

# EMHJ

Eastern Mediterranean  
Health Journal

المجلدُ الصحِّيُّ لشرقِ المتوسِّطِ



La Revue de Santé de la  
Méditerranée orientale



a call for  
solidarity  
and action

The Vision 2023 for the Eastern Mediterranean Region seeks to collectively strive and accelerate progress towards the health and well-being of all people in the Region via four strategic priorities: expanding universal health coverage; addressing health emergencies; promoting healthier populations; and making transformative changes in the World Health Organization.

## Eastern Mediterranean Health Journal

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## Editorial

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This issue of the Eastern Mediterranean Health Journal covers a spectrum of public health research throughout the Region, much of which has direct relevance with the work of the World Health Organization. From industrial environmental health to vector control disease surveillance, the public health issues that currently afflict the Region are not necessarily unique, but certainly highlight areas of research that can have a particular urgency when considering the specific challenges faced by populations throughout the Middle East and North Africa.

Chemical accidents have the potential for immense destruction not only through potential loss of life, but also through the degradation of the environment and contamination of air, water and thus agriculture. As low and middle-income countries are keen to industrialize and look to raise their standard of living, so must legal oversight and processes to ensure environmental health considerations are met. The Islamic Republic of Iran has witnessed a number of industrial chemical incidents that have raised the need for urgent review of current legislation and enforcement, as highlighted in the research article “Industrial chemical accidents: a growing health hazard in the Islamic Republic of Iran” (1) and examination of the application of International Health Regulations.

Keeping with the theme of efficiency and effective oversight, this issue also examines research on proposed conceptual integrated models in the adoption of electronic medical records, and thus seek to promote quality of healthcare services, as discussed in the research article “Determining factors in applying electronic medical records in healthcare” (2).

Common to many of the countries of the Eastern Mediterranean Region is the issue of air quality and prevalence of tobacco use that has led to increasing rates of chronic obstructive pulmonary disease (COPD). Considered an environmental health concern, whether highlighting industrial air pollution or substance use, the article “The global prevalence of chronic obstructive pulmonary disease: a systematic review and meta-analysis” (3) synthesizes worldwide published data to assess its geographical extent and gender balance: interestingly the Americas reported the highest rates of COPD and a higher diagnosis in males.

However, environmental health is not limited to industrial pollution or chemical hazards; the combination of working life and cultural or religious observance can also have environmental health implications not necessarily foreseen in the natural world. Such is the area of research

in the article “Effect of fasting during Ramadan on heat parameters in the Middle East” (4), examining how some religious practices may potentially have adverse effects on outdoor workers if robust workplace measures are not enforced in high-temperature environments to prevent heat exhaustion.

Mobile populations, either as migrants or tourists, may present a challenge to the effective control of infectious diseases. The travel industry is one area that has grown exponentially in the Gulf States with its rapidly rising standard of living, yet awareness of the importance of travel health is lagging. From vaccinations to effective prevention of transmissible infections, the article “Knowledge, attitudes and practices of travel medicine among primary care physicians in Oman: the need for intervention” (5) researched just how developed travel medicines are in the Sultanate and where weaknesses lie in travel health awareness and promotion.

Following the theme of communicable disease prevention, this issue also includes a timely update on the management of Zika virus transmission outlined in the short research communication “Enhancing surveillance for early detection of Zika virus infection: strategies for the countries of the Eastern Mediterranean Region” (6). Currently the Region has not had any reported cases of the Zika virus despite the presence of its vector: *Aedes* mosquitoes. Maintaining this Zika-free status for the Region is a priority for the WHO Regional Office for the Eastern Mediterranean, and here the considerations are put forward for enhanced surveillance using a combination of syndromic and event-based surveillance approaches within the existing system in operation.

Quality assessment of health service providers and hospital healthcare are two areas examined in this issue and draw attention to the necessity of effective healthcare. The research article “National quality assessment questionnaire for physiotherapy centres: a pilot study in Lebanon” (7) highlights the importance of responsive quality control tools for physiotherapy centres that often come under the private sector. Such tools can also form part of the accreditation of such health service providers, not only to ensure required staff qualification levels, but also to address the problem of infection due to below standard levels of hygiene.

Moreover, a hospital environment would appear to be the ideal environment for early diagnosis and management of paediatric illnesses, yet as the research article “Nutritional risk screening of hospitalized children aged < 3 years” (8) highlights, it can be surprisingly difficult to identify malnutrition in such

hospital settings. This research draws attention to the need for effective screening tools for children vulnerable to malnutrition, ensuring prompt interventions that may contribute to overall improvements in patient care, as well as shortening the hospitalization period.

Finally, a WHO event summary of the “interregional meeting on leishmaniasis” (9) held in September 2018<sup>1</sup> draws attention to the fact that almost 70% of the total number of cutaneous leishmaniasis cases reported worldwide have been from the Region; the

implementation of effective control measures remains an important challenge for the Organization.

Looking forward, February issue of the EMHJ will cover a wide spectrum of public health topics, including a review of family planning policies in the WHO Eastern Mediterranean Region; inequalities in access to hospitals; antenatal care among Palestinian refugees in Jordan; and tobacco and waterpipe use among Saudi university students.

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<sup>1</sup> Summary report on the Interregional meeting on leishmaniasis among neighbouring endemic countries in the Eastern Mediterranean, African and European regions, Amman, Jordan, 23–25 September 2018 ([http://applications.emrowho.int/docs/IC\\_Meet\\_Rep\\_2019\\_EN\\_22325.pdf?ua=1](http://applications.emrowho.int/docs/IC_Meet_Rep_2019_EN_22325.pdf?ua=1)).

# Industrial chemical accidents: a growing health hazard in the Islamic Republic of Iran

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## Abstract

**Background:** Occupational chemical accidents have increased in recent years in the Islamic Republic of Iran. In June and August 2015, three large explosions occurred at chemical warehouses in Rey, Tehran Province, and toxic vapours were released.

**Aims:** This study reviewed the three chemical accidents and assessed the extent to which the requirements for chemical safety and preparedness for chemical incidents under the International Health Regulations (IHR) are in place, and implemented at local and national levels in the Islamic Republic of Iran.

**Methods:** Data were obtained from secondary data and field visits to selected chemical plants. The secondary data were used to complete a 33-item checklist based on the IHR and the Ministry of Health and Medical Education checklist. A sample of 15 warehouses in Kahrizak district, Rey County, were visited to assess their capacity in relation to the IHR using a 15-item checklist.

**Results:** Some weaknesses were seen in the IHR capacity in the study area. The main weaknesses were lack of an effective surveillance system for chemical accidents and low levels of safety in chemical plants and warehouses. Other weaknesses included the lack of awareness of residents about chemical hazards and poorly equipped health centres for the management of victims of chemical accidents. The study area was not prepared for chemical accidents both within industrial plants and residential areas.

**Conclusions:** Action is needed to improve the areas of weakness so as to achieve the necessary capacities for chemical safety, and preparedness and response to chemical incidents in line with the IHR.

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## Introduction

The Islamic Republic of Iran is a developing country with a lot of capacity in the manufacturing sector. Industrialization has been growing quickly because of market demands in the country (1,2). Rapid industrialization without the provision of established infrastructures to prevent industrial accidents can cause problems for countries (3–5). The statistics on industrial chemical accidents have shown an increase in accidents between 2010 and 2013 in the Islamic Republic of Iran (6). Figure 1 shows the distribution of industrial chemical accidents in the Islamic Republic of Iran between 2010 and 2013 according to type and number. In addition, in 2014, over 230 people were hospitalized for the release toxic gases in the city of Zahedan, in the south of the country (7).

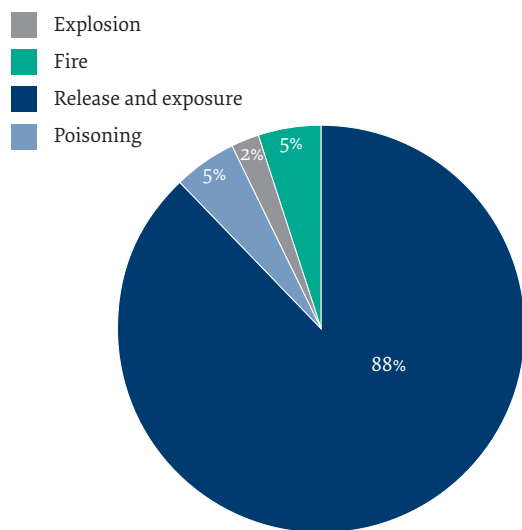
In some industrial cities of the Islamic Republic of Iran, the distance between chemical installations and residential areas has not been taken into consideration (8). As a result, concern is growing about the public health effects of chemical plants, particularly the release of

chemicals, as happened at Flixbrough, Bhopal and Seveso (9–13).

The province of Tehran has 38 counties and Rey is one of the largest and most industrial of them. In June and August 2015, 3 large chemical incidents occurred in Rey.

### Case 1

A fire broke out at a warehouse at kilometre 3 of the Qom–Tehran road on the morning of Friday, 12 June 2015. The blaze was caused by a tanker containing chemical liquids which then extended to 11 other chemical tankers that were parked in the 4 000 square metres of the warehouse. Police and firefighters put out the fire within 4 hours. More than 25 000 L of chemical liquids completely burned which resulted in the release of toxic vapours several kilometres away from the warehouse where the incident occurred. Three firefighters had minor chemical burns to their skin and were taken to the hospital but there are no data on injuries, such as respiratory distress, and eye and skin irritation in the residents of the area.



**Figure 1** Distribution of industrial chemical accidents according to type in the Islamic Republic of Iran, 2010–2013 (n = 16 386)

### Case 2

On the evening of Tuesday, 18 August 2015, a fire broke out at a chemical warehouse, with an area of 1 500 square metres, in Kahrizak district. The local fire station requested help from the cities of Rey and Tehran, and 6 firefighters and 8 fire trucks were sent to the scene. The fire brigade stated that the fire was under control within 2 hours. A hazardous materials (Hazmat) team also accompanied the firefighting teams. There were no injuries to workers, residents or firefighters but one building of the warehouse was completely destroyed by fire and several tons of chemicals, including glycerin and raw materials, were damaged.

### Case 3

On Thursday evening, 20 August 2015, 2 days after case 2, fire destroyed another chemical warehouse at the same place, Shourabad, Kahrizak. Many chemicals, sponges and large rolls of paper were stored in 2 buildings of the warehouse in over 6 000 square metres. The local fire station called for help, and 4 teams of firefighters and 10 fire trucks managed to put out the fire within 3 hours. The emergency responders and residents were exposed to chemical vapours but there are no accurate data about the number of injuries.

Figure 2 shows the location of the 3 chemical accidents in June and August 2015.

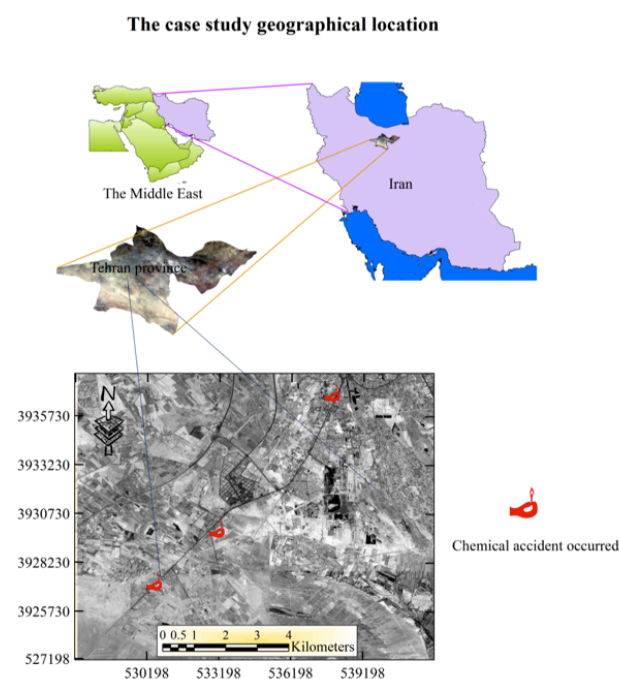
The International Health Regulations (IHR) specifically deal with human health hazards. Chemical events such as fires, explosions, leakages or release of chemicals are health hazards that could have serious harmful effects on human health and the environment. Chemical events may affect human health directly or indirectly. Therefore, providing the minimum chemical core capacities under the IHR could help decrease human vulnerability in the areas at risk of chemical accidents.

The aim of this article was to identify compliance with the IHR for chemical safety management in industrial zones and the neighbouring residential areas in the Islamic Republic of Iran.

## Methods

This study was conducted in 2015. The sources of data were secondary data and field visits. The secondary data included censuses, information collected by local health centres, regional health networks, organizational records, protocols and data that were originally collected for other research purposes. In order to complete the data, 15 chemical warehouses, out of 80 in Kahrizak, were randomly selected for a visit. We developed a 15-item checklist, based on IHR core capacities, to complete during the visit to each selected chemical warehouse by observation (14). All field visits were conducted during 1 week in Kahrizak, Rey. We developed another checklist also based on IHR and the checklist of the Ministry of Health and Medical Education. This 33-item checklist was used to analyse the management of chemical events at the local and national levels. We also interviewed the local authorities and competent experts at the Ministry of Health and Medical Education, and reviewed available documents, reports and other literature (e.g. websites of the Ministry of Health and Medical Education and the Ministry of Labour) for information related to chemical accident management at local and national level in the Islamic Republic of Iran. We used content analysis for the subjective interpretation of the interviews to identify concepts, and the information from interviews and secondary data were used to complete the checklist.

The data collected were used to assess the extent to which the minimum requirements of the IHR for



**Figure 2** Location of the 3 chemical accidents in June and August 2015



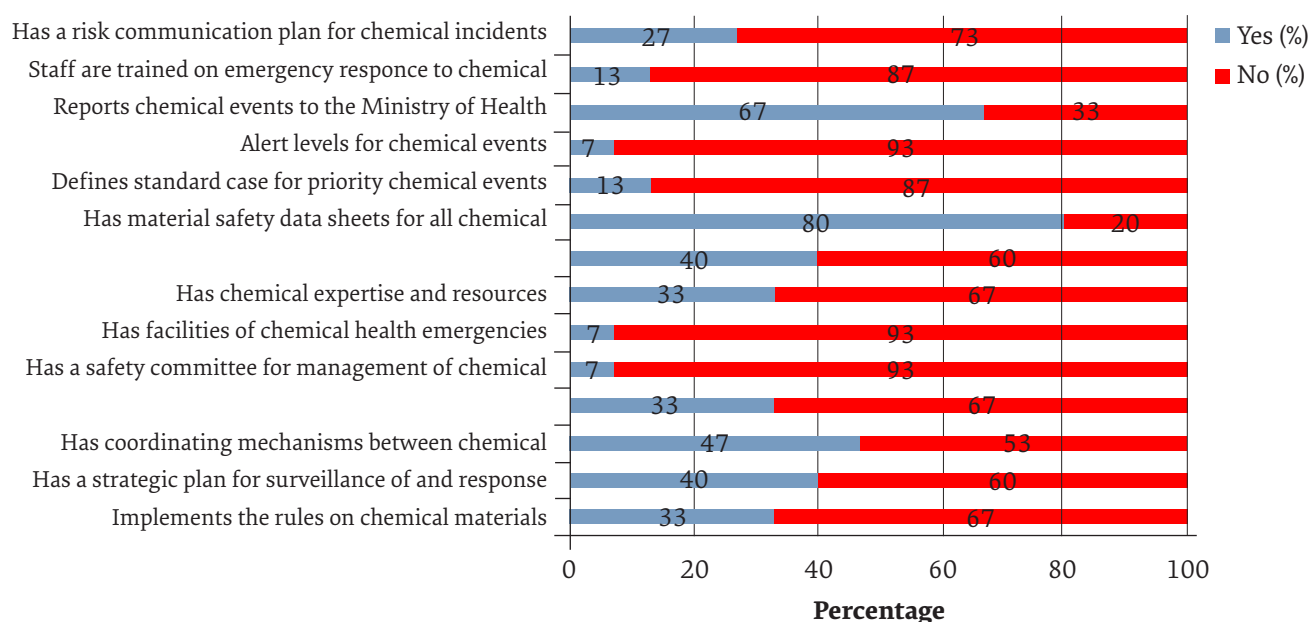


Figure 3 Proportion of warehouses meeting the requirements of chemical safety management, 2016

mitigation of chemical hazards were in place in the surveyed area and nationally.

## Results

According to the field visits, more than of 80% of the warehouses had a material safety data sheet for all the chemicals they have stored and maintained. In addition, 10 of the 15 warehouses report their chemical events to the Ministry of Health and Medical Education. The IHR elements that were least present were: providing facilities such as equipped hospitals with trained staff for management of chemical health emergencies, having a safety committee at the workplace and having established alert levels for chemical events; only 1 of the 15 warehouses had these requirements in place (Figure 3).

The requirements for the management of chemical accidents were extracted from secondary data and using the health inspection checklist of the Ministry of Health and Medical Education. Some of these requirements are established at the national level but not at the local level because of weak supervision, the lack of a strategic plan or insufficient capacity to implement them. However, we tried to check the extent of implementation of the requirements by reviewing documents and through the field visits in order to analyse the management of chemical events in the country. In total, 7 of the 33 core elements required for the management of chemical incidents were present at national and local levels. Almost half (14) of the core elements of the checklist were not established at the national level or the local level. Also, 12 of the 33 core elements were established at the national level but not at the local level. The main differences between the national and local levels related to: having the required components for the management of chemical incidents, having a policy and road map for the surveillance of and response to chemical emergencies, having access to a hazmat team for chemical incidents and having case

management and poison centres available for chemical exposures and poisoning (Table 1).

## Discussion

The aim of this study was to explore compliance with the IHR related to chemical accidents which should be in place in industrial zones and the neighbouring residential areas. Our findings showed that the most important factor was the lack of a coordinated approach to prevent, prepare for, respond to and recover from chemical accidents in the area under study. Further investigations showed that the lack of a coordinated approach for management of chemical incidents was also evident at the national level. Implementing the core IHR capacities in the field is the foundation for managing chemical incidents correctly.

The 6 main IHR capacities (14) were assessed.

### National legislation, policy and financing

Chemical regulations, standards, codes and management systems were established after major accidents such as Seveso, Flixborough (15). At the present time in the Islamic Republic of Iran, there are chemical safety legislations for manufacturing, storing, transporting and using chemicals at the national level in order to prevent chemical events and harmful health effects on the general public (8). However, through our field observation and review of the relevant documents, there are clearly some difficulties in the implementation of the regulations. For example, there is a lack of adequate supervision by the authorities of chemical plants and warehouses at the local level, and a lack of knowledge updates, such as the use of a global harmonized system of classification and labelling of chemicals in companies and warehouses which are exposed to hazardous materials. In addition, chemical safety principles at work and in public environments were not a priority in chemical plants, probably because

**Table 1** Presence/absence of the requirements for the management of chemical incidents at national and local levels

No.	Item	National		Local	
		Yes	No	Yes	No
1	Legislation on surveillance and response to chemical events				
2	Policy for the surveillance of and response to chemical emergencies				
3	Policy for industrial waste management				
4	Strategic plan to strengthen the surveillance of and response to chemical events				
5	Operational public health plan for responding to chemical events				
6	Coordination mechanism between chemical safety and national health authorities				
7	Coordination mechanism between chemical safety authorities and the International Health Regulations				
8	Intersectoral committee/taskforce for management of and response to chemical events				
9	Inventory of potential hazard facilities for chemical health emergencies				
10	Inventory of chemical expertise and resources				
11	Assessment of chemical risks in chemical plants				
12	List of priority chemical events and syndromes for surveillance				
13	List of information sources for chemical events				
14	Manuals available for surveillance, investigation and control of chemical events				
15	Guidelines disseminated to relevant levels and stakeholders				
16	Standard definition of health hazard from chemical contamination of water				
17	Standard definition of health hazard from chemical contamination of air				
18	Standard definition of health hazard from chemical contamination of food				
19	Standard definition of health hazard from chemical contamination of others				
20	Standard case definitions for priority chemical events				
21	Multisectoral risk assessment during chemical event of public health concern				
22	Alert levels established for chemical events				
23	Chemical events reported to the Ministry of Health and Medical Education as part of surveillance				
24	Specified time frame for reporting urgent chemical events				
25	Hazmat team skilled in emergency response to chemical events				
26	Staff in related industries trained in emergency response to chemical events				
27	Case management centres for chemical exposures and poisoning				
28	Poison centres established				
29	Health staff trained in case management for chemical poisoning				
30	First responder staff trained in case management for chemical poisoning				
31	Risk communication plan for chemical incidents				
32	Public health education on chemical accidents management, specifically for residents who live near chemical plants				
33	Laboratory capacity to confirm the etiology of chemical events				

the authorities are more concerned with industrialization and increasing the manufacturing output of factories.

### Coordination

The effective implementation of relevant chemical regulations requires a multidisciplinary approach with partners and stakeholders in order to have effective alert and response systems. Developing a national chemical profile is a multisectoral effort that was started by the Iranian Ministry of Health and Medical Education in the past five years. However, it will not be possible to do this without the cooperation of other ministries, agencies, and govern-

mental and nongovernmental organizations. In addition, efficient and effective management of the victims of a chemical incident depends upon a coordinated response between the Emergency Medical Services and other first responders (police and firefighters) who attend the scene (16).

### Surveillance

Having an effective surveillance system for chemical accidents and their public health impact requires a strong reporting and analysis process (17). This surveillance system should be able to identify high-risk locations, provide

early detection of major events, and plan an emergency response programme (18,19). Surveillance and lessons learned from major chemical accidents may lead to new legislative and regulatory actions just as changes took place in the United States chemical safety legislation following Bhopal (17).

In the past 2 years, some measures have been adopted to integrate the surveillance system for chemical accidents into primary health care in the Iranian Ministry of Health and Medical Education. However, this requires the necessary infrastructure to be in place, such as communication lines, and equipped laboratories and hospitals in the areas exposed to chemical hazards. At the same time, the Ministry of Labour has its own surveillance system for chemical accidents. It would be more effective to coordinate and integrate the activities and systems of these 2 ministries.

### Preparedness

Preparedness for chemical events includes the development of public health emergency response plans at national, regional and local levels. Chemical risk assessment at the hazardous sites, mapping of human vulnerability to chemical hazards, planning emergency evacuation if there is a disaster in residential areas, and the identification of available resources and capacities are other components of preparedness (12,20,21).

Apart from the chemical plants seeking international certification, conducting risk assessment is not compulsory for the rest of the chemical installations in the Islamic Republic of Iran. However, risk assessment is a good opportunity to identify hazards and make local authorities focus more on the hazardous sites. Moreover, the authorities should include some private companies and factories, which have resources for chemical emergencies, in the local planning of this industrial district (22,23). Having knowledge about what chemicals exist in the community, establishing a database, and providing appropriate training to health care workers and first responders in relation to chemicals are the first steps that should be taken for preparedness in the study area.

### Response

Hazmat teams are essential for responding to the accidental or intentional release of dangerous chemical agents into the environment (24). Hazmat teams are also responsible for rapid assessment of the situation and controlling the operations to deal with such an event, including case management and the decontamination process in the area exposed to chemical accidents.

One of the priorities should be to establish and distribute hazmat teams in appropriate locations throughout the country so they are quickly available in the required areas when needed. Having a rapid response in the areas exposed to chemical accidents helps to mitigate later and worse effects (12,25).

In addition, the public health service is responsible for public health protection against chemical incidents,

and health care workers should have enough knowledge and capacity to manage the victims (26). At the present time, the Iranian public health system does not have specific training courses on chemical injuries for health workers. Furthermore, the health centres do not have the necessary capacity to manage chemical incidents.

### Risk communication

Risk communication is a multilevel process which aims to sensitize stakeholders to chemical risk management in the areas that might be affected by chemical events (20). The stakeholders are different groups including the authorities, policy-makers and the general population. An essential part of risk communication is the dissemination of information to the public about chemical incidents, including their mitigation or relevant disease outbreaks (27). Risk communication should consider the social, religious, cultural, political and economic aspects associated with the chemical event (28).

All stakeholders in the country need to be identified for risk communication. A timely and robust communication mechanism should also be established to coordinate correct responses at the time of an incident. Because of the points mentioned earlier, any emergency communication plan needs to be developed and tested in the study area. In addition, risk communication to the population living in this area is essential. They should have information about hazards in the vicinity and the protective actions that they can benefit from if a chemical incident occurs. For instance, many lives would have been saved in Bhopal if people had been aware of the simple safety measure to stay in an enclosed space and put wet cloths on the face (23).

### Conclusion

Our results show that Rey County is not well prepared for chemical accidents both in industrial and residential areas. The situation analysis of chemical warehouses in Kahrizak demonstrated weaknesses related to chemical hazards with regard to IHR capacities, including poor coordination among stakeholders in chemical legislation, few hazmat teams, the lack of an integrated chemical surveillance system, and the lack of preparedness among the general public and local health centres.

Further studies are needed on the risks to the population, and the action taken to rectify the weak points outlined in this report and to provide adequate capabilities at national and local levels in the 6 capacities of the IHR discussed. Determining the factors that make people vulnerable to chemical incidents could reduce the chemical harm within the chemical plants and also to the residents living close to such industrial installations.

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**Competing interests:** None declared.

## Accidents chimiques industriels : un risque sanitaire croissant en République islamique d'Iran

### Résumé

**Contexte :** Le nombre d'accidents chimiques en milieu de travail a augmenté au cours des dernières années en République islamique d'Iran. En juin et août 2015, trois explosions majeures se sont produites dans des entrepôts de produits chimiques de Rey, dans la province de Téhéran, provoquant le dégagement de vapeurs toxiques.

**Objectifs :** La présente étude s'est penchée sur les trois accidents chimiques et a évalué dans quelle mesure les exigences du Règlement sanitaire international (RSI) en matière de sécurité chimique et de préparation aux accidents chimiques sont respectées et mises en œuvre aux niveaux local et national en République islamique d'Iran.

**Méthodes :** Les données ont été obtenues en recourant à des données secondaires et des visites sur le terrain dans des usines chimiques sélectionnées. Les données secondaires ont été utilisées pour remplir une liste de contrôle en 33 items inspirée de la liste de contrôle du RSI et du ministère de la Santé et de l'Éducation médicale. Un échantillon de 15 entrepôts du district de Kahrizak, dans le comté de Rey, ont été visités pour évaluer leurs capacités au titre du RSI en utilisant une liste de contrôle en 15 items.

**Résultats :** Certaines faiblesses ont été identifiées dans la zone étudiée en ce qui concerne les capacités au titre du RSI. Les principales faiblesses étaient l'absence de systèmes efficaces pour la surveillance des accidents chimiques et le faible niveau de sécurité dans les entrepôts et les usines chimiques. Les autres faiblesses incluaient le manque de sensibilisation des résidents aux risques chimiques et la piètre qualité des équipements dont disposaient les centres de santé pour traiter les victimes d'accidents chimiques. La zone étudiée n'était pas préparée à faire face aux accidents chimiques dans les usines industrielles et les zones résidentielles.

**Conclusions :** Des mesures doivent être prises pour corriger les faiblesses observées et se conformer au RSI en mettant en place les capacités nécessaires en matière de sécurité chimique et de préparation et de riposte aux accidents chimiques.

### الحوادث الكيميائية الصناعية: خطر صحي متزايد في جمهورية إيران الإسلامية

فرين فاطمی، علي اردلان، نبي الله منصورى، بنيكنو اكر، ايرج محمدفام

#### الخلاصة

**الخلفية:** زادت الحوادث الكيميائية المهنية في السنوات الأخيرة في جمهورية إيران الإسلامية. ففي يونيو/حزيران وأغسطس/آب من عام ٢٠١٥، وقعت ثلاثة انفجارات كبيرة في المستودعات الكيميائية في ري، مقاطعة طهران، وانطلقت معها أبخرة سامة.

**الأهداف:** استعرضت هذه الدراسة ثلاثة حوادث كيميائية، وقيمت مدى الاحتياجات اللازمة للسلامة الكيميائية والتأهب للحوادث الكيميائية وفقاً للوائح الصحية الدولية التي تُطبَّق وتُنفَّذ على الصعيدين المحلي والوطني في جمهورية إيران الإسلامية.

**طرق البحث:** تم الحصول على البيانات من البيانات الثانوية، ومن الزيارات الميدانية لمشاريع كيميائية مختارة. واستخدمت البيانات الثانوية لاستكمال قائمة تفقد تضم ٣٣ بنداً تستند إلى اللوائح الصحية الدولية وإلى قائمة تفقد لوزارة الصحة والتعليم الطبي. كما تمت زيارة عينة مستودعات عددها ١٥ مستودعاً في مقاطعة قهريزاك في إقليم ري، لتقييم قدراتها التي تتعلق باللوائح الصحية الدولية باستخدام قائمة تفقد فيها ١٥ بنداً.

**النتائج:** شوهدت بعض مواطن الضعف في القدرات التي تتعلق باللوائح الصحية الدولية في منطقة الدراسة. وكانت مواطن الضعف الرئيسية هي غياب نظام للترصد الفعال للحوادث الكيميائية، وتدني مستويات السلامة في المشاريع الكيميائية وفي المستودعات. ومن مواطن الضعف الأخرى قلة وعي السكان بالمخاطر الكيميائية وسوء المعدات في المراكز الصحية للتدبير العلاجي لضحايا الحوادث الكيميائية. فمناطق الدراسة لم تكن مجهزة للحوادث الكيميائية سواء في داخل المنشآت الصناعية وفي المناطق السكنية.

**الاستنتاجات:** تدعو الحاجة إلى العمل لتحسين مواطن الضعف بغية تحقيق القدرات اللازمة للسلامة الكيميائية، وللتأهب والاستجابة للحوادث الكيميائية تمشياً مع اللوائح الصحية الدولية.

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# National quality assessment questionnaire for physiotherapy centres: a pilot study in Lebanon

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## Abstract

**Background:** Lebanon still lacks a unified platform upon which private physiotherapy practitioners can base and apply their knowledge and practice. Accreditation of physiotherapy centres would promote collaboration, boost consistency and enhance quality of services. The Order of Physiotherapists in Lebanon is called on to provide a high quality of service by focusing on standards.

**Aims:** The aim of this study was to assess the feasibility and applicability of a standard for the quality assessment of physiotherapy centres, and to assess the current status of a sample of centres in Lebanon.

**Methods:** A questionnaire was developed by a panel of experts based on a review of international and national requirements in physiotherapy centres. A set of 14 items was generated covering 3 categories: qualifications of the team, facility and environmental status, and data collection and analysis. A pilot study was conducted from December 2013 to February 2014 in 6 Lebanese physiotherapy centres. Descriptive statistics are reported.

**Results:** The highest median score and compliance score for the 6 centres were reported for the “Facility and environmental status” category (median = 8.0) and the lowest were reported in the “Data collection and analysis” category (median = 5.0).

**Conclusions:** Further studies are needed to validate the quality assessment in physiotherapy centres questionnaire, and to implement it as a primary tool for assessing quality standards and for accreditation of physiotherapy centres.

Keywords: quality assurance; physiotherapy; Lebanon; questionnaire, accreditation

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## Introduction

Physiotherapists operate as independent practitioners as well as members of health care service provider teams and are subject to the ethical principles of the World Confederation for Physical Therapy and the code of ethics of the country in which they practice. The World Confederation for Physical Therapy encourages its member organizations to support and work towards unified education and practice guidelines (1). Physiotherapists should implement quality monitoring tools such as clinical indicators that would enable individual practitioners to evaluate their performance against that of their peers (2). While international bodies have common programmes or policies such as in the European, American and Australian regions of the World Confederation for Physical Therapy, Lebanon still lacks a unified platform upon which private physiotherapy practitioners can base and apply their knowledge and practice.

Evaluation of health care is scrutinized by both the government and consumers, more precisely the patients (3). Consequently, plans to tackle health quality have gained momentum over the past few years, and the

need for accreditation has become more prominent to match the high standards of performance and to avoid inconsistencies between different private centres. Hence, accreditation of physiotherapy centres would promote collaboration, boost consistency for more standardized practice and enhance quality of services.

According to data from the Order of Physiotherapists in Lebanon (OPTL), Lebanon has more than 100 private physiotherapy centres, but unlike academic institutions (e.g. hospitals or medical centres), they are not under the control of any international or local assessment body. Consequently, a collaboration was initiated between the OPTL and Quality Systems International to prepare a standardized platform for quality in physiotherapy.

Quality Systems International is a consultancy company working on the development and improvement of the quality infrastructure of health care companies, institutions and organizations. It was assigned by the OPTL to work with its research and quality committee, the Research Center for Quality in Physiotherapy. The committee included 5 expert physiotherapists and members of the OPTL having extensive experience in quality of physiotherapy centres or postgraduate degrees

in quality management.

The rationale behind this standardized platform was to build a quality management system (part of an accreditation plan) for private sector physiotherapy centres in Lebanon based on the primary requirements promulgated by OPTL experts and the Lebanese Ministry of Public Health as well as on available international guidelines. This programme will enable the private centres to upgrade their systems and secure safe and professional treatment to patients/clients. In this setting, a tool for the quality assessment of physiotherapy centres was developed.

The aim of this study was to pilot and test the assessment tool in a sample of 6 private physiotherapy centres to evaluate its feasibility and applicability for auditing the quality of services audit setting. The study also aimed at assessing the current situation of physiotherapy centres in Lebanon.

## Methods

### *Development of the quality assessment in physiotherapy centres questionnaire*

A set of 47 items were originally generated by Quality Systems International based on the requirements of the Ministry of Public Health and the Order of Physical Therapy in Lebanon. The items covered “Qualifications of the team” (15 items), “Facility and environmental status” (19 items) and “Data collection and analysis” (13 items). The 47 items were answered on a 3-point Likert scale based on criteria fulfilment (0 = no/not fulfilled, 1 = partially/partially fulfilled, and 2 = yes/completely fulfilled).

The questionnaire was translated and adapted into Arabic by 3 independent professional translators. Backward translation was applied to all items. Translation inconsistencies were resolved by consensus in collaboration with Quality Systems International. The content validity of the resulting version was assessed by members of the Research Center for Quality in Physiotherapy who were not involved in the initial development.

Lebanese physical therapist experts were asked to rate the relevance of each item on a 4-point Likert scale from 1 (not relevant) to 4 (very relevant). The content validity index for each item was calculated as the proportion of experts giving a rating of 3 or 4 (quite relevant and very relevant) divided by the total number of experts. All items with a content validity index of 0.8 or above were retained (4). Consequently, 33 items were discarded and the final questionnaire used for the assessment of the physiotherapy centres consisted of 14 items (Table 1).

### *Pilot testing of the assessment tool*

The pilot study was conducted from December 2013 to February 2014 to assess the feasibility and applicability of the 14-item questionnaire for the audit of quality of services at physiotherapy centres. Out of the 100 physiotherapy centres in Lebanon, Quality Systems International agreed with the OPTL to select 6 centres from different

Lebanese districts based on the following criteria: average number of employees, ranging from 1 (owner of the centre) to 10, and the centre's extent of experience, ranging from a few months to more than 2 years. The centres were selected from 4 of the 5 districts in Lebanon: 2 from Beirut, 2 from South, 1 from North and 1 from Bekaa (i.e. the regions where the majority of centres are located). Two independent, trained investigators from Quality Systems International audited the 6 centres and completed the questionnaire.

### *Statistical analysis*

Statistical analyses were descriptive in nature and generated by SPSS, version 22.0. The median score was calculated for each item, for each category and for the total. The category score was calculated by summing all individual item scores in the category, while the total score was calculated by summing all 3 category scores.

## Results

The questionnaire was usually completed within approximately 2 hours, including inspection of the premises. The investigators did not report any difficulties or ambiguity in responding to the items. Data were complete for all 6 centres.

The median score for the “Qualifications of the team” category for the 6 selected centres was 4.0 (Table 2). None of the physiotherapy centres was compliant with the “Availability of an orientation manual/checklist for new staff” standard (median score = 0.0). The highest score was for the “Management of the physiotherapy centre by a qualified individual” standard (median score = 2.0).

Regarding the “Facility and environmental status” category, the median score was 8.0 (Table 2). The physiotherapy centres were compliant with most of the requirements in this category, with a median score of 1–2 on the different items.

For the “Data collection and analysis” category, the median score was 5 for the 6 centres (Table 2). The median score for each item ranged between 0 and 1 reflecting average compliance. The majority of the physiotherapy centres were not compliant with the “Data collected used for research purposes” standard (median = 0.0).

## Discussion

Accreditation is a system through which an institution is evaluated based on a set of predetermined standards (5). It aims at advocating progress in quality and it is usually authorized by either independent specialized agencies or by governmental bodies. It is increasingly being used as an assessment tool by governments to regulate the quality of health care services. Accreditation programmes appear to enhance patient care and improve clinical outcomes. Unfortunately, a study performed by the World Health Organization in 2000 highlighted the lack of accreditation in the Middle East (6).

This pilot study verified the feasibility of the quality assessment questionnaire based on the ease of its completion and the relevance of the items included in

**Table 1 The 47-item quality assessment questionnaire for quality in physiotherapy centres, showing the final 14-item questionnaire piloted in Lebanon, 2014**

Category	Question
<b>1 Qualifications of the team</b>	
1.1	Does an appropriately qualified individual manage the physiotherapy centre?* (List the qualifications, education, years of experience.)
1.2	Please define the number of staff available in the centre as well as the responsibility of each one.
1.3	Are the authorizations of work from the Ministry of Public Health and the Order of Physiotherapists in Lebanon displayed in a clear place in the facility?*
1.4	Do the personnel files contain evidence of educational qualifications of each employee?*(Please provide copies.)
1.5	Does the physiotherapy centre conduct formal performance appraisals of staff? If yes, please define frequency (if applicable).
1.6	Are the job descriptions reviewed on a regular basis? Please define frequency.
1.7	Is there any evidence that all physiotherapy centre staff receive annual education?
1.8	Is there any evidence that all physiotherapy centre staff receive annual recertification in cardiopulmonary resuscitation/basic cardiac life support (CPR/BCLS)?
1.9	Is there an updated list of staff with their respective contact details and job descriptions?
1.10	Is there any working schedule for the staff working in this centre?
1.11	Is there an evident updated organizational chart with clear reporting lines?
1.12	Is there any orientation manual/checklist for staff who join the centre?*
1.13	Does the orientation manual/checklist contain general physiotherapy centre issues-related sections?
1.14	Is there any evidence in the orientation manual that the physiotherapy centre provides manual handling education to existing employees?
1.15	Is there any checklist to verify that all sections of the orientation programme have been completed?
<b>2 Facility and environmental status</b>	
2.1	Please indicate the surface area of the facility and its different divisions.*
2.2	Are there adequate facilities and equipment available in the centre?
2.3	Is there in place a stretcher table for treatments? If yes, how many?
2.4	Is there any low table for treatments pertaining to young/old people?*
2.5	Are there changing and toilet facilities available within the centre? If yes, how many?
2.6	Is the width of the entrance for all doors over 75 cm?*
2.7	Are the room(s) for group treatment equipped with a full size mirror?
2.8	Are the toilet facilities suitable for disabled patients?
2.9	Are all toilet facilities equipped with liquid soap, paper towels and a foot pedal bin?
2.9	Are the temperature and humidity levels of the centre controlled in all rooms?
2.10	Is the distance between the floor and the ceiling $\geq 2.75$ metres?
2.11	Are all the walls/floors finished with a material that can be subject to continuous cleaning?
2.12	Is there any procedure for defining frequency and requirements in regard to cleaning and changing mats?
2.13	Does the centre provide any specific clothing in order to minimize contamination?*
2.14	Is the centre equipped with extinguishers for fire incidents?
2.15	Is there any schedule for equipment validation and checking?*
2.16	Is the facility equipped with a first aid box as well as other required items?
2.17	If yes, what is the frequency of checking and validation
2.18	Are there any direction signs for specific areas in the centre?
2.19	Is access fully restricted and the location of the centre totally secured?
<b>3 Data collection and analysis</b>	
3.1	Is there a policy/procedure for identification of both management and clinical activities?
3.2	Is a list of policies/procedures available within the centre?
3.3	If yes, is there a schedule for updating procedures?
3.4	Are there any guidelines for infection control in the physiotherapy centre?
3.5	Is there any procedure for maintenance of equipment, methods followed and frequency?
3.6	Are there any procedures/guidelines for patient/client safety/privacy?
3.7	Is there any document listing all types of treatments followed in the centre?
3.8	Are there any procedures/guidelines/protocols detailing all type of treatments followed in the centre?*
3.9	Are patient data collected and documented?*(name, treatment, dates, continuous feedback, etc.)
3.10	When applicable, are data collected used for research purposes?*
3.11	Is there a patient/client satisfaction survey?*
3.12	Are post-discharge recommendations communicated and documented?*
3.13	Is any internal audit performed?

\*Items retained in the final 14-item questionnaire



**Table 2 The quality assessment questionnaire: scoring for the six physiotherapy centres, Lebanon, 2014**

Item	Score						Median
	Physiotherapy centre						
	1	2	3	4	5	6	
<b>Qualifications of the team</b>							
Management of the physiotherapy centre by a qualified individual	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Display of the authorization of work from Ministry of Public Health and the Order of Physiotherapists in Lebanon in the facility	1.0	2.0	0.0	1.0	1.0	1.0	1.0
Evidence of educational qualifications to all physiotherapy centre staff	1.0	1.0	1.0	1.0	2.0	1.0	1.0
Availability of an orientation manual/checklist for new staff	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total category score	4.0	5.0	3.0	4.0	5.0	4.0	4.0
<b>Facility and environmental status</b>							
Surface area and divisions of the facility	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Availability of a low table for treatments pertaining to young/old people	2.0	2.0	2.0	0.0	2.0	2.0	2.0
Width for the entrance of all doors is over 75 cm	2.0	2.0	1.0	2.0	2.0	2.0	2.0
Availability of specific clothing/changing facilities to limit contamination	2.0	1.0	2.0	1.0	2.0	1.0	1.50
Availability of a schedule for equipment validation and checking	0.0	2.0	1.0	1.0	1.0	1.0	1.0
Total category score	7.0	9.0	8.0	6.0	9.0	8.0	8.0
<b>Data collection and analysis</b>							
Availability of procedures/guidelines/protocols detailing all types of treatments followed in the centre	0.0	2.0	0.0	1.0	2.0	1.0	1.0
Collection and documentation of patient data	1.0	1.0	2.0	1.0	2.0	1.0	1.0
The data collected used for research purposes	0.0	0.0	2.0	0.0	2.0	0.0	0.0
Availability of a patient/client satisfaction survey	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Communication and documentation of post-discharge recommendation	1.0	1.0	1.0	1.0	2.0	2.0	1.0
Total category score	3.0	5.0	6.0	4.0	9.0	5.0	5.0
Total score	14.0	19.0	17.0	14.0	23.0	17.0	17.0

assessing the centres' conformity with quality standards. The ease of completion was not dependent on the region or area where the centre was located; thus, the tool is likely to be applicable on a national level. In addition, the questionnaire was based on national and international requirements, which ensured the exhaustiveness of the functional areas it covers.

Compliance was highest in the second category "Facility and environmental status" with a median score of 8.0. However, we identified a lower score on the "Availability of a schedule for equipment validation and checking" standard, which reflects the lack of maintenance and calibration of the equipment and machines in most of the centres in this pilot study.

Regarding the "Qualification of the team" category, a relatively low compliance was observed, mainly driven by the low score on the "Availability of an orientation manual/checklist" standard in the majority of the centres.

"Data collection and analysis" was the lowest scoring category. Centres were only partly engaged in using the collected data for research purposes. Moreover, there was a lack of information on patient satisfaction; this

could help the centres to improve their performance by enhancing the patients' experience.

In this setting, clinical physiotherapy research can play an important role in ensuring continuing growth of the profession. Indeed, previous research has advocated the need to base the physiotherapy practice on scientific evidence (7). Physiotherapists are expected to evaluate published studies, to assess data related to new and established techniques and technology, relate the results to patient or consumer care and engage in scholarly activities.

One of the limitations of this study was related to the scoring method owing to the presence of dichotomous items (e.g. the "Availability of a patient/client satisfaction survey" standard can only be scored with 0 or 2). In addition, the results reported above cannot be generalized to all Lebanese physiotherapy centres because we used a small sample size of only 6 centres. Further studies should be conducted in order to validate the quality assessment tool and to involve a greater number of physiotherapy centres throughout Lebanon.

## Conclusion

The quality assessment questionnaire we developed was easy to use and is relevant in terms of the functional areas it covers when assessing the quality of services in physiotherapy centres in Lebanon. Further studies are needed to validate the tool and to get a better insight into the current situation of physiotherapy centres in Lebanon in order to tailor plans for improving the quality of services.

iotherapy centres in Lebanon. Further studies are needed to validate the tool and to get a better insight into the current situation of physiotherapy centres in Lebanon in order to tailor plans for improving the quality of services.

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**Competing interests:** None declared.

## Questionnaire d'une évaluation nationale de la qualité des centres de physiothérapie : étude pilote au Liban

### Résumé

**Contexte :** Le Liban n'a toujours pas de plateforme unifiée permettant aux physiothérapeutes privés de baser et d'appliquer leurs connaissances et leurs pratiques. L'accréditation des centres de physiothérapie permettrait de promouvoir la collaboration, d'améliorer la cohérence et de renforcer la qualité des services. Il est demandé à l'ordre des physiothérapeutes libanais de fournir un service de haute qualité en se concentrant sur les normes.

**Objectifs :** La présente étude vise à évaluer la faisabilité et l'applicabilité d'une norme pour l'évaluation de la qualité des centres de physiothérapie, et d'évaluer la situation actuelle d'un échantillon de centres au Liban.

**Méthodes :** Un questionnaire a été mis au point par un groupe d'experts sur la base d'une analyse des exigences nationales et internationales pour les centres de physiothérapie. Un ensemble de 14 items a été établi pour couvrir trois catégories : les qualifications des équipes, l'établissement et son milieu, et la collecte et l'analyse des données. Une étude pilote a été réalisée de décembre 2013 à février 2014 dans six centres de physiothérapie libanais. Des statistiques descriptives ont été notifiées.

**Résultats :** Les notes médianes et les scores de conformité les plus élevés (en fonction du respect des critères d'exigence) pour les six centres ont été signalés pour la catégorie « Établissement et son milieu » (médiane = 8,0) et les plus faibles pour la catégorie « Collecte et analyse des données » (médiane = 5,0).

**Conclusions :** Des études complémentaires sont requises pour valider le questionnaire sur l'évaluation de la qualité des centres de physiothérapie, et l'appliquer en tant qu'outil principal dans l'évaluation des normes de qualité et l'accréditation des centres de physiothérapie.

## الاستبيان الوطني لتقييم جودة مراكز العلاج الطبيعي في لبنان: دراسة أولية

محمد أبو حيدر، خليفة خليفة، ليندا أبو عباس، زينة ناصر، جسي شرايبة طنوس، جوزيف يمين

### الخلاصة

الخلفية: لا يزال لبنان يفتقر إلى منصة موحدة يمكن أن يعتمد عليها ممارسي العلاج الطبيعي في القطاع الخاص في تأسيس معرفتهم وتطبيق ممارساتهم. وسيساعد اعتماد مراكز العلاج الطبيعي في تعزيز التعاون والتوافق ويحسن من جودة الخدمات. ويُدعى إلى إصدار مرسوم أخصائيي العلاج الطبيعي في لبنان لتقديم خدمة عالية الجودة من خلال التركيز على المعايير.

الأهداف: هدفت هذه الدراسة إلى تقييم جدوى وضع معيار لتقييم الجودة في مراكز العلاج الطبيعي وإمكانية تطبيق هذا المعيار، وتقييم الحالة الحالية لعينة من المراكز في لبنان.

طرق البحث: وضعت لجنة من الخبراء استبياناً قائماً على استعراض للشروط الدولية والوطنية المطلوب توافرها في مراكز العلاج الطبيعي. وتنتج عن ذلك مجموعة من 14 بنداً تغطي ثلاث مجموعات هي: مؤهلات الفريق، وحالة المنشأة والبيئة، وجمع البيانات وتحليلها. وأجريت دراسة أولية في الفترة ما بين ديسمبر/ كانون الأول 2013 وحتى فبراير/ شباط 2014 في 6 مراكز لبنانية للعلاج الطبيعي. وبلغت هنا عن الإحصائيات الوصفية النتائج: لقد كانت أعلى نقاط الوسيط ونقاط الامتثال بالنسبة للمراكز الستة في فئة "حالة المنشأة والبيئة" (الوسيط = 8, 0) وأقلها في فئة "جمع البيانات وتحليلها" (الوسيط = 5, 0).

الاستنتاجات: من الضروري إجراء المزيد من الدراسات لتقييم صلاحية استبيان تقييم الجودة في مراكز العلاج الطبيعي، ولتطبيقه كأداة أساسية في تقييم معايير الجودة واعتماد مراكز العلاج الطبيعي.

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# Nutritional risk screening of hospitalized children aged < 3 years

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## Abstract

**Background:** Identification of children at risk of malnutrition is not easily achieved in hospital settings.

**Aims:** To assess the merits of using the Screening Tool for Risk on Nutritional status and Growth (STRONG<sub>kids</sub>) as a nutrition screening tool in hospitalized children aged < 3 years and correlate it with the severity of their nutritional derangements.

**Methods:** This cross-sectional study was conducted on 500 children aged < 3 years admitted to the Children's Hospital, Ain Shams University, Cairo, Egypt. STRONG<sub>kids</sub> score was used to assess the risk for nutritional derangements and World Health Organization growth charts were used to define underweight, wasted and stunted patients upon admission and discharge.

**Results:** According to STRONG<sub>kids</sub> score, 19.6% of patients were low risk, 42.6% were moderate risk and 37.8% were high risk. Out of the enrolled patients, 62.4% were underweight, 58.4% were stunted and 57.8% were wasted. Among the 66 patients with severe wasting, nutritional status improved in 6.06% while deterioration was observed in 13.0% of the moderately wasted patients. STRONG<sub>kids</sub> score was worse among those who deteriorated, which together with its significant positive correlation with the duration of hospital stay, emphasized that STRONG<sub>kids</sub> score can be a predictive tool.

**Conclusions:** The use of STRONG<sub>kids</sub> screening tool can ensure early identification of children vulnerable to malnutrition, ensuring prompt interventions that may contribute to overall improvements in patient care, as well as shortening hospitalization period.

Keywords: malnutrition, screening, underweight, paediatrics, hospital.

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## Introduction

Malnutrition in hospitalized children is an important pathological condition and a risk factor for unfavourable outcomes, prolonged hospital stay, delayed recovery and increased care costs. Reduction of dietary intake and increased energy requirements are the main causes of hospital undernutrition (1). The reported prevalence of acute malnutrition in infants and children admitted to hospitals from different countries ranges from 6.1 to 40.9% (2). In children with an underlying disease, higher prevalence of chronic malnutrition (44–64%) was reported in several studies (3).

To prevent hospital-acquired malnutrition, the risk of nutritional depletion needs to be identified as soon as possible, ideally at admission, so that appropriate nutritional intervention can be initiated at an early stage (4). Routine nutritional screening is rarely carried out in paediatric patients because of the lack of a simple and properly validated nutritional screening tool. The current practice of identifying children at risk of malnutrition is reliant on interpretation of anthropometric data and clinical judgement; the reliability of which is dependent on nutritional knowledge of paediatricians (5). Severe cases of malnutrition are easily recognized; however, the identification of children with lesser degrees

of malnutrition or at risk of malnutrition, which is also important, is not as easily achieved. Reports of malnutrition prevalence among hospitalized Egyptian infants and children are lacking.

This study was thus designed to assess the merits of using the Screening Tool for Risk on Nutritional status and Growth (STRONG<sub>kids</sub>) as a nutrition screening tool in hospitalized Egyptian children aged < 3 years and correlate it with the severity of their nutritional derangements.

## Methods

This cross-sectional study was conducted on 500 newly hospitalized children recruited from the Children's Hospital, Ain Shams University, Cairo, Egypt, between 1 January and 31 July 2015. There were 297 boys (59.4%) and 203 girls (40.6%). Their mean age was 13.73 [standard deviation (SD) 10.68] months with a range of 1–36 months; 315 patients (63%) were ≤ 12 months old and 185 (37%) were > 12 months old. The mean hospital stay was 6.62 (3.85) days with a range of 2–14 days. They were classified, as surgical or nonsurgical patients and underlying diseases were explored clinically and using laboratory and imaging assessment methods.

For all enrolled children aged < 3 years, we recorded age, sex, diagnosis and length of hospital stay. Nutritional

status was assessed using  $STRONG_{kids}$  and complete anthropometric evaluation of body weight, body length/height, weight for length/height, skinfold thickness and mid arm circumference was done upon admission and discharge.  $STRONG_{kids}$  is an easy to apply nutritional risk screening tool developed according to the latest European Society for Parenteral and Enteral Nutrition (ESPEN) guidelines (6). It consists of 4 elements: subjective clinical assessment, high-risk disease, nutritional intake and weight loss or poor weight gain. It is a comprehensive summary of commonly asked questions concerning nutritional issues, combined with a clinical view of the child's status. Each of the 4 elements of the questionnaire was allocated a score of 1 or 2 points with a maximum total score of 5 points. Patients obtaining 0 points were considered low risk; 1–3 points, moderate risk; and 4 or 5 points, high risk.

Anthropometric measurements were estimated by 2 trained investigators (Y. El-Gendy and B. El-Shaer). Height was measured to the nearest 0.1 cm with a portable stadiometer (Marsden, Rotherham, UK) with children standing bare foot, and recumbent length was measured by an infantometer (Model 416; Seca, Hamburg, Germany). Body weight was recorded to the nearest 0.1 kg using a calibrated baby scale (Model 834; Seca, Germany), with the patients' wearing only underpants or a clean diaper. Triceps skinfold thickness was measured vertically over the left triceps muscle midway between the acromion and olecranon process using a triceps skinfold caliper (Beta Technology Inc., Houston, TX, USA). Mid arm circumference was measured to the nearest centimetre using a nonstretchable tape (Butterfly, China), with the left arm hanging and relaxed in a sitting or lying position, midway between the tip of the acromion and the olecranon process.

Children with malnutrition were divided according to the World Health Organization (WHO) Global Database on Child Growth and Malnutrition, which uses a Z-score cutoff point of  $< -2$  SD to classify low weight-for-age, low height-for-age and low weight-for-height as moderate undernutrition, and  $< -3$  SD to define severe

undernutrition (7).

IBM SPSS version 20 was used for data analysis. Descriptive statistics were generated and numbers and percentages were used. Multivariate logistic regression analysis was performed for predictors of higher  $STRONG_{kids}$  score. Correlation studies were demonstrated in figures and r values provided ( $P < 0.05$  was considered significant).

## Results

According to disease type 86 (17.2%) patients had chronic illnesses and 414 (82.8%) had acute conditions; the most common causes of which were chest infection in 190 (38%) and gastroenteritis in 176 (35.2%). According to  $STRONG_{kids}$  score, 98 (19.6%) patients were classified as low risk, 213 (42.6%) as moderate risk and 189 (37.8%) as high risk. Table 1 shows the details of the points given to the screened patients.

Two hundred and eighty-nine (57.8%) patients were underweight (weight for age  $< -2$  Z score), 292 (58.4%) were stunted (height for age  $< -2$  Z score) and 312 (62.4%) were wasted (weight for height  $< -2$  Z score). Among the wasted cases, 66 had severe wasting and the rest moderate wasting. Table 2 shows that among the 66 patients with severe wasting, nutritional state was not altered in 62 (93.93%) while it improved in 4 (6.06%) who became moderately wasted. Nutritional deterioration was observed in 32 (13.00%) children, who had been moderately wasted at admission and progressed to severe wasting, while 214 (86.99%) remained moderately wasted. Also nutritional deterioration was observed in 6 (3.19%) children who had been normal at admission and progressed to moderate wasting while 182 (96.8%) remained normal.

Five of the 6 patients in the normal weight for height group and 28 of the 32 patients in the moderate wasting group who deteriorated were high risk according to  $STRONG_{kids}$  score. Three of the 4 severely wasted patients who improved were moderate risk according to  $STRONG_{kids}$  score, and the other one was high risk. Among the 62 severely wasted patients who showed no

**Table 1 Nutritional risk screening tool  $STRONG_{kids}$  results among the studied series**

	Yes	No
(1) Subjective clinical assessment (1 point) Is the patient in a poor nutritional status judged by subjective clinical assessment (diminished subcutaneous fat and/or muscle mass and/or hollow face)?	215 (43%)	285 (57%)
(2) High-risk disease (2 points) Is there an underlying illness with a risk of malnutrition or expected major surgery?	270 (54%)	230 (46%)
(3) Nutritional intake and losses (1 point) Is one of the following items present? Excessive diarrhoea ( $> 5$ times/day) and/or vomiting ( $> 3$ times/day) in the last few days? Reduced food intake during the last few days before admission (not including fasting for an elective procedure or surgery)? Pre-existing dietetically advised nutritional intervention? Inability to consume adequate intake because of pain?	378 (75.6%)	122 (24.4%)
(4) Weight loss or poor weight gain? (1 point) Is there weight loss or no weight gain (infants aged $< 1$ year) during the last few weeks/months?	440 (88%)	60 (12%)

**Table 2 Follow-up of nutritional status in children aged < 3 years during hospitalization according to weight for height Z score**

Classification	Patient progress		
	Severe wasting	Moderate wasting	Normal
Severe wasting, 66 (100%)	62 (93.93%)	4 (6.06%)	0 (0.00%)
Moderate wasting, 246 (100%)	32 (13.00%)	214 (86.99%)	0 (0.00%)
Normal weight for height, 188 (100%)	0 (0.00%)	6 (3.19%)	182 (96.8%)
Total, 500 (100%)	94 (18.8%)	224 (44.8%)	182 (36.4%)

improvement, 51 were high risk and 11 moderate risk.

Figure 1 demonstrates a significant positive correlation between  $STRONG_{kids}$  score and duration of hospital stay ( $r = 0.114$ ,  $P = 0.01$ ). However, there was a significant negative correlation between  $STRONG_{kids}$  score and maternal education ( $r = -0.633$ ,  $P = 0.005$ ). The logistic regression showed that after elimination of all other factors, there was significant association between higher  $STRONG_{kids}$  score and each of the following: low maternal education, high duration of hospital stay and low admission weight for age (Table 3).

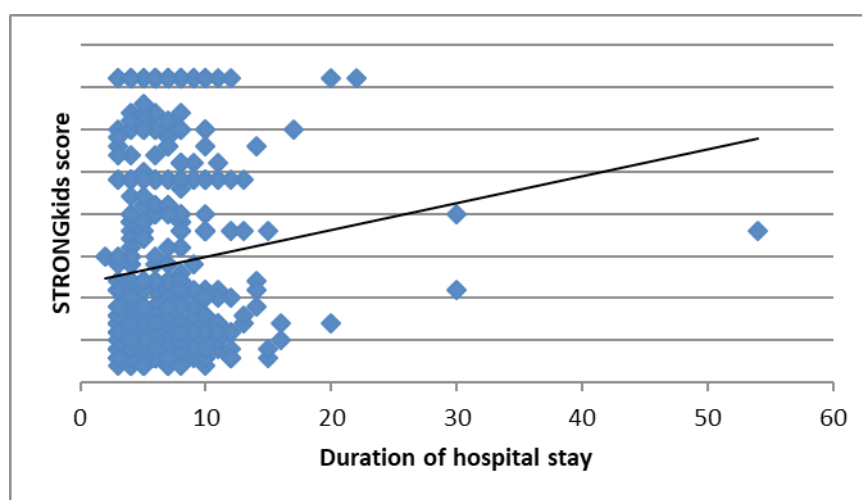
## Discussion

We showed that 17.2% of the patients had chronic illnesses and 82.8% had acute ones. The most common acute illnesses were chest infection in 38% and gastroenteritis in 35.2%. This patient profile is similar to that of Silveira et al. (8) and Saccardo Sarni et al. (9) who reported that respiratory diseases were the main reason for hospitalization. Additionally, Rocha et al. (5) found that the most frequent disease responsible for hospital admission was pneumonia (33%) followed by diarrhoea (6.4%). The noticeable difference in the current study figures is the percentage of hospitalization from gastroenteritis compared to pneumonia, which still has a high disease burden, despite the various preventive efforts of Egyptian governmental and nongovernmental agencies.

According to WHO cutoff values, 62.4% of our patients were underweight, 58.4% were stunted and

57.8% were wasted, which are higher than those for children aged < 5 years (6%, 21% and 8%, respectively) reported in the 2014 Egyptian Demographic and Health Survey (10). Although Rocha et al. (5) reported lower figures for underweight, stunting and wasting in Brazil (18.7, 18.2 and 6.9%, respectively), they mentioned that hospital malnutrition in Latin America can reach up to 70–80%, which agrees with our results. Ozturk et al. (11) found that 31.8% of hospitalized children in Turkey were malnourished and added that well-nourished children do not carry nutritional risk due to hospitalization for other medical reasons. Another Turkish study by Dogan et al. (12) reported that 27% of the hospitalized patients were stunted, 52.4% were underweight and 40.9% were wasted, which is closer to the results in the current study. Malnutrition rates of 32% among hospitalized children in Turkey (13) and 60% among hospitalized children in Thailand (14) further demonstrate the diversity of the published results.

Nutritional deterioration was observed in 13% of the moderately wasted children and 3.19% of patients who were normal at admission. Ferreira and França (15) observed that 20% of children who were well nourished upon admission became malnourished. Rocha et al. (5) reported that 51.6% of 186 hospitalized children lost weight and 9.17% of well-nourished children developed mild malnutrition during hospitalization. Pacheco-Acosta et al. (16), also reported nutritional deterioration in their series of hospitalized children with nonserious disease and advised early



**Figure 1 Correlation between  $STRONG_{kids}$  score and duration of hospital stay.**

**Table 3 Multivariate logistic regression analysis for predictors of higher STRONG<sub>kids</sub> score**

	Significance	OR	95% CI
Age	0.221 (NS)	2.009	0.988–3.029
Maternal education	0.002 (S)	8.007	1.979–10.036
Admission weight	0.01 (S)	6.989	1.952–8.027
Duration of hospital stay	0.001 (S)	8.022	1.995–10.049
Cause of admission	0.128 (NS)	1.071	0.896–1.280

detection of children at risk to enable early interventions. Special attention should be paid to children who are already malnourished upon admission, as they are at risk of further nutritional deterioration during their hospital stay (17).

In the current study 42.6% of the patients were at moderate risk and 37.8% at high risk of developing malnutrition according to STRONG<sub>kids</sub>. These percentages are higher than the risk score recorded in a multicentre Dutch study by Hulst et al. (18). The latter authors reported that 62% of hospitalized children were classified at moderate and high risk by the STRONG<sub>kids</sub> tool. In Romania 58% of children were found to be at risk of malnutrition (24% high risk) by the STRONG<sub>kids</sub> tool (19). The higher figures in the present study can be attributed to the initial increased incidence of underweight, stunting and wasting, as well as persistence of the high rate of hospitalization for gastroenteritis which, if prolonged, can affect weight greatly (20).

The current study showed significant associations between STRONG<sub>kids</sub> score and both prolonged hospital stay and low admission weight for age. These findings are consistent with the above-mentioned Dutch study (18), which predicted a significant relationship between high risk score, a negative SD score for weight for height, and prolonged hospital stay. Several other studies have also documented that malnourished patients stay longer in hospital than well-nourished patients (21,22), confirming the need for early detection of such vulnerable patients.

The results of the current study showed that patients whose nutritional status deteriorated had initial high risk score by STRONG<sub>kids</sub> compared to moderate risk score for those who improved. In retrospect, this emphasizes that STRONG<sub>kids</sub> can be a predictive prognostic tool. Similarly,

Sermet-Gaudelus et al. (23) advised implementation of their simple pediatric nutrition risk score to prevent hospital-acquired malnutrition. In contrast, Huysentruyt and associates (24) did not find a significant correlation between STRONG<sub>kids</sub> risk categories and weight loss during hospitalization. However, they mentioned that these categories correlated with the length of hospital stay and establishment of nutritional intervention during hospitalization.

To our knowledge, this is the first study to explore the STRONG<sub>kids</sub> as a screening and prognostic tool in an Egyptian hospital setting. Nevertheless, this study has its limitations; mainly in the small sample size and lack of long-term follow-up. Additionally, there should be a larger multicentre study including other age groups from all over Egypt to allow us to draw conclusions on a nationwide basis.

## Conclusion

Use of the STRONG<sub>kids</sub> for screening hospitalized children aged < 3 years revealed that nearly 80% were at risk of nutritional derangements, and its scores correlated positively with the length of hospital stay and negatively with body weight at admission. Moreover, the overall malnutrition among these children is a significant problem and patients whose nutritional status deteriorated had higher STRONG<sub>kids</sub> scores. We thus recommend implementation of the STRONG<sub>kids</sub> nutritional risk assessment tool for early screening of hospitalized Egyptian children to avoid prolonged hospitalization and further compromise in their nutritional status.

**Funding:** None.

**Competing interests:** None declared.

## Évaluation du risque nutritionnel des enfants de plus de trois ans hospitalisés

### Résumé

**Contexte :** L'identification des enfants à risque de malnutrition n'est pas une entreprise facile en milieu hospitalier.

**Objectifs :** Évaluer les mérites du recours à l'outil d'évaluation du risque pour l'état nutritionnel et la croissance (STRONG<sub>kids</sub>) en tant qu'outil de dépistage nutritionnel pour les enfants de plus de trois ans hospitalisés et le corréler à la sévérité des troubles nutritionnels.

**Méthodes :** La présente étude transversale a été réalisée auprès de 500 enfants de plus de trois ans admis à l'hôpital des enfants de l'Université d'Ain Shams, au Caire (Égypte). Le score STRONG<sub>kids</sub> a été utilisé pour évaluer le risque de trouble nutritionnel et les diagrammes de croissance de l'Organisation mondiale de la Santé ont été employés pour définir les enfants présentant une insuffisance pondérale, une émaciation et un retard de croissance à l'admission et à la sortie d'hôpital.

**Résultats :** Selon le score STRONG<sub>kids</sub>, 19,6 % des patients présentaient un faible risque, 42,6 % un risque modéré et 37,8 % un risque élevé. Sur les patients participant à l'étude, 62,4 % avaient une insuffisance pondérale, 58,4 % une émaciation et 57,8 % un retard de croissance. Sur les 66 patients présentant une émaciation sévère, l'état nutritionnel s'est amélioré pour 6,06 % et on a observé une détérioration de cet état chez 13,0 % des patients ayant une émaciation modérée. Le score STRONG<sub>kids</sub> était pire chez ceux ayant connu une détérioration de leur état, ce qui, en association avec sa corrélation positive significative avec la durée du séjour hospitalier, soulignait le fait que le score STRONG<sub>kids</sub> peut constituer un outil prédictif.

**Conclusions :** L'utilisation de l'outil de dépistage STRONG<sub>kids</sub> peut permettre l'identification précoce des enfants vulnérables à la malnutrition, ainsi que la mise en place d'interventions rapides qui peuvent contribuer à des améliorations générales des soins aux patients, ainsi qu'à une réduction de la période d'hospitalisation.

## تحري المخاطر التغذوية لدى الأطفال الذين تقل أعمارهم عن ٣ سنوات داخل المستشفيات

سواء شعبان، مي نصار، ياسمين الجندي، بسام الشاعر

### الخلاصة

الخلفية: لا يجري تحديد الأطفال المعرضين لخطر سوء التغذية بسهولة داخل المستشفيات.

الأهداف: هدفت الدراسة إلى تقييم مزايا استخدام أداة الكشف عن المخاطر التي تهدد الحالة التغذوية والنمو (STRONG<sub>kids</sub>) كأداة للكشف عن سوء التغذية لدى الأطفال الذين تقل أعمارهم عن ٣ سنوات داخل المستشفيات، وربطها بمدى شدة الاختلالات التغذوية لديهم.

طرق البحث: أُجريت هذه الدراسة المقطعية على ٥٠٠ طفل تقل أعمارهم عن ٣ سنوات والذين أُدخلوا إلى مستشفى الأطفال، جامعة عين شمس، القاهرة، مصر. واستُخدمت أداة STRONG<sub>kids</sub> في تقييم خطر الاختلالات التغذوية، كما استُخدمت مخططات النمو لمنظمة الصحة العالمية في تحديد نقص الوزن والهزال ونقص النمو لدى المرضى عند إدخالهم إلى المستشفى وإخراجهم منها.

النتائج: وفقاً لأداة STRONG<sub>kids</sub>، كان ١٩,٦ % من المرضى معرضين لخطر منخفض، و٤٢,٦ % معرضين لخطر متوسط، و٣٧,٨ % معرضين لخطر مرتفع. ومن بين المرضى المسجلين، كان ٦٢,٤ % يعانون من نقص الوزن، و٥٨,٤ % يعانون من نقص النمو، و٥٧,٨ % يعانون من الهزال. ومن بين ٦٦ مريضاً يعانون من شدة الهزال، تحسنت الحالة التغذوية لدى ٦,٠ %، بينما لوحظ تدهور لدى ١٣,٠ % من المرضى الذين يعانون من هزال متوسط. وقد كانت نقاط STRONG<sub>kids</sub> أسوأ لدي المرضى الذين تدهورت حالتهم هذا إلى جانب ارتباطها الإيجابي الكبير مع مدة الإقامة في المستشفى مما يثبت أنه يمكن استخدام أداة STRONG<sub>kids</sub> بمثابة أداة تنبؤية.

الاستنتاجات: يمكن أن يضمن استخدام أداة التحري STRONG<sub>kids</sub> لتشخيص المبكر للأطفال المعرضين لخطر سوء التغذية، مما يساعد على التدخل الفوري الذي يساهم في تحسين رعاية المرضى بشكل عام ويقلل من مدة الإقامة في المستشفى.

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# Determinant factors in applying electronic medical records in health-care

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## Abstract

**Background:** Electronic Medical Record (EMR) offers remarkable facilities such as reducing medical errors, decreasing healthcare costs and promoting quality of healthcare services by collecting, storing and displaying information at the point of care.

**Aims:** This study was carried out to identify the determinants of electronic medical record (EMR) adoption by presenting a comprehensive model.

**Methods:** This was a cross-sectional study in which 330 healthcare personnel working in hospitals affiliated to Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran, were selected as the study sample. A proposed conceptual path model of technology, organization and environment (TOE), and technology acceptance model (TAM) was developed to identify the determinants of EMR adoption. The model was authorized by structural equation modeling (SEM) and represented by Analysis of Moment Structures (AMOS).

**Results:** The results of the study showed that the integrated model of TOE–TAM explained 68 percent ( $R^2 = 0.68$ ) of the variance of EMR adoption. The findings also evidenced that perceived ease of use, perceived usefulness, technological context, organization context and environmental context have significant effect on EMR adoption.

**Conclusions:** The study findings suggest that the proposed conceptual integrated model of TOE–TAM is a favourable model for identifying the relevant factors of EMR adoption. The present study clearly recognized nine significant determinants that affect end-users' intention when comprehensive implementation of ERM is considered.

Keywords: electronic medical record, healthcare staff, technology acceptance model, technology organization and environment

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## Introduction

Electronic Medical Records (EMRs) are computerized health information systems that are set to alter the current largely paper-based medical records practice (1). EMR adoption is a significant issue when the system is used for collecting, storing and displaying information for the delivery of healthcare. Moreover, EMRs have appeared to be a vital tool for changing and transforming current healthcare services due to their potential benefits such as reducing medical errors, decreasing healthcare costs, and promoting quality of healthcare services (2,3).

Although it is widely believed that adoption of EMR can lead to improvement in clinical efficiency, the literature provides evidence concerning the failure of implementation of EMR due to end users' resistance (4). A wide variety of models have been established to develop an insight for elucidating and anticipating end-users' intention and supporting the main determinants of information technology adoption (1,2,4–8). For example, a study was carried out by Gagnon et al. (2014) to identify the main determinants of physicians' acceptance of

electronic healthcare records (EHRs), and found that the perceived ease of use and demonstrability had a significant effect on physicians' behaviour in EHR usage (9). However, much of these attempts have failed to present a comprehensive model for EMR adoption.

This study was conducted to revisit the current models and identify new determinants for EMRs adoption by extending the former model developed by researchers and presenting a new comprehensive model. This study was based on the integration and modification of two classical models: Technology, Organization and Environment (TOE) and Technology Acceptance Model (TAM). Effective factors in the adoption and perception of EMRs by healthcare staff were also addressed in this study.

## Hypotheses of the study

Initially, TAM was developed by Davis et al. (1989) (10) in order to understand the process of accepting and adopting information technology. The model, in which Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitude, and Usage were the main components,

was then widely used to elucidate users' behavioural intention with respect to modern technology (10–12). This model shows that PEOU and PU affect attitude, while PU and Attitude together control usage (10). To address the main questions of the study, the following hypotheses, H1 and H2 concerning PU and PEOU, were proposed as; H1: PEOU has a direct effect on EMRs adoption; and H2: PU has a direct effect on EMR adoption.

The TOE model, explaining the level of information system adoption and information technology products, was developed by Tornatzky and Fleischer (1990) (13). The TOE model, which is extensively used for information technology adoption (14), employs three main contexts: technological, organizational, and environmental context, and affecting new technology implementation (15). Relative advantages, compatibility and complexity – categorized under Technology context – seem to have a considerable effect on PU and PEOU. The literature shows relative advantages have direct and significant effects on the variables of TAM; i.e., PU and PEOU (1,13,16,17). Cucciniello et al. (2015) examined the interaction of sociological and technological factors in EMRs' implementation, and found that organizational, cultural, technological and financial considerations should be taken into consideration when comprehensive implementation of EMR is in progress (18). Regarding relative advantages, hypotheses H3 and H4 were proposed as; H3: Relative advantages have positive effects on PEOU; and H4: Relative advantages have positive effects on PU.

Compatibility is defined as “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (19). Given that several studies approve the positive and significant effect of compatibility on PU and PEOU, the following hypotheses were proposed (1,16,19,20) as; H5: Compatibility has a direct effect on PEOU; and H6: Compatibility has a direct effect on PU. There are a number of studies acknowledging the negative role of complexity in information technology (IT) adoptions (1,13,21,22). Concerning complexity, the following hypotheses were proposed as; H7: Complexity has a negative effect on PEOU; and H8: Complexity has a negative effect on PU.

In the TOE model organizational competency, management support, and training and education are categorized as the organizational context. Regarding organizational competency, hypothesis H9 was proposed; H9: Organizational competency has a positive effect on PU.

The role of top management commitment and management support in development, implementation and adoption of new technology, have been addressed in several studies (5,13,23–25). Therefore, we made the following two hypotheses: H10: Management support has a direct effect on PEOU; and H11: Management support has a direct effect on PU. Training decreases the user's technophobia and stress, reduces ambiguity, provides motivation to apply new technology, and helps to better understand new technology adoption (13). Thus,

hypotheses 12 and 13 were proposed to address this variable as follows: H12: Training and education has a positive effect on PEOU; and H13: Training and education has a positive effect on PU.

Finally, environmental context contains two main variables: competitive pressure and trading partner. Both variables impose an effect on adoption of EMR. Thus, hypothesis 14 was proposed as: H14: Competitive pressure has a positive effect on EMR adoption. In the system development life cycle (SDLC) 'support' is a main component and is known as conducting post-implementation system review, identifying errors and enhancements and monitoring system performance (26). In this study we investigated the effect of trading partner support on EMR adoption; thus, hypothesis 15 was proposed as: H15: Trading partner support has a positive effect on EMR adoption. Summary of hypotheses and proposed integrated model is presented in Figure 1.

## Methods

In this cross-sectional study, conducted in teaching hospitals of Tehran University of Medical Sciences (TUMS) from March to September 2016, a modified and integrated model of TOE and TAM was applied for understanding the determinants of EMRs adoption. The population of the study consisted of 1100 healthcare staff working in hospitals affiliated to TUMS. Although Tanaka (1987) has remarked that sample size is a controversial issue in structural equation modeling (27), eight subjects were selected for each item on the basis of Schumacker and Lomax (2004). Stratified random sampling was then used and resulted in a sample of 330 physicians, nurses and medical records experts/ technicians and managers (28). Thereafter, the sample of the study was divided into four groups: physicians, nurses, medical record experts, and managers from each stratum of the study.

A questionnaire based on Gangwar et al. (2015) and Abdekhoda et al. (2016) (1,13) was developed for data collection (Table 1). The face validity of the questionnaire was confirmed by 10 faculty members of the school of Health management and Information Sciences, TUMS. Reliability analysis showed Cronbach  $\alpha = 0.89$ , indicating that the data collection tool was reliable. The items of the questionnaire were framed on a five point Likert scale in which 'Totally agree', 'Agree', 'Neutral', 'Disagree' and 'Totally disagree' were assigned to test the items.

A correlation analysis was performed to identify the correlation coefficient of the variables. Also a graphical path model was adopted to test the hypothesis of the proposed model. The proposed conceptual path model (Figure 1) was developed and tested by using AMOS. In the path analysis, the path coefficients ( $\beta$ ) and corresponding P-values were estimated and presented as the measures of the relationship. Finally, the authorized conceptual path model was presented. Survey questions used to measure the constructs of TOE-TAM are shown in Table 1.

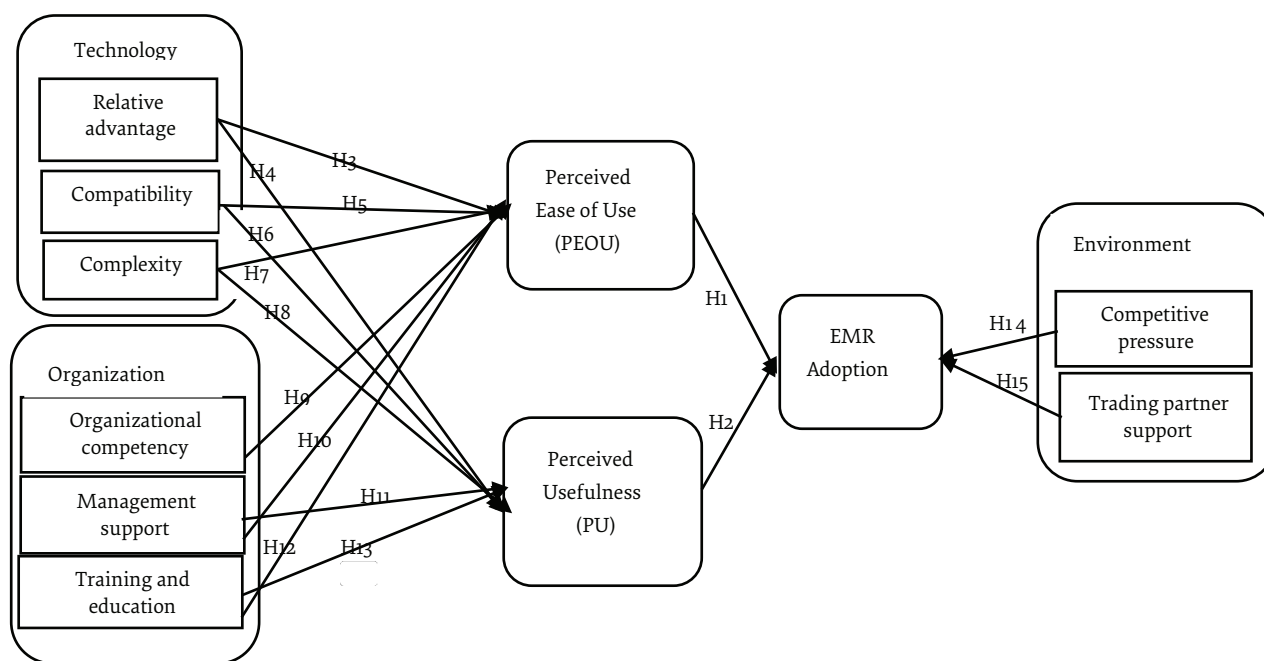


Figure 1 Hypotheses and the proposed conceptual path model of TOE-TAM

## Results

From 330 questionnaires distributed, 278 were returned completed (response rate = 84.24%). Due to the inclusion of wrong information or only partially filled-out questions, 41 questionnaires were not suitable for analysis; thus, the final analysis was conducted for 237 questionnaires. Table 2 shows demographic information of the participants of the study.

The correlation between variables of the proposed integrated model is shown in Table 3. As seen, there is a significant correlation between TAM variables, i.e., PEOU and PU, and the use of EMRs. Moreover, there is a significant correlation between technological context, organizational context and environmental context and TAM variables (PU and PEOU) and the use of EMR.

Figure 2 indicates that PU and PEOU have a positive and significant effect on the EMRs' adoption ( $\beta = 0.71, P \leq 0.01$ ;  $\beta = 0.49, P \leq 0.01$ ). Thus, relative advantage, compatibility, and complexity indicated positive and significant effects on both PU and PEOU. Figure 2 also indicates organizational competency has a direct and significant effect on PEOU ( $\beta = 0.21, P \leq 0.01$ ); and management support has a direct and significant effect on both PU and PEOU ( $\beta = 0.31, P \leq 0.01$ ;  $\beta = 0.27, P \leq 0.01$ ). However, training and education appeared to have a positive and significant effect on PEOU whereas no significant effect on PU was found. Finally, Figure 2 indicates that environmental context has a direct and significant effect on the adoption of EMR. These findings revealed altogether that technological context and organizational context explained 48% of the variance observed in PEOU, and 57% of the variance observed in

PU. Furthermore, 68% of variance of EMRs adoption can be explained by the integrated model of TOE and TAM

Table 4 indicates the recommended goodness-of-fit measure. The ratio  $\chi^2$  was used to test whether the selected distribution was a good fit to the data. A relative  $\chi^2$  value appeared to be acceptable (Relative  $\chi^2 = 1.02$ ). Moreover, Tucker Lewis Index (TLI), Comparative Fit Indices (CFI), Normal Fit Index (NFI), and Relative Fit Index were measured and obtained values that were favourable.

## Discussion

The results of the present study indicate that technological context, organizational context, and Environmental context as well as variables of TAM are important determinants when comprehensive implementation of EMR is considered.

Concerning the correlation between PEOU and PU on one side, and the adoption of EMRs on the other, the findings show PEOU have a direct and significant effect on EMRs adoption. Thus H1 was supported. Also, the findings revealed that PU had a strong effect on EMRs adoption; hence, H2 was supported. These findings are in line with the findings reported in the literature (1,14,19,20,29,30). It is believed that when comprehensive implementation of EMRs is considered, the personnel's interaction with EMRs should be clear and understandable, while the operation of EMR should be easy and navigation of such systems should be user friendly.

Concerning the association between relative advantages and PEOU, the standard coefficient of PEOU and adoption of EMRs was 0.27 ( $P = 0.01$ ), supporting

**Table 1** Survey questions used to measure the constructs of TOE–TAM

Construct	Item Number	Items
<b>Perceived Usefulness</b>	1	“Applying EMRs in my job would enable me to accomplish tasks more quickly.”
	2	“Applying EMRs improve my job performance.”
	3	“Applying EMRs would make it easier to do my job.”
	4	“Applying EMRs are useful in my job.”
<b>Perceived Ease Of Use</b>	5	“I believe that interaction with EMRs would be clear and understandable.”
	6	“I believe navigation of EMRs would be easy.”
	7	“Learning to operate EMRs would be easy for me.”
	8	“It would be easy for me to become skillful at using EMRs.”
<b>Using EMRs</b>	9	“I use EMRs in my work routinely.”
	10	“In future, I would like to adopt EMR in my work.”
	11	“In my job, considerable part of routinely work was carried out by adopting EMR.”
<b>Relative Advantage</b>	12	“Adopting EMR, improve the quality of my work.”
	13	“Using EMRs improves my job performance.”
	14	“Adopting EMR causes enhance effectiveness in my job.”
	15	“By adopting EMR, my work productivity will increase.”
<b>Compatibility</b>	16	“Using EMRs is compatible with all aspects of my work.”
	17	“Using EMRs is completely compatible with my current situation.”
	18	“Using EMRs fits into my work style.”
<b>Complicatedness</b>	19	“I believe that EMRs is complicated to use.”
	20	“It is difficult for me to remember how to perform tasks using EMRs.”
	21	“Using EMRs is often frustrating”.
	22	“Adopting EMRs need a lot of mental effort”.
<b>Organizational Competency</b>	23	There are highly specialized and knowledgeable personnel for EMRs implementation.
	24	There are sufficient technological resources to implement EMRs in our hospital.
	25	There are sufficient technological resources to implement EMRs in our hospital.
	26	A percent of total revenue has been allocated for EMRs adoption in our hospital.
<b>Management Support</b>	27	“The EMR project is important to top management.”
	28	“The EMR project will be introduced to me effectively by the management.”
	29	“Management will do a helpful job during the implementation of the EMR.”
	30	“Management expects me to use the EMR.”
<b>Training and Education</b>	31	“I will receive the training that I need to be able to understand and use the EMR.”
	32	“The EMR training will make it more useful to me.”
	33	“The EMR training will make it easier for me to use this technology.”
	34	“The training gave us confidence in use ERMs.”
	35	My organization provided me complete training in using EMRs.
<b>Competitive Pressure</b>	36	We are aware of EMRs implementation in our hospital.
	37	We understand the competitive advantages offered EMRs in our hospital.
	38	I believe that EMRs adoption is competitive advantage.
<b>Trading Partner Support</b>	39	Our trading partner support provides technical assistance for readiness of EMRs services.
	40	Our hospital ensure that EMRs provider considerably invest in promotion EMRs services and they are responsible about it.
	41	We are confident that the EMRs' partner has a systematic program for handling and examining for EMRs adoption.
	42	We ensure that EMRs vendors implement strong access and identity management to ensure unauthorized access to EMRs.

H3, and indicating relative advantages have positive and significant effect on PEOU. The standard coefficient of PU and EMRs adoption was 0.35 ( $P = 0.01$ ), supporting H4. These findings are similar to the results of the studies carried out by Zhang (2008), Wu (2008), Conrad (2009), Ping (2009), Gangwar (2015) and Abdekhoda et al. (2015,2016), who reported that relative advantages have positive and significant effect on PEOU and PU

(1,13,16,17,23,24,31). This finding can imply that if EMRs adoption had no noticeable advantage for healthcare staff, its implementation would not be welcome.

As for the relationship between compatibility and TAM variables, the results show that compatibility has a positive and significant effect on PEOU and PU, supporting H5 and H6. Likewise, Rogers (2003), Chew (2004), Zhang (2008), Tung (2008) and Abdekhoda et

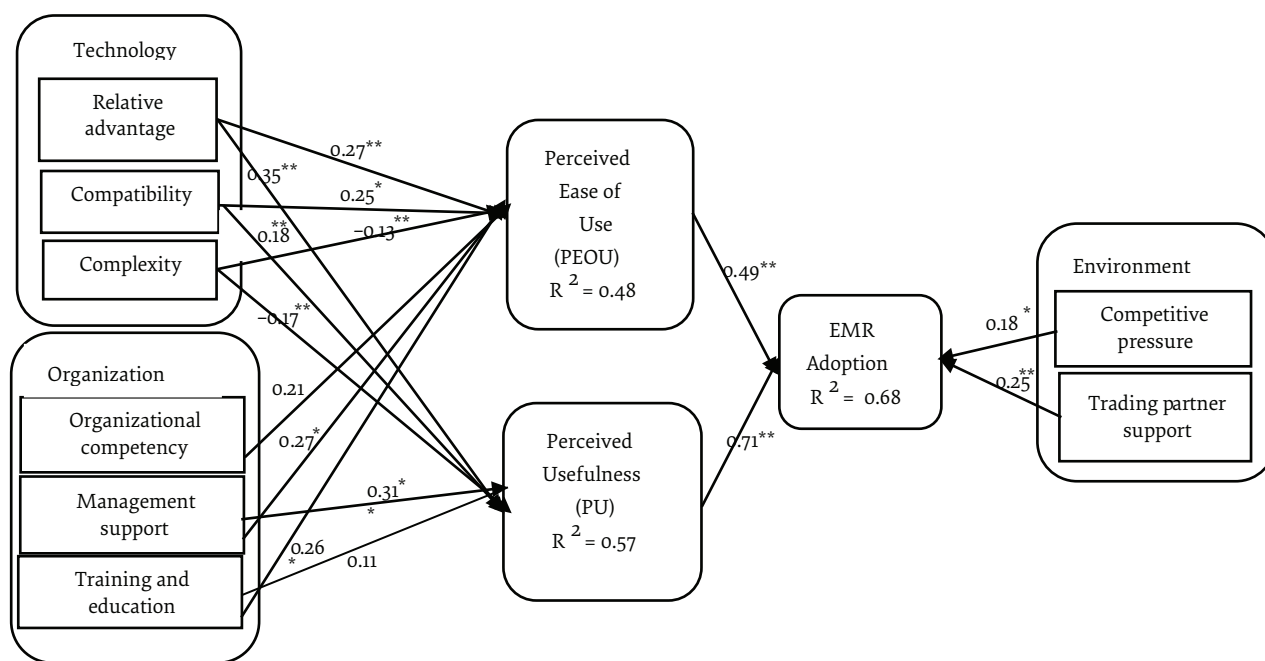
**Table 2 Demographic breakdown of the sample**

Demographics	Category	Frequency	%	Mean	SD
<b>Gender</b>	Male	75	34.88		
	Female	140	65.11		
	Missing	22	-		
	Total	237	100		
<b>Age</b>	25-30	45	22.16		
	31-35	79	38.91		
	36-40	85	41.87		
	40-45	23	11.33	38.1	4.07
	45 ≤	5	2.4		
	Missing	34	-		
	Total	237	100		
<b>Profession</b>	Physicians	70	29.53		
	Nurses	79	33.33		
	Medical records specialists	32	13.5		
	Managers	56	23.62		
	Total	237	100		
<b>Work experience</b>	1-5	46	24.86		
	5-10	75	40.54		
	10 ≤	64	34.59	7.09	4.2
	Missing	52	-		
	Total	237	100		

**Table 3 Correlation between variables of proposed integrated model**

Constructs	Adoption	Perceived Ease of Use	Perceived Usefulness	Relative advantage	Compatibility	Complexity	Organizational competency	Management support	Training and education	Competitive pressure	Trading partner support
<b>Adoption</b>	1										
<b>Perceived Ease of Use</b>	0.531**	1									
<b>Perceived Usefulness</b>	0.542**	0.514**	1								
<b>Relative advantage</b>	0.403**	0.578**	0.725**	1							
<b>Compatibility</b>	0.208**	0.732**	0.543**	0.571**	1						
<b>Complexity</b>	-0.395**	-0.632**	-0.564**	-0.612**	-0.635**	1					
<b>Organizational competency</b>	0.374**	0.543**	0.451**	0.678**	0.342**	-0.683**	1				
<b>Management Support</b>	0.564**	0.679**	0.629**	0.696**	0.617**	-0.725**	0.516**	1			
<b>Training and education</b>	0.193	0.203**	0.208	0.114	0.203**	0.359**	0.354**	0.516**	1		
<b>Competitive pressure</b>	0.195**	0.104	0.203**	0.526**	0.431**	0.215**	0.435**	0.325**	0.389**	1	
<b>Trading partner support</b>	0.604**	0.709**	0.203**	0.368**	0.269**	0.287**	0.342**	0.431**	0.425**	0.345**	1

\*\*P-value is significant at 0.01



\* P ≤ 0.05; \*\* P ≤ 0.01.

Figure 2 Validated proposed integrated model results

al. (2016) found that compatibility had a direct and significant effect on TAM variables (1,16,19,20,32). When implementing EMR, we should consider whether it is well matched with the personal characteristics of healthcare staff and fits well into the workflow.

Regarding the correlation between complexity with PEOU and PU, complexity was found to have a negative and significant effect on PEOU and PU. Thus, H7 and H8 were supported. The literature has reported that complexity has a negative effect on implementation of new technology (1,17,26,29–31). The findings imply that when the adoption of EMR is accompanied with complexity, end users' tendency to apply this system decreases significantly.

The findings on the relationship between organizational competency and PEOU (Figure 2), suggest that organizational competency has a positive and significant effect on PEOU. Hence, H9 was supported, and supports Gangwar 2015 (13). Organizational competency is defined as “the institutional capacity or efficiency

that is necessary to enable the organization to achieve the goal and objectives in its strategies plan” (33). Thus, for the successful implementation of EMRs, sufficient technological resources and allocation of a percentage of total revenue should be considered by healthcare organizations. Furthermore, the finding shows that management support has a positive and significant effect on both PEOU and PU. Thus, H10 and H11 were supported. Morton (2008), Kowitlawakul (2008), Wu et al. (2008), Gangwar (2015), and Abdekhoda et al. (2015) have reported a direct and significant path coefficient rate between management support and TAM variables (PU and PEOU) (5,13,23–25). The implementation of EMR should be considered as an imperative change for top managers and must be fully supported by them.

Concerning the effects of training and education on TAM variables (PEOU and PU), the results show that training and education have a positive and significant effect on PEOU, but they have no significant effect on PU. Hence, H12 was supported; whereas H13 was not

Table 4 Recommended goodness-of-fit measure

Fit Index Category	Suggested index	Suggested value	Obtained value
Absolute fit	Relative X2	Relative X2 < 3.0	1.02
Incremental fit	Tucker-Lewis Index (TLI)	0.90 or above acceptable fit	0.91
Incremental fit	Comparative fit index (CFI)	0.90 or above	0.93
Incremental fit	Normal fit index (NFI)	0.90 or above	0.92
Incremental fit	Relative Fit Index (RFI)	0.90 or above	0.94

**Table 5 Summary of proposed results for the theoretical model**

Proposed research paths	Coefficient value	P value	Empirical evidence
H1	0.49	≤ 0.01	Supported
H2	0.71	≤ 0.01	Supported
H3	0.27	≤ 0.01	Supported
H4	0.35	≤ 0.01	Supported
H5	0.25	≤ 0.01	Supported
H6	0.18	≤ 0.01	Supported
H7	0.13	≤ 0.01	Supported
H8	0.17	≤ 0.01	Supported
H9	0.21	≤ 0.01	Supported
H10	0.27	≤ 0.01	Supported
H11	0.31	≤ 0.01	Supported
H12	0.26	≤ 0.05	Supported
H13	0.11	≥ 0.05	Not supported
H14	0.18	≤ 0.05	Supported
H15	0.25	≤ 0.01	Supported

supported. Similarly, Morton (2008) and Abdekhoda et al. (2015) found that training had no significant effect on PU (5,23). Other studies reported that training should be considered as an important determinant when successful implementation of new technology was followed.

Finally, the results show that environmental context, i.e., competitive pressure and trading partner support, have a positive and significant effect on EMRs adoption. Concerning the association between comparative pressure and EMRs adoption, the coefficient rate of 0.18 ( $P = 0.05$ ) was obtained, indicating competitive pressure had a positive and significant effect on EMRs adoption; thus, H14 was supported. Similarly, Gangwar et al. (2015) found that when cloud computing was considered as a competitive instrument, pressure to adopt cloud computing and having a competitive edge were encouraged (13).

The findings also revealed that EMRs adoption was significantly driven by trading partner support. In EMRs adoption phases, trading partner support should provide technical assistance for EMRs services, while conducting post-implementation system review, identifying errors and enhancements and monitoring system performance should be taken into consideration. However, some limitations are noted in this study. Self-reported use of EMRs by healthcare staff (instead of monitoring the actual use of this system), self-selection biases in the process of completing the questionnaire, and limiting the population of this study to the teaching hospital of TUMS, were a number of the limitations that should be

considered in upcoming studies. A summary of proposed results for the theoretical model are presented in Table 5.

## Conclusion

This study was conducted to determine the significant factors that may affect EMRs adoption. To this end, two classical models of TOE and TAM were integrated and extended. The findings of this study suggest that the proposed integrated model of TOE and TAM is appropriate for identifying the relevant factors of EMRs adoption. The present study identified nine significant determinants that affect the end user's behaviour when comprehensive implementation of EMRs is considered. Overall, the findings show that the two main components of TAM, PEOU and PU act as mediating variables for external variables of the modified model. External variables of TAM, relative advantages, compatibility, complexity, organizational competency, management support, competitive pressure, and trading partner support appeared to have significant effects on EMRs adoption. Thus, in order to fulfill the implementation of EMR, a wide variety of factors such as perceived ease of use, perceived usefulness, technological context, organizational context and environmental context should be considered. Future studies should focus on the role of other factors such as personnel characteristics, security and confidentiality that may affect EMR adoption.

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**Competing interests:** None declared.



## Facteurs déterminants de l'utilisation de dossiers médicaux électroniques dans les soins de santé

### Résumé

**Contexte :** Les dossiers médicaux électroniques offrent des possibilités remarquables telles que la réduction du nombre d'erreurs médicales, la diminution des coûts de santé et la promotion de la qualité des services de soins de santé grâce à la collecte, au stockage et à l'affichage de l'information sur le lieu où sont prodigués les soins.

**Objectifs :** La présente étude a été menée dans le but d'identifier les déterminants de l'adoption de dossiers médicaux électroniques en recourant à une présentation d'un modèle complet.

**Méthodes :** Il s'agissait d'une étude transversale au cours de laquelle 330 personnels de santé travaillant dans les hôpitaux rattachés à l'Université de Sciences médicales de Téhéran (République islamique d'Iran) ont été sélectionnés pour constituer un échantillon d'étude. Un modèle conceptuel de type PATH (outil d'évaluation de la performance pour améliorer la qualité dans les hôpitaux) pour le cadre de technologie, organisation, environnement (TOE) et le modèle d'acceptation de la technologie (MAT) a été proposé et élaboré afin d'identifier les déterminants de l'adoption de dossiers médicaux électroniques. Ce modèle a été validé par la modélisation d'équations structurelles et représenté au moyen du logiciel de statistiques AMOS.

**Résultats :** Les résultats de l'étude ont montré que le modèle intégré TOE-MAT permettait d'expliquer 68 % de la variance ( $R^2 = 0,68$ ) de l'adoption de dossiers médicaux électroniques; ils ont aussi mis en évidence la facilité d'utilisation et l'utilité perçues, ainsi que le fait que les contextes technologique, organisationnel et environnemental avaient une influence importante sur cette dernière.

**Conclusions :** Les conclusions suggèrent que le modèle conceptuel intégré TOE-MAT proposé constitue un modèle utile pour l'identification des facteurs pertinents de l'adoption de dossiers médicaux électroniques. L'étude identifie également clairement neuf déterminants importants qui influent sur l'intention des utilisateurs finaux de mettre en place ce système de façon exclusive.

### العوامل المحددة لاستخدام السجلات الطبية الإلكترونية في مجال الرعاية الصحية

محمد هيوأ عبدخدا، أفسانه دهناد، جواد زارعي

#### الخلاصة

الخلفية: يوفر السجل الطبي الإلكتروني تسهيلات ملحوظة، مثل الحد من الأخطاء الطبية، وتخفيض تكاليف الرعاية الصحية، وتعزيز جودة خدمات الرعاية الصحية من خلال جمع المعلومات وتخزينها وعرضها في مكان توفير الرعاية.

الأهداف: أجريت هذه الدراسة لتحديد العوامل المحددة لاستخدام السجل الطبي الإلكتروني من خلال عرض نموذج شامل.

طرق البحث: لقد كانت دراستنا مقطعية، حيث تم اختيار 330 عاملاً في مجال الرعاية الصحية في المستشفيات التابعة لجامعة طهران للعلوم الطبية، طهران، جمهورية إيران الإسلامية، بمثابة عينة للدراسة. ووضِع نموذج المسار المفاهيمي المقترح للتكنولوجيا والتنظيم والبيئة، ونموذج قبول التكنولوجيا بهدف تحديد العوامل المحددة لاستخدام السجل الطبي الإلكتروني. واعتمد النموذج بواسطة نمذجة المعادلة الهيكلية، وتم تمثيله باستخدام تحليل الهياكل اللحظية.

النتائج: أظهرت نتائج الدراسة أن النموذج المتكامل للتكنولوجيا والتنظيم والبيئة ونموذج قبول التكنولوجيا يوضح 68٪ ( $R^2 = 0,68$ ) من التباين في استخدام السجل الطبي الإلكتروني. كما أثبتت النتائج أن سهولة الاستخدام الملموسة والفائدة المتصورة والسياق التكنولوجي والتنظيمي والبيئي لهم تأثير كبير على استخدام السجل الطبي الإلكتروني.

الاستنتاجات: اقترحت نتائج الدراسة أن النموذج المتكامل المفاهيمي المقترح للتكنولوجيا والتنظيم والبيئة ونموذج قبول التكنولوجيا نموذج ملائم لتحديد العوامل ذات الصلة باستخدام السجل الطبي الإلكتروني. وحددت الدراسة الحالية بوضوح تسعة عوامل محددة مهمة تؤثر في مقصد المستخدمين النهائيين عندما يتم الأخذ في الاعتبار التنفيذ الشامل للسجلات الطبية الإلكترونية.

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# Effect of fasting during Ramadan on thermal stress parameters

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## Abstract

**Background:** High process temperatures associated with industrial operations augment risk of heat stress and illness, particularly during summer months in the Gulf Region. Lack of hydration and nutrition during day time, during Ramadan can subject workers to even greater risk of heat stress and illness.

**Aims:** To examine the physiological effects of prolonged fasting in thermally challenging conditions.

**Methods:** Longitudinal measurements were carried out on employees during fasting in Ramadan in three departments of an aluminium smelter. After informed consent, physiological parameters were measured at 4-hour intervals.

**Results:** Average heart rate and urine specific gravity increased in the first 4 hours of shift work, while tympanic temperature did not rise significantly. Moreover, in the second 4 hours of shift work, urine specific gravity stabilized compared to the first 4 hours.

**Conclusions:** Robust workplace measures are needed for industries with high process temperatures, located in the Gulf Region, in order to minimize the enhanced risk of heat stress and illness during Ramadan.

Keywords: Heat stress, heat illness, Ramadan, aluminium smelting, work place, Gulf

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## Introduction

Stressors of various kinds affect manual labourers including physiological as well as sociocultural factors (1,2). High heat exposure is one of the primary reasons for work stress in the Middle East. In parts of the Region, ambient temperatures rise above 45°C in the summer and the accompanying relative humidity can reach 90%, putting immense pressure on the bodily systems of outdoor workers (3). Manual labourers often consist of national and expatriate workforces (4), and many local workers are known to be reticent in terms of intake of fluids and food in the morning when reporting to work during Ramadan, resulting in hypohydration (5). While this behaviour is erratic and differs between individuals, there are few studies examining the effect of food and fluid deprivation during the fasting months of Ramadan in the Middle East (6). This fasting period of Ramadan occurs during the summer months in successive years in accordance with the Islamic calendar and creates a unique situation for health and safety professionals (7). While consumption of water *ad libitum* does not completely eliminate dehydration of workers during other times, the mandatory withholding of fluids and food during daylight hours in Ramadan places health and safety professionals in a challenging environment in the context of ensuring worker health and safety (8).

Lifestyle prior to industrialization in the Gulf Region was predominantly based on agriculture and fishing, which permitted periods of rest during the heat of the day (9) as well as the requirements and practices of Ramadan

(10). However, the discovery of oil and subsequent industrialization brought about new occupational challenges. Industries that require operation 24 hours a day for 7 days a week generally employ 3 shifts of 8 hours or 2 shifts of 12 hours. Changes in lifestyle after the onset of industrialization include longer working hours, consumption of diets high in processed foods, higher calorie count, carbonated drinks, and lower physical activity levels (11).

Maintaining the health and safety of fasting individuals (workers) during Ramadan is a challenge in the modern industrial context (12). Ramadan follows the lunar calendar and thus moves back 10 days each year, meaning that the month of Ramadan takes place at different times over several years, and eventually the cycle repeats every 33 years (13). When Ramadan occurs during the summer months, daytime duration is longer and predisposes the fasting individual to greater risks of heat fatigue due to lack of fluids and nutrition, especially in workers engaged in physically strenuous tasks outdoors. This study aimed to examine the physiological effects of prolonged fasting in thermal stress conditions mandated for religious reasons.

## Methods

### Study procedure

Longitudinal observations were conducted by selecting 2010 operational (field) male employees (average age 27.33 years) involved in physically strenuous and demanding work in an aluminium smelter in Oman. All participants

took part in consecutive fasting for > 14 days during Ramadan from 2009 to 2010. The periods of observation were the summer months of August and September covering the beginning, middle and end of Ramadan. One third of the subjects was hypo-hydrated at the start of the shifts and was excluded from the analysis. Fasting during Ramadan can be considered as intermittent fasting for 29–30 days (14). Three departments at the smelter were identified as prone to excessive heat, namely: (1) casting house (due to high temperatures from metal melting and casting furnaces; 73 participants); (2) carbon anode plant (due to radiation from anode baking furnaces; 76 participants); and (3) electrolytic reduction (due to a temperature of ~950°C in the pot cells; 52 participants). Sets of employees working in the same shift for 2 successive days were chosen each day. Two employees from each work area mentioned above were the focus of observations for 2 consecutive days. Informed consent (both English and Arabic versions made available) of participating employees was obtained before enrolment in the study.

### Heat strain measurement

Heat strain was measured using a chest strap that monitored heart rate continuously, and was a surrogate for physical strain resulting from activity and heat. Heart rate data were transmitted to a remote recorder (FT 80; Polar Electro, Kempele, Finland) worn by the worker. Hydration status was assessed from urine specific gravity measured at the start, middle and end of the shift. Hypohydration was defined as specific gravity > 1025. Tympanic temperature and blood pressure were also measured at these times or as demanded in between. The heart rate data were downloaded from the Polar Electro watch and transferred to the Case Record Form as mean and maximum heart rates over 4-hour periods. An Excel spreadsheet was used to collect and analyse the data separately for the 3 departments.

### Statistical analysis

Continuous data such as heart rate, tympanic temperature, blood pressure and urine specific gravity were summarized as means and standard deviations (SDs). The observations at the end of 4 and 8 hours were analysed in this fashion. Hypohydration data were presented as percentages and departmental data were compared by  $\chi^2$  test. One-way analysis of variance (ANOVA) was used to compare the parameters at baseline and 4 and 8 hours into the shift period. Repeated-measures ANOVA was undertaken to determine the overall effect of heat stress between the various time points across departments. All statistical analyses were done using SPSS version 20.  $P < 0.05$  was taken as statistically significant.

### Results

The departments were similar in terms of the baseline parameters, except systolic and diastolic blood pressures, which were significantly lower in the casting house (Table 1). The mean values of other baseline parameters were not significantly different, especially urine specific gravity.

After the first 4 hours of work, average heart rate increased from resting heart rate by > 13 beats per minute; tympanic temperature increased slightly; and urine specific gravity increased substantially (Table 2). None of these differences were significant. Average heart rate during the second 4-hour shift increased beyond what was recorded during the first 4 hours. The tympanic temperature increased in the electrolytic reduction department and casting house, whereas the average heart rate registered an increase in all three areas (Table 3). Urine specific gravity stabilized compared to the first 4 hours of the shift.

Estimated marginal means of the 3 main physiological parameters adjusted by department using repeated-

**Table 1 Baseline parameters of workers in different departments of the aluminium smelter**

Department	Age (yr)	BMI	RHR (beats/min)	SBP (mmHg)	DBP (mmHg)	USG	TT (°C)
Carbon anode plant	27.59 (4.17)	24.83 (4.42)	73.05 (8.14)	122.32 (14.00)	77.36 (9.54)	1014 (8)	36.22 (0.47)
Electrolyte reduction	28.12 (6.18)	24.31 (4.55)	71.98 (7.83)	123.17 (11.29)	75.40 (9.45)	1016 (7)	36.19 (0.44)
Casting house	26.50 (4.26)	25.48 (4.14)	70.14 (7.11)	118.22 (12.76)	72.86 (9.21)	1015 (7)	36.15 (0.46)
P	0.089	0.418	0.731	0.033	0.036	0.677	0.498

Results are presented as mean (standard deviation). BMI = body mass index; RHR = resting heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure; USG = urine specific gravity; TT = tympanic temperature.

**Table 2 Physiological parameters after 4 hours of work in the 3 departments of the smelter**

Parameters	Carbon anode plant	Electrolyte reduction	Casting house	P
TT	36.29 (0.49)	36.21 (0.5)	36.17 (0.45)	0.592
Average heart rate	86.28 (12.54)	89.13 (12.42)	87.62 (10.16)	0.852
Maximum heart rate	136.0 (22.34)	135.45 (22.02)	137.26 (23.48)	0.645
USG	1022 (5)	1023 (5)	1020 (4)	0.230

Results are expressed as mean (standard deviation). TT = tympanic temperature; USG = urine specific gravity.

**Table 3 Physiological parameters after 8 hours of work in the 3 departments of the smelter**

Parameters	Carbon anode plant	Electrolyte reduction	Casting house	P
TT	36.18 (0.50)	36.32 (0.55)	36.18 (0.46)	0.780
Average heart rate	90.12 (12.54)	92.15 (12.13)	91.82 (10.16)	0.854
Maximum heart rate	137.66 (21.45)	138.55 (26.54)	140.09 (16.08)	0.311
USG	1021 (6)	1023 (4)	1021 (4)	0.134

Results are expressed as mean (standard deviation). TT = tympanic temperature; USG = urine specific gravity.

measures ANOVA are graphically represented in Figure 1. The data show steady increases up to 4 hours for urine specific gravity and average heart rate, followed by later stabilization. There was only a marginal increase in tympanic temperature during the corresponding periods.

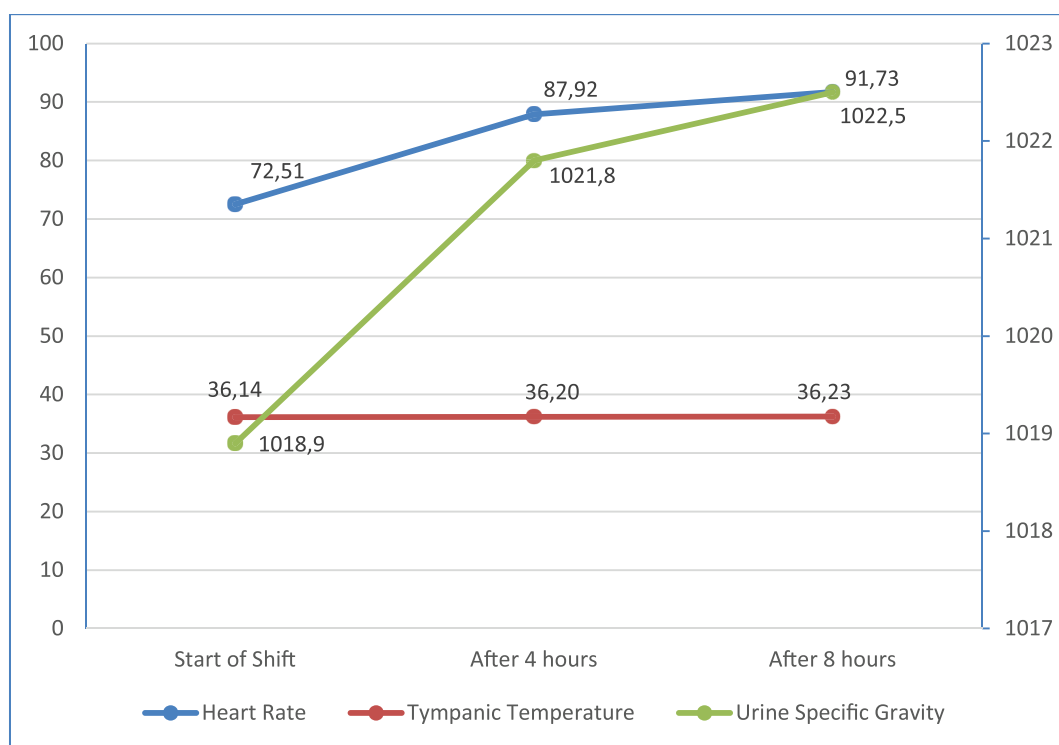
The effect of Ramadan fasting in statistical terms is shown in Table 4. The above-mentioned changes were all statistically significant in employees normally arriving hydrated at the start of the shift. However, there was no significant increase beyond the clinically accepted values of tympanic temperature. The interdepartmental differences were not statistically significant.

Intervention by means of hydration of workers that is usually followed during normal times could not be enforced in the fasting period. Hence, the percentage of employees becoming hypo-hydrated during shift progressed to 34%, 51.2% and 24.6% in carbon anode plant, electrolytic reduction department and casting house, respectively, in the first 4 hours. At the end of the second shift, the casting house showed that 32.9% of employees were dehydrated, whereas the electrolyte reduction department (48%) and carbon anode plant (32.9%) corrected the situation to some extent.

### Discussion

Average heart rate during the first 4 hours of shift increased from resting heart rate by > 13 beats per minute and there was a corresponding increase in the tympanic temperature and urine specific gravity. Variations in these parameters are clear indicators of increased risk of developing heat stress in fasting individuals exposed to high occupational heat. Average heart rate during the second 4 hours of shift increased without a corresponding increase in tympanic temperature. Urine specific gravity more or less stabilized in the second compared to the first 4 hours. This most likely reflects the physiological slow-down brought on by fatigue and consequent self-pacing. Cognitive and physical capabilities of workers may be significantly lowered due to inadequate nutrition and fluid intake (15). Clearly, this sequence of events significantly lowers productivity. Safety of workers could be significantly jeopardized in the absence of self-pacing and other supportive workplace measures (16).

Classically, heat stress is characterized by elevation of average heart rate above 110 beats per minute for a period, as per 1969 World Health Organization recommendations



**Figure 1 Repeated-measures analysis of variance estimates of the parameters by shift phases**

**Table 4 Repeated-measures analysis of variance of results showing effect of duration of work adjusted by smelter department**

Source	Measure	Type III sum of squares	df	Mean square	F	P
Shift	TT	0.648	1	0.648	4.136	0.044
	USG	0.001	1	0.001	54.042	< 0.001
	HR	26 705.525	1	26 705.525	354.612	< 0.001
Shift * Department	TT	0.219	2	0.110	0.701	0.498
	USG	0.000	2	5.03×10 <sup>5</sup>	2.927	0.057
	HR	252.624	2	126.312	1.677	0.190
Error (Shift)	TT	22.710	145	0.157		
	USG	0.002	145	1.718×10 <sup>5</sup>		
	HR	10 919.835	145	75.309		

df = degrees of freedom; TT = tympanic temperature; USG = urine specific gravity; HR = heart rate.

(17). If the heart rate is above the maximum sustainable rate, performance deteriorates, putting the worker and the process at risk (18). The increase in heart rate is consistent with loss of hydration to the extent of 10 beats for every 1% loss in body weight. Hypohydration also increases the core temperature at proportionate levels of 0.22°C for every 1% loss of mass. Core body temperature above 38°C puts workers at risk of exhaustion (19). Religiously mandated fasting can subject people to higher stresses than caused by lack of fluid intake, which curtails production of sweat for body cooling.

This study had some limitations. Physiological observations were made in a factory setting and could not be conducted in a manner similar to those in a controlled laboratory environment. Although tympanic temperature may not be the best way to measure body temperature in an ideal laboratory or clinical setting, it is the most convenient means available in a factory setting. The other limitations were that heart rate and urine specific gravity were also affected by personal factors, including use of certain medications. Even though observations were made throughout Ramadan, analyses were not done separately for different phases of Ramadan (early, middle and end). Although the context of physiological adaptations during different phases was

essential for the purpose of this article, the difficulty in the availability of volunteers for real-time observations limited our sample size.

## Conclusions

Physiological observations during fasting showed a steady increase in the 4-hour period with regard to urine specific gravity and average heart rate. These changes were all significant in employees arriving normally hydrated at the start of the shift. Our observations indicate that workplaces with high environmental temperatures and physically demanding tasks require better administrative workplace controls, including temperature reduction, generous work–rest regimens, and optimization of shift duration and number of workers during hotter parts of the day, to ensure that variations in physiological parameters do not jeopardize the health and safety of workers. We also recommend investigating development or use of a thermal index more suitable to local conditions and culture in the Gulf Region than currently available heat indices, to improve the health and safety of workers while sustaining productivity levels and targets.

## Acknowledgements

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**Competing interests:** None declared.

## Effets du jeûne pratiqué pendant le Ramadan sur les paramètres du stress thermique Résumé

**Contexte :** Les températures de process élevées, associées à des opérations industrielles, augmentent le risque de stress thermique et de maladie, en particulier pendant les mois d'été dans la Région du Golfe. L'absence d'hydratation et de nutrition pendant la journée sur la période du Ramadan peut exposer les travailleurs à des risques encore plus élevés de stress thermique et de maladie.

**Objectifs :** Étudier les effets physiologiques du jeûne prolongé dans des conditions thermiques difficiles.

**Méthodes :** Des mesures longitudinales ont été effectuées sur les employés de trois départements d'une fonderie d'aluminium pendant le jeûne du Ramadan. Après obtention de leur consentement éclairé, leurs paramètres physiologiques ont été mesurés toutes les quatre heures.

**Résultats :** La fréquence cardiaque et la gravité spécifique de l'urine moyennes augmentaient au cours des quatre premières heures de travail posté, tandis que la température tympanique ne connaissait pas d'augmentation significative. En outre, au cours des quatre heures suivantes de travail posté, la gravité spécifique de l'urine se stabilisait en comparaison des quatre heures précédentes.

**Conclusions :** Il est nécessaire que les industries où les ouvriers sont confrontés à des températures de process élevées dans la Région du Golfe prennent des mesures énergiques sur le lieu de travail, afin de minimiser le risque accru de stress thermique et de maladie pendant Ramadan.

## تأثير الصيام في رمضان على مؤشرات الإجهاد الحراري

جومانة مانجوناث، راجيف أرافينداكشان، شيجو فارجين

### الخلاصة

الخلفية: يزيد العمل في درجة الحرارة المرتفعة المرتبطة بالعمليات الصناعية من خطر الإصابة بالإجهاد الحراري والمرض، لا سيما خلال شهور الصيف في منطقة الخليج. وقد يؤدي الجفاف ونقص التغذية خلال فترة النهار خلال شهر رمضان إلى تعريض العاملين إلى خطر أكبر للإصابة بالإجهاد الحراري والمرض.

الأهداف: فحص الآثار الفسيولوجية للصيام المطول في حالات درجات الحرارة المرتفعة.

طرق البحث: أجريت قياسات طويلة على الموظفين أثناء صيامهم شهر رمضان، في ثلاثة أقسام تحتوي على صاهر للمعادن مصنوع من الألومنيوم. وبعد الحصول على الموافقة المستنيرة، تم أخذ القياسات الفسيولوجية على فترات مدتها 4 ساعات.

النتائج: ارتفع متوسط نبض القلب والثقل النوعي للبول في أول 4 ساعات من نوبة العمل، بينما لم ترتفع درجة حرارة طبلة الأذن بشكل كبير. إضافة إلى ذلك، في الأربع ساعات التالية من نوبة العمل، استقر الثقل النوعي للبول مقارنة بالأربع ساعات الأولى.

الاستنتاجات: يجب وضع تدابير فعالة لأماكن العمل في المجالات الصناعية التي تتضمن العمل في درجة حرارة مرتفعة، والموجودة في منطقة الخليج، بهدف الحد من الخطر المتزايد للإصابة بالإجهاد الحراري والمرض خلال شهر رمضان.

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# Knowledge, attitude and practice of travel medicine among primary care physicians in Oman: the need for intervention

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## Abstract

**Background:** Oman is witnessing an increase in outbound and inbound travelers.

**Aims:** This study was undertaken to assess the current knowledge, attitude, and practice of travel medicine among primary care physicians (PCPs) working in the Muscat Governorate.

**Methods:** We conducted a cross-sectional survey of 108 primary healthcare physicians in primary healthcare institutions in the Muscat Governorate in December 2014 using a self-administered questionnaire.

**Results:** We had a response rate of 81%, 78% ( $n = 84$ ) were females, 56.5% ( $n = 61$ ) were Omani nationals. More than 50% ( $n = 54$ ) of study participants had been in practice for more than 8 years. Sixty-eight (58.3%) reported having pre-travel consultations during the previous 1-month period and 86 (79.6%) had post-travel consultations. Most of the PCPs were aware of the issues that needed to be addressed in pre-travel consultation.

**Conclusions:** This study showed that travel health is in an early stage of development in Oman and supports the need for the establishment of travel medicine services.

Keywords: travel, Oman, knowledge, vaccination, prophylaxis, primary healthcare

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## Introduction

Internationally, travel has become a very common practice whether for business, pleasure or other reasons. The number of international travelers is estimated at 900 million per year and is projected to reach 1.6 billion per year in 2020 (1). Oman is witnessing a significant increase in outbound as well as inbound travelers and this is likely to increase exponentially with the introduction of enhanced airport facilities in the country. This, combined with a large expatriate population that frequently travels to home countries, makes travel-related diseases an important public health issue (2). It also sets the need for a travel medicine service to cover travel-related diseases and other health issues such as the risks associated with long-haul flights.

Oman is located in the south-eastern part of the Arabian Peninsula with a land area of 309 500 square kilometres, and the country is divided into 11 administrative governorates. The mid-year population in 2014 was 3.9 million, of which 43% are expatriates. Most of the population is located in the north and south of the country. Oman has achieved remarkable developments in healthcare within a relatively short span of four decades and has implemented good infrastructure for health services. Healthcare in Oman is largely the responsibility of the state and the cost is borne by the government. As of 2013, the Ministry of Health (MOH) had 195 primary care centres and 49 hospitals. Out of these 49 hospitals, four are in the capital Muscat, which offers tertiary

care services. The primary health centres offer primary care services to the population residing in the assigned catchment area of the centre. The secondary and tertiary care services are provided through a referral process (3). Services are free for Omani nationals; however, the expatriate workforce access to free medical care is limited to emergency services only (2).

Travel medicine is an emerging discipline born from the rising demand of the traveling population. However, practicing physicians have not given the importance that is due for travel-related risks and issues (4). The practice of travel medicine is complex; there are currently dynamic changes in global health risks and with increasing population mobility, emerging diseases, lifestyle diseases, and various other host factors, all of which result in the complexity of travel medicine. In addition, travelers include at-risk groups: pregnant women, the very old and the very young (4–7). To add to the complexity of the practice of travel medicine, there is an expansion in new vaccines targeted at travelers. Travel medicine clinics can advise on the required and recommended health precautions needed before traveling through an individual risk assessment as well as offering services for returning travelers.

Primary care physicians (PCPs) are often the first line contacts for travelers seeking pre-travel advice or post-travel consultation, and their role has become increasingly significant. Physicians advising travelers need to know about the changing epidemiology of travel-associated

diseases and the availability of specific new preventive and treatment measures (8,9). Several worldwide surveys have investigated the quality of travel medicine practice among PCPs since 1987 (1,9–16). There are significant differences among PCPs in the quality of advice given and also in their efforts to improve the quality of PCP practices in this field (10,12,16). In addition, the high level of knowledge in travel medicine was mostly linked to PCP motivation to practice in this specialized field (1).

A retrospective analysis of communicable diseases notified between 1999 and 2013 in Oman showed that travel-associated infections account for 8% of reported cases. Typhoid, measles, and dengue fever were the most common infections reported (17). Malaria cases are notified through a separate vertical programme. As per annual statistical reports from the MoH, the incidence of malaria is showing an increasing trend from a low of 443 in 2006 to 2051 in 2012 and the occurrence is predominantly in foreign nationals (3). In Oman, individuals who travel abroad, especially to endemic African countries, can get malaria prophylaxis from primary care centres. In addition, people going on pilgrimage to Saudi Arabia and those traveling to countries affected by yellow fever (YF) receive the mandatory meningococcal vaccine and YF vaccine, respectively, from primary health care centres. However, there is a lack of information about the extent of use of travel-related medical consultations in the primary care setting in Oman, although there are data available on the type and extent of advice and prophylactic treatment provided. The KAP study of Muscat International Airport travelers from Oman reported that even though more than 50% of respondents had a positive attitude towards travel medicine, only 22.5% sought advice and only 6.9% reported seeking pre-travel advice. The study reports inadequate levels of traveler knowledge and poor utilization of travel medicine services and recommends the development of a well-structured travel medicine service and promotional strategy (18).

The aim of this study was to assess the current knowledge, attitude, and practice of travel medicine of PCPs in the Muscat Governorate with a special interest on health advice, vaccinations, and malaria prophylaxis. In addition, we aimed to identify the factors associated with a higher level of specific knowledge of travel medicine.

## Methods

We conducted a cross-sectional survey of PCPs in primary health care institutions in the Muscat Governorate during the month of December 2014. There were 361 PCPs distributed among 28 primary care institutions in the Muscat Governorate. They cater primarily to the Omani population but also offer travel-related vaccinations and malaria chemoprophylaxis to non-Omanis. We expected to recruit 100 participants and assumed that 50% of PCPs would have adequate awareness levels with regard to travel medicine relevant for the country. The sample size calculated for +/- 10% precision. A self-administered questionnaire was distributed to all PCPs who were working in 14 randomly selected primary care centres represent-

ing all locations of the Muscat Governorate. There are a total of 28 primary care centres in the Muscat Governorate each having around 10 to 14 PCPs. The questionnaire was prepared in English specifically for the study and was pilot tested. It was developed focusing on the same domains that were used in similar published literature (9,16). Although assessment of attitudes were included, no attempt was made to establish validity of questionnaire as the study primarily focused on current knowledge and practice relevant to the Omani setting. Ethical approval was obtained from the research committee at the Directorate General for Health Services for the Muscat Governorate.

The questionnaire covered demographic information, the setting of the general practice, and travel health-related knowledge and practice. We assessed the extent of pre-travel consultations in the practice and the travel health-related issues addressed in such consultations. Respondents were asked about specific travel health issues related to YF, malaria chemoprophylaxis, travelers' diarrhoea, and air travel-related health problems. Some questions were designed to understand the nature of the resources available for general practitioners (GPs) with respect to travel health, any training undertaken, and their attitude to travel medicine practice.

Data collected were entered in EpiData software (version 3.1) and analysed using SPSS (version 16.0). We used proportions to describe the information. The association between knowledge scores and PCP characteristics were analysed using chi square statistics. The knowledge levels were analysed by assigning scores for each correct response and a total score was calculated (maximum score = 14). The knowledge score was analysed as a dichotomous variable taking mean (which also corresponded to 50% score) as cut off. Crude and adjusted odds ratios with 95% confidence limits were calculated for those variables that were considered relevant for the study. All tests were considered significant if  $P < 0.05$ .

## Results

The questionnaire was distributed to 134 PCPs and 108 participated, a response rate of 81%. Among the 108 respondents, 84 (78%) were female, 61 (56.5%) were Omani nationals, while the rest were various other nationalities. Forty-three (40%) of the respondents graduated from medical schools in Oman. Fifty-four (50%) of the study participants had been in practice for more than eight years. Thirty-four (32%) had postgraduate qualifications. These characteristics are summarized in Table 1.

### Extent of travel medicine practice

Most practitioners see an average of 30 patients per day; 68 (58.3%) report having carried out pre-travel consultations during the previous 1-month recall period (Figure 1). Seventy-five percent of PCPs see less than five consultations per month with median number of three consultations [interquartile range (IQR) 2–6]. Eighty-six (79.6%) reported that they have provided post-travel consultations. Fever, diarrhoea, skin disorders, and respiratory infections were the top four presentations during post-trav-

**Table 1 Characteristics of respondents and profile of their clinical practice**

Characteristics of study participants	# (%)
<b>Gender (n = 108)</b>	
Male	24 (22%)
Female	84 (78%)
<b>Nationality (n = 108)</b>	
Omani	61 (57%)
Non-Omanit	47 (43%)
<b>Graduation (n = 108)</b>	
In Oman	43 (40%)
Outside Oman	65 (60%)
<b>Postgraduate training (n = 108)</b>	
Yes	34 (32%)
No	74 (68%)
<b>Clinical experience (n = 99)</b>	
Less or equal to 3 years	14
4 to 8 years	31
9 to 15 years	27
16 years or more	27
<b>Practice levels (consultations/day) (n = 98)</b>	
Up to 20 consultations	23 (23.6%)
21 to 30 consultations	41 (41.8%)
31 to 40 consultations	25 (25.5%)
41 to 50 consultations	9 (9.1%)
<b>Pre-travel consultations in the past month (n = 108)</b>	
Yes	63 (58%)
No	45 (42%)
<b>Post-travel consultation in the past year (n = 108)</b>	
Yes	86 (80%)
No	22 (20%)
<b>Access to journals in primary care setting (n = 108)</b>	
Yes	36 (33%)
No	72 (67%)
<b>Source of information (n = 108)</b>	
Reviews	53 (49%)
MoH guidelines	26 (24%)
Expert/senior staff	11 (10%)
Websites	8 (7%)
Others (books, journals, CDs)	10 (10%)
<b>Attended travel medicine updates (CME) (n = 108)</b>	
Yes	19 (18%)
No	89 (82%)
<b>Most common presentations (post travel, n = 86)</b>	
Fever	72 (84%)
Diarrhoea	66 (77%)
Skin problems	41 (48%)
Respiratory infections	36 (42%)
Trauma	29 (34%)
Other problems	27 (31%)
Other infections	26 (30%)
<b>Knowledge levels (No. of correct responses, n = 108)</b>	
Yellow fever vaccination	64 (59%)
Malaria chemoprophylaxis	51 (47%)
Travelers' diarrhoea	55 (51%)
Case practice: diarrhea in returned traveler	11 (10%)
Long haul flight risks	82 (76%)
Air travel risks	31 (29%)

el consultations (Table 1). Fifty-five (50%) respondents reported that they referred to journals rarely during a 6-month recall period. For specific travel medicine-related information, reviews were the common source for information for most practitioners; 26 (24%) informed that

they depended on MoH circulars, and 11 (10%) on expert opinion. Nineteen (18%) had attended the short introductory update for travel medicine conducted by the Governorate in October 2014 (Table 1).

### Knowledge Scores

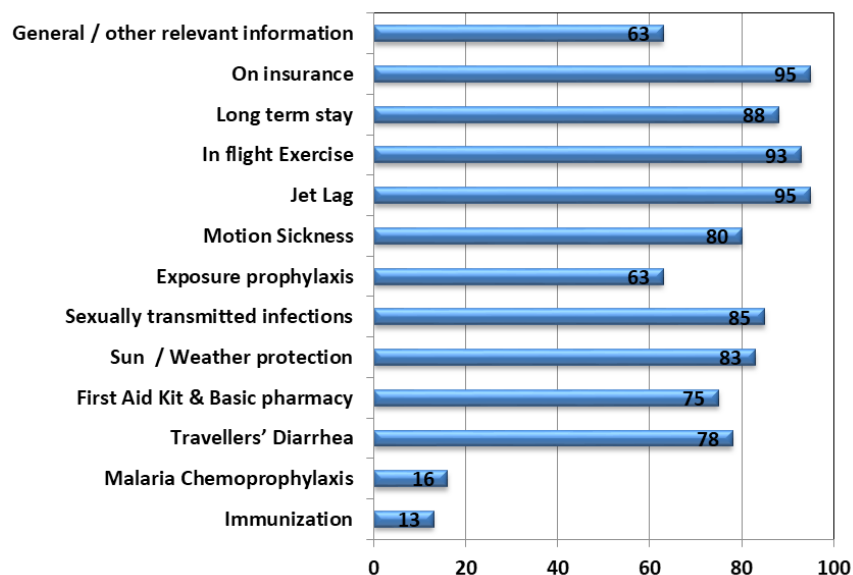
The extent of correct responses obtained for questions that were aimed at assessing knowledge is provided in Table 1. A scoring criterion was applied with 14 as the maximum score. The mean score obtained was 7.1 (SD 2.7, Median 8, IQR 5–9). We explored the association of certain PCP characteristics such as postgraduate training, clinical experience, pre-travel consultation experience, post-travel consultation experience, attendance to travel medicine continuing medical education programmes (CME) and the extent of journal use with knowledge scores (Table 2).

### Attitudes

The perceptions and practice of the PCPs with respect to issues relating to travel health practice in their primary healthcare setting was explored; 72/97 respondents (74%) strongly agreed for the need to have training in travel health, and even with the understanding it would not be free, 55/95 (58%) expressed interest to attend a locally available course. For updates regarding general practice seventy-eight (80%) out of 97 of the respondents referred to scientific journals or expert opinion and only 43/97 (45%) consulted MOH circulars and guidelines.

### Discussion

Fifty-eight percent of the PCPs who participated in the study reported pre-travel-related consultations in their practice. Al Hajri M et al. reported that 44.7% of participating primary healthcare physicians provided pre-travel medical advice in Qatar (9). Reports from developed countries show a much higher proportion, such as 90% of GPs in Germany and 85% in the UK (12,19). Travel medicine-related consultations in Oman, though to a lesser extent, are confined to physicians alone whereas in some countries, such as the United Kingdom, nurses play an active role. The low consultation rate in our study could be due to the lack of designated travel medicine clinics as well as poor awareness among the public. Perceived risk by a traveler is an important determinant for seeking travel medicine services. Poor risk perception leads to less seeking of pre- and post-travel medicine services. A study looking at travel health KAP of travelers in Oman showed that even among experienced travelers, the overall level of knowledge about vaccine-preventable diseases, food safety, and preventive measures against insect bites was inadequate. About one fifth of travelers in this study had poor knowledge scores regarding the risk of travel-associated illnesses and their prevention. Moreover, 75% of travelers with a negative attitude towards travel medicine denied the need for any preventive measures (18). However, with the increasing need to cater to the mandatory travel health requirements for Hajj or travel to certain African countries, such consultations are increasing and this might have created the need to incorporate these



**Figure 1** Percentage of respondents addressing specific pre-travel consultation issues (a total of 63 respondents had pre-travel consultations; however, n varies from 58 to 63)

services in primary health care.

Most of the PCPs in our study were aware of the issues that need to be addressed in pre-travel consultation, and in most consultations these issues were addressed. However, immunizations and malaria chemoprophylaxis were found to be addressed in lower rates than expected. This finding could be due to the fact that PCPs relate vaccinations to YF, which is not available in all institutions. It is also important to note that Oman has a historical connection with Zanzibar and travel to East Africa by a major segment of the Omani population is very frequent, which could result in less importance given to pre-travel consultation for travel to this part

of Africa. Other studies, such as the one by Piote et al., have highlighted that “quality of advice given differs substantially from one PCP to another” and our findings indicate the same (1). The study from Qatar also reported that “GPs generally gave advice to travelers regarding travel vaccines, malaria prophylaxis, STI, personal protective measures against insect bites, first aid knowledge and safety” (9). The findings from our study suggests the need for improving the quality of pre-travel health care provisions especially pre-travel vaccinations, malaria prophylaxis, and prevention.

Post-travel consultations were reported in the practice of 86 (80%) PCPs. In Oman anti-malarials are

**Table 2** Effect of level of experience and Training on assessed levels of Knowledge of PCPs. Number responding to each question vary

PCP characteristics	Category	Score < /=7	Score > 7	Odds ratio (95% C.I)	Adjusted Odds ratio (95% C.I)
Postgraduate	No	33 (69%)	39 (67%)	0.93 (0.41-2.12)	0.85 (0.26-2.75)
	Yes	15 (31%)	19 (33%)		
Clinical experience	<9 years	20 (46%)	26 (47%)	0.93 (0.42-2.06)	0.79 (0.26-2.41)
	9 years	24 (54%)	29 (53%)		
Pre-travel consultation experience	No	19 (40%)	24 (41%)	1.08 (0.49-2.35)	0.68 (0.23-2.01)
	Yes	29 (60%)	34 (59%)		
Post-travel consultation experience	No	13 (27%)	9 (16%)	2.02 (0.78-5.26)	1.89 (0.5-7.17)
	Yes	35 (73%)	49 (84%)		
Participation in travel medicine CME	No	38 (80%)	49 (84%)	1.43 (0.5-3.9)	2.23 (0.64-7.65)
	Yes	10 (20%)	9 (16%)		
Journal use	Nil/Rarely	16 (53%)	17 (50%)	0.79 (0.37-1.67)	0.66 (0.29-1.49)
	Occasional	9 (30%)	16 (47%)		
	Frequent	5 (17%)	1 (3%)		

available only in MoH institutions and malaria cases in Oman are all imported. This would possibly contribute to higher post-travel consultations in the primary care setting. Fever and diarrhoea were the most common presentations following travel. Typhoid, measles and dengue fever were the most common travel-associated infections reported through communicable disease surveillance in Oman (17). The majority of travel-associated infections were reported among expatriate males from South Asia aged between 19 and 35 (17). This group has limited access to free medical services. Travel-associated infections in Oman, although they have a low mortality rate, are considered to be a threat to sensitive polio eradication and measles elimination programmes. In the case of malaria, imported *Plasmodium vivax* cases are diagnosed most often in expatriate workers from the Indian subcontinent. *Plasmodium falciparum* cases arise in Omani nationals traveling to East Africa (2,3). The importance of travel-related illnesses, especially infections, is emphasized as part of disease surveillance in the primary care setting in Oman. This would also contribute to a better awareness of the importance of post-travel consultations among PCPs.

The wide range of sources relied on by the study participants for travel medicine-related information indicates the need for a uniform standard guidance system in this area. Several studies showed the availability of country-specific methods adopted by practitioners to access information; for example, the Internet in Qatar (78.9%), online access to a medical library in the United Kingdom, and a national handbook in Germany (9,12,19). Leggat et al. reports that 96% of GPs surveyed in New Zealand found that “the most useful resource was Health Advice for Overseas Travellers, which outlines the New Zealand recommendations for medical practitioners providing travel health advice” (20).

Our study demonstrated substantial differences in knowledge levels in each specific area assessed (Table 1). We attempted to explore associations of adequate knowledge scores with qualification, experience, training, etc. (Table 2). Attending travel medicine CME and experience of post-travel consultations in their clinical practice increased the probability of a higher knowledge score in the study. However, none of these associations were found to be statistically significant, possibly due to our small sample size, which was not calculated to test an association. However, the findings do suggest that exposure to travel-related illnesses, pre-travel consultations, and regular targeted educational programs would help significantly in establishing travel medicine services with substantial quality.

More than 80% of respondents expressed a positive attitude and eagerness to undertake travel medicine training. This positive attitude among the PCPs will be an asset in the development of services in primary health care system. A significantly higher proportion of respondents referred to scientific journals or expert opinion when in doubt, compared to 45% who referenced MoH guidelines or circulars. PCPs need an understanding of global health

issues, emerging illnesses and health risks, vaccines, antimalarial drugs, drug resistant organisms, and familiarity with changing health regulations in order to provide an effective pre-travel advice (2,7,9). The specific knowledge and practice deficits brought out indicate that there is a need for establishing practice guidelines, and educational programs for PCPs.

The experience of different approaches utilized in different parts of the world, such as CME accreditation in the United States of America, networking in the United Kingdom (National Travel Health Network and Centre – NaTHNaC), or the travel health practitioner’s registry system in the Netherlands could be explored to develop an appropriate strategy for Oman (16,21,22). The development of a “ready to use” handbook in the context of Oman would be an area to focus on in the current situation in addition to online access to health information in the clinics. These findings also indicate the need for organizing the services with high-quality training and support materials, and for continuous educational and professional development.

Our study found that most of the PCPs surveyed did not have any formal training in travel medicine. However, a majority of them indicated the need for training, especially in the form of short courses with certification. It is important that undergraduate and postgraduate medical curricula to include more training in travel medicine (23,24).

### Limitations

Our study was not without its limitations. It was confined to MoH institutions which are not consulted often by non-Omanis. Although pre-travel immunizations and malaria chemoprophylaxis is available only through MOH institutions, it is likely that travel-related consultation patterns of expatriates are not reflected accurately in the study. It is also important to note that some of the responses needed recall, which could have led to bias. The study was attempted using a questionnaire developed for the setting of Oman adapted from main areas focused upon in similar published studies and was not subjected to strict validation process. This may have led to major bias in the findings relating to attitudes of the respondents. The study sample was not adequate to identify factors associated with poor knowledge levels, hence caution needs to be exercised in interpreting this finding.

### Conclusion

This study showed that travel health as a discipline is in its early stages of development in Oman and supports the need for establishment of travel medicine services. The service provision was not distributed evenly in terms of quantity or quality. In order to set the programme in its right direction, the information obtained from this study becomes significant. The results of the study provided information on the status of travel medicine services delivered through the primary care setting in the Muscat Governorate, which can be considered as a snapshot of the available service in the country.

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## Connaissances, attitudes et pratiques concernant la médecine des voyages chez les médecins de soins de santé primaires à Oman : besoin d'intervention

### Résumé

**Contexte :** Oman est confronté à une augmentation du nombre de voyageurs qui entrent dans le pays ou qui en sortent.

**Objectifs :** La présente étude a été réalisée pour évaluer les connaissances, les attitudes, les pratiques courantes en matière de médecine des voyages parmi les médecins de soins de santé primaires travaillant dans le gouvernorat de Mascate.

**Méthodes :** Nous avons mené une enquête transversale auprès de 108 médecins de soins de santé primaires dans des établissements de ce niveau de soins dans le gouvernorat de Mascate en décembre 2014 à l'aide d'un auto-questionnaire.

**Résultats :** Nous avons eu un taux de réponse de 81 %; 78 % (n = 84) étaient des femmes, 56 % (n = 61) étaient des ressortissants omanais. Plus de 50 % (n = 54) des participants de l'étude exerçaient depuis plus de huit ans. Soixante-huit médecins (68,3 %) signalaient avoir eu des consultations préalables au voyage durant le mois qui précédait et 86 médecins (79,6 %) avoir eu des consultations au retour du voyage. La plupart des médecins de soins de santé primaires connaissaient les points à aborder lors des consultations préalables au voyage.

**Conclusions :** Cette étude a montré que la médecine des voyages est à un stade de développement précoce à Oman et vient étayer la nécessité de mise en place de services pour ce type de médecine.

### معلومات واتجاهات وممارسات أطباء الرعاية الأولية بخصوص طب السفر في عُمان: الحاجة إلى التدخل

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#### الخلاصة

الخلفية: تشهد عُمان زيادة في عدد السكان المسافرين منها وإليها.

الأهداف: أُجريت هذه الدراسة لتقييم معلومات واتجاهات وممارسات أطباء الرعاية الأولية العاملين في محافظة مسقط.

طرق البحث: أجرينا استطلاعاً مقطوعياً شمل ١٠٨ طبيباً للرعاية الأولية في مؤسسات الرعاية الأولية في محافظة مسقط في ديسمبر/ كانون الأول ٢٠١٤ باستخدام استبيان ذاتي الإجابة.

النتائج: حصلنا على معدل استجابة ٨١٪، حيث كان ٧٨٪ (n = ٨٤) من الإناث، وكان ٥٦٪ (n = ٦١) مواطنين عُمانيين. وكان أكثر من ٥٠٪ (n = ٥٤) من المشاركين في الدراسة ممارسين لمدة تزيد على ٨ سنوات. وذكر ثمانية وستون شخصاً (٣، ٥٨٪) تقديمهم لاستشارات خلال شهر قبل السفر، بينما قدم ٨٦ شخصاً (٦، ٧٩٪) استشارات بعد السفر. وكان معظم أطباء الرعاية الأولية على علم بالأمر التي يجب تناولها في استشارات قبل السفر.

الاستنتاجات: توضح هذه الدراسة أن الصحة أثناء السفر لا تزال في مرحلة مبكرة من التطور في عُمان، وتدعم الحاجة إلى إنشاء خدمات طب السفر.

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# Global prevalence of chronic obstructive pulmonary disease: systematic review and meta-analysis

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## Abstract

**Background:** Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide.

**Aims:** To synthesize data on the worldwide prevalence and severity of COPD by geographical region, age groups, and smoking status in a systematic review.

**Methods:** A systematic search was performed following Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines. International databases including PubMed, Scopus and Web of Science were searched for population-based studies published between January 2004 and May 2015 that reported the prevalence of COPD anywhere in the world. The prevalence of COPD was calculated based on World Health Organization (WHO) regions and sex and severity stages using metaprop. Meta-regression and subgroup analysis were applied to determine the sources of heterogeneity.

**Results:** Sixty papers were screened with a combined subject sample size of 127 598. The prevalence of post-bronchodilator COPD was 12.16% (10.91–13.40%). The pooled prevalence of COPD was 15.70% (13.80–18.59%) in men and 9.93% (8.73–11.13%) in women. Among all WHO regions, the highest prevalence was recorded in the Region of the Americas (14.53%), and the lowest was recorded in the South-East Asia Region/Western Pacific Region (8.80%). Meta-regression model variables were: sample size, WHO region, study quality score, level of gathering data, publication year, and sampling methods that justified 29.82% of heterogeneity detected among COPD prevalence rates worldwide.

**Conclusions:** Global prevalence of COPD among men is about 5% higher than among women. The most prevalent stage of COPD is stage 1.

**Keywords:** chronic obstructive pulmonary disease, spirometry, GOLD criteria, systematic review, meta-analysis.

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## Introduction

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality globally. According to the Global Burden of Disease (GBD) study, COPD rose from the eighth to the fifth leading cause of global burden of disease from 1990 to 2013. In 2013, COPD was the fourth leading cause of death globally, and it is predicted that COPD will become the third leading cause by 2020 (1).

Emphysema and bronchitis can cause loss of daily function in many ways (2), and impose a massive and growing burden, both in direct and indirect costs to society. For example, in 2010, the cost of COPD in the United States of America was estimated at US\$ 50 billion, which included US\$ 30 billion of direct healthcare expenditure and US\$ 20 billion of indirect costs (3). In Italy, as a European example, the total cost of a COPD patient has been calculated as €2706.70, of which €2460.40 is direct costs and €246.30 is indirect costs (4).

A recently published systematic review and meta-analysis that included studies based on different definitions of COPD without distinguishing between them reported the global prevalence of COPD (5), so the pooling of data based on these 2 different definitions was not reasonable. Thus, we undertook a new meta-analysis of COPD prevalence, according to data based on clinically distinct definitions separately. We analysed the worldwide COPD prevalence according to the standard definition of Global Initiative for Chronic Obstructive Lung Disease (GOLD). Additionally, we estimated the COPD prevalence by geographic regions, clinical severity stages, age groups, and smoking status.

## Methods

### Study design

The study was designed as a systematic review and meta-analysis of the published literature on COPD. It was performed according to Meta-analysis of Observational

Studies in Epidemiology (MOOSE) guidelines (7).

## Definitions

There are several different definitions of COPD in the literature. In this study, we used the GOLD definition (8): the presence of a post-bronchodilator forced expiratory volume in 1 second/forced vital capacity (FEV<sub>1</sub>/FVC) < 0.70. The stages of COPD were defined as follows: mild COPD or stage I: FEV<sub>1</sub>/FVC < 70% and FEV<sub>1</sub> ≥ 80% predicted; moderate COPD or stage II: FEV<sub>1</sub>/FVC < 70% and 50% ≤ FEV<sub>1</sub> < 80% predicted; severe COPD or stage III: FEV<sub>1</sub>/FVC < 70% and 30% ≤ FEV<sub>1</sub> < 50% predicted; and very severe COPD or stage IV: FEV<sub>1</sub>/FVC < 70% and FEV<sub>1</sub> < 30% predicted.

## Search strategy

We searched PubMed, Scopus and Web of Science (ISI) databases for population-based studies published between January 2004 and May 2015 that reported the prevalence of COPD worldwide. The inclusion and exclusion criteria were applied to full-text articles. PubMed was searched using medical subject headings (MeSH) terms, and Scopus was searched using Emtree terms. We also considered all the references and related published systematic reviews in various regions. Figure 1 depicts the search flow diagram, and the search strategy is provided in Online Resource 1.

## Inclusion and exclusion criteria

The study included the total sampling population (i.e., survey respondents or general population, population-based cohort studies and population-based case-control studies). From all sampling articles specific groups were excluded as well as studies published in languages other than English, studies using a definition of COPD other than the GOLD definition, and studies conducted before 2004. If the full-text of a study was unavailable, up to 3 requests were e-mailed to the corresponding authors. The reference lists of related systematic reviews were also checked for further studies that might be eligible for inclusion. Two independent reviewers examined the titles and the abstract, then the full texts of the studies to see if they met the inclusion criteria. In case of disagreement, the principal investigator made the final decision.

## Data extraction

The data were extracted into a standardized Excel spreadsheet approved by the GBD investigators, including study variables such as name of first author, year of publication, study region, total sample size, response rate, age and sex of participants, number of subjects with COPD or point prevalence based on demographics and severity stages, and 95% confidence intervals of the point prevalence. All data were double-checked by another researcher to ensure it was accurate.

The included studies (6, 9–56) were from the following World Health Organization (WHO) regions: 2 from the African Region, 2 from the South-East Asia Region, 30 from the European Region, 4 from the Eastern

Mediterranean Region, 13 from the Western Pacific Region, and 10 from the Region of the Americas. Also, 1 study that was conducted at an international level was included. Because of the scarcity of data, the Eastern Mediterranean Region was merged into the African Region, and South-East Asia Region was merged into the Western Pacific Region. The characteristics of the studies included are described in Table 1.

## Study quality assessment

The quality of the studies was scored according to the GBD quality assessment checklist. The total study quality score ranged from 1 to 24 and was based on summing up the level of gathering data (subdistrict = 1, district = 2, provincial = 3, ≥ 2 provinces = 4, ≥ 2 subgroups = 5, and national = 6); sampling method (multilevel clustering random = 1, 1 level clustering random = 2, random simple sampling = 3, random stratified sampling = 4, and census = 5); sample size code (< 1000 = 1, 1000–5000 = 2, 5000–10 000 = 3, > 10 000 = 4); study design (case control = 1, cohort = 2, cross-sectional = 3); and response rate code (< 59% = 0, 60–74% = 2, 75–89% = 4, and > 90% = 6).

## Statistical analysis

The aggregated prevalence of COPD was calculated based on WHO region, sex, and severity stage using metaprop random effects analysis in Stata version 12. Forest plots illustrated both the pooled and individual data of the surveys. We used I<sup>2</sup> for calculating the heterogeneity among the studies included. Meta-regression and subgroup analysis methods were used to determine the sources of heterogeneity. We carried out meta-regression based on quality assessment score, WHO regions, sample size, level of gathering data, publication year, and sampling methods. In addition, subgroup analysis was applied using regions, sex, and severity stages. In order to increase the data points, we estimated the post-bronchodilator COPD prevalence by crosswalking using a regression model from pre-bronchodilator data.

## Results

### Characteristics of the studies included

The primary search recognized 61 588 published papers, including 22 639 in PubMed, 15 916 in Web of Science and 23 033 in Scopus. From those, 15 578 articles were eliminated after removal of duplicates. Thereafter, 45 503 studies were excluded after reading the titles and abstracts. Finally, a total of 60 papers, with a combined subject sample size of 127 598, met the inclusion criteria (Figure 1).

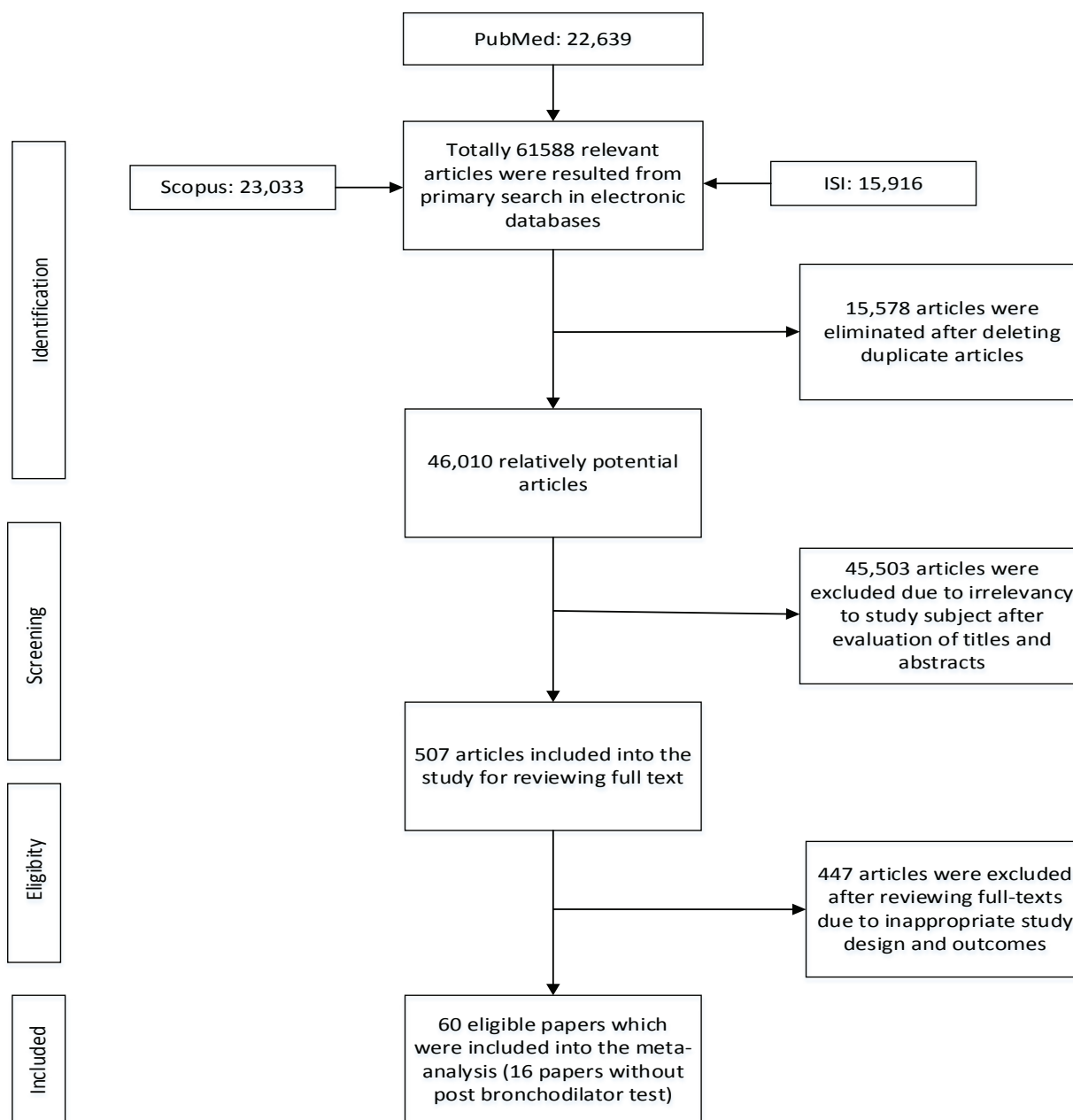
### Estimated prevalence of COPD

The prevalence of post-bronchodilator COPD was calculated using a crosswalking method for 16 papers. The R<sup>2</sup> of the regression model was 0.97. Using the random effects method, the prevalence of COPD in terms of post-bronchodilator COPD was 12.16% (10.91–13.40%) (Table 2). By regions, COPD prevalence ranged from 8.80% in the combined South-East Asia and Western Pacific Regions to 14.53% in the Region of the Americas. The pooled

**Table 1 Characteristics of included studies**

First author (ref)	Year of publication	Country	Age (yr)	WHO Region	Quality score
De Marco (18)	2004	International	20–40	4	17
Fukuchi (22)	2004	Japan	> 40	6	13
Johannessen (6)	2005	Norway	26–82	4	13
Kim (26)	2005	Korea	> 45	6	11
Kotaniemi (28)	2005	Finland	21–70	4	11
Lindberg (55)	2005	Sweden	23–72	4	12
Menezes (54)	2005	America	> 40	2	18
Sichletidis (41)	2005	Greece	21–80	4	17
Wilson (50)	2005	Australia	> 18	6	11
Kim (27)	2006	Republic of Korea	40–69	6	13
Lindberg (29)	2006	Sweden	46–77	4	14
Shahab (40)	2006	United Kingdom	> 35	4	14
Al-Hazmi (12)	2007	Canada	20–44	2	13
Buist (10)	2007	Australia	> 40	6	16
Buist (10)	2007	Iceland	> 40	4	18
Buist (10)	2007	Austria	> 40	4	18
Buist (10)	2007	Canada	> 40	2	16
Buist (10)	2007	China	> 40	6	20
Buist (10)	2007	Germany	> 40	4	18
Buist (10)	2007	Norway	> 40	4	18
Buist (10)	2007	Philippines	> 40	6	16
Buist (10)	2007	Poland	> 40	4	20
Buist (10)	2007	South Africa	> 40	1	20
Buist (10)	2007	Turkey	> 40	4	20
Buist (10)	2007	United States of America	> 40	2	16
Frank (21)	2007	United Kingdom	> 30	4	5
Nizankowska-Mogilnicka (37)	2007	Poland	> 40	4	14
Schirrhofer (39)	2007	Austria	> 40	4	12
Shirtcliffe (42)	2007	New Zealand	> 25	6	12
Zhong (51)	2007	China	> 40	6	15
Caballero (15)	2008	Colombia	> 40	2	14
Hansen (9)	2008	Denmark	45–84	4	20
Mahesh (30)	2009	India	> 40	3	15
Methvin (34)	2009	United States of America	> 40	2	8
Bridevaux (14)	2010	Switzerland	> 30	4	11
Melville (33)	2010	United Kingdom	45–69	4	11
Minas (35)	2010	Greece	> 30	4	10
Szanto (43)	2010	Sweden	60–93	4	9
Al Zaabi (11)	2011	United Arab Emirates	40–80	5	14
Fabricius (19)	2011	Denmark	> 35	4	8
Hwang (23)	2011	Republic of Korea	> 40	6	13
Mascarenhas (31)	2011	Portugal	> 40	4	8
Petrescu (52)	2011	Romania	45–74	4	9
Tan (44)	2011	Canada	> 35	2	13
Danielsson (17)	2012	Sweden	> 40	4	8
Joo (24)	2012	Republic of Korea	> 40	6	11
Vanfleteren (48)	2012	Netherlands	> 40	4	8
Arslan (13)	2013	Turkey	> 40	4	15
Daldoul (16)	2013	Tunisia	> 40	1	11
Ford (20)	2013	United States of America	20–79	2	19
Kainu (25)	2013	Finland	20–79	4	9
Toelle (46)	2013	Australia	> 40	4	12
Chuchalin (56)	2014	Russian Federation	20–88	4	12
Lâm (45)	2014	Viet Nam	23–72	6	9
Wali (49)	2014	Saudi Arabia	> 40	5	21
Matsumoto (32)	2015	Japan	> 40	6	6
Miravittles (36)	2015	Spain	40–80	4	15
Parasuramalu (38)	2015	India	> 35	3	12
Sharifi (53)	2015	Islamic Republic of Iran	> 40	5	11
Van Gemert (47)	2015	Uganda	30–49	1	18

UK = United Kingdom of Great Britain and Northern Ireland; USA = United States of America.



**Figure 1** Process of search and analysis for selection of studies conducted on chronic obstructive pulmonary disease.

prevalence of COPD according to sex was 15.70% in men and 9.93% in women. The most common stage of COPD was stage I (7.06%) and the least common were stages III and IV (1.61%).

The COPD prevalence among different stages, both sexes, and WHO regions is shown in Online Resource 2. Furthermore, the COPD prevalence was calculated according to age groups and smoking status. The prevalence of COPD was increased from 5.28% in the < 50 years group to 21.38% in the  $\geq 60$  years group (Table 3). In terms of smoking status, the least prevalence was found with the never smoked group (7.20%) and the highest prevalence was in the current smokers (18.36%).

### Meta-regression

Univariate and multivariate meta-regression analyses

were conducted to detect sources of heterogeneity. Meta-regression model variables were: sample size, WHO Region, study quality score, level of gathering data, publication year, and sampling method (Table 4). In the univariate models, significant factors were WHO region, level of gathering data, and sample size. None of the factors could justify the total heterogeneity in the meta-analysis and the mentioned factors explained just 29.82% of the heterogeneity.

### Discussion

We found that more than 12% of the general population of the world suffered from COPD. Among all the patients, 44.16% had mild COPD, 44.22% had moderate COPD, and the rest had severe COPD. Our results indicate a higher global prevalence of COPD than that in a previously pub-

**Table 2 Prevalence of chronic obstructive pulmonary disease in terms of sex, disease severity stage, and WHO Region**

Stage	WHO Region	Male (%)	Female (%)	Total (%)
I	SEA-WP	6.15 (3.83–8.47)	2.31 (1.43–3.18)	4.40 (2.88–5.93)
	Americas	9.39 (6.08–12.71)	6.37 (3.82–8.93)	8.53 (7.18–9.89)
	EM–Africa	6.50 (4.27–9.78)	3.30 (2.09–5.18)	3.24 (2.33–4.15)
	European	9.60 (5.63–13.57)	6.27 (4.06–8.48)	7.74 (5.79–9.69)
	Total	8.63 (6.75–10.52)	4.68 (3.65–5.72)	7.06 (5.90–8.21)
II	SEA-WP	6.32 (3.35–9.29)	3.26 (1.84–4.69)	4.95 (2.92–6.99)
	Americas	7.07 (5.13–9.0)	7.03 (3.80–10.27)	5.59 (4.39–6.79)
	EM–Africa	14.20 (10.78–18.49)	11.00 (8.62–13.94)	6.44 (5.16–7.72)
	European	10.20 (8.49–11.92)	5.98 (4.25–7.70)	8.14 (6.95–9.33)
	Total	8.61 (6.68–10.54)	5.48 (4.25–6.71)	6.58 (5.41–7.74)
III/IV	SEA-WP	2.46 (0.70–4.23)	4.23 (0.33–1.74)	1.69 (0.58–2.63)
	Americas	0.75 (0–1.68)	1.57 (0.32–2.81)	0.96 (0.68–1.24)
	EM–Africa	8.00 (5.49–11.53)	5.70 (4.03–8.01)	0.08 (0–0.29)
	European	2.16 (1.38–2.94)	1.15 (0.81–1.50)	1.89 (1.40–2.37)
	Total	2.62 (1.85–3.39)	1.27 (0.97–1.57)	1.61 (1.30–1.92)
All stages	SEA-WP	12.28 (9.91–14.64)	6.24 (4.65–7.83)	8.80 (7.08–10.52)
	Americas	17.19 (13.39–21.00)	12.26 (9.74–14.78)	14.53 (12.04–17.02)
	EMR–Africa	11.57 (5.57–17.57)	10.25 (3.87–16.63)	9.98 (4.51–15.46)
	European	18.03 (15.66–20.39)	11.06 (9.23–12.89)	13.29 (11.22–15.35)
	Total	15.70 (13.80–17.59)	9.93 (8.73–11.13)	12.16 (10.91–13.40)

EM = Eastern Mediterranean; SEA = South-East Asia; WHO = World Health Organization; WP = Western Pacific.

lished meta-analysis (5). The higher prevalence calculated in our study may have been because we considered more recent studies than the previous meta-analysis did. In addition, the previous meta-analysis did not distinguish between different COPD definitions (5). Moreover, it did not consider the severity of COPD, which is a critical factor in specific mortality and burden of COPD. The present study was designed to resolve these shortcomings. Another finding of our study was that the prevalence of COPD increased at a steady rate with ageing of population. These findings are consistent with previous studies (57, 58). Also, we observed that the prevalence of COPD among individuals who had ever smoked was more than twice as high as that among those who had never smoked. This finding confirms that smoking is one of the most important risk factors for COPD (59).

It seems that the prevalence of COPD is increasing. A worldwide prevalence of 8.9% was reported in 2006 (60), based on a meta-analysis of 37 papers, which was lower than the prevalence in the most recent analysis in 2015 (5). It is possible that the difference resulted from using different definitions of COPD. Furthermore, our results are consistent with the findings of some regional studies (61,62), in which the prevalence of COPD was closer to our results than others (5).

The prevalence of COPD is usually more common among men than women (63,64). Our meta-analysis also demonstrated a higher prevalence among men. This difference could be due to higher occupational

risks (65) or higher rates of smoking among men (66). The highest prevalence of COPD was observed in the Region of the Americas and the lowest in the South-East Asia Region/Western Pacific Region. These results are consistent with the results of Adeloje et al. (5). Our pooled estimation of the prevalence for the regions is also close to the prevalence reported by regional studies (61,62). This variability of the prevalence between the different regions is partially explained by the level of industrialization, the prevalence of smoking, the geographic situation, and the ethnicities of the populations (67–69). Martin et al. reported a higher rate of COPD among those of white

**Table 3 Prevalence of COPD according to age-groups and smoking status**

	Point prevalence of COPD (%)	95% confidence interval (%)
<b>Age groups, yr</b>		
< 50	5.28	4.08–6.49
50–59	10.16	7.94–12.37
≥ 60	21.38	18.42–25.40
<b>Smoking status</b>		
Current smokers	18.36	15.38–21.34
Ex-smokers	16.33	14.49–18.17
Never smokers	7.20	6.26–8.13

COPD = chronic obstructive pulmonary disease.

**Table 4 Univariate and multivariate meta-regression analysis for detecting sources of heterogeneity**

Variable	Univariate analysis				Multivariate analysis			
	Coefficient	SE	P*	Adjusted R <sub>2</sub> (%)	Coefficient	SE	P	Adjusted R <sub>2</sub> (%)
<b>Sample size</b>	-0.026	0.008	0.004	11.39	0	0	0.001	
<b>Region</b>	Reference			7.46				
EM-African	0.049	0.032	0.127		0.038	0.033	0.263	
European	0.033	0.027	0.227		0.045	0.031	0.146	
Americas	-0.010	0.030	0.732		-0.011	0.032	0.741	
SEA-WP	0.002	0.002	0.204	0.66	-0.001	0.004	0.749	
<b>Study quality score</b>								
<b>Level of gathering data</b>								
Subdistrict	Reference			13.25				
District	0.081	0.061	0.190		0.001	0.040	0.978	
Provincial	0.053	0.064	0.408		-0.042	0.042	0.321	
≥ 2 provinces	0.066	0.065	0.319		0.027	0.043	0.530	29.82
≥ 2 subnational regions	0.066	0.069	0.344		0.015	0.040	0.709	
National	0.055	0.062	0.3705		0.070	0.041	0.092	
International	0.129	0.062	0.041		—	—	—	
<b>Publication year</b>	-0.001	0.002	0.577	-1.14	0.001	0.002	0.572	
<b>Sampling method</b>								
Census	Reference			-3.65				
Random stratified sampling	0.073	0.068	0.287		0.043	0.071	0.552	
Random simple sampling	0.089	0.066	0.183		0.034	0.068	0.616	
One level clustering random	0.064	0.073	0.384		0.055	0.070	0.434	
Multilevel clustering random	0.077	0.070	0.277		0.065	0.072	0.372	
Others	0.063	0.073	0.392		0.017	0.077	0.824	

\*Significant at the 5% level. EM = Eastern Mediterranean; SE = standard error; SEA = South-East Asia; WP = Western Pacific.

ethnicity than among other ethnicities (70). Eisner et al. concluded that communities with low socioeconomic status were at higher risk of COPD. They also observed a higher prevalence of COPD among populations with low education or income (71). A cohort study that followed a population of > 57 000 subjects for 35 years concluded that long-term exposure to traffic air pollutants may have contributed to the increase in COPD (72). In fact, some researchers believe that COPD would not really exist in the absence of smoking (73).

Our study was a systematic approach for the estimation of COPD severity stages worldwide. We found that most subjects with COPD were in stage 2 (moderate) by GOLD definitions. These findings are important for adjusting the estimation of the global burden of COPD, since the years lived with a disability (YLDs) for COPD is calculated based on the years lost due to disability weight, which is substantially different among different COPD stages. For example, the weight of disability for COPD in the GBD study in 2013 was 0.019 for stage 1 but 0.408 for stage 4 (74).

Our meta-analysis found a high level of heterogeneity among the studies included. Subgroup analysis by sex

and region could not relieve this heterogeneity. Besides, we found that WHO region, level of collection data, and sample size were more associated with heterogeneity. However, after adjusting for all factors, we could only account for about 30% of the heterogeneity. This finding is similar to many other meta-analyses of prevalence studies (60,75). This high heterogeneity of the prevalence may have been due to the variability of the prevalence in different populations and regions. It might also have been due to differences among studies regarding the years when they were conducted, their approach to population sampling, and data collection methods. In meta-analysis of prevalence, heterogeneity is more than expected for meta-analysis of relative risks. This could be due to significant real difference in the prevalence rates in various countries and regions (76).

The main limitations of our study were the lack of data for some key regions and inconsistency between the numbers of studies conducted in different regions, which led us to merge the data of 2 WHO regions. The fact that we only included English-language papers was another limitation, since many papers discussed the subject in other languages. Moreover, the age group distribution was inconsistent between some papers so that we could

not extract data for all age groups; consequently, we could not standardize the results for age and sex.

However, a strength of our study was the use of a standard definition of COPD to estimate the pooled global prevalence of COPD. This approach eliminated the role of the variable definitions of COPD in the heterogeneity of results in different studies. Another strength of our study was reporting the severity of COPD stages.

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## Conclusion

It seems that the prevalence of COPD is higher in the Region of the Americas than in other regions. Because of the lack of data in some regions such as the Eastern Mediterranean Region and African Region, we recommend conducting research on the prevalence, incidence, and mortality rate of COPD in these regions.

## Prévalence mondiale de la bronchopneumopathie chronique obstructive : analyse systématique et méta-analyse

### Résumé

**Contexte :** La bronchopneumopathie chronique obstructive (BPCO) est l'une des principales causes de morbidité et de mortalité dans le monde.

**Objectifs :** Réaliser une synthèse des données relatives à la prévalence et à la gravité de la BPCO par régions géographiques, tranches d'âges et statut tabagique à partir d'une analyse systématique de la littérature médicale disponible.

**Méthodes :** Une recherche systématique a été réalisée conformément aux lignes directrices pour la méta-analyse des études observationnelles (MOOSE). Des recherches ont été lancées dans des bases de données internationales, notamment PubMed, Scopus et Web of Science, afin d'identifier les études populationnelles, publiées entre janvier 2004 et mai 2015, faisant état de la prévalence de la BPCO partout dans le monde. La prévalence de la BPCO a été calculée à l'aide du programme Metaprop en fonction des régions définies par l'Organisation mondiale de la Santé (OMS), du sexe et du stade de sévérité. Des méthodes de méta-régression et d'analyse de sous-groupes ont été appliquées afin d'identifier les sources d'hétérogénéité.

**Résultats :** Au total, 60 articles ont été analysés portant sur un échantillon composite de 127 598 sujets. La prévalence de la BPCO après utilisation d'un bronchodilatateur était de 12,16 % (10,91 à 13,40 %). La prévalence globale de la BPCO était de 15,70 % (13,80 à 18,59 %) chez les hommes et de 9,93 % (8,73 à 11,13 %) chez les femmes. Sur l'ensemble des régions OMS, la prévalence la plus forte était enregistrée pour les Amériques (14,53 %) et la plus faible pour l'Asie du Sud-Est/le Pacifique occidental (8,80 %). Les variables du modèle de méta-régression utilisé incluaient la taille de l'échantillon, la région, le score de la qualité de l'étude, le niveau des données recueillies, l'année de publication et la méthode d'échantillonnage, justifiant ainsi l'hétérogénéité de 29,82 % associée aux taux de prévalence de la BPCO à travers le monde.

**Conclusions :** La prévalence mondiale de la BPCO chez les hommes s'avère supérieure d'environ 5 % à celle observée chez les femmes. Le stade 1 de la BPCO est celui ayant la prévalence la plus élevée.

### معدل الانتشار العالمي لمرض الانسداد الرئوي المزمن: استعراض منهجي وتحليل تلوي

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### الخلاصة

الخلفية: يُعدُّ مرض الانسداد الرئوي المزمن أحد الأسباب الرئيسية التي تسبب المراضة والوفيات على مستوى العالم.

الأهداف: هدفت هذه الدراسة إلى جمع البيانات حول معدل الانتشار العالمي لمرض الانسداد الرئوي المزمن ومدى شدته حسب المنطقة الجغرافية والفئات العمرية وحالة التدخين، وذلك من خلال استعراض منهجي للمواد الطبية المنشورة.

طرق البحث: أُجري بحث منظم اتبع التحليل التلوي للمبادئ التوجيهية الخاصة بالدراسات الرصدية في علم الوبائيات. وتم البحث في قواعد البيانات الدولية، بما في ذلك PubMed و Scopus و Web of Science، عن الدراسات القائمة على السكان التي أبلغت عن معدل انتشار مرض الانسداد الرئوي المزمن في أي مكان بالعالم، والمنشورة في الفترة بين يناير/ كانون الثاني ٢٠٠٤ ومايو/ أيار ٢٠١٥. وتم حساب معدل انتشار مرض

الانسداد الرئوي المزمن بناءً على أقاليم منظمة الصحة العالمية والجنس ومراحل شدة المرض باستخدام برنامج Metaprop الإحصائي. وطُبقت أساليب التحوف التلوي وتحليل المجموعات الفرعية لتحديد مصادر عدم التباين.

**النتائج:** استُعرضت ٦٠ ورقة بحثية إجمالاً، وبلغ مجموع حجم العينة ٥٩٨، ١٢٧ شخصاً. وبلغ معدل انتشار مرض الانسداد الرئوي المزمن ما بعد إعطاء موسع للقصبات ١٦، ١٢٪ (٩١، ١٠–٤٠، ١٣٪). وبلغ مجموع معدل انتشار مرض الانسداد الرئوي المزمن ٧٠، ١٥٪ (٨٠، ١٣–٥٩، ١٨٪) بين الرجال، و٩٣، ٩٪ (٧٣، ٨–١٣، ١١٪) بين النساء. ومن بين أقاليم منظمة الصحة العالمية، سُجِّل أعلى معدل انتشار في إقليم الأمريكتين (١٤، ٥٣٪)، وأقل معدل انتشار في إقليم جنوب شرق آسيا/إقليم غرب المحيط الهادئ (٨، ٨٠٪). وفي نموذج التحوف التلوي، شملت المتغيرات ما يلي: حجم العينة، والأقاليم، ومستوى جودة الدراسة للبيانات المجمعة، وسنة النشر، وأساليب أخذ العينات، والتي توضح ٢٩، ٨٢٪ من عدم التباين المكتشف بين معدلات انتشار مرض الانسداد الرئوي المزمن على مستوى العالم.

**الاستنتاجات:** يبدو أن معدل الانتشار العالمي لمرض الانسداد الرئوي المزمن بين الذكور أعلى بنسبة ٥٪ تقريباً عنه بين النساء. وأكثر المراحل انتشاراً من المرض هو المرحلة الأولى.

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## Enhancing surveillance for early detection of Zika virus infection: strategies for the countries of Eastern Mediterranean Region

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### Abstract

**Background:** Zika virus infection (ZIKV) has caused major outbreaks in tropic and sub-tropic areas. No case from ZIKV has yet been reported in the countries of the Eastern Mediterranean Region (EMR) despite the presence of competent vector *Aedes* mosquitoes in many of these countries.

**Aims:** This study addresses appropriate surveillance strategies for early detection of ZIKV infection, which is important for EMR countries with established *Aedes* populations, but with no known or documented autochthonous transmission of ZIKV.

**Methods:** The WHO Regional Office for the Eastern Mediterranean developed a strategic framework for enhancing surveillance for ZIKV infection in EMR countries with established *Aedes* populations through a consultative process and review of available evidence.

**Results:** The framework calls for enhancing surveillance for early detection of ZIKV infection using a combination of both syndromic and event-based surveillance approaches.

**Conclusions:** Enhancing surveillance for ZIKAV would require no shift in the existing system. A number of considerations would be required to integrate this syndromic and event-based surveillance approaches within the existing system.

Keywords: Zika virus infection, Eastern Mediterranean Region, syndromic surveillance, *Aedes*, event-based surveillance

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### Introduction

Zika virus (ZIKV), is an arbovirus transmitted primarily by *Aedes* mosquitos to humans, and has caused major outbreaks in French Polynesia, Brazil and elsewhere in tropic and sub-tropic areas in the past. (1–4). ZIKV causes mild and self-limiting infection in majority of patients but recent evidence indicates that ZIKV infection can be potentially associated with severe complications including congenital birth defects and neurological disorders such as microcephaly and Guillain-Barré syndrome. (5–10). In February 2016, the World Health Organization (WHO) declared the clusters of microcephaly and neurological disorders potentially associated with ZIKV as Public Health Emergency of International Concern (PHEIC) (11).

Although no ZIKV infection has yet been reported in the countries of the Eastern Mediterranean Region (EMR), competent disease vector *Aedes* mosquitoes are present in many countries in the Region (12,13) and a number of countries have reported outbreaks of dengue, chikungunya and yellow fever in the past, which are all transmitted by the same *Aedes* mosquitoes (13). In the globalized world, the risk of importation of ZIKV into

EMR countries through a viraemic traveler returning from one of the ZIKV affected countries is a possibility, since it has happened in the recent past (14,15). Once the virus is introduced, the risk of local transmission of ZIKV remains high in EMR countries where *Aedes* populations and major arboviral disease outbreaks transmitted by the same *Aedes* species have occurred in the past (12,16–18). In the WHO's new country classification scheme for ZIKV, eight countries from the Eastern Mediterranean Region are included in Category 4, which means that a main competent vector is established in these countries with no known or documented autochthonous case of ZIKV infection (19). Considering that the Region is already besieged with so many health problems, including the fact that many of the countries within the WHO's Zika virus classification are chronically affected by fragility and conflict, it is imperative for early detection and timely response to any cluster of ZIKV infection. This will not only reduce the potential consequences of ZIKV infection but will also reduce the economic cost of health systems managing these severe complications of ZIKV infection.

In view of the threat of introduction of ZIKV infection,

the WHO Regional Office for the Eastern Mediterranean (WHO/EMRO) launched a regional plan for enhancing preparedness and readiness measures for ZIKV infection to improve prevention, detection and response to the spread of the virus in the Region. One of the key priority activities of this plan was to recommend an effective surveillance strategy for early detection of the introduction, or any autochthonous transmission of ZIKV infection in EMR countries with competent *Aedes* species populations. This article describes the recommended strategy for enhancing surveillance systems for detection of ZIKV infection in settings where the *Aedes* mosquitoes are known to exist and no cases have so far been reported or documented.

## Framework development for enhancing surveillance

To define an appropriate surveillance strategy for detection of clusters of ZIKV infection transmitted by *Aedes* mosquitoes, WHO/EMRO organized a consultative meeting for selected countries that are endemic for other arboviral infections in Islamabad, Pakistan during 14–16 November 2016. Senior level epidemiologists and disease surveillance officers working in these countries as well as a number of experts from WHO and WHO Collaborating Centers came together and reviewed the available evidence and data on the epidemiology and clinical manifestations of the ZIKV infection. A draft framework for enhancing surveillance systems in EMR countries with no known or autochthonous transmission of ZIKV infection was developed following this consultative process.

To follow up on the outcome of the regional consultative workshop, an expert group meeting was held 22–23 January 2017 in Cairo, Egypt, with the objectives of finalizing the framework and developing an algorithm for detection, verification and investigation process.

## Framework for enhancing surveillance for detection of cluster of ZIKV infection

In areas where ZIKV infection is not endemic, early detection of a single case is highly improbable since over 80% of cases can be asymptomatic (20). Conventional indicator-based disease surveillance systems may not be able to pick up the first few cases since such systems rely on well-known diseases with specific case definitions and/or laboratory confirmation. More importantly, there is considerable overlapping of clinical symptoms (Table 1) between ZIKV and other arboviral diseases caused by the same *Aedes* species (20). There is also serologic cross-reactivity among arboviral diseases occurring in similar geographic areas. (4,21,22). In view of limitations of existing conventional disease surveillance systems to detect ZIKV infection in non-endemic settings, effective surveillance systems that are appropriate for resource-poor settings and can identify a potential cluster where laboratory capacity to detect the ZIKV is limited, should be the goal to prevent local transmission (12,23).

### Syndromic surveillance approach for early detection

There was a consensus that the goal of an appropriate surveillance strategy for EMR countries with no known or documented autochthonous transmission of ZIKV infection would be to detect early a “cluster” of suspected ZIKV cases. Owing to overlapping symptoms and clinical manifestations, single or first few suspected cases of ZIKV infection are likely to be missed. As such, a syndromic surveillance approach would be the best fit since the focus here is to detect a “cluster” on the basis of early symptoms of cases using a syndromic case definition before clinical diagnosis or laboratory confirmation is

**Table 1** Classification of case definitions of Dengue, Chikungunya and Zika

Symptoms	Dengue	Chikungunya	Zika
Fever	++++	+++	+++
Myalgia/Arthralgia	+++	++++	++
Edema of extremities	0	0	++
Maculopapular rash	++	++	+++
Retro-orbital pain	++	+	++
Conjunctivitis	0	+	+++
Headache	++	++	++
Vomiting	++	++	++
Joint pains	+	+++	+
Lymphadenopathies	++	++	+
Hepatomegaly	0	+++	-
Leukopenia/thrombopenia	+++	+++	-
Haemorrhage (petechiae, ecchymosis, purpura, epistaxis, bleeding gums, hematuria, or a positive tourniquet test result)	+	-	-
Oropharynx and facial erythema	+	-	-

made. In the context of syndromic surveillance approach, warning signs (Table 2) remain important aspects for early detection of diseases that present themselves initially with mild clinical manifestations, while the evidence for any specific clinical or laboratory marker is weak or not available.

After a review of the main epidemiological and clinical characteristics and existing case definitions of Zika, dengue and chikungunya, a working case definition for a suspected “case” and “cluster” was developed for use for a syndromic approach. (Table 3). Using such a syndromic case definition, health workers, even at the primary health care level, can alert/report the cluster corresponding to the case definition of clusters. This will then trigger steps for conducting field investigation by the district level surveillance officials as well as collecting more detailed epidemiological and clinical information in a line list and also collecting samples for laboratory confirmation. Blood samples should be collected preferably from acute febrile patients during the viraemic phase within 5 days of illness onset and should be sent for serological tests and reverse transcription polymerase chain reaction (RT-PCR). The laboratory confirmation tests should be considered in patients with acute onset of fever, maculopapular rash, arthralgia, or conjunctivitis who live in or have traveled to an area with ongoing transmission in the 2 weeks preceding the illness onset. The possible diagnostic tests for confirming the presence of one of the targeted arboviral diseases should be available in the reference laboratory of the country.

### Event-based surveillance for detection of ZIKV infection

In countries where event-based surveillance (EBS) systems have been functioning as part of national disease surveillance systems for early detection of health threats, including other arboviral diseases, such systems can also be used for detection of ZIKV infection. The strategy here would be to use the existing non-conventional sources of information related to other arboviruses such as dengue or chikungunya as well as other important information sources that may be specific to ZIKV infection. As the

neurological manifestations potentially associated with ZIKV infection may appear late, identification of excess numbers of Guillain-Barré syndrome (GBS) or incidence of congenital birth defects and microcephaly in health facilities regarded as “excess” or “unusual”, should be a trigger for further investigation to rule out or confirm its association with ZIKV infection. In accordance with the source of information, the verification processes should consider establishing formal channels of communication for validation at national or local level.

A generic algorithm for detection of ZIKV infection using a syndromic case definition approach and event-based surveillance approach is presented in Figure 1.

### Discussion

Syndromic surveillance is now being used in many countries, specifically in resource limited settings for the early detection of outbreaks and clusters of health events. (24–27). The system relies on early stage of illness (symptomatic period) and uses both clinical and alternative data sources (28). In the case of ZIKV infection where majority of cases are either asymptomatic or present with mild infection and considerable overlapping of clinical symptoms with other diseases such as dengue, chikungunya, influenza, measles and malaria (29), the goal of the surveillance system in the countries where these diseases are endemic should be to detect a “cluster” of febrile syndromes and not a “case” using a more broader and sensitive syndromic case definition. It is plausible that detection of a “case” will lead to unnecessary resource-intensive and time-consuming procedures, while detection of a cluster can lead to a series of specific field investigations leading to verification and laboratory testing either to confirm (or dismiss) the existence of ZIKV circulation. In parallel, entomological surveillance needs to be purposeful and aligned to periodical risk assessment to detect high densities of competent vectors in high-risk areas (30). The entomological surveillance should be directed in high-risk areas not only to detect high densities of competent vectors, but also to assess the probability and efficiency of transmission of ZIKV from mosquitoes to human by detecting the virus and assessing the infec-

**Table 2** Diagnosis based on warning signs of dengue, chikungunya and Zika

Dengue	Chikungunya	Zika
Severe abdominal pain	Sever joint pains (hands, feet, proximal joints)	Cluster of patients with fever, conjunctivitis and maculopapular rash with majority or some of the patients having positive travel history
Persistent vomiting	High density of <i>Aedes</i> mosquitoes	Microcephaly in newborn
Difficulty breathing		Congenital Zika syndrome
Liver enlargement		Guillain-Barré syndrome
Mucosal bleeding		High density of <i>Aedes</i> mosquitoes
High hematocrit with low platelets		
Lethargy or restlessness		
Hypovolemic shock		
High density of <i>Aedes</i> mosquitoes		

**Table 3 Suggested syndromic case definition of Zika Virus Infection for use in the Eastern Mediterranean Region**

- **Case:** Fever and at least one of the following symptoms: myalgia, joint pain, rash, retro-orbital pain, conjunctivitis, headache and vomiting.
- **Cluster:** A cluster of ZIKAV infection is considered as two or more cases meeting the case definition and having plausible epidemiologic link (time, place and contact).

tivity of mosquito vectors through appropriate molecular diagnostic tests.

On the basis of this rationale, the syndromic surveillance approach is highly recommended in EMR countries where indigenous transmission is low or absent or not documented, since the cost for establishing such a system is reasonable, supplements the functions of the existing surveillance system in the country, and has been ideally used to detect a new health event elsewhere (31,32). It is expected that using a syndromic approach, the warning signs of an impending outbreak of ZIKV infection would be detected early on, leading to further field investigation for confirmation.

The framework also suggests to enhance syndromic surveillance in only those geographic areas of the countries which are known to be habitats for *Aedes* population. These areas should also be targeted for enhanced entomological surveillance in order to detect early any evolving signs of high densities of competent vectors. Active surveillance for detection of high density of competent vectors should be conducted in and around areas where a single or preferably a cluster of cases of chikungunya, dengue and yellow fever has been detected or suspected in the past. The algorithm presented in the framework is only for verification purposes. It starts with case definitions to be used for detection purpose and flows in a stepwise manner, and include steps for verification and response as well as setting a clear pathway for laboratory confirmation of the collected sample.

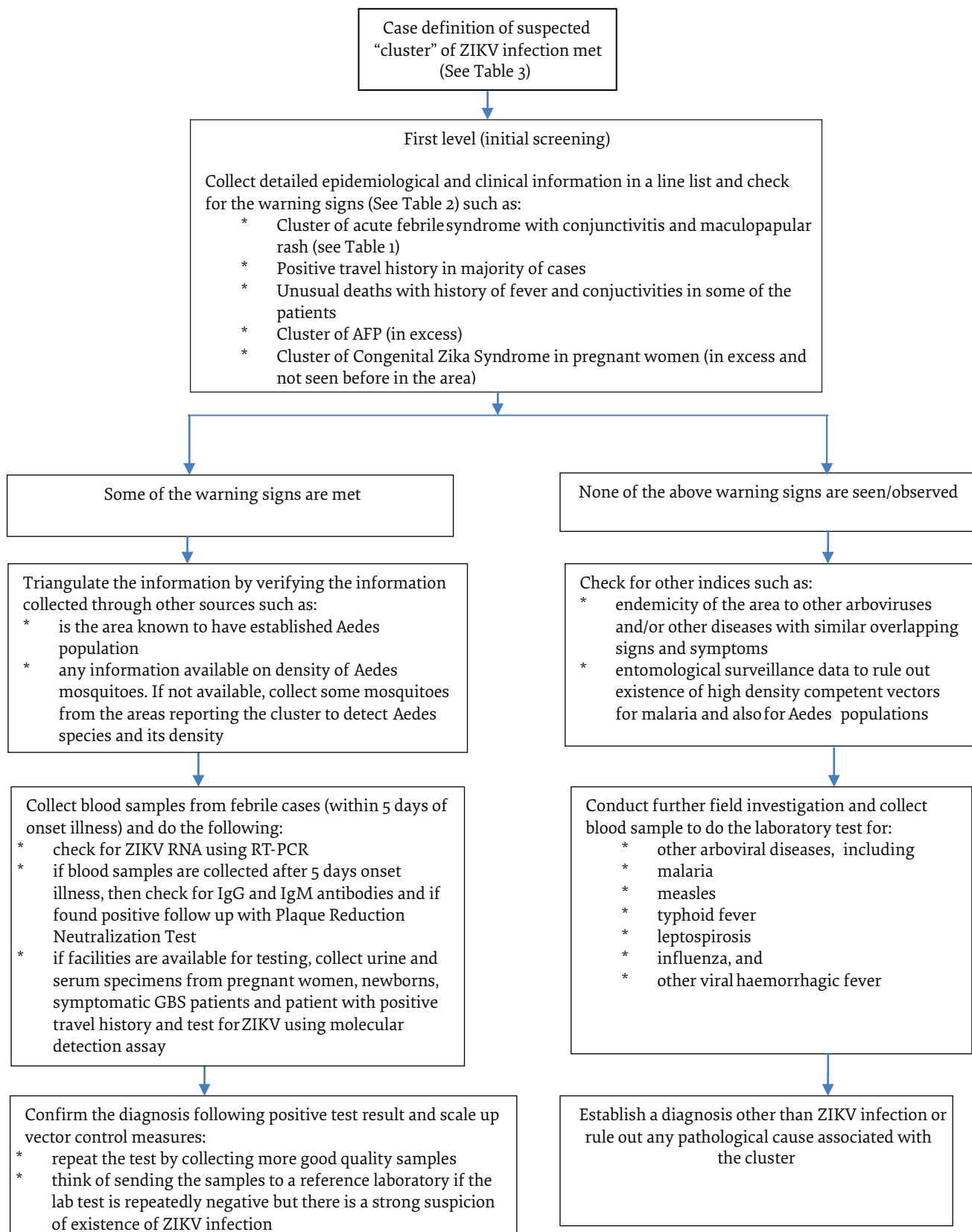
The silent introduction of ZIKV infection can be picked up by an existing EBS system of a country if the data sources for EBS become tuned to the nature and clinical manifestations of ZIKV infection in humans. In addition to using data from nonconventional sources (e.g., media news, reports, stories, rumours etc.) could be useful (33,34). In case of detecting ZIKV transmission, the existing EBS of a country should focus on all established data sources that may represent early signs of arboviruses, but in particular the system should be geared to collecting information on the complications of ZIKV infection such as congenital Zika syndrome and GBS. The information in this phase of the process should be gathered by 'triage', e.g., cluster of fever and conjunctivitis (or others clinical symptoms/syndromes) or death from arboviral disease or syndrome, unusual increase in deaths particularly in an array of fever and conjunctivitis (or other clinical symptoms/syndromes), and unexpected and excess microcephaly signs among recently born babies. A multi-sectoral approach is also required for EBS and should rely on sources of information beyond the traditional health system sources (35).

Several strategic requirements need to be considered to implement an enhanced surveillance system for ZIKV infection. Syndromic definitions for early detection of any cluster or outbreak need to be validated constantly. Risk communication to improve the level of knowledge among health workers and the population at risk is helpful in order to consider the diagnosis of ZIKV infection when experiencing an acute febrile illness. Travel history within the past 2 weeks of acute febrile illness is an important marker that should not be overlooked.

Finally, such a system must be an integral part of the country's existing disease surveillance and reporting system. Experience has shown that incorporating both syndromic and EBS systems into existing surveillance systems could be useful and realistic for detection of ZIKV infection (36). In order to do so, there is a need to include ZIKV infection as one of the newly emerging notifiable disease conditions, establish a case definition, and train public health professionals on the use of syndromic and EBS system approach. While integrating the surveillance system for ZIKV infection within the existing disease reporting system in the country, data from the existing AFP surveillance system, as well as from any other surveillance system to detect and monitor the trend of GBS, microcephaly or other congenital birth defects, should be used for verification purpose. Relying on these existing reporting systems with adequate laboratory network support could prove to be decisive (37-39). In order to ensure the sustainability of the performance of the surveillance system, the quality of the data reported should be monitored rigorously. Consequently, the system needs to collect data that are more sensitive than specific, and both primary and secondary sources of data need to be explored for triangulation and verification.

### Future direction

The emergence of Zika and other arboviral diseases in recent years has posed formidable challenges to public health, disease control and particularly the conventional disease surveillance system. Novel surveillance approaches including both the syndromic and EBS need to be implemented at country levels, which would also serve to fulfill the real-time surveillance function as required by International Health Regulations (2005). In malaria endemic countries, one of the important considerations would be to establish an integrated vector control management system for arboviruses, leveraging on the existing malaria control programme and infrastructure for greater efficiency measure. An integrated vector control management system should seek to reduce the potential breeding sites; this would mean that vector populations should be kept as low as practically possible throughout



**Figure 1** Algorithm for detection of ZIKV infection using both syndromic surveillance and EBS



the year, particularly in their habitats until an outbreak occurs.

The proposed framework for enhancing surveillance for ZIKV infection highlighted the importance of defining surveillance strategies for the detection of clusters of ZIKV infection in EMR countries with established *Aedes* populations. High-risk countries need to roll out this framework in order to reduce the threat of the introduction of ZIKV. According to the prevailing surveillance systems and situations of each country,

the at-risk countries should make arrangements for establishing such systems including setting mechanisms for collaboration and communication within health sectors as well as among other sectors. Such systems once functional can also be used for early detection of other arboviral diseases outbreaks, including the detection of other emerging and novel infectious diseases.

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## Renforcement de la surveillance pour le dépistage précoce de l'infection par le virus Zika : stratégies destinées aux pays de la Région de la Méditerranée orientale

### Résumé

**Contexte :** L'infection par le virus Zika est à l'origine d'importantes flambées épidémiques dans les régions tropicales et subtropicales. Aucun cas d'infection par le virus Zika n'a encore été signalé dans les pays de la Région de la Méditerranée orientale malgré la présence, dans nombre d'entre eux, de moustiques compétents du genre *Aedes*, vecteurs du virus.

**Objectifs :** La présente étude porte sur les stratégies de surveillance à mettre en œuvre pour le dépistage précoce de l'infection par le virus Zika, particulièrement important dans les pays de la Région de Méditerranée orientale où des populations d'*Aedes* sont établies mais dans lesquels aucune transmission autochtone de ce virus n'est connue ou documentée à ce jour.

**Méthodes :** Par l'intermédiaire d'un processus consultatif et d'examen des données disponibles, le Bureau régional de l'OMS pour la Méditerranée orientale a développé un cadre stratégique en vue d'améliorer la surveillance de l'infection par le virus Zika dans les pays de la Région de Méditerranée orientale où sont établies des populations d'*Aedes*.

**Résultats :** Afin de dépister de façon précoce l'infection par le virus Zika, ce cadre préconise une meilleure surveillance en recourant à la fois à la surveillance syndromique et basée sur les événements.

**Conclusions :** Le renforcement de la surveillance du virus Zika n'impliquerait pas le changement du système actuel. Un certain nombre d'aspects devraient être pris en compte afin d'intégrer ces approches de surveillance syndromique et basée sur les événements dans le système existant.

### تعزيز الترصد للكشف المبكر عن عدوى فيروس زيكا: استراتيجيات لبلدان إقليم شرق المتوسط

مجدولين أوبطيل، مأمون مالك، تران نهو نجوين، إيفانس بوليفا، أحمد الخوي، سالم عبد الرحمن سالم، ندى غصن، بيان همتي، فو تون، بيتر مالا

#### الخلاصة

**الخلفية:** سببت عدوى فيروس زيكا أوبئة كبرى في المناطق المدارية وشبه المدارية. ولم يتم الإبلاغ بعد عن أي حالات لعدوى فيروس زيكا في بلدان إقليم شرق المتوسط، رغم وجود الناقلات المختصة للبعوض الزاعج في العديد من هذه البلدان.

**الأهداف:** تتناول هذه الدراسة استراتيجيات الترصد المناسبة للكشف المبكر عن عدوى فيروس زيكا، والتي تُعد مهمة لبلدان إقليم شرق المتوسط التي يوجد فيها البعوض الزاعج، ولكن دون أي حالات انتقال محلية الأصل معروفة أو موثقة للعدوى.

**طرق البحث:** وضع المكتب الإقليمي لشرق المتوسط لمنظمة الصحة العالمية إطار عمل استراتيجي لتعزيز ترصد عدوى فيروس زيكا في بلدان الإقليم التي يوجد فيها البعوض الزاعج، وذلك من خلال عملية تشاورية واستعراض للبيانات المتاحة.

**النتائج:** يدعو إطار العمل إلى تعزيز الترصد بهدف الكشف المبكر عن عدوى فيروس زيكا، باستخدام مجموعة من نهج الترصد القائم على الأحداث والمتلازمات.

**الاستنتاجات:** لا يتطلب تعزيز ترصد عدوى فيروس زيكا أي تغيير في النظام الحالي. ومن المطلوب أخذ عدة اعتبارات في الحسبان من أجل دمج نهج الترصد القائم على الأحداث والمتلازمات في النظام الحالي.

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## Leishmaniasis among neighbouring endemic countries in the Eastern Mediterranean, African and European regions

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### Introduction

The World Health Organization (WHO) Eastern Mediterranean Region reported 69.6% of the total number of cutaneous leishmaniasis cases detected worldwide in 2016 (1). Over 90% of reported cases in the Region were from three countries only: Afghanistan, Pakistan and Syrian Arab Republic. Moreover, the number of reported cases in Syrian Arab Republic and the neighbouring countries of Iraq, Jordan and Lebanon, indicated a remarkable increase between 2010 and 2016 (1). For visceral leishmaniasis, the Region carries about 19% of the global burden, with the highest number of cases reported from Somalia and Sudan (1).

The Organization has strengthened its efforts in leishmaniasis prevention and control in the Region in recent years, producing a framework for action on cutaneous leishmaniasis in the Eastern Mediterranean Region 2014–2018, and a regional manual for case management of cutaneous leishmaniasis (2).

However, the Region faces many challenges in implementing the control measures for leishmaniasis, including uncontrolled urbanization, limited funding, weak surveillance, and emergencies and crisis situations that have led to the deterioration of sanitation and water supply, collapse and destruction of health system infrastructure, and population displacement. Furthermore, endemic zones for cutaneous and visceral leishmaniasis traverse country borders and WHO regions, underlining the need for cross-border collaboration between neighbouring countries and WHO regions.

Given this background, WHO held an interregional meeting on leishmaniasis among neighbouring endemic countries in the WHO Eastern Mediterranean, African and European regions, in Amman, Jordan, from 23 to 25 September 2018.

The objectives of the meeting were to:

- review epidemiology and control of leishmaniasis in countries of the Eastern Mediterranean Region, as well as neighbouring countries in the African and European Regions;
- discuss the strategic elements and operational action required to enhance early diagnosis and treatment, including surveillance and data management/report-

ing, access to medicines and consumables, control of vectors and reservoir hosts, and capacities of health staff;

- share experiences on surveillance of leishmaniasis with emphasis on the District Health Information Software (DHIS2) online tool;
- identify ways to address and overcome the challenges faced by countries in controlling the disease, notably in complex operational environments;
- identify cross-border issues and areas of collaboration to improve disease control; and
- agree on priority research topics for leishmaniasis within the universal health coverage agenda.

The meeting was attended by representatives from the ministries of health of Albania, Georgia, Greece, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Morocco, Pakistan, Saudi Arabia, Sudan, Syrian Arab Republic, and Tunisia. The WHO Secretariat included staff from headquarters, regional and country levels.

Dr Hoda Atta, Coordinator HIV, TB, Malaria and Tropical Diseases, WHO Regional Office for the Eastern Mediterranean, Cairo, Egypt, inaugurated the meeting by welcoming the participants and acknowledging its importance, given the current socio-political context and related challenges for neglected tropical diseases in the three regions.

### Summary of discussions

Weak surveillance and underreporting are key challenges. High-burden countries need to ensure that they enter data onto the WHO District Health Information System 2 (DHIS2) platform. It is important to establish unified case definitions when reporting and to differentiate between autochthonous and imported cases in order to identify the most probable sources of infection.

Global, regional and country level experience in responding to outbreaks of leishmaniasis was presented. WHO is currently supporting countries endemic for visceral leishmaniasis with donations of medicines and/or funds for control programmes through agreements and donations from Gilead Sciences (GILEAD) and the United Kingdom's Department for International Development (DfID). Extensions of these agreements are

<sup>1</sup> This report is extracted from the Summary report on the Interregional meeting on leishmaniasis among neighbouring endemic countries in the Eastern Mediterranean, African and European regions, Amman, Jordan, 23–25 September 2018 ([http://applications.emro.who.int/docs/IC\\_Meet\\_Rep\\_2019\\_EN\\_22325.pdf?ua=1](http://applications.emro.who.int/docs/IC_Meet_Rep_2019_EN_22325.pdf?ua=1)).

dependent on the effective use and reporting of activities by control programmes. For cutaneous leishmaniasis, there are currently no medicine donations and only limited funding from WHO.

The global leishmaniasis programme at WHO headquarters has an emergency warehouse stocked with medicines and diagnostics that has very limited capacity. Priority is given to visceral leishmaniasis over cutaneous leishmaniasis due to the fatal nature of the disease if left untreated. This limited capacity greatly hinders the capability of the warehouse to respond to emergency requests from countries, especially in cases of cutaneous leishmaniasis. There is a need for high level advocacy in order to ensure access to treatment for all those affected. Countries should consider procurement through national resources or partner support.

Challenges for vector control include inadequate infrastructure for vector surveillance and control, lack of standardized vector and reservoir control measures, lack of monitoring and evaluation of WHO-interventions, insufficient human capacity and capability, limited contribution of research to the development of vector control policies and strategies, and poor community engagement and health education messaging. Hence, there is a dire need to strengthen the capacity of health staff in skin neglected tropical diseases, including leishmaniasis, and address poor compliance with recommended diagnostic methods for cutaneous leishmaniasis. This includes capacity-building in diagnosis and treatment (for health professionals), surveillance to align with WHO global reporting requirements (for programme officers/data managers), vector and reservoir control (for entomologists and mammalogists), and reinforcing programme management (for managers of control programmes). WHO Collaborating Centres have a key role to play in providing expert technical support, guidance and information exchange.

Moreover, countries face many external challenges that hinder the effective implementation of interventions, including ongoing insecurity in some areas, population movement, inadequate financial resources, high trained staff turnover, and weak intersectoral collaboration. The diversity of the disease and associated vectors and animal reservoir hosts, coupled with these external challenges, underpins the need for standardization and clarity of guidance.

In addition, to enhance cross-regional collaboration it is important to have uniform reporting mechanisms for disease surveillance, sharing relevant research findings, and using standardized case management protocols. There is also a need for mapping at subnational levels, especially in bordering areas, in order to inform both national and local coordination.

## Recommendations

1. Implementing resolution WHA60.13 on Control of leishmaniasis (3) to ensure that:
  - domestic funds are allocated for the procurement of first-line treatment for both cutaneous and visceral leishmaniasis; and
  - human leishmaniasis is included in the national surveillance system so that countries can collect and analyse routine data.
2. Building/sustaining political commitment to ensure uninterrupted implementation of activities for prevention and control of leishmaniasis.
3. Developing/updating national programmes and strategies on prevention and control of leishmaniasis, using a multisectoral approach and community engagement, and protocols for case management of leishmaniasis, to ensure compliance with WHO recommendations.
4. Promoting cross-border collaboration and cooperation on leishmaniasis prevention and control among neighbouring countries of the WHO Eastern Mediterranean, African and European regions.
5. Identifying, in collaboration with WHO, research priorities for prevention and control of leishmaniasis, and support the relevant research activities.
6. Providing technical support to countries to implement web-based surveillance of leishmaniasis within the national health information system.
7. Creating and funding a central procurement mechanism to promptly ship medical supplies (medicines and rapid diagnostic tests) on emergency or routine basis to selected countries where WHO has temporarily taken over this function on behalf of the health ministry.
8. Continuing to support capacity-building for the prevention, control and surveillance of leishmaniasis and to publish self-learning training packages, online and offline, on visceral leishmaniasis (*Leishmania infantum*) and cutaneous leishmaniasis (African and Asian forms).
9. Continuing to facilitate intercountry and interregional coordination on prevention and control of leishmaniasis.
10. Developing guidance outlining core interventions for emergency and complex control situations.

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1. World Health Organization. Leishmaniasis: key facts. Geneva: World Health Organization; 2018 (<https://www.who.int/news-room/fact-sheets/detail/leishmaniasis>).
2. World Health Organization Regional Office for the Eastern Mediterranean. Framework for action on cutaneous leishmaniasis in the Eastern Mediterranean Region 2014–2018. Cairo: World Health Organization Regional Office for the Eastern Mediterranean; 2014 ([http://applications.emro.who.int/dsaf/EMROPUB\\_2013\\_EN\\_1591.pdf?ua=1](http://applications.emro.who.int/dsaf/EMROPUB_2013_EN_1591.pdf?ua=1)).
3. Sixtieth World Health Assembly. WHA60.13 control of leishmaniasis. Geneva: World Health Organization; 2007 ([https://www.who.int/neglected\\_diseases/mediacentre/WHA\\_60.13\\_Eng.pdf](https://www.who.int/neglected_diseases/mediacentre/WHA_60.13_Eng.pdf)).

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The Eastern Mediterranean Health Journal extends sincere thanks to the following experts for their generous and invaluable assistance in the review of papers considered for publication during 2018.

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2. Papers submitted for publication to the EMHJ should conform with the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (<http://www.icmje.org/icmje-recommendations.pdf>) of the International Committee of Medical Journal Editors (ICMJE).
3. **Ethical considerations:** Where applicable, a statement must be included indicating approval for the study was granted by the ethics committee/institutional review board of the relevant institution. Authors should verify where appropriate that all persons on whom research has been carried out have given their voluntary, informed, written consent, and where participants (living or dead) were unable to give such consent, that surrogate consent was obtained. Authors may be asked to supply such consent forms. Conflicts of interest: Authors will be asked to provide details of any competing interests and funding. Please see the ICMJE Recommendations.
4. **Reporting guidelines:** EMHJ encourages and recommends authors to adhere to the best research protocols available and follow established reporting guidelines. Reporting guidelines are available at the EQUATOR Network (<http://www.equator-network.org/>). The key guidelines for research in the field of public health are: CONSORT (guidelines for reporting randomized trials); STROBE (guidelines for reporting observational studies); PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses); STARD (Standards for Reporting of Diagnostic Accuracy); COREQ (Consolidated criteria for reporting qualitative research); CARE (guideline for clinical case report) as well as the COCHRANE handbook (for systematic reviews of interventions). Links to these sites and other useful resources are available under “Useful resources for authors and reviewers” (<http://www.emro.who.int/emh-journal/links/>).
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## دلائل إرشادية للمؤلفين

١. ينبغي للأبحاث المقدّمة للنشر في المجلة الصحية لشرق المتوسط ألا تكون قد نشرت أو قبلت للنشر أو تكون محلاً للنظر في نشرها في مكان آخر. ويحتفظ المكتب الإقليمي لمنظمة الصحة العالمية لشرق المتوسط بجميع حقوق إعادة إنتاج المواد التي تُنشر في المجلة الصحية لشرق المتوسط أو إعادة نشرها.
٢. ينبغي للأبحاث المقدّمة للنشر في المجلة الصحية لشرق المتوسط أن تلبي التوصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية التي أصدرتها اللجنة الدولية لمحري المجلات الطبية.
٣. اعتبارات البعد الأخلاقي: بحسب الاقتضاء يجب إرفاق البحث المقدم للنشر في المجلة الصحية لشرق المتوسط بما يفيد الموافقة على الدراسة من جانب لجنة الأخلاقيات/ مجلس المراجعة المؤسسية في المؤسسة ذات الصلة بالبحث، كما يجب على المؤلفين التأكد، حيثما كان ذلك مناسباً، من أن جميع الأشخاص الذين شملهم البحث قد قدموا موافقة كتابية طوعية مستنيرة، وعندما يتعذر ذلك على المشاركين في البحث (سواء الأحياء منهم أو الأموات)، يجب على المؤلفين الحصول على موافقة بديلة. وقد يُطلب من المؤلفين تقديم نماذج هذه الموافقات. تضارب المصالح: سيطلب من المؤلفين تقديم معلومات تفصيلية حول أي تضارب في المصالح وحول التمويل. يُرجى الاطلاع على توصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية.
٤. دلائل إرشادية حول إعداد التقارير: تشجع المجلة الصحية لشرق المتوسط المؤلفين وتوصيهم بالالتزام بأفضل بروتوكولات البحوث المتاحة، واتباع الدلائل الإرشادية المعتمدة في إعداد التقارير، ويمكن الاطلاع على الدلائل الإرشادية حول كتابة التقارير على شبكة EQUATOR (<http://www.equator-network.org>). وتمثّل الدلائل الإرشادية الرئيسية للبحوث في ميدان الصحة العامة فيما يلي: المعايير المجمعّة لكتابة التقارير حول الدراسات (CONSORT) وهي الدلائل الإرشادية لإعداد التقارير حول الدراسات المعشاة، و STROBE وهي الدلائل الإرشادية حول كتابة التقارير للدراسات المعتمدة على الملاحظة، والمكونات المفضلة في كتابة تقارير المراجعات المنهجية والتحليل البعدي PRISMA ومعايير إعداد التقارير حول الدقة التشخيصية STARD، والمعايير المجمعّة لكتابة التقارير حول البحوث النوعية COREQ، وكتيب كوكرين COCHRANE (للمراجعات المنهجية للتدخلات). والروابط إلى تلك المواقع وغيرها من المصادر المفيدة متاحة على الرابط "المصادر المفيدة للمؤلفين والمراجعين" (<http://www.emro.who.int/emh-journal/links>).
٥. وفقاً لتوصيات منظمة الصحة العالمية وتوصيات اللجنة الدولية لمحري المجلات الطبية، فإن المجلة الصحية لشرق المتوسط تطلب تسجيل الدراسات السريرية (الإكلينيكية) في سجل للدراسات العامة كشرط للنظر في نشرها، ويوصي المؤلفون بالتسجيل في أحد سجلات الدراسات السريرية المشهود لها من قبل منظمة الصحة العالمية واللجنة الدولية لمحري المجلات الطبية، وتتوافر هذه السجلات على البوابة الدولية لسجل الدراسات السريرية (<http://www.who.int/ictpr/en>).
٦. تقديم الأبحاث: يمكن تقديم الأبحاث الأصلية المكتوبة باللغة العربية أو الإنجليزية أو الفرنسية للنظر فيها وذلك من خلال نظام التقديم عبر الإنترنت الخاص بالمجلة الصحية لشرق المتوسط. ويمكن الاطلاع على التعليمات حول تقديم مخطوط البحث عبر نظام التقديم على الإنترنت والدخول على ذلك النظام على موقع المجلة الصحية لشرق المتوسط على الإنترنت، وهو <http://www.emro.who.int/emh/emh-journal/>) (authors) ثم الضغط على أيقونة Editorial Manager.
٧. سوف تُترجم ملخصات الأبحاث التي قبلت للنشر إلى اللغات الثلاث، ومن أجل ضمان الكتابة الصحيحة لأسماء المؤلفين في سياق الملخص بالعربية، فإن على المؤلفين الذين كتبوا بحوثهم بالإنجليزية أو الفرنسية ولكن لغتهم الأم تكتب بالحروف العربية أن يكتبوا أسماءهم بالحروف العربية مع مقابلاتها باللغة الإنجليزية أو بالفرنسية.
٨. يجب إعداد المخطوطة باستخدام برامج معالجة الكلمات (ويفضل برنامج ميكروسوفت - وورد) وأن تكتب بفواصل مضاعفة بين الأسطر وفي عمود واحد ويفضل استخدام الخط Times New Roman وأن يكون حجم الخط ١٢.
٩. تخضع جميع الأبحاث التي تقدم للنشر لمراجعة الزملاء، وتحتفظ هيئة التحرير بحق قبول أو رفض أي ورقة استناداً إلى الملاحظات التي يديها المراجعون، وإلى السلامة العلمية، وإلى ملاءمة البحث للمجلة. ومن المتفق عليه أن قبول الأبحاث يستند إلى مراجعتها إحصائياً وتحريرياً وفق ما تقتضيه الحاجة، ويتضمن ذلك اختصار النص وحذف بعض الجداول أو الرسوم البيانية.
١٠. المواضيع يجب أن يكون موضوع البحث له صلة بالصحة العامة أو بأي مادة تقنية أو طبية حيوية في مجال يحظى باهتمام منظمة الصحة العالمية وله أهمية خاصة لإقليم شرق المتوسط.
١١. ينبغي لعنوان البحث أن يكون مختصراً على قدر المستطاع، ويفضل ألا يزيد على ١٥ كلمة. وينبغي لجميع المؤلفين أن يكونوا قد أسهموا مساهمة مادية في تصميم الدراسة أو تحليلها أو كتابتها، وأن يكونوا قد وافقوا على النسخة النهائية المقدمة. ولن يسمح بأي تغيير في ما يتعلق بتأليف الورقة بعد قبولها للنشر، كما يجب أن يحظى كل تغيير على موافقة مسبقة من جميع المؤلفين المذكورة أسماؤهم. وقد يطلب من المؤلفين إثبات إسهاماتهم، كما يمكن إدراج أسماء مساهمين آخرين في عبارات الشكر، ويُرجى النظر في توصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية حول التأليف والإسهام.
١٢. الملخصات: يجب أن تحتوي الأبحاث المقدمة على ملخص منظم على النحو التالي: معلومات أساسية، والأهداف، والطرق، والنتائج، والاستنتاجات. ومن الممكن أن يكون التنظيم مرناً إذا اقتضى البحث ذلك، وساق المؤلف تبريراً لذلك وقت تقديم البحث.
١٣. مقالات البحوث: يجب أن تتقيد الأبحاث التي تتضمن الإبلاغ عن نتائج أصلية بالتنسيق التالي: المعلومات الأساسية، والأهداف، والطرق، والنتائج، والمناقشة، والاستنتاجات. ويجب ألا تتجاوز مقالات البحوث والتقارير ٣٠٠٠ كلمة (دون أن يتضمن ذلك المراجع). ويجب ألا يتجاوز الملخص المنظم ٢٥٠ كلمة (انظر البند

من النصوص أن تتضمن مكان النشر (المدينة ثم البلد)، واسم الناشر (تجاري أم مؤسسة)، وتاريخ النشر. وينبغي للنصوص التي اقتصر نشرها على الإنترنت أن تتضمن العنوان الإلكتروني للصفحة المقتبسة وتاريخ الدخول عليها آخر مرة. وينبغي للنصوص التي لا يزيد عدد المؤلفين لها عن ٦ مؤلفين أن يذكر أسماء جميع المؤلفين، أما النصوص التي يزيد عدد المؤلفين لها على ٦ مؤلفين، فتذكر أسماء المؤلفين الستة الأوائل متبوعة بكلمة "وزملاؤهم". (برجاء مراجعة النص الإنجليزي لأمثلة الأنماط التي يفضل اتباعها في المجلة الصحية لشرق المتوسط).

٢٠. الأشكال والجداول المشفوعة بشروحات ملائمة، ينبغي لكل منها أن يكون في صفحة مستقلة، وأن تُعطى أرقاماً متتالية بأعداد عربية. ويجب الإشارة في النص لكل شكل ولكل جدول. ويجب توضيح المراجع حيثما كان ملائماً. وإذا ما نسخ المؤلفون أي شكل أو جدول أو مادة أخرى من مراجع أخرى، فإنهم يتحملون وحدهم المسؤولية عن تأمين الإذن اللازم للقيام بذلك. وبغية تفادي مشكلات التنسيق في مرحلة الإخراج النهائي، يجب الاقتصاد على أقل عدد ممكن من الجداول ومن الأشكال.

٢١. ويجب تقديم الأشكال في صيغة قابلة للتعديل، ويفضل (ميكروسوفت - إكسل)، كما أن الأشكال المستخلصة من البيانات يجب أن تُرفق بها تلك البيانات، مثلاً صفحة إكسل للبيانات، حتى يصبح بالإمكان إعادة إنتاجها عند الضرورة. كما يجب إرسال الصور الفوتوجرافية والرسومات التوضيحية في ملفات منفصلة، ويفضل أن تكون في شكل ملفات JPG أو TIFF، كما يجب أن يكون الوضوح بدرجة لا تقل عن ٣٠٠ نقطة لكل بوصة.

٢٢. سَتُعَاد الأبحاث المقدمة التي لا تلتزم بالدلائل الإرشادية المذكورة إلى المؤلفين من أجل تصحيحها قبل النظر في نشرها.

٢٣. التعليقات: (ويقصد بها الورقات التي تقدم معلومات عن الأبحاث/ قضايا الصحة العامة ذات الأهمية لإقليم شرق المتوسط). ومواصفات المخطوط (الطول، والمراجع، والجداول/ الأشكال) هي ذاتها التي تنطبق على المراسلات القصيرة، غير أنه -ولأغراض تتعلق بالورقات المُقدّمة- لا ينبغي أن يتجاوز الملخص (غير المنظم) ١٥٠ كلمة، وينبغي أن يتطابق الملخص مع الفقرة الأولى من الورقة المقدمة.

المقالات الافتتاحية: يجري التعاقد مع أحد الأشخاص لكتابة المقالات الافتتاحية؛ وعادة ما تُرفق المقالات التي تُقدّم دون طلب. وفي حال التعاقد على كتابتها، تحتوي المقالة الافتتاحية على ٨٠٠ كلمة، وتدعمها ٨-١٠ مراجع.

١٢). أما العدد الأقصى المسموح به للمصادر والمراجع فهو ٣٥ مصدراً ومرجعاً، مع ضرورة أن تتضمن معرفات الوثائق الرقمية (DOI) إن وجدت، كما يجب ألا يتجاوز عدد الجداول والأشكال ٥.

١٤. مقالات المراجعة: وهي تقييمات دقيقة للبحوث حول المواضيع ذات الصلة بالصحة العامة في الإقليم. وينبغي لهذه المقالات أن تضم فقرات تتعلق بالأهداف والمصادر وطرق اختيار البيانات وتجميعها وتفسيرها والاستنتاجات. وينبغي للنص ألا يزيد عن ٣٠٠٠ كلمة (ولا يتضمن ذلك ما يرافقه من ملخص ومراجع وجداول وأشكال)، كما يجب أن يرفق بملخص لا يتجاوز ٢٥٠ كلمة (انظر البند ١٢)، وألا يتجاوز عدد الجداول والأشكال ٥.

١٥. التقارير: وهي تقارير أعدت حول مشاريع ذات صلة بالصحة العامة في إقليم شرق المتوسط، وتتطابق مواصفات المخطوطات (من حيث الطول والمراجع والجداول والأشكال) مع ما هو مطلوب بالنسبة لمقالات البحث.

١٦. مراسلات قصيرة: يمكن النظر في نشر مقالات لا تضم دراسة بحثية كاملة، ولكنها ذات صلة أو أهمية خاصة فيما يتعلق بقضايا الصحة العامة في الإقليم. وينبغي للنص ألا يتجاوز ١٥٠٠ كلمة (ولا يتضمن ذلك ما يرافقه من ملخص ومراجع وجداول وأشكال)، كما يجب أن يرفق بملخص منظم لا يزيد عن ١٥٠ كلمة (انظر البند ١٢)، أما عدد الجداول والأشكال فيجب ألا يزيد عن ٣ جداول وأشكال.

١٧. تقارير حالات: لا ينظر للنشر إلا في تقارير حالات ذات طبيعة غير معتادة. وينبغي للنص أن يتضمن مقدمة وتقريراً عن الحالة أو الحالات ومناقشة لها. وينبغي للنص ألا يزيد على ١٥٠٠ كلمة، وأن يكون عدد المراجع في حده الأدنى، والملخص لا يزيد عن ١٥٠ كلمة (انظر البند ١٢).

١٨. رسالة إلى المحرر: إن الرسائل التي تتضمن تعليماً على المقالات المنشورة هي موضع ترحيب، وترسل هذه الرسائل إلى مؤلفي المقالة الأصلية للتعليق عليها، ثم تنشر تلك التعليقات مع الرسائل. ويجب ألا يتعدى التعليق ٥٠٠ كلمة.

١٩. المراجع: يجب أن يقتصر الاقتباس من الأعمال المنشورة على المراجع الأساسية والمحدثة. ويجب ترقيم هذه المنشورات على نحو منفصل وفق ظهورها في النص مع استخدام أرقام عربية متتابعة، مثل (٨ - ٥، ١). ويجب عرض هذه المراجع في شكل قائمة مرقمة على صفحة منفصلة بعد قسم المناقشة، وينبغي للمراجع أن تتضمن العناصر التالية، وفق المتضى: اسم المؤلف ولقبه وعنوان الورقة أو الكتاب باللغة الأصلية مع ترجمته؛ وينبغي لمقالات البحث أن تتضمن الاسم المختصر للمجلة مع رقم المجلد وحدود الصفحات. وينبغي للكتب وغيرها

## Directives à l'intention des auteurs

1. Les articles soumis pour publication à *La Revue de Santé de la Méditerranée orientale* ne doivent pas avoir été publiés, avoir été acceptés pour publication dans d'autres revues ou être en cours d'examen par d'autres revues. Le Bureau régional de l'Organisation mondiale de la Santé (OMS) pour la Méditerranée orientale se réserve tous les droits de reproduction et de republication des matériels qui paraissent dans *La Revue de Santé de la Méditerranée orientale*.
2. Les articles soumis pour publication à *La Revue de Santé de la Méditerranée orientale* doivent être conformes aux Recommandations pour la conduite, la présentation, la rédaction et la publication des travaux de recherche soumis à des revues médicales (<http://www.icmje.org/recommendations/translations/french2015.pdf>) de l'*International Committee of Medical Journal Editors* (Comité international des éditeurs de revues médicales, ICMJE).
3. **Considérations éthiques** : Le cas échéant, une déclaration devra être incluse, indiquant que le Comité d'éthique ou le Comité d'examen institutionnel de l'organisme concerné a donné son accord à l'étude. Les auteurs doivent vérifier, le cas échéant, que toutes les personnes sur lesquelles la recherche porte ont donné leur consentement volontaire et informé par écrit et que si certains participants (en vie ou décédés) n'ont pas pu le donner, un consentement de substitution a été obtenu. Il peut être demandé aux auteurs de fournir ce type de formulaire de consentement. Conflits d'intérêts : Il sera demandé aux auteurs de préciser tout conflit d'intérêts et financement. Veuillez vous reporter aux recommandations de l'ICMJE.
4. **Directives de présentation** : La Revue de Santé de la Méditerranée orientale encourage les auteurs à respecter les meilleurs protocoles de recherche disponibles et leur recommande de suivre les directives de présentation établies. Les directives de présentation sont disponibles sur le site Web du réseau EQUATOR (<http://www.equator-network.org/>). Les principales directives pour la recherche en santé publique sont les suivantes : directives CONSORT (essais randomisés) ; directives STROBE (études observationnelles) ; directives PRISMA (revues systématiques et méta-analyses) ; directives STARD (normes de présentation de rapports concernant l'exactitude de diagnostic) ; critères COREQ (recherche qualitative) ; directives CARE (publication de cas cliniques) et le manuel COCHRANE (pour les revues systématiques des interventions). Les liens vers ces sites Web et d'autres ressources utiles sont disponibles sous la rubrique « Ressources à l'intention des auteurs et des réviseurs » à l'adresse suivante : <http://www.emro.who.int/fr/emh-journal/links/>.
5. Suite aux recommandations de l'OMS et de l'ICMJE, *La Revue de Santé de la Méditerranée orientale* impose comme condition de publication que les essais cliniques soient enregistrés auprès du registre public des essais cliniques. Il est recommandé aux auteurs d'enregistrer leurs essais dans un des registres des essais cliniques certifiés par l'OMS et l'ICMJE disponibles dans la base de données du Système d'enregistrement international des essais cliniques (<http://www.who.int/ictrp/fr/>).
6. **Soumission** : Les articles originaux rédigés en anglais, arabe ou en français peuvent être soumis pour examen en utilisant notre système en ligne. Les instructions relatives à la soumission d'un manuscrit en utilisant le système en ligne sont disponibles en anglais sur notre site Web accessibles à l'adresse suivante : <http://www.emro.who.int/emh-journal/authors/>, et en cliquant sur « Editorial Manager ».
7. Les résumés des articles acceptés pour publication seront traduits dans les trois langues. Pour assurer que les noms des auteurs soient correctement écrits dans les résumés en arabe, les auteurs rédigeant en anglais ou en français mais dont la langue maternelle s'écrit en caractères arabes doivent fournir leur nom complet en écriture arabe avec une translittération de leur nom en anglais ou en français.
8. Les manuscrits doivent être préparés en format traitement de texte (Microsoft Word, de préférence), avec double interlignage, mise en page d'une seule colonne, police Times New Roman, taille de caractère 12.
9. Tous les articles dont la publication est envisagée seront revus par des pairs. Le Comité de rédaction se réserve le droit d'accepter ou de refuser tout article, sur la base des commentaires des réviseurs, de la rigueur scientifique et de la pertinence de l'article pour La Revue. Les articles sont acceptés sous réserve de la révision statistique et rédactionnelle dont ils feront l'objet, comme jugé nécessaire, ce qui peut amener à abrégier le texte et à supprimer certaines données présentées sous forme de tableaux ou de graphiques.
10. **Sujets** : Le sujet de l'article doit concerner la santé publique ou un autre sujet biomédical ou technique connexe faisant partie du champ d'intérêt de l'OMS, et se rapporter plus particulièrement à la Région de la Méditerranée orientale ou revêtir une importance particulière pour celle-ci.
11. Le titre de l'article doit être aussi concis que possible, et de préférence ne pas dépasser 15 mots. Tous les auteurs devraient avoir apporté une contribution importante à la conception, à l'analyse ou à la rédaction de l'étude et avoir approuvé la version finale soumise. Aucun changement dans les noms des auteurs ne sera autorisé après l'acceptation de l'article pour publication; avant cette acceptation, tout changement doit être accepté par l'ensemble des auteurs figurant dans la liste. Une vérification de leur contribution peut être demandée aux auteurs. Les noms d'autres contributeurs peuvent être inclus

dans les remerciements. À ce sujet, veuillez vous reporter aux *ICMJE recommendations for authorship and contributorship* [Recommandations de l'ICMJE relatives à la qualité d'auteur et de contributeur].

12. **Résumés structurés** : Les articles soumis devraient inclure un résumé structuré organisé selon les titres suivants : Contexte ; Objectifs ; Méthodes ; Résultats ; et Conclusion. La structure peut être ajustée selon les besoins de l'article et si l'auteur fournit une justification au moment de la soumission.
13. **Articles de recherche** : Les articles présentant des résultats de recherche originale devront suivre le format suivant : Contexte ; Objectifs ; Méthodes ; Résultats ; Analyse ; Discussion et Conclusion. Le texte des articles et des rapports de recherche ne doit pas excéder 3 000 mots (références exclues). Un résumé structuré ne doit pas dépasser 250 mots (voir paragraphe 12). Le nombre maximal de références autorisées est de 35 et les identifiants d'objet numérique (DOI) doivent être inclus le cas échéant. Le texte ne doit pas comporter plus de cinq tableaux ou figures.
14. **Articles d'analyse** : il s'agit d'évaluations critiques d'études de recherche sur des sujets pertinents concernant la santé publique dans la Région. Ils doivent être composés de paragraphes traitant des objectifs, des sources, des méthodes de sélection, de la compilation et de l'interprétation des données et des conclusions. Le texte ne doit pas excéder 3000 mots (résumé, références, tableaux et figures exclus) et doit être accompagné d'un résumé de 250 mots au maximum (voir paragraphe 12). Le nombre maximal de tableaux et de figures autorisé est de 5.
15. **Rapports** : il s'agit d'articles présentant des projets pertinents de santé publique dans la Région de la Méditerranée orientale. Le format des manuscrits (longueur, références, tableaux et figures) est le même que pour les articles de recherche mais la longueur des résumés ne doit pas excéder 150 mots.
16. **Brèves communications de recherche** : Les articles ne constituant pas une étude de recherche complète, mais présentant un intérêt ou revêtant une importance particulière pour les questions de santé publique dans la Région peuvent être examinés pour publication. Le texte ne doit pas excéder 1 500 mots (références exclues) et doit être accompagné d'un résumé de 150 mots au maximum. Le nombre maximal de tableaux et de figures est de 3.
17. **Commentaires** : (par ex. les articles rendant compte de la recherche/des questions pertinentes pour la santé publique dans la Région de la Méditerranée orientale). Les spécifications des manuscrits (références, tableaux/figures) sont les mêmes que pour une brève communication de recherche, mais le texte ne doit pas excéder 1000 mots au maximum. Le résumé (non structuré) ayant pour objectif d'être soumis à proposition ne devrait pas dépasser 150 mots ; ce

résumé doit refléter le contenu du premier paragraphe de la soumission.

18. **Études de cas** : Seules les études de cas inhabituels seront examinées pour publication. Le texte doit comprendre une introduction, un exposé du/des cas et une discussion. Il ne doit pas excéder 1 500 mots et le nombre de références doit être minimal. Il n'est pas nécessaire de fournir un résumé.
19. **Lettres à la rédaction** : Les lettres commentant des articles publiés sont les bienvenues. Elles seront envoyées aux auteurs de l'article afin qu'ils fournissent leurs commentaires, qui seront publiés aux côtés de la lettre. Le texte des lettres ne doit pas dépasser 500 mots.
20. **Éditoriaux** : Les éditoriaux sont réalisés sur commande ; les soumissions non sollicitées ne sont généralement pas acceptées. Lorsqu'ils font l'objet d'une commande, les éditoriaux comprennent 800 mots et huit à dix références.
21. **Références** : Les citations dans le texte de travaux publiés doivent être limitées aux références essentielles récentes. Elles doivent être numérotées séparément à l'aide de chiffres arabes indiqués entre crochets, par exemple (1,5-8). Les références doivent figurer sous forme de liste numérotée sur une page séparée après la partie « Discussion ». Elles doivent contenir les éléments suivants, selon le cas : nom(s) et initiales du ou des auteurs ; titre de l'article ou de l'ouvrage dans sa langue originale ainsi que sa traduction ; pour les articles de recherche, le nom abrégé de la revue ainsi que le numéro du volume et les pages concernées ; pour les ouvrages et autres textes, le lieu de publication (ville et pays) et le nom de la maison d'édition (commerciale ou institutionnelle) ; la date de publication et l'identifiant d'objet numérique (DOI) ; pour les textes publiés exclusivement sur Internet, l'URL exact de la page citée et la date du dernier accès. Lorsque les textes comptent moins de six auteurs, tous les auteurs doivent être nommés. Lorsque les textes comptent plus de six auteurs, seul les noms des six premiers auteurs sont mentionnés, suivis de « et al. ». Exemples du style préféré de La Revue :  
Livre :  
Al Hamza B, Smith A. The fifth sign of identity. Cairo, American University Press, 1990.  
Article de revue :  
Rehmani R, Elzubair AG, Al Maani M, Chaudary IY, Al Qarni A, Khasshogi T et al. Population - based health survey in eastern region of Saudi Arabia. East Mediterr Health J. 2013; 19(5):417-25.  
Document :  
Al - Itneen M, ed. The principles of uncertainty. Geneva, World Health Organization, 1985 (WHO/DOC/537).  
Thèse :  
Smith S. Use of healthcare services by the elderly with the introduction of technical innovations.

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London: Drake University; 2013.

Texte Web :

Child growth standards. Geneva, World Health Organization, 2006 (<http://www.who.int/childgrowth/en/>, consulté le 8 octobre 2008).

22. Les figures et les tableaux accompagnés des légendes appropriées doivent être placés chacun sur une feuille séparée, numérotés en chiffres arabes selon leur ordre. Chaque figure et chaque tableau doivent être référencés dans le texte, et le cas échéant, les sources doivent être indiquées. Si des figures, tableaux ou d'autres matériels ont été copiés d'autres sources, les auteurs portent l'entière responsabilité d'obtenir les autorisations nécessaires. Afin d'éviter les problèmes de mise en page lors

de la production finale, le nombre de tableaux et de figures doit être aussi limité que possible. Les figures doivent être fournies dans un format permettant les modifications, de préférence Microsoft Excel, et celles qui sont établies à partir de données doivent être accompagnées de ces données, sur une fiche technique Excel par exemple, pour permettre une reconstitution, le cas échéant. Les photographies et illustrations doivent être envoyées dans des fichiers séparés. Les formats préférés sont JPG et TIFF, et la résolution des images doit être de 300 dpi au minimum.

23. Les manuscrits ne respectant pas ces directives seront renvoyés à leurs auteurs pour correction avant d'être examinés en vue de la publication.

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## **البلدان أعضاء اللجنة الإقليمية لمنظمة الصحة العالمية لشرق المتوسط**

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