Yousef M. Alsofayan et al. Saudi J Er Med. 2024;5(2):101-109
DOI: 10.24911/SJEMed.72-1700632673

ORIGINAL ARTICLE

An innovative curriculum development experience: emergency medical dispatch role in the healthcare transformation vision of Saudi Arabia

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ABSTRACT

Background: Healthcare medical dispatch systems play a fundamental role in the daily operations of prehospital services. This study aims to describe the curriculum development of the Emergency Medical Dispatch (EMD) Program to improve the training of dispatchers and to share the experience in the interest of better prehospital dispatch systems.

Methods: A selected group of education experts and academics in emergency medical services dispatch were assigned to develop an EMD curriculum over 6 months. The data of this study was collected by reviewing approved documents of the EMD Program including program curriculum, syllabus, logbook, and exam blueprint after approval letters were received from the Health Academy, Saudi Commission for Health Specialties.

Results: The development of the EMD program utilized a consecutive mixed approach starting with a competency-based with backward design method to ensure the achievement of targeted outcomes followed by the Kern Six-step curriculum development model, namely: (1) problem identification and general need assessment; (2) targeted need assessment; (3) goals and objectives; (4) educational strategies; (5) implementation; and (6) evaluation and feedback. This resulted in four comprehensive modules with a 14-week EMD Program.

Conclusion: EMD services play a fundamental role in the daily operations of prehospital healthcare services. Developing an EMD Program with a consecutive mixed approach might improve the current operations of EMD services.

Keywords: Dispatch, curriculum, Saudi Arabia, healthcare transformation, vision 2030.

Introduction

Healthcare medical dispatch systems play a fundamental role in the daily operations of prehospital services. It allows the basic interpretation of various dispatch-related systems, receiving incident calls, categorizing cases, guiding proper resources deployment, and providing proper instructions before the arrival of healthcare providers. The scope of services extends to include interfacility transport, medivac missions, and certain overwhelming situations such as mass causality incidents. In light of the Kingdom of Saudi Arabia's (KSA's) health sector transformation plan as part of Vision 2030, developing an Emergency Medical Dispatch (EMD) Program as part of the essential prehospital services will

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Received: 22 November 2023 | **Accepted:** 31 December 2023

allow rapid and competent healthcare delivery. Vision 2030 involves many sectors in the country and contains a group of themes to achieve a vibrant society with a solid national identity and a healthy life, a thriving economy, and an ambitious nation [1].

In KSA, the Saudi Red Crescent Authority (SRCA) is the national provider of prehospital services and receives incidents via the unified number "997," as the main source, along with others such as the public safety unified number "911" and certain electronic applications, such as Asafny and Tawakkalna [2-5]. The dispatching process is subsequently facilitated by a dispatcher with prerequisite exposure to selected training courses including an Emergency Telecommunicator Course (ETC) and an EMD Course [6]. The triage, resource deployment, and pre-arrival instruction are applied according to local SRCA protocols. Nevertheless, to ensure rapid access to healthcare services efficiently dispatchers are required to fulfill specific competencies in EMD. Therefore, considering the urgent demand for a competency-based program, the Health Academy (HA), affiliated with the Saudi Commission for Health Specialties (SCFHS), which specializes in health professional training in KSA, developed a novel curriculum named EMD Program as part of vocational training of health professions education [7].

The EMD Program fulfills an essential role in caring for patients in the prehospital field and is geared towards favorable outcomes based on the acquisition of foundational knowledge, skills, and attitudes. This program prepares dispatchers to be a member of the healthcare system by providing rapid access to essential prehospital services efficiently and effectively. It will be used to meet the demand in the dispatch workforce for the nationalization of healthcare professions' roles and jobs in alignment with the KSA Vision 2030 and the health sector transformation plan [1].

In this study, we aim to describe the curriculum development of the EMD Program in KSA to improve the novel training of dispatchers and share our experience to allow better prehospital dispatch systems.

Materials and Methods

Due to the urgent demand for a comprehensive EMD Program in the region, as part of the national health sector transformation plan to improve access to prehospital services, the HA, in collaboration with the SRCA, recruited a group of education experts in Emergency Medical Services (EMS) dispatch to develop the dispatch curriculum. Affiliated with SCFHS, the HA, located in Riyadh, Saudi Arabia, aims to improve training in the health sector by increasing the knowledge and effectiveness of the healthcare provider through well-structured training programs. The SRCA is the national provider of prehospital services in KSA with over 450 dispatchers in thirteen different dispatch centers, centrally monitored by the operations center at headquarters in Riyadh, Saudi Arabia. Experts from both entities included emergency medicine consultants (Prehospital and Medical Education Fellowships), senior paramedics (PhDs with more than 5 years of experience in EMD), and experts in health professions education and curriculum development who joined the EMD education committee. Frequent focus group discussions of the twelve members of the committee were conducted over 6 months, in Riyadh, to discuss best dispatch practices and build a framework for the program curriculum, syllabus, logbook, and exam blueprint. All decisions of the committee were attempted to be made by a unanimous vote and for any disagreement, an affirmative vote of a majority of members was taken. The development of the EMD program utilized a consecutive mixed approach starting with a competency-based with backward design method followed by the Kern Six-step curriculum development model and adapting "progressivism" as a philosophical foundation of the program to ensure the achievement of targeted learning outcomes [8,9].

The backward design method which includes identifying the learning outcomes before structuring the program competencies led to four modules and seventeen competencies designed in a stepwise comprehensive approach that mandates trainees go through consecutively. First, introduction to EMD (Module one) targeting basic communication and ethics-related issues in the dispatch profession. Next, the basic interpretation of the dispatch system is addressed in Basic EMD Concepts (Module two). In EMD Response and Management (Module three) trainees will learn how to approach a variety of incidents, categorize them, deploy proper services, and instruct callers in a certain fashion to respond properly (pre-arrival instructions). Finally, Crisis Management, Quality and Legal Issues and Coaching in EMD (Module four) contains advanced requirements in dealing with overwhelming resources, dispatch quality, medicolegal aspects, stress coping mechanisms, and how to coach others in the profession. The total content hours are 40 hours for module 1, 40 hours for module 2, 120 hours for module 3, 200 hours for module 4, 120 hours for internship and certifications, and 40 hours for the final exams. All competencies embedded in each module used Bloom's Taxonomy of Educational Objectives that embraces the domain of learning, namely (i) knowledge, (ii) psychomotor skills, and (iii) attitude as shown in Table 1 [10].

The Kern Six-step curriculum development model, the approved approach by the HA, SCFHS used nationally for medical and allied health programs guided the logical progression of the curriculum including (1) problem identification and general need assessment; (2) targeted need assessment; (3) goals and objectives; (4) educational strategies; (5) implementation; and (6) evaluation and feedback [9]. The curriculum was subsequently reviewed by two independent expert external reviewers and feedback was addressed accordingly. Upon fulfillment, the EMD Program was uploaded to the HA platform for EMD Program trainees and interested individuals to access easily [11].

The main aim of this study is to describe the approach followed in the development of the newly developed EMD Program and ultimately standardize dispatch-related training programs. The data of this study was collected by reviewing approved documents of the EMD Program including the program curriculum, syllabus, logbook, and exam blueprint after approval letters were received from the HA, SCFHS.

Table 1. *Modules and competencies of EMD program.*

Module	Competencies	Knowledge	Skill	Attitude
Module 1 Introduction to EMD	Act professionally and ethically in a capacity as an EMDs	✓		✓
	Demonstrate roles and responsibilities of the EMDs	✓		
	Recognize the basics of telecommunication skills for emergency and non-emergency cases	✓	✓	
Module 2 Basic EMD Concepts	Outline the basics of emergency telecommunication technologies	✓	✓	
	Interpret data from Geographical Information System/Mapping systems	✓	✓	
	Interpret computer-aided dispatch system	✓	✓	
Module 3 EMD Response and Management	Describe the basics of anatomy and physiology of the human body as it pertains to EMDs practice	✓		
	Organize dispatch coding system for emergency and non-emergency cases	✓	✓	
	Apply dispatch life support services	✓	✓	
	Describe call instruction management techniques for various scenarios	✓	✓	
	Make use of the caller management techniques	✓		✓
	Define common medical and traumatic emergencies in EMD	✓	✓	
Module 4 Crisis Management, Quality and Legal Issues and Coaching in EMD	Evaluate crises and emergency management in EMD	✓	✓	
	Utilize quality management in EMD	✓	✓	
	Identify essential legal aspects and security situations in EMD	✓	✓	✓
	Analyze stressors in the EMD profession	✓	✓	✓
	Practice coaching in EMD	✓	✓	✓

All Minutes of Meetings of the committee were gathered by two data collectors and filled into electronic sheets and any discrepancies were judged by the main author after reviewing approved documents. Data privacy was maintained by a two-step verification system with limited access to two experts in medical education as they analyzed and interpreted all data of this paper.

Results

Upon writing this manuscript, the EMD Program training has not yet started, and the first batch is expected to be enrolled in the program by the end of the year 2021. Trainees will be enrolled on a full-time, continuous basis for the entire 14-week duration of the EMD Program including examination weeks. After trainees complete graduation requirements, they will receive along with a certificate of graduation, a professional classification and registration as an EMD specialist by SCFHS and be licensed to work in dispatch centers in KSA. The admission criteria for applicants are detailed in Table 2 and were kept in mind when designing the curriculum based on the expected competencies of the trainees [11].

All dropout, postponement, and withdrawal requests during the EMD Program will follow HA guidelines and a service request should be applied accordingly [12]. After written notification of acceptance into the EMD Program, trainees' responsibilities and rights will apply before and during the clinical experience as shown in Table 2.

Problem identification and general needs assessment

The EMD system is growing in the healthcare sector and more functions are added constantly. Receiving emergency calls requires achieving competencies in knowledge, skills, and attitudes to enable the categorization of cases and the deployment of proper resources. Globally, a variety of dispatch systems exist and are built based on local demand, type of incidents, and terrain differences leading to a complex of operation services, hence standardizing international dispatch policies and procedures is impractical. Moreover, Emergency Medical Dispatchers (EMDs) are from different backgrounds and experiences and receive a variety of training programs to develop and maintain their fundamental dispatching skills throughout their career, adding more to the challenge of unifying dispatch language.

In KSA, EMDs receive vigorous dispatch-related training programs set by the SRCA to maintain daily operation services in EMD. However, no dispatch program with targeted competencies and learning objectives according to which dispatcher trainees can be assessed regularly, currently exists. Building an EMD Program with a recognized SCFHS classification, in alignment with the national health sector transformation plan, would improve access to prehospital services through efficient and effective dispatch services and develop a clear career pathway for EMDs in KSA.

Targeted needs assessment

An international benchmarking of many EMD systems, curricula, programs, and courses was set by the committee after reviewing several EMD books, relevant training manuals, and related scientific papers. This included: (1) National Emergency Communication Institute-USA (EMD National Certification Course); (2) National Highway Traffic Safety Administration-USA (NHTSA) (NHTSA EMD National Standard Curriculum); (3) The Association of Public Safety Communications Officials International; (4) Seneca College-Canada (911 and Emergency Services Communications); (5) The Principles of EMD textbook 6th edition; and (6) Many

Table 2. *EMD program admission criteria, trainees responsibilities, and rights.*

Admission Criteria	
Qualification	Bachelor's degree in Health Administration or its equivalent
Licenses	Valid SCFHS medical license in Health Administration
Certification	Active Basic Life Support Certificate
Health status	Good health
Skills	Adequate computer skills
English language proficiency	Proof of English exam with a total International English Language Testing System score not less than 4.5, or Test of English as a Foreign Language total score of 32-34 minimum
Trainees Responsibilities	
Before the EMD program	➢ Purchase required uniforms and required equipment ➢ Provide health requirements according to the institution's regulations ➢ Arrange and plan transportation needs to avoid absenteeism
During the EMD program	➢ Are expected to wear the required uniform and adhere to all clinical settings rules and regulations as inappropriate behaviors and offensive remarks will not be tolerated in the program ➢ Must notify their clinical instructor, or faculty member regarding any absences (emergencies, absence from classes, and clinical settings) as any unexcused absences may result in non-admission to examinations
Trainees Rights	
➢ Introduced to the program and have clear roles and objectives described ➢ Receive orientation on the educational material and training sites ➢ Trained in fundamental aspects of EMD ➢ Access dispatch operation centers to gain the required knowledge and skills ➢ Allowed to take authorized breaks ➢ Provided with regular constructive feedback	

Table 3. *Goals and objectives of EMD program.*

Goals and Objectives
➢ Illustrate proper communications skills and professionalism ➢ Describe basic telecommunication skills ➢ Interpret dispatch-related systems ➢ Prioritize incidents categories ➢ Explain common medical emergencies ➢ Provide pre-arrival instructions ➢ Recognize occupational stress and coping mechanism ➢ Identify quality improvement projects ➢ Recognize major legal issues ➢ Coach others in EMD

others [13-33]. Locally, the committee evaluated current dispatch systems, met with employees and experts in the field, and collected feedback evaluations from the local dispatch community, to set a group of learning outcomes covering the three learning domains of knowledge, skills, and attitudes. The proposed targeted needs, therefore, were set to contain competencies in professionalism and communication, basic knowledge, and skills in interpreting various dispatch systems, prioritizing emergency calls, providing pre-arrival instruction, and dealing with special situations in EMD classified into four modules as shown in Table 1.

Goals and objectives

The goal of the EMD Program is to improve the integration of current dispatch systems and unify the dispatch language as part of the national health sector transformation plan and Vision 2030 to accelerate the provision of efficient prehospital services and reinforce the role of the EMDs in receiving emergency and non-emergency calls, the dispatch of ambulances to the sites required according to the medical protocol, coordination with the concerned authorities, and directing callers on how to deal with emergency and non-emergency cases. The EMD Program objectives were identified and matched with competencies followed by further elaboration of specific learning outcomes for each module to guide the educational process and Bloom's Taxonomy of Educational Objectives was used as shown in Table 3 [10].

Educational strategies

E-learning and simulation-based learning activities are evolving in health professions education and are being adopted to test different dispatch skills along with the program. In a well-equipped simulation environment (simulation lab), trainees will be exposed to a variety of pre-recorded scenarios to measure each competency by specialized expert simulation educators. A debriefing discussion after each session will take place to highlight passing points, lessons learned, and areas for improvement in every case. To ensure effective educational strategies and achieve the educational objectives of the EMD Program, Kolb's two levels of experimental learning theory (a four-stage cycle and four separate learning styles) were adopted [34]. The experimental learning cycle includes: concrete experience (CE) (feeling); reflective observation (RO) (watching); abstract conceptualization (AC) (thinking); and active experimentation (AE) (doing). In

Table 4. *Tentative schedule and modules exam percentages of EMD program.*

Week	Module	Topics	Educational Strategies	Clinical Rotation (EMD Center) per week	Module Exam Percentage
1	Module 1	• Introduction to EMD Program • Essential basics of ethics and communication skills • EMD professionalism attributes • Impact of EMD on health system • Profiles of EMD duties • Misconceptions in EMD • Partnership in EMD	• Group discussion • Reading assignments • Simulation with debriefing and discussion • Review and summary of the week	1 day (orientation)	10%
2	Module 2	• Basic model of communication in EMD • Techniques in telecommunications • Role of telecommunications in EMD • Key steps of the EMD call process • Quantity and quality care in EMD • Approach to callers and EMD protocols • Handing over the dispatch message • Dispatch diagnostic tools • Interpreting geographical information system/mapping system • Interpret computer-aided dispatch system	• Simulation with debriefing and discussion • Videos • Images • Educational games • Review and summary of the week	2 days	30%
3	Module 3	• Surface anatomy and physiology in EMD • Transfer and vectoring in traumatic events • Basic pathological concepts leading to medical emergencies • Dispatch coding system • Dispatch life support	• Simulation with debriefing and discussion • Group discussion • Videos • Images • Medical dictionaries • Educational games • Reading assignments • Review and summary of the week	2 days	40%
4		• Post-dispatch and pre-arrival instructions • Caller management techniques	• Simulation with debriefing and discussion • Reading assignments • Videos • Educational games • Case discussion	3 days	
5		• Common medical emergencies • Common traumatic emergencies	• Simulation with debriefing and discussion • Reading assignments	2 days	
6	Module 4	Crises and emergency management in EMD	• Simulation with debriefing and discussion • Videos • Educational games	3 days	20%
7		Quality management in EMD	• Group discussion • Simulation with debriefing and discussion	3 days	
8		Essential legal aspects in EMD	Case discussion	3 days	
9		Stressors in the EMD profession	Group discussion	3 days	
10		Coaching in EMD	• Group discussion • Educational games • Simulation with debriefing and discussion	3 days	
11	**Internship and certifications**[a] (Clinical skills demonstrations)				
12					
13					
14	**Final examinations**				

[a]ETC and EMD courses

his theory, learning styles are usually a product of two learning variables that include: diverging (CE+RO); assimilating (AC+RO); converging (AC+AE); and accommodating (CE+AE). He further elaborates in his matrix, the two continuum east-west axis also called processing continuum (how we approach a task by watching or doing) and the north-south axis also known as perception continuum (our emotional response to a task, or how we think or feel) and he believed that only one variable on a single axis can be achieved at a time. Based on that, a set of educational strategies were identified to be the most appropriate educational methods to achieve the desired learning outcomes in the EMD Program. A detailed tentative schedule and educational strategies of the program are illustrated in Table 4.

Implementation

Considering KSA Vision 2030 and the health sector transformation plan, implementing this program on a national level would ease access to healthcare systems, provide efficient and effective prehospital services, and allow the integration of existing EMD systems in the country. The use of Kolb's theory was crucial to implementing the program's educational strategies and achieving educational objectives [34]. Moreover, to implement this program, a set of formal proposals by higher authorities concerned with prehospital healthcare services and medical education for healthcare providers approved the launch and sponsorship of the program [2,7]. Nevertheless, setting specific criteria for faculty requirements and training sites was crucial for the program's implementation [11]. Having said that, the achievement of the desired learning outcomes of the EMD Program was facilitated by many elements. First, the national intention to transform the health sector and ease access to services was the driving energy to build this program. Second, the curriculum was developed by an experienced educational committee in the field of prehospital service, EMD systems, medical education, and curriculum development. This committee had specified the required personnel, time, facilities, and funding resources needed to develop this program. Finally, the partnership with SRCA, the national provider of prehospital services, empowered the implementation of the program outcomes in the actual dispatch operations services. It is worth mentioning that the EMD program was established as part of HA initiatives to fill in gaps in the healthcare system. As part of KSA's national qualification framework candidates with a Bachelor's degree in Health Administration or its equivalent were chosen for the program based on their availability and EMD needs in the country.

Evaluation and feedback

The curriculum evaluation and feedback will be collected by the HA from different stakeholders (students, faculty, and training sites) periodically by filling in electronic surveys for ongoing quality improvements during the program implementation and screening for rapidly reversible corrections related to curriculum faculty and training centers. By the end of the program, a comprehensive survey will be distributed among all stakeholders to revise and update any changes related to the curriculum content, modes of delivery, training facilities, tutors' performance, and suggestions for further improvement in the program by a curriculum review committee. As part of the curriculum development of the EMD Program, trainees are evaluated constantly by formative and summative assessments to ensure the targeted learning outcomes are achieved [35]. Overall, the assessment and evaluation of trainees are carried out in alignment with the SCFHS training and examination rules and regulations. This included every aspect of the trainee's performance, whether in classrooms, simulation labs, or dispatch operations centers. For each module, the assessment process enables those involved in the training process (i.e., faculty) to provide objective feedback to the trainees periodically (every month). For each module, the grading system will be 20% for attendance and punctuality, 40% for ongoing formative assessment (quizzes, presentations, or group activities), and 40% for the summative assessment (end of module exam). The final written exam (summative assessment) will be conducted centrally by the SCFHS, covering a detailed exam blueprint that is mapped to the competencies across all program modules. The exam format shall consist of no more than 120 multiple choice questions with a single best answer (one correct answer out of four options) covering basic concepts and clinical topics relevant to the EMD. The distribution of grades in the exam blueprint is different depending on formative and summative assessment, Kolb's educational strategies, competency-based aspects, and various distribution of knowledge, skill, and attitude percentages in each module as shown in Table 4.

To obtain an EMD Program certificate, the trainee must fulfill the following requirements: successful completion of all modules, successful completion of the internship period, attendance: total absence percentage during the program is 10% or less, passing the final examination with no less than 60%, passing the Objective Structured Clinical Examination or Structured Oral Exam with no less than 60%, and passing the ETC and EMD courses.

Discussion

To our knowledge, this is one of the first structured EMD Programs in Saudi Arabia. This program will serve the prehospital EMS system by developing the knowledge and skills of dispatchers, so they can respond to incident calls efficiently, deploy proper services and resources, and provide proper lifesaving instructions, as envisaged in the national health sector transformation plan and Vision 2030. In the EMD Program, modules discuss essential communication skills and how to act professionally in the EMD field, interpretations of a dispatch system, dispatch coding and deployment of proper resources, knowledge of common medical emergencies, applying dispatch life support services, and addressing certain aspects of EMD (crises management, quality management, legal issues, coping with stressors, coaching skills). The development of the EMD program utilized a consecutive mixed approach starting with a competency-based with backward design method to ensure the achievement of targeted outcomes [8]. This was followed by the adoption of Kern's Six-step approach for structure content and integrated module development which has proven efficacy in many education settings [9,36-40]. The EMD Program targeted learning objectives were then developed by the education committee and Miller's pyramid of competencies was considered following its successful use in recent programs [41]. The impact of the EMD Program will strongly affect the prehospital dispatch system in KSA as we recommend that other dispatch training programs adopt the suggested curriculum to validate its efficacy and perhaps adopt outcomes for their related dispatch systems. Furthermore, designing a career pathway for EMDs by recognizing the graduation certificate and granting a dispatcher license recognized by authorities will attract more dispatchers to join the EMD community and seek it as a career.

The curriculum developed by the HA is approved for implementation as part of a greater timeline for healthcare transformation in KSA. Consequent monitoring of the implementation will measure the impact that will be feedback on curriculum improvement and overall evaluation of the medical dispatch system. Although this study addressed a novel curriculum development in KSA, it is not without any limitations. First, this is a descriptive study which cannot be used to establish cause and effect relationship. Second, the study is missing further details of the curriculum development that could have been addressed by interviews with the EMD education committee. Finally, the impact of this program on rapid access to healthcare facilities and on saving lives was not evaluated.

Further studies are recommended to measure outcomes and effectiveness concurrent to international benchmarking of results.

Conclusion

As part of the health sector transformation plan in KSA, EMD services play a fundamental role in the daily operations of prehospital healthcare services. Developing an EMD Program with a consecutive mixed approach including a competency-based with backward design method followed by the Kern Six-step curriculum development model led to a set of learning outcomes in the EMD Program including interpreting various dispatch systems, prioritizing incidents, deploying proper resources, and providing pre-arrival instructions that might improve the current operations of EMD services.

Acknowledgement
We would like to thank the Health Academy of the Saudi Commission for Health Specialties, the Saudi Red Crescent Authority, and the education committee of the Emergency Medical Dispatch Program for their support in writing this paper. Professor Mustafa Bodrick, Adjunct Faculty at King Saud University, is acknowledged for the final review and related improvements of this manuscript.

List of Abbreviations

AC	Abstract conceptualization
AE	Active experimentation
CE	Concrete experience
EMD	Emergency medical dispatch
EMDs	Emergency Medical Dispatcher
EMS	Emergency Medical Services
ETC	Emergency Telecommunicator Course
HA	Health Academy
KSA	Kingdom of Saudi Arabia
NHTSA	National Highway Traffic Safety Administration-USA
RO	Reflective observation
SCFHS	Saudi Commission for Health Specialties
SRCA	Saudi Red Crescent Authority

Conflict of interest
The authors have no conflicts of interests to declare.

Funding
This study was not supported by any sponsor or funder.

Consent to participate
Not applicable.

Ethical approval
An ethics statement was not required for this study type, no human or animal subjects or materials were used.

Data availability
The data referred to in this study are available from HA, SCFHS but restrictions apply to the availability of these data, which were used under license for the current study, and can be released by justified written request to the relevant authorities. Data for verification of scientific purposes are however available from the author primary investigator upon request with permission of HA, SCFHS.

Author contributions
Yousef M. Alsofayan, Nawfal A. Aljerian, Ameera A. Cluntun, Waad S. Alshammari, and Salman S. Alharthi developed the study design. Kharsan M. Almakhalas and Mohammed S. Arafat analyzed and interpreted the study data. Abdullah A. Alabdali and Abdulrahman Y. Sabbagh mapped study results on a structural framework. Yousef M. Alsofayan wrote the manuscript. Fahad S. Alhajjaj, Jalal M. Alowais, Bandr Y. Mzahim, Sami J. Alsolamy, and Abdulrahman Y. Sabbagh were heavily involved in the editing. All authors read and approved the final manuscript.

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