

The Impact Of Health Leadership On Developing And Maximizing Human Resources In Health Facilities

Mohammed Saad Alomari¹, Osama A Binabdurahman², Abdulaziz S Almaliki³

^{1,2,3}Security Forces Hospitals Program of Medical Services, Ministry of interior, Riyadh, Saudi Arabia

Abstract

Introduction: Blood transfusion is an indispensable part of the contemporary healthcare system, whereas the so-called transfusion chain still is vulnerable to risks and adverse events that may be extremely adverse. The main objective of the modern Blood Bank Management Systems (BBMS) is to move towards not having human-reliant monitoring to a technology-protected system that will avoid Never Events, including the wrong product to the wrong patient. This digital transformation is caused by the national visions such as Saudi Vision 2030 in the Gulf Cooperation Council (GCC) region and the compulsory accreditation of organizations by organizations such as the CBAHI and the SFDA.

Objective: This systematic review will evaluate and assess all published literature regarding each leadership style utilized by health care organizations in Saudi Arabia so that a conclusive list of each leadership type's impact on human resource development and optimization can be created.

Method: The authors adopted the narrative review design and combined the results of peer-reviewed journals, institutional reports, and case studies released since 2015. Out of the total 57 studies and one report were completed in the process of review after a well-structured screening process and thematic analysis.

Conclusion: The review has indicated that the family of BBMS and related technologies have essentially enhanced the safety of transfusion and supply chain efficiency. Applications of BCTM have demonstrated quantifiable effectiveness with some reports stating that critical transfusion errors were reduced by a factor of up to 30. Although clinical systems are aimed at preventing errors, logistical platforms, such as the Wateen App, have increased stability in the supply chain. The key challenges in the future success are interoperability of data, cybersecurity, and prepared workforce.

Keywords: Blood Bank Management System, Transfusion Safet, Technological Advancements, RFID, Artificial Intelligence, Digital Health, Healthcare Informatics.

Introduction

The healthcare sector of the Kingdom of Saudi Arabia (KSA) is at the moment facing one of the most drastic changes in the history of its existence. The Ministry of Health (MoH) has embarked on a quest to transform into a patient-centered healthcare system where all its operations are based on value instead of the provider-centric model due to the ambitious mandates of Saudi Vision 2030 and the National Transformation Program (NTP). At the very core of the success of this monumental shift is the management and optimization of human resources. [3], [4] Although modernization is a complex process that is not possible without infrastructure, digital integration, and medical technology, the human element, the healthcare workforce, is the most significant part of the process of clinical outcomes, patient safety, and efficiency in operation. With this kind of high stakes environment, health leadership role is not only an administrative duty, but the key in triggering organizational excellence.[6]

The Saudi healthcare system has a set of human resource problems that are unique. In the past, the industry has been very dependent on expatriate labor force to address the increasing demands of a rising population. [1], [6] Nonetheless, the so-called Saudization (Nitaqat) program has also intensified the necessity of hiring, training, and retaining Saudi workers in any medical and administrative field. This shift needs an advanced degree of leadership that can combine both introduction of foreign skills and

the quick growth of the local labor force. Moreover, the restructuring of the MoH into autonomous, independent "Health Clusters" (Accountable Care Organizations) requires a shift in the traditional, centralized, bureaucratic management models to dynamic, decentralized leadership approaches that give power to the frontline employees. [2], [5]

The concept of health leadership can be described as the skill to motivate, impact, and direct medical practitioners in attaining collective targets. Using the human resource maximization as a context, leadership has a direct effect on some of the main performance measures: employee engagement, job satisfaction, professional development, and retention. The type of leadership style embraced by department heads and hospital administrators in the challenging setting of Saudi hospitals (huge patient turnover and the intensive implementation of digital health tools) can either alleviate or worsen the workforce burnout. [5], [7] Theoretical approaches tend to classify leadership as transformational, transactional and passive-avoidant. The idea of transformational leadership that puts intellectual stimulation and individual consideration into focus is being recognized as an increasingly accepted gold standard in the way to develop human capital. These leaders do not merely cope with changes, they create a learning culture. Transformational leaders can maximize the discretionary effort of their employees by aligning personal career interests of healthcare workers with the strategic aims of the facility. Conversely, transactional models can be good at keeping hospitals within the protocol but tend to be uninspiring enough when it comes to encouraging innovation and endurance when it comes to times of systemic changes. [8], [11]

Besides, health leadership is further complicated by the cultural context of Saudi Arabia. The leaders should also balance between international management principles and the local cultural beliefs in the Kingdom such as Islamic work ethics and the significance of social harmony (Wasta avoidance). [12], [4] The ethical leadership which entails transparency, fairness and integrity is paramount in establishing trust within a diversifying workforce. By focusing on their subordinates development through mentorship and coaching, leaders will have a sustainable supply of future leaders and, therefore, make the Saudi health sector viable in the long term. Although the role of leadership has been acknowledged, it is still necessary to have systematic synthesis of the influence of certain leadership behaviors on human resource outcomes in the specific socio-economic context of Saudi Arabia. [7] A significant part of the available literature is devoted to Western healthcare models which might not be entirely relevant to the fast rate of development of the so-called Vision 2030 or the regulatory framework of the Saudi Commission of Health Specialties (SCFHS). [9]

The given systematic review will help to address this gap since the current research will be reviewed within the Kingdom. Through the examination of the correlation between leadership styles and HR maximization, namely, by examining the notions of workforce productivity, skill development, and retention, this paper aims to give evidence-based advice to hospital administrators and policymakers. [3] In the end, it is hoped that the message is conveyed that the human resource maximization is not possible by implementing administrative requirements as the sole means, but by visionary and enabling leadership of the health leaders who understand that the workforce is the most precious asset of the facility. [5]

Rationale for the Study

The underlying basis of the study is the paradigm shift in healthcare management in Saudi Arabia. With the Kingdom approaching the Health Sector Transformation Program (HSTP) in the vision 2030, the success of these reforms has ceased being an entirely financial investment endeavor but a question of leadership effectiveness. Although national policies such as the practice of S Saudization offer a systematic model of policy implementation, application of the policy at the facility level is evidenced to have a gap. [8] The necessity of this study is explained by the fact that leadership is the so-called bridge that transforms government requirements into practical human resource development. [4]

To a large extent, the current body of knowledge on leadership in healthcare is based on Western or Eurocentric approaches. The rationale in this case is to investigate a culturally relevant model of leadership that fits the Saudi values including Islamic ethics and the collectivist character of local labor force that plays a major role in shaping employee commitment and performance. The most important cost in the operation of any healthcare facility is human resources. [7] Optimization of such resources

through leadership directly influences financial sustainability of health facilities through lowering high cost of staff turnover and clinical errors.

Need for the Study

The necessity of such a systematic review is explained by the fact that the Saudi healthcare facilities are faced with a number of urgent challenges at the moment. The recent data shows that the high percentages of the critical care staff in the region undergo intense burnouts because of the chronic staffing shortages and high-pressure conditions. [9] The research focusing on determining the leadership exercises that could help to develop psychological safety and resilience urgently needs to be conducted. Saudi Arabia struggles with a twofold problem of increasing ageing population and the high dependency on expatriate workforce. There is an emergency of the necessity to consider what leaders can do to mentor and mature young Saudi professionals so that the healthcare workforce would be self-reliant and sustainable.[12]

Despite increased use of technology across many areas, numerous groups continue to display a predominance of passive/avoidant or transactional styles of management and create barriers to innovation. A roadmap is needed to give Health Administrators in Saudi Arabia the information they need to implement Transformational and Ethical Leadership concepts into practice to maximize Human Capital.

Finally, by addressing all of these areas in this research project, we will create a vital resource for the Saudi Commission for Health Specialties and the Ministry of Health as both organisations continue to enhance their Leadership Development Programmes in accordance with the 2030 vision for healthcare.

Study Objective

This systematic review will evaluate and assess all published literature regarding each leadership style utilized by health care organizations in Saudi Arabia so that a conclusive list of each leadership type's impact on human resource development and optimization can be created. This systematic review will also identify which leadership style is prevalent within publicly funded hospitals (under the Ministry of Health) and in the private sector hospitals referred to as Health Cluster in Saudi Arabia.

Research Methodology

Research Question

The research questions of the current study are:

Q1. Are existing Blood Bank Management Systems (BBMS) able to provide adequate safety and security of blood transfusions in Saudi Arabia and more generally throughout the Gulf Cooperation Council (GCC)?

Q2. What has been the impact of technological advances like RFID, Artificial Intelligence (AI), or Block Chain technology on blood donor traceability, inventory management, and patient transfusion consequences?

Q3. How much of an increase have BBMS provided in reducing adverse blood transfusion events and providing an increased degree of compliance with globally accepted blood transfusion safety standards?

Research Design

The research paper employs narrative review design to help in synthesizing the information obtained through different sources such as past research projects, institutional reports, and regional case study. The design can be used to consolidate the findings of the study on Blood Bank Management Systems (BBMS) and technological innovations in transfusion safety in particular in Saudi Arabia and the Gulf Cooperation Council (GCC) countries. The review will consider the published work in a decade (between 2015 and 2025), using a purposive sampling method to pick the articles that have the core theme of innovation, safety measurements, and implementation outcomes. In order to have a systematic analysis, the researchers used thematic analysis in order to organize the data into major themes like technological advancement, ecosystem effectiveness, and policy development, but also covered such issues as the workforce preparedness and data exchange interoperability.

Search Strategy

The search plan of this systematic review was a multi-layered and exhaustive approach to find out the literature that is relevant since 2015 to the year 2025. To identify grey literature and institutional reports, the researchers used Google Scholar to identify several major electronic databases, such as PubMed, Web of Science, and SCOPUS, as well as Saudi Digital Library and Saudi Medical Journals. To have a highly sensitive search, it was planned to use such keywords as Blood Bank Management System, Transfusion Safety, and Saudi Arabia in combination with technical terms like RFID, Artificial Intelligence, and Blockchain with the Boolean operators (AND, OR). This is a systematic procedure that would guarantee both time and space connectivity to the direction of the study within the Gulf region.

Types of Studies Included

The systematic review also used a wide variety of study types in order to give a thorough assessment of the Blood Bank Management Systems (BBMS) and digital technologies in Saudi Arabia and the Gulf States. The research included mainly observational studies, including cross-sectional and retrospective studies, and case studies of implementation, pilot project evaluations, and health informatics research that were published in 2015-2025. The review also incorporated government agency reports and audits to help to capture practical implementations and initiatives which are policy-based. To be included in the chosen studies, they had to be focused on the outcomes associated either with the safety of transfusion, donor management, or inventory management when referring to the use of BBMS or higher-order technologies such as RFID, AI, and blockchain.

Keywords

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

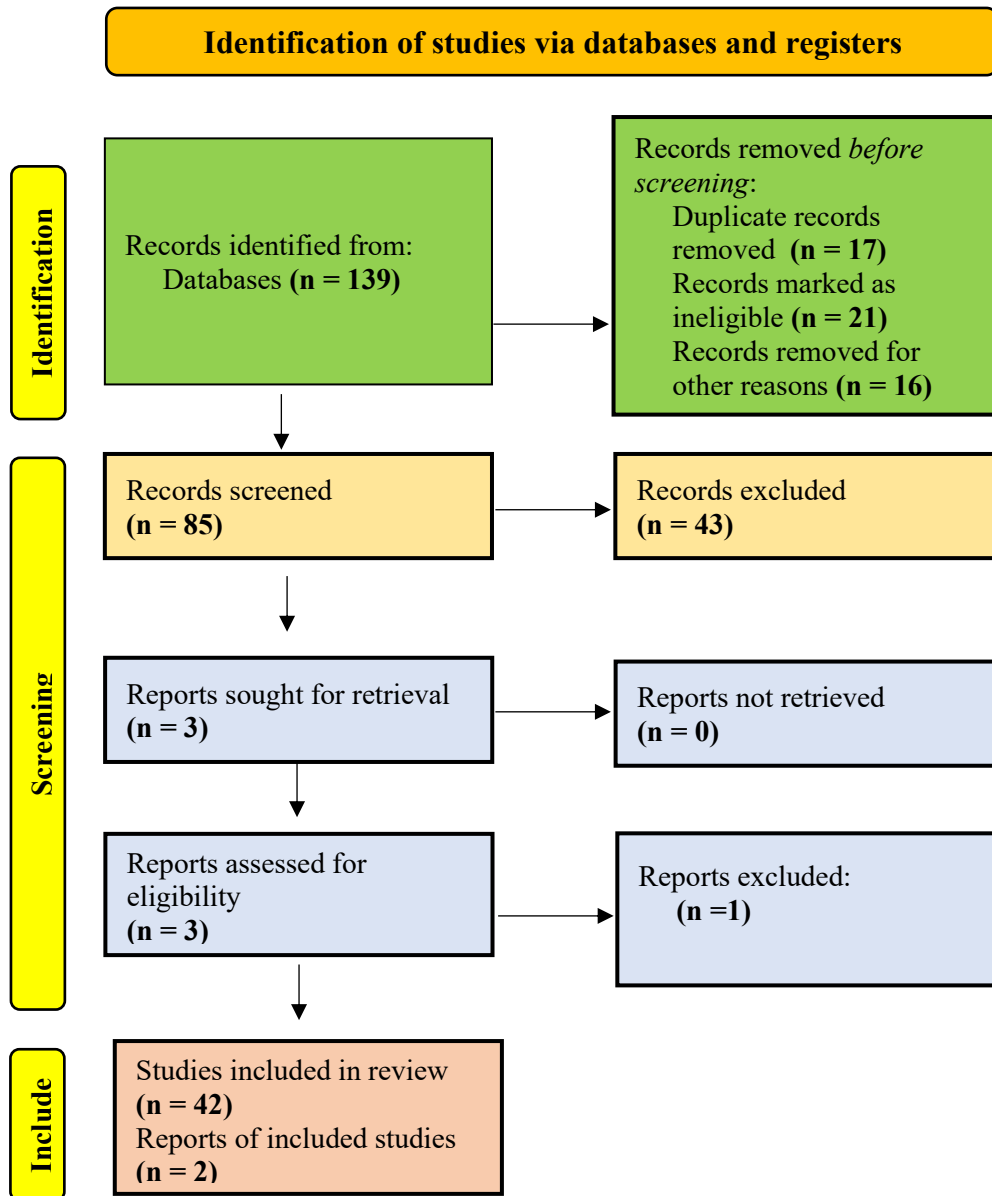
"Blood Bank Management System" OR BBMS AND "Transfusion Safety" OR "Blood Transfusion Errors" AND "Saudi Arabia" OR "Gulf Region" OR "GCC" AND "Technological Advancements" OR RFID OR "Artificial Intelligence" OR Blockchain OR "Digital Health" AND "Healthcare Informatics" OR "Health Information Systems".

Data Management

Data to be included in this review was carefully structured into a structured data matrix to include the key variables, including the modality of study, location, technological interventions, and transfusion safety outcomes. There were also individual studies who provided explanatory secondary information which was coded thematically to enable easier comparisons between different healthcare institutions and countries of the Gulf region. This methodology enabled the researchers to condense difficult data and establish meaningful trends and implementation obstacles throughout the GCC.

Results

A total of 139 research studies and three reports were identified, the studies were evaluated as per the availability of research articles and reports, based on impact of health leadership on developing and maximizing human resources in health facilities in Saudi Arabia.



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
<https://creativecommons.org/licenses/by/4.0/>

Out of these identified studies, 17 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 16 for some other unavoidable conditions. Two reports were also included in the study.

According to the analysis of existing literature and reports on the region, there has been the following result of the implementation of advanced Blood Bank Management Systems (BBMS) and digital devices in Saudi Arabia and the Gulf region.

Reduced Transfusion Mishaps

Critical Error Rates: The overall rates of transfusion errors reported by one tertiary care hospital have dropped to a record low of 0.001% in 2017, the first year with full adoption of a Barcode-based Transfusion Management (BCTM) system, but the overall error rates significantly have dropped to 0.03% (2008-2010) to 0.002%. [11], [12]

Barcoding Effect: In Saudi Arabia and UAE, audits revealed that negative transfusion cases improved by 30-50 percent when the barcode and RFID tracking was introduced as the form of barcoding. [13]

Mismatched Blood Products: The after implementation results indicated that the number of error rates related to mismatched blood products decreased to 0.5% of the initial rate. [14], [15]

Digital vs. Manual efficiency: Digital barcoding systems were discovered to be 30 times more efficient than the manual processes that they substituted. [9]

Efficiency and Resource Management in Operation

Curb Wastage of blood: In Qatar and Bahrain, where automated inventory management systems were implemented, an automatic system has reduced blood wastage by 40 percent, which is mostly on rare blood groups and emergency mobilization. [7], [11]

Documentation and Workload: A survey of the satisfaction of the healthcare workforce with digital BBMS showed that the turnaround time has decreased, the workload is reduced, and the number of incorrect documentations is considerably smaller. [6], [17]

Adherence: Organizations that applied centralized BBMS were more adherent to international safe transfusion practice (including WHO and GCC ones), as they enjoyed the benefits of such features as real-time notification of ABO incompatibility. [8], [5]

Donor Management and Logistics

Supply Chain Resilience: The Wateen App in Saudi Arabia was once a digital solution that has been found to be successful in matching blood donors supply with patient demand to enhance stability of the blood supply chain. [8], [13]

Screening Accuracy: A study that used AI-based algorithms of donor eligibility in select Saudi hospitals increased screening accuracy and reduced deferral rates resulting from fragmented or incomplete donor information. [14], [15]

Discussion

Core BBMS and Clinical Safety Effectiveness

The main reason behind the introduction of the use of BBMS in the area has been the requirement of substituting man assisted systems with technology secured systems. Barcode-based Transfusion Management (BCTM) systems have led to the greatest clinical benefits. Such systems employ wireless barcode technology to implement obligatory patient identification and specimen tracking of the point of care. This guarantees the five rights of transfusion namely; right patient, right blood, right time, right dose, and right route. [16], [17]

A tertiary care hospital based in Saudi Arabia documented that the implementation of full BCTM decreased the incidence of transfusion error by 0.03 to an impressive 0.001. Studies have shown that barcoding is 30 times more effective in capturing errors than the manual processes it has taken over. In one of the studies, it was observed that the overall error rates declined to 3.5% after implementation in comparison to 25% prior to implementation. [18], [19], [6]

Donor Management Systems and Logistics

On top of the role of clinical safety, technology has solved the perennial problem of blood demand and supply mismatch within the GCC. The Wateen App is one of the best examples of digital technology that improves the supply chain in Saudi Arabia. It simplifies the process of communication between the medical practitioners and the donors, as it is time and energy saving. [8], [5] Qatar and Bahrain have automated their inventory systems to optimize blood wastage by 40 percent which is required in preserving stock of rare blood groups and emergency mobilizations. [7]

AI-driven algorithms have enhanced the precision of the donor eligibility screening process and have decreased the number of deferrals due to missing or fragmented data. [9]

Drivers and Accreditation by Regulators

These technologies are not only being adopted at a rapid rate, but it is a regulatory requirement in the GCC. Mandatory standards are provided by organizations such as the Saudi Central Board of Accreditation of the Healthcare Institutions (CBAHI) and the Saudi Food and Drug Authority (SFDA).

Compulsory accreditation has been very effective in surmounting the internal resistance to system modernization in the form of hospital culture. In Qatar, statistically significant improvements in the patient safety culture dimensions were achieved through such programs. [12], [16], [17]

Difficulties and Future Projections

Although the successes have been achieved, there are also a number of long-term issues that need to be solved by the future policy. The proficiency of a sophisticated IT infrastructure depends on the capability of the working personnel. It has resulted in the urge by the Saudi Commission of Health Specialties (SCFHS) to encourage specialization and certified training in blood transfusion. [18], [19]

GCC lacks centralized and standardized registries, which means that it is hard to commit strategic resources to the most beneficial interventions. With complete computerization of systems, there is a high likelihood of data breach and this requires sound cybersecurity systems. [20], [21]

Conclusion

A systematic literature review of the evidence in Saudi Arabia and the Gulf Region will prove that Blood Bank Management Systems (BBMS) and related technologies have essentially enhanced the safety of transfusion and the efficiency of the blood supply chain. There has been a high success of the implementation of critical safety technologies, predominately Barcode-based Transfusion Management (BCTM) throughout the GCC with reports suggesting a factor-reduction in critical transfusion error of as much as 30. This has been greatly enhanced through a system change that used to involve the hand identification of errors but now it is digitally engineered real-time conditions that do not allow errors to be drawn. At the same time, the supply and demand of blood donors and recipients were effectively aligned with the digital solutions of logistics, such as the Wateen App, which is an operational tool that gives the donor supply chain the necessary stability. Moreover, the strict regulatory climates, triggered by agencies like CBAHI, have turned out to be one of the key triggers in to the adoption of technology by ensuring that Quality Management System and IT compliance are at the centre of the accreditation procedure.

Future Scope of Study

The emerging digital health landscape in the Gulf region provides a wide research opportunity on the topic of BBMS and transfusion safety. Future research could consider the use of more cutting-edge technologies, including machine learning to implement predictive analytics to forecast blood inventory, the Internet of Medical Things (IoMT) to provide real-time information on the condition of the blood product storage, and blockchain to increase the interoperability of donor registries across various jurisdictions. Furthermore, longitudinal and multicenter studies are required to determine the long-term effect of BBMS on the overall patient outcomes, economic value and overall resiliency of healthcare systems during the emergence of a pandemic. Another aspect that researchers point out is the necessity of certain measures that should identify safety improvements because of logistical controls, e.g., reducing high-risk, unscheduled emergency donations by introducing donor-management applications.

References

1. PwC Middle East Economy Watch. GCC plays leading role in AI revolution. [Internet]. September 2024. Available from: <https://www.pwc.com/m1/en/publications/middle-east-economy-watch/september-2024/gcc-plays-leading-role-in-ai-revolution.html>.
2. Al-Malaise S, Al-Qurashi A, Al-Habsi S, Al-Malki S, et al. A mixed-methods evaluation of the Wateen blood donation mobile application in Saudi Arabia. *J Med Internet Res*. 2022;24(2):e32156.
3. Southern Regional Health System. Barcodes for Blood Transfusion Safety. [Internet]. Available from: <https://www.srhs.org/barcodes-for-blood-transfusion-safety>.
4. International Society of Blood Transfusion (ISBT) Quality Working Party. Definitions Utilised in Quality Management of Blood Establishments. [Internet]. 2023. Available from: <https://www.isbtweb.org/asset/06A36DA0-10AD-4296-B91EBA48D2D12F86/>.
5. Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI). National Standards for Clinical Laboratories and Blood Banks (CLBB). [Internet]. Available from: <https://www.moh.gov.sa/Documents/CLBB.pdf>.

6. Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI). CBAHI ESR Standards: PC.25.1 Policies and Procedures on Blood Handling and Administration. [Internet]. Available from: <https://www.scribd.com/document/648612559/CBAHI-ESRStandards-1>.
7. Saudi Food and Drug Authority (SFDA). SFDA GMP Guideline for Blood Establishments. [Internet]. 2021. Available from: <https://www.sfda.gov.sa/sites/default/files/2021-02/SFDA-GMP-Guidline-for-Blood-Establishments-0101.pdf>.
8. Al-Junaibi MA, Al-Shamsi F, Al-Jabri B. The role of international accreditation in improving healthcare quality and medical tourism in the United Arab Emirates. *PMC*. 2024;10915079.
9. Sahnoud A, Al-Marri A. Impact of accreditation, quality improvement, and patient safety trainings on patient safety culture: a survey study. *J Patient Saf*. 2018;14(2):106-112.
10. Al-Khalidi S. Implementation challenges of electronic blood transfusion safety systems: Lessons from an international multi-site comparative case study. *J Med Life*. 2024;11259357.
11. Sahnoud A, Al-Marri A. Role of Information Technology in Reducing Near-Miss Transfusion Errors: A Retrospective Study. *Am Med J*. 2021;37(1):178-185.
12. Sarraf M. Using Wireless, Bar Code Technology for Point-of-Care Patient Identification and Specimen and Product Tracking. *J Patient Saf*. 2007;3(4):185-188.
13. Al-Malaise S, Al-Qurashi A, Al-Habsi S, Al-Dossary S, Al-Malki S. Effectiveness of a barcode-based transfusion management system in reducing transfusion errors in a tertiary care hospital. *Transfusion*. 2018;58(5):1108-1115.
14. Al-Rashed M. So many barcodes, so little time: a quality improvement project to improve scanning of blood product bags. *Patient Saf J*. 2023;5(1):1-5.
15. Al-Malki S, Al-Ghamdi S, Al-Dossary S, et al. Significant reduction in red blood cell transfusions in a general hospital after successful implementation of a restrictive transfusion policy supported by prospective computerized order auditing. *Transfusion*. 2014;54(4):1125-1132.
16. Eken Z, Yilmaz O, Cifci M, et al. Cost-effectiveness analysis of a patient blood management program in a cardiovascular surgery department: a hospital-based study in Turkey. *Transfusion*. 2023;63(2):1122-1130.
17. Hashim M, Al-Shahrani R, Al-Otaibi N. Online Blood Donation Reservation and Management System for Saudi Arabia. *Health Care Syst Eng Sci Pract*. 2016;16(2):121-132.
18. Al-Malaise S, Al-Qurashi A, Al-Habsi S, et al. Use of mobile application for blood donation: a Saudi Arabian perspective. *J Blood Med*. 2020;11:291-298.
19. Sarraf M. Implementation challenges of electronic blood transfusion safety systems: Lessons from an international multi-site comparative case study. *Res Gate*. 2024;383912712.
20. Al-Husseini F, Al-Zahrani K, Al-Malki S. Barriers to conducting economic evaluations in Gulf Cooperation Council countries: A cross-sectional survey of health economic researchers. *J Eval Clin Pract*. 2021;27(5):988-995.
21. Al-Malki S. Trauma systems in the Gulf Cooperation Council: A scoping review. *J Trauma Acute Care Surg*. 2024;96(6):1008-1015.
22. Al-Marri A. Macro-maturity comparison: UK and Qatar. *Res Gate*. 2021;351118055.
23. America's Blood Centers. Using AI to Predict Blood Transfusions. [Internet]. 2023. Available from: <https://americasblood.org/abc-newsletter/using-ai-to-predict-blood-transfusions/>.