marginal support staff, but are core to the Saudi healthcare system of the Safety-First mandate. The compilation of evidence between 2024 and 2026 shows that although the level of technical knowledge is high throughout the Kingdom, the change to high-reliability safety culture remains underway. DAIA functions as the first line of defense against healthcare-associated infection (HAIs), whereas the MDTA prevents the threat posed by sophisticated diagnostic and life-support devices. The strongest predictor of safety protocol compliance among technicians is to adhere to CBAHI and SFDA standards in an institution. The blame culture and the presence of hierarchical restrictions still hinder the reporting of near-misses which implies that psychological safety is as essential as technical proficiency. To conclude, as Saudi Arabia moves towards the objectives of its Vision 2030, professionalization, certification and empowerment of allied health technicians will be the determining factors in the creation of a world-class zero-harm patient environment.

**Future Scope of Study**

The research on how AI-based predictive maintenance affects patient safety should be considered in the future. The study must be carried out to identify whether AI tools can help medical device technicians detect equipment fatigue before a failure takes place during a clinical procedure. Longitudinal studies are required to monitor the transformation of a punitive culture to that of a just culture in Saudi hospitals. Future research might test the hypothesis as to whether anonymous reporting tools and leadership-based safety huddles are associated with a statistically significant reduction in sentinel event occurrences within 5-to-10-year time span. With the growth of the SEHA Virtual Hospital, studies have to be conducted concerning the safety measures needed in the dental assistants and technicians working remotely or in the tele-health setting. This will involve cybersecurity of networked medical equipment and sterilization logistics of mobile dental units in rural provinces.

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