The theme for Universal Health Coverage Day on 12 December 2020 is “Protect Everyone”, emphasizing global and individual health security in the context of the COVID-19 pandemic – the causative agent of which (SARS-COV2) has been implicated to infect more than 4 million people in the Eastern Mediterranean Region. More than ever, Universal Health Coverage is a priority agenda of policy-makers and practitioners in the Region in order to save lives, advance health and protect livelihoods.
Editorial

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The Universal Health Coverage (UHC) Day has been commemorated on 12 December every year since 2017 (1). In 2019, the theme of the day was “Keep the Promise”, referring to the Political Declaration on UHC endorsed by Heads of States at the United Nations General Assembly High-Level Meeting on 23 September 2019 (2). In 2020, the theme is “Protect Everyone”, emphasizing global and individual health security in the context of the COVID-19 pandemic, attributed to SARS-CoV 2 – a virus that infected more than 4 million people in the Eastern Mediterranean Region (EMR) and left over 100 000 dead in less than 12 months (6.6% and 7.1% of the global toll, respectively) (3). Keeping the promise of UHC, while ensuring health security, is becoming a priority agenda of policy-makers and practitioners in the EMR in order to save lives, advance health and protect livelihoods (4).

Covering everyone: where are we in the Eastern Mediterranean Region?

Universal health coverage is about ensuring that all individuals and communities have access to their needed health services of good quality and with financial protection (5). Primary Health Care (PHC) is recognized as the most inclusive, effective and efficient approach to promote health and achieve UHC (6). The EMR was the first WHO region to express collective political commitment towards UHC by signing the UHC2030’s Global Compact (7) and endorsing the 2018 Salalah Declaration (8). The latter provides a regional roadmap on PHC to achieve UHC by 2030 (9). Nevertheless, in 2019 the UHC Global Monitoring Report (10) showed that the EMR is lagging behind in achieving the UHC targets of the Sustainable Development Goals (SDGs): Service Coverage (SDG target 3.8.1) and Financial Protection (SDG target 3.8.2).

Countries in the EMR face a plethora of public health challenges: from high rates of smoking to high intake of sugar and salt, emerging and re-emerging communicable diseases, weak disease surveillance and response, and the unfinished agenda in many countries of high maternal and child mortality (11). The Service Coverage Index in the EMR was estimated at 58 (out of 100) in 2019, below the global average of 66 (out of 100), and behind three other WHO Regions (12). Close to 77 million people in the EMR faced financial hardship in 2015 by spending more than 10% of their resources as direct out-of-pocket payments – 15 million more compared with 2010 (13). These overall indices reflect difficulties in provision of care to key subgroups, countries and geographical areas in the Region. Several vulnerable groups in the EMR remain uncovered by financial protection or without access to their needed quality health care – including communities impacted by conflict and state fragility, refugees, migrants and those in the informal sector (14). The COVID-19 pandemic has amplified all these challenges (15).

Protecting everyone: where are we in the Eastern Mediterranean Region?

Health security is about reducing vulnerability to health threats at individual and collective levels (16). The EMR is prone to emergencies from multiple hazards, including disease outbreaks, natural disasters, conflicts, displacements, and technological disasters. Of particular concern are the multiple conflicts and humanitarian crises across the Region, where major health system disruptions pose enormous obstacles to health service delivery and health security (17). Over 69.6 million people living in the Region require humanitarian assistance, representing 42% of the global total (18). The Region is also source of 64% of the world’s refugees, many of whom remain in the EMR (19).

Between 2016 and 2018, Joint External Evaluations (JEEs) (20) assessed 18 EMR countries in terms of their ability to prevent, prepare for, detect and respond to public health risks, as pertains to International Health Regulations’ implementation (21). The evaluations revealed varying levels of capacities. Accordingly, National Action Plans for Health Security were developed but not adequately implemented. The response to COVID-19 pandemic has exposed additional gaps in emergency
preparation and management across the Region that the JEEs did not fully reveal. After almost one year of the pandemic, the most pressing challenges continue to exist – scaling up proven public health measures, tackling COVID-19 fatigue, balancing the easing of COVID-19 control measures while maintaining suppression of the virus transmission, and establishing a platform for distribution of COVID-19 vaccines (22).


Dr Adhanom Ghebreyesus Tedros, World Health Organization (WHO) Director-General, has repeatedly indicated that UHC and Health Security are two sides of the same coin (23). COVID-19 unveiled how ill-prepared the world was to face a pandemic of such magnitude and how vulnerable most national health systems are to ensure continuous access to essential health services amid emergencies. A survey conducted in the EMR revealed that about 75% of essential health services had some level of disruption (in 13 out of 22 countries that responded), mostly affecting routine immunizations, dental services, rehabilitation services, and family planning, in addition to chronic disease management, including cancer care (22). Moreover, the pandemic has exposed the fragility of medicine and vaccine supply chains.

The pandemic is projected to cost the world up to US$ 21 trillion; a cost which could have been largely avoided with an adequate investment in emergency preparedness (24). The pandemic has demonstrated the value of decisive and collaborative leadership based on evidence-informed decisions (25). It has also highlighted more than ever the importance of whole-of-society, whole-of-government approaches in formulating policies and ensuring their effective implementation. Furthermore, it reminded us of the key role of health professionals, stressing their chronic universal shortages as previously reiterated by the High-Level Commission on Health Employment and Economic Growth (26). Finally, the pandemic signaled the low investment in Essential Public Health Functions (27) and other Common Goods for Health in building equitable and resilient health systems (28).

How to build a resilient health system that supports the dual goal of Universal Health Coverage and Health Security?

The concept of “health system strengthening” made its way to global public health in the last few decades as key for the effective implementation of global and national health policies. Health systems mean ‘all institutions and activities whose primary purpose is to promote, maintain or restore health’ (29). COVID-19 unveiled gaps in current health systems analytical approaches, calling for a paradigm shift towards developing resilient health systems that ensure health security while advancing UHC based on the PHC approach. The ‘Step o’ in health system recovery from COVID-19 requires adequate investment in Essential Public Health Functions and other Common Goods for Health (e.g. policy and coordination, taxes and subsidies, regulations and legislations, information, analysis and communication and population services) (30), coupled with rebuilding ‘fit-for-purpose’ institutions towards UHC and health security (31). This calls for integrating health programs’ specificities; e.g. communicable diseases, noncommunicable diseases, mental health, and reproductive, maternal, neonatal, child and adolescent health, in all endeavors that aim for strengthening health systems.

What is needed to protect everyone and keep the promise of Universal Health coverage in the Eastern Mediterranean Region?

Advancing UHC and ensuring health security are two key Regional Strategic Priorities in the EMR Vision 2023 (32). Moving ahead requires building resilient health systems that are able to resist, absorb, accommodate and recover from external shocks in a timely and efficient manner (16). The ‘Turning Vision into Action’ paper (33) endorsed by the 66th Session of Eastern Mediterranean Regional Committee in 2019 identified the Strategic Directions to advance the complementary goals of UHC and Health Security. Prominent among those are: investing in health protection and promotion, evidence-informed policy-making (34), building effective information systems (35) and disease surveillance approaches, strengthening emergency preparedness and response, investing in health workforce and facilitating community engagement. Sustainability can only be ensured by institution building.

We have always known that diseases have no borders and that only collective efforts ensure the safety and security of all. A pandemic is not the time to stall investments in public health. Just the opposite. As we respond to COVID-19, countries must invest more and invest better in strong health systems to ‘Protect Everyone’ – during and after the pandemic. This should include the young and the old, men and women, citizens and residents, refugees, migrants and internally displaced people, etc. WHO together with all health and development partners shall continue to build and rebuild health systems to achieve UHC and Health Security, via technical cooperation, capacity building and experience sharing. ‘Health for All by All’ has been the regional motto since 2018. COVID-19 has underscored its relevance today more than ever.
References

3. World Health Organization Regional Office for the Eastern Mediterranean (WHO/EMRO). Eastern Mediterranean Regional Office COVID-19 dashboard. Cairo: WHO/EMRO; 2020 (https://app.powerbi.com/view?r=https://app.powerbi.com%3A%2F%2F%3A%2F%2Fapp.powerbi.com%3A%2F%2F%2F&c=eyJrIjoiN2ExNWI3ZGQtZDk3Ny00MjIyLTk4OTUtMTEwMDI1NGJjMGQyIiwidCI6IjBmYzY1ZjIzLWQ3ZGQtMDU4OS0xMjMyLTk5ZTU1NTUwODZmIiwidSI6IjBmYzY1ZjIzLWQ3ZGQtMDU4OS0xMjMyLTk5ZTU1NTUwODZmIiwiZ2V0X2lkIjoiaW1hZ2UyOTYwM2EiLCJwYXglIjoiZjA5NjIyZjMtOGQ3Ni00MTFjLTM2MzUtZTY4NzI2ZDQ2NDc2IiwiaWRfX2MyIjoiYWJvdXQifQ%3D&viewAs=application%2Fpdf).


Why is COVID-19 more deadly among physicians than other health-care workers in the Islamic Republic of Iran?

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A report by Amnesty international released 13 July 2020 announced that more than 3000 health-care workers had died due to infection with SARS-CoV-2 since the beginning of the current pandemic (1). The highest death toll was from the Russian federation with 545 deaths, followed closely by the United Kingdom and United States of America with 540 and 507 fatalities, respectively. The report suggests these high figures are probably an under-reporting of the true statistics. For example, the numbers in the United States alone are believed to be more than 800 as of July 2020 (2). While a major concern in some of these countries are disparities in the death toll among ethnic minorities with disproportionately higher death rates among black, Asian and minority ethnic (BAME) physicians (3), the case in the Islamic Republic of Iran appears different.

According to data from the Islamic Republic of Iran Medical Council, 138 health-care workers in the Islamic Republic of Iran had died due to COVID-19 (23 July 2020) (4). While nursing staff constituted nearly 20% of the fatalities, another 20% were those working in other hospital services, as well as health technicians working in the primary health care system. However, nearly 60% of those who died were physicians, of whom 28% were general practitioners and 32% were specialists. This is in contrast to data from the United Kingdom where nurse fatalities outnumbered that of physicians (5).

Although the death of any health worker is a tragic loss, especially in the middle of a pandemic, the significant proportion of physicians dying from COVID-19 needs special attention.

A number of countries have raised concerns over the availability of personal protective equipment (PPE). However, this could not explain the disproportionate number of deaths of Iranian physicians. When considering that the exposure time of nurses to COVID-19 patients in hospitals, specifically in intensive care units, is several times greater than physicians, and yet both have the same access to PPE, then other factors are implicated. One factor may be the careless use of PPE by physicians. There is greater discipline to follow safety procedures in nursing, likely due to the presence of supervisors observing their activities. This is not the case for most physicians, especially senior grades, possibly resulting in inconsiderate use of PPE. Despite good knowledge on infection control practices, the real observation of these safety measures by physicians in practice might be as low as 3-26% (6,7).

While most hospitals in the Islamic Republic of Iran now provide PPE to all staff, the situation in out-patient departments, public or private, is not the comparable. There are more examples of negligence in following appropriate precautions in out-patient departments, such as non-observance of physical distancing resulting in crowded clinics increasing the risk of transmission. By contrast, it is much more feasible to observe physical distancing in hospitals with their no visitor policies.

Symptomatic patients arriving at clinics with atypical extra pulmonary manifestations may result in reduced observation of standard precautions by physicians, who consider their patients not having COVID-19. It is significant that several Iranian physicians who died from COVID-19 were not involved in hospital care of infected patients, including physicians from disciplines such as ear nose and throat and ophthalmology, but had confirmed exposure to infected patients with atypical symptoms such as anosmia or conjunctivitis. More than 10% of Iranian gastroenterologists were found to have symptomatic COVID-19 in the early phase of the pandemic during late March 2020 (8). This high number could be related to the fact that up to 50% of SARS-CoV-2 infected patients may have had gastrointestinal complaints, even without respiratory symptoms, at the onset of the disease. In addition, many physicians can be negligent of their own health, resulting in a delay before seeking medical care, yet continue working despite the need for hospitalization or at least rest (9).

Moreover, the concerns over airborne transmission of SARS-CoV-2 outside of medical procedures have made the situation even more challenging. Any contact without proper physical distancing or in closed unventilated space could potentially increase the chance of transmittance of SARS-CoV-2. Added to this is the fact that any health-care worker fatality not only reduces available human resources needed to confront the pandemic, but also affects the mental health of remaining staff, reducing their capacities to carry out their work effectively, and disrupting family life. This issue needs to be taken
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seriously and health systems should have a programme in place for the safety of their staff.

In conclusion, Iranian physicians appear to be at a higher risk of death due to COVID-19. There are several suggested explanations for this disproportionately higher rate, and effective measures for all health workers, including physicians, should be enacted through a systematic approach (10). While availability of PPE and their proper use is of the utmost importance, the practice of hand hygiene and approach that all patients and visitors could be potentially infected should encourage physicians to follow strict infection prevention measures. Specific programmes to encourage the monitoring and support of health-care workers would address many of the risks mentioned, with a particular focus on physicians, who have been observed to be particularly negligent over their own health.

References

Early responses to COVID-19 in Afghanistan

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Introduction

The World Health Organization (WHO) declared COV-1D-19 as a pandemic on 13 March 2020. It has spread to more than 200 countries, with over 35 million cases and 1 million deaths, with no guaranteed treatment but recommended preventive measures like hand hygiene and social distancing (1). As a donor-dependent conflict-affected country, Afghanistan faces challenges with health-care delivery and managing its double burden of diseases, given the limited health literacy and preventative measures, shortages of skilled health workers, and fragile health infrastructure (2,3). Afghanistan has a population of 32 million; 75% live in the rural areas and 80% living below the poverty line (4). Given Afghanistan’s close proximity to China, the Afghan Ministry of Public Health (MoPH) began discussing preparedness measures for COVID-19 as early as December 2019 and predicted that 80% of the population could be infected with upward of 125 000 deaths in Kabul alone if preventative measures were not followed (5–7).

The first case of COVID-19 in Afghanistan was reported on 22 February 2020, when 150 000 nationals returned from the Islamic Republic of Iran to Herat (8). More recently (5 October 2020), there were 39 422 confirmed cases, 32 879 recovered and 1466 deaths, and increasing (9,10). Kabul and Herat are the most affected parts of the country (9,11). Despite its fragile health system and limited preparedness and surveillance capacities, Afghanistan was among the first countries in the Eastern Mediterranean Region and world to consider multisectoral and proactive preparedness measures in managing the COVID-19 outbreak.

National interventions

Measures to increase preparedness, detection and response to COVID-19 were issued and implemented at a national scale starting January 2020, prior to the first case being diagnosed in-country. One of the earliest measures included cross-border screenings at points of entry (Figure 1); this was due to the surge of returnees from the Islamic Republic of Iran, which at the time was a hot-spot for COVID-19 cases. Presidential decrees to avoid large crowds and upscale hand-hygiene were issued, and Ministry of Interior Affairs (MoI) banned large gatherings, sporting and entertainment events (2,12). Quarantine and lockdown were implemented throughout the country (Figure 1) (2,13,14). Notably, the political changes in government and new ministers of health disrupted the national response to COVID-19 and resulted in policy modifications, fragmentation and delays in implementation.

In March 2020, the MoPH developed the National Emergency Response Plan for COVID-19, in collaboration with the World Health Organization (WHO) (15,15). The government allocated 8 billion afghans1 (Af) (0.5% of GDP) for emergency pandemic response, of which 1.9 billion afghan (0.1% of GDP) for urgent health needs (6). The government announced lockdown in three provinces bordering the Islamic Republic of Iran due to surge in cases and all flights were suspended from Kabul (14).

Role of media and communication

Collaboration with media and religious leaders was essential in assuaging panic in communities, combatting misinformation on the virus’ spread, and growing stigma against the overburdened health system. MoPH and Ministry of Communication and Technology Affairs jointly developed a mobile application providing updates on COVID-19 (9). The WHO emergency team launched a media campaign, conducted month-long roundtables, and oriented 55 256 community and religious leaders in all 34 provinces (13). Information Education and Communication (IEC) materials were developed from the Islamic perspective (including a fatwa regarding COVID-19 preventive measures), and distributed by Ministry of Religious Affairs and WHO; further materials were prepared for those illiterate or have no access to internet (9,16,17). This was particularly important as the first wave of COVID-19 coincided with numerous religious holidays where large gatherings and close physical contact would have been common and a potential spreader of the infection. Unfortunately, MoPH struggled to control communities’ adherence to these preventive measures, especially given the shortages of personal protection equipment (PPE) and the harsh economic conditions facing the country (5).

1 afghani = US$ 0.013 (29 October 2020)
WHO confirmed that novel Coronavirus as a cause of respiratory illness. Screening of points of entry (borders) - COVID-19 three suspected cases were identified - Temporarily closed its border with Iran - First confirmed COVID-19 case

First recovered COVID-19 patient - RestRICTED most international flights - President Ashraf Ghani told the public to avoid large public gatherings - International Aid - Beijing announced Aid to Afghanistan - Ministry of Interior Affairs banned all large gatherings - All land borders were closed - Pandemic declared by WHO - First case in China - Restricted most international flights - President Ashraf Ghani told the public to avoid large public gatherings - International Aid - Beijing announced Aid to Afghanistan - First confirmed COVID-19 case - Screening of points of entry (borders)

Afghanistan's Challenges and Responses amid COVID-19

- The first possible fatality of COVID-19 was also announced - Lockdown of the city of Herat was announced - Ministry of Education launched an online website for school students in Dari and Pashto - Ministry of Education launched an online website for school students in Dari and Pashto - Ministry of Education launched an online website for school students in Dari and Pashto

Pakistan announced Chaman and Torkham borders will open between 6 and 9 April for stranded Afghans at the request of the Afghan Government

The lockdown measures in Kabul Province were made stricter - 16 doctors and nurses in Herat and two further cases in the capital, Kabul were announced - First recovered COVID-19 patient - Restricted most international flights - President Ashraf Ghani told the public to avoid large public gatherings - International Aid - Beijing announced Aid to Afghanistan - Ministry of Interior Affairs banned all large gatherings - All land borders were closed

Pakistan reopened its border with Afghanistan - The first possible fatality of COVID-19 was also announced - Lockdown of the city of Herat was announced - Ministry of Education launched an online website for school students in Dari and Pashto

Ministry of Education launched an online website for school students in Dari and Pashto - Pakistan announced Chaman and Torkham borders will open between 6 and 9 April for stranded Afghans at the request of the Afghan Government - The World Bank approved $100.4 million of aid to help Afghanistan and EU would provide technical support and €117 million

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RETURN FROM CHINA AND PAKISTAN

First case in China - WHO confirmed that novel Coronavirus as a cause of respiratory illness

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Health systems interventions

In February 2020, the MoPH designated the Afghan Japan hospital in Kabul as an immediate COVID-19 treatment facility (9). In Afghanistan, 1541 beds are designated for COVID-19 patients, 700 beds in Herat, 200 beds in Kabul, and the remainder are spread around the country (9,11). In Kabul, Darulaman Palace and Kabul and Polytechnic universities’ dormitories were converted into isolation facilities. Isolation wards were identified for treatment of patient with COVID-19 in all provinces (9,11). By March 2020, there were 300 ICU beds available for quarantine throughout the country (11).

Regarding service delivery, under the isolation ward protocol, mild and moderate cases were to be quarantined at home to allow severe cases to be monitored at the hospital (18). The role of private hospitals was neither compulsory nor voluntary in COVID-19 response. Given Afghanistan’s vertical and contracted-out health systems infrastructure, the provision of non-COVID-19 and essential health services was continued through NGOs, utilizing additional triage and infection prevention and control (IPC) measures (19).

Despite the increasing cases, Afghanistan had one of the lowest national testing capacities in the Region for COVID-19; this challenge was exacerbated by the shortages of testing kits nationally, high costs of testing, insecurity in transporting tests, and the need to export samples abroad for confirmation and verification (2,5,15). By May 2020, there were a total of 9 certified laboratories with the capacity of 1790 tests per day (9). Additionally, Afghanistan decentralized its testing capacity. In addition to the Central Public Health Laboratory (CPHL) (processing 200-300 samples/day) and two veterinary laboratories in Kabul, there were also two laboratories in Herat (150 test/day), one in Nangarhar and one in Paktya, Kandahar, and Balkh provinces, each testing about 100-150 COVID-19 cases daily (2,11,13,16).

Despite the limited capacity to confirm and diagnose the virus, Afghanistan stepped up its capacity for identification and contact tracing through utilizing existing surveillance infrastructure. Afghanistan used 520 sentinel sites in all the 34 provinces in both public and private health facilities (11,13). In addition, active surveillance sites have been established in all border-crossings around the country and involvement of polio workers and rapid response teams (RRTs) used to expand contact tracing, sample collection, and risk communication in insecure areas (16). Regarding equipment, supplies and medicines, United Nations’ reports confirmed that due to the reliance on humanitarian and international organizations, Afghanistan had enough PPEs, masks and gloves available in the COVID-19 designated hospitals at the beginning of the response, including approximately 85,000 test kits and 600 ventilators throughout the country (9). There are total of 8,996 medical doctors, 12,588 nurses and 26,696 midwives, resulting in a shortage of skilled health workers nationally, and the issue of maldistribution since the majority are concentrated in urban areas and some 60% work in public-health facilities (9). To respond to the COVID-19 pandemic, MoPH issued a call to recruit fresh graduates, volunteers, and registered medical professionals to work in designated hospitals. In May 2020, 763 medical staff were trained on IPC and case management (9,20). However, despite some financial incentives (hardship payments), it was difficult to retain many of these staff due to the challenging working conditions, high risk of infection, limited PPE, and inadequate training and experience in managing critical cases (especially for new graduates).

Recommendations to improve the COVID-19 response

The impact of COVID-19 on health, education, and the economy, especially in fragile contexts such as Afghanistan, is difficult to ignore. An evaluation of Afghanistan’s experiences in combating COVID-19 and the lessons learned from responses and interventions in the early months would benefit policy-makers at the national level as well as public health researchers and humanitarian actors in similar settings. While Afghanistan has taken many pro-active measures to prevent the transmission of the disease, further multi-sectoral policies would not only improve the efficiency of the current response but may be proactively established ahead of a second wave (5); these include:

- Increasing budget allocation towards the health-care sector to improve hospital facilities, proper staffing, and procurement of required medical equipment;
- Scaling up capacity building of health-care professionals for use of PPE, IPC, rapid detection, case management, and critical care services;
- Recruiting additional health workers, and engaging community health workers and community actors in COVID-19 surveillance;
- Expanding use of telehealth care and helpline services to support service delivery while maintaining quarantine, particularly to improve access in rural and remote areas;
- Continuing health promotion activities, particularly for illiterate and hard-to-reach populations, to raise awareness and increase use of preventive practices such as handwashing and using masks;
- Raising awareness to reduce myths and stigma associated with COVID-19, through continued media campaigns and engagement of religious and community leaders;
- Focusing on internally displaced populations and returnees to ensure adequate screening, health...
education, and access to health services;

• engaging with the private sector to expand and optimize service delivery, surveillance, laboratory capacity and prevention;

• analyzing the psychological impact of COVID-19 on the population and incorporating therapy and psychological support services in the service delivery plan; and

• conducting scientific research on preventive measures and practices in rural and urban areas to limit the spread of infection.

References
Knowledge, attitudes and practices towards COVID-19 among Pakistani residents: information access and low literacy vulnerabilities

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Abstract

Background: Coronavirus disease (COVID-19) has accentuated the need for speedy access to information. Digital divide and socio-demographic disparity create an information hiatus and therefore unhealthy practices with regard to dealing with COVID-19, particularly in low- and middle-income countries.

Aims: We assessed knowledge, attitudes, practices and their determinants regarding COVID-19 in Pakistan during March–April 2020.

Methods: 905 adults ≥18 years (males and females) participated: 403 from a web-based survey; 365 from an urban survey; and 137 from a rural survey. Frequency of adequate knowledge, attitudes and practices for the three populations was determined based on available global guidelines. Multivariable logistic regression analysis determined factors of adequacy of knowledge, attitudes, practices, and association of knowledge with attitudes and practices.

Results: Mean age of the participants was 33.5 (+ SD 11.1) years, 51% were females. More females and young adults (18–30 years) participated in the web-based survey. The urban survey and web-based survey participants had significantly higher adequate knowledge (2–7 times) and practices (4–5 times) towards COVID-19. Adequate knowledge had a significant influence on healthy attitudes and practices for COVID-19, after adjustment for covariates. Overall, two-thirds of the population had high levels of fear about COVID-19, which was highest among the rural survey population.

Conclusion: Substantial gaps exist in adequate knowledge, attitudes and practices, particularly among rural populations, and underscores the variation in access to information according to level of education and access to the internet. Thus, a comprehensive, contextually congruent awareness raising strategy is urgently needed to confront COVID-19 among these populations.

Keywords: knowledge, attitude, practice, COVID-19, Pakistan

Introduction

The coronavirus disease (COVID-19) outbreak has caused over 7.15 million infections and more than 408 000 deaths during 31 December 2019–11 June 2020 (1). The pandemic has stretched health systems globally, affecting high- and low-income countries. An almost global consensus con- firms that tackling COVID-19 would require a multisec- toral response, well beyond health systems, that requires engagement not only from other sectors but also from communities and the public at large (2). While much has been published on the nature and extent of the health system response (3,4), there is relatively limited understanding of how communities perceive COVID-19, especially in low- and middle-income countries (LMICs) (5).

Simple measures related to personal protection such as wearing masks or hand washing, or those that involve testing and tracing contacts, and more complex interventions such as imposition of lockdowns, prohibitions on public gatherings and closures of public places, can only be successful if the population has adequate knowledge and appropriate attitudes that would ensure their effective implementation (6). This becomes an even bigger challenge in populations where literacy levels are not universal and traditional, cultural and religious practices can impede the implementation of such interventions. The only hope for resource-constrained LMICs lies in empowering communities so that they can take both short and long-term protective measures (7).

Pakistan currently has over 120 000 confirmed cases and 2356 deaths (11 June 2020) with 92% of cases being due to community transmission (8). It also suffers from a weak health system, a digital divide and low literacy levels, thus highlighting the need for a comprehensive communication strategy to protect the population against COVID-19. In light of the above, the department of Community Health Sciences at The Aga Khan University conducted a survey to determine the level of knowledge, attitudes and practices (KAP) and their determinants towards COVID-19 among three sub-populations in...
Pakistan: web-users, urban and rural communities. In addition, we also determined the level of fear among the study populations regarding COVID-19 and their satisfaction with government efforts to mitigate the effects of the pandemic.

Methods

Design, setting and sampling strategy

A cross-sectional survey was conducted among three separate sections of the sample adult population (>18 years male and female) in Pakistan. The primary reason for selecting three diverse groups was to access equal representation of both urban and rural communities, as well as those who have better access to internet and social media. For the first group (web-based survey [WBS]), the data were collected online through a self-administered questionnaire developed using Google Forms. The link for the questionnaire was disseminated throughout Pakistan via email, WhatsApp and Facebook groups (16–31 March 2020). The second group (rural survey [RS]), was an interviewer-based household survey (19–22nd March 2020); however, the survey was interrupted due to the lockdown by the government in Thatta district. The third survey (urban survey [US]) was conducted by telephone (list was available from previous study) in Karachi. For the US group, a total of 30 clusters were randomly selected using sampling frame of the Pakistan Bureau of Statistics. From each cluster approximately 15 interviews were conducted. Similarly, for the RS group the villages (as clusters) (n=10) were randomly selected based on available sampling frame of the Rural Health Programme (RHP) at the Aga Khan University. The RHP is an implementation science approach to improving population health, which was established in collaboration with the Health Department of Thatta district from January 2018.

Sample size

The survey was designed to determine the proportion of adequate KAP. ‘Adequacy’ refers to being aware of, having a favourable attitude towards, and practicing key set standards (Table 1). In the absence of any local evidence, we used 50% as the anticipated proportion of adequate KAP with 95% confidence level (CI) and a 7% margin of error; a sample of 196 was estimated for each strata (total for three strata was 588). The sample was inflated by 1.25 for design effect (735) and 10% for non-response, creating a total of 809 participants, i.e. 269.7 or 270 per survey strata. Total number of respondents was 905; however, the number was less for RS group due to a local lockdown (WBS=403, US= 365 and RS=137).

Data collection tool and measures

The study was approved by the Ethics Review Committee of Aga Khan University. All interview-based data (US and RS) were collected electronically using Epicollect5, which has validation checks to minimize data errors. Data collectors with prior experience were hired and trained to conduct face-to-face and telephone interviews. Moreover, a qualified biostatistician performed data analysis for the study. The socio-demographic variables included age, sex, place of residence (Karachi vs. other cities), education and employment status. Furthermore, we also inquired about perceived satisfaction (on Likert scale of 1 to 5) regarding government efforts and fear among participants regarding COVID-19 on a scale of 1 to 10 (1 being ‘no fear’ to 10 ‘extreme fear and anxiety’).

The knowledge questionnaire was developed in accordance with international guidelines for the prevention of COVID-19 (9,10). The questionnaire was pre-tested at Aga Khan University among the interviewers. It comprised of questions on COVID-19 signs and symptoms, modes of transmission, high-risk populations, preventive measures, myths and misconceptions, incubation and quarantine period, and health-seeking behaviours (Supplementary Table 1 online). Based on key knowledge parameters (Table 1), participants were categorized as having ‘adequate’ or ‘inadequate’ knowledge.

Attitudes and practices towards COVID-19 transmission and its prevention were each assessed using 7 items, recorded on a 5-point and 3-point Likert scale, respectively (Supplementary Table 2 and 3 online). The respondents were considered to have a positive attitude if they responded correctly to all 7 attitude items. Similarly, the participants who ‘always’ ensured hand hygiene, cough etiquette and social distancing were considered to have ‘adequate’ practice against COVID-19.

Table 1: Criteria for adequate knowledge

<table>
<thead>
<tr>
<th>Knowledge parameter</th>
<th>Criteria for adequate knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and symptoms</td>
<td>Mentioned 4 key signs and symptoms out of 10 listed i.e. fever, cough, joint/muscle pain, and breathing difficulty.</td>
</tr>
<tr>
<td>Modes of transmission</td>
<td>Mentioned coughing/sneezing, hand shaking, and sharing personal belongings with infected person as potential modes of transmission.</td>
</tr>
<tr>
<td>At-risk population</td>
<td>Identified smokers, asthmatics, diabetics, the elderly and people in crowded places as high risk individuals for acquiring COVID-19 disease.</td>
</tr>
<tr>
<td>Preventive measures</td>
<td>Mentioned hand hygiene, cough etiquettes and social distancing as essential practices to protect themselves from COVID-19 infection.</td>
</tr>
<tr>
<td>Quarantine guidelines</td>
<td>Knew the exact quarantine duration, i.e. 14 days.</td>
</tr>
<tr>
<td>Treatment practices</td>
<td>Identified antibiotics, pneumonia vaccine and herbal remedies as incorrect therapies for COVID-19.</td>
</tr>
</tbody>
</table>
Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics for the three surveys (WBS, US and RS) and overall statistics were generated. Multivariable logistic regression was conducted to determine the adjusted factors associated with adequate knowledge, attitudes and practices, respectively. Furthermore, association of adequate knowledge with attitudes and practices were also determined after adjusting for socio-demographic covariates.

**Results**

### Sociodemographic characteristics

Sociodemographic characteristics for all three survey groups and the total sample are summarized in Table 2. A total of 905 participants were included in the survey with a mean age of 33.51 ± SD 11.1 years, 51.1% were females. More females participated in the RS (60%) and WBS (78%) group surveys compared to the telephone survey in the US group (19%). The literacy rate was higher in the WBS (100%) and the US groups (70%) compared to the RS group (20%).

Almost all participants had heard about COVID-19. Overall, 12% respondents gave a history of contact with a foreign traveler during the past 14 days. The main sources of information for WBS and US groups were online and social media (82% and 79% respectively). The RS group, however, received 32% of its information from family/friends/colleagues and only 18% through social media (Supplementary Figure 1 online). The frequency of correct responses for each KAP item/question for the three survey groups are provided in supplementary Tables 1–3 (online). Figure 1 shows the overall adequacy of KAP among survey participants according to the criteria mentioned in Table 1.

### Knowledge regarding COVID-19

A majority (76–92%) were aware of the common signs and symptoms of COVID-19 including fever, cough and shortness of breath; however, joint/muscle pain was identified by only 40%. Furthermore, only 12.7% were aware that it can present without any symptoms (Supplementary Table 1 online). US group participants (AOR=4.1, compared to RS group) and participants holding a Bachelor’s degree or above (AOR=3.5, compared with no literacy) had a higher odds of adequate knowledge about the signs and symptoms (Table 3).

Shaking hands, droplet infection and sharing personal belongings were considered as the three most common modes of transmission by 74–96% of the US and WBS group participants. Knowledge about transmission...
Table 3 Factors associated with adequacy of knowledge regarding COVID-19 among adult population

<table>
<thead>
<tr>
<th>Factors</th>
<th>Signs and Symptoms</th>
<th>Mode of transmission</th>
<th>Knowledge High risk</th>
<th>Preventive measure</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>AOR (95% CI)</td>
<td>n (%)</td>
<td>AOR (95% CI)</td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Strata</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban population (US)</td>
<td>160 (43.8)</td>
<td>4.1 (1.8, 9.5)</td>
<td>142 (38.9)</td>
<td>1.5 (0.73, 3.0)</td>
<td>181 (49.6)</td>
</tr>
<tr>
<td>Web-based population (WBS)</td>
<td>110 (27.3)</td>
<td>2.3 (0.9, 6.9)</td>
<td>279 (69.2)</td>
<td>3.4 (1.5, 7.7)</td>
<td>123 (30.5)</td>
</tr>
<tr>
<td>Rural population (RS)</td>
<td>11 (2.8)</td>
<td>1</td>
<td>20 (4.6)</td>
<td>1</td>
<td>9 (6.6)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>165 (37.4)</td>
<td>1</td>
<td>199 (45.1)</td>
<td>1</td>
<td>186 (42.2)</td>
</tr>
<tr>
<td>Female</td>
<td>116 (25.2)</td>
<td>0.83 (0.5, 1.3)</td>
<td>241 (52.3)</td>
<td>1.1 (0.81, 1.7)</td>
<td>124 (26.9)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>118 (26.5)</td>
<td>1</td>
<td>245 (56.1)</td>
<td>1</td>
<td>147 (33.0)</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>163 (35.4)</td>
<td>1.1 (0.21, 1.5)</td>
<td>196 (42.6)</td>
<td>0.9 (0.61, 1.3)</td>
<td>166 (36.1)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No literacy</td>
<td>15 (11.0)</td>
<td>1</td>
<td>14 (10.2)</td>
<td>1</td>
<td>16 (11.7)</td>
</tr>
<tr>
<td>Undergraduate or below</td>
<td>134 (37.0)</td>
<td>2.2 (1.0, 4.6)</td>
<td>149 (41.2)</td>
<td>3.8 (1.8, 8.2)</td>
<td>157 (43.4)</td>
</tr>
<tr>
<td>Graduate or above</td>
<td>132 (32.5)</td>
<td>3.5 (1.5, 8.0)</td>
<td>278 (68.5)</td>
<td>9.0 (4.12, 9.9)</td>
<td>140 (34.5)</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>120 (29.2)</td>
<td>0.6 (0.4, 1.1)</td>
<td>232 (56.4)</td>
<td>1.81 (1.13, 3.1)</td>
<td>134 (32.6)</td>
</tr>
<tr>
<td>Student</td>
<td>36 (21.4)</td>
<td>0.5 (0.3, 1.0)</td>
<td>107 (63.7)</td>
<td>1.6 (0.92, 2.9)</td>
<td>55 (32.7)</td>
</tr>
<tr>
<td>Unemployed/retired</td>
<td>81 (45.1)</td>
<td>1.6 (0.9, 3.0)</td>
<td>51 (31.7)</td>
<td>0.9 (0.51, 1.7)</td>
<td>84 (57.1)</td>
</tr>
<tr>
<td>Housewife</td>
<td>44 (24.6)</td>
<td>1</td>
<td>51 (28.5)</td>
<td>1</td>
<td>40 (22.3)</td>
</tr>
<tr>
<td><strong>Source of information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>241 (52.1)</td>
<td>1</td>
<td>540 (45.3)</td>
<td>1</td>
<td>268 (35.7)</td>
</tr>
<tr>
<td>Only social media</td>
<td>40 (25.8)</td>
<td>0.8 (0.5, 1.3)</td>
<td>101 (65.2)</td>
<td>1.1 (0.71, 1.7)</td>
<td>45 (29.8)</td>
</tr>
</tbody>
</table>

* *** p < 0.001  ** p < 0.01  * p < 0.05
was comparatively lower among the RS group, with 74% of the participants incorrectly considering a mosquito bite as a means of transmission for COVID-19 (Supplementary Table 1 online). Belonging to the WBS group (AOR=3.4, compared to RS group), having higher literacy i.e. graduate level and above (AOR=9.0, compared to no literacy), and those who were employed (AOR=1.8, compared with housewives) had a higher likelihood of adequate knowledge about the mode of transmission of COVID-19 (Table 3).

Older people as a high-risk group for acquiring COVID-19 infection were uniformly (90–97%) identified by all three survey groups. However, the knowledge about other common risk factors (smokers, asthmatics, diabetics, and crowded places) was less known, especially in the RS group (<50%) (Supplementary Table 1 online). Adequate knowledge about risk factors was significantly higher among the US (AOR=7.6) and WBS (AOR=3.6) groups compared to the RS group, while females had less awareness about high risks (AOR=0.6) compared to males (Table 3).

Uniformly, all three survey groups had knowledge about hand hygiene (97%), cough etiquette (94%), social distancing (93%) and wearing a face mask in crowded places (68%). However, about half of the respondents incorrectly believed that vaccination can protect against COVID-19 (Supplementary Table 1 online). The adequacy of knowledge about preventive measures were significantly higher among US participants (AOR=2.7, compared to RS) (Table 3a).

A higher proportion of participants (71–83%) in the RS group were supportive of incorrect treatment practices such as herbal remedies, pneumonia vaccine and antibiotics/medicines against COVID-19. Incorrect treatment measures were also supported commonly (60–82%) by WBS and US groups (Supplementary Table 1 online). The adequacy of knowledge about correct treatment measures was significantly higher among the US and WBS groups (AOR=2.4-2.5, compared to RS group), graduate level and above (AOR=5.6, compared to no literacy), and employed (AOR=3.4, compared to housewives) (Table 3a).

**Attitude towards COVID-19 prevention**

As compared to US group (52%), a higher percentage (94%-98%) of RS and WBS population agreed that a handkerchief must be used by a person to cover his nose/mouth while coughing/sneezing. Similarly, most people believed that COVID-19 could spread from one to others (80.2%) hence they must restrict their routine mobility (90%). More than 95% of the survey respondents agreed that it is important to report a suspected COVID-19 case to health authorities and the government should restrict travel from and to areas of high transmission. Nearly 100% of the population in the RS group considered themselves prepared for the COVID-19 outbreak, however, 33% people in the WBS group gave a contrasting response (Supplementary Table 2 online). Computing the overall attitude showed an unfavourable attitude prevalent in more than 90% of the survey population (Figure 2). Educated participants (AOR=4.9-7.3, compared to no literacy) had significantly better attitudes. However, the WBS (AOR=0.6) and US (AOR=0.2) group participants had poorer attitudes than the RS group (Table 4).

**Practices regarding COVID-19 prevention**

Washing and sanitizing hands was fairly common in the WBS (88.3%) and US (91.2%) groups and less common (54.7%) in the RS group. Most participants (approximately 65%) ensured hand hygiene took place more commonly after touching personal belongings or shaking hands with...
people suffering from a cough or cold. A lesser proportion (43.6%) were washing hands after touching door handles. Among the RS group, 60% participants did not practice cough etiquette and only 17.5% reported disposing of used tissues (Supplementary Table 3 online). The adequacy of key practices against COVID-19 prevention were significantly better in the US and WBS groups (AOR=5.2, 4.1, compared to RS), graduates and above (AOR=2.0) while students had less likelihood of following adequate practices (AOR=0.4, compared to housewives) (Table 4).

Fear score and satisfaction of survey participants with government efforts

The mean anxiety (fear) score of the participants was measured on a scale of 1 to 10 and equaled 6.4 (Supplementary Figure 2 online). Nearly 52.7% of the participants were not satisfied with the level of preparedness by the government in their community against the COVID-19 outbreak.

Association of knowledge with attitude and practice

Adequate knowledge was significantly associated with improved attitudes (AOR=1.5–2.0) (Table 3a) and healthy practices (AOR=1.5–2.0) (Table 3a), after adjustment for covariates (Supplementary Table 4 online).

Discussion

This is among the first studies to determine the KAP regarding COVID-19 from a LMIC (Pakistan) in three population subgroups. It provides a comparison between those who are literate and have ready access to information, and those who are less literate and less likely to have access to reliable information – presently the majority in Pakistan. First, not surprisingly our study noted that those who responded through WBS were more literate and lived in a large city (Karachi), had a higher level of knowledge, favourable attitudes, and practices. The rural population on the other hand had the least information about COVID-19. Second, the study identified substantial gaps and variations in knowledge about signs and symptoms, risk factors, modes of transmission and treatment options for COVID-19. Third, the study substantiates that having adequate knowledge correlates well with the likelihood of appropriate attitudes and healthy practices and underscores the need for urgent intervention for improving the level of knowledge. Lastly, the study also highlights that the key prevention messages currently circulating through various media/channels do have an impact on improving knowledge on different aspects of COVID-19. Thus, if the messages are made comprehensive, it will make a difference and disseminate throughout the population.
Pakistan and many LMICs are facing a substantial digital divide; 81% of the population in high-income countries compared to 41% among low- and middle-income countries have access to the internet (11). In Pakistan, internet penetration has risen to 68 million citizens (33% population), of which 21% are males and 12% females, and the majority is urban populations (12). There is also evidence that the COVID-19 crisis has accelerated the uptake of digital solutions, tools and services, speeding up the global transition towards a digital economy, as well as exposing the wide gap between those who enjoy access to the internet and those who do not (13).

Few online KAP surveys have been conducted in Pakistan that primarily targeted the educated segment of the population, such as health-care providers and university students. Most of these studies have indicated a good knowledge about the common signs and symptoms (84–93%) and preventive strategies related to COVID-19 (72–92%). However, few (55%) were aware of the correct incubation period of the disease, as evident through our study (14,15). Another community-based survey showed relatively poor knowledge about the disease, where only 45.3% of the study population considered close physical contact as a risk factor for the spread of infection (16).

Similar studies conducted in Jordan (17,18), Viet Nam (19), China (20) and India (21,22) also discovered better knowledge among educated people who have access to reliable information. Younger adults, males and those who were unemployed had a lower level of knowledge about COVID-19 in our study population. These trends are similar to studies conducted in China and Spain, where younger adults, males, never-married, less educated, and unemployed perceived the pandemic as less threatening, and scored lower on knowledge, personal concern and compliance with safety measures (23,24).

Attitudes regarding COVID-19 need improvement when considering a third of the overall population thought the disease to be of no significance. A country’s response and leadership also shape attitude. For example, Nicaragua had the poorest response to COVID-19 by refusing World Health Organization (WHO) recommended mitigation strategies at the state level. There are similarities to such responses in subpopulations in Pakistan where certain political and religious clerics are defying government orders (25). Our survey also suggests that 75% of the population in Pakistan have a high level of fear about COVID-19, especially those living in rural areas. Thus, there is an urgent need to provide psychosocial support to prevent adverse mental health conditions in Pakistan.

The government in partnership with academia, civil society and the media should launch a campaign using innovative strategies targeted at different population groups. Electronic and print media provide good access to information among populations with access to the internet. However, broadband internet penetration is only 36% and two-thirds of the population in Pakistan use non-smart phones (dumb-phones); therefore, audio messages and other community platforms are needed to reach this population (26).

**Limitations**

A number of limitations need to be considered. First, the WBS platform was not sent to a specified number of respondents, rather its link was uploaded on various social media platforms; hence the response rate for WBS could not be determined. However, a higher proportion of the younger and well-educated population responded to the online survey, thus it may serve as an indicator of the highest level of knowledge base among the population sub-groups in Pakistan. The response rate for telephone survey (US group) was 33%, with most respondents being older males, whereas the response rate for the face-to-face survey (RS) reached 100%. Low response rates in telephone surveys is a commonly encountered problem; response rates for telephone surveys in the United States of America have been declining consistently since 1997 (36%) and have now bottomed out at around 9% in 2016 (27). Furthermore, wish-bias may play a role in the response, as with all KAP studies. The survey provided valuable information on KAP and the best possible coverage of the population of Pakistan. However, it cannot be considered a representative survey for Pakistan. Lastly, the findings of this study are self-reported and dependent on the participant’s ability to recall; thus, the likelihood of recall bias cannot be excluded.

**Conclusion**

There was a substantial gap in knowledge, attitudes and practices regarding COVID-19 among the various population groups, particularly for those residing in rural areas of Pakistan. Certain gaps in information such as the mode of transmission of disease, quarantine period and treatment options were uniformly seen across all groups irrespective of their level of literacy. Thus, a comprehensive and contextually congruent awareness-raising strategy suited to the need of urban and rural population is urgently needed in the fight against COVID-19.

**Funding:** None.

**Competing interests:** None declared.
Connaissances, attitudes et pratiques vis-à-vis de la COVID-19 dans la population totale du Pakistan : accès à l’information et vulnérabilité associée à une faible alphabétisation

Résumé

Contexte : La maladie à coronavirus (COVID-19) a accentué la nécessité d’un accès rapide à l’information. La fracture numérique et la disparité sociodémographique créent un hiatus de l’information et conduisent ainsi à des pratiques malsaines en ce qui concerne la prise en charge de la COVID-19, en particulier dans les pays à revenu faible et intermédiaire.


Méthodes : 905 adultes âgés de 18 ans et plus (hommes et femmes) ont participé : 403 dans le cadre d’une enquête en ligne, 365 au titre d’une enquête en milieu urbain et 137 dans une enquête en milieu rural. La fréquence des connaissances, des attitudes et des pratiques adéquates pour les trois populations a été déterminée sur la base des lignes directrices mondiales disponibles. L’analyse de régression logistique multivariable a déterminé des facteurs d’adéquation des connaissances, des attitudes, des pratiques et de l’association des connaissances avec les attitudes et les pratiques.

Résultats : L’âge moyen des participants était de 33 ans et demi (+ écart-type 11,1), 51 % étant des femmes. Davantage de femmes et de jeunes adultes (18 à 30 ans) ont participé à l’enquête en ligne. Les participants à l’enquête menée en milieu urbain et à l’enquête en ligne avaient des connaissances et des pratiques adéquates beaucoup plus importantes en matière de COVID-19 (2 à 7 fois et 4 à 5 fois plus importantes respectivement). Le fait d’avoir des connaissances adéquates avait une influence significative sur les attitudes et les pratiques concernant la COVID-19, après ajustement en fonction des covariables. Globalement, les deux tiers de la population ont exprimé une grande crainte à l’égard de la COVID-19, le niveau le plus élevé se trouvant parmi la population ayant participé à l’enquête menée en milieu rural.

Conclusions : Il existe des lacunes substantielles dans les connaissances, les attitudes et les pratiques adéquates, en particulier parmi la population rurale, et il convient de souligner les variations dans l’accès à l’information selon le niveau d’éducation et l’accès à l’Internet. Il est donc urgent de mettre en place une stratégie de sensibilisation globale, adaptée au contexte, pour lutter contre la COVID-19 dans ces populations.
References


Compliance with design principles: a case study of a widely used laboratory information system

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Abstract

Background: Laboratory information systems are widely used health information systems that have the potential to improve health care quality. Despite their benefits, many studies have indicated problems with user interaction with these systems due to poor interface design.

Aims: To evaluate the usability of a laboratory information system.

Methods: In this descriptive, cross-sectional study, we used heuristic evaluation to examine the user interface design of a laboratory information system in an academic hospital affiliated with Kerman University of Medical Sciences in 2017. This system is also used in 59 other Iranian hospitals. We investigated the usability of different parts of the usability of a laboratory information system (outpatient admission, inpatient admission, sample collection, and test result reporting). Data were collected using a standard form based on the heuristic evaluation method, and categorized based on their severity and violated heuristics. The content validity was confirmed by 3 medical informatics specialists.

Results: We identified 162 usability problems. In terms of the heuristics, the highest number of problems concerned flexibility and efficiency of use (n = 32, 19.75%) and the lowest concerned help users recognize, diagnose, and recover from errors (n = 2, 1.23%). In terms of different modules of the system, the highest number of problems (n = 51, 31.48%) concerned outpatient admission and the lowest (n = 29, 17.9%) concerned sample collection. In terms of severity, 45.06% of the problems were rated as major.

Conclusions: Despite widespread use of laboratory information systems, their user interface design has usability problems that diminish the quality of user interaction with these systems and may affect the quality of health care. Consideration of standards and principles for interface design, such as the heuristics used in this study, could improve system usability.

Keywords: laboratory information system, usability evaluation, user interface, human–computer interaction, heuristic evaluation.

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Introduction

The health system of the Islamic Republic of Iran functions in an environment with rapidly changing social, economic and technical factors (1). The private and public sectors both provide healthcare services; however, the public sector, especially the Ministry of Health, plays a more important role in this regard (2). Comparative studies of healthcare systems in successful countries, introduced by the World Health Organization (WHO), and using their experiences, will assist the Islamic Republic of Iran to achieve a prosperous health system (3). Hospital information systems (HISs) are some of the most important and widely used information systems in health care (3). HISs are used for collecting, processing and retrieving patient information from different sources and using it for clinical and management decision-making (3–4). These systems can improve the quality of care and increase patients’ safety and providers’ efficiency (4–6). Most HISs contain subsystems including inpatient, outpatient, emergency, pharmacy, accounting, radiology, laboratory and medical records (7).

Laboratory information systems (LISs) are HISs that can be used to order tests, process samples, receive results, and create and communicate reports (8). LISs can improve laboratory processes and documentation accuracy of laboratory test results. Nevertheless, research has shown that the use of LISs can have major errors (8–10). Laboratory errors can lead to wrong diagnosis, inappropriate care, delayed treatment, poor clinical research, increased costs, and endanger patients’ lives (9). Many of these errors are related to usability problems of the LISs (11–14). So, identifying and then preventing the usability problems of LISs seem essential (15). The interface design of an LIS can have a dramatic effect on user interaction and satisfaction with the system (16–18). Evaluation of the system can be used for user interface redesign, to improve user acceptance and eliminate major problems in the system.
Heuristic evaluation (HE) is one of the usability evaluation methods. In this method, the compliance of an IS user interface design with some recognized standards is evaluated (19). Several studies have used HE in the healthcare sector, including evaluation of electronic health records (20), LISs (12,15,21,22) and radiology information systems (22).

To make working with ISs convenient, efficient and satisfactory, a series of standard principles should be followed in user interface design. The evaluation of systems according to these principles, which is called HE, was developed by Nielsen in 1990 (19). In this method a group of evaluators examine the user interface and judge its compliance against recognized principles (the heuristics) (23). According to Nielsen, 3–5 expert evaluators can identify an average of 74–87% of the problems (19,23). In Nielsen’s method, 10 main principles (heuristics) are used for evaluation of ISs.

Many studies have reported high usability problems that have a negative effect on user–system interaction (12,20,24). Several studies have evaluated the usability of LISs in developed countries (10,12,13,15,21), but it has not been sufficiently studied in some developing countries such as the Islamic Republic of Iran (22). Considering the importance of LISs in patient safety, the objective of this study was to evaluate the user interface design of an LIS in Kerman University of Medical Sciences, as an example of LISs used in Iranian hospitals.

Methods

In this study the user interface design of an LIS was evaluated in an academic hospital in 2017. This LIS is a sub-system of an HIS used actively in 60 hospitals (45 general and academic and 15 private) in the Islamic Republic of Iran. This LIS included the following 4 parts: outpatient admission, inpatient admission, sample collection and result reporting. The features of the LIS included patient records, patient information editing, patient search, test search, list of tests, sample collection editing, blood requests and delivery, quality control, and paraclinical services. This system was accessed in Bahonar Hospital in Kerman. We evaluated the user interface of the LIS in general; therefore, the results are not specific to this hospital.

Four evaluators independently evaluated the LIS using the Neilson principles (23). Evaluators included 2 medical informatics professionals, expert in usability evaluation, and 2 other evaluators who had master’s degrees in information technology management and information systems management with a background in software engineering. The latter 2 were trained in HE. Each evaluator examined conformity of different parts of the LIS with heuristics based on the method proposed by Neilson (23) and recorded any problems in a data collection form. The content validity of the form was confirmed by 3 medical informaticians. This form consisted of a table including problem name, problem description, problem location, and violated heuristic columns. After identification of the problems, their severity was determined according to Nielsen (25), based on 3 factors: frequency, impact and persistence (Table 1).

The collected data from independent evaluations were compared and duplications were removed by evaluators from the identified problems. Then, the problem was inserted into 2 separate lists in terms of violated heuristics and evaluated modules of the system. The number of evaluators was recorded in front of the identified problem. Any disagreement about identified problems and the allocation of them to each heuristic was discussed and resolved in a joint meeting. Then data were analysed using SPSS version 22 (SPSS Inc., Chicago, IL, USA).

Results

HE of the LIS using Neilson’s principles identified 162 problems. The number of single problems were 68, of which, 46 were repeated in more than 1 part of the system. From the 68 single problems, 9 (13.24%) were identified by only 1 evaluator, 42 (61.76%) by 2 evaluators and 17 (25%) by all 4 evaluators.

Most of the identified problems were related to the flexibility and efficiency of use principles (n = 32, 19.73%), followed by aesthetic and minimalist design and visibility of system status (n = 27, 16.66%), consistency and standards (n = 36, 16.04%), error prevention (n = 15, 9.25%), recognition rather than recall (n = 11, 6.79%), help and documentation (n = 9, 5.55%), match between system and real world (n = 8, 4.93%), user control and freedom (n = 5, 3.08%), and the lowest number of problems was related to helping users recognize, diagnose and recover from errors (n = 2, 1.23%) (Table 2). Considering the different parts of the LIS, the greatest number of problems was related to outpatient (n = 51, 31.48%) and inpatient (n = 47, 29.01%) parts, and the least, was related to sample collection with 29 problems (17.9%) from a total of 162.

<table>
<thead>
<tr>
<th>Problem type</th>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No problem</td>
<td>0</td>
<td>I do not agree that this is a usability problem at all.</td>
</tr>
<tr>
<td>Cosmetic</td>
<td>1</td>
<td>Need not be fixed unless extra time is available on project.</td>
</tr>
<tr>
<td>Minor</td>
<td>2</td>
<td>Fixing this should be given low priority.</td>
</tr>
<tr>
<td>Major</td>
<td>3</td>
<td>Important to fix, so should be given high priority.</td>
</tr>
<tr>
<td>Catastrophe</td>
<td>4</td>
<td>Imperative to fix this problem.</td>
</tr>
</tbody>
</table>
Table 3 presents the average severity of the problems related to each heuristic and the frequency of problems based on their severity. The average severity of problems concerning 4 heuristics, flexibility and efficiency of use, match between system and real world, user control and freedom, and help and documentation was major, while the average severity of problems related to other heuristics was minor. The maximum average severity of problems was 3.2, related to flexibility and efficiency of use, and the minimum was 2.0, related to aesthetic and minimalist design. Major severity was the most common (n = 73, 45.06%), followed by minor severity (n = 48, 29.62%), cosmetic severity (n = 22, 13.58%) and catastrophic severity (n = 19, 11.72%) (Table 3). Some of these problems, if they continue, can have negative effects on user performance, such as fatigue, confusion, and wasting time. This can cause errors and subsequently reduce the quality of care and patient safety (Table 4).

**Problems identified by Nielsen’s principles**

**Visibility of system status**

Problems concerning nonconformity to this principle were more frequent in Inpatient and Outpatient Admission sections. These problems included selecting inappropriate titles in windows; lack of the horizontal scroll bar in presentation of patients’ search information; unspecified hierarchy under windows; and not showing row number of task list in reports. Some of these problems, such as the first and second, were identified by all 4 evaluators.

**Match between the system and real world**

Two problems associated with this principle confused the users and wasted their time: (1) nonidentical order of displayed tests on the computer and on the printed results sheet (this can cause mistakes while entering the results, demanding a lot of time to review the input data); and

---

Table 3** Identified usability problems per violated heuristics and severity**

<table>
<thead>
<tr>
<th>Heuristic</th>
<th>Cosmetic</th>
<th>Minor</th>
<th>Major</th>
<th>Catastrophe</th>
<th>Total</th>
<th>Average severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility of system status</td>
<td>22 (13.58%)</td>
<td>48 (29.62%)</td>
<td>73 (45.06%)</td>
<td>19 (11.72%)</td>
<td>162 (100%)</td>
<td></td>
</tr>
<tr>
<td>Match between system and real world</td>
<td>0</td>
<td>5</td>
<td>17</td>
<td>0</td>
<td>27</td>
<td>2.4</td>
</tr>
<tr>
<td>User control and freedom</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Consistency and standards</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>26</td>
<td>2.2</td>
</tr>
<tr>
<td>Help users recognize, diagnose and recover from errors</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td>Error prevention</td>
<td>0</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>15</td>
<td>2.4</td>
</tr>
<tr>
<td>Recognition rather than recall</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>11</td>
<td>2.4</td>
</tr>
<tr>
<td>Flexibility and efficiency of use</td>
<td>0</td>
<td>4</td>
<td>20</td>
<td>8</td>
<td>32</td>
<td>3.2</td>
</tr>
<tr>
<td>Aesthetic and minimalist design</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>27</td>
<td>2.0</td>
</tr>
<tr>
<td>Help and documentation</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>9</td>
<td>2.6</td>
</tr>
</tbody>
</table>
(2) inconsistency of the pop-up message with the actual task executed (such that, in the delivered samples section, when the user clicked on Removal of the Delivered Sample, a deletion message popped up; however, nothing actually happened), and (2) inability to remove a sample in the delivered samples section; the latter confused the users more than the former.

**Consistency and standards**

Violation of this principle was mostly related to the sections Inpatient and Outpatient Admission and Test Orders. Some problems included: inconsistency of the window titles (Farsi/English/No Title); inconsistent application of highlighting techniques (like bolding text); different information display for test orders.

**User control and freedom**

Compared to other principles, problems associated with this area seemed fewer; 2 of which were: (1) inaccessibility to the previous or next windows (there was only the back button in some windows; otherwise, users needed to close the window and start over); and (2) inability to remove a sample in the delivered samples section; the latter confused the users more than the former.

### Table 4 Identified examples of usability problems according to violated heuristics and potential errors

<table>
<thead>
<tr>
<th>Heuristic</th>
<th>Examples of usability problems</th>
<th>Potential errors on users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility of system status</td>
<td>1. Lack of the horizontal scroll bar in presentation of patients search information. 2. Unspecified hierarchy under windows. 3. Not giving a message to user when selecting invalid information for the patients.</td>
<td>Fatigue User confusion Waste of time Dissatisfaction</td>
</tr>
<tr>
<td>Match between system and real world</td>
<td>1. Nonidentical order of displayed tests on the computer and on the printed results sheet. 2. The pop-up message and the actual task executed.</td>
<td>User confusion Waste of time Incorrect data entry Failure of quality of care Risk patient safety</td>
</tr>
<tr>
<td>User control and freedom</td>
<td>1. Inaccessibility to the previous or next windows. 2. Inability to remove a sample in the delivered samples section</td>
<td>Fatigue User confusion Incorrect data entry Waste of time</td>
</tr>
<tr>
<td>Consistency and standards</td>
<td>1. Lack of a consistent standard for displaying the window titles (Farsi/English/No Title). 2. Inconsistent application of highlighting techniques (like bolding text). 3. Different information display for test orders.</td>
<td>Hesitate Fatigue Dissatisfaction</td>
</tr>
<tr>
<td>Help users recognize, diagnose and recover from errors</td>
<td>1. Including the serial number of patients insured by the Armed Forces Insurance Organization is a requirement. 2. Failure to record number results in inappropriate message reading: ‘no match found in the patient search’</td>
<td>User confusion Reduce performance Slow down Waste of time Error in performance</td>
</tr>
<tr>
<td>Error prevention</td>
<td>1. Failure to prevent the entering of wrong data. 2. Allowing the users to enter numerical data in letter fields.</td>
<td>User confusion Incorrect data entry User confusion Waste of time Incorrect data entry Failure of quality of care Risk patient safety</td>
</tr>
<tr>
<td>Recognition rather than recall</td>
<td>1. Inability to identify the functions of the existing items on the previous orders of the patient and the abbreviated name field in the test orders window. 2. Separated and scattered insurance data.</td>
<td>Slow down Dissatisfaction Fatigue</td>
</tr>
<tr>
<td>Flexibility and efficiency of use</td>
<td>1. Inability to magnify windows. 2. Lack of settings to accommodate user preferences (colour, font, window size, and customization of the program). 3. Invisibility of the titles of patient information columns. 5. Inability to print the test fees or perforating (the users have to manually write down the test fees one by one on the prescription).</td>
<td>difficult to work Fatigue Dissatisfaction Hesitate Reduce performance</td>
</tr>
<tr>
<td>Aesthetic and minimalist design</td>
<td>1. Application of small font size. 2. Bad colours (overly light-coloured text). 3. Crammed information on the test orders page. 4. A large load of information in advanced search results.</td>
<td>Fatigue Slow down Dissatisfaction</td>
</tr>
<tr>
<td>Help and documentation</td>
<td>1. Absent or inaccessible program Help (including help buttons, and descriptive, procedural, interpretational, and navigational info).</td>
<td>User confusion Waste of time Reduce performance Error in performance</td>
</tr>
</tbody>
</table>

Compared to other principles, problems associated with this area seemed fewer; 2 of which were: (i) inaccessibility to the previous or next windows (there was only the back button in some windows; otherwise, users needed
Error prevention

Problems arising from violation of this principle were found mostly in the Outpatient Admission and Results sections. Some examples were: failure to prevent entering of wrong data (the input field for year of birth provided 4 characters, yet, when entering the data, only the first 2 characters were recorded); generating no error message for entering numerical data in letter fields; allowing the user to disable the year of birth field, and then, upon submission, displaying an error message for missing year of birth.

Recognition rather than recall

Problems concerning this principle were mostly detected in the Admission and Test Orders, as well as Results sections. Inability to identify the functions of the existing items on the previous orders of the patient and the Abbreviated Name field in the test orders window; unknown function of the field According to Patient List on the laboratory working list; separated and scattered insurance data; and lack of a title for the sidebar checkbox for the list of tests on the test orders window were some of these problems.

Flexibility and efficiency of use

Problems arising from ignoring this principle mostly involved the Test Orders section. Fifty percent of them were identified by all 4 evaluators. Some problems were: inability to magnify windows; lack of settings to accommodate user preferences (colour, font, window size, and customization of the program); and difficulty using the vertical scrollbar. Among the problems rendering the interface challenging for the users were: invisibility of the titles of patient information columns (some information remained invisible even after widening the cells); inability to print the test fees (users had to manually write down the test fees one by one on the prescription).

Help users recognize, diagnose and recover from errors

Problems concerning this principle had the lowest frequency, and were mostly centred on the Test Orders section. An example of this was application of inappropriate messages in response to the user’s action. For instance, failure to record the serial number of patients insured by the Armed Forces Insurance Organization resulted in an inappropriate message reading: ‘no match found in the patient search, which did not help the user to understand and solve the problem.

Aesthetic and minimalist design

Nonobservance of this principle caused problems throughout the system. Some major problems were: application of small font size, overly light-coloured text, cramped information on the test orders page, and confusing page titles. Also, in some pages, titles were outside the box. A large load of useless information in advanced search results was another problem.

Help and documentation

Problems associated with violation of this principle were mostly related the Test Orders section. Some identified problems included: absent or inaccessible Help anywhere throughout the system (including help buttons, and descriptive, procedural, interpretational, and navigational information); untitled test lists and tables in previous orders in the Test Orders section.

Discussion

HE of the LIS showed that, despite widespread usage throughout Iranian hospitals, it had a high number of usability problems. If some of these problems were to continue, they could have negative effects on user performance, such as fatigue, confusion, and wasting time. This could cause errors and reduce the quality of care and patient safety. Similar studies have shown that problems such as incomprehensibility of the system design have negative effects on the quality of patient care (20,26).

In our study, most of the identified problems were related to violation of flexibility and efficiency of use (19.75%), visibility of system status (16.66%), aesthetic and minimalist design (16.66%), and consistency and standards (16.04%). The lowest number of problems was related to help users recognize, diagnose and recover from errors (1.23%). In some previous studies in developing and non-developed countries (13,20,22), most of the problems were related to consistency and standards. In contrast, in other studies (18,27) violation of flexibility and efficiency of use had the lowest number of problems.

The results show that the number of problems with major severity (45.06%) was the highest and the number with catastrophic severity was the lowest (11.72%). In previous studies (18,28), the severity of problems was classified as major and catastrophic, and they had a greater number of catastrophic violations compared with our study. In two other similar studies (29,30), the severity of problems was classified as major.

Our results confirm those of other studies. The surveys of Alanaziet al. (15) and Mathews et al. (21) using System Usability Scale (SUS) showed that usability of LISs was poor. Most evaluation methods have reviewed user satisfaction and attitude about HISs (31); compliance with the users’ needs (32); the impact of HISs on the factors influencing quality of clinical services, hospital performance, and work processes (7); and usability and efficiency of HISs (33). Evaluations conducted in these previous studies used questionnaires, interviews and checklists, and did not address the usability problems that users may have encountered during actual interaction with the computer.

Our results show that many of the problems with existing ISs are preventable by following the standards and principles for designing systems. Major problems of ISs include inconsistency between system messages and actions, nonvisible column headings for patients, and inability to print the cost of laboratory tests. These problems can be solved by definition of correct and clear messages corresponding to their functions, accurately defining scrollbars and correctly designing patient data entry forms, and providing printing output for the costs of laboratory tests. In accordance with the results of this
study, we observed that because of poor usability and difficulty in working with the LIS, users refuse to use some sections and perform their tasks manually.

Expertise in evaluation and in the domain of the studied system results in better identification of problems (29,34). Two of our evaluators were medical informaticians with a long history of working in healthcare, and usability evaluation skills, and the other 2 evaluators were proficient in computer systems. This increased the reliability of our findings.

Nielsen (19) has shown that increasing the usability of user interfaces requires regular evaluation and updating indifferent stages of the system development lifecycle (19). The updating process must include adding new functions and troubleshooting of the existing problems, which increases users' understanding of the system. This type of evaluation can be done using an inexpensive and simple evaluation method such as HE (35). It is easy to train the evaluators and it produces large amounts of information. Also, HE can be carried out in a short time, so the list of problems is quickly available (19,35).

This study had 2 limitations. First, we evaluated a widely used LIS (in 60 hospitals) at a single hospital. Since it was not checked whether the other 59 hospitals use the same version of the system or an upgraded or customized version, generalization of the results to the other LISs should be done with caution. However, we believe that since most and the main functionalities and features of the systems are similar, this cannot significantly affect our results. Second, HE identifies problems that mostly hinder novice users' interaction with a system. Therefore, if the users have received extensive training and supervision specifically concerning how to work around or be careful of the user interface issues that was found in this study, these problems should not be critical threats for the outcomes of users' interaction, such as clinical actions. Future studies can check this issue by evaluating the effect of user interface problems on actual users' actions.

**Conclusion**

We have shown that conducting a usability evaluation can help identify the origin of problems causing new errors, users' fear of operating the system, and their resistance to it. These problems occur due to noncompliance of ISs design with the accepted standards and principles, which may impede user–IS interaction. A defective or unsuccessful interaction leads to an undesirable experience when operating the system and result in poorer quality of care. Our results can be used to obviate the identified problems in redesign process and prevent them in the new ISs.

**Recommendations**

The following recommendations may improve and correct ISs.

- Providing printable output for test fees; documentation and accessibility of help; appropriate design of patient information forms; proper definition of search options; use of attractive techniques including bold colours, text size, fonts, etc.; hierarchical categorization and structuring to prevent information overload; use of specific and short titles for pages; definition of icons proportionate to the expected function; and preventing user errors in the system.

- Conducting user need assessment prior to IS design to ensure compliance with user needs, and conducting usability studies throughout all design and development stages.

- Providing developers with design standards prior to commencing design to improve system usability.

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Respect des principes de conception : étude de cas d’un système d’information de laboratoire dont l’utilisation est largement répandue

Résumé

Contexte : Les systèmes d’information de laboratoire sont des systèmes d’information sanitaire largement utilisés qui ont le potentiel d’améliorer la qualité des soins de santé. Ces systèmes présentent des avantages, mais de nombreuses études ont mis en évidence des problèmes d’interaction avec les utilisateurs en raison d’une mauvaise conception de l’interface.

Objectifs : La présente étude visait à évaluer l’utilisabilité des systèmes d’information de laboratoire en milieu hospitalier.


Résultats : Nous avons recensé 162 problèmes d’utilisabilité. L’heuristique pour laquelle le plus grand nombre de problèmes ont été rapportés était la flexibilité et l’efficacité d’utilisation (n = 32, 19.75 %), tandis que l’aide à la reconnaissance, au diagnostic et à la réparation des erreurs était celle pour laquelle on rapportait le plus petit nombre de problèmes (n = 2, 1.23 %). L’admission ambulatoire était le module du système pour lequel le plus grand nombre de problèmes a été notifié (n = 51, 31.48 %), tandis que la collecte d’échantillons était celui pour lequel on rapportait le plus petit nombre de problèmes a été notifié (n = 29, 17.9 %). En ce qui concerne la gravité, 45.06 % des problèmes ont été jugés majeurs.

Conclusions : Malgré l’utilisation répandue des systèmes d’information de laboratoire, les interfaces présentent souvent des problèmes d’utilisabilité qui diminuent la qualité de l’interaction avec les utilisateurs et peuvent affecter la qualité des soins de santé offerts. Ainsi, au moment de concevoir les interfaces utilisateurs, il pourrait être utile de s’appuyer sur des normes et des principes, à l’instar des heuristiques utilisées dans cette étude. Cela pourrait en effet permettre d’améliorer la convivialité des systèmes.

الامتثال لمبادئ التصميم: دراسة حالة لنظام معلومات مختبري مستخدَم على نطاق واسع

الخلاصة

نُظم المعلومات المختبرية هي نُظم المعلومات الصحية المستخدَمة على نطاق واسع والتي لديها القدرة على تحسين جودة الرعاية الصحية. وعلى الرغم من فوائدها، أشارت العديد من الدراسات إلى وجود مشاكل في تفاعل المستخدمين مع هذه النُظم بسبب سوء تصميم الواجهة.

أهداف هذه الدراسة هي تقييم قابلية استخدام نظام معلومات المختبرات في مستشفى إيراني آخر. وبحثنا في قابلية استخدام مختلف أجزاء نظام المعلومات المختبرية (دخول المرضى الخارجيين، ودخول المرضى الداخليين، وجمع العينات، وإعداد تقارير النتائج). وَجُمع البيانات باستخدام نموذج قياسي يستند إلى طريقة التقييم الاستدلالي. وصنفت البيانات على أساس وخامة المشكلة وانتهاك الاستدلالات. وأكَّد ثلاثة أخصائيين في المعلوماتية الطبية صحة المحتوى.

رغم انتشار استخدام نُظم المعلومات المختبرية، يكتنف تصميمي تصميم واجهة المستخدم مشاكل تُقلل من جودة تفاعل المستخدمين مع هذه النُظم. ويمكن أن تؤثر على جودة الرعاية الصحية. ويمكن أن يؤدي النظر في المعايير والمبادئ المتعلقة بتصميم واجهة المستخدم، مثل الاستدلالات المستخدمة في هذه الدراسة، إلى تحسين قابلية استخدام هذه النُظم.
References


13. Alanazi, F. Evaluating the usability of the laboratory information system (LIS) in Coombe Hospital and Hail Hospital [thesis]. Dublin: Dublin Institute of Technology; 2015.


17. Nielsen J. Technology transfer of heuristic evaluation and usability inspection. 1995 (http://dx.doi.org/10.1007/s10916-014-0035-z


Predicted 10-year risk of cardiovascular disease in the Islamic Republic of Iran and the body mass index paradox

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Abstract

Background: Assessment of the risk of cardiovascular disease is essential for disease prevention in every region.

Aims: This study aimed to investigate the 10-year risk of cardiovascular disease and its determinants in an adult population in Shahroud, Islamic Republic of Iran.

Methods: A total of 4737 people aged 45–69 years were evaluated. The 10-year risk of cardiovascular disease was calculated using the Framingham risk scoring method. Cardiovascular disease risk is reported as per cent risk and 95% confidence intervals (CI). Factors affecting the risk of cardiovascular disease were assessed using multiple beta regression analysis.

Results: The mean age of the participants was 55.9 years; 41% were males. The mean 10-year risk of developing cardiovascular disease was 16.4% (95% CI: 16.0–16.8%); 28.3% of the participants had a risk of more than 20% (47.8% of the men and 14.9% of the women). Age, diabetes, smoking (only in men), high blood pressure, triglycerides (only in women), waist circumference, total cholesterol and high-density lipoprotein cholesterol were significantly associated with cardiovascular disease risk. In men, there was a non-significant increase in risk with higher body mass index up to body mass index 39.9 kg/m²; however, the risk decreased by 4.4% at body mass index ≥ 40 kg/m² (P = 0.18).

Conclusions: The cardiovascular disease risk was very high, especially in men. Effective interventions should be implemented to reduce risk factors for cardiovascular disease. Longitudinal studies are recommended to investigate the effect of body mass index on the risk of cardiovascular disease.

Keywords: cardiovascular diseases, risk factors, body mass index, Iran


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Introduction

Cardiovascular diseases (CVDs) with about 422.7 million cases and 17.9 million deaths a year (31% of all deaths) are the leading cause of death in the world (1,2). About three quarters of these deaths occur in low- and middle-income countries. However, most of these deaths could be prevented with the avoidance of certain risk factors, such as smoking, unhealthy diet, obesity, sedentary lifestyle and alcohol use. People with CVD or those with increased risk of the diseases require early diagnosis and therapy (2). Although the CVD deaths increased by 21% between 2007 to 2017, the age-adjusted death rates declined during this period in all high-income and some middle-income countries (1,3). The Islamic Republic of Iran has one of the highest age-standardized prevalence rates of CVD (> 9000 cases per 100 000 people) (1) and a high CVD mortality rate (4). By 2025, the burden of the CVD in the country will be more than double the rate in 2005 (5).

Since 2001, several guidelines have calculated and predicted the risk of CVD (6). Such calculations are important in guiding primary and secondary prevention of CVDs (6). By identifying CVD risk, in addition to raising awareness, appropriate interventions can be designed and implemented at the community level (primary prevention). In addition, medications such as lipid-lowering drugs may also be prescribed at the individual level (secondary prevention).

The Framingham risk score is one of the most widely used risk scores with a good ability to separate high-risk individuals from others (discrimination) and to predict the risk of CVD (calibration) (6). This score has been used in various countries as a useful tool to predict the CVD risks (6–9). A cohort study with long-term follow-up confirmed the correctness of the predictive power of the Framingham risk score (10).

A few studies have investigated the risk of CVD in the Islamic Republic of Iran (7,11–17), but the results have varied because of differences in the objectives and methods; therefore, it is difficult to draw conclusions about the risk of CVD in the country. The aim of our study was to evaluate the risk of CVD in a population-based study using the Framingham risk score and to identify factors associated with CVD risk in Shahroud, Islamic Republic of Iran.
**Methods**

**Study population**

Our study is based on data from the second phase of the Shahroud Eye Cohort Study, done in Shahroud, northern Islamic Republic of Iran. Details of the study methodology have already been described (18) but here we provide a summary of the methodology of the Shahroud Eye Cohort Study.

In 2009, 6311 people in the 300 clusters from nine strata of Shahroud city were selected using stratified cluster random sampling. The strata were the nine health care centres in the city and the number of clusters was calculated proportionate to the population served by the centre. We selected 20 people aged 40–64 years from each cluster for the study. The selected people were interviewed and invited to have an ophthalmologic examination. Demographic characteristics, employment status, medical and ophthalmic history were recorded for participants. The second phase of the study began in 2014 and the participants of the first phase were invited to take part. In the first phase, 5190 people aged 40–64 years participated in the study (82.2% response rate). In the second phase 4737 of the participants of the first phase (92.3%) agreed to participate. In the second, phase 5 years later, the ages of the participants ranged from 45–69 years.

**Measurements**

In both phases, weight was determined using a portable digital scale (in kilograms with an accuracy of 0.1 kg). Height was measured using non-elastic tape measure in standing position and without shoes (in metres). Body mass index (BMI) was calculated as weight (in kilograms) divided by the square of height (in metres). Waist circumference was measured in the horizontal plane midway between lowest rib and the iliac crest to the nearest 0.1 cm using a non-elastic tape measure.

A trained nurse measured blood pressure in the right hand in a sitting position after resting for 5 minutes using an electronic sphygmomanometer. Blood pressure was measured two consecutive times with an interval of 3 minutes. After the two measurements, if a difference between values was more than 10 mmHg in systolic blood pressure or 5 mmHg in diastolic blood pressure, the measurement was repeated for a third time and the two measurements closer together were used. Mean systolic and diastolic blood pressure of the two measurements was calculated. People with high blood pressure were those with a mean systolic blood pressure ≥ 140 mmHg or a mean diastolic blood pressure of ≥ 90 mmHg or who were taking blood pressure medications.

Participants who had smoked cigarettes, the water pipe or pipe for most days of the week over at least 6 months were considered as smokers.

**Blood tests**

Fasting plasma glucose, serum triglycerides, total cholesterol, high-density lipoprotein (HDL) cholesterol and glycosylated haemoglobin (HbA1c) were measured.

All laboratory tests were performed using the Alpha Classic–At autoanalyser (Tajhizat Sanjesh Company, Islamic Republic of Iran) after 10–12 hours fasting. The kits used were manufactured by Pars-Azmoon Company and were within the expiry date. Quality control of the autoanalyser was done daily before the start of the measurements.

A participant was considered to have diabetes if he/she: had fasting plasma glucose ≥ 126 mg/dL and/or HbA1c ≥ 6.5% and/or was taking medicines to lower blood glucose.

**Statistical analysis**

Variables including age, sex, systolic blood pressure, total cholesterol, HDL cholesterol, taking blood pressure medicines, smoking and diabetes were used to calculate the 10-year risk of CVDs as percentage according to the Framingham risk score (19). The participants with 10-year risk more than 20% were identified as a high-risk group.

Estimated mean CVD risk and the prevalence of risk over 20% were compared by age and sex with 95% confidence intervals (CI). The association of CVD risk with the independent variables was investigated using multiple beta regression models. Considering the statistical interactions between sex and BMI, and also between age and triglycerides, the beta regression analyses were performed for men and women separately. The significance level for all tests was 0.05 and the effect of cluster sampling was considered in the calculation of CIs.

**Ethical considerations**

The study protocol was reviewed and approved by the Ethics Committee of Shahroud University of Medical Sciences in both phases of the Shahroud Eye Cohort Study.

After explaining the purpose of the project, written informed consent was obtained from each participant. Illiterate participants signed the consent form with their fingerprint after it was explained to them.

**Results**

Of the 4737 people who participated in the second phase of study, data to calculate the CVD risk were available for 4661 people aged between 45 and 69 years, including 1907 men (40.9%) and 2754 (59.1%) women. The mean age (standard deviation) was 55.9 (6.2) years. The mean CVD risk per cent was 16.4% (95% CI: 16.0–16.8%). The risk in men was 23.3% (95% CI: 22.6–24.0%) and in women was 11.6% (95% CI: 11.3–12.0%) (P < 0.001). In addition, 47.8% (95% CI: 45.4–50.2%) of the men and 14.9% (95% CI: 13.5–16.3%) of the women had a high CVD risk (> 20%). Mean CVD risk and prevalence of high CVD risk according to age and sex are shown in Table 1. The relationship between the age and risk of CVD is also shown in Figure 1. It shows that the risk of CVD increased with age in both men and women, but the increase was greater in men.
Age, diabetes, hypertension, waist circumference, total cholesterol and HDL cholesterol levels were significantly associated with CVD risk in both men and women (Table 2). Smoking and BMI ≥ 40 kg/m² were also associated with CVD risk in men, while triglyceride level was also associated with CVD risk in women. Generating elasticities for the coefficients in Table 2 showed that diabetes and hypertension increased the CVD risk by 7.6% and 5.6% in women and 11.7% and 7.7% in men. Smoking was also an important risk factor which increased the CVD risk by 7.4% in men. Smoking increased the CVD risk by 3.0% in women but this was not statically significant ($P = 0.059$). Each 1% increase in HDL cholesterol, decreased the CVD risk by 0.48% and 0.17% in men and women, respectively. Each 1% increase in age, waist circumference, total cholesterol and triglycerides increased the CVD risk in women by 0.52%, 0.05%, 0.06% and 0.005%, respectively. For men these rates were 1.0%, 0.05%, and 0.11% for age, waist circumference and total cholesterol, respectively. The CVD risk decreased by 4.4% in men with a BMI ≥ 40 kg/m² ($P = 0.18$), while no significant association between BMI and CVD risk was seen in women.

The relationship of BMI with CVD risk, total cholesterol and triglycerides is shown in Figure 2. In both sexes, higher BMI was associated with an increase in CVD risk. However, this increase was linear in women and quadratic in men; that is, in men, the risk plateaued at BMI 35 kg/m² and more and even decreased with further increases in BMI (BMI paradox). The associations of total cholesterol and triglycerides with BMI were also different in men and women. In men, this association had a reverse U shape (Figure 2).

**Discussion**

Our results showed that the risk of CVD is high in people aged 45–69 years old in Shahroud. The mean risk was 23.3% and 11.6% in men and in women, respectively; and 47.8% of men and 14.9% of women had a CVD risk > 20%. This emphasizes the need for rapid implementation of treatment and preventive interventions. Similar studies in the Islamic Republic of Iran have reported lower risk in both males and females (11,13,15). However in a longitudinal study in the country with a 10-year follow-up of people aged 40–75 years, a high incidence of CVD (21.0% in men and 12.0% in women) was reported (20). Another study found that 46.5% of Iranians were eligible for statin therapy according to the ACC/AHA guideline (21). Our prevalence of high CVD risk (28.3%) is slightly higher than recent research in Malaysia (20.5%) (22), Australia (19.9%) (23) and the United States of America (22.6% in hypertensive patients) (24). The laboratory-based mean 10-year risk of fatal and non-fatal CVD in Iranian people aged 40–64 years was 11.2% in men and 9.0% in women, which similar to Cambodia and were the highest risk of 10 countries with recent national health surveys (25). Differences in age groups, race and ethnicity of participants, and different methods for estimating CVD risk are important fac-

<table>
<thead>
<tr>
<th>Age groups (years) by sex</th>
<th>Mean CVD risk % (95% CI)</th>
<th>Prevalence (95% CI) of high CVD risk (&gt; 20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45–49</td>
<td>14.1 (13.0–15.1)</td>
<td>19.3 (14.9–23.7)</td>
</tr>
<tr>
<td>50–54</td>
<td>17.5 (16.5–18.4)</td>
<td>28.2 (24.6–32.9)</td>
</tr>
<tr>
<td>55–59</td>
<td>23.5 (22.3–24.7)</td>
<td>49.5 (45.2–53.8)</td>
</tr>
<tr>
<td>60–64</td>
<td>29.5 (28.0–31.0)</td>
<td>68.1 (63.5–72.7)</td>
</tr>
<tr>
<td>65–69</td>
<td>35.7 (33.6–37.9)</td>
<td>83.8 (79.1–88.5)</td>
</tr>
<tr>
<td>Total</td>
<td>23.3 (22.6–24.0)</td>
<td>47.8 (45.3–50.2)</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45–49</td>
<td>5.9 (5.6–6.2)</td>
<td>1.0 (0.2–1.9)</td>
</tr>
<tr>
<td>50–54</td>
<td>8.9 (8.4–9.4)</td>
<td>7.0 (5.2–8.7)</td>
</tr>
<tr>
<td>55–59</td>
<td>12.8 (12.1–13.6)</td>
<td>16.2 (13.4–18.9)</td>
</tr>
<tr>
<td>60–64</td>
<td>15.7 (14.9–16.6)</td>
<td>26.1 (22.1–30.1)</td>
</tr>
<tr>
<td>65–69</td>
<td>21.2 (19.5–22.9)</td>
<td>43.4 (37.4–49.4)</td>
</tr>
<tr>
<td>Total</td>
<td>11.6 (11.3–12.0)</td>
<td>14.9 (13.5–16.3)</td>
</tr>
<tr>
<td><strong>Total sample</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45–49</td>
<td>8.6 (8.1–9.1)</td>
<td>7.0 (5.3–8.6)</td>
</tr>
<tr>
<td>50–54</td>
<td>12.3 (11.8–12.8)</td>
<td>15.6 (13.5–17.6)</td>
</tr>
<tr>
<td>55–59</td>
<td>17.4 (16.6–18.1)</td>
<td>30.4 (27.7–33.1)</td>
</tr>
<tr>
<td>60–64</td>
<td>22.0 (21.1–23.0)</td>
<td>45.3 (42.1–48.5)</td>
</tr>
<tr>
<td>65–69</td>
<td>27.9 (26.4–29.4)</td>
<td>62.1 (57.8–66.3)</td>
</tr>
<tr>
<td>Total</td>
<td>16.4 (16.0–16.8)</td>
<td>28.3 (27.1–29.6)</td>
</tr>
</tbody>
</table>

CI: confidence interval.
In our study, the risk of CVD in women was considerably higher than in many studies ([1,13,14,22,26,27]). Only one American study had a similar prevalence of high CVD risk as our study: prevalence of CVD risk > 20% was 15.0% (24) while ours was 14.9%. It should be noted that some researchers concluded that CVD risk in women is overestimated if using the Framingham risk score (8). Similar to other studies, CVD risk was higher in men than women, and increased with age in both sexes ([7,11,13,26,27]). One of the important points of our results was the interaction between age and sex; increased CVD risk with age was higher in men than women. Men had a higher rate of increase in CVD risk from the age of 55 years onwards, indicating the presence of more risk factors in men in middle age and early old age than women of the same age. Therefore, more attention should be paid to developing prevention and treatment interventions for men.

There was also interaction between BMI and sex for CVD risk. Increasing BMI up to 35 kg/m² was associated with higher CVD risk in men than in women. However, in men, the risk decreased with further increase in BMI (BMI paradox). This finding is difficult to explain and requires further investigation. A possible explanation may be differences in the type of obesity (abdominal versus non-abdominal) in men with BMI over 35 kg/m² or better lifestyle (i.e. healthier eating, more physical activity and less smoking) in this obese group. Some studies have shown that changes in low-density lipoprotein cholesterol and triglycerides with an increase in BMI are not the same in men and women (28). In our study, BMI above 33 kg/m² in men was associated with a reduction in total cholesterol and triglycerides, while this was not the case for women. A possible explanation may be that obese men comply more with use of lipid-lowering drugs when they reach a high level of obesity. An Iranian study in 2012 reported that the prevalence of metabolic syndrome (which is directly related to the risk of CVD) and those with medium risk for CVD decreased in men with a BMI of ≥ 40 kg/m², while it increased linearly in women (29). In a large cohort study in the Islamic

Table 2: Association of independent variables with cardiovascular disease risk: multiple beta regression analysis by sex

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient (95% CI)</th>
<th>Elasticity (95% CI)</th>
<th>P-value</th>
<th>Coefficient (95% CI)</th>
<th>Elasticity (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>-0.029 (-0.032 to -0.027)</td>
<td>-0.003 (-0.006 to 0.002)</td>
<td>&lt; 0.001</td>
<td>-0.028 (-0.031 to -0.026)</td>
<td>-0.004 (-0.007 to 0.002)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Education (years)</td>
<td>-0.003 (-0.006 to 0.000)</td>
<td>-0.000 (-0.000 to 0.000)</td>
<td>0.551</td>
<td>-0.003 (-0.006 to 0.000)</td>
<td>-0.000 (-0.000 to 0.000)</td>
<td>0.551</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>-0.018 (-0.021 to -0.155)</td>
<td>-0.001 (-0.002 to 0.000)</td>
<td>0.361</td>
<td>-0.018 (-0.021 to -0.155)</td>
<td>-0.001 (-0.002 to 0.000)</td>
<td>0.361</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>-0.043 (-0.076 to -0.010)</td>
<td>-0.006 (-0.008 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.043 (-0.076 to -0.010)</td>
<td>-0.006 (-0.008 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Smoking (yes/no)</td>
<td>-0.005 (-0.008 to 0.000)</td>
<td>-0.000 (-0.000 to 0.000)</td>
<td>0.079</td>
<td>-0.005 (-0.008 to 0.000)</td>
<td>-0.000 (-0.000 to 0.000)</td>
<td>0.079</td>
</tr>
<tr>
<td>Diabetes (yes/no)</td>
<td>-0.009 (-0.012 to -0.006)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.009 (-0.012 to -0.006)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Hypertension (yes/no)</td>
<td>-0.031 (-0.041 to -0.021)</td>
<td>-0.004 (-0.005 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.031 (-0.041 to -0.021)</td>
<td>-0.004 (-0.005 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>-0.007 (-0.007 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.007 (-0.007 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>-0.007 (-0.007 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.007 (-0.007 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>High-density lipoprotein cholesterol (mg/dL)</td>
<td>-0.008 (-0.008 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
<td>-0.008 (-0.008 to 0.000)</td>
<td>-0.001 (-0.001 to 0.000)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

CI: confidence interval.
Republic of Iran, BMI was not associated with CVD mortality in men and was inversely associated with CVD mortality in women (30). In addition, a cross-sectional study of office workers with limited sample size did not find any association between CVD risk (predicted by the Framingham risk score) and BMI level (15). Furthermore, a study with an international cohort showed that CVD risk in obese and overweight people was not higher than those with normal BMI, and a reverse J-shaped curve persisted between BMI category and incidence of CVD outcomes (31). A longitudinal study in the United States showed that BMI had little independent influence (0.07% per 1 kg/m² increase) on 10-year atherosclerotic CVD risk scores (32). A systematic review of 40 cohort studies found that overweight and obese people had better survival and lower CVD events (33). The above-mentioned studies (31–33) highlight that BMI is not a good proxy for body fat.

As expected, having diabetes, smoking and having high blood pressure were associated with higher risk of CVD. Other studies also have reported the same (7,8,24,34,35). Of these three risk factors, diabetes is associated with the greatest risk of CVD. In our study, low levels of HDL cholesterol increased the risk of CVD more significantly than high levels of total cholesterol and triglycerides.

The main strengths of our study are its study design, large sample size and accuracy of measurements of the variables, including blood pressure, height, weight and laboratory measures. However, our study has some limitations. The risks calculated in the study are based on the Framingham model, which was assumed to be applicable to the Islamic Republic of Iran. However, the Framingham risk score has been reported to be the most useful risk assessment tool in Asian countries such as India (36). As ours was a cross-sectional study, the associations found between the variables examined and CVD cannot be considered causal. In the next phases of the Shahroud Eye Cohort Study, it will be possible to assess more accurately the risk of CVD.

Shahroud can be considered a typical city in the Islamic Republic of Iran with population and health indices about average for the country. Therefore, our results show that the 10-year risk of incident CVD is high in the middle-aged and elderly Iranian population in urban areas. Our findings may be useful for policy-making and highlight the need for a concerted effort to provide effective interventions to reduce CVDs in the country.

Funding: The Shahroud Eye Cohort Study was supported by the Noor Ophthalmology Research Center and Shahroud University of Medical Sciences (Grant Number 8737). Our study did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Competing interests: None declared.
**Prédiction du risque de maladie cardio-vasculaire sur une période de 10 ans en République islamique d'Iran, et paradoxe de l'indice de masse corporelle**

**Résumé**

**Contexte :** L'évaluation du risque de maladie cardio-vasculaire est essentielle pour la prévention des maladies dans chaque région.

**Objectifs :** La présente étude visait à étudier le risque de maladie cardio-vasculaire sur 10 ans et ses déterminants dans une population adulte à Shahroud, en République islamique d'Iran.

**Méthodes :** Au total, 4737 personnes âgées de 45 à 69 ans ont été évaluées. Le risque de maladie cardio-vasculaire sur 10 ans a été calculé à l'aide de la méthode de notation du risque de Framingham. Le risque de maladie cardio-vasculaire est indiqué en pourcentage du risque et en intervalles de confiance (IC) à 95 %. Les facteurs affectant le risque de maladie cardio-vasculaire ont été évalués au moyen d'une analyse de régression multiple bêta.

**Résultats :** L'âge moyen des participants était de 55,9 ans ; 41 % étaient des hommes. Le risque moyen de développer une maladie cardio-vasculaire sur 10 ans était de 16,4 % (IC à 95 % : 16,0-16,8 %) ; 28,3 % des participants avaient un risque de plus de 20 % (47,8 % des hommes et 14,9 % des femmes). L'âge, le diabète, le tabagisme (uniquement chez les hommes), l'hypertension artérielle, les triglycérides (uniquement chez les femmes), le tour de taille, le cholestérol total et le cholestérol des lipoprotéines de haute densité étaient associés de manière significative au risque de maladie cardio-vasculaire. Chez les hommes, on a constaté une augmentation non significative du risque avec un indice de masse corporelle plus élevé pouvant atteindre 39,9 kg/m² ; cependant, le risque diminuait de 4,4 % lorsque l'indice de masse corporelle était supérieur ou égal à 40 kg/m² ($p = 0,18$).

**Conclusions :** Le risque de maladie cardio-vasculaire était très élevé, surtout chez les hommes. Des interventions efficaces devraient être mises en œuvre pour réduire les facteurs de risque des maladies cardio-vasculaires. Des études longitudinales sont recommandées pour étudier l'effet de l'indice de masse corporelle sur le risque de maladie cardio-vasculaire.
References


Workplace violence among health-care workers in emergency departments of public hospitals in Dammam, Saudi Arabia

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Abstract

Background: Workplace violence is a serious occupational health problem. Emergency health-care workers have a high risk of exposure to violence with negative personal consequences.

Aims: To estimate the prevalence and possible associated factors of workplace violence among health-care workers in emergency departments of public hospitals in Dammam, Saudi Arabia.

Methods: A cross-sectional study was conducted during August to October 2018 at 4 emergency departments of public hospitals belonging to the Saudi Ministry of Health. Data were collected using a self-administered questionnaire.

Results: Of 380 questionnaires distributed, 324 were returned (85% response rate). Almost two thirds of the participants were women (66.4%) and more than half (54%) were nurses. A total of 155 health-care workers (47.8%) had experienced at least 1 type of violent incident in the preceding 12 months. Of the total violence incidents, 52% were verbal abuse, 19% were physical violence, and sexual harassment (3%) was the least common. Lack of encouragement to report incidents and Saudi nationality were the only significant variables associated with workplace violence.

Conclusions: Workplace violence was prevalent, and verbal abuse was the commonest type among health-care workers in emergency departments of Saudi hospitals. Encouragement to report violent incidents and raising awareness among health-care workers about violence reporting systems are important strategies to improve workplace safety.

Keywords: emergency departments, healthcare workers, Saudi Arabia, reporting, workplace violence

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Introduction

Health care workers (HCWs) are among the groups most experiencing violence and aggressive behaviour at work, especially those who work in emergency departments (EDs) in public hospitals (1). Workplace violence has negative consequences on safety and workplace activities of HCWs (2). However, the estimated prevalence of violence against HCWs is still unknown because there is no clear definition of a violent incident (1,2). The World Health Organization (WHO) defined violence as “The intentional use of physical force or power, threatened or actual, against another person or against oneself or a group of people that results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation” (3). The National Institute for Occupational Safety and Health defines workplace violence as “violent acts (including physical assault and threats of assault) directed towards persons at work or on duty” (4). According to WHO, physical or psychological violence can appear in different forms, which may often overlap (4,5). Physical violence is defined as the use of physical force against another person or group that results in physical, sexual or psychological harm, and such violence includes beating, kicking, slapping, stabbing, shooting, pushing, biting and pinching (3,5). Psychological violence is defined as intentional use of power, including threat of physical force, against another person or group that can result in harm to physical, mental, spiritual, moral or social development. Psychological violence includes verbal abuse, bullying/mobbing, harassment (including sexual and racial) and threats.

Many studies worldwide have examined the prevalence of workplace violence among HCWs (2). A survey of workplace violence across 65 American EDs conducted in 2008 showed that the violence and weapons in the EDs were common, and nurses were less likely to feel safe than other staff were (6). A cross-sectional study in 2009 in Tokyo, Japan revealed that 36.4% of 11,095 HCWs in 19 hospitals experienced workplace violence by patients or their relatives; 15.5% experienced physical aggression, 29.8% experienced verbal abuse and 9.9% experienced sexual harassment (7). In another large study conducted between October 2012 and July 2013 at primary healthcare centres in Belgrade, Serbia, the prevalence of workplace violence was 52.6% among 1757 HCWs (8). In the Middle East, workplace violence has been investigated in several studies. An Iranian cross-sectional survey in 2011 among 196 nurses in 11 EDs in teaching hospitals in Tehran, showed that 19.7% of nurses faced physical violence and 91.6% experienced verbal abuse (9). Another cross-sectional study in Jordan in 2011 among 227 nurses in 12 provinces revealed that...
75.8% were exposed to at least 1 type of violence (10). A comprehensive survey of workplace violence among 713 physicians in EDs in Turkey found that 78.1% had experienced violence (11). Factors related to the increased risk of workplace violence are related to the offenders, HCWs or the workplace environment (2). Personality and mental health disorders (such as schizophrenia, paranoia, anxiety, antisocial attitude, dementia and alcohol abuse) are the most significant factors related to the offenders (7). HCW-related factors include understaffed working conditions, working alone and long working hours (7, 12). Factors related to the workplace include long waiting times, overcrowding, inadequate security, and lack of policies for preventing violence (12). In a few studies in Saudi Arabia, there was difficulty in estimating the magnitude of the problem due to lack of reporting and other factors (2,13). In 2009, a self-reporting questionnaire study in Al-Hassa of 1091 primary health care professionals revealed that 28% suffered from workplace violence (12). A cross-sectional study in Riyadh in 2011 of 600 physicians and nurses found that 67.4% were exposed to workplace violence, and that nurses were more susceptible than physicians (14). In another cross-sectional study in 2014 in 12 family medical centres in Riyadh, 45.6% of 270 HCWs experienced some sort of violence during the 12 months prior to the study (2). Three studies were conducted in Saudi Arabia in 2015. A cross-sectional study at King Fahd Hospital showed that 30.7% of 391 nurses were exposed to verbal abuse (13). In EDs of 3 hospitals in Riyadh, 89.3% of 121 nurses experienced a violent incident in the 12 months prior to the study (15). In EDs in Tabuk, 90.7% of 129 had history of workplace violence (1). EDs are in operation 24 hours a day, 7 days a week (16). Patients usually come to EDs with relatives or friends with expectations of a rapid response and good service from HCWs regardless of the severity of the case (12). EDs receive a huge number of patients, therefore, the chance of HCWs being exposed to violence is high (1,12).

This study was conducted to estimate the prevalence of workplace violence among HCWs in EDs in public hospitals in Dammam, Saudi Arabia and to determine possible associated factors.

Methods

This was a cross-sectional survey conducted during August to October 2018 at 4 public hospitals belonging to the Ministry of Health in Dammam, Saudi Arabia: Dammam General Medical Complex, Dhahran Eye Specialist Hospital, Maternal and Children’s Hospital and Al-Amal Complex for Mental Health. All HCWs in all duty shifts (morning, evening and night) in EDs were invited to participate, with exclusion of those with work experience < 1 year. The sample size was calculated using epi info, assuming the level of violence among HCWs was 89% from previous data (5), with an accepted margin of error 4%. The sample by population survey was 235 HCWs at 95% confidence level and was increased to 294 HCWs, expecting 80% response.

Data were collected from 324 participants, using a self-administered questionnaire that was based on questionnaires developed by WHO (5) and was modified by the researchers. The English language questionnaire was translated into Arabic by the authors and validated by 3 experts in the Department of Family and Community Medicine, Imam Abdulrahman Bin Faisal University. The questionnaire consisted of 8 sections. The first part included demographic information such as age, sex, marital status, occupational title, nationality, educational level, and years of work experience. The second part consisted of items that addressed occupational characteristics (working multiple shifts, shift time worked, number of coworkers in the same work area, encouragement to report violent events, and availability of a violence reporting system). The other sections consisted of items that addressed the characteristics of the violent acts experienced (time, place and frequency of violence) and the identity, age and sex of the offender. There were also questions about reasons for violence (e.g., lack of security and absence of punishment) and the consequences for the HCWs and the offenders. Finally, there was a question about reasons for not reporting acts of violence. Types of violence were classified into physical, verbal, bullying, and sexual and racial harassment (5). A pilot study was carried out on 10 HCWs in 1 public hospital on 1 day, to check the clarity of the language used and estimate the average time to answer the questionnaire. The participants in the pilot study were not included in the present study.

All statistical analyses were conducted using SPSS version 25, setting our level of confidence at 95%. Descriptive statistics by frequency and percentage were used for categorical variables, while continuous variables were assessed for normality. The frequency of workplace violence was calculated by dividing the number of those who had experienced violence during the preceding 12 months by the total number of HCWs in the study. The c2 and independent samples t test were used to assess the relation between demographic and occupational characteristics and workplace violence. Logistic regression analysis was used to assess factors independently associated with the occurrence of workplace violence. Adjusted odds ratios with corresponding 95% confidence intervals were presented.

Results

Demographic and occupational characteristics

Of 380 questionnaires distributed, 324 were returned (85% response rate). The age of participants ranged between 22 and 55 years, with a mean of 32.7 (standard deviation, 6.2) years, and 215 were women (60.4%) (Table 1). The majority (78.1%) of HCWs were Saudis and almost two thirds were married. The largest proportion had a diploma (50.3%) followed by a bachelor’s degree (43.5%). More than half the HCWs (54%) were nurses and 40.1% had work experience of 6–9 years.

Report encouragement and system availability

One hundred and ninety-three (59.6%) of 324 respondents
Ninety-nine (41.1%) violent incidents occurred once a year and 73 (30.3%) more than once a month. Most (n = 102, 42%) of the offenders were patients, followed by relatives of patients (n = 75, 31%). The majority (n = 197, 82%) of the offenders were aged 21–45 years and 41 (17%) were ≥ 46 years. Both men and women committed the violent act in 97 (40.25%) cases, men only in 95 (39.42%) and women only in 49 (20.33%). Most (n = 180, 74.7%) of the participants exposed to violence believed that the incident could have been prevented. The violence incident ended with the following consequences for the offenders: none (n = 154, 63.9%), verbal warning (n = 51, 21.2%) and reported to the police (n = 16, 6.6%). The consequences for HCWs were: none (n = 112, 46.5%), reduced work performance (n = 107, 44.4%), documented complaint against HCWs (n = 20, 8.3%) and injuries (n = 2, 0.8%). Almost all (n = 41, 91.1%) incidents of physical violence happened without a weapon and 23 (51.1%) were committed by men. Most physical (n = 22, 48.9%) and verbal abuse (n = 55, 43.7%) occurred in the evening. The majority (n = 29, 74.4%) of bullying incidents occurred in the morning and managers were a major source (n = 22, 56.4%) of violent incidents, followed by staff members (n = 14, 35.9%). In 34 (87.2%) of those incidents, no action was taken. Sexual harassment among staff members was the highest (n = 3, 42.9%). Decline in work performance was reported in 20 (44.4%) HCWs who experienced physical violence and in 13 (54.2%) who were subjected to racial harassment.

**Factors associated with workplace violence**

HCWs who experienced violence reported that it was caused by absence of punishment (67%), lack of security (51%), staff shortage (34%), long waiting time for patients (33%), overcrowding (29%), personality type (17%), cultural beliefs (9%), lack of patient privacy (3%) and language barrier (2%). Absence of punishment was the most common cause of verbal abuse (61%), bullying (95%), sexual (71%) and racial (58%) harassment, whereas, lack of security was the most common cause of physical violence (64%).

**History of workplace violence related to characteristics of health-care workers**

Demographic and occupational features of HCWs who did and did not experience violence are shown in Table 3. Sex was significantly associated with violence, with violence being more frequent for men (n = 63, 57.8%) than women (n = 92, 42.8%). Nationality was significantly associated with violence and was more frequent for Saudis (n = 131, 51.8%) than non-Saudis (n = 24, 33.8%). Those who worked with ≤ 10 coworkers (n = 124, 53.4%) reported significantly more frequent violence than those who worked with > 10 coworkers (n = 31, 33.7%). Those who lacked encouragement to report violent acts (n = 79, 60.3%) reported significantly more frequent violence than those who had such encouragement (n = 76, 39.4%). Those who confirmed lack of availability of a system for reporting violence (n = 57, 56.7%) reported significantly more frequent violence than those who confirmed system availability (n = 98, 43.6%).

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**Table 1: Demographic and occupational characteristics of health-care workers in emergency departments**

<table>
<thead>
<tr>
<th>Health-care worker characteristics</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician</td>
<td>63</td>
<td>19</td>
</tr>
<tr>
<td>Nurse</td>
<td>175</td>
<td>54</td>
</tr>
<tr>
<td>Others*</td>
<td>86</td>
<td>27</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>109</td>
<td>33.6</td>
</tr>
<tr>
<td>Female</td>
<td>215</td>
<td>66.4</td>
</tr>
<tr>
<td><strong>Age (yr)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 30</td>
<td>153</td>
<td>47.2</td>
</tr>
<tr>
<td>31–40</td>
<td>136</td>
<td>42</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>35</td>
<td>10.8</td>
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<tr>
<td><strong>Marital status</strong></td>
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<tr>
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<td>69.8</td>
</tr>
<tr>
<td>Unmarried</td>
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<td>30.2</td>
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<tr>
<td><strong>Nationality</strong></td>
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<td></td>
</tr>
<tr>
<td>Saudi</td>
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<td>78.1</td>
</tr>
<tr>
<td>Non-Saudi</td>
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<td>21.9</td>
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<tr>
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<tr>
<td>Bachelor’s</td>
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<td>43.5</td>
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<tr>
<td>Master’s</td>
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<td>37</td>
</tr>
<tr>
<td>Board</td>
<td>8</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Work experience (yr)</strong></td>
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<td></td>
</tr>
<tr>
<td>1–5</td>
<td>126</td>
<td>38.9</td>
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<tr>
<td>6–9</td>
<td>130</td>
<td>40.1</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>68</td>
<td>21</td>
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<tr>
<td><strong>Multiple shifts</strong></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>292</td>
<td>90.1</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>Shift time</strong></td>
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<td></td>
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<tr>
<td>Morning</td>
<td>42</td>
<td>13</td>
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<tr>
<td>Alternate</td>
<td>282</td>
<td>87</td>
</tr>
<tr>
<td><strong>No. of coworkers</strong></td>
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<td></td>
</tr>
<tr>
<td>Mean (standard deviation)</td>
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<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>232</td>
<td>71.6</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>92</td>
<td>28.4</td>
</tr>
</tbody>
</table>

*Pharmacists, technicians and clerical workers.

*Mean age 32.7 (6.2) years.

Medical degree for physicians to receive privileges and to practice medicine in a particular field.

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*stated that they were encouraged to report workplace violence and 31 (40.4%) that they were not encouraged. Two hundred and twenty-five (69.4%) HCWs reported that a system was available for reporting violence and 99 (30.6%) reported no such system.

**Frequency and type of violent incident**

Out of 324 HCWs, 155 (47.8%) had experienced at least 1 type of violent incident during the preceding 12 months. Among 241 incidents, 126 (52%) were verbal abuse, 45 (19%) physical violence, 39 (16%) bullying, 24 (10%) racial harassment and 7 (3%) sexual harassment (Table 2). Ninety-five (39.4%) violent incidents happened in the morning and the same number in the evening. Almost all (n = 232, 96.3%) of the violent incidents occurred in the workplace. Ninety-nine (41.1%) violent incidents occurred once a year.
Table 2 Characteristics and types of workplace violence among health-care workers in emergency departments

<table>
<thead>
<tr>
<th>Characteristics and types of violence</th>
<th>Physical</th>
<th>Verbal</th>
<th>Bullying</th>
<th>Sexual</th>
<th>Racial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Shift time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>10</td>
<td>22.2</td>
<td>42</td>
<td>33.3</td>
<td>29</td>
<td>74.4</td>
</tr>
<tr>
<td>Evening</td>
<td>22</td>
<td>48.9</td>
<td>55</td>
<td>43.7</td>
<td>6</td>
<td>15.4</td>
</tr>
<tr>
<td>Night</td>
<td>13</td>
<td>28.9</td>
<td>29</td>
<td>23</td>
<td>4</td>
<td>10.3</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside</td>
<td>40</td>
<td>88.9</td>
<td>123</td>
<td>97.6</td>
<td>38</td>
<td>97.4</td>
</tr>
<tr>
<td>Outside</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.8</td>
<td>1</td>
<td>2.6</td>
</tr>
<tr>
<td>Both</td>
<td>5</td>
<td>11.1</td>
<td>2</td>
<td>1.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Frequency*</td>
<td></td>
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<tr>
<td>Once a year</td>
<td>24</td>
<td>53.3</td>
<td>39</td>
<td>31</td>
<td>21</td>
<td>53.8</td>
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<td>Once a month</td>
<td>14</td>
<td>31.1</td>
<td>39</td>
<td>31</td>
<td>9</td>
<td>23.1</td>
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<td>More than once per month</td>
<td>7</td>
<td>15.6</td>
<td>48</td>
<td>38</td>
<td>9</td>
<td>23.1</td>
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<td>Offender identity</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Patient / client</td>
<td>24</td>
<td>53.3</td>
<td>65</td>
<td>51.6</td>
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<td>Relatives</td>
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<td>39.6</td>
<td>48</td>
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<td>Staff member</td>
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<td>4</td>
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<td>Management</td>
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<td>External colleague</td>
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<td>General public</td>
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<td>6.7</td>
<td>6</td>
<td>4.8</td>
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<tr>
<td>Offender age</td>
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</tr>
<tr>
<td>20–24 years</td>
<td>42</td>
<td>93.3</td>
<td>100</td>
<td>79.4</td>
<td>30</td>
<td>76.9</td>
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<tr>
<td>≥ 46 years</td>
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<td>6.7</td>
<td>23</td>
<td>18.3</td>
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<td>23.1</td>
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<td>23</td>
<td>51.1</td>
<td>40</td>
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<td>46.2</td>
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<td>Female</td>
<td>7</td>
<td>15.6</td>
<td>24</td>
<td>19</td>
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<td>28.2</td>
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<td>33.3</td>
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<td>49</td>
<td>10</td>
<td>25.6</td>
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<td>91</td>
<td>72.2</td>
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<tr>
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<td>27.8</td>
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<td></td>
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<td>5.1</td>
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<td>8.9</td>
<td>10</td>
<td>7.9</td>
<td>3</td>
<td>7.7</td>
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<td>16</td>
<td>35.6</td>
<td>61</td>
<td>48.4</td>
<td>20</td>
<td>51.3</td>
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<td>Reduce work performance</td>
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<td>44.4</td>
<td>54</td>
<td>42.9</td>
<td>18</td>
<td>46.2</td>
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<td>Injured</td>
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</tr>
</tbody>
</table>

*Percentage calculated from HCWs that could have been subjected to > 1 incidence of violence.

1 Physicians, nurses, pharmacists, technicians and clerical workers.
2 HCW = health care worker.

Type of workplace violence related to characteristics of health-care workers

Men (n = 22, 20.2%) experienced significantly more physical violence than women did (n = 23, 10.7%) (Table 4). Men (n = 51, 46.8%) also had significantly more verbal abuse than women had (n = 75, 34.9%). Violence was significantly more frequent for unmarried (n = 5, 5.1%) than married (n = 2, 0.9%) HCWs. Saudi HCWs (n = 106, 41.9%) experienced verbal abuse significantly more often than non-Saudis did (n = 20, 28.2%). Physical violence was significantly more frequent in HCWs with < 10 coworkers (n = 38, 16.4%) than in those with > 10 coworkers (n = 7, 7.6%). Verbal abuse was also significantly more frequent in HCWs with < 10 coworkers (n = 101, 43.5%) than in those with > 10 coworkers (n = 25, 27.2%). HCWs who lacked encouragement to report violent incidents reported significantly more verbal abuse (n = 65, 49.6%) than those who had encouragement (n = 61, 31.6%). Similarly, HCWs who lacked encouragement to report violence reported significantly more bullying (n = 23, 17.6%) than those who had encouragement (n = 16, 8.3%). In contrast, demographic and occupational characteristics, such as age, occupation, shift time, direct contact with patient, and patient types, were not significantly associated with general or specific types of violence.
Logistic regression analysis of workplace violence

After entering sex, nationality, number of coworkers, lack of report encouragement and system availability into the regression model, the only independent variables significantly associated with general violence were lack of report encouragement and Saudi nationality (Table 5). For physical violence, the only significant independent factor was male sex. Lack of report encouragement was the only variable that remained significantly associated with verbal abuse and bullying.

Discussion

The main aim of this study was to estimate the prevalence of workplace violence in a sample of 324 participants working in EDs in 4 public hospitals in Dammam, Saudi Arabia. The study showed that the prevalence of violence among HCWs was 47.8%, which was considerably lower than 89.3% in nurses in the EDs in 3 public hospitals in Saudi Arabia (15). However, our result was closer to the prevalence of 57.5% in HCWs in 2 government hospitals and 10 primary healthcare centres in Saudi Arabia who experienced at least 1 violence incident (22), and similar to the prevalence of 45.6% among HCWs in 12 family medical centres in Riyadh (2).

Most studies have shown that psychological violence (especially verbal abuse) was higher than physical violence (15,21,26). The number of incidents of verbal abuse was approximately 5-fold that of the number of incidents of physical violence among nurses in several EDs in Jordan (10), which can be explained by the stress of acute illness experienced by patients and/or families at the time of the violent act. In the current study, verbal abuse formed 52% of the violent incidents, physical violence 19%, bullying 16%, racial harassment 10% and sexual harassment was the least common (3%). Similarly, a study in Macau revealed incidents of verbal abuse (53.4%), physical assault (16.1%), bullying (14.2%), sexual harassment (4.6%) and racial harassment (2.6%) among physicians and nurses (24). Verbal abuse was the most common form of violence because it was easy to perpetuate and could not be controlled by any sort of security measures. The

Table 3 History of workplace violence related to characteristics of health-care workers in emergency departments

<table>
<thead>
<tr>
<th>Health-care worker characteristics</th>
<th>History of exposure to violence</th>
<th>Total n = 324</th>
<th>c2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>63</td>
<td>57.8</td>
<td>46</td>
<td>42.2</td>
</tr>
<tr>
<td>Female</td>
<td>92</td>
<td>42.8</td>
<td>123</td>
<td>57.2</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>155</td>
<td>48.2</td>
<td>169</td>
<td>51.8</td>
</tr>
<tr>
<td>Age group, yr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 30</td>
<td>70</td>
<td>45.8</td>
<td>83</td>
<td>54.2</td>
</tr>
<tr>
<td>31–40</td>
<td>71</td>
<td>52.2</td>
<td>65</td>
<td>47.8</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>14</td>
<td>40</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>109</td>
<td>48.2</td>
<td>117</td>
<td>51.8</td>
</tr>
<tr>
<td>Unmarried</td>
<td>46</td>
<td>46.9</td>
<td>52</td>
<td>53.1</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi</td>
<td>131</td>
<td>51.8</td>
<td>122</td>
<td>48.2</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>24</td>
<td>33.8</td>
<td>47</td>
<td>66.2</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Physician</td>
<td>34</td>
<td>54</td>
<td>29</td>
<td>46</td>
</tr>
<tr>
<td>Nurse</td>
<td>84</td>
<td>48</td>
<td>91</td>
<td>52</td>
</tr>
<tr>
<td>Others</td>
<td>37</td>
<td>43</td>
<td>49</td>
<td>57</td>
</tr>
<tr>
<td>Shift time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>17</td>
<td>40.5</td>
<td>25</td>
<td>59.5</td>
</tr>
<tr>
<td>Alternate</td>
<td>138</td>
<td>48.9</td>
<td>144</td>
<td>51.1</td>
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<tr>
<td>No. of coworkers</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>124</td>
<td>53.4</td>
<td>108</td>
<td>46.6</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>31</td>
<td>33.7</td>
<td>61</td>
<td>66.3</td>
</tr>
<tr>
<td>Report encouragement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>76</td>
<td>39.4</td>
<td>117</td>
<td>60.6</td>
</tr>
<tr>
<td>No</td>
<td>79</td>
<td>60.3</td>
<td>52</td>
<td>39.7</td>
</tr>
<tr>
<td>System availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>98</td>
<td>43.6</td>
<td>127</td>
<td>56.4</td>
</tr>
<tr>
<td>No</td>
<td>57</td>
<td>57.6</td>
<td>42</td>
<td>42.4</td>
</tr>
</tbody>
</table>

SD = standard deviation.
majority (74.4%) of bullying incidents occurred in the morning and managers were a major source (56.7%) of incidents followed by staff members (35.9%), which is often explained by the presence of most managerial staff in the morning. Moreover, interprofessional violence may have played a role in these incidents.

Most of the workplace violence was experienced by Saudi nationals, which is explained mainly by the high number of Saudi participants in the study. The majority of offenders were patients (42%) followed by their relatives (31%), which was similar to some previous studies (2,15,20,26) but contrary to others (1,14,23), in which the companions of the patients were the main offenders. The fact that patients were the major aggressors in the current study could be explained by the absence of deterrent action (63.9%) towards violent incidents as supported by management in the workplaces, following the rule “the patient is always right”.

Workplace violence had negative consequences on HCWs, such as reduced work performance (44.4%), complaints against HCWs (8.3%) and injuries (0.8%), which is supported by previous studies (1,2,18,19). Reduced work performance could be explained by feeling unsafe, anger, anxiety or distress or performing duties in an unprofessional way. Some previous studies suggested that the reasons for violence in EDs were staff shortage, absence of punishment, lack of security, and long waiting times for patients. Certain characteristics of HCWs, including age, sex, years of experience and marital status, have been associated with increased workplace violence (27,28). In the current study, the frequency of physical violence was high among men (20.2%) and sexual harassment was high among unmarried HCWs (5.1%).

More than half of violent incidents (66.7%) were not reported and the main reason was the feeling that reporting was useless. This could be related to the existing system that includes reporting the incident to a supervisor, duty director, or the police. Most HCWs (n = 57, 57.6%) exposed to workplace violence questioned the availability of a violence reporting system. Moreover, the majority (75.9%) raised queries about the efficiency of the security measures applied in EDs of the studied hospitals. Our results could be explained by lack of awareness of the reporting systems and inefficient security measures. Hogarth et al. (29) noted that the solution agreed upon by HCWs to decrease workplace violence was encouragement by management to report violent incidents and to develop preventative measures.

The current study is one of few to cover all types of violence (physical and psychological, including verbal threats, bullying, and sexual and racial harassment) and used the standard WHO definition of violence.

---

**Table 4** Type of workplace violence related to characteristics of health-care workers in emergency departments

<table>
<thead>
<tr>
<th>Health-care worker characteristics</th>
<th>Physical</th>
<th>Verbal</th>
<th>Bullying</th>
<th>Sexual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>20.2</td>
<td>87</td>
<td>79.8</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
<td>10.7</td>
<td>192</td>
<td>89.3</td>
</tr>
<tr>
<td><strong>No. of coworkers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>38</td>
<td>16.4</td>
<td>194</td>
<td>83.6</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>7</td>
<td>7.6</td>
<td>85</td>
<td>92.4</td>
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<tr>
<td><strong>Nationality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi</td>
<td>106</td>
<td>41.9</td>
<td>147</td>
<td>58.1</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>20</td>
<td>28.2</td>
<td>51</td>
<td>71.8</td>
</tr>
<tr>
<td><strong>No. of coworkers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>101</td>
<td>43.5</td>
<td>131</td>
<td>56.5</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>25</td>
<td>27.2</td>
<td>67</td>
<td>72.8</td>
</tr>
<tr>
<td><strong>Report encouragement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>61</td>
<td>31.6</td>
<td>132</td>
<td>68.4</td>
</tr>
<tr>
<td>No</td>
<td>65</td>
<td>49.6</td>
<td>86</td>
<td>50.4</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>2</td>
<td>0.9</td>
<td>224</td>
<td>99.1</td>
</tr>
<tr>
<td>Unmarried</td>
<td>5</td>
<td>5.1</td>
<td>93</td>
<td>94.9</td>
</tr>
</tbody>
</table>

SD = standard deviation.
Additionally, all HCWs in EDs of public hospitals were targeted. However, limitations cannot be excluded. The size of the sample may limit generalization of the results. The questionnaire was self-administered and recall bias could not be excluded, as in most similar surveys.

**Conclusions and recommendations**

In this study, workplace violence was prevalent among HCWs, and verbal abuse was the commonest type. The most important associated factor was absence of punishment, which was agreed upon by the majority of HCWs. Creation of an environment that encourages HCWs to report violent incidents and raising awareness of HCWs about violence reporting systems in EDs are recommended. Ensuring the reporting of all violent incidents and follow-up of the appropriate actions are essential. Supporting programmes to help and provide HCWs with the knowledge to manage and control incidents are needed.

**Funding:** None.

**Competing interests:** None declared.

### Table 5 Logistic regression analysis of workplace violence using significantly associated characteristics of health-care workers in emergency departments

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>Wald test</th>
<th>df</th>
<th>Sig</th>
<th>Exp(B)</th>
<th>95% CI for Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi nationality</td>
<td>1.015</td>
<td>0.438</td>
<td>5.375</td>
<td>1</td>
<td>0.020</td>
<td>2.759</td>
<td>1.170 – 6.507</td>
</tr>
<tr>
<td>Lack of report encouragement</td>
<td>-0.915</td>
<td>0.375</td>
<td>5.945</td>
<td>1</td>
<td>0.015</td>
<td>2.497</td>
<td>1.197 – 5.209</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.351</td>
<td>0.723</td>
<td>0.236</td>
<td>1</td>
<td>0.627</td>
<td>0.704</td>
<td></td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male sex</td>
<td>1.045</td>
<td>0.485</td>
<td>4.612</td>
<td>1</td>
<td>0.031</td>
<td>2.842</td>
<td>1.098 – 7.358</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.380</td>
<td>0.331</td>
<td>51.824</td>
<td>1</td>
<td>&lt; 0.001</td>
<td>0.093</td>
<td></td>
</tr>
<tr>
<td><strong>Verbal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of report encouragement</td>
<td>0.887</td>
<td>0.425</td>
<td>4.350</td>
<td>1</td>
<td>0.037</td>
<td>2.428</td>
<td>1.055 – 5.589</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.260</td>
<td>0.595</td>
<td>14.448</td>
<td>1</td>
<td>&lt; 0.001</td>
<td>0.104</td>
<td></td>
</tr>
<tr>
<td><strong>Bullying</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of report encouragement</td>
<td>0.857</td>
<td>0.348</td>
<td>6.074</td>
<td>1</td>
<td>0.014</td>
<td>2.356</td>
<td>1.192 – 4.657</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.260</td>
<td>0.570</td>
<td>32.676</td>
<td>1</td>
<td>&lt; 0.001</td>
<td>0.038</td>
<td></td>
</tr>
</tbody>
</table>

*df = degrees of freedom; SE = standard error; Sig = significance.*

---

**Violence au travail chez les agents de santé œuvrant dans les services d’urgence des hôpitaux publics de Dammam, en Arabie saoudite**

**Résumé**

**Contexte :** La violence est un grave problème de santé au travail. Les agents de santé des services d’urgence sont particulièrement susceptibles d’être exposés à la violence et d’en subir les conséquences négatives sur le plan personnel.

**Objectifs :** La présente étude visait à estimer la prévalence de la violence au travail et des facteurs qui y sont potentiellement associés chez les agents de santé œuvrant dans les services d’urgence des hôpitaux publics de Dammam, en Arabie saoudite.

**Méthodes :** Une étude transversale a été menée d’août à octobre 2018 dans quatre services d’urgence d’hôpitaux publics relevant du ministère saoudien de la Santé. Les données ont été recueillies au moyen de questionnaires auto-administrés.

**Résultats :** Sur les 380 questionnaires distribués, 324 ont été renvoyés (taux de réponse de 85 %). Près des deux tiers des participants étaient des femmes (66,4 %) et plus de la moitié (54 %) étaient des infirmières. Au total, 155 agents de santé (47,8 %) ont subi au moins un type de violence au cours des 12 mois précédents. Sur l’ensemble des faits de violence signalés, 52 % étaient des violences verbales et 19 % des violences physiques. Le harcèlement sexuel (3 %) était le type de violence le moins fréquent. Le manque d’encouragement à signaler les actes de violence et la nationalité saoudienne étaient les seules variables significatives associées à la violence sur le lieu de travail.

**Conclusions :** La violence sur le lieu de travail est répandue. Les violences verbales sont les plus fréquemment rapportées par les agents de santé œuvrant dans les services d’urgence des hôpitaux saoudiens. Pour améliorer la sécurité sur le lieu de travail, il est important d’encourager les agents de santé à signaler les faits de violence et de leur faire connaître les mécanismes qui leur permettent de le faire.
References


Access to health care for patients with thalassaemia in Greece: a cross-sectional study

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Abstract

Background: The prevalence and clinical burden of beta-thalassaemia in Greece is high. Little information is available on the unmet needs of patients with beta-thalassaemia and barriers to access to care.

Aims: This study investigated barriers that patients with transfusion-dependent beta-thalassaemia in Greece face when accessing care and the associations between socioeconomic factors and access to care.

Methods: A cross-sectional study was conducted between November 2018 and January 2019. The sample consisted of 116 beta-thalassaemia patient-members of two Panhellenic patient associations for people with thalassaemia. All respondents were transfusion-dependent. The survey customized and used the Patient Access Partnership 5As of access tool to measure participants’ access to health care services (subscales: accessibility, adequacy, affordability, appropriateness and availability). Data on their socioeconomic characteristics were also recorded. The association between the total score of each subscale and patient characteristics was examined using the Mann–Whitney or Kruskal–Wallis tests.

Results: Respondents considered inpatient services less adequate and appropriate, and outpatient services and laboratory tests less affordable. Outpatient services were also perceived as less available. Participants’ income was statistically significantly associated with all the subscales except accessibility, and rural residence was significantly associated with all five subscales.

Conclusion: Barriers in access to health care among beta-thalassaemia patients receiving transfusions still persist, especially for those who live far from transfusion centres and have lower incomes. It is important to understand and map current unmet medical and social needs of beta-thalassaemia patients in Greece, in order to design and implement a targeted health policy that can measurably improve patients’ lives.

Keywords: beta-thalassaemia, transfusion, health services accessibility, socioeconomic factors, Greece

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Introduction

Management of beta-thalassaemia major includes regular blood transfusions and iron chelation therapy to manage iron overload in the body (1,2). Allogeneic haematopoietic stem cell transplantation is the only definitive cure for transfusion-dependent young patients before the development of iron-related tissue damage (3). New therapies are currently in development for the treatment of anaemia and iron overload based on the correction of the pathophysiological mechanisms of the disease (4).

In Greece, the mean prevalence of beta-thalassaemia is estimated at 7.4%. Its distribution is very uneven and frequencies as high as 15% have been reported in certain geographic areas (5). For example, in Halkidiki, of 3931 hospitalized patients screened for haemoglobinopathies, 10.8% were identified as heterozygotes for beta-thalassaemia (6). Equally, molecular analysis of 199 unrelated patients in south-western Greece confirmed distinct distribution patterns of specific mutations of the HBB gene in the Achaia and Ilia prefectures (7).

According to the National Registry for Haemoglobinopathies in Greece, among 4032 patients registered, the peak distribution among thalassaemia major patients is the 36–45-year-old age group (8). The prognosis for transfusion-dependent beta-thalassaemia patients in Greece has changed with transfusions and chelation therapy, from being fatal in early childhood to becoming a chronic disorder with prolonged survival (9).

Despite regular transfusion and chelation therapy, patients with thalassaemia have an increased mortality rate compared with the general population (10). Heart disease is the most common cause of death, accounting for 51.0% of total deaths in patients with thalassaemia between 2000 and 2010 and 28.1% between 2010 and 2015 (8,11). The age of death from heart disease was higher after 2005 than before 2005 (8).

Amid the economic crisis in Greece, reduced resources have had a negative impact on access to health care services mostly due to increases in demand, waiting times and co-payments and the decreased ability to pay for informal payments (12). As ability to pay declines,
access to care becomes a critical issue, particularly for low-income and vulnerable groups (13). A series of previous studies investigated the impact of decreased ability to pay, due to the economic crisis, in several patient groups, such as patients with rheumatoid arthritis (14), multiple sclerosis (15) and cancer (16). These studies confirmed that most patients had considerable difficulty in accessing medication, with the most common barriers to treatment being low income, geographical distance from a physician, long waiting lists and a complicated prescription process, in combination with the low availability of medicines in the national health service hospitals. Inequalities in access were also evident in intravenous drug users, diagnosed with hepatitis C virus (17).

Given these findings, and considering the high prevalence and clinical burden of beta-thalassaemia in Greece, the high cost of blood in the country (18,19) and current blood shortages (20,21), we aimed to assess barriers in access to health care services among patients with transfusion-dependent thalassaemia in Greece.

Methods

Study design

We conducted a descriptive, observational cross-sectional study. Data were collected during a 3-month period, between November 2018 and January 2019.

Study population and procedures

Our study sample consisted of beta-thalassaemia patients, who were members of two thalassaemia patient associations, the Greek Thalassaemia Federation, which is an umbrella organisation for all thalassaemia patient associations, and the Panhellenic Association for Patients with Thalassaemia which is the largest thalassaemia patient association in the country. The health care system in Greece is centralized and patient associations are mostly located in Athens, but their members live all over the country (22); therefore, our sample can be considered a national sample.

We used purposive sampling (23) to select study participants, as people with beta-thalassaemia are a special treatment group. We sent an email to the president of the board of directors of each association along with the study’s protocol and instrument for approval. Both patient associations agreed to participate in the study. Each patient association sent a participation invitation, an informed consent form, information on the study and a link to the questionnaire to its members. The email clearly stated that patients not currently undergoing transfusion were not eligible to participate. All members aged 18 and over, who were diagnosed with beta-thalassaemia and were transfusion-dependent at the time of the study were eligible to participate.

200 emails were sent out. 46 responses were excluded from the analysis as non-eligible to participate. 38 did not respond. 116 completed the questionnaire in full (estimated response rate 75.3%).

Data collection tool

A questionnaire with the following subsections was developed.

- Participant characteristics: This section recorded anonymized data on the sociodemographic (sex, age, education and marital status) and socioeconomic characteristics (source of income, self-evaluation of financial status and profession) of the participants and their health insurance.
- 5As questionnaire to assess access: We customized and used the Patient Access Partnership 5As framework for measuring access to health care services (24) as a composite tool to measure all elements of access to services related to transfusion (accessibility, adequacy, affordability, appropriateness and availability) among our transfusion-dependent beta-thalassaemia participants.

We defined the transfusion burden as the sum of the burden on the patient and his/her family of each of the following six types of health care services related to having transfusions: (i) transfusion (the actual process), (ii) general health services (outpatient), (iii) general health services (inpatient), (iv) medications (prescription), (v) medications (dispensing) and (vi) laboratory tests. We evaluated each of these elements against the 5As. All items are rated on 5-point Likert scale ranging from 0 (not at all) to 4 (very).

Two bilingual translators translated the scale from English to Greek and back-translated to ensure that the Greek version was equivalent to the original English questionnaire. The questionnaire was then piloted in 30 patients for content and linguistic clarity. The results of the pilot study and the content validity of the questionnaire were evaluated by a group of experts. Patients who participated in the pilot phase were excluded from the final analysis.

Statistical analysis

We calculated the Cronbach alpha for each of the five subscales (accessibility, adequacy, affordability, appropriateness and availability) to assess internal consistency. As all continuous variables were not normally distributed, we calculated the medians and interquartile range (IQR). We used the Kolmogorov–Smirnov criterion to check for normality as well as graphical representation. For categorical variables (sex, residence, educational level, age, marital status, income, profession, source of income, health insurance status and self-evaluation of financial status), we calculated absolute and relative frequencies. We examined the association between the total score of each subscale and patient characteristics in a univariate analysis using the Mann–Whitney U test or Kruskal–Wallis test with Dunn pairwise tests adjusted using Bonferroni correction.

Ethical considerations

The study was approved by the institutional board of each participating patient association (Greek Thalassaemia
Results

Patient characteristics

Table 1 shows the characteristics of the respondents: most were women (51.7%), were between 36 and 50 years old (53.4%) and lived in urban areas (82.7%). Over half (69.0%) held a tertiary education degree. Just over 70% had a monthly income of between 501 and 1500 euros (€), 36.2% thought that their economic status was bad or very bad, i.e. they faced financial challenges, and 95.7% were covered by social insurance, while 4.3% received welfare benefits, which in Greece grant free access to expensive pharmaceutical and hospital care. Due to the sufficiency of coverage, 96.6% did not have a complementary private insurance plan.

5 As questionnaire

The reliability for each subscale was good. The Cronbach alpha was 0.858, 0.870, 0.905, 0.908 and 0.918 for the subscales of accessibility, adequacy, affordability, appropriateness and availability, respectively. Kolmogorov–Smirnov normality tests were statistically significant for all subscales.

Table 2 shows the total mean and median scores for the 5A subscales and the scores per questionnaire item. The adequacy subscale had the lowest median score (14.0, IQR = 6), followed by availability (16.0, IQR = 7) and appropriateness (16.5, IQR = 6) (Table 2). The highest median scores were for accessibility (17, IQR = 7) and affordability (17, IQR = 8).

Availability subscale

Overall, respondents were not faced with overwhelming barriers to accessing health care services in relation to their transfusion. All items in the accessibility subscale had a median score equal to 3.

Adequacy subscale

Inpatient health services were rated as less adequate by responders (median 2, IQR = 2) whereas all other health services provided in relation to a transfusion had a median adequacy score of more than 3.

Affordability subscale

Outpatient health care services and laboratory tests in relation to transfusions were a substantial financial burden on patients and their families (median 2, IQR = 1). Higher median scores were reported for all other items of the subscale.

 Appropriateness subscale

Inpatient health care services also ranked low in the appropriateness subscale (median 2, IQR = 1), indicating that participants were concerned about the suitability of the inpatient health services they received. All other health care services had higher scores in this subscale.

Association between subscale scores and patient characteristics

Correlations between responses and respondent sociodemographic characteristics (Table 3) identified low income and living in rural areas as the main barriers to access to health care services for transfusion-dependent patients. These characteristics were associated with lower scores in almost all subscales.

Participants living in rural areas had significantly lower scores in accessibility (Mann–Whitney U = 468.0, P = 0.014), adequacy (U = 490.5, P = 0.036), affordability U = 519.5, P = 0.011), appropriateness (U = 398.0, P = 0.005) and availability (U = 449.0, P = 0.012) compared with those living in urban areas.

Furthermore, participants with low incomes had statistically lower scores for adequacy (χ² = 9.0, P = 0.029) affordability (χ² = 19.61, P ≤ 0.001) appropriateness (χ² = 17.70, P ≤ 0.001) and availability (χ² = 9.14, P = 0.027) subscales, the association between the total score of the accessibility subscale and income (χ² = 5.80, P = 0.122) was statistically significantly.

Pairwise comparison indicated that patients with an income of € 1001–1500 a month were less satisfied with the adequacy of the services compared with those with an income of more than € 1500 (P = 0.028). Moreover, patients in the lowest income category (€ ≤ 500) had significantly lower scores in the appropriateness subscale compared with those in the second income category (€ 501–1000, P = 0.027) or in the highest income category (€ ≥ 1501, P ≤ 0.001). Patients in the highest monthly income category had statistically significant higher scores in the affordability subscale compared with those with a monthly income of ≤ € 500 (P ≤ 0.001), € 501–1000 (P ≤ 0.001) or € 1001–1500 (P = 0.007). Participants in the highest income category also had better overall score in the availability subscale compared with those with an income of ≤ € 500 (P = 0.013) or € 501–1000 (P = 0.048).

On the other hand, participants who self-evaluated their financial situation as very bad/bad scored higher on the affordability subscale than those who evaluated their financial situation as very good/good or average; this difference was marginally statistically significant (χ² = 5.66, P = 0.059).

Discussion

We investigated barriers that patients with beta-thalassaemia in Greece may face in accessing the care they require as well as associations between socioeconomic
factors and access to care. Correlations between responses and respondent characteristics identified low income and living in rural areas as the main barriers to access. Respondents with these characteristics scored lower in almost all questionnaire subscales.

Our findings confirm that respondents are not faced with overwhelming barriers when accessing the transfusion centre or the hospital. However, responses range from being extremely close to home or public transportation to having to use three different means of travel to access the centre. However, accessing outpatient services seems to be harder for more patients, who stated that they incurred additional costs to access private physicians, particularly out of hours. Barriers to accessing pharmaceutical care comes mostly from the fact that in Greece, all medications for an associated condition have to be prescribed by a specialist outside the transfusion unit and this results in additional expense.

Table 1  Sociodemographic and economic characteristics of the sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
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<td><strong>Sex</strong></td>
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<tr>
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<tr>
<td>Female</td>
<td>60 (51.7)</td>
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</tr>
<tr>
<td>26–35</td>
<td>10 (8.6)</td>
</tr>
<tr>
<td>36–50</td>
<td>62 (53.4)</td>
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<tr>
<td>51–65</td>
<td>39 (33.6)</td>
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<tr>
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<td>5 (4.3)</td>
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</tr>
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<td>19 (17.3)</td>
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<tr>
<td>Urban</td>
<td>92 (82.7)</td>
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</tr>
<tr>
<td>Secondary</td>
<td>23 (19.8)</td>
</tr>
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<td>Tertiary</td>
<td>80 (69.0)</td>
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<td>60 (51.7)</td>
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<tr>
<td>Divorced</td>
<td>16 (13.8)</td>
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<td>111 (95.7)</td>
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<tr>
<td><strong>Private insurance</strong></td>
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<tr>
<td>Yes</td>
<td>112 (96.6)</td>
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<td>16 (14.2)</td>
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<tr>
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<td>42 (37.2)</td>
</tr>
<tr>
<td>1,001–1,500</td>
<td>39 (34.5)</td>
</tr>
<tr>
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<td>16 (14.2)</td>
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<td><strong>Source of income</strong></td>
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<tr>
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<td>35 (31.3)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>11 (9.8)</td>
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<tr>
<td>Pension</td>
<td>66 (58.9)</td>
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<tr>
<td><strong>Self-evaluation of financial status</strong></td>
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</tr>
<tr>
<td>Very good/Good</td>
<td>25 (21.6)</td>
</tr>
<tr>
<td>Fair</td>
<td>49 (42.2)</td>
</tr>
<tr>
<td>Bad/Very bad</td>
<td>42 (36.2)</td>
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<tr>
<td><strong>Profession</strong></td>
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<tr>
<td>Agricultural, fishery worker</td>
<td>1 (0.9)</td>
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<tr>
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<td>4 (3.7)</td>
</tr>
<tr>
<td>Shop and market sales worker</td>
<td>4 (3.7)</td>
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<tr>
<td>Clerk</td>
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<tr>
<td>Administrative, executive or managerial worker</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>Scientist, self-employed, technical assistant</td>
<td>21 (19.3)</td>
</tr>
<tr>
<td>Not working or seeking work for first time</td>
<td>55 (49.5)</td>
</tr>
</tbody>
</table>
and time. Respondents were also faced with challenges in accessing laboratory test services and were required to carefully plan the day and time of their visit to ensure access.

The situation is somewhat different when it comes to adequacy of services in the transfusion centre. Responders considered the care they receive somewhat adequate; most of the concerns centred around the
Table 3: Associations between participant characteristics and subscale total scores

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Median (IQR)</th>
<th>P-value</th>
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<tr>
<td><strong>Accessibility</strong></td>
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<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
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</tr>
<tr>
<td>Male</td>
<td>17.00 (6.00)</td>
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</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
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<tr>
<td>Urban</td>
<td>17.00 (6.00)</td>
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<td>Education</td>
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<td>Secondary</td>
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<td>Tertiary</td>
<td>17.50 (7.00)</td>
<td></td>
</tr>
<tr>
<td>Age group (years)</td>
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<td></td>
</tr>
<tr>
<td>26–35</td>
<td>13.50 (6.75)</td>
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</tr>
<tr>
<td>36–50</td>
<td>17.00 (7.00)</td>
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</tr>
<tr>
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<tr>
<td>Income (€)</td>
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</tr>
<tr>
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<td>14.50 (6.00)</td>
<td>0.122</td>
</tr>
<tr>
<td>501–1000</td>
<td>16.50 (5.25)</td>
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</tr>
<tr>
<td>1001–1500</td>
<td>15.00 (6.00)</td>
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<tr>
<td>≥ 1501</td>
<td>18.50 (4.00)</td>
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<tr>
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<td>Age group (years)</td>
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Table 3  Associations between participant characteristics and subscale total scores (continued)

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<th>Subscale</th>
<th>Median (IQR)</th>
<th>P-value</th>
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<td><strong>Income (€)</strong></td>
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<td>≥ 1501</td>
<td>17.00 (5.75)</td>
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<tr>
<td>Average</td>
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<td><strong>Appropriateness</strong></td>
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<tr>
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Table 3 Associations between participant characteristics and subscale total scores (concluded)

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<th>Subscale</th>
<th>Median (IQR)</th>
<th>P-value</th>
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<tr>
<td><strong>Age group (years)</strong></td>
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</tr>
<tr>
<td>36–50</td>
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<td>17.00 (6.00)</td>
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</tr>
<tr>
<td>Divorced</td>
<td>16.00 (6.00)</td>
<td></td>
</tr>
<tr>
<td><strong>Income (€)</strong></td>
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<td></td>
</tr>
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<td>12.00 (7.00)</td>
<td>&lt; 0.001</td>
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<td>501–1000</td>
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<tr>
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<tr>
<td>≥ 1501</td>
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</tr>
<tr>
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<td>18.00 (5.00)</td>
<td></td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Male</td>
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<tr>
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<tr>
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<tr>
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<td>18.50 (4.50)</td>
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<td><strong>Self-evaluation of financial status</strong></td>
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<td>Average</td>
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</tr>
<tr>
<td>Very bad/Bad</td>
<td>16.00 (7.50)</td>
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</tbody>
</table>

IQR = interquartile range.
condition of the blood they receive (particularly if it is fresh or not). Adequacy scores of outpatient and inpatient care were similar. Most problems came from the fact that patients had to carefully plan the time and date of their visit. On the other hand, pharmaceutical care was considered more adequate. Once a prescription is issued, patients feel that they receive adequate care at the point of dispensing.

Access is also largely free at the point of delivery. This is especially true in the transfusion centre and inpatient hospital services, although not as much when it comes to outpatient and laboratory test services, which was reflected on total affordability scores. Equally, even though all thalassaemia-related therapies in Greece are dispensed at a 0% copayment rate, patients thought that accessing pharmaceutical care placed a disproportionate burden on their or their family’s finances.

Despite their long-standing relationship with their physicians and staff at the transfusion centre, patients still felt that the care they receive might not be appropriate and looked for additional information or services elsewhere. In addition, the scores for the appropriateness of inpatient hospital services were low. This possibly comes from the fear that patients are under-transfused because of blood shortages, which is a serious challenge affecting blood transfusions in Greece (20). Patients appear to be happier with outpatient services. This may be largely explained by the fact that they can select their own outpatient care provider, most of the times at a fee paid out of pocket, so they have greater freedom of choice. Equally, responders considered their pharmaceutical care appropriate to a lesser or greater extent.

Responses to the composite measure of availability are important as they may be used to cross-validate responses to other sections of the survey. Lower availability scores in the transfusion centres and in inpatient and outpatient services were mostly due to the long waiting times and the need for careful planning to access those services. Respondents found pharmaceutical care and laboratory tests more available.

While data are limited on access to treatment among thalassaemia patients in Greece, our findings confirm a previous qualitative survey that highlighted barriers in access to pharmaceutical care and diagnostic tests, primarily due to cost (25).

Our findings are also in accordance with previous studies on barriers to access to health care for other chronic diseases, such as rheumatoid arthritis (14), multiple sclerosis (15) and cancer (16), which identified socioeconomic status and distance from urban centres as key contributors to barriers to access. Inequalities in health care were also reported among vulnerable patient subgroups, such as intravenous drug users (17).

To our knowledge, this is the first study that assesses levels of and barriers to access to health care services among patients with transfusion-dependent beta-thalassemia in Greece and elsewhere. Our study was conducted by email, therefore, patients with no registered email with their patient association could not participate. This may have introduced sampling bias as it is likely that elderly patients with no access to the Internet or no computer skills were not able to participate.

The limited literature on the unmet needs of patients with thalassaemia in Greece may indicate that the widespread availability of oral chelators has reduced the pressure on payers, providers and patients to further advance treatment. Current treatment options are mainly limited to blood transfusion and oral chelation. Research is needed on new treatment pathways, including possibly new treatments, to minimize transfusion burden in the first place.

As advances in the management of beta-thalassaemia are being made, it is important to understand, map and agree on the transfusion burden of patients with beta-thalassaemia in Greece and elsewhere to realign health policies to deliver measurable improvement in the lives of patients.

Acknowledgement

We thank the Greek Thalassaemia Federation and the Panhellenic Association for Patients with Thalassaemia that responded to our call for this research and particularly their members, who shared their perspective and experience with us.

Funding: This work was supported by an unrestricted research grant from the biopharmaceutical company, Celgene (grant number: 3422389/11.04.2018). The funding body had no role in the design of the study, data collection and analysis, interpretation of the data and in writing the manuscript.

Competing interests: None declared.
Accès aux soins de santé pour les patients thalassémiques en Grèce : étude transversale

Résumé

Contexte : La prévalence et la charge clinique de la bêta-thalassémie en Grèce sont élevées. Peu d'informations sont disponibles sur les besoins non satisfaits des patients atteints de bêta-thalassémie et les obstacles à l'accès aux soins.

Objectifs : La présente étude avait pour objectif d'examiner les obstacles auxquels les patients grecs atteints de bêta-thalassémie dépendante des transfusions sont confrontés lors de l'accès aux soins, ainsi que les associations entre les facteurs socio-économiques et l'accès aux soins.

Méthodes : Une étude transversale a été menée entre novembre 2018 et janvier 2019. L'échantillon comprenait 116 patients atteints de bêta-thalassémie membres de deux associations de patients panhelléniques pour les personnes atteintes de thalassémie. Tous les répondants étaient dépendants des transfusions. L'enquête a personnelisé et utilisé l'outil Patient Access Partnership 5As of access pour mesurer l'accès des participants aux services de soins de santé (sous-échelles : accessibilité, adéquation, accessibilité économique, pertinence et disponibilité). Des données sur leurs caractéristiques socio-économiques ont également été enregistrées. Le lien entre le score total à chaque sous-échelle et les caractéristiques des patients a été examiné à l'aide des tests de Mann-Whitney ou de Kruskal-Wallis.

Résultats : Les répondants considéraient que les services de soins hospitaliers étaient moins adéquats et appropriés et que les services ambulatoires et les analyses en laboratoire étaient plus coûteux. Les services ambulatoires sont également perçus comme moins disponibles. Le revenu des participants était significativement associé à toutes les sous-échelles sauf l'accessibilité, et la vie en milieu rural était fortement liée aux cinq sous-échelles.

Conclusions : Les obstacles à l'accès aux soins de santé parmi les patients atteints de bêta-thalassémie qui reçoivent des transfusions persistent, en particulier pour ceux qui vivent loin des centres de transfusion et ont des revenus plus faibles. Il est important de comprendre et de recenser les besoins médicaux et sociaux non satisfaits des patients atteints de bêta-thalassémie en Grèce au moment de l'étude, afin de concevoir et de mettre en œuvre une politique de santé ciblée permettant d'améliorer sensiblement la vie des patients.
References


Factors affecting hookah tobacco smoking among females in the Islamic Republic of Iran: a qualitative study

Mohammad Bazrafshan,1 Amir Mansouri,1 Hamed Delam,1 Behnam Masmouei4 and Nasrin Shokrpour5

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Abstract

Background: The prevalence of hookah smoking in the Islamic Republic of Iran is increasing among females, especially in the southern cities.

Aims: The aim of this study was to investigate the factors influencing hookah tobacco smoking among females in the Islamic Republic of Iran.

Methods: In this qualitative study, 52 females who use hookah were selected (25–71 years old) from the cities of Evaz and Gerash and were interviewed. The participants were selected using purposive sampling and the data were gathered using semi-structured interviews. Data analysis was performed using the conventional approach of qualitative content analysis.

Results: Most participants were aged between 25 and 35 years old and 55.8% were married. Three main themes were identified from the qualitative data including: personal factors, family factors and social factors.

Conclusions: The findings of this study indicate that the reasons for hookah smoking were based on complex interactions between individual, family, and social factors. In order to successfully reduce hookah smoking in females it is necessary to consider an approach that uses these social factors.

Keywords: Smoking, hookah, qualitative research, addiction, Iran

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Background

Tobacco use is one of the leading causes of death, illness and poverty globally. It has been estimated that there are more than 1.3 billion smokers worldwide, of which 82% live in low- and middle-income countries (1). There are various types of tobacco products such as cigarettes, cigars, bidi, pipes and hookah (2). Much attention has been focused on cigarette smoking but many people, especially in low- and middle-income regions, smoke tobacco using hookah (3). Known as ‘ghalyan’ in the Islamic Republic of Iran (4), hookah has a historical and cultural origin (5,6). Studies have shown that hookah is more socially acceptable than cigarette smoking and is considered less harmful and addictive (7).

Using tobacco has increased among females of whom many are unaware of the gender-specific health risks associated with tobacco use including cervical cancer, osteoporosis, poor pregnancy outcomes, and early menopause (8,9). In the Islamic Republic of Iran one of the health and social concerns is the increasing consumption of hookah smoking among females. The results of the National Survey of Risk Factors of Non-Communicable Diseases in showed that more than half of female tobacco smokers used hookah (10). Currently, most tobacco smoking studies in the Islamic Republic of Iran have focused on cigarette smoking, with only a few studies conducted on hookah smoking among males and females, and were primarily quantitative rather than qualitative (11-13).

In a study conducted by Baheiraei et al. four main themes were extracted from the qualitative data, including positive attitudes towards hookah smoking, social and family facilitators, and psychosocial needs (14). In a study by Sakineh Dadipoor (15) the themes of climate-related association or erroneous beliefs was deduced. Thus, a variety of themes have been extracted from a number of qualitative studies attempting to examine the causes of women’s tendency to smoke tobacco, especially hookah. Due to the high rate of tobacco use and its health risks and the apparent importance of hookah smoking among females, a qualitative study was deemed to be the best approach to research this area.

Methods

In this study a qualitative content analysis approach with a conventional qualitative content analysis method was used. Coded classes were extracted directly and inductively from the raw data without formatting the preconceived categories or theoretical views (16). The samples in this study were female current hookah smokers. Inclusion criteria were the subjects’ willingness to participate in the study, residents of the cities of Evaz and Gerash,
familiarity with the Farsi language, and ability to share their experiences about the reasons for hookah smoking. Participants were excluded if they were reluctant to continue participation in the study.

The method of data collection was the use of semi-structured interviews between July and September 2019. Interviews began with an explanation of the purpose of the research for the participants, followed by the general open-ended question, “Can you talk about your first experience of hookah smoking?” This was followed by more focused questions on specific issues. If needed, the researcher used exploratory questions such as, “Can you explain more?” or “Can you give an example?” The form and order of the questions were flexible in response to participants’ replies. At the end of each interview, the interviewer asked the participants to discuss other important issues that were not addressed during the interview. The time and place of the interview were determined after completing the consent form. With the consent of the participants, audio recordings and field notes were used to enhance the accuracy of the data collection. Interviews were conducted with a researcher.

The mean duration of each interview for participants was approximately 45 minutes. The data collection was finalized after researchers reached saturation. After 47 interviews were conducted, further interviews did not have any extra information to offer.

To analyze the data, researchers first recorded each interview followed by verbatim transcription that was entered into MAXQDA 10 software. Each text was broken down into meaning units, which were grouped together. Finally, based on the content and similarities, the main classes were formed using subcategories. Lincoln and Guba’s criteria (2007) were used to improve the accuracy and rigour of the findings. After extensive processing of data collection and analysis, a selection of representative samples were checked for accuracy by qualitative research experts, and the initial codes were checked by contributors to increase the credibility of the data in this study.

Ethical considerations

This study was approved by Larestan University of Medical Sciences Ethics Committee (IR.LARUMS.REC.1398.012).

Results

Fifty-two interviews were undertaken with female hookah smokers, mean age was 44.53 ± 12.86 years. Through data analysis, 39 subcategories and 3 main categories including personal factors, family factors, and social factors were extracted from the data.

Personal factors

Some participants considered the imitation of other people as an effective draw to hookah smoking. A 58-year-old woman said, “Others smoke hookah, I also smoke hookah”.

Some participants considered following others as role-models an effective draw to smoking hookah. A 35-year-old woman said, “my aunt had great presence when she smoked a hookah and command over others. I like to be like my aunt”.

Believing hookah smoking to be harmless, and even to have healing effects. A 57-year-old woman said, “Many people smoked hookah and lived to 70 and 80 years and more. Even our elderly drank water from the vase of hookah for abdominal pain or they rub its ashes into the throat of a person with a cold”.

Dependence on hookah smoking. A 42-year-old woman said, “I just know that if I don’t smoke, I have a bad mood, and I feel better when I smoke”.

Individuality and attention-seeking were also reasons for smoking hookah. A 39-year-old woman said, “I would like to show off. Hookah is one way to show that I’m fearless”.

Curiosity and seeking new experiences. A 47-year-old woman said, “It was interesting for me to experience hookah”.

Craving during pregnancy. A 41-year-old woman said, “I had pica during my pregnancy. I found smoking hookah calmed me down. Gradually I became a hookah smoker”.

Lack of negative attitudes toward hookah. A 26-year-old woman said, “Hookah didn’t affect my health and appearance”.

Reducing discomfort and pain. A 40-year-old woman said, “When I’m worried I smoking hookah to give me peace”.

Rebellion and feminist sympathies. A 45-year-old woman said, “Why can men do anything but women cannot? They use hookah and do other things. At least I can smoke hookah”.

The aspects of fun and pleasure of hookah smoking were another factor factors. A 28-year-old woman said: “When I smoke a hookah, it gives me pleasure and joy. Hookah really entertains me and it is a pleasure means for me”.

A feeling of loneliness was one of the personal factors.

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A 64-year-old woman said: "My husband has gone to work in the Gulf countries. I am alone. The hookah is a friend for me".

The temptation for hookah smoking in the encounter with hookah smokers was one of the personal factors. A 48-year-old woman said: "When I am in a group of people who smoke hookah I also like to do so. I cannot control it".

Having a mental illness. A 49-year-old woman said, "The doctor said I am depressed, I think hookah makes me feel better".

Preferring flavoured tobacco. A 29-year-old woman said, "There is flavoured tobacco that most young people prefer to use. It is attractive".

Being single and later age of marriage. A 44-year-old woman said, "A married woman is busy with home life but I do not have these concerns. For me, hookah smoking is a pretext to being in a family".

Belief that they can quit hookah smoking. A 33-year-old woman said, "Hookah does not cause addiction. Little effort is needed to quit smoking hookah".

Low education level. A 46-year-old woman said, "Illiteracy makes us not understand what doctors and books say about the dangers of hookah".

**Family factors**

Marital problems and family conflicts. A 31-year-old woman said, "I have problems with my husband. I do not have a family. The price of the ticket for the swimming pool is small. There is no appropriate place for women to have fun in the city. A 43-year-old woman said, "There is no opposition to hookah smoking in public places – approval of hookah smoking among women - hookah smoking as a form of social protection for women - Impact of media - peer pressure"

A 59-year-old woman said, "Hookah as a household item - traditional view of the role of women in society - easy access to hookah paraphernalia - availability of online hookah stores - existence of places for hookah smoking - lack of appropriate recreational facilities for women - poverty - Lack of attention to anti-smoking laws - affordable hookah prices - possibility of hookah smoking in public places – approval of hookah smoking among women - hookah smoking as a form of social protection for women - Impact of media - peer pressure"

**Themes**

<table>
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<th>Subthemes</th>
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<td>Personal factors</td>
<td>Imitation - role-modeling - believing hookah smoking to be harmless - dependence on hookah smoking - exhibitionism - curiosity - craving during pregnancy - positive attitude towards hookah – relaxation and discomfort alleviation - rebellion - pleasure - loneliness - temptation - mental illness - preferring flavoured tobacco - being single and higher age of marriage - illiteracy and low education level</td>
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<td>Family factors</td>
<td>Marital problems - family conflicts - responsibility for the preparation of hookah - pretext for family gatherings and meeting friends - strict household smoking restrictions - Lack of adequate control and awareness from the family - hookah smoking by family members - gender bias</td>
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<tr>
<td>Social factors</td>
<td>Hookah as a household item - traditional view of the role of women in society - easy access to hookah paraphernalia - availability of online hookah stores - existence of places for hookah smoking - lack of appropriate recreational facilities for women - poverty - Lack of attention to anti-smoking laws - affordable hookah prices - possibility of hookah smoking in public places – approval of hookah smoking among women - hookah smoking as a form of social protection for women - Impact of media - peer pressure</td>
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**Research article**

A 64-year-old woman said: "My husband has gone to work in the Gulf countries. I am alone. The hookah is a friend for me".

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**Family factors**

Marital problems and family conflicts. A 31-year-old woman said, "I have problems with my husband. I smoke hookah to keep calm". A 30-year-old woman said, "I have a disagreement with my husband, so I smoke hookah".

Responsibility for the preparation of the hookah. A 55-year-old woman said: "I remember I was responsible for preparing hookah. I gradually became a hookah smoker".

Hookah smoking was a pretext for family gatherings and meeting friends. A 42-year-old woman said, "I think hookah can bring people together and keep them friendly".

Strict household smoking restrictions (lack of) were instrumental in women smoking hookah. A 28-year-old woman said, "My father who died was not someone who seriously prevented me from smoking hookah".

Lack of sufficient control and familial awareness. A 50-year-old woman said, "My family thought it was normal. They didn’t even talk about its dangers. They didn’t even know about them".

Hookah smoking by family members. A 49-year-old woman said, "Both my parents smoke hookah. Well, like them, I started smoking hookah".

Gender-bias. A 66-year-old woman said, "My parents just wanted to put the girls into housekeeping. Hookah smoking was a kind of protest against this discrimination".

**Social factors**

The traditional view of the role of women. A 31-year-old woman said, "Women in small towns often have to stay at home. I’m bored at home. My fun is hookah".

The availability of hookah as a household item. A 59-year-old woman said, "There is at least one hookah in every home, if they have guests, they serve them hookah".

Accessibility and ease of purchase of hookah. A 71-year-old woman said, "From past to now, it was easy to buy hookah and tobacco".

Some coffee shops or traditional restaurants offer hookah. A 40-years-old woman said, "hookah is essential in tea and coffee houses".

Availability of online hookah stores. A 28-year-old woman said, "You can just go to an online store and order hookah".

The lack of appropriate recreational facilities for women in the city. A 43-year-old woman said, "The city is small. There is no appropriate place for women to have fun".

Poverty. A 36-year-old woman said, "I do not have a wealthy family. The price of the ticket for the swimming pool is high, but hookah is inexpensive".

The freedom to smoke hookah publically. A 55-year-old woman said, "Anyone who wants to smoke hookah can do so anywhere, for example, in the park".

The lack of attention to laws prohibiting smoking in public places. A 53-year-old woman said, "There is a legal ban on tobacco smoking in workplaces and other public spaces, but it is just a slogan".

Approval of hookah smoking among females. A 46-year-old woman said, "There is no opposition to hookah smoking for women".

Believing that hookah smoking by a woman at home...
would help protect her from exposure to risks outside the home. A 63-year-old woman said, “It is better for a woman to stay at home and smoke hookah instead of going out and engage in immoral activities”.

The Impact of media on hookah smoking. A 56-year-old woman said, “Hookah smoking was shown in movies. We watched these movies and were impressed”.

The influence of peer groups on hookah smoking. A 25-year-old woman said, “In friends gatherings if they smoke hookah and offer it to me I have no choice”.

Discussion

Personal domain

In the findings of this study 17 codes were observed, which have the highest multiplicity. One participant reported role-modeling in the draw to hookah use. Other studies have shown that imitating others can trigger or encourage continuing cigar smoking (18,19). However, this finding has not been reported in hookah studies. This difference may be due to the fact that smoking cigars/ cigarettes is easier to do in public whereas hookah is a tool that requires a seated environment. Another finding of this study was the use of hookah for self-expression, which was also reported by Baheiraei et al. (20), but Anbarlooi et al. showed that there was a significant relationship between smoking and high school students’ self-esteem, yet this relationship was not indicated for hookah smoking (21). However, participants in the present study stated that hookah use is a factor for individuality and self-expression; Mahmoodabad et al. (22) indicated that there was a significant relationship between tobacco use, including hookah, and self-esteem and identity.

In this study it was found a major reasons for using hookah was curiosity, which was supported by Gentzke et al. (23) whereby 14.6% of people who had never used tobacco and 45.9% of those who always use tobacco were curious about hookah, and this finding is consistent with those of the present study. In this study, temptation is also mentioned as one of the reasons for using hookah; this finding was also indicated in a study by Jelhooni who examined the causes of hookah use in students (24).

Another personal finding of this study on hookah use was the lack of a negative view of the effects of hookah use on the body, which may have been due to declining levels of knowledge and awareness. It was also observed in a study in the United States of America that most hookah users did not have a high level of literacy (25).

A study of 270 students in Serbia found that the most common reason for students to use hookah was to create a sense of tranquility (26). This finding was also indicated in the present study where participants stated that one of the reasons for using hookah was to induce a feeling of calm and reduce discomfort and pain. Another study conducted on male high school students stated that the reasons for smoking hookah were the need to feel calm and reduce stress (27), but Grinberg’s study showed that people who use hookah had a greater perception of pain than non-users, but this was not significant (28).

In the present study the perception of loneliness was indicated as a draw to hookah smoking and supported by other studies that also indicate hookah use is higher among single people and widows (29); this finding could confirm that loneliness as well as being single can lead to hookah use. Reducing discomfort was another reason for the use of hookah, which has been confirmed in several studies (30,31).

Breaking the norms of gender roles and feminist tendencies have been cited as one of the reasons for the use of hookah, which equates to equality with men, but this finding has not been observed in other studies. In addition, one of the reasons for using hookah was association with mental illness, which has been confirmed in various studies (32,33); however, no such finding was found in Goodwin et al. (34), who found that there was no significant relationship between hookah use and mental illness and stress, but there was a significant relationship between cigarette use and mental illness.

Another reason indicated for the increase in the use of hookah is the appeal of flavoured tobacco, which was also found in American society (35). This type of tobacco is more popular among women of childbearing age, and if this category of tobacco is banned then the use of hookah could be reduced (36). One of the reasons found for using hookah in this study was Pica during pregnancy, but was not found in the Kahr et al. study, which found that women considered cigarettes less dangerous than hookah during pregnancy. However, in another study it was observed that women preferred flavoured tobacco hookah during pregnancy such as menthol, believing that it is good for the health of the mother and fetus (37,38).

Family domain

In the family domain 8 subthemes were extracted and dominated by the factor of imitation. As shown in the Bashirian et al. study, adolescents who have family members using hookah are also more likely to use hookah (27). In addition, other studies have observed that an important factor influencing addiction was inhalation of second-hand smoke (39). In a study conducted in 2016, more than 20,000 young people in the United States found that most people who used hookah frequently lived with an addicted hookah smoker (40).

Considering that hookah smoking is frequently seen as integral to family and friends gatherings, a qualitative study by Baheiraei et al. which looked at the prevalence of hookah use in women, supported the current study finding that hookah preparation was a factor in hookah smoking addiction. It was also observed that husbands and wives played an important role in women’s addiction to hookah, suggesting that education about the risks should also be aimed at the family level (5).

Hookah smoking is also suggested as a cause of family relationship problems, which is in line with the Bhat et al. study (41). However, another study looked at it from a different approach and reported that the observed causes of problems in family and marital relationships due to hookah smoking is the resultant prevalence of bad breath.
Familial disapproval of smoking cigarettes was also observed as a reason for smoking hookah. In this regard, a study reported that disapproval of women smoking cigarettes was prevalent in the Iranian population, but less disapproval of smoking hookah, which is consistent with the results of the present study (43).

Other factors influencing the draw to hookah smoking among women include reduced supervision and control by the family. This finding was also observed in the Farideh et al. study, which reported children who were of a low socioeconomic and educational level were more exposed to tobacco smoking (44).

**Social domain**

In the social domain 13 codes were extracted. A primary reason observed for using hookah was the lack of entertainment for women, which supports studies indicating that the draw to smoking hookah in young females was its entertainment and social interaction value (45). These findings are in line with the results of the present study highlighting the lack of appropriate recreational facilities for women in the social domain (46). In a qualitative study on 37 Swedish adolescents, reasons for using hookah were meeting friends, being accepted by a group, or using hookah as a criterion for admission into a group. Moreover, participants did not have a negative concerning hookah smoking (47), and related studies have indicated that there was a strong link between hookah use and having friends who are addicted to hookah or smoking cigarettes (48).

Not viewing hookah smoking as harmful has been observed in various studies (46,49) as well as ease of access due to moderate pricing as important reasons for addiction (46,50) and the lack of any legal restriction to the use of hookah (51). Poverty was also found to be a cause for hookah addiction and supported by the Salloum et al. study (52), which indicated that lack of legal controls over access to hookah is a contributing factor to addiction (51,53).

In a qualitative study published in 2019 (54), the tendency of individuals to use hookah was divided into three areas: attitude, mental norm, and receiving controlling behaviours. These three areas included 9 subcategories, and the results of this study showed that in hookah addiction, people maintained a positive attitude towards hookah and consider it harmless when compared to cigarettes, and is considered a suitable substitute. In addition, acceptance in the community and availability were mentioned in the social domain, which is in line with the findings of the present study. However, the current study differed in the manner of classifying the factors influencing hookah addiction.

Another study conducted in Fasa in 2015 (24) examined students’ knowledge and attitudes toward hookah use, which observed that more than 80% of students who held intentions to give it up for health reasons, yet continued to use it. This underlies the belief that hookah smoking was not addictive, but rather its use could reduce anxiety. This observation is included in the personal domain of the current study.

One finding in the current study remains unique, which is the view that hookah smoking can protect women from high-risk behaviours and addiction to more dangerous substances outside the home. This finding is consistent with Weina Qu et al. (55), which showed how stress can increase risk taking and aggressive behaviour.

The existence of centres outside home for hookah use was also observed as a contributing factor to hookah addiction among women; in contrast, a study found that hookah use was the most common behaviour within the home for users in the United States (40). Another study in Iraq found that hookah was mostly used in coffee shops (56) while in the Islamic Republic of Iran, the use of hookah in traditional restaurants is common (57), thus there are cultural dimensions to this phenomenon. Finally, an important reason for using hookah is the power of the media, which has been confirmed in a number of studies, promoting the use of hookah significantly (58,59).

**Conclusion**

One of the strengths of this study is the qualitative extraction of various factors shown to influence the behaviour and attitudes of women towards hookah smoking. These factors were classified into three themes: personal, family and social. These factors were considered from several perspectives, including childhood and adolescence, such as exposure to preparation of hookah at home or having parents smoking hookah, as well as experiencing loneliness in adulthood. Despite the psychological contributing factors, such as mental illness, physical aspects are also prevalent such as Pica during pregnancy. Some factors are also related to the individual, such as curiosity or exhibitionism, as well as social ignorance of the harm of hookah smoking. The role of society also manifests itself in factors such as the lack of appropriate recreational facilities for women, or poverty. Certain factors transcend local or national borders such as the media, while current legislation fails to exert sufficient control of access to hookah.

A sense of gender equality has encouraged some women to take up hookah smoking, while at the same time there is an opinion that hookah smoking among women prevents them from being exposed or tempted by inappropriate behaviours beyond the control of the family. The reasons are numerous and indicate that influences behind women taking up hookah smoking are individual and not necessarily predictable. Qualitative studies such as the present study draw data directly from women themselves, making it possible to plan and take appropriate measures on an individual, family and social.
العوامل المؤثّرة في تدخين تبغ الشيشة بين الإناث في جمهورية إيران الإسلامية: دراسة نوعيّة

محمد بذرافشان، أمير المنصوري، حامد دلام، بهنام مسموعی، نسرين شكریور

الخلاصة

يتزايد معدل انتشار تدخين الشيشة في جمهورية إيران الإسلامية بين الإناث، لا سيّما في المدن الجنوبية. هدفت هذه الدراسة إلى استقصاء العوامل التي تؤثّر على تدخين تبغ الشيشة بين الإناث في جمهورية إيران الإسلامية.

الأهداف:

- من مدينتي إيفاز وجيراش، وأُجريَت مقابلات معهن. واختيرت المشاركات عن طريق أخذ عيّنات هادفة، وجمعت البيانات بمقابلات شبه منظّمة. وحلّلت البيانات بالنهج التقليدي لتحليل المحتوى النوعي.

النتائج:

- تراوحت أعمار معظم المشاركات بين 25 و35 عامًا، وكان 55.8% منهن متزوجات. وحُدّدت ثلاثة مواضيع رئيسية من البيانات النوعيّة: العوامل الشخصية، والعوامل العائلية، والعوامل الاجتماعية.

الاستنتاجات:

- تشير نتائج الدراسة إلى أن أنسب تدخين الشيشة اعتمد على تفاعلات معقدة بين العوامل الفردية والأسرية والاجتماعية. ويستلزم النجاح في الحدّ من تدخين الشيشة لدى الإناث التفكير في نهج يستخدم هذه العوامل الاجتماعية.

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References


19. Luhulima R. The imitation of smoking behavior during real life and digital interaction. Faculty of Social and Behavioural Sciences, Utrech University 2012.


Eating disorders among Jordanian adolescents with and without dysglycaemia: a comparative study

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Abstract

Background: Studies on eating disorders among Jordanian adolescents have reported variable prevalence rates of 12–40%.

Aims: This study aimed to determine the prevalence of eating disorders among Jordanian adolescents with and without dysglycaemia and determine the associated factors.

Methods: A comparative cross-sectional study was conducted during the period November 2017–February 2018. The Eating Disorder Diagnostic Scale was used to assess the presence of different types of eating disorders, including anorexia nervosa, bulimia nervosa and binge eating disorder. A typical anorexia nervosa and purging disorder were considered “other eating disorders” in this study.

Results: This study included 497 patients with dysglycaemia and 504 age-matched nondysglycaemic participants. Patients with dysglycaemia had a significantly higher prevalence of binge eating disorders compared with nondysglycaemic participants (11.9% vs 5.8%, P < 0.001). In dysglycaemia group, adolescents who were aged ≥ 14 years were more likely to have bulimia nervosa compared with those < 14 years old. Patients with a sedentary lifestyle were less likely to have bulimia nervosa and binge eating disorders. In the nondysglycaemic group, those aged 14–18 years were more likely to have other eating disorders. Those with dysglycaemia were more likely to have binge eating disorders than those in the nondysglycaemic group (OR = 2.1, 95% CI: 1.3–3.3; P = 0.002) after adjusting for possible confounders.

Conclusions: Adolescents with dysglycaemia had higher prevalence of eating disorders compared with their nondysglycaemic peers. Screening for eating disorders is recommended among adolescents to secure early detection and subsequent intervention.

Introduction

Eating disorders (EDs) are psychiatric conditions characterized by severe disturbances in eating behaviour that result in significant psychosocial impairment and, in some cases, increased mortality in some types (1,2). These conditions have significant health effects on people with diabetes. Many studies have been conducted to determine the association between EDs and type 1 diabetes mellitus (T1DM) and have reported that diabetes is a risk factor (3–5). Eating disorders have been shown to be more frequent in adolescents with diabetes compared with nondiabetic adolescents (6,7). A 2013 meta-analysis showed that EDs were more common in adolescents with T1DM (7.0%) compared with their adolescents with no diabetes (2.8%) (8). Previous research has shown that EDs are more than twice as common in young females with T1DM compared with their nondiabetic peers (9).

The Diagnostic and statistical manual of mental disorders (DSM) specifies a number of diagnoses under “Feeding and eating disorders”, including anorexia nervosa (AN), which is characterized by restriction of energy intake relative to requirements, leading to significantly low body weight, and bulimia nervosa (BN), which involves binging followed by purging to prevent weight gain. In 2013, the DSM also officially recognized binge eating disorder (BED) as a distinct eating disorder characterized by the ingestion of too much food in a short time (10).

Adolescents with diabetes are at higher risk of eating disturbances and consequently of higher rates of disease complications; EDs among adolescents with TIDM are associated with poor diabetes control and higher rates of diabetes complications, including ketoacidosis and hospitalization (11).

Studies on EDs among adolescents in the Eastern Mediterranean Region are limited in number and also limited to healthy adolescents. In Egypt, El-Bakry et al. reported that 34.7% of adolescent patients with T1DM have disordered eating behaviours (12). In Jordan, studies on EDs were limited to healthy female adolescents; these reported variable prevalence rates between 12% and 40% (13–15). The prevalence of EDs among Jordanian adolescents with T1DM is unknown; knowing the prevalence is important to help care providers make decisions on screening activities and management. Therefore, this study aimed to determine the prevalence of EDs among Jordanian adolescents with and without
dysglycaemia and to determine their associated factors.

**Methods**

**Design and participants**

This cross-sectional comparative study included 497 (172 males and 325 females) patients aged 10–24 years with dysglycaemia (T1DM and pre-DM) who attended the National Center for Diabetes, Endocrinology and Genetics and Jordan University Hospital in Amman from November 2017 to February 2018, and 504 (175 males and 329 females) age-matched nondysglycaemic control participants randomly selected from government schools and universities.

This study was reviewed and approved by the research ethics committee at the National Center for Diabetes, Endocrinology and Genetics. The ethical aspects of the present study are covered in the Declaration of Helsinki.

**Inclusion and exclusion criteria**

Only adolescents aged 10–24 years were included in this study. The dysglycaemic group included patients diagnosed with T1DM or pre-DM. Participants were diagnosed as having prediabetes if they had impaired fasting blood glucose (fasting blood glucose 100–125mg/dL) and/or impaired glucose tolerance (blood glucose 140–199 mg/dL 2 hours after a 75-g oral glucose tolerance test). The exclusion criteria were: having hypothyroidism, Cushing’s syndrome, Addison’s disease, growth hormone deficiency, receiving growth hormone therapy and pregnancy.

**Sample size**

The sample size was calculated based on the most recent estimate of ED prevalence rate (14). Assuming that prevalence of ED is 12%, the minimum sample size needed to estimate the prevalence within a margin of error of 5% at a level of significance of 5% and power of 80% was estimated as 163 in each group. The sample size was increased in both groups to have a higher power.

**The study tool**

A questionnaire was designed to collect demographic and lifestyle data including age, sex, education level, employment, physical activity level, and duration of dysglycaemia when present. The diagnostic instrument for EDs was the Eating Disorder Diagnostic Scale, a 22-item self-report questionnaire that evaluates the presence of 3 EDs: AN, BN and BED, based on the criteria of the DSM-IV (16). The scale is composed of a combination of Likert scores, dichotomous scores and frequency scores. The questions explored the person’s feelings toward his or her appearance and having incidents of eating with a loss of control and how he/she felt after overeating. The estimated time for completing the questionnaire was 30 minutes.

In addition, the questionnaire included questions about the person’s experiences of fasting, skipping at least 2 meals, making themselves vomit, and using laxatives or diuretics or being engaged in more intense exercise to prevent weight gain. There were also questions about how much body image problems impact the subject’s relationships and friendships with others. The final questions were about the patient’s current weight, height, sex and age.

Atypical AN and purging disorder were considered “other EDs”. The Eating Disorder Diagnostic Scale has been translated into Arabic and validated by a study done at the National Center for Diabetes, Endocrinology and Genetics in 2010 (17). Cronbach’s alpha was 0.80, which is considered acceptable.

**Anthropometric measures**

Height was recorded to the nearest 0.5 cm using a stadiometer, with the subject in a standing position and without shoes. Body weight was recorded to the nearest 0.1 kg using a calibrated scale. The nondysglycaemic participants’ weight and height were measured at their schools or universities. Body mass index (BMI) was calculated using the standard formula: weight (kg)/height (m)² and classified into severe thinness, underweight, normal weight, overweight and obese. Participants younger than 19 years of age were classified according to the WHO growth charts 2007.

**Metabolic control**

The choice of treatment for those with T1DM was insulin plus metformin or insulin alone, whereas pre-DM patients were treated with metformin. Metabolic control was assessed by HbA1c levels, measured using the Bio-Rad VARIANT II TURBO HbA1c Kit-2.0 (Bio-Rad, Hercules, California), which utilizes the principles of ion-exchange high-performance liquid chromatography.

**Statistical analysis**

Analyses were conducted using SPSS, version 21.0. Continuous variables were described using means and standard deviations and categorical variables were described using percentages. The chi-squared test was used to compare percentages. Multiple binary logistic regression analysis was conducted to determine factors associated with EDs and to determine the association between dysglycaemia and EDs. P-value < 0.05 was considered statistically significant.

**Results**

**Participants’ characteristics**

The dysglycaemic group included 497 participants (65.4% females and 34.6% males) with a mean age of 16.7 years. The nondysglycaemia group included 504 participants (65.3% females and 34.7% males) with a mean age of 16.6 years (Table 1). Of those with dysglycaemia, 45.9% had T1DM and 54.1% had pre-DM. The mean BMI was higher in the dysglycaemic group compared with the nondysglycaemia group (25.0 vs 21.2 kg/m², P < 0.001). Just over a quarter of the dysglycaemia group and around 6% of the nondysglycaemia group were obese. The mean HbA1c was 8.6% in the dysglycaemia group.
Prevalence of eating disorders

Those with dysglycaemia showed a higher prevalence of BED compared with those who did not have nondysglycaemia (11.9% vs 5.8%, \(P < 0.001\)) (Table 2). However, there were no significant differences in the prevalence of BN and other EDs between the 2 groups.

Table 3 shows the prevalence of EDs in both groups according to the participants’ characteristics. For the nondysglycaemia group, BED was significantly more prevalent among females and the other EDs were less common among those who were 14–18 years old. In the dysglycemic group, the prevalence was higher among older adolescents, females, obese patients, the physically inactive, and patients with pre-DM. Higher BMI, sedentary lifestyle, and pre-DM were statistically significantly associated with BED.

Multiple regression analysis

Table 4 shows the multiple regression analysis of factors associated with different types of EDs. In the dysglycaemia group, adolescents aged ≥14 years were more likely to have BN compared with those < 14 years old. Age was not significantly associated with the other 2 types of ED. Patients who reported having a sedentary lifestyle were less likely to have BN (OR = 0.2, 95% CI: 0.1–0.5; \(P = 0.001\)) and BED (OR = 0.4, 95% CI: 0.2–0.8; \(P = 0.005\)).

In the nondysglycaemia group, participants who were aged 14–18 years were 2.6 times more likely to have other EDs compared with those < 14 years (\(P = 0.014\)). Also in this group, a physical activity was not significantly associated with the 3 different types of ED.

A separate analysis (after adjusting for possible confounders) showed that those with dysglycaemia were 2.1 times more likely to have BED than the nondysglycaemic group (OR = 2.1, 95% CI: 1.3–3.3; \(P = 0.002\)).

Discussion

In this study, we estimated the prevalence of EDs among dysglycaemic and nondysglycaemic adolescents in Jordan. The prevalence of EDs was higher in dysglycaemic
patients compared with nondysglycaemic participants (35.7% vs 25.0%). The EDs identified in this study included BN, BED, and other EDs; no cases of AN were identified in either group. The finding of higher prevalence of EDs among patients with dysglycaemia is consistent with the findings of other studies (4,7,18). Young et al. reported that the prevalence of EDs in adolescents with T1DM was greater compared with their nondiabetic counterparts (7% vs 2.8%) (8). Jones et al. found that EDs were more prevalent in females with diabetes (10%) than in nondiabetic females (4%) (9). Some research has indicated that diabetes is associated with psychosocial difficulties and worries (19). This might explain the higher prevalence of EDs among those without diabetes, especially adolescents and young adults.

In the current study, the most common eating disorder seen in the dysglycaemic patients was BED, which is the most common ED worldwide when compared with AN and BN (20,21). The prevalence of BED in community samples ranges from 2% to 5% (22). We found that patients with dysglycaemia were 2 times more likely to have BED than the nondysglycaemic group. This finding is consistent with previous research (23). Mannucci et al. reported that the prevalence of BED was 4.9% in IDDM, patients and 2.7% in controls (24). d’Emden et al. reported that 17.7% of Australian adolescents with T1DM had BED (25). It was also more common in preteens and early teenage girls with T1DM than in nondiabetic girls (3.0% vs 0.3%) (26). Although EDs can affect individuals of all ages, adolescence represents a peak lifetime period of increased vulnerability for the onset of EDs; BED has 2 peaks of onset, the first at a mean age of 14 years and the second between 19 and 24 years old (27). The age range for the current study was 10–24 years, and the mean age was 16 years, which might explain the reason that BED was the most common ED in this group.

Obesity is known as a risk factor for inappropriate weight control practices, and is therefore a risk factor for

Table 3 Distribution of eating disorders among Jordanian adolescents with dysglycaemia and nondysglycaemia according to demographic characteristics, 2017–2018

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Bulimia nervosa (n = 33) No. (%)</th>
<th>Binge eating disorder (n = 59) No. (%)</th>
<th>Other eating disorders (n = 85) No. (%)</th>
<th>Bulimia nervosa (n = 25) No. (%)</th>
<th>Binge eating disorder (n = 29) No. (%)</th>
<th>Other eating disorders (n = 70) No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt; 14</td>
<td>3 (1.8)</td>
<td>13 (7.8)</td>
<td>30 (18.1)</td>
<td>7 (4.2)</td>
<td>8 (4.8)</td>
<td>25 (15.1)</td>
</tr>
<tr>
<td>14–18</td>
<td>12 (8.0)</td>
<td>22 (14.7)</td>
<td>19 (12.7)</td>
<td>5 (3.3)</td>
<td>5 (3.3)</td>
<td>10 (6.6)</td>
</tr>
<tr>
<td>&gt; 18</td>
<td>18 (9.9)</td>
<td>24 (13.3)</td>
<td>36 (19.9)</td>
<td>13 (7.0)</td>
<td>16 (8.6)</td>
<td>35 (18.8)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.007</td>
<td>0.132</td>
<td>0.204</td>
<td>0.257</td>
<td>0.093</td>
<td>0.005</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (4.1)</td>
<td>19 (11.0)</td>
<td>23 (13.4)</td>
<td>6 (3.4)</td>
<td>3 (1.7)</td>
<td>18 (10.3)</td>
</tr>
<tr>
<td>Female</td>
<td>26 (8.0)</td>
<td>40 (12.3)</td>
<td>62 (19.1)</td>
<td>19 (5.8)</td>
<td>26 (7.9)</td>
<td>52 (15.8)</td>
</tr>
<tr>
<td>P-value</td>
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<td>0.679</td>
<td>0.108</td>
<td>0.248</td>
<td>0.005</td>
<td>0.088</td>
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<tr>
<td>Severe thinness</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (7.1)</td>
<td>1 (7.1)</td>
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</tr>
<tr>
<td>Underweight</td>
<td>0 (0.0)</td>
<td>1 (5.3)</td>
<td>2 (10.5)</td>
<td>0 (0.0)</td>
<td>1 (2.3)</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>Normal</td>
<td>3 (1.6)</td>
<td>18 (9.9)</td>
<td>24 (13.2)</td>
<td>15 (5.0)</td>
<td>15 (5.0)</td>
<td>43 (14.3)</td>
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<tr>
<td>Overweight</td>
<td>12 (7.5)</td>
<td>10 (6.3)</td>
<td>32 (20.0)</td>
<td>7 (6.0)</td>
<td>10 (8.6)</td>
<td>22 (19.0)</td>
</tr>
<tr>
<td>Obese</td>
<td>18 (13.3)</td>
<td>30 (22.2)</td>
<td>27 (20.0)</td>
<td>2 (6.9)</td>
<td>2 (6.9)</td>
<td>4 (13.8)</td>
</tr>
<tr>
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<td>&lt; 0.001</td>
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<td>0.614</td>
<td>0.436</td>
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<td>Physical activity*</td>
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<td></td>
<td></td>
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<tr>
<td>Sedentary</td>
<td>29 (10.2)</td>
<td>44 (15.5)</td>
<td>52 (18.3)</td>
<td>13 (5.6)</td>
<td>13 (5.6)</td>
<td>36 (15.4)</td>
</tr>
<tr>
<td>Active</td>
<td>4 (1.9)</td>
<td>15 (7.0)</td>
<td>33 (15.5)</td>
<td>12 (4.4)</td>
<td>16 (5.9)</td>
<td>34 (12.6)</td>
</tr>
<tr>
<td>P-value</td>
<td>&lt; 0.001</td>
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<td>0.409</td>
<td>0.567</td>
<td>0.359</td>
<td>0.366</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>T1DM</td>
<td>8 (3.6)</td>
<td>19 (8.3)</td>
<td>40 (17.5)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Pre-DM</td>
<td>25 (9.3)</td>
<td>40 (14.9)</td>
<td>45 (16.7)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>P-value</td>
<td>0.010</td>
<td>0.025</td>
<td>0.810</td>
<td>–</td>
<td>–</td>
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</table>

BMI = body mass index; T1DM = type 1 diabetes mellitus; Pre-DM = pre-diabetes mellitus.

*Physical activity was classified according to the International Physical Activity Questionnaire (sedentary: physical activity ≤ 10 continuous minutes per week and up to 150 minutes per week. active: moderate to high activity like walking for ≥ 5 days/week and ≥ 30 minutes per session).
ED. The EDs that have been most frequently studied in obese individuals are BED and BN (28). In our study, obese people with dysglycaemia showed a higher prevalence of BED and BN than overweight, normal weight and underweight participants; about 30% of the dysglycaemic participants who had BED were either overweight or obese.

Several studies have identified factors that increase the risk of developing psychiatric problems that lead to EDs (29,30). These include age, female sex, increased body weight, body image dissatisfaction, history of dieting and history of depression. In the current study, age and physical activity were associated with BN and BED in the dysglycaemic group. Takii et al. reported that individuals with T1DM with an onset between age 7 and 18 years were at significantly higher risk of subsequently developing EDs such as AN or BN than those who were diagnosed before 7 or after 18 years of age (31). The association of age with EDs in this study is in agreement with previous research (9,32); patients older than 18 years were 5 times more likely to have BN than young patients who were less than 14 years old. In the nondysglycaemic group, age was the only factor associated with other EDs such as atypical AN and purging disorders. Participants between 14–18 years old were 2.6 times more likely to have other EDs. Adolescence is a critical period of human development during which several physical and psychological changes occur, and peer influences and the continuous use of social media may increase the risk of developing EDs in this age group.

In the nondysglycaemic group, females were 4 times more likely to have BED compared with males. Studies conducted on BED have shown that girls had a higher risk than boys (33,34). Research in Jordan has also shown that the prevalence of EDs was higher among females compared with males (13,14). Generally, females are very concerned about their weight, and it is somewhat common for adolescent girls to engage in inappropriate weight management such as using laxatives, fasting and vomiting (35). Moreover, females are more likely to report eating-related distress or loss of control because expressing emotions is sometimes more socially accepted and expected from females (36). However, it is also possible that males may not feel distressed or out of control when they overeat.

Physical activity is another risk factor for EDs. Individuals with BED are commonly described as sedentary (37,38). In the current study, dysglycaemic patients who had a sedentary lifestyle had a higher prevalence of BED and BN than patients with an active lifestyle, which might be due to a number of factors, such as psychological and emotional factors, negative body attitude, social support, and the financial cost of the exercise facility. Moreover, participants with a sedentary lifestyle are less likely to develop BED and BN than people with an active lifestyle, which might be due to the fact that people with BED consider exercise a factor that allows them to eat greater quantities of food without getting fat, while people with BN use exercise as a way to overcome excessive food consumption. Individuals with BED have been described as sedentary, whereas the opposite has been the case for those with BN (38).

As a final point, the prevalence of EDs among diabetic patients showed incongruities. Many screening tools have been used to assess the existence of EDs; however, they were used for different age groups and not designed for people who have medical conditions such as diabetes. Thus, these tools might not display the actual

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Bulimia nervosa</th>
<th>P-value</th>
<th>Binge eating disorder</th>
<th>P-value</th>
<th>Other eating disorders</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<td>OR (95% CI)</td>
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<td>OR (95% CI)</td>
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<td><strong>Dysglyaemic group</strong></td>
<td></td>
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<tr>
<td>14–18</td>
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<td>0.018</td>
<td>2.0 (0.9–4.2)</td>
<td>0.060</td>
<td>1.5 (0.8–2.8)</td>
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<tr>
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<td>0.9 (0.6–1.5)</td>
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<tr>
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<td>1.0</td>
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<td>1.0</td>
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</tr>
<tr>
<td>Sedentary</td>
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<td>0.001</td>
<td>0.4 (0.2–0.8)</td>
<td>0.005</td>
<td>1.2 (0.8–2.0)</td>
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<tr>
<td><strong>Non-dysglyaemic group</strong></td>
<td></td>
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<td><strong>Age (years)</strong></td>
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<td>14–18</td>
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<tr>
<td>Active</td>
<td>1.0</td>
<td></td>
<td>1.0</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>0.8 (0.4–1.9)</td>
<td>0.640</td>
<td>1.1 (0.5–2.4)</td>
<td>0.751</td>
<td>1.3 (0.8–2.2)</td>
<td>0.321</td>
</tr>
</tbody>
</table>
estimate of EDs and might lead to a misclassification of eating disorder risks in those with chronic illness. Another limitation of this study is inherent in the cross-sectional design: causality cannot be established using this design. Further studies with the appropriate design are needed to establish the causal link between dysglycaemia and EDs.

**Conclusion**

Adolescents with dysglycaemia showed a higher prevalence of EDs compared with their nondysglycaemic peers even though the diagnosis of EDs in individuals with diabetes is difficult due to the frequent disguise and denial of disordered eating behaviour. Therefore, care providers must pay attention to warning signs such as poor glycaemic control and a refusal to be weighed. Screening is recommended to secure early detection and subsequent intervention.

**Funding:** This study was funded by the National Center for Diabetes, Endocrinology and Genetics, Amman, Jordan.

**Competing interests:** None declared.

**Étude comparative sur les troubles alimentaires chez les adolescents jordaniens avec et sans dysglycémie**

**Résumé**

**Contexte :** Des études sur les troubles alimentaires chez les adolescents jordaniens ont fait état de taux de prévalence variables compris entre 12 et 40 %.

**Objectifs :** La présente étude visait à déterminer la prévalence des troubles alimentaires chez les adolescents jordaniens avec et sans dysglycémie et à déterminer les facteurs qui y sont associés.

**Méthodes :** Une étude transversale comparative a été menée au cours de la période allant de novembre 2017 à février 2018. L'échelle de diagnostic des troubles alimentaires a été utilisée pour évaluer la présence de différents types de troubles alimentaires, notamment l'anorexie mentale, la boulimie et l'hyperphagie boulimique. L'anorexie nerveuse atypique et le trouble de purge ont été considérés en tant « qu’autres troubles alimentaires » dans cette étude.

**Résultats :** Cette étude portait sur 497 patients atteints de dysglycémie et 504 participants sans dysglycémie apparisés selon l'âge. Les patients atteints de dysglycémie présentaient une prévalence significativement plus élevée de troubles de la boulimie par rapport aux participants sans dysglycémie (11,9 % contre 5,8 %, \( p < 0,001 \)). Les adolescents atteints de dysglycémie âgés de 14 ans ou plus étaient plus susceptibles de souffrir de boulimie nerveuse que ceux de moins de 14 ans. Les patients ayant un mode de vie sédentaire étaient moins susceptibles de souffrir de boulimie et d'hyperphagie boulimique. Dans le groupe des sujets non dysglycémiques, la probabilité d’avoir d’autres troubles alimentaires était plus élevée ceux âgés de 14 à 18 ans. Les participants atteints de dysglycémie étaient plus susceptibles d’avoir une hyperphagie boulimique que ceux du groupe non dysglycémique (\( OR = 2,1, IC à 95 % : 1,3-3,3 ; p = 0,002 \)) après ajustement en fonction des facteurs de confusion possibles.

**Conclusions :** Les adolescents atteints de dysglycémie présentaient une prévalence plus élevée de troubles alimentaires par rapport à leurs pairs non atteints de dysglycémie. Le dépistage des troubles alimentaires est recommandé chez les adolescents afin d’assurer une détection précoce et une intervention ultérieure.

اضطرابات الأكل بين المراهقين الأردنيين المصابين بخلل سكر الدم وغير المصابين به: دراسة مقارنة

هدي الحوراني، رنا أبابنة، نهلة خواجة، يوسف خضر، كامل العجلوني

الخلاصة: أفادت الدراسات التي أُجريت على اضطرابات الأكل بين المراهقين الأردنيين أن معدلات الإنتشار المقدرة تتراوح بين 12-40 %.

الهدف: هدفت هذه الدراسة إلى تحديد معدل انتشار اضطرابات الأكل بين المراهقين الأردنيين المصابين بخلل سكر الدم وغير المصابين به، وتحديد العوامل المرتبطة بذلك.

طرق البحث: أجريت دراسة مقطعية مقارنة خلال الفترة من نوفمبر/تشرين الثاني 2017 إلى فبراير/شباط 2018. واستُخدِم مقياس تشخيص اضطرابات الأكل لتحديد وجودة أنواع مختلفة من اضطرابات الأكل، بما فيها فقرة الشهية العصبي، وإظهار العصبي، واضطراب نهم الطعام.

وحصلت الدراسة بعين الاعتبار فقرة الشهية العصبي غير النمطي والاضطراب المتعلق "اضطرابات الأكل الأخرى".

النتائج: شملت هذه الدراسة 497 مريضاً يعانون من خلل سكر الدم و504 مشاركين من العمر نفسه لا يعانون من خلل سكر الدم. وكان معدل انتشار اضطراب نهم الطعام لدى المرضى المصابين بخلل سكر الدم أعلى بكثير مقارنةً بالمشاركين غير المصابين بخلل سكر الدم (11.9% vs 5.8%, \(P<0.001 \)). وفي مجموعة المصابين بخلل سكر الدم، كان المراهقون الذين بلغت أعمارهم 14 سنة أكثر عرضة للإصابة بالنظام العصبي مقارنةً بالمراهقين الذين تقل أعمارهم عن 14 سنة. وكان المرضى الذين يُفجرون نمط حياة يتسم بقلة الحركة أقل عرضة للإصابة بالنظام العصبي
واضطراباتهم مثل الطعام. وفي مجموعة غير المصابين بخلل سكر الدم، كان أولئك الذين تتراوح أعمارهم بين 14–18 سنة أكثر عرضة للإصابة باضطرابات الأكل الأخرى. وكان أولئك الذين يعانون من خلل سكر الدم أكثر عرضة للإصابة باضطرابات مزمنة مع ارتفاع مستويات السكر في الدم من أولئك الذين يتمنون إلى مجموعة غير المصابين بخلل سكر الدم (OR = 2.1; 95% CI = 1.3–3.3; p = 0.002) بعد التصحيح من أجل التمييز المحتملة للاستنتاجات: كان معدل التصريح ضعف الأكل لدى المراهقين المصابين بخلل سكر الدم يؤثر بشكل أكثر صموداً بتأثيرهم الذين لا يعانون من خلل سكر الدم. ومرضى بفحص المراهقين للتحرّي عن اضطرابات الأكل لضمان الكشف المبكر والتدخل اللاحق.

References


Does socioeconomic status influence oral cancer awareness? The role of public education

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1International Research Collaborative, Oral Health and Equity, School of Human Sciences, University of Western Australia, Crawley, Australia. (Correspondence to: Somayyeh Azimi: somayyeh.azimi@uwa.edu.au), 2Community Oral Health Department, Dental School; 3Department of Biostatistics, School of Paramedical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Islamic Republic of Iran.

Abstract

Background: Public awareness on oral cancer is thought to improve prevention and early diagnosis; however, the role of socioeconomic status in this awareness is not clear.

Aims: The aim was to investigate whether an association exists between socioeconomic status and oral cancer awareness in adults.

Methods: A multi-stage random sample of adults was investigated in Tehran in 2016–2017. The outcome was awareness of oral cancer and knowledge of risk factors and signs and symptoms using a self-administered questionnaire. The main exposures were self-reported socioeconomic status of 8 indicators of family assets and economic situation. Wealth index was created using principal component analysis, and participants were classified into 5 quintiles. Regression analysis was applied to test associations.

Results: Out of 1800 adults, 1312 completed questionnaires were returned (72.8% response rate). The mean age was 37.8 (standard deviation 9.0) years; about 60% were female. Statistical analysis revealed the higher the wealth index, the higher the score for oral cancer knowledge and awareness. Awareness and knowledge were significantly lower among participants in the poorest quintile: they had a knowledge score on oral cancer risk factors 1.58 points [95% confidence interval (CI): −2.19;−0.96] lower, and a knowledge score on oral cancer signs 1.34 points (95 CI: −1.98;−0.72) lower compared with the richest quintile.

Conclusion: Socioeconomic inequalities were observed in oral cancer awareness in the Islamic Republic of Iran.

Keywords: socioeconomic status; principal components analysis; oral cancer; awareness

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Introduction

The association between socioeconomic status (SES) and health outcomes has been widely documented in previous studies (1–5). Evidence of inequalities in oral health has been repeatedly illustrated between and within countries. Oral cancer, including cancer of the lip and oral cavity, is not an exception, and recent global data has shown differences in incidence and mortality in different countries (5–8). Global Cancer Incidence, Mortality and Prevalence (GLOBCAN) estimated 354 864 (2.0% of all sites) new cases of lip and oral cavity cancer, and 177 384 (1.9% of all sites) deaths worldwide in 2018. Age-standardized lip and oral cavity cancer incidence among men and women in Western Asia has been reported to be 2.1 and 1.1 per 100 000 (8). However, country-specific incidence and mortality rates have not been documented in this Region (7,9).

Associations between oral cancer risk and low SES (10), as well as the relationship between survival and mortality of oral cancer and both individual and area deprivation have been determined previously (11). Despite some theoretical explanations for the disparity in health, public health researchers still debate of how SES is a factor in impaired health (1,5,12).

In patients of lower SES, first presentation with more-advanced stages of oral cancer has been proposed as a possible association with disparity in oral cancer burdens (13). Moreover, lack of or insufficient knowledge of oral cancer has been suggested as an effective factor in late diagnosis (13). Therefore, it could be proposed that socioeconomic position has an effect on awareness and knowledge about oral cancer, and in turn advanced stage diagnosis.

Previous studies have used various indicators, single or combined, to measure SES, mostly focused on occupation, education and income (14–17). However, unavailable or unreliable results have been mentioned for income and occupation, especially in developing countries (18). Ghorbani et al. developed an asset-based SES index using principal component analysis (PCA) as a method for determining weights for the components of a wealth index from a set of variables; they explored oral health inequalities in the Iranian population and suggested that household assets could be a good indicator
for assessment of “long-run” economic status (18).

There have been multiple studies assessing the levels of awareness and knowledge of symptoms and risk factors of oral cancer all over the world (19–21), however, most of them used sociodemographic measures such as age, sex and education as attributing factors. Also, a review of the literature found that studies reporting oral cancer awareness in the Islamic Republic of Iran are rare with inconsistent results about sociodemographic factors (22–25). To the best of our knowledge, there is no study associating wealth status and level of knowledge about oral cancer in a developing country. The aim of this study was to investigate the association between individual wealth (by determining SES) and its association with awareness about oral cancer in the Islamic Republic of Iran.

Methods

Background

This cross-sectional study is follow-up to an oral cancer knowledge study that was conducted in Tehran in 2016–2017 using self-administered questionnaires (26).

Ethics

The research project was approved by the ethics committee of Shahid Beheshti University of Medical Sciences. The purpose of the study was fully explained in the questionnaire and responses to questions was on a voluntary basis. All participants were assured of anonymity and confidentiality.

Questionnaire

The questionnaire assessed the awareness and knowledge of risk factors and symptoms of oral cancer as well as socioeconomic status. It included demographic questions (sex, age), 4 yes/no questions about oral cancer awareness (heard about cancer, non-communicable nature, early diagnosis and treatment); 15 questions about knowledge of risk factors (tobacco, alcohol, sunlight, diet, genetics, age and human papilloma virus) and 11 questions about signs and symptoms (ulcers, red or white patches, swelling, difficulty swallowing, discomfort, change in voice and weight loss) (26). Oral cancer knowledge questions were closed-ended positive and negative questions with yes/no/do not know options (27,28). The questionnaire was designed by slightly modifying previous valid questionnaires considering the local cultural, environmental and language environment (27,28). For assessment of SES, we used an 8-item composite wealth index by adapting the existing validated asset questions (18), including house ownership (own/rent); yes/no questions about having a car, personal computer, dishwasher, steam-cleaner (a device to clean surfaces) and microwave; and questions about income satisfaction (How satisfied are you with your current household income? Highly satisfied, satisfied, dissatisfied, highly dissatisfied) and financial management (Do you have the ability to manage expenditure with the available monthly income? can’t make ends meet, manage to get by, have enough money plus some extra, money is not a problem) considering the previous studies (27,29,30).

Before finalizing the questionnaire, a pilot study was conducted on a random sample of 60 patients attending a dental school clinic to ensure clarity and practicability of the questions (α = 0.81). Eventually, the final Farsi language questionnaire we created fitted onto a double-sided plus one single A4 sheet stapled together. The purpose of the study and instructions were explained at the beginning of the questionnaire. It took approximately 15 minutes to complete the questionnaire.

Sampling and participation

In accordance with previous studies in the Islamic Republic of Iran in recent years (24), 16% was considered the proportion of knowledgeable patients (with regard to risk factors of oral cancer) for the sampling formula, and we estimated that 1000 participants should be sufficient for the survey. Additional sampling was added in order to compensate for losses and refusals.

The study population comprised adults who were parents of public primary school students in Tehran. The sampling method used a multi-stage, stratified, random technique. First, from the 22 municipal regions in Tehran and according to geographic location, 4 regions were selected in the south, east, west, and north. Then, were randomly selected 1 or 2 schools from the school list in each region. In each school, a grade was randomly selected and the invitation letter sent to all the parents in that grade. The invitation letter was sent home with each student so both parents had the chance to see the letter.

Study design

A total of 1800 parents were invited to participate in this study, which was conducted in Tehran in 2016–2017. Those who agreed to participate were asked to sign the consent form.

Participants were requested to return the completed questionnaires on the same day, without any time restrictions and to use their own knowledge, without seeking information from online resources. Illiterate persons, who were not able to write/read, were excluded due to the self-administered nature of questionnaire. A brochure containing information about oral and lip cancer was provided to all parents in the sampled schools after finishing the study. This brochure was approved by the panel expert of community oral health and oral medicine specialists in Shahid Beheshti University of Medical Sciences, Tehran.

Outcome variables

Awareness about oral cancer and knowledge of risk factors and signs and symptoms were collected using a numerical scale. Each correct answer was allocated a score of 1; incorrect answers, including “do not know” answers scored zero. The final scores for each participant were summed up separately: 0–4 for awareness, 0–15 for risk factor knowledge, and 0–11 for the signs and symptoms knowledge.
Explanatory variables
The main explanatory variable was a composite wealth index as the proxy for SES; PCA was applied to indicator variables and the samples classified into 5 equal wealth quintiles, where the first quintile represented the poorest 20% of the sample.

Covariates
Age was recorded in date of birth and was categorised into groups of 25–35, 35–45, and > 45 years.

Statistics
We used PCA to develop the wealth index using STATA, version 11.1. Because the items included both binary and continuous variables, polychoric correlations were applied in the principal factor analysis correlation matrix. Then the SES classification into 5 quintiles was conducted via cluster analysis of the 8-item composite wealth using the data-driven approach. Descriptive and univariate analyses were used to explore the distribution of oral cancer knowledge and awareness using SPSS, version 22. Statistical tests, including ANOVA and post hoc tests and general linear regression were used for analysis of the level of knowledge and awareness among sociodemographic groups. P < 0.05 was considered statistically significant in the survey.

Results
Out of 1800 adults invited, 1312 completed questionnaires were returned (72.8% response rate). In total, 62% of participants were female and 38% were male with the average age 37.8 [standard deviation (SD) 9.0] years.

Mean score for awareness was 1.09 (SD 1.60) (out of 4), for risk factors knowledge was 5.3 (SD 3.0) (out of 15), and for signs and symptoms, knowledge was 4.5 (SD 2.9) (out of 11). Analysis indicated that oral cancer awareness and knowledge of oral cancer signs or risk factors were not significantly different between age categories. Male participants had less knowledge of oral cancer signs and risk factors (P < 0.05), however awareness did not differ between males and females (Table 1).

Principal component analysis revealed a single component with an Eigen-value > 1, covering 84% of variance (data not shown). All variables included in this factor had positive factor scores, and all were associated with higher socioeconomic status.

Table 1 also demonstrates the relationship between SES and level of knowledge and awareness. There was a statistically significant difference between level of awareness and knowledge of oral cancer risk factors and signs and symptoms in the different socioeconomic groups (P < 0.001). The post hoc test results showed the higher the wealth index, the higher the score for oral cancer knowledge and awareness.

Table 2 shows general linear model analysis. The level of the wealth index remained statistically significantly associated with knowledge and awareness of oral cancer, controlling for age and sex (Table 2). People from the poorest quintile had a knowledge score on oral cancer

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency No. (%)</th>
<th>General awareness Mean (SD)</th>
<th>Knowledge of risk factors Mean (SD)</th>
<th>Knowledge of signs Mean (SD)</th>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
<td>489 (38.2)</td>
<td>1.60 (1.09)</td>
<td>4.90 (2.92)</td>
<td>4.21 (2.96)</td>
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<td>788 (61.7)</td>
<td>1.64 (1.01)</td>
<td>5.60 (3.00)</td>
<td>4.70 (2.88)</td>
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<td>P-value</td>
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<td>25–35</td>
<td>318 (28.2)</td>
<td>1.60 (1.07)</td>
<td>5.26 (3.00)</td>
<td>4.38 (2.88)</td>
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<td>35–45</td>
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<td>5.44 (3.08)</td>
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<td>165 (14.6)</td>
<td>1.59 (1.0)</td>
<td>5.17 (2.83)</td>
<td>4.26 (2.88)</td>
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<td>P-value</td>
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<td>Socioeconomic status quintile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th</td>
<td>204 (17.5)</td>
<td>1.92 (1.12)</td>
<td>6.23 (2.82)</td>
<td>5.09 (2.98)</td>
</tr>
<tr>
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<td>5.85 (2.87)</td>
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</tr>
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<tr>
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SD = standard deviation.
*Independent samples t-test.
†Analysis of variance test.
*1st = poorest; 5th = richest.
risk factors 1.58 points (95% confidence interval (CI): 
–2.19;–0.96) lower, and a knowledge score on oral cancer 
signs 1.34 points (95% CI: –1.98;–0.72) lower compared 
with the richest quintile.

Discussion

This study is one of the first epidemiological studies on 
oral cancer awareness in the Islamic Republic of Iran, 
studying awareness of both risk factors and signs. Our 
findings indicate that oral cancer awareness is insuffi-
cient among the studied population, the mean scores 
for both risk factors and signs being around 30% of the 
full scores. Mean general awareness score (1.09 out of 4) 
points to a lack of knowledge on oral cancer in adults. 
Details have been provided in previous studies (26,31).
Also, people in the lower SES quintiles had lower gener-
al awareness and less knowledge about risk factors and 
signs and symptoms of oral cancer.

In light of the difficulties in accessing the adult 
population to get a random sample, we tried to use public 
schools as the setting for sampling. Considering the 
random selection of schools from different geographic 
areas of the huge city of Tehran, it seemed to achieve a 
large sample of adults in a low-cost way. Compared to the 
whole adult population, parents are of special importance; 
an informed parent can affect the health of the whole 
family, including the next generation. However, the 
parent population is not a representative sample of the 
adult population, making our findings ungeneralizable 
to the whole adult population of Tehran. The lack of 
iliterate participants also affected generalizability. The 
results may, however, be generalizable to Iranian parents 
because the SES and education level is higher in Tehran 
than other urban and rural areas across the country.

Oral cancer, being a life-threatening disease, is 
usually diagnosed late. The survival rate may be 
improved significantly if the disease is diagnosed in the 
early stages or if the precancerous lesions are treated 
(32). Our findings showed that the level of awareness of 
oral cancer risk factors was low. This is a crucial issue 
in prevention of oral cancer as people do not even know 
which harmful behaviours and exposures may cause oral 
cancer. Awareness is the first step, and it is the primary 
step towards changing attitudes and performance in this 
regard. We found that the level of awareness of oral cancer 
signs was low as well. This lack of information may lead 
to late diagnosis, hence affecting survival rates. The low 
level of public awareness of oral cancer has also been 
reported by other researchers from different countries, 
which reveals the need for education all around the world 
(16,21,33).

Another finding of this study was the lower awareness 
among people from the low-SES group, who may have 
limited access to knowledge sources about their health, 
including information on oral cancer. This may be 
because of their lower level of educational attainment, 
lower level of health literacy and public education, and 
less frequent physician/dental visits (34–36).

A number of studies have evaluated the association 
between sociodemographic indices such as age, sex, 
education, occupation and level of knowledge of oral 
cancer (33,37). Different studies reported inconsistent 
results on the relationships between level of knowledge

<table>
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<th>SES(^a)</th>
<th>B(^b)</th>
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All analyses adjusted for age and sex.
R = reference.
\(^a\)1st = poorest; 5th = richest.
\(^b\)Coefficient estimate.
and sex and age. In the Islamic Republic of Iran, only Pakfetrat et al. reported significant differences in knowledge among people with different occupations (23). Occupation may not be a good indicator of SES due to the existence of income inequalities within an occupation, as well as high rates of women without formal jobs in developing countries. Tadbir et al., Pakfetrat et al., and Gholami et al. reported the higher the education level, the higher the score for oral cancer knowledge (22,23,25). Although education is a good predictor of SES, it is not a sole indicator of it. Income has been used as an indicator of SES in oral cancer knowledge studies before (17,33). However, there are high non-response rates on items directly measuring income, especially in developing countries due to cultural factors (18,38).

In neighbouring countries, Al-Maweri et al. in Riyadh reported dental patients with lower SES were significantly less aware about oral cancer and had much less knowledge of the signs and risk factors (39). Hassona et al. also reported people with lower SES in Jordan were less well informed about the signs and risk factors of oral cancer (40).

In a recent study in the United Kingdom, Kawecki et al., using the deprivation index, indicated lower knowledge of mouth cancer in the most deprived areas (41). These studies are in line with our study. However, the measurement of SES can be different in different populations.

An asset-based approach, collecting information on ownership of a range of durable assets, is an alternative to traditional monetary indicators such as consumption expenditure or income, for measuring SES (1,5). Ghorbani et al. created an asset-based wealth index for measuring oral health inequality in Tehran and demonstrated the low level of oral health in the poorest quintile (5). Also, Islami et al. in the north of the Islamic Republic of Iran constructed an asset-based wealth index for assessing SES and oesophageal cancer, and reported the protective effect of high wealth scores in the group with the highest wealth status (top 20%) (38), which is in line with the current study.

In the present study, a wealth index has been developed using asset items, as well as 2 indirect monetary questions about financial management and income satisfaction. Previous studies have shown that people often refuse to discuss their income information with others, and it is treated as sensitive or confidential, however, income satisfaction questions dealt with the emotional self-evaluation of income considering past or current income, or standard income relative to one’s own merits and qualifications. Miething, in a survey in Germany, argues that it could be an indicator of perceived inequality as well as a non-income-based exogenous measure of income inequality (29). Also, financial management as the self-rated ability to manage with the available monthly income has been used as a component of measuring SES in previous studies (30).

In the current study, we used PCA for weighting to construct a wealth index based on a previous study (5) and our results show the first component explained more than 80% of the original variables. The criteria for the selection of variables for PCA are not well defined, and the number of selected components is arbitrary (42). In an Iranian study, Ghorbani et al., used PCA methods for measuring socioeconomic inequalities. They used the first component factor scores with coverage of 34% of variance. Also, they classified the samples into 5 equal wealth quintiles, similar to this study (18). Krefis et al. in a study in Ghana, used PCA asset-based wealth index for SES assessment with 20% coverage of the first component, and argued that combined SES indicators using PCAs provides a quantification and classification of individual SES levels and enables the use of the resulting score for risk analyses (30).

Although a well-designed PCA analysis has been set up as a suitable tool for assigning weights to the indicators in this study, all information on asset measures are based on self-reports of the participants, and were not confirmed by direct observation, and this is considered a limitation. However, we asked questions about easily recalled ownership or appliances, which reduces the possibility of recall bias. In addition, prices are not taken into consideration in asset ownership, so, the appropriateness of the wealth index may differ between regions. However, most previous studies used this approach for construction of a wealth index (18,43). Moreover, based on the multi-stage sampling design, it is desired to run a multi-level regression model in any future analysis of the present data.

Also, as a strength of this study, a brochure about oral cancer risk factors and signs and symptoms has been handed out in primary schools after the study, which can help parents as well as children acquire oral cancer-related knowledge, emphasizing the role of public education.

A recent study in India used a mobile app for oral cancer awareness in the general population. They argued that mobile technology is used by all socioeconomic groups and the app can be used as a tool for patient education about prevention and early detection of oral cancer (44).

**Conclusion**

The results of this study demonstrate the advantage of multiple variables rather than a single indicator of SES. The inverse association between combined indicators of SES and all components of oral cancer knowledge (general awareness, knowledge of risk factors and signs and symptoms) has been confirmed in the present study. Although improvement in SES is not achievable without changing the general economy, dental public health policy makers should conduct active educational programmes, especially for the most deprived parts of the population to reduce the gap in oral cancer burden.
Influence du statut socio-économique sur le niveau de sensibilisation au cancer de la cavité buccale et rôle de l’éducation du public

Résumé

Contexte : La sensibilisation du public au cancer de la cavité buccale permettrait d’améliorer la prévention et le diagnostic précoce. On ignore cependant encore dans quelle mesure le statut socio-économique influence le niveau de sensibilisation.

Objectifs : La présente étude visait à déterminer l’existence d’un lien entre le statut socio-économique et le niveau de sensibilisation au cancer de la cavité buccale chez les adultes.

Méthodes : Un échantillon aléatoire à plusieurs degrés composé d’adultes a été analysé à Téhéran (République islamique d’Iran) en 2016-2017. Un questionnaire auto-administré a été distribué en vue d’évaluer le niveau de sensibilisation au cancer de la cavité buccale et la connaissance des facteurs de risque et des signes et symptômes. Pour évaluer le statut socio-économique, huit indicateurs portant sur le patrimoine familial et la situation économique ont été utilisés. Un indice de richesse a été créé en utilisant l’analyse en composantes principales et les participants ont été classés en cinq quintiles. Une analyse de régression a été appliquée aux associations de tests.

Résultats : Sur les 1 800 adultes approchés, 1 312 ont rempli et retourné le questionnaire (taux de réponse de 72,8 %). L’âge moyen était de 37,8 ans (écart type 9,0); environ 60 % des participants étaient des femmes. L’analyse statistique a révélé que plus l’indice de richesse est élevé, meilleur est le niveau de connaissance et de sensibilisation à l’égard du cancer de la cavité buccale. Le niveau de connaissance et de sensibilisation était significativement plus faible chez les participants appartenant au quintile le plus pauvre : ils ont obtenu un score de connaissance sur les facteurs de risque du cancer de la cavité buccale inférieur de 1,58 point [intervalle de confiance à 95 % (IC) : –2,19 ; –0,96] et un score de connaissance sur les signes du cancer de la cavité buccale inférieur de 1,34 point (IC à 95 ; –1,98 ; –0,72) par rapport au quintile le plus riche.

Conclusion : Le statut socio-économique a une influence sur le niveau de sensibilisation au cancer de la cavité buccale en République islamique d’Iran.
References


Tobacco price increase and consumption behaviour among male smokers in Saudi Arabia: a community-based study

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Abstract

Background: Saudi Arabia doubled its tobacco tax in June 2017.

Aims: To examine the association between an increase in tobacco prices and consumption behaviour among current male smokers in Riyadh.

Methods: We conducted a community-based study using a self-administered questionnaire distributed to current male smokers aged 15+ years in Riyadh in 2018. The survey included questions on sociodemographic characteristics, tobacco consumption and self-reported chronic health conditions.

Results: A total of 1481 participants were included in the final data analysis. After the tobacco tax was doubled, 25.6% of the participants reduced their cigarette consumption and 1.0% quit smoking. The average daily cigarette consumption after enforcing the tobacco tax [19.77, standard deviation (SD) 10.7], was statistically significantly lower than before taxation [21.19, SD 10.8] (P < 0.0001). The calculated price elasticity of demand was −0.20 (inelastic). Employment status (P = 0.002) and per capita gross domestic product purchasing power parity (P = 0.001) were the only statistically significant factors associated with the change in smoking habits.

Conclusions: Increasing tobacco prices reduced tobacco consumption by 26.6% among Saudi Arabian male smokers.

Keywords: tobacco tax, tobacco consumption, male smokers, smoking habits, Saudi Arabia

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Introduction

Tobacco consumption is one of the biggest contributors to public health problems, killing approximately 7 million people worldwide each year (1). An average of 6 million deaths is attributable to the direct use of tobacco, while an average of 890 000 deaths result from second-hand smoking. According to global health observational data, more than 1 billion people smoked tobacco in 2015, and nearly 80% of them lived in low- and middle-income countries (1).

In 2016, the World Health Organization (WHO) reported that the overall rate of tobacco use in Saudi Arabia among those aged 15+ years was 12.2%, with a rate of 23.7% among males compared with 1.5% among females (2). In a previous survey of Saudi Arabian adolescents aged 13–15 years, the prevalence of tobacco use was 21.2% among males and 9.1% among females (3).

Tremendous efforts have been made to reduce tobacco consumption all over the world in the form of bans on smoking in public places, anti-smoking advertising campaigns, and comprehensive tobacco control programmes (4–7).

The Gulf Cooperation Council governments provide access to smoking cessation treatments such as nicotine replacement therapy (e.g. patch, inhaler, gum). However, the availability of these smoking alternatives did not increase their utilization because of a lack of social support, costs and access constraints (8). Also, clinicians were not likely to advise patients to quit or use smoking cessation alternatives due to either time constraints with patients or inadequate training in delivering smoking cessation services (8).

Imposing taxes on tobacco products has proven to be the most effective policy to reduce tobacco use and its adverse effects on health, the economy and society (9–13). After joining the WHO Framework Convention for Tobacco Control in 2005, the Saudi Arabian Ministry of Health initiated a national tobacco control programme with remarkable efforts. Saudi Arabia announced the doubling of tobacco tax on June 10, 2017 following the decision of the Gulf Cooperation Council countries. Increasing the price of tobacco products is considered to be a highly effective policy to reduce tobacco use, which eventually decreases the associated morbidity and mortality (14). Indeed, reducing tobacco use is a key component of the Healthy People 2030 vision, part of the national action plan for improving the health of all Saudi Arabians.

This study aimed to assess the association between the tobacco price increase due to higher tobacco taxes and consumption behaviour among current male smokers in Riyadh.
Methods

Participants and questionnaire

A community-based cross-sectional study was conducted between April and October 2018 in all 5 districts of Riyadh city (North, South, East, West, Central). Male smokers (current and those who quit after the tobacco tax increase) aged 15+ years were eligible to participate. Males below the age of 15 years, females, and males over 15 years old who had never smoked were excluded. The study was approved by the institutional review board at King Fahad Medical City in Riyadh.

Participants were approached in coffee shops and other public places to take part in this study by completing a self-administered questionnaire that was created based on an in-depth review of the literature (3,9–13). Considering the age categories, the sample size was equally distributed across the 5 districts. The following procedures were followed to ensure the validity of the questionnaire. First, the literature was reviewed and previous instruments were examined to develop drafts of the questionnaire. The questionnaire was then reviewed by 4 experts in research methodology and epidemiology. Finally, to ensure the questionnaire was clear and well understood by the target population, a pilot study was conducted on 50 Saudi Arabian males aged 15+ years recruited in coffee shops and other public places. Based on the experts’ recommendations and the outcome of the pilot study, a few questions were reformulated and amended to enhance the questionnaire’s validity. The pilot survey data were not included in the final analysis. The reliability, measured using Cronbach’s alpha, was 0.72.

The questionnaire had 3 parts covering sociodemographic characteristics, tobacco consumption and self-reported chronic health conditions. It took an average of 10 minutes to complete.

Sociodemographic characteristics included age group, education level, marital status, employment status, and yearly income based on Saudi Arabia’s gross domestic product (GDP) per capita purchasing power parity (PPP), equal to US$ 45 821 (14).

Tobacco consumption was assessed using 9 questions: opinion regarding the increase in tobacco prices, type of tobacco consumed, change in consumption behaviour based on the tax increase, change of cigarette brand to one with a cheaper price, number of cigarettes smoked before and after taxation, number of years as a smoker, place where cigarettes are purchased, price of preferred type of tobacco, and current tobacco use.

Sample size estimate

According to a 2016 census of the population of Riyadh, there were 3 747 557 males aged 15+ years. Given the prevalence of smoking among this population is 25%, which equates to 936 889 smokers aged 15+ years. To generate a 95% confidence interval from a representative sample within a 2.5% margin of error, adjusting for the adult population across all districts of Riyadh and considering an incomplete and non-response rate of 20%, we would need a sample of 1534 male smokers. The sample collected was almost equal across the 5 districts: North 310, South 303, East 308, West 308, Central 305. The sampling frame included coffee shops that had a seated smoking area. Site visits and meetings with coffee shops managers were done in advance to acquire their approval for data collection. A convenience sample of 107 coffee shops was reviewed for eligibility; 10 (9%) were determined ineligible due to the absence of an outdoor space designated for smoking. An additional 5 (4.5%) coffee shops did not allow us to collect data on their premises. Therefore, data collection took place in 92 coffee shops: North 20, East 19, South 18, West 18, Central 17.

Statistical analysis

Demographic characteristics of study participants were reported as mean and standard deviation (SD) of a continuous variable, and categorical variables were reported as number and percentage.

Chi-squared was used to measure the association between the change in smoking habit (stopping, reducing, the average number of cigarettes per day) and the covariates, including age, marital status, education, employment status, and yearly income based on the GDP per capita PPP in Saudi Arabia (US$ < 45 821.61, ≥ 45 821.61). For the multivariate analysis, a backward-elimination approach in a multiple logistic regression model was performed. Odds ratios and 95% confidence intervals were reported. The correlation coefficient, the standard deviation of the coefficient, and P-values were reported. We used SPSS, version 22, for data analysis and accounted for the complex sampling design. A 2-tailed P-value of 0.05 was considered significant.

The effect of increasing the tobacco tax on consumption behaviour was evaluated by calculating the tobacco price elasticity.

The price elasticity of demand for tobacco was estimated using the ratio between the percent change in the quantity demanded and the corresponding percent change in price as in the formula below:

\[
\text{Price elasticity of demand} = \frac{\% \text{ change in quantity}}{\% \text{ change in price}}
\]

Percentage change in quantity = \(\frac{(Q_2 - Q_1)}{(Q_1 + Q_2)/2}\) × 100

Percentage change in price = \(\frac{(P_2 - P_1)}{(P_1 + P_2)/2}\) × 100

Results

The final data set included 1481 out of 1534 male participants since 53 questionnaires were excluded because of extensive missing data. A total of 694 participants (47.0%) were in the 25–34 years age group, 821 (55.7%) were single, and 1168 (79.6%) were employed. Employment status (P = 0.002) and GDP per capita PPP (P = 0.001) were the only statistically significant factors associated with a change in smoking habits (Table 1).

The most common type of tobacco used was cigarettes.
in 1269 (85.7%). We found that 372 participants (25.1%) agreed with the increased taxes on cigarettes versus 896 participants (60.5%) who disagreed. After taxes were increased, 379 participants (25.6%) reduced cigarette consumption and 15 (1.0%) quit smoking. The daily mean cigarette consumption before the tax increase was 22.19 (SD 10.8) compared with 19.77 (SD 10.70) afterwards ($P < 0.0001$). The mean price of cigarettes before and after the tax increase was US$ 3.68 (SD 4.59) and US$ 6.63 (SD 4.96) respectively. Respondents’ smoking characteristics are presented in Table 2: 375 (25.3%) purchased cigarettes from both local markets and duty-free shops, and 110 (7.4%) from duty-free shops only.

The calculated tobacco price elasticity was ($-0.20$):

\[
\text{Change in quantity} = \frac{(22.9 - 19.77)}{(22.19 + 19.77)/2} \times 100 = 14.9\%
\]

\[
\text{Change in price} = \frac{(6.63 - 3.68)}{(6.63 + 3.68)/2} \times 100 = 57.2\%
\]

Price elasticity of demand $=$ 11.53/57.22 $=$ 0.20

The demand for tobacco is, therefore, said to be price inelastic; this means that tobacco consumption behaviour is unresponsive to a change in price.

From the multivariate analysis, we determined that participants with a GDP per capita PPP below 45 821.61 USD were 1.45 times more likely to stop or significantly reduce the average number of cigarettes smoked per day compared with participants with a higher GDP per capita PPP ($P = 0.01$). Employment status was also a significant factor that affected tobacco consumption behaviour among the study participants. The employed participants were less likely to stop or reduce smoking in comparison with unemployed participants (odds ratio: 0.72, $P = 0.04$) (Table 3).

**Discussion**

A decrease in cigarette consumption could result from reducing the number of cigarettes consumed per smoker or by reducing the number of smokers. The results of our study showed that increasing the prices of tobacco products was associated with a significant reduction in the number of cigarettes consumed by smokers.

According to our findings, a 100% increase in tobacco tax reduced tobacco consumption by 26.6% among our participants. This is consistent with previous studies documenting that increasing cigarette prices through taxation is one of the most effective methods of decreasing cigarette consumption (15–20). Several

<table>
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<td>3.5</td>
<td>6</td>
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<tr>
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<tr>
<td>GDP per capita PPP ($US)</td>
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<td></td>
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<td>&lt; 45 821.61</td>
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<td>288</td>
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</tr>
<tr>
<td>≥ 45 821.61</td>
<td>375</td>
<td>27.1</td>
<td>77</td>
<td>20.6</td>
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</tr>
</tbody>
</table>

$P < 0.05$ considered significant

GDP = gross domestic product; PPP = purchasing power parity.
countries have started to implement such taxes after these positive results were observed (19–31). Numerous studies in high-income countries have shown that a 10% increase in cigarette prices decreases consumption by about 4% (32). Available data indicate that consumption in low- and middle-income countries is even more responsive to price. For example, estimated decreases were about 5.5% in China, 5.2% in Mexico, and 5.4% in South Africa (17–19).

In economics, price elasticity is defined as the percentage change in consumption in response to a 1% change in price. The price elasticity of demand is a measure to show the responsiveness, or elasticity, of the quantity of a good or service, demanded by a given change in its price. In our study, the demand for smoking is classed as inelastic (~0.20). Inelastic demand indicates low responsiveness to price changes, which suggests that after the tax increase, cigarettes are still affordable. Future increases in cigarette prices might increase the price elasticity, which could suggest a more effective use of tax increases to control tobacco. A study employing panel data for the period 2005–2014 from Euromonitor International, the World Bank and WHO in the 28 countries of the European Union explored the effects of an increase in cigarette prices on consumption. The study showed that the price elasticity of cigarette demand varied from −0.503 to −1.227 in those countries. Countries with a per capita gross national income below US$ 5418 had the highest cigarette price elasticity (~1.227). Those with a per capita gross national income greater than US$ 5418 exhibited less cigarette price elasticity (20). In our results, GDP per capita PPP and employment status were shown to significantly affect smoking habits among the participants. Employed participants with a higher GDP per capita PPP were less likely to stop smoking or reduce their consumption of tobacco after the tax increase. The primary concerns that have been expressed relative to this tax increase were: an increase in smuggling to avoid the additional tax burden; the most common strategy for tax avoidance was purchasing cigarettes from duty-free shops; our data showed that 25.3% of respondents purchased cigarettes from both local markets and duty-free shops and 7.4% from duty-free shops only; and secondly, smokers switching to cheaper alternatives and lower quality tobacco products, which was expressed by 15% of our study participants.

The majority of our respondents disagreed about the

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase tobacco price (n = 1474)</td>
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<td></td>
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<tr>
<td>Agree</td>
<td>370</td>
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</tr>
<tr>
<td>Disagree</td>
<td>892</td>
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</tr>
<tr>
<td>No comment</td>
<td>212</td>
<td>14.4</td>
</tr>
<tr>
<td>Type of tobacco (n = 1481)</td>
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<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td>1269</td>
<td>85.7</td>
</tr>
<tr>
<td>Hookah (water pipe)</td>
<td>128</td>
<td>8.6</td>
</tr>
<tr>
<td>Electronic cigarettes</td>
<td>52</td>
<td>3.5</td>
</tr>
<tr>
<td>Cigar</td>
<td>16</td>
<td>1.2</td>
</tr>
<tr>
<td>Pipe</td>
<td>5</td>
<td>0.3</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
<td>0.7</td>
</tr>
<tr>
<td>Change in consumption behaviour (n = 1481)</td>
<td></td>
<td></td>
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<tr>
<td>Stopped</td>
<td>35</td>
<td>1.0</td>
</tr>
<tr>
<td>Reduced</td>
<td>379</td>
<td>25.6</td>
</tr>
<tr>
<td>Change to a cheaper brand</td>
<td>223</td>
<td>15.1</td>
</tr>
<tr>
<td>No change</td>
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<tr>
<td>Mean (SD) no. of cigarettes before taxation increase</td>
<td>22.19</td>
<td>10.8</td>
</tr>
<tr>
<td>Mean (SD) no. of cigarettes after taxation increase</td>
<td>19.77</td>
<td>10.7</td>
</tr>
<tr>
<td>Mean (SD) no. years of smoking</td>
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</tr>
<tr>
<td>Source of cigarettes (n = 1481)</td>
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<tr>
<td>Local market</td>
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<td>Duty free</td>
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<tr>
<td>Other</td>
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<td>1.2</td>
</tr>
<tr>
<td>Mean price of cigarettes pack before taxation (US)</td>
<td>3.68±4.59</td>
<td></td>
</tr>
<tr>
<td>Mean price of cigarettes pack after taxation (US)</td>
<td>6.63±4.96</td>
<td></td>
</tr>
</tbody>
</table>

*Except where indicated as mean and standard deviation (SD).*
increase in the price of tobacco products. Similarly, a study conducted by Green and Gerken showed that smokers disagreed more often with increases in tobacco taxation compared to nonsmokers (29). Another study conducted by Dixon et al. reported that the relationship between income difference and support for higher tobacco sales taxes was considered minor for nonsmokers, but essential for smokers (30).

Public health authorities need to promote educational programmes to provide youth with knowledge about tobacco hazards, and to further assist and provide needed guidance and support to tobacco consumers who are willing to quit. Many policy-makers in other countries use some of the revenue produced from tobacco taxes to support anti-smoking activities. For instance, the California Tobacco Tax and Health Promotion used tobacco tax revenue to develop educational programmes to prevent and reduce cigarette use (22). In Australia, a 5% tax on the sale of tobacco products is used to support health promotion programmes (21). In Egypt and Nepal, additional tax revenues were used in health-related activities to support health care for children and low-income families (21).

Our study is subject to certain limitations. First, smoking variables were self-reported without biomarker validation. Second, this study was done only on males as the use of addictive substances, including smoking cigarettes, is considered deviant behaviour among female Saudi Arabsians. Thus, the results of this study cannot be generalized to the entire Saudi Arabian population. Finally, the reliability of the data is dependent on the respondents’ recall and honesty. Underreporting of the number of cigarettes smoked before and after the tax increase could also be a significant problem.

**Conclusion**

Although increasing tobacco prices reduced tobacco consumption by 26.6% among Saudi Arabian male smokers, cigarette price elasticity was less than 1. The results of the study might be important for policymakers to develop a strategic plan to adopt new measures to control smoking. Furthermore, there is a need to design and develop educational programmes to enhance the knowledge of the community regarding the negative impact of smoking on health. Future research is needed in this area, especially in the Middle East and specifically in Saudi Arabia, because published studies in this field are relatively scarce.

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**Competing interests:** None declared.

<table>
<thead>
<tr>
<th>Characteristic</th>
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<th>SD of the coefficient</th>
<th>P-value</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-0.06</td>
<td>0.403</td>
<td>0.02</td>
<td>0.72</td>
<td>0.53-0.98</td>
</tr>
<tr>
<td>GDP per capita PPP $US &lt; 45,821.61</td>
<td>0.08</td>
<td>0.443</td>
<td>0.003</td>
<td>1.45</td>
<td>1.08-1.95</td>
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</tbody>
</table>

SD = standard deviation; CI = confidence interval.
GDP = gross domestic product; PPP = purchasing power parity.
P < 0.05 is considered significant.

*Hausse du prix du tabac et comportements de consommation chez les fumeurs masculins en Arabie saoudite : enquête en communauté*

**Résumé**

**Contexte :** L’Arabie saoudite a doublé sa taxe sur le tabac en juin 2017.

**Objectifs :** Examiné le lien entre la hausse du prix du tabac et les comportements de consommation des fumeurs masculins à Riyad.

**Méthodes :** En 2018, nous avons mené une enquête en communauté à Riyad en distribuant un questionnaire auto-administré à des fumeurs masculins âgés de 15 ans et plus. L’enquête comprenait des questions sur les caractéristiques sociodémographiques, la consommation de tabac et les maladies chroniques autodéclarées.

**Résultats :** Au total, 1 481 participants ont été pris en compte dans l’analyse finale des données. Après le doublement de la taxe sur le tabac, 25,6 % des participants ont réduit leur consommation de cigarettes et 1,0 % ont cessé de fumer. La consommation quotidienne moyenne de cigarettes après l’imposition de la taxe sur le tabac (19,77 ; écart type : 10,7) était, d’un point de vue statistique, significativement plus faible qu’avant son imposition (21,19 ; écart type : 10,8) (p < 0,0001). L’élasticité-prix de la demande était de –0,20 (inélastique). Le statut professionnel (p = 0,002) et le produit intérieur brut par habitant mesuré en parité de pouvoir d’achat (p = 0,001) ont été les seuls facteurs statistiquement significatifs associés au changement des habitudes tabagiques.

**Conclusions :** La hausse des prix a réduit de 26,6 % la consommation de tabac des fumeurs masculins saoudiens.
ارتفاع أسعار التبغ والسلوك الاستهلاكي في صفوف المدخنين الذكور في الرياض: دراسة مجتمعية
محمد التنير، أماني أبو شاهين، يوسف التنير، مصطفى التنير
الخلاصة
أظهرت هذه الدراسة إلى دراسة العلاقة بين زيادة أسعار التبغ والسلوك الاستهلاكي في صفوف المدخنين الذكور الحاليين في الرياض.
الأهداف: أجرينا دراسة مجتمعية باستخدام استبيان يُستكمَل ذاتياً وُزِّع على المدخنين الذكور الحاليين الذين تبلغ أعمارهم 15 سنة فما فوق في الرياض في عام 2018. وتضمن السؤال استمارة حول الخصائص الاجتماعية السكانية، واستهلاك التبغ والحالات الصحية المزمنة المبلغ عنها ذاتياً.
الطريقة: ضاعفت المملكة العربية السعودية الضريبة التي تفرضها على التبغ في يونيو/حزيران 2017.
النتائج: ضعَّفت المملكة العربية السعودية الضريبة التي تفرضها على التبغ في يونيو/حزيران.
إنفاذ ضريبة التبغ، خفَّض 1481 من المشاركين استهلاكهم للسجائر، 25.6% مشاركاً. وبعد مضاعفة ضريبة التبغ، خفَّض 1481 من المشاركين استهلاكهم للسجائر، 25.6% مشاركاً.
المستنتاجات: أدَّت زيادة أسعار التبغ إلى خفض استهلاك التبغ بنسبة 26.6% في صفوف المدخنين الذكور في المملكة العربية السعودية.

References
Relative risk of injury due to alcohol consumption in car and motorcycle drivers

Mahnaz Yadollahi 1 and Forough Pazhuheian 1

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Abstract

Background: There is strong evidence that a substantial number of fatal as well as nonfatal injuries in road traffic accidents result from alcohol consumption and abuse.

Aims: To examine the relationship between blood alcohol concentration and characteristics of injury in trauma patients admitted to a major teaching hospital.

Methods: This was a cross-sectional investigation of trauma characteristics among 38,435 car and motorcycle drivers referred to the South of Iran Trauma Center between October and March 2018. A log-binomial regression model was used to evaluate the relative risk of each covariate on the Injury Severity Score.

Results: There were 253 patients (7.78%) with alcohol consumption. Also, blood alcohol level was positive in 8.66% and 6.93% of car and motorcycle drivers, respectively. The ISS in alcohol consumers and nonconsumers was 6.34 (standard deviation; 8.73) and 4.12 (7.78), respectively, which was significantly higher in the alcohol consumers (t test = 12.96, P < 0.001). Therefore, alcohol consumption was a significant factor in increasing the relative risk of injury, which was 2.83 units more than among drivers who had not consumed alcohol.

Conclusions: Our findings show that the police and law enforcement agencies have a responsibility to enforce stricter rules to reduce drink driving and the burden of trauma on the healthcare system.

Keywords: drink driving, traffic accident, Injury Severity Score, Islamic Republic of Iran

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Introduction

Road traffic accidents (RTAs) are the leading cause of death and disability among people aged 20–50 years (1). Despite improved hospital care, mortality from RTAs is the second leading public health problem in the Islamic Republic of Iran (2). There is strong evidence that a substantial number of fatal as well as nonfatal injuries result from alcohol consumption and abuse (3); therefore, it can be argued that alcohol consumption is one of the most well-known risk factors for RTAs (4,5). High alcohol consumption was attributed to 14% of all road traffic injuries and the rate of alcohol consumption in RTAs has been reported to vary from 14% to 26% (4,6). It is reported that the chance of an accident after alcohol consumption is 6.1 times higher than without alcohol consumption (7). Among the Iranian population in 2015, the prevalence rate of substance use was 2.65% in people aged 15–64 years and the approximate number of addicts was estimated to be 1,235,000 (8). Despite strict rules and prohibitions on consuming, buying and selling of alcohol in the Islamic Republic of Iran, the prevalence of alcohol consumption among young educated people is still increasing (9). Although studies have found a direct correlation between alcohol and mortality (10,11), the effect of blood alcohol level on Injury Severity Score (ISS) has not been measured when this group is matched with drivers who do not consume alcohol (12).

No specific study has determined the prevalence of alcohol-related injuries in RTAs in the Islamic Republic of Iran where, as a Muslim-majority country, alcohol is illegal. Moreover, no study has reported the consequences of alcohol consumption and other demographic variables on severity of injury in RTAs. The aims of this study were to determine the prevalence of alcohol consumption in car and motorcycle drivers involved in RTAs and to compare the severity of injuries between alcohol consumers and non-consumers. We also compared the prevalence of drink driving in the Islamic Republic of Iran to that in other Muslim-majority countries in the Middle East and countries in which alcohol is legal.

Methods

This was a retrospective cohort investigation of trauma characteristics among car and motorcycle drivers involved in RTAs who were referred to Shahid Rajaee Trauma Center (Emtiaz) between October and March 2018. We excluded patients aged < 15 years; patients who were discharged or died within 24 hours; patients dead on arrival at hospital; patients without the data necessary to calculate their trauma score; patients whose Abbreviated Injury Scale (AIS) values were not measurable; patients with unclear type of trauma; and patients with mild injuries such as soft tissue damage and fractures.

Alcohol consumption was determined by measuring
blood alcohol level in a diagnostic laboratory. ISS was considered as the outcome variable. ISS was based on radiological findings and the International Statistical Classification of Diseases, 10th revision (ICD-10) codes.

Demographic data including age, sex, type of driver, time of admission to hospital, duration of hospitalization, and ISS were studied. Experts calculated severity by referring to patients’ medical records, including diagnostic ICD-10 codes, surgical reports, primary triage papers and emergency reports. Each ICD-10 injury code was assigned to one of the 6 ISS body regions. According to the AIS, each patient’s injured body regions corresponded to the injured body region with the highest ISS. In this regard, all injuries received an AIS code ranging from 1 (minor injury) to 6 (an injury considered incompatible with life). Patients with multiple injuries were scored by adding the squares of the three highest AIS scores in 3 predetermined body regions. This process provided the ISS which ranged from 1 to 75. Additionally, because there was no information on alcohol consumption in patients’ records, this information was based on the patients’ admission code.

Statistical methods such as chi2 test, two independent t tests, and one-way analysis of variance were used for descriptive comparisons of demographic characteristics and clinical indicators in alcohol and non-alcohol consumers. Binary outcomes in cohort studies are commonly analysed by applying a logistic regression model to the data to obtain odds ratios (ORs) for comparing groups with different sets of characteristics. Although this is often appropriate, there may be situations in which it is more desirable to estimate a relative risk or risk ratio (RR) instead of OR. With minor modification of the statements for logistic regression, a log-binomial model can be run to obtain the RR instead of the OR. All that needs to be changed is the link function between the covariates and outcome (13). Therefore, a log-binomial regression model was used to evaluate the RR of each covariate in ISS (divided into ISS ≤ 8 vs ISS > 8 based on distribution of injury severity). A 2-sided P < 0.05 was considered statistically significant. Data were analysed using Stata14 software and figures were prepared using R 3.4.3 for Windows.

This project was approved by the Research Ethics Committee with number of IR.SUMS.REC.1397.420 by Shiraz University of Medical Sciences in Shiraz, Islamic Republic of Iran.

Results

There were a total of 38 435 injured patients, which included 253 (7.78%) who were positive for alcohol consumption. Blood alcohol level was positive in 8.66% of car and 6.93% of motorcycle drivers involved in RTAs. The average age of alcohol users was 26.16 (7.98) years, 95.26% of whom were male and 4.74% female (Table 1). The ISS in alcohol users was 6.34 (8.73) and there was a significant difference between the alcohol consumers and nonconsumers. The number of people with ISS > 8 was greater among alcohol consumers than nonconsumers (26.49% vs 15.01%).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Alcohol consumption (253)</th>
<th>No alcohol consumption (2998)</th>
<th>P</th>
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<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>26.16 (7.98) years</td>
<td>33.02 (13.85) years</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>0.045</td>
</tr>
<tr>
<td>Male</td>
<td>241 (95.26)</td>
<td>2749 (91.69)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12 (4.74)</td>
<td>249 (8.31)</td>
<td></td>
</tr>
<tr>
<td>Type of driver</td>
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<tr>
<td>Car</td>
<td>139 (54.96)</td>
<td>1467 (48.93)</td>
<td></td>
</tr>
<tr>
<td>Motorcycle</td>
<td>114 (45.06)</td>
<td>1531 (51.07)</td>
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<tr>
<td>Injury severity score, mean (SD)</td>
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<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>1–4</td>
<td>6.34 (8.73)</td>
<td>4.12 (778)</td>
<td></td>
</tr>
<tr>
<td>5–8</td>
<td>156 (61.66)</td>
<td>2371 (79.09)</td>
<td></td>
</tr>
<tr>
<td>9–15</td>
<td>30 (11.86)</td>
<td>177 (5.9)</td>
<td></td>
</tr>
<tr>
<td>16–25</td>
<td>39 (15.42)</td>
<td>247 (8.24)</td>
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<tr>
<td>&gt; 25</td>
<td>17 (6.72)</td>
<td>146 (4.87)</td>
<td></td>
</tr>
<tr>
<td>Time of accident</td>
<td></td>
<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>00:00–04:00</td>
<td>204 (80.63)</td>
<td>1093 (36.46)</td>
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</tr>
<tr>
<td>04:00–12:00</td>
<td>19 (7.51)</td>
<td>560 (18.68)</td>
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</tr>
<tr>
<td>12:00–20:00</td>
<td>30 (11.86)</td>
<td>1345 (44.86)</td>
<td></td>
</tr>
<tr>
<td>Injured patients per day, mean (SD)</td>
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<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>In holidays</td>
<td>2.04 (0.34)</td>
<td>16.31 (0.56)</td>
<td></td>
</tr>
<tr>
<td>In non-holidays</td>
<td>0.79 (0.07)</td>
<td>11.55 (0.12)</td>
<td></td>
</tr>
</tbody>
</table>

SD = standard deviation
accidents (80.63%) among alcohol consumers occurred between 20:00 and 04:00 hours. The average number of patients injured daily was significantly greater during holidays in comparison to working days for both alcohol consumers and nonconsumers.

A log-binomial regression model was performed to determine the relative risk of covariates on ISS (Table 2). The predictive variables were age, sex, type of driver (motorcycle or car) and alcohol consumption and the independent variable was ISS. Increasing age with control of other variables led to a 0.01 increase in risk of ISS in > 8 patients. The risk of severe injury was significantly higher in motorcycle compared to car drivers. Alcohol consumption was a significant factor in increasing the relative risk which was 2.83 units more in comparison to that in non-alcohol consumers.

A closer look at the alcohol titer among surviving patients indicates that the severity of injury increased with alcohol consumption and it was higher in motorcycle than car drivers (Figure 1).

Figure 2 shows the percentage of accidents among drinkers in each age group. The percentage of accidents in alcohol users was higher among younger drivers. About 12% of injured drivers aged 15–20 years had a positive result for alcohol consumption at the time of the accident. As age increased, the number of accidents also decreased among alcohol users.

**Discussion**

The current study evaluated the effect of alcohol consumption on severity of injury in drivers involved in RTAs. The relationship between percentage of alcohol consumption and increased risk of accident was evaluated using log-binomial regression.

The prevalence of alcohol consumption while driving was 7.78% in our study, which is less than in other studies. The results of a study in US National Trauma Data Bank (2007–2010) indicated that among a total of 88 794 motorcycle drivers, 30.9% showed positive test results for alcohol (14). A study in Virginia, United States of America showed that prevalence of alcohol consumption while driving was about 36.89% (15). In Australia, blood alcohol was present in 29.1% of all drivers (16). In a study of RTAs in Turkey, alcohol was detected in the blood of about 54.4% of cases, although subjects were considered to be positive when alcohol blood concentration exceeded 50 mg/dl (17). In other studies the prevalence of alcohol in drivers was lower than in our study. A study in the United Arab Emirates found that the prevalence of

<table>
<thead>
<tr>
<th>Variables</th>
<th>RR</th>
<th>Z statistic</th>
<th>P</th>
<th>95% CI for RR</th>
</tr>
</thead>
<tbody>
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<td>Age</td>
<td>1.01</td>
<td>2.91</td>
<td>0.04</td>
<td>1.00</td>
</tr>
<tr>
<td>Sex (Female to Male)</td>
<td>2.16</td>
<td>4.27</td>
<td>&lt; 0.001</td>
<td>1.51</td>
</tr>
<tr>
<td>Type of driver (motorcycle to car drivers)</td>
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<td>-6.69</td>
<td>&lt; 0.001</td>
<td>0.65</td>
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<tr>
<td>Alcohol</td>
<td>2.83</td>
<td>-44.06</td>
<td>&lt; 0.001</td>
<td>1.54</td>
</tr>
</tbody>
</table>

CI = confidence interval; RR = relative risk.

**Figure 1** ISS stratified by blood alcohol level

![ISS stratified by blood alcohol level](image-url)
alcohol consumption in car drivers was about 2.2% (18). Also, prevalence of alcohol among injured drivers was reported as 0.45% in Norway (19). In a study in Qatar, the prevalence of driving while under the influence of alcohol was estimated as 1.8% (20). A study in Singapore showed that 2.3–3.0% of fatal and injury-sustaining RTAs were alcohol related (21). The differences in alcohol consumption patterns in different countries are due to stringent laws as well as religion. Moreover, it should be noted that our study considered blood alcohol > 80 mg/dl as alcohol consumption. The permissible amount of alcohol in the blood differs between countries; in some it is 100 mg/dl and in others it is 50 mg/dl.

Our results revealed that consumption of alcohol increased ISS by 2.8 times to > 8 compared to nonconsumers. Our results are consistent with those of Valdez et al., who showed that blood alcohol level is associated with ISS for specific types of injuries; however, across all types of injuries, there was no significant association between blood alcohol level and ISS (22).

We found that ISS in motorcycle drivers was higher than that in car drivers. This is consistent with the studies of Bolandparvaz et al., who reported injury patterns among trauma patients of different ages and sex in the Islamic Republic of Iran (23), and Yadollahi et al., who conducted an epidemiological study of trauma patients who attended national, cultural and religious events in the Islamic Republic of Iran (24). Both those studies included RTAs and showed that injury in motorcycle drivers was more severe than in car drivers. Our study was the first to evaluate the risk of accidents caused by alcohol consumption in Fars Province. The highest prevalence of alcohol consumption among victims of RTAs occurred in those aged 20–25 years and it seemed that high-risk behaviour such as alcohol consumption decreased with advancing age. As we indicated, ISS was in direct correlation with blood alcohol titre. Our study showed that the percentage of accidents among young drinkers was higher than among older patients, which is consistent with a study of alcohol consumption in Denmark (25).

A log-binomial regression model was used in this study to analyse injury severity due to alcohol consumption in RTAs, with control of other variables. Hoong et al. have used this model to evaluate occurrence of RTAs at road intersections for several years and have shown that the log-binomial model is more effective than survival models for evaluation of relative risk of injury (26). Our study can pave the way for developing theories about the reasons behind the high incidence of RTAs due to alcohol consumption in holidays. As a result of higher injury severity among alcohol consumers, we recommend that greater supervision is needed regarding high-risk driving behaviour. We also advise law enforcers to implement stricter laws concerning the ban on alcohol consumption.

The limitations of our study include the fact that we were not able to determine the type of body injuries compared to injury severity in different parts of the body. Moreover, data about deaths at the scene as well as prehosital deaths, type of car, speed, seat belt use and drowsy driving were not available. The effect of these variables as well as opioid substances should be evaluated in future studies for evaluation of competitive risks related to alcohol consumption in occurrence of RTAs.

**Conclusion**

Trauma is harmful to patients, imposes a burden on the healthcare system, and is of significant concern to public health. The findings of our study show that the police and law enforcement agencies have a responsibility to arrange preventive laws to reduce the overall prevalence of drink driving and decrease the burden of trauma on the healthcare system.

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**Competing interests:** None declared.
Risque relatif de traumatismes dus à la consommation d'alcool chez les conducteurs de voitures et de motos

Résumé

Contexte : Il existe des preuves solides indiquant qu'un nombre important de traumatismes, mortels et non mortels, dans les accidents de la circulation résultent de la consommation et de l'abus d'alcool.

Objectifs : Examinier la relation entre le taux d'alcoolémie et les caractéristiques des blessures chez les patients traumatisés admis dans un grand hôpital universitaire.

Méthodes : Il s'agissait d'une étude transversale des caractéristiques des traumatismes chez 38 435 conducteurs de voitures et de motos envoyés au Centre de traumatologie du sud de la République islamique d'Iran entre octobre et mars 2018. Un modèle de régression log-binomial a été utilisé pour évaluer le risque relatif de chaque covariable en utilisant le Score de gravité des traumatismes.

Résultats : 253 patients (7,78 %) avaient une consommation d'alcool. En outre, le taux d'alcoolémie était positif chez 8,66 % et 6,93 % des conducteurs de voitures et de motos, respectivement. Le Score de gravité des traumatismes chez les consommateurs d'alcool et les non-consommateurs était de 6,34 (écart-type ; 8,73) et 4,12 (7,78), respectivement, ce qui était significativement plus élevé chez les consommateurs d'alcool (test t = 12,96, p < 0,001). La consommation d'alcool est donc un facteur important dans l'augmentation du risque relatif de blessure, qui est de 2,83 unités de plus que chez les conducteurs qui n'ont pas consommé d'alcool.

Conclusions : Nos conclusions montrent que la police et les forces de l'ordre ont la responsabilité d'appliquer des règles plus strictes pour réduire la conduite sous l'emprise de l'alcool et le fardeau des traumatismes qui pèsent sur le système de soins de santé.

الخطر النسبي لتعاطي الكحول

الخلاصة

الخلفية: تُمَّثُ دلائل قوية على أن عددًا كبيرًا من الإصابات المميتة وغير المميتة المرتبطة بحوادث المرور على الطرق ناجمة عن تعاطي الكحول وإساءة استخدامه.

الأهداف: هدفت هذه الدراسة إلى دراسة العلاقة بين تركيز الكحول في الدم وخصائص الإصابة لدى مرضى الإصابات الشديدة الذين أُدخلوا إلى مستشفى تعليمي رئيسي.

طرق البحث: أُجري هذا الاستقصاء المقطعي لخصائص الإصابات الشديدة لدى 38 435 سائق سيارة ودراجة نارية أُحیلوا إلى مركز جنوب إیران خلال الفترة بين أكتوبر/تشرین الأول ومارس/آذار 2018. واستُخدم نموذج انحدار لوجستي ذو حدین لتقییم الخطر النسبي للإصابات الشدیدة في الفترة ما بين سائقي السیارات وسائقي الدراجات الناریة على التوالي. وبلغت درجة شدة الإصابة لدى الأشخاص المتعاطون للإصابات الشديدة الذين أدخلوا إلى مستشفى تعليمي رئيسي 6.93% و8.66% و6.93% على التوالي. وبلغت درجة شدة الإصابة لدى الأشخاص المتعاطون للإصابات الشديدة الذين أدخلوا إلى مستشفى تعليمي رئيسي 6.34 (الانحراف المعیاري، 8.73) و4.12 (7.78) على التوالي، وهي أعلى بكثير لدى المتعاطون للإصابات الشديدة الكرمیة، والتي زاد لدى السائقين المتعاطين للإصابات الشديدة إلى مستوى نسبي 2.83 وحدة مقارنةً بالسائقين الذين لم يتعاطوا الكحولاً.

النتائج: كان هناك 253 مريضاً (7.78%) يتعاطون الكحولاً. وكان مستوى التكحولا في الدم إيجابياً لدى 8.66% و6.93% من سائقي السيارات والإدراجات النارية على التوالي. وبلغت درجة شدة الإصابة لدى الأشخاص المتعاطين للإصابات الشديدة 6.34 (الانحراف المعیاري، 8.73) و4.12 (7.78) على التوالي، وهي أعلى بكثير لدى المتعاطين للإصابات الشديدة الكرمیة، والتي زاد لدى السائقين المتعاطين للإصابات الشديدة إلى مستوى نسبي 2.83 وحالة مماثلة بالسائقين الذين لم يتعاطوا الكحولاً.

المستندات: تُنَفَّذ النتائج التي توصلنا إليها أن الشرطة ووكالات إنتفاض القانون تحمل مسؤولية إنتفاذ قواعد أكثر صرامة للحد من القيادة تحت تأثير تعاطي الكحولاً، وخصوصاً عبء الإصابات الشديدة الذي ينويه ب نظام الرعاية الصحية.
References


Geographic risk of general and abdominal obesity and related determinants in Iranian children and adolescents: CASPIAN-IV Study

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Abstract

Background: Obesity, as a risk factor for many noncommunicable diseases, is a common public health problem in developed and developing countries. Among Iranian children and adolescents, the prevalence of being overweight has increased by almost 50% in the past two decades.

Aims: To visualize the geographic differences in general and abdominal obesity risks and related determinants among Iranian children and adolescents.

Methods: Participants consisted of 14,880 students, aged 7–19 years, living in urban and rural areas of the Islamic Republic of Iran. Spatial patterns of obesity and its association with related risk factors were identified using Bayesian spatial modeling.

Results: The highest spatial risks of general obesity (odds ratio 1.21–1.66 for males and 1.81–2.02 for females) and abdominal obesity (odds ratio 1.20–1.82 for males and 1.25–1.78 for females) were observed in the north-west and south-west of the country. Risk of obesity was significantly higher in areas with a higher rate of urban residence, active current smokers and prolonged screen time.

Conclusion: Identification of high-risk regions for obesity and spatially related risk factors can be used as informative tools for decision-making and planning in health systems at national and subnational levels.

Keywords: geographical mapping, obesity, paediatrics, risk factors, spatial modelling

Introduction

Obesity, as a risk factor for many noncommunicable diseases, is a common public health problem in developed and developing countries. It has several adverse consequences on different body organs (1). Obesity is one of the most complex clinical disorders in the paediatric age group (2,3). Among Iranian children and adolescents, the prevalence of being overweight has increased by almost 50% in the past two decades. In 2011, 11.9% of Iranian children and adolescents had general obesity and 19.1% had abdominal obesity (4).

Most studies about obesity have focused on determinants of obesity at the individual level. For example, any association of obesity with socioeconomic and lifestyle-related variables has been investigated in different populations (5–7). However, it would be useful to recognize how these factors contribute to geographic variations. Some recent studies have investigated the association and geographic clustering of obesity risk factors (8–12). For instance, spatial clustering of obesity and moderate physical activity attributes have been investigated at regional levels without considering the relevant determinants (10). In one study, spatial clustering of cardiovascular risk factors revealed a significant correlation between high-body mass index (BMI) clusters and low socioeconomic status (SES) of the surrounding community, as well as between elevated BMI and high frequency of smoking in the clustered region (9).

A global overview of obesity indicates a large geographic variation in the prevalence rates (13); therefore, knowledge of changes in distribution of obesity helps to identify populations at risk of future noncommunicable diseases. However, few studies have assessed the geographic distribution of general and abdominal obesity (14). BMI has been used frequently in clinical settings and population studies in order to assess obesity. BMI is imprecise, but useful for measuring overall adiposity (5). It has become evident that body fat distribution is also important in predicting obesity-related health risks. It is well known that abdominal obesity is strongly associated with cardiovascular and metabolic risks (15). Abdominal obesity is mainly investigated using waist circumference (WC), waist-to-hip ratio or weight to height ratio (WHtR) (1,15–18). Whether these measures should be used to assess obesity-related risks is still unclear. Yan et al. reported WHtR as an accurate measurement of obesity (18).
To visualize geographic variation in outcome, mapping is most frequently performed, using an ordinary Poisson or logistic model; however, this approach has some disadvantages. This model does not take into account any spatial pattern in outcome; that is, the tendency for geographically close areas to have similar outcome rates (19). In this regard, considering prior information on the rates, local geographic dependence could induce the spatial patterns. Hence, Bayesian estimates of the rate in an area is shrunk toward a local mean according to the rates in the neighbouring areas (20). Also, in this modelling framework, covariates as spatial risk factors can be accounted for by describing variations of rates between areas. A fully Bayesian approach via Markov Chain Monte Carlo (MCMC) methods is efficient to estimate prevalence rates and risk of obesity and modelling-associated risk factors (19,20).

While the national prevalence rate of different types of obesity is an important tool for policy-makers, investigating the distribution of obesity among geographic areas is equally important for informed decision-making in the allocation of resources for prevention programmes.

The present study aimed to visualize the geographic differences in general and abdominal obesity risk and prevalence rates, and to determine, using spatial modelling, some environmental and socioeconomic risk factors in a large sample of 7-19-year-old children and adolescents in the Islamic Republic of Iran. The maps of general and abdominal obesity were extracted from smoothed spatial odds ratios (ORs), representing spatial obesity risk in different areas of the country, adjusted by local autocorrelation and uncorrelated heterogeneity.

To the best of our knowledge, this is the first and largest epidemiological study in the Middle East and North Africa, examining the geographic variation at the provincial level, concerning the prevalence rate of general and abdominal obesity in a nationally representative sample of children and adolescents.

**Methods**

**Study population and sampling**

This study was conducted in 2011 and 2012 as part of a national school-based project entitled Childhood and Adolescence Surveillance and Prevention of Adult Non-Communicable Disease (CASPIAN-IV) in urban and rural areas in different Iranian provinces. The study population consisted of 14,880 school students aged 7-19 years. Data were collected in a multistage sampling framework in 30 provinces. Stratification was carried out in each province, according to the area of residence (urban/rural) and school grade (elementary/intermediate/high school). The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences and Isfahan University of Medical Sciences. After a complete explanation of the study objectives and protocols, written informed consent and verbal consent were obtained from the parents and students, respectively. More details can be found elsewhere (4).

**Anthropometric measurements**

In the CASPIAN-IV study, all anthropometric measures were obtained under standard protocols, using calibrated instruments. Body weight was measured in light clothing to the nearest 0.1 kg, and height was recorded barefoot, to the nearest 0.1 cm. BMI was calculated as a measure of obesity. WC was measured using a nonelastic tape to the nearest 0.1 cm, at a point midway between the lower border of the rib cage and the iliac crest at the end of normal expiration. The World Health Organization (WHO) growth charts categorize BMI, based on obese and nonobese groups (21). Abdominal obesity was also determined as WHR > 0.5 (22).

**Covariates assessment**

Students’ information was collected through the students’ healthcare system. The questionnaires were prepared according to the WHO Global School-based Student Health Survey (WHO-GSHS). The validity and reliability of the questionnaire had been reported elsewhere (23). Students completed the questionnaire under the supervision of healthcare experts. Information was entered into a checklist by a trained team. The student’s parents answered part of the questionnaire.

Screen time (ST), defined as the hours spent per day at weekends and weekdays in watching television and using computers, was assessed by the WHO-GSHS questionnaire. The weighted average of ST in a day was obtained by calculating the sum of 1/7 * ST on a weekend day and 6/7 * ST on a weekday. This weighted average was divided into quartiles, and the fourth quartile, 4 hours/day, was considered as prolonged ST.

SES was calculated through an approved method in the International Reading Literacy Study (PIRLS) (24). The SES score was calculated, using the principal component analysis (PCA) method based on a questionnaire; asking parents about their level of education and occupation, type of school (private or public), type of home (rented or owned), and family assets (private car and computer). The first tertile of SES score was considered low.

Physical activity was assessed by 3 self-report questions. (1) During the past week, how many days have you been physically active, for 30 minutes/day? (2) Do you have regular sports classes at school? (3) How much time do you spend on regular sports classes at school every week? A total physical activity score was extracted by PCA. The first tertile was considered to be low physical activity (25). Current smoking status of children and adolescents was also considered as a covariate.

**Statistical analysis**

The percentage of obesity and its determinants were calculated and compared between the sexes. Due to significant differences between males and females, subsequent analyses were carried out by sex using the c2 test. To visualize spatial variations in general and abdominal obesity, the Bayesian spatial model represented by Besag, York and Mollie was used to detect the ORs of obesity in 30 provincial clusters, compared with the global odds of
the whole country (19,20).

The estimated ORs implied spatial pattern of obesity risk across the regions. In addition, in this modelling approach, the risk factors associated with provincial prevalence rate of general and abdominal obesity were investigated spatially.

The model was fitted using OpenBUGS version 3.2.2 (MRC Biostatistics Unit, Cambridge, United Kingdom of Great Britain and Northern Ireland). In performing the MCMC algorithm, each parameter was observed to converge within 50,000 iterations of Gibbs sampler, so after discarding the initial 50,000 burn-in values, an additional 20,000 samples were generated for the Bayesian inference, by choosing the 10th iteration to avoid possible autocorrelation. The convergence of model parameters was, moreover, evaluated by tracing and autocorrelation plots, and Gelman–Rubin criterion. Estimated ORs and 95% confidence intervals (CIs) for general and abdominal obesity were calculated and shown through geographic maps, using the map option in GeoBUGS. Statistical significance was indicated when 95% CIs did not include 0.

Results

Table 1 shows the prevalence of obesity and related risk factors in the Islamic Republic of Iran by sex. The rate of general and abdominal obesity in males was 10 and 14%, respectively, which was significantly lower than the corresponding rate in females (18% and 20%, respectively). The rate of obesity-related risk factors, including current smoker and prolonged ST, were significantly higher in males than females \( (P < 0.05) \). In contrast, physical activity rate in females was significantly less than in males \( (P < 0.05) \).

Figure 1 (online) depicts spatial distribution of selected obesity risk factors across the Islamic Republic of Iran. Urban residence was the dominant lifestyle in most provinces. Central provinces, including the capital, compared to other areas, had the highest rates of low physical activity, prolonged ST, current smokers and higher SES.

For evaluating the association of obesity-related risk factors and prevalence rates of obesity in different geographic areas, the Bayesian spatial regression was used (Table 2). According to 95% CIs, in provinces with significantly higher rates of obesity (general and abdominal), there was a higher rate of urban residence. Urban residence had a stronger impact on the occurrence of general obesity in females. Low physical activity did not show a significant association with any type of obesity. Furthermore, there was no significant association between high SES and obesity. Abdominal and general obesity rates in males had a direct significant association with prolonged ST. Those provinces with higher rates of active current smokers had significantly higher rates of male abdominal obesity.

To obtain a geographic map of obesity, a mixed conditional autoregressive model was considered, without using covariates. Figures 2 and 3 (online) show the variation in ORs of general and abdominal obesity in different provinces for males and females. The spatial ORs were smoothed for spatial autocorrelation and unstructured over dispersion. Spatial risk of abdominal and general obesity is geographically varied and there were sex differences in the distribution of general and abdominal obesity.

The geographic variation of ORs denoted that the risk of general obesity for males and females was higher in the north, northwest, and southwest Iranian provinces, compared with the whole country. The provinces with the highest ORs for males were Gilan (1.66), Mazandaran (1.63), East Azerbaijan (1.54), Qazvin (1.56), Tehran (1.21), Qom (1.48) and Bushehr (1.29). The provinces with the highest ORs for females were Ardebil (1.81), East Azerbaijan (1.31), Gilan (1.66), Mazandaran (1.70), Kermanshah (1.32), Bushehr (2.02) and Khuzestan (1.50). The south and southeast provinces had the lowest ORs for general obesity in both male and female groups.

The risk of abdominal obesity was also higher for females and males in the north, northwest and southwest Iranian provinces, compared with the whole country. The highest ORs for abdominal obesity in males were in Ardebil (1.82), East Azerbaijan (1.44), Isfahan (1.39), Gilan (1.59), Hamedan (1.27), Kermanshah (1.20), North Khorasan (1.34), Markazi (1.30), Mazandaran (1.83), Semnan (1.25) and Qazvin (1.33). In females, the highest ORs occurred in Ardebil (1.52), East Azerbaijan (1.36), Qazvin (1.37), Kermanshah (1.25), Gilan (1.28), Golestan (1.42), Mazandaran (1.78), Tehran (1.46) and Bushehr (1.33).

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Female</th>
<th>Male</th>
<th>( P^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>General obesity</td>
<td>630 (0.10)</td>
<td>859 (0.14)</td>
<td>0.043</td>
</tr>
<tr>
<td>Abdominal obesity</td>
<td>1105 (0.18)</td>
<td>1290 (0.20)</td>
<td>0.023</td>
</tr>
<tr>
<td>Low physical activity</td>
<td>2440 (0.40)</td>
<td>1816 (0.29)</td>
<td>0.014</td>
</tr>
<tr>
<td>Prolonged ST</td>
<td>931 (0.15)</td>
<td>1379 (0.22)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Current smoking</td>
<td>102 (0.02)</td>
<td>231 (0.04)</td>
<td>0.034</td>
</tr>
<tr>
<td>High socioeconomic status</td>
<td>1867 (0.33)</td>
<td>2015 (0.34)</td>
<td>0.143</td>
</tr>
</tbody>
</table>

\( *P \) test.
Discussion

In this large epidemiological study based on a representative sample of children and adolescents aged 7–19 years in the Islamic Republic of Iran, we investigated using the Bayesian spatial model the geographic variation at the provincial level of the rate of general and abdominal obesity. The maps were extracted from smoothed spatial ORs, representing the risk of obesity in different regions according to local autocorrelation and uncorrelated heterogeneity. Both types of obesity had a large geographic variation. The higher risks of general and abdominal obesity were found in the north, northwest and southwest regions. Possible explanations for this variation are: (i) differences in subjects' characteristics, such as dominant lifestyle behaviour, eating habits or dietary patterns, and SES; (2) dissimilarities in healthcare accessibility of different provinces; and (3) differences in health policy-making by authorities who support a healthy lifestyle.

The rate of abdominal obesity was higher than general obesity. The overall rates of both types of obesity were higher in males than females, which is in line with CASPIAN-IV data from 2003 (26), although the distribution of general and abdominal obesity in males and females differed throughout the country.

The Bayesian spatial regression model was used to model the provincial level determinants of obesity in 30 provinces. The risk factors included urban residence, low physical activity, active current smokers, low SES and prolonged ST. A few studies have investigated the determinants of geographic obesity variation (8–11). The current study showed no significant relationship between the rate of low physical activity in different areas and obesity, which is in line with the study of Schuurman et al. in Vancouver, Canada (10). They found no significant clustering, based on obesity and physical activity association. However, in contrast to the data obtained by Ford et al. (27) about adults’ obesity-related determinants, in 100 metropolitan areas in the United States of America, we found a significant association between physical activity and obesity rate, using Poisson regression. This discordance might be due to a different age range of their target population and the statistical methods, compared to ours.

The effect of urban residence on obesity has been investigated in some recent national studies in the Islamic Republic of Iran, for age 7-19 years (7,26,28). Our results identified the spatially direct association between urban residence and obesity in females. Provinces with more urban residents had significantly higher rates of obesity. Qom, a province in the centre of the country, had the highest number of urban residents, while Hormozgan, in the south, had the lowest number.

Smoking is recognized as a critical risk factor for obesity (28,29). Our results demonstrated that abdominal obesity in females was significantly more prevalent in provinces with higher rates of active current smokers. This is in agreement with Chioloer et al. (29) but in contrast with Bakhshi et al. (28). Tehran, the capital, had the highest rate of female current smokers.

In line with previous studies (5,6), our results revealed that prolonged ST was significantly associated with higher rates of abdominal and general obesity among males.

The ethnicity of individuals in this study has been considered, as a part of geographic variations that substantially are latent in spatially random parts of the model. One study of Iranian school children indicated that residents of Baluch ethnicity in the southeast had the lowest BMIs, whereas residents of Turk ethnicity in the northwest had the highest BMIs, among male children. Moreover, Arab female residents in the southwest had the highest BMI (30), which is in line with our extracted maps, based on estimated obesity rates.

One of the limitations of the current spatial epidemiological study was the occurrence of confounding bias, which is a common feature in epidemiological studies. For example, socioeconomic factors are strong predictors of the majority of health outcomes, but when exposed to some environmental factors, the confounding impact occurs. Lack of many other determinants of obesity,

### Table 2

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>General obesity</th>
<th>Abdominal obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living in urban area</td>
<td>1.33* (0.46–2.20)</td>
<td>2.76* (1.65–3.88)</td>
</tr>
<tr>
<td>Low physical activity</td>
<td>1.20 (5.89 to 8.32)</td>
<td>0.06 (-10.20 to 10.83)</td>
</tr>
<tr>
<td>High socioeconomic status</td>
<td>2.78 (3.51 to 9.09)</td>
<td>3.41 (-4.88 to 11.46)</td>
</tr>
<tr>
<td>Prolonged ST</td>
<td>10.50* (2.04–18.72)</td>
<td>2.79 (-6.54 to 12.0)</td>
</tr>
<tr>
<td>Current smoking</td>
<td>2.18 (3.14 to 7.44)</td>
<td>0.73 (-3.71 to 5.12)</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living in urban area</td>
<td>2.76* (1.65–3.88)</td>
<td>3.41 (2.04–18.72)</td>
</tr>
<tr>
<td>Low physical activity</td>
<td>0.06 (-10.20 to 10.83)</td>
<td>0.73 (-3.71 to 5.12)</td>
</tr>
<tr>
<td>High socioeconomic status</td>
<td>3.41 (2.04–18.72)</td>
<td>0.73 (-3.71 to 5.12)</td>
</tr>
<tr>
<td>Prolonged ST</td>
<td>6.41* (2.04–18.72)</td>
<td>0.73 (-3.71 to 5.12)</td>
</tr>
</tbody>
</table>

Regression coefficients and 95% confidence intervals, in Bayesian spatial modelling. * Statistical significance level 0.05.
such as major nutritional habits was another limitation that could be considered in future investigations. Our results were based on information from 30 provinces, in which Alborz was considered as part of Tehran; however, in the latest country divisions, Alborz was separated from Tehran and there are now 31 provinces. The main advantages of the current study were using data from a large population-based survey and providing up-to-date estimates of rates of general and abdominal obesity in 30 Iranian provinces. Longitudinal studies are suggested for determining the trends in general and abdominal obesity, and examining precise determinants that can be useful for health policy-makers.

**Conclusion**

We estimated the rates of abdominal and general obesity, and specified the local risk of obesity across Iranian provinces, using a spatial Bayesian model that considered spatial autocorrelation and heterogeneity. In the same modelling framework, we evaluated the spatial impact of obesity risk factors. Indeed, environmental and lifestyle-related risk factors, including urban residence, current smoking and prolonged ST were spatially associated with increased risk of obesity in children and adolescents aged 7-19 years. As a result, the spatial Bayesian regression model could be effectively used to identify spatial risk factors and spatial patterns of obesity. The geographic mapping of high-risk regions for general and abdominal obesity presented could be useful for decision-making and planning in health systems. A high incidence rate of obesity-related disorders is expected in the future, imposing a considerable economic burden on the health system; therefore, identifying high-risk regions, spatial pattern of obesity and the spatial risk factors could be applied to epidemiological prediction and optimal allocation of health resources among different regions.

**Acknowledgement**

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References


Views of community pharmacists in Lebanon on the unified prescription: a mixed method study

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Abstract

Background: The unified prescription was introduced in Lebanon in 2011; an aim was to save on medication expenditure. Aims: The aim of this study was to evaluate the views of community pharmacists on the effect and usefulness of the unified prescription.

Methods: A cross-sectional telephone survey of community pharmacists from all governorates of Lebanon was conducted. A questionnaire was used to collect demographic data, pharmacists’ views on the effect of the unified prescription on their work, the percentage of prescriptions in which the prescriber had indicated that the medicine should not be substituted with a generic equivalent and the percentage needing clarification from the prescriber. Face-to-face interviews were held with 12 pharmacists to explore their views further.

Results: Of 251 pharmacists interviewed, 56.8% did not think the unified prescription was useful, 34.8% thought it complicated their work and 24.0% that it reduced their autonomy. The in-depth interviews showed that autonomy was perceived to be restricted because of the difficulty in convincing patients to accept a substitute generic medicine, which the unified prescription allowed. The unified prescription complicated pharmacists’ work because of increased paperwork and the need for more storage. Pharmacists felt that the large number of prescriptions in which the prescriber had indicated that the medicine should not be substituted undermined the purpose of the unified prescription.

Conclusion: The implementation of the unified prescription was not considered a success by community pharmacists in Lebanon. Efforts are needed to improve communication with prescribers and educate the public about pharmacists’ role and generic medicines.

Keywords: pharmacists, prescriptions, drugs, generics, Lebanon

Introduction

In 2011, a new unified prescription was introduced in Lebanon, as a result of which the pharmacy profession had to make some substantial changes to their practices. This new policy was designed to improve health care services, in which pharmacists play an important role; however, no studies have evaluated the effect of the unified prescription on the daily practice of community pharmacists and whether they were able to adapt to the changes.

The triplicate prescription form was instated by ministerial decision no. 1925 issued by the Lebanese government in 2011. This decision introduced the unified prescription form with three copies: white for the patient, pink for the pharmacist and yellow for the physician. Its objective differed from that of the triplicate prescription programme in North America.

Triplicate prescription forms have been used in the United States of America (USA), Canada and other countries to monitor certain drugs with high potential for abuse. For instance, in 1989, New York State mandated triplicate prescription for benzodiazepines (1,2). The triplicate prescription allows the monitoring of prescribing practices, provides feedback on targeted drugs and identifies areas of misuse (3).

The Lebanese government’s intention with the unified prescription programme was to reduce medication costs by increasing the use of cheaper generic medicines. The programme would empower pharmacists to suggest substitution to their clientele who were presenting prescriptions to be filled (4). Relieving the burden on public finances is essential, particularly as expenditure on prescription drugs in Lebanon is estimated to rise to US$ 2.71 billion in 2020, accounting for 52% of total health expenditure (4).

With generic substitution at the core of the unified prescription programme, pharmacists are supposed to play a key role in addressing patients’ enquiries about generic drugs and correcting any misconceptions on their effectiveness and value (5,6). The usually lower cost of generic medicines is often mistakenly interpreted as inferiority of these medicines compared with proprietary medicines with known brand names. This obstacle for substitution is more obvious with lower educational...
level and socioeconomic status of patients (7–9). As such, pharmacists are in a unique position to educate patients about bioequivalence studies and good manufacturing practices that generic medicines undergo to overcome any mistrust patients may have about accepting drug substitution (9,10).

The implementation of the unified prescription was expected to affect the physician–pharmacist–patient relationship, especially the pharmacists who are the link between the prescriber, the patient and the medication. Therefore, the aim of our study was to evaluate the views of community pharmacists on the newly implemented unified prescription in terms of its usefulness and its effect on their workflow – its complexity and their autonomy. Pharmacists’ autonomy is their ability to do their jobs independently without having to refer to physicians for drug substitutions, and to make and implement decisions for the benefit of the patient.

Methods

Design and sample

This was a mixed-method study: the first part (phase 1, June–August 2016) was a quantitative survey and the second part was qualitative interviews (phase 2, April 2017). Phase 1 was a national cross-sectional survey of community pharmacists working in Lebanon. A complete list of these pharmacists was extracted from the directory of the Order of Pharmacists of Lebanon, which included also the pharmacy’s name, telephone number and address. The list was stratified by the six Lebanese governorates and a stratified random sample proportionate to size was selected. The targeted sample size was 300 pharmacists based on a 95% confidence interval with 5–6% precision. To reach the target sample size of 300, we attempted to contact 463 pharmacists, of whom 161 either declined to participate, the telephone number was wrong, or there was no answer, giving a response rate to 65.2%. Furthermore, we excluded 51 participants because they did not hold a pharmacy degree, so the final sample size was 251. Phase 2 was an in-depth face-to-face interview with 12 pharmacists from the six governorates, representing both sexes and employment status (owner versus employee). This sample proved to be sufficient as data saturation was reached (11).

Questionnaire

The questionnaire included different sections: demographic data of the pharmacists, views of the unified prescription. The demographic section included questions about age, sex, years of experience, degree (BSc in pharmacy versus PharmD) and ownership of the pharmacy (versus employee) (independent variables). The unified prescription section asked three questions: was the unified prescription useful, did it affect work autonomy and did it affect the workflow (did it make it more complicated or simpler). The last section were questions about the percentage of prescriptions: (i) in which the prescriber had indicated that no substitution of the prescribed medicine should be made by the pharmacist and (ii) that required an intervention from the pharmacist. We developed the questionnaire in English and two independent professional translators translated it into Arabic and then back-translated it for validation; there were no major discrepancies between the translators. Finally, we pilot-tested the questionnaire on community pharmacists who were not included in the final sample for clarity and appropriateness of questions, as well as the length of the interview.

The in-depth interview was based on three areas of discussion: (i) How do you define autonomy in your pharmacy practice?; (ii) How did the new unified prescription affect your work?; and (iii) How useful has the unified prescription been?

Data collection

Two pharmacy graduates collected the data for phase 1 over the phone. They were trained on how to remain objective, how to probe and how to prevent divergence from the questions. All respondents gave verbal consent to participate. In case of refusal or a wrong number, we randomly selected a replacement from the same governorate. We gave the respondents the option to be called later at a more convenient time.

In the second phase, all 12 pharmacists who participated in the face-to-face in-depth interview provided their consent. We interviewed these pharmacists at their pharmacies. The interviews were audio-recorded and tapes were reviewed for data analysis and theme identification.

Data analysis

The interviewers used Excel for data entry of the data collected during the telephone survey using a coding scheme. The final data entry sheet was imported to SPSS, version 24 (12). We used frequencies and percentages to summarize categorical variables, and means and standard deviations (SD) to summarize numerical variables. We used the Pearson chi-squared test and the ANOVA F test to assess differences in proportions and means, respectively. We set the level of significant at $P \leq 0.05$.

We reviewed and analysed the audio recordings and notes taken during the face-to-face interview to identify the themes that emerged.

Ethical considerations

This study was approved by the Institutional Review Board of the Lebanese American University (LAU.SOP. HD2.0/Jul/2016), and amended for face-to-face interviews (LAU.SOP.HD2.5/Jul/2016). Oral consent was obtained from the participants for the telephone and the face-to-face interviews.

Results

Results from the telephone survey

The sample represented all six Lebanese governorates with a distribution that closely matched the distribution of community pharmacies in the country. Males (51.8%)
and females (48.2%) were almost equally represented and the biggest proportion were aged 30–39 years (35.2%). Most of the pharmacist had a bachelor of science degree (61.4%) compared with 38.6% with a degree in pharmacy, 80.1% were pharmacy owners and 74.8% had more than 6 years of experience (Table 1).

More than half of the pharmacists (56.8%) did not think that the unified prescription was useful, and 48.8% did not think it had affected their workflow (neither simplifying nor complicating it) and 63.2% did not think it had affected their autonomy. Nonetheless, of the remaining 128 pharmacists, most perceived a negative impact: 68% of the 128 reported that the unified prescription complicated their work (rather than simplified it), and 65% reported that it reduced their autonomy (rather than increased it).

Pharmacists reported an average of 59.8% (median 70%) of prescriptions were labelled with no substitution by the prescribing physician. Furthermore, they reported an average of 23.7% prescriptions needed further clarification from the prescribing physician, mostly because of unclear handwriting (92.4%), followed by wrong dose (45.0%) (Table 2).

Responses to the three unified prescription questions were statistically associated. Pharmacists who perceived the unified prescription to be useful, compared to not useful, were more likely to report that unified prescription simplified their work (36.4% versus 1.4%, \( P < 0.001 \)), and increased their autonomy (23.4% versus 4.9%, \( P < 0.001 \)) (Table 3). In addition, those claiming that unified prescription increased their autonomy were more likely to report it simplified their work as well (56.3% versus 10.0% among those that reported less autonomy, \( P < 0.001 \); Table 4).

Results of a bivariate analysis comparing responses to the three questions on the unified prescription across the independent variables in the study failed to detect any significant differences, indicating that the pharmacists’ answers to the unified prescription questions were uniform across their socioeconomic backgrounds. Therefore, we decided to carry out in-depth interviews with a group of pharmacists to further understand their viewpoint.

**Results of the qualitative analysis**

When we asked the pharmacists interviewed about how they defined work autonomy, they pointed to the ability to do their jobs independently, without having to refer to physicians for drug substitutions, and the ability to make and implement decisions for the benefit of the patient. When we asked how their autonomy was linked to the unified prescription, most pharmacists said that it did not add to their autonomy. “Autonomy was restricted by unified prescription, either because of no substitution use or because generics are more expensive than brands” (male, Mount Lebanon, owner). In fact, most of the pharmacists we interviewed brought up the lack of an adequate pricing strategy. They reported that the price of brand medications had decreased substantially over the previous year, making generic substitution no longer meaningful. As one pharmacist explained: “Unified prescription was meant to decrease costs through generic substitution; whereas currently, some generics are more expensive than brands” (female, Beirut, employee).

On the other hand, a few pharmacists thought that the unified prescription added to their autonomy: “Unified prescription provided autonomy by giving us the ability and authorization to substitute brand for generic” (male, Mount Lebanon, owner). Another pharmacist described the actual situation: “Theoretically, the unified prescription was supposed to give more autonomy to pharmacists, however, it did not, since the list of substitutes is not clear nor readily accessible, and doctors are using ‘no substitution’ excessively” (female, North, owner). A female pharmacy owner in South governorate raised a concern shared by other pharmacists: “When no substitution is not recorded on the prescription, we have trouble convincing patients of the substitution without calling the physician. They obviously trust their doctors much more than they trust us.”
When we asked the pharmacists if the unified prescription had simplified or complicated their work, most complained that it complicated their daily tasks. It added to their paperwork and increased the storage space required. The pink copy of the prescription, which is to be kept at the pharmacy, is hard to read, of poor quality and the ink fades with time. As explained by one pharmacist: “The pink copy is worthless after a few months because the ink disappears” (male, Mount Lebanon, owner). “It is not clear how long we should keep the prescription forms, and they are taking significant storage space” (male, Mount Lebanon, owner). Another pharmacist said: “Pink copies are almost never stamped, and when it comes to prescriptions for controlled substances, we have to send the patient back to the doctor’s office to have it stamped, otherwise, it is not valid for dispensing” (female, South, owner).

As for the usefulness of the unified prescription, the interviewees stated that, although the form used is professional, well divided and user-friendly, it is not of added value. They stated that doctors do not fully abide by the form. Pharmacists still receive old prescription forms, especially for non-Lebanese patients and patients without third-party coverage. One pharmacist stated: “We should dispense the drug despite the use of the old form, otherwise, we will lose customers” (female, Mount Lebanon, employee). Therefore, a commonly reported concern of pharmacists was reinforcing the use of the unified prescription among all physicians. Interviewees reported that a large number of prescriptions are marked with no substitution, even when the prescription is for a generic medicine, indicating that doctors may lack an understanding of the purpose of no substitution or are receiving remuneration from companies to write no substitution.

A shared idea among pharmacists was that: “Unified prescription could have been more useful if it involved a change in the health care strategy, introduction of a patient profile system and electronic prescribing” (male, Mount Lebanon, owner). However, one pharmacist was a little more optimistic: “Unified prescription is partially useful. We are on the right track, but it has to be part of a whole system change” (male, North, owner). Additional reported barriers to effective implementation of the unified prescription included lack of patient awareness about generic medicines and little trust in community pharmacists: “I have to call the physician so that he/she convinces the patient of the proposed swap [to a generic medicine]” (female, Mount Lebanon, employee). Similarly, another pharmacist explained that he rarely

| Table 2 Views of community pharmacists on the unified prescription, Lebanon |
|---------------------------------|-----------------|----|
| Question                        | No. (n = 250)   | %  |
| **Is the unified prescription helpful?** |                 |    |
| Yes                             | 108             | 43.2 |
| No                              | 142             | 56.8 |
| Missing                         | 1               |     |
| **Did the unified prescription simplify or complicate your work?** |                 |    |
| Simplified                      | 41              | 16.4 |
| Complicated                     | 87              | 34.8 |
| No change                       | 122             | 48.8 |
| Missing                         | 1               |     |
| **How did the unified prescription affect your autonomy?** |                 |    |
| Less autonomy                   | 60              | 24.0 |
| More autonomy                   | 32              | 12.8 |
| Did not change                  | 158             | 63.2 |
| Missing                         | 1               |     |
| **Percent of prescriptions:**   |                 |    |
| Labelled as non-substitutable a | 59.8 (28.2)     | 70 (38.7) |
| Needed clarification from prescriber | 237 (24.5) | 15 (35.0) |
| **Problem encountered with prescriptions** | No. (n = 251) | %  |
| Wrong dose                      | 113             | 45.0 |
| Drug–drug interaction           | 68              | 27.1 |
| Wrong dosage form               | 60              | 23.9 |
| Drug–disease interaction        | 53              | 21.1 |
| Wrong drug                      | 47              | 18.7 |
| Unclear handwriting             | 232             | 92.4 |

SD: standard deviation; IQR: interquartile range.

aThe doctor indicates on the prescription that the brand medicine should not be replaced by the pharmacist with an equivalent generic medicine.
bothers to offer a substitute: “It is a waste of energy to try to explain to the patient that I am only offering an equivalent drug. I have had several patients who came back after purchasing the generic to exchange it for the initially prescribed drug” (male, Mount Lebanon, owner). Other pharmacists commented: “A whole population attitude needs to be changed through education, including education about the role of the pharmacist” (male, Mount Lebanon, owner), and “We are not allowed to exert our role as drug experts, and that needs a national awareness campaign” (female, Beirut, employee).

Discussion
In this study, we tried to examine the effect of introducing the new unified prescription, 5 years after its launch by the Lebanese government. In response to this new procedure, we found that the majority of Lebanese pharmacists had a negative opinion of the introduction of the unified prescription.

The new unified prescription form is available in three colour-coded copies: white for the patient (primarily for third party payer reimbursement), pink for the pharmacist (as a record of dispensing) and yellow for the physician (as proof of prescribing). The main difference from the previously used prescription form was the introduction of the generic substitution which allowed pharmacist to dispense an equivalent generic medicine rather than the proprietary branded one indicated by the doctor. Nonetheless the authority of the physician was maintained as he/she could select the non-substitutable medication option as per article 47 of the law of practice of pharmacy profession (13), which the pharmacist cannot override. However, implementation of the new form is still incomplete which may explain the mixed reactions of the community pharmacists surveyed. The main problems reported were related to generic substitution, unclear guidance on implementation of the new form and lack of public education about generic drugs and the role of a community pharmacist.

Generic medicines are often considered by health care professionals as inferior to their brand counterparts, mainly because of a sense of lack of compliance with the good manufacturing practices (14). Our findings that a large number of physicians frequently use the no substitution option concur with previous studies (15,16). Possible explanations could be the poor trust of physicians in generic drugs as well as promotional incentives given to them by pharmaceutical companies. A review of physicians’ perceptions on proprietary medicine concluded that the poor knowledge of physicians about biosimilar generic medicines was the main reason for such practice (17). A study in Jordan showed that 50–80% of physicians in Jordan were likely to oppose the replacement of brand drugs with generic substitutes (18). Another study from the United Arab Emirates showed that only 17% of patients were prescribed a generic drug and 56% received no background information from their physician about the availability of a generic medicine (19). Furthermore, a Danish study highlighted the importance of removing incentives to use branded drugs as a way to increase prescription of generic medicines (20). In spite of a documented surge in pricing of generic medicines across the world because, for example, drug shortages, supply disruptions and consolidations in the generic-drug industry, they are still the cheaper option (21,22).

### Table 3: Perception of community pharmacists of the usefulness of the unified prescription and its effect on their work and autonomy, Lebanon

<table>
<thead>
<tr>
<th>Effect of unified prescription on:</th>
<th>Unified prescription perceived as:</th>
<th></th>
<th></th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Useful (n = 107)</td>
<td>Not useful (n = 142)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less complicated</td>
<td>39</td>
<td>36.4</td>
<td>2</td>
<td>1.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>More complicated</td>
<td>21</td>
<td>19.6</td>
<td>65</td>
<td>45.8</td>
<td></td>
</tr>
<tr>
<td>No change</td>
<td>47</td>
<td>43.9</td>
<td>75</td>
<td>52.8</td>
<td></td>
</tr>
<tr>
<td><strong>Autonomy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less autonomy</td>
<td>27</td>
<td>25.2</td>
<td>33</td>
<td>23.2</td>
<td></td>
</tr>
<tr>
<td>More autonomy</td>
<td>25</td>
<td>23.4</td>
<td>7</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td>No change</td>
<td>55</td>
<td>51.4</td>
<td>102</td>
<td>71.8</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Effect of the unified prescription on the autonomy of community pharmacists and the complexity of their work, Lebanon

<table>
<thead>
<tr>
<th>Effect on work complexity</th>
<th>Less autonomy (n = 60)</th>
<th>More autonomy (n = 32)</th>
<th>No change (n = 157)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Less complicated</td>
<td>6</td>
<td>10.0</td>
<td>18</td>
<td>56.3</td>
</tr>
<tr>
<td>More complicated</td>
<td>29</td>
<td>48.3</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>No change</td>
<td>25</td>
<td>41.7</td>
<td>11</td>
<td>34.4</td>
</tr>
</tbody>
</table>
In fact, decreasing the health care cost for both patients and governmental agencies was and remains the main objective of the unified prescription. However, a unique cost reduction policy that came into effect in Lebanon in 2015 (23) resulted in substantial decrease in the price of brand name medicines, which counteracted the financial benefit of many generic substitutions.

Pharmacists reported a collective sense that the execution of the unified prescription was ill-prepared, a finding supported by a 2017 study which reported a lack of adequate infrastructure and no clear direction on how to use the forms (16). Pharmacists were unsure of how long they should keep the pink copies or how they should file them while pointing out to the poor ink quality, a problem that has been previously raised (24). Moreover, physicians continue to use the old form, especially for uninsured or non-Lebanese patients, and pharmacists find themselves obliged to fill the prescription.

A study in Denmark listed a number of difficulties facing the implementation of a new prescription policy, including insufficient knowledge of physicians and uncertainty about procedures, unclear responsibilities, insufficient communication, clinician autonomy and low acceptance of the change (25). Pharmacists surveyed reported on average a 1-hour increase in workload per day, while most physicians stated that they did not fully understand all parts of the form. Overall, both pharmacists and physicians were dissatisfied with the new system (26).

Lebanese pharmacists believed that the unified prescription could have been more meaningful if it had been part of a larger national drug policy change. Such an initiative could include implementation of patient profiles, electronic pharmacy records and electronic prescribing, and a clear list of over-the-counter medicines. Studies confirm that electronic prescribing has a positive effect on the safety of prescribing practices (26) and can eliminate transcription errors (27). In theory, a modified prescription form that requires relevant medication information would reduce prescribing problems (28).

Pharmacists lacked the motive to dispense generic medicines because of poor incentives, lower profit and patients’ resistance to change. According to a 2017 study, more than half of the Lebanese population is not aware of a definition of a generic drug and a larger proportion (68%) is not sure of the pharmacological equivalency of the generic drug (15). Patients have constantly shown poor acceptance of substitution and insistence on the drug selected by the doctor. This is in contrast to the USA where the generic drug is widely prescribed (22), accounting for about 86% of all filled prescriptions (29).

The 2017 Lebanese study also supported the need for raising awareness about generic drugs among the public (15). For instance, discussing monetary concerns with patients might be a good start for the pharmacists to highlight the financial value of generics while correcting any common false beliefs that they may have about those drugs (10).

A different but related issue is the low public trust in community pharmacists. Pharmacists are the experts in medicines and their role extends far beyond dispensing; they frequently have to intervene to correct prescription errors (30). Educating and raising awareness among the public about the role that pharmacists in product selection is needed.

In light of these issues, we recommend that efforts are made by the government to raise awareness among the public that brand medicines can be changed for their generic equivalent and to help them understand that generic medicines are a cost-saving option with the same efficacy as their brand counterparts. The government should also work alongside pharmacists to highlight these issues and come up with solutions that will improve the unified prescription and support the role of pharmacists in providing the best patient care.

A limitation of our study is that it focused on how the unified prescription affected the work of pharmacists and overlooked the perspectives of patients and physicians. Taking account of the views of all involved parties on the prescription process could allow a better understanding of the issue at hand. Another limitation is the possibility of measurement bias. Perceptions and views are indirect measures and cannot substitute for direct measures. However, direct measurement of usefulness and workflow is hard to undertake.

Notwithstanding these limitations, our study used a mixed-method approach where the qualitative data along with the quantitative data provided a more comprehensive understanding of the issues with the unified prescription and a clearer insight of pharmacists’ perceptions of this problem. Furthermore, to our knowledge, this is the first national study, whereby the results are representative of all Lebanese community pharmacists.

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**Competing interests:** None declared.
آراء الصيادلة المجتمعين في لبنان بشأن الوصفة الطبية الموحدة: دراسة قائمة على مزيج من الأساليب

هاني ديماسي، الين بو مارون، مارجريتا سعادة، جوان خبصا، جسيكا-لين عبده، شادي صالح

الخلاصة

وَثْبَت أحد أهدافها في التوفير في نفقات الأدوية.

أُدخلت الوصفة الطبية الموحدة في لبنان في عام 2011.

هدف هذه الدراسة إلى تقييم آراء الصيادلة المجتمعين بشأن التأثير المترتب على الوصفة الطبية الموحدة وفائدتها.

الطريق البحث: أجري مسح هاتفي مقطعي للصيادلة المجتمعين من جميع محافظات لبنان. واستُخدم استبيان لجمع بيانات سكانية وآراء الصيادلة بشأن تأثير الوصفة الموحدة على عملهم، ونسبة الوصفات الطبية التي أشار فيها واصفوها إلى ضرورة عدم استبدال الدواء بما يكافئه من الأدوية صيدلياً للتعرف على آرائهم بشكل كامل.

النتائج: أُجريت مقابلات مع 251 صيدلياً أُجريَت مقابلات معهم، رأى 56.8% منهم أنها خفضت من استقلاليتهم. وأظهرت المقابلات المعمقة أن الصيادلة رأوا أن استقلالهم بات محددة بسبب صعوبات إقناع المرضى بقبول أحد الأدوية الجينية المكافئة، وهو الأمر الذي ظهرت له الوفاء في بعض الوصفات الطبية الموحدة. وقد أظهرت الاختلافات التالية بين الصيدليات الحالية والصيادلة الجينية.

الاستنتاجات: أرى الصيادلة الجينيات في الصيدليات في لبنان أن تنفيذ الوصفة الطبية الموحدة لم يحقق النجاح. وهناك حاجة إلى بذل جهود لتحسين الاتصال بمقدمي الوصفات الطبية وتثقيف الجمهور بشأن دور الصيدلة والأدوية الجينية.
References


Identification of immunoreactive proteins in secretions of Leishmania infantum promastigotes: an immunoproteomic approach

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Abstract

Background: In the Mediterranean region, Leishmania infantum is the main cause of visceral leishmaniasis. Dogs with canine visceral leishmaniasis are an important reservoir of visceral leishmaniasis. Control of canine visceral leishmaniasis could disrupt transmission of visceral leishmaniasis to humans. The secreted antigens of Leishmania promastigotes are potential stimuli of the host immune system. Proteomic techniques facilitate the identification of new protein markers.

Aims: This study aimed to identify immunoreactive proteins in the secretions of L. infantum promastigotes which could be possible targets for the diagnosis and treatment of canine visceral leishmaniasis and the development of vaccines against the disease.

Methods: Secretions of L. infantum promastigotes were obtained from the cultivation of $6 \times 10^6$ promastigotes in serum-free RPMI-1640 medium during a period of 72 h. After deionization and lyophilization, two-dimensional gel electrophoresis was used for protein separation followed by Western blotting. Thirteen common and repeatable immunoreactive spots were analysed by mass spectrometry.

Results: Nine proteins were identified by spectrometry. Most of these proteins were involved in metabolism pathways, survival and pathogenicity of Leishmania parasites. Phospholipase C, immune inhibitor A, chitin-binding protein and a single peptide match to chain A crystal structure of selenomethionine were observed in the secretions of L. infantum promastigotes.

Conclusions: The proteins identified in metabolism pathways, survival and pathogenicity of Leishmania parasites are possible targets that could be used for the diagnosis and treatment of canine visceral leishmaniasis and the development of vaccines against the disease in the future.

Keywords: visceral leishmaniasis, Leishmania infantum, dogs, proteomics, mass spectrometry


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Introduction

Visceral leishmaniasis (VL) is the severe form of a group of diseases caused by Leishmania donovani complex. In VL, the reticuloendothelial system is invaded by these parasites. L. infantum is the main cause of VL in the Mediterranean region. The prevalence of VL is high in endemic areas such as the Indian subcontinent and south-west Asia (1,2). Dogs infected with canine VL (CVL) are an important reservoir for VL (2) and by controlling canine VL, the transmission cycle of VL to humans may be disrupted.

The available anti-leishmanial drugs have important side-effects and there is growing evidence of drug resistance in leishmaniasis (3,4). In the absence of suitable drugs for VL, using proteomic techniques to identify new markers for diagnosis, treatment and vaccination is an appropriate strategy for the control of leishmaniasis in humans and animal reservoirs (5).

Proteomic techniques can show the proteome profile of cells and biological fluids and can also provide more information on protein functions and post-translational modifications of proteins (5). The application of mass spectrometry and proteomic techniques in the laboratory and in the identification of therapeutic targets has been reported in the past decade (6–9). Furthermore, proteomic techniques have received more attention in parasitology for the indication of possible new targets in the diagnosis and treatment of and vaccination against protozoan parasites such as Leishmania (5,10).

The importance of proteome identification of protozoan secretions has been highlighted (11,12). Studies have shown that the antigens from Leishmania parasites that are able to stimulate Th1 cells are appropriate candidates for designing vaccines against leishmaniasis (13,14). Secretions of Leishmania promastigotes as activators of the host immune response have been suggested to be
suitable sources of antigens for the design of vaccines and diagnostic tests in leishmaniasis (15,16).

Given these issues and the ability of proteomic technology to provide information on secreted proteins from Leishmania parasites, our study aimed to identify immunoreactive proteins in the secretions of L. infantum promastigotes using sera of dogs infected with CVL. Identification of these proteins might open a new path for the effective diagnosis and treatment of and vaccination against CVL in the future.

**Methods**

**Obtaining secretions**

*L. infantum* (MCAN/IR/07/Moheb-gh strain: from CVL-infected dogs) promastigotes were mass cultivated at 25 °C in Schneider insect culture medium (Sigma Chemical Co., United States of America) supplemented with 20% (v/v) bovine serum (heat-inactivated at 56 °C for 50 min), 100 U/mL penicillin and 100 μg/mL streptomycin. The promastigotes were collected in the exponential growth phase (on the third day) by centrifugation at 2000 × g for 10 min at 4 °C and then washed three times with serum-free RPMI-1640 medium (Shelmax Co., China).

Washed promastigotes (6 × 10⁶ promastigotes) were transferred to 10 mL serum-free RPMI-1640 to obtain secretions. After checking the viability of the promastigotes at different times using flow cytometry and propidium iodide, the secretions were collected after 72 h. The secretions obtained were centrifuged at 9000 × g for 30 min at 4 °C and the supernatants were collected (17).

**Deionization and lyophilization of secretions**

Contamination of the secretions with the ions (salts) stops the isoelectric focusing stage. To remove these ions, 50 mL of supernatant were aliquoted in dialyzed bags containing a ethylenediaminetetraacetic acid (EDTA)-free protease inhibitor cocktail (Roche, Germany) at 1 × final concentration. The mixture was dialyzed overnight at 4 °C using a membrane (with a 14 kDa molecular mass cut-off) in 10 L of 1 mM ammonium bicarbonate buffer (Sigma) with four solution changes (18). The dialyzed secretions were frozen and lyophilized to dryness. As a negative control, this procedure was repeated with the RPMI-1640 without promastigote secretions. Lyophilized proteins were resuspended in lysis buffer (7 M urea, 2 M thiourea, 4% CHAPS and 2% immobilized pH gradient buffer (pH 3–10); GE Healthcare, Sweden), aliquoted and stored at −70 °C. The protein concentration was determined using Bradford assay and bovine serum albumin stored at −70 °C. The protein concentration was determined using Bradford assay and bovine serum albumin stored at −70 °C.

**Gel electrophoresis and Western blotting**

About 40 μg of the secreted proteins recovered were electrophoresed using sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) on 4% stacking gels over 12% separating gels (Roche Applied Science, Germany). Sample lysates were boiled at 100 °C for 5 min in SDS gel loading buffer (6X) consisting of 375 mM Tris-HCl (pH 6.8), 12% SDS, 60% glycerol, 30% 2-mercaptoethanol and 0.6% bromophenol blue. Then, gels were run using an electrophoresis system (Bio-Rad, United States of America).

In the next step, the sample lanes were transferred (Voltage 20, 1 h) from the gel to a polyvinylidene difluoride membrane (Bio-Rad, USA). After the transfer, 3% bovine serum albumin in phosphate buffered saline was used for blocking the non-specific binding sites on the polyvinylidene difluoride membrane (12 h at 4 °C). Pooled sera from five CVL-infected dogs (asymptomatic and symptomatic) were used to probe the membranes (19). All CVL-infected and non-infected sera had been previously checked for CVL using the direct agglutination test. Pooled sera from non-infected dogs were used as negative control. Antibody binding proceeding was done with 1:1000 dilutions of primary anti-sera in skim milk (2 h at room temperature). After three washes (15 min each) with phosphate buffered saline containing 0.5% Tween-20, the rabbit anti-dog IgG (1:4000 dilutions; Abcam, USA) was then allowed to react (1.5 h at room temperature). Finally, the immunoreactive bands were detected using diaminobenzidine tetrahydrochloride substrate (Sigma, Germany). The ChemiDoc MP Imaging System (Bio-Rad, USA) was used to scan the bands obtained. To confirm the results, the experiment was repeated three times using sera from different CVL-infected and non-infected dogs.

**Western blotting**

The protein isoelectric focusing cell system (Bio-Rad, USA) was used for isoelectric focusing. About 200 μg of the protein sample was added for each immobilized pH gradient strip (pH 3–10 nonlinear, 18 cm) by active rehydration (50 V, 20 °C, 14 h) in rehydration buffer (8 M urea, 2 M thiourea (Merck, Germany), 0.3% w/v dithiothreitol, 2% w/v CHAPS, 2% vol/vol immobilized pH gradient buffer (pH 3–10) and bromophenol blue) followed by isoelectric focusing for a total of 62 000 Vh.

After isoelectric focusing, each strip was equilibrated in 10 mL equilibration buffer (6 M urea, 50 mM Tris, pH 8.8, 2% w/v SDS, 30% w/v glycerol) containing 65 mM dithiothreitol (in the first step) and 135 mM iodoacetamide (in the second step) at room temperature for 15 min. Two-dimensional gel electrophoresis followed by Western blotting was done using the same procedures described earlier. To confirm the results, each experiment was repeated three times using pooled sera from different CVL-infected and non-infected dogs.

After the immunodetection step, GS-800 calibrated densitometer (Bio-Rad) and Prodigy SameSpots software (version 1.0) (Nonlinear Dynamics, United Kingdom of Great Britain and Northern Ireland) were used to scan the spots and analyse the digital images, respectively. The reference image was an image with the greatest number of spots. Each spot was analysed in a semi-automated way and background intensity was subtracted from each image.
Isolation of immunoreactive spots

After mapping the immunoreactive spots on the membrane, two-dimensional gel electrophoresis was conducted again with the secreted proteins lysate. Coomassie brilliant blue staining (containing 8% ammonium sulfate (Sigma, USA), 1.6% orthophosphoric acid (Sigma, USA), 20% methanol (Merck, Germany), and 0.12% Coomassie blue G 250 (Merck, Germany)) was used for visualization of spots (overnight incubation) (20). After staining, gels were destained with distilled water. Finally, the immunoreactive spots identified on the membrane were punched from the gel using a pipette.

In-gel digestion of protein samples and mass spectrometry

In-gel digestion of protein samples and mass spectrometry analysis were done according to the protocol of the metabolomics and proteomics laboratory technology facility, Department of Biology, University of York, United Kingdom (20). According to the company procedures, MASCOT scores of more than 62 are significant (P < 0.05).

Database search

The mass spectra generated by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI TOF/TOF MS) were searched against peptide masses in the UniProt database (555 594 sequences, 199 016 217 residues) (Table 1) and also the NCBI database (132 460 369 sequences; 48 620 496 129 residues) (Table 2).

Ethical considerations

Experiments with animals were done following guidelines of the Institutional Animal Care and Committee on Ethics of Animal Experimentation of the Shiraz University of Medical Sciences.

Results

Viability of promastigotes

When we obtained secretions, to decrease the release of secretory proteins from dead promastigotes to the secretions, we carried out propidium iodide staining to check the viability of *L. infantum* promastigotes. The propidium iodide results showed that the best time for collecting the secretions with a high concentration was 72 h after cultivating in serum-free RPMI-1640 medium. The rate of promastigotes viability at this time was 83% (17).

SDS-PAGE and Western blotting

Before doing the two-dimensional gel electrophoresis following Western blotting, we determined the molecular weights of the immunoreactive protein bands in the secretions. As shown in Figure 1, we detected several sharp bands between 25 and 35 kDa and 66.2 and 116 kDa. We also saw a weak band between 45 and 66.2 kDa. Performing Western blotting before 2-DE-Western blotting facilitates the identification of immunoreactive spots on the polyvinylidene difluoride membrane and gel.

Western blotting and identification of immunoreactive proteins by mass spectrometry

We extracted and lysed secretions of *L. infantum* promastigotes. Since the aim of our study was to identify immunoreactive proteins in the secretions of *L. infantum* promastigotes, we separated proteins in lysates by using isoelectric focusing over a pH range from 3 to 10 and then two-dimensional gel electrophoresis. Three gels were run for each test. We detected more than 1000 spots and about 100 immunoreactive spots on each of the gels and polyvinylidene difluoride membranes, respectively. We isolated 13 repeatable and intense immunoreactive spots from the
gel for mass spectrometry analysis (Figure 2). Of these spots, nine immunoreactive proteins were characterized by MALDI TOF/TOF MS. Due to contamination with keratin, three spots showed spectra dominated with keratin. The identified proteins were chitin-binding protein, immune inhibitor A (immune In A), a peptide matched to bacillolysin (6-endotoxin), a single peptide match to hsvnu complex proteolytic subunit-like, a single peptide match to chain A crystal structure of selenomethionine, iron superoxide dismutase, phospholipase C, and some proteins matched to enterotoxins.

We used the L. infantum genome project database (www.genedb.org) and published literature for the identification of multiple functions of the detected proteins. The scores of all the proteins obtained were significant (> 62). According to the mass spectrometry data, spot number 17 (SEC 13) was identified as “immune In A” and “selenomethionine” in the Uniprot and NCBI databases, respectively.

### Discussion

We applied an immunoproteomic approach on secretions of L. infantum promastigotes, using pooled sera from CVL-infected dogs (asymptomatic and symptomatic), to find immunoreactive proteins that could be possible new targets for diagnosis and treatment of, and vaccination against CVL. The use of pooled sera might reduce the effect of individual animal immune response variations on L. infantum antigens.

Chitin-binding protein as an immunoreactive protein in the secretions of L. infantum promastigotes has been previously reported in Toxoplasma gondii (21). Chitin-binding protein is part of chitinase enzyme and synergistic effects of chitin-binding proteins on chitinases have been described in bacteria (22). Although the activity of chitinase is two-to-four-fold higher in amastigotes than in promastigotes in vitro (23), in a previous study on the secretions of L. donovani, chitinase and chitin-binding proteins were not detected in mass spectrometry results (24). More investigations on the elucidation of the potential action of chitin-binding proteins in Leishmania and gene sequencing and cloning of chitin-binding proteins (23) might be useful to understand the role of chitin-binding proteins in the biology of Leishmania parasites.

The function of immune In A in Leishmania parasites is still not known; however, this protein has been described as a neutral metalloprotease in bacteria (25). Based on the presence of metalloproteases in Leishmania parasites and their involvement in parasite virulence, the discovery of immune In A as a possible metalloprotease in Leishmania parasites suggests that this protein may be of clinical interest for leishmaniasis prognosis and the prediction of treatment efficacy (26). Since IgA protease is the only homologous protein of immune In A, the detection of anti-immune In A in CVL- and VL-infected sera might suggest new approaches using tools based on immune In A for the diagnosis of leishmaniasis in the future (27).

We identified a peptide that matched bacillolysin (6-endotoxin). Bacillolysin is a virulence factor and lethal toxin in bacteria (28). Interestingly, the role of the disulfide bond A as a homologue of the protein disulfide isomerase is associated with the production of toxins in bacteria (29). Because protein disulfide isomerases are important proteins in the pathogenicity of Leishmania parasites, the possible expression of such endotoxins in these parasites could be related to protein disulfide isomerases (29,30). Due to the scarce data on endotoxins in Leishmania parasites, molecular techniques including gene expression and quantitative real-time polymerase chain reaction could be used to confirm the production of endotoxins in these parasites.

The survival, virulence and proteolytic functions of hsvnu in Leishmania parasites have been described in previous studies (31–33). In addition, the relationship between hsvnu and 3M3I protein (a hypothetical protein in L. major likely involved in nucleotide metabolism) may be helpful to elucidate the metabolic function of hsvnu in Leishmania parasites (34). The potential and critical functions of hsvnu, and the overexpression of this protein

### Table 1 Identificaion of immunoreactive proteins in the secretions of Leishmania infantum promastigotes (UniProt)

<table>
<thead>
<tr>
<th>Spot name</th>
<th>No. of spots on gel</th>
<th>Protein name</th>
<th>No. of matched peptides</th>
<th>Mr (theoretical)</th>
<th>pI (theoretical)</th>
<th>Score</th>
<th>Protein sequence coverage (%)</th>
<th>Accession no.</th>
</tr>
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<tbody>
<tr>
<td>SEC 5</td>
<td>10</td>
<td>PLC</td>
<td>4</td>
<td>32.3</td>
<td>7.14</td>
<td>101</td>
<td>7</td>
<td>P09598</td>
</tr>
<tr>
<td>SEC 6</td>
<td>6</td>
<td>A single peptide match to Enterotoxin (fragment)</td>
<td>1</td>
<td>47.8</td>
<td>4.23</td>
<td>90</td>
<td>35</td>
<td>P80567</td>
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<tr>
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<td>8</td>
<td>PLC</td>
<td>2</td>
<td>32.3</td>
<td>7.14</td>
<td>101</td>
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<td>P09598</td>
</tr>
<tr>
<td>SEC 12</td>
<td>9</td>
<td>PLC</td>
<td>4</td>
<td>32.3</td>
<td>7.14</td>
<td>275</td>
<td>14</td>
<td>P09598</td>
</tr>
<tr>
<td>SEC 13</td>
<td>17</td>
<td>A single peptide match to Immune In A</td>
<td>1</td>
<td>74.9</td>
<td>5.13</td>
<td>54</td>
<td>1</td>
<td>P23382</td>
</tr>
</tbody>
</table>

Mr = molecular weight; pI = isoelectric point; PLC = phospholipase C.
in the viscerotropic form of L. tropica (31) suggest a role of this protein as a valuable marker in the treatment and diagnosis of CVL and VL in a clinical setting.

Selenoproteins are involved in the regulation of oxidative stress in the cells. Isolation of leishmanial-selenomethionine derivatives from L. donovani proteins, and the sequencing of the gene encoding this protein in Kinetoplastida support our detection of selenomethionine through mass spectrometry assays (35,36).

We also identified Fe-SOD which protects Leishmania parasites against radical superoxide anions. The expression of SODs as conserved molecules with a high degree of homology in Leishmania species (24,37,38) highlights the possible use of these proteins in the development of candidate drug and vaccine targets in leishmaniasis. In recent years, nanovaccines against Leishmania parasites have been evaluated by producing the recombinant form of leishmanial-SODB1 and loading on the chitosan nanoparticles (39).

The report of phospholipase C-orthologue genes and phospholipase C-related signalling pathways in protozoa in previous studies confirms our results on the expression of phospholipase C in secretions of Leishmania parasites (40,41). It has been suggested that the escape of protozoan parasites from parasitophorous vacuoles could be mediated by phospholipase C (42). The expression of inositol phosphosphingolipid phospholipase C-like protein, the cleavage of the glycosphatidyl-inositol anchor through phospholipase C and the induction of GP63-shedding via phospholipase C in Leishmania parasites are related to the virulence and pathogenicity functions of phospholipase C in these parasites (43–45). Nevertheless, the exact role of phospholipase C is unknown in Leishmania parasites so far. Given the aforementioned functions of phospholipase C in the pathogenicity of Leishmania parasites and also the role of phospholipase C in hydrolysis of miltefosine, the use of phospholipase C-inhibitors can be evaluated as a therapeutic target in CVL and VL in the future (46).

**Conclusion**

The isolation of high protein concentrations in proteomic studies on secretions provides reliable data. Since secreted antigens of Leishmania promastigotes are potential stimulants of the host immune system, the identified immunoreactive proteins in our study might be valuable proteins for developing diagnostic candidates and vaccine targets in the future. In addition, according to the main roles of such molecules in metabolism pathways, survival and pathogenicity of Leishmania parasites, they could be possible therapeutic targets for CVL in the future. Validation of our results – the proteins we found expressed in Leishmania parasites – through further laboratory techniques including gene cloning, Western blotting, enzyme-linked immunosorbent assay (ELISA) and quantitative real-time polymerase chain reaction is warranted.

### Table 2

<table>
<thead>
<tr>
<th>Spot name</th>
<th>No. of spots on gel</th>
<th>Protein name</th>
<th>No. of matched peptides</th>
<th>Mr (theoretical)</th>
<th>pI (theoretical)</th>
<th>Score</th>
<th>Protein sequence coverage (%)</th>
<th>Accession no.</th>
</tr>
</thead>
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<td>24.2</td>
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<td>73</td>
<td>5</td>
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</tr>
<tr>
<td>SEC 2</td>
<td>7</td>
<td>A single peptide match to chain A, crystal structure of selenomethionine</td>
<td>1</td>
<td>83.3</td>
<td>5.75</td>
<td>73</td>
<td>1</td>
<td>4YU5_A</td>
</tr>
<tr>
<td>SEC 4</td>
<td>14</td>
<td>Chitin-binding protein</td>
<td>3</td>
<td>49.9</td>
<td>6.18</td>
<td>295</td>
<td>9</td>
<td>WP_000350588.1</td>
</tr>
<tr>
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<td>Enterotoxin 40 kDa subunit</td>
<td>2</td>
<td>43.09</td>
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<td>171</td>
<td>6</td>
<td>CRG01534.1</td>
</tr>
<tr>
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<td>1</td>
<td>36.3</td>
<td>6.01</td>
<td>85</td>
<td>4</td>
<td>EOP01994.1</td>
</tr>
<tr>
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<td>12</td>
<td>A single peptide match to bacilolysin (insecticidal δ-endotoxin)</td>
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<td>62.6</td>
<td>5.78</td>
<td>77</td>
<td>2</td>
<td>EEM05310.1</td>
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<tr>
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<td>Iron superoxide dismutase</td>
<td>2</td>
<td>26.5</td>
<td>8.46</td>
<td>185</td>
<td>12</td>
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<tr>
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<td>3</td>
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<td>SEC 13</td>
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<td>A single peptide match to chain A, crystal structure of selenomethionine</td>
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<td>83.3</td>
<td>5.75</td>
<td>82</td>
<td>1</td>
<td>4YU5_A</td>
</tr>
</tbody>
</table>

Mr = molecular weight; pI = isoelectric point.
Identification de protéines immunoréactives dans les sécrétions des promastigotes de *Leishmania infantum*: une approche immunoprotéomique

Résumé

Contexte : Dans la Région méditerranéenne, *Leishmania infantum* est la principale cause de leishmaniose viscérale. Les chiens atteints de leishmaniose viscérale canine constituent un important réservoir de leishmaniose viscérale. La lutte contre la leishmaniose viscérale canine pourrait empêcher la transmission de cette maladie à l’homme. Les antigènes sécrétés par les promastigotes de *Leishmania* sont des stimuli potentiels du système immunitaire de l’hôte. Les techniques protéomiques facilitent l’identification de nouveaux marqueurs protéiques.

Objectifs : La présente étude visait à identifier des protéines immunoréactives dans les sécrétions de promastigotes *L. infantum* qui pourraient être utilisées pour le diagnostic et le traitement de la leishmaniose viscérale canine et la mise au point de vaccins contre cette maladie.

Méthodes : Les sécrétions de promastigotes *L. infantum* ont été obtenues à partir de la culture de 6 x 10⁹ promastigotes dans un milieu sans sérum RPMI-1640 pendant une période de 72 h. Après déionisation et lyophilisation, on a utilisé une électrophorèse bidimensionnelle en gel pour séparer les protéines, suivie d’un transfert de type Western. Treize points immunoréactifs communs et répétables ont été analysés par spectrométrie de masse.

Résultats : Neuf protéines ont été identifiées par spectrométrie. La plupart de ces protéines étaient impliquées dans les voies métaboliques, la survie et la pathogénicité des parasites *Leishmania*. La phospholipase C, l’inhibiteur immunitaire A, la protéine de liaison à la chitine et un peptide unique correspondant à la structure cristalline de la chaine A de la sélénométhionine ont été observés dans les sécrétions de promastigotes de *L. infantum*.

Conclusions : Les protéines identifiées dans les voies métaboliques, la survie et la pathogénicité des parasites *Leishmania* sont des cibles possibles qui pourraient être utilisées pour le diagnostic et le traitement de la leishmaniose viscérale canine et la mise au point de vaccins contre la maladie à l’avenir.

Les auteurs ont identifié neuf protéines dans les sécrétions de promastigotes de *Leishmania infantum* qui pourraient être utilisées pour le diagnostic et le traitement de la leishmaniose viscérale canine et la mise au point de vaccins contre cette maladie. Les protéines identifiées sont impliquées dans les voies métaboliques, la survie et la pathogénicité des parasites *Leishmania*. Les protéines identifiées sont la phospholipase C, l’inhibiteur immunitaire A, la protéine de liaison à la chitine et un peptide unique correspondant à la structure cristalline de la chaine A de la sélénométhionine.
References


National food policies in the Islamic Republic of Iran aimed at control and prevention of noncommunicable diseases

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Abstract

Background: Diet plays an important role in the risk of noncommunicable diseases. In the Islamic Republic of Iran, national activities were started after release of the World Health Organization’s (WHO) action plan on prevention and control of noncommunicable diseases.

Aims: This study describes national food policies implemented by the government in order to reduce noncommunicable diseases in the country in line with WHO action plan.

Methods: Newly adopted food standards and regulations linked to noncommunicable diseases from 2013 to 2018 were reviewed and the maximum permitted levels of salt and trans and saturated fats were compared in the old and new standards. Nutritional traffic light labelling to raise public awareness of healthy diets was evaluated.

Results: Fifteen food standards associated with eight food items that make up a large share of the daily Iranian food basket and three that make up a small share were evaluated. Policies on salt included reduction in maximum permitted percentage in bread, cheese and doogh (a fermented drink) to 1%, 3% and 0.8%, respectively. For trans and saturated fats, maximum permitted percentages were set as 2–5% and 30–65% of edible oils and fats, respectively. Nutritional traffic light labelling, which indicates the content of salt, sugar, fat and trans fat in foods, has been mandatory for all foods since 2016.

Conclusions: In view of the policies implemented to reduce the salt and fat/oil content of foods, significant decreases in noncommunicable diseases are expected in coming years in the country. However, further studies are needed to show the effectiveness of the interventions.

Keywords: diet, nutrition policy, noncommunicable diseases, Iran

Introduction

Noncommunicable diseases (NCDs) are chronic disorders caused by non-infectious agents. NCDs kill 41 million people annually, which represents 71% of all deaths worldwide (1). Based on World Health Organization (WHO) reports, annual deaths from NCDs are mostly linked to cardiovascular diseases (44%), cancers (22%), respiratory diseases (10%) and diabetes (4%) (2). NCDs are an important health concern in the Islamic Republic of Iran; the annual death rate from NCDs represents about 82% of the total mortality in the country (2). National studies show a 14.5% increase in deaths from NCDs in the past 20 years (3). This is of concern, especially as the population is ageing.

Several factors should be considered when developing and implementing strategies to reduce NCDs. For example, diet, and preparation and consumption of foods vary in different societies and according to demographic, cultural and socioeconomic characteristics (4,5). Therefore, one of the main global challenges in designing strategies to control and manage NCDs in large countries such as the Islamic Republic of Iran is modification of food traditions. Practical recommendations to follow a healthy lifestyle are regularly published by WHO. In 2013, WHO made a global call for a 25% decrease in premature deaths from NCDs in people aged 30–70 years by 2025 (6). Furthermore, Member States of WHO endorsed the 2013–2020 action plan that focuses on four behavioural risk factors for NCDs: unhealthy diet, harmful use of alcohol, insufficient physical activity and tobacco use. The action plan describes 25 indicators classified under nine targets (3,6) to help countries develop their national strategies for decreasing NCDs. To respond to this call and the action plan, The Ministry of Health and Medical Education of Iran established the national NCD committee in 2015 with the aim of integrating all decisions and activities on the prevention and control of NCDs at the national level.
in line with the WHO global call. Because NCD mortality from other causes not included in WHO nine targets is high in the country, four further targets were added to the list by the health ministry. These targets were: zero trans fatty acids in all manufactured food products, reduced traffic injuries, reduced drug abuse and access to treatment for mental diseases.

Similar to other countries, dietary risk factors are significant contributors to NCDs in the Islamic Republic of Iran, and their assessment and management are fundamental to preventing NCDs (3,7,8). Thus, close collaboration between the public sector, private health associations and the food industry is needed to establish healthy food policies to achieve national and international targets. In the Islamic Republic of Iran, the Food and Drug Administration is responsible for national food safety and, as a member of the national NCD committee, works closely with other key players in food and nutrition fields to improve the effectiveness of food policies and strategies linked to NCDs. Many interventions and factors have important roles in the prevention of NCDs, including food reformulation, labelling, monitoring, and public awareness and marketing (7). For example, socioeconomic factors, such as incentives to choose larger packages through advertisements and price encouragements, may negatively affect dietary patterns (9). To minimize the adverse effects of diet on the prevalence of NCDs in the Islamic Republic of Iran, international guidelines and recommendations on food intake were studied by stakeholders including regulatory experts such as risk managers and academic staff. As a result, the maximum permitted levels of salt and saturated and trans fatty acids in food in the national regulations were modified based on Iranian dietary patterns. These modifications were used for staple foods such as bread, dairy products and oil products. In parallel, to increase consumer awareness and its contribution to preventive mechanisms, a new graphical feature was designed and used on all food packaging – a nutritional traffic light.

In this study, policies and interventions adopted in the Islamic Republic of Iran to decrease NCDs following the WHO action plan were reviewed. As the Islamic Republic of Iran is a pioneer in the region in adopting measures to reduce NCDs, especially for trans fatty acids and nutritional traffic lights, we aimed to share our experiences in NCD control with other countries in the region.

Methods

In this study, a comprehensive review was carried out on newly adopted food standards and regulations by the Iran Food and Drug Administration and the Iran National Standards Organization. Furthermore, the maximum permitted levels of salt, and trans and saturated fats in old and revised standards were compared. The activities of the Iran Food and Drug Administration and raise public awareness about healthy food consumption were also assessed.

Since one of the nine NCD targets introduced by WHO is salt reduction and several national policies have been put in place to decrease and control daily salt consumption, the population attributable risk of the percentage of the incidence of disease that is due to salt was calculated using the following equation:

\[
\text{Population attributable } \text{risk } \% = \frac{P_s \times (RR - 1)}{[P_s \times (RR - 1) + 1]}
\]

where, \(P_s\) is the proportion of the population exposed to the risk factor (salt in this case) and RR is the relative risk of the risk factor (salt).

Results

Several interventions such as modifications of existing standards or adoption of new standards have been implemented in the country based on the international recommendations of daily intakes of: < 5 g of salt, < 10% total energy intake from saturated fatty acids and < 1% total energy intake from trans-fats (10). We identified eight food items that make up a large share of the daily Iranian food basket and three that make up a small share. As shown in Table 1, 17 standards were identified for these food products, 15 of which were selected for further assessments after removing duplications.

Interventions on salt

Since 2015, the Iran Food and Drug Administration has taken action on bread, doogh (Iranian fermented drink) and cheese as the major sources of salt intake in the country. No new standards have been developed for these food items. As shown in Table 2, three standards were revised with regard to the permitted level of salt in each food item. The permitted percentage of salt in bread was gradually reduced from 1.8% to 1.0% to adapt consumer taste, a decrease of 44%. With regard to foods that make up a small share of the daily food basket, a new national standard was established and implemented in 2015 on the amount of edible salt in food products such as canned foods, tomato pastes, processed olives, sauces and pickles (16). In addition, salt use was banned in probiotic yoghurts in 2018 (15).

Based on epidemiological data, the relative risks of cardiovascular diseases and stroke associated with salt are 1.14 and 1.23, respectively (26). The population attributable risk of both diseases in the Islamic Republic of Iran before the modified salt standards were implemented was calculated. For the analysis, \(P_e = 97.66\%\) was used based on a previous study (27). Therefore, population attributable risk % was 12.03% for cardiovascular disease and 18.34% for stroke before the modified standards.

Interventions on oils

To follow WHO recommendations, a number of restric-
tions have been imposed on oil products in the Islamic Republic of Iran since 2015. The trans fat level was reduced to 2% and saturated fat level to 30% in final oil products for household use. For frying oils added to food products in industry and minarine (a cream-like product used in confectionary), higher saturated fat levels were allowed compared with household products (Table 3). Moreover, higher maximum permitted levels of trans and saturated fats were set for shortening because it is directly used in oil industries and makes a negligible contribution to daily food baskets (Table 3).

Annual palm oil imports were restricted in the country in 2014, leading to a drop in imports from 750,000 tons in 2013 to about 465,000 tons in 2017 (unpublished report). Furthermore, import tariffs on palm oil increased substantially from 2–4% in 2013 to 26–40% in 2016 (unpublished report). Production of analogue foods using vegetable oils such as analogue cheese and butter, and addition of palm kernel oil/palm stearin to minarine have been banned since 2015.

### Nutritional traffic light

A nutritional traffic light system has been designed using three colours – green, orange and red – to indicate low, medium and high levels of ingredients, respectively (Table 4). Calculation of amounts and assigning the colours for each food was based on the quantities per 100 g of solid foods, 100 mL of liquid foods or the serving size. If the serving size is less than 100 g or 150 mL, the levels under heading of per 100 g/100 mL are used. Otherwise, the levels in the last column (per serving size) must be used. Then, if the product does not match with the last column, the colour is selected by converting the quantity per 100 g or 100 mL and using numbers of other columns.

Since early 2016, nutritional traffic light labelling on food packages is mandatory for all imported and

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**Table 1** Number of standards on salt, and trans and saturated fats related to food items that make up large and small shares of the daily Iranian food basket

<table>
<thead>
<tr>
<th>Component</th>
<th>Food product</th>
<th>New standard</th>
<th>Modified standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt</td>
<td>Large share (Ref.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bread (11,12)</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fresh cheese (13)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Dough (Iranian fermented drink) (14)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Probiotic yoghurt (15)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Other products (16)</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Oil Trans/saturated fat</td>
<td>Frying oil (household &amp; industry use) (17)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Semisolid oil for household use (18)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Table margarine and spread margarine (19)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Minarine &amp; sweetened minarine (20)</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Palm oil</td>
<td>Cheese (fresh cheese, lactic cheese, pre-cheese) (13,22,23)</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Butter (pasteurized butter, spread butter) (24,25)</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Minarine (20)</td>
<td>–</td>
<td>1</td>
</tr>
</tbody>
</table>

| Ref. = reference. | Similar standards have been developed for both indices. | Examples are canned foods, tomato paste, processed olives, sauces and pickles. | Similar standards have been developed for both indices. |

---

**Table 2** Changes in maximum permitted percentage of salt in foods that make up a large share of foods bought and consumed

<table>
<thead>
<tr>
<th>Food (reference)</th>
<th>Before (%)</th>
<th>After (%)</th>
<th>Decrease (%)</th>
<th>Base year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread (11,12)</td>
<td>1.8</td>
<td>1.0</td>
<td>44</td>
<td>2016–2017</td>
</tr>
<tr>
<td>Cheese (13)</td>
<td>4.0</td>
<td>3.0</td>
<td>25</td>
<td>2015</td>
</tr>
<tr>
<td>Doogh (Iranian fermented drink) (14)</td>
<td>1.0</td>
<td>0.8</td>
<td>20</td>
<td>2015</td>
</tr>
</tbody>
</table>
domestic foods, except for products that are not chemically processed or formulated, such as vegetables, spices, vinegar, lemon juice, tea, infusions, coffee, honey, dates, flour and barberry.

**Discussion**

Unhealthy diet is one of the four behavioural risk factors associated with NCDs (6). As people of all ages are more likely to be exposed to this risk factor than the other three (tobacco use, harmful use of alcohol and physical inactivity), food interventions to reduce the intake of certain products to safer levels have been instigated by countries. Salt evidence

Salt is necessary for normal body function and food preservation. Nonetheless, excessive daily salt intake results in diseases such as high blood pressure, cardiovascular diseases and gastric cancers (29,30). For example, sodium intake of 3480 mg/day, equal to 8.8 g/day of salt, was the main contributor to cardiometabolic diseases, mainly in elderly people, in the United States of America (31). This intake is similar to the daily intake of salt in the Islamic Republic of Iran in 2016 – 9.52 g (27). Based on the clinical adverse effects, WHO has recommended a maximum salt intake of 5 g/day, which allows normal function of the human body with no adverse effects on health (32). Since the national salt intake in the Islamic Republic of Iran was about twice the WHO recommended level, regulatory authorities brought in new restrictions. Mandatory reformulation of popular foods is the most cost-effective approach to decreasing disease burdens associated to salt (33–35). Therefore, we examined salt content of and regulations on staple foods such as bread, cheese and doogh.

The Iran national survey on average daily consumption of food reported a daily consumption of 310 g of bread, 16 g of cheese and 6 g of doogh per capita (36). Based on these data, it is estimated that 2.65 g/day of salt has been removed from the food of every Iranian after the adoption of new interventions in 2017. Therefore, the current salt intake is estimated to be 6.87 g/day. We also showed that 12% of cardiovascular diseases and 18% of strokes could be attributed to high salt intake in 2016 (before the regulations). Therefore, large decreases in these diseases are expected in coming years as a result of the reduction in salt intake through staple foods. It is worth noting that the daily salt intake is still higher than that recommended by WHO and further restrictions through reformulations are not practical because of technical limitations. For example, other than the flavour and preservative roles of salt, addition of salt to dough for bread baking is responsible for texture due to the electrostatic interactions between amino acids and effects on hydration of proteins (37). Therefore, to achieve further reduction in salt intake, consumers’ awareness of their salt consumption should be promoted. About 50–60% of daily salt intake is from salt that is directly added

<table>
<thead>
<tr>
<th>Index</th>
<th>Low level</th>
<th>Medium level</th>
<th>High level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per 100 g</td>
<td>Per 100 mL</td>
<td>Per 100 g</td>
</tr>
<tr>
<td></td>
<td>≤ 0.3</td>
<td>≤ 0.3</td>
<td>&gt; 0.3 to ≤ 0.75</td>
</tr>
<tr>
<td></td>
<td>≤ 5</td>
<td>≤ 2.5</td>
<td>&gt; 2.5 to ≤ 8.75</td>
</tr>
<tr>
<td></td>
<td>≤ 3</td>
<td>≤ 1.5</td>
<td>&gt; 15.10 to ≤ 17.5</td>
</tr>
<tr>
<td></td>
<td>≤ 0.5</td>
<td>≤ 0.5</td>
<td>&gt; 0.5 to ≤ 2</td>
</tr>
</tbody>
</table>

100 g is used for solid foods and 100 mL for liquid foods.
Risk of type 2 diabetes from milk and liquid oils increased the overall role of saturated fatty acids in type 2 diabetes as saturated fats, respectively (39). Cardiovascular diseases impose heavy financial burdens on governments annually because of productivity losses and health care expenses (40). Other than salt contribution, the high cardiovascular disease rates are possibly due to the consumption of saturated and trans fats (41,42). Trans fats have further hazards as they can induce thrombogenesis and atherogenesis (41,42). Despite previous reports, new findings have shown that ruminant-produced and industrial trans fatty acids adversely change the ratio of low-density lipoprotein cholesterol to high-density lipoprotein cholesterol in the human body (43). However, the adverse effects of industrial fatty acids are greater than those of ruminant isomers in normal diets. This effect possibly occurs because of the presence of bioactive components and nutrients in ruminant-derived foods containing trans fats (43). Therefore, lower intake of these two fatty acids or their substitution with cis unsaturated fatty acids results in healthier blood lipid profiles (43). Moreover, iso-caloric substitution of saturated fatty acids with cis unsaturated fatty acids, particularly polyunsaturated fatty acids, results in lower rates of cardiovascular diseases and significant decreases in low-density lipoprotein and total cholesterol (40,44). Studies have also shown the negative role of saturated fatty acids in type 2 diabetes as saturated fatty acids from milk and liquid oils increased the overall risk of type 2 diabetes (45).

Previously, the main source of trans isomers for humans included partially hydrogenated oils (46). However, the use of these oils has decreased because of the evidence of their clinical adverse effects (41,42). In the Islamic Republic of Iran, similar to other countries, restrictions on the production of partially hydrogenated oils have led to further use of palm oil because of its cost–effectiveness. However, high levels of saturated fatty acids, such as palmitic acid in palm oil and the known carcinogenicity of monochloropropane diol esters which is mainly formed in palm oil during the refining processes (47), were important health concerns. Therefore, the Iran Food and Drug Administration aimed to decrease saturation levels of fats by requiring industries to use other vegetable oils. The main strategy was setting a maximum permitted saturation in popular household frying oils which previously was not limited, and similar policies were adopted for industrial frying oils. As a result, addition of palm oil to foods was restricted in national food industries and people’s exposures to the hazardous compounds decreased to safe levels. Today, Iranian oil industries use various oil fractions to produce food products under the modified regulations. For example, they use emulsifiers in the mixture of unsaturated vegetable oils with small portions of fully hydrogenated oils to prepare healthier semisolid formulations compared with partially hydrogenated oils. These mixtures consist of about 70% common vegetable oils such as canola and sunflower, up to 25% of palm olein and a maximum 5% of fully hydrogenated oils. Therefore, recent formulations contain higher unsaturation rates and reduced levels of trans and saturated fatty acids compared with earlier formulations.

**Nutritional traffic light**

According to the Codex Alimentarius, “labeling includes any written, printed or graphic matter that is present on the label, accompanies the food or is displayed near the food including that for the purpose of promoting its sale or disposal” (48). To minimize the negative contribution of overweight and obesity to NCDs, simple policies to inform consumers, including nutritional labelling, were introduced for preventive purposes in the Islamic Republic of Iran. Nutritional labelling helps consumers to choose healthy products within various commercial brands based on their daily food baskets and calorie intakes. This strategy also helps the government to control NCDs and reduce budgets for medical care as a result of NCDs. Experiences in other countries show that nutritional traffic light labelling is a preferred method compared with other labelling guides such as octagons, nutritional claims, logos and numerical levels per serving sizes (49). Therefore, design of graphical feature showing total calorie, salt, sugar, fat and trans-fat indices was motivated by Iran FDA. Despite similar targets of nutritional labelling by different countries (50), differences exist in the details in the labels. For example, most countries include the total calorie, fat, sugar and salt in foods (50); however, level of trans fat was also added to the nutritional traffic light by the Iran Food and Drug Administration because of the clear involvement of trans fatty acids in cardiovascular diseases in the country.

Studies that assessed the effectiveness of nutritional traffic light labelling on food selection have shown that raising consumer awareness and knowledge would increase the effects of such interventions (51,52). Thus, the Iran Food and Drug Administration ran a health campaign to introduce the nutritional traffic light
labelling to people. The campaign included educational programmes at schools, interviews in the media and public advertisements. However, this is the beginning of nutritional traffic light labelling in the country and further research must be carried out on consumer perceptions to have a better understanding of effectiveness of this policy.

Conclusion
The Islamic Republic of Iran is a large country with a variety of cultures and dietary behaviours. Our study shows that, in addition to revising food product regulations and encouraging the food industry to reformulate food products, behavioural modifications should be considered by consumers to reduce their risk of NCDs as a result of their diet. In the Islamic Republic of Iran, salt levels in various foods, as well as saturated and trans fatty acids in oil products, decreased through implementation of new national strategies. Furthermore, nutritional traffic light labelling was established as a strategy to raise public awareness. Further studies are needed to assess the effectiveness of these interventions in reducing NCDs in the Islamic Republic of Iran.

Acknowledgement
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Competing interests: Dr. Mehrnaz Kheirandish was Director General for Department of Assessment and Control of Prescribing and Use of Medicines and Health Products at Iran FDA from 2016 to 2020. Dr. Masoumeh Moslemi and Dr. Atefeh Fooladi Moghaddam worked at Iran FDA and Mr. Nader Karimian Khosroshahi currently works at Iran FDA. Dr. Hedayat Hosseini, Dr. Behrooz Jannat and Dr. Vahid Mofid were Director General for Department of Foods and Beverages at Iran FDA from 2012 to 2015, 2016 to 2017 and 2018 to 2019, respectively.

Les politiques alimentaires nationales de la République islamique d’Iran visant la prévention et la maîtrise des maladies non transmissibles.

Résumé
Contexte : Le régime alimentaire joue un rôle important dans le risque de contracter des maladies non transmissibles. Après la publication du plan d'action de l'Organisation mondiale de la Santé (OMS) sur la prévention et la maîtrise des maladies non transmissibles, des activités nationales ont été mises en route en République islamique d’Iran.

Objectifs : La présente étude décrit les politiques alimentaires nationales mises en œuvre par le gouvernement afin de lutter contre les maladies non transmissibles dans le pays conformément au plan d’action de l’OMS.

Méthodes : Les normes et réglementations alimentaires récemment adoptées, liées aux maladies non transmissibles de 2013 à 2018, ont été examinées et les teneurs maximales autorisées en sel et en graisses saturées et en acides gras trans ont été comparées dans les anciennes et les nouvelles normes. Le système de feux tricolores pour l’étiquetage nutritionnel visant à sensibiliser le public aux régimes alimentaires sains a été évalué.

Résultats : Quinze normes alimentaires associées à huit produits alimentaires qui constituent une grande partie du panier alimentaire quotidien iranien et trois qui en constituent une petite partie ont été évaluées. Les politiques relatives au sel comprennent la réduction du pourcentage maximum autorisé dans le pain, le fromage et le doogh (une boisson fermentée) à 1 %, 3 % et 0,8 %, respectivement. En ce qui concerne les graisses saturées et les acides gras trans, les pourcentages maximums autorisés des huiles et graisses comestibles ont été fixés respectivement à 2-5 % et 30-65 %. L’étiquetage nutritionnel aux feux tricolores, qui indique les teneurs en sel, sucre, graisses et acides gras trans des aliments, est obligatoire pour tous les aliments depuis 2016.

Conclusions : Les politiques mises en œuvre pour réduire la teneur en sel et en graisses/huiles des aliments devraient entrainer une baisse significative des maladies non transmissibles dans les années à venir dans le pays. Cependant, des études supplémentaires sont nécessaires pour démontrer l’efficacité des interventions.
السياسات الغذائية الوطنية في جمهورية إيران الإسلامية الرامية إلى مكافحة الأمراض غير السارية والوقاية منها
مصوره مسلمي، مهناز خيراندش، رامين نجاد فرد، هداية حسيني، بهروز جنات، وحيد مفيد، عاطف مقدم، نادر كريميان

اختصار
يُلعب النظام الغذائي دورًا مهماً في التعرض لخطر الإصابة بالأمراض غير السارية. وفي جمهورية إيران الإسلامية، بدأت الأنشطة الوطنية الخلفية: بعد إطلاق خطة عمل منظمة الصحة العالمية بشأن الوقاية من الأمراض غير السارية ونِمْكَاحتها. الأهداف: هدفت هذه الدراسة إلى توضيح السياسات الغذائية الوطنية التي تُبَقِّي الحكومة من أجل الحد من الأمراض غير السارية في البلاد وفقًا خطة عمل منظمة الصحة العالمية.

طرق البحث: استُعرضت الدراسة المعايير واللوائح الغذائية المعتمدة حديثًا والمتعلقة بالأمراض غير السارية خلال الفترة من 2013 إلى 2018، كما قمت مقارنة المستويات القصوى المسموح بها من الملح والدهون المتحولة والدهون المشبعة في المعايير القديمة والجديدة. وُقِم تَوْسِيم إشارات المرور التغذوية لإذكاء الوعي العام بالنظم الغذائية الصحية.

النتائج: تم قِمَّة خمسة عشر معيارًا غذائيًا مرتبطًا بانية أصناف غذائية تشكل حصة كبيرة من سلالة الأغذية الإيرانية اليومية وثلاثة أصناف تشكل حصة صغيرة. وشملت السياسات الخاصة بالملح خفض المحتوى الأقصى للفصيلة المسموح بها في الخبز والجبن والمشروبات المخمرة إلى 0.8٪/0.8٪ على التوالي. وبالنسبة للدهون المتحولة والدهون المشبعة، أُحدِّدت النسب المئوية القصوى المسموح بها على 30-65٪ من الزيوت والدهون الصالحة للأكل، على التوالي. وأصبح تَوْسِيم إشارات المرور التغذوية، الذي يشير إلى محتوى الملح والسكر والدهون والدهون المخلوطة في الأغذية، إلزاميًا جمعياً منذ عام 2016.

الاستنتاجات: في ضوء السياسات المُنَفَّذة خفض المحتوى الملح والدهون/الزيوت في الأغذية، من المتوقع حدوث تراجع كبير في الأمراض غير السارية في السنوات القادمة في البلاد. ومع ذلك، ثمة حاجة إلى مزيد من الدراسات لإثبات فعالية التدخلات.

References


The status of cryptosporidiosis in Jordan: a review

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Abstract

Background: Cryptosporidium is a waterborne intestinal parasite that causes diarrhoea in low and middle-income countries worldwide. Reports from Mediterranean countries have documented the prevalence of cryptosporidiosis in children at various ages, also among cancer patients, and in cases of chronic kidney disease, haemodialysis, and organ transplant. Untill now, modified-acid staining preceded by stool concentration preparation remains the leading screening diagnostic test for the infection. In Jordan, few studies for cryptosporidiosis have been performed during the last 3 decades.

Aims: This paper reviewed the status of cryptosporidiosis in Jordan and tracked recent updates for this emerging protozoal infection among different population groups.

Methods: In this study, an online search was conducted on Google Scholar and PubMed databases using the keywords: Jordan, cryptosporidiosis and Cryptosporidium to inspect studies done on this parasite in Jordan.

Results: Only 9 articles were identified from 1994 to 2019. These were analysed in terms of population group, demographic, clinical history and the diagnostic tools used.

Conclusion: Cryptosporidiosis is still neglected in Jordan as indicated by the low number of studies over the last 3 decades and the prevalence is diverse depending on the diagnostic test used and socioeconomic status.

Keywords: cryptosporidiosis, Jordan, diagnostic tools, identification

Background

Cryptosporidium spp. are intracellular parasites of principal concern, especially in some Mediterranean countries with limited resources and in communities with low socioeconomic status (1,2). Globally, cryptosporidiosis has been ranked as the sixth most important foodborne parasitic infection of humans and domestic animals (3).

Human cryptosporidiosis was first reported in 1976; after that, it was identified as the major cause of chronic diarrhoea in HIV-positive patients and children and as a cause of zoonotic and waterborne diarrhoeal outbreaks (4). Later, Cryptosporidium infection prevalence was seen to be on the rise among malnourished children and a cause of premature death in low-resource settings (5–7). Cryptosporidium is acquired mainly via contaminated water and the ingested oocysts cause gastrointestinal symptoms before being shed in the stool and transmitted to another host via the faecal–oral route (8). Cryptosporidiosis causes acute diarrhoea in children (9), immunocompromised patients (3), cancer patients (10) and haemodialysis patients (11,12). The infection is usually self-limiting in immunocompetent individuals, however, it might be life-threatening in immunocompromised patients (2). The prevalence of cryptosporidiosis varies among different patient groups and this has been attributed to the endemcity of the parasitic infection in the region of sampling along with environmental, climatic and sanitary factors (13).

Microscopic examination of stool using acid-fast staining, with or without stool concentration, is the most frequently applied screening technique for cryptosporidiosis. Acid-fast staining microscopy is cheap and accessible in poor rural settings; it is the best parasitological method in terms of sensitivity and specificity (14) and shows good performance when compared with immunological and molecular methods (15).

In Jordan, Cryptosporidium has been investigated either alone or along with other intestinal parasites in various population groups (10,16), in the environment (17) and in domestic animals (18). Prevalence ranges from 4% to 19%. Modified acid-fast staining microscopy has frequently been used as the diagnostic method of choice. Cryptosporidiosis risk factors have been reported in Jordan, including drinking groundwater that is exposed to contamination from sewage (17), immunosuppression (10), contact with domestic animals and eating unwashed vegetables (19,20).

This paper reviews the status of cryptosporidiosis in Jordan and tracks recent updates for this emerging protozoal infection among different population groups.

Literature review

The search was performed on Google Scholar and PubMed databases using the keywords: Jordan, cryptosporidiosis and Cryptosporidium. Only 9 articles were identified from 1994 until 2019 and were downloaded;
this reflects the scarcity of studies on this parasite in Jordan.

The first study was published in 1994, it reported on the prevalence of various parasites in elementary school children in northern Jordan. Using various parasitological methods, Cryptosporidium spp. was detected in 40 out of 1000 stool specimens collected from symptomatic and asymptomatic elementary school children aged 6–14 years in northern Jordan (16). The same study reported a higher infection rate in the younger age group (< 9 years) than among children in the older age group, and a higher infection rate in villages than in cities (16).

After that, and consistent with previous results relating to Cryptosporidium prevalence, the same author further explored cryptosporidiosis in pre-school children (less than 6 years old) who suffered from symptoms of gastroenteritis and who were living in Irbid city, 85 km north of Amman, the capital of Jordan (20). In this study, Cryptosporidium oocysts were investigated using the formalin–ether concentration technique and cold acid-fast staining followed by microscopy. Cryptosporidium oocysts were detected in 6.7% (20 out of 300) of the stool specimens collected from patients; 7/20 were also infected with other pathogens. Risk factors did not differ from those reported previously (16). However, it was noticed that breastfed children had a lower infection rate than those weaned early and those who were bottle-fed; this was attributed to passive maternal immunity as well as reduced exposure to contaminated water during bottle preparation (20).

Another study was done to explore different intestinal parasites associated with diarrhoea in a rural area in the northeast of Jordan. The researchers collected 200 stool samples from patients with symptomatic gastroenteritis and these were examined using a number of parasitological methods including formalin–ethyl acetate concentration, wet preparation and modified acid-fast staining. Diagnosis revealed the oocysts of Cyclospora spp. and Cryptosporidium spp., Entamoeba histolytica, Giardia lamblia, Blastocystis hominis, Endolimax nana, Hymenolepis nana and Ascaris lumbricoides. Bacteria and other enteropathogens were also identified, including Salmonella spp., Shigella spp. and Escherichia coli. Oocysts of Cryptosporidium spp. were observed in the samples from 16 (8%) patients, distributed as follows: 10 in children ≤ 14 years old (mean 7.5 years) and 6 in adults 15–87 years (mean 51 years). Statistically significant risk factors for the infection were related to the source of drinking water, contact with animals and eating unwashed vegetables (19).

Ten years later, 2 studies were published from the same northern city; the first focused on drinking-water as a source of infection (17), while the second study explored diagnostic methods, children groups, infection seasonality and source of drinking water (14). Abo-Shehada et al. concluded that private groundwater reservoirs northern Jordan were significant enhancing risk factors for contamination with C. parvum in rural villages (17). They postulated the source of contamination was sewage disposal systems that were constructed near water reservoirs, which increased the risk of the leakage of their contents to be absorbed by the soil. Consequently, there is a health hazard through the contamination of drinking water stored in underground reservoirs. Therefore, the underground location of water reservoirs must be considered to avoid groundwater–faecal contamination.

Another survey was done to investigate for cryptosporidiosis among children from birth to 12 years at a hospital in Irbid (14). A single stool sample was collected from 300 children, 7 of whom were under chemotherapy treatment for cancer. This study compared several diagnostic methods, including direct wet mount microscopy, flotation concentration, cold Kinyoun Ziehl–Neelsen stain and direct immunofluorescence. Oocysts were detected in 112 samples using direct

### Table 1 Cryptosporidiosis in selected Mediterranean countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Population group</th>
<th>Diagnostic method</th>
<th>Prevalence (%)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>Diarrhoeal patients aged 2–17 years</td>
<td>Lugol’s iodine, immunofluorescence assay</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Egypt</td>
<td>Children aged ≤ 8 years</td>
<td>Nested-PCR</td>
<td>1.4</td>
<td>23</td>
</tr>
<tr>
<td>Lebanon</td>
<td>Schoolchildren</td>
<td>Modified Ziehl–Neelsen staining and nested-PCR</td>
<td>10.4</td>
<td>24</td>
</tr>
<tr>
<td>Palestine</td>
<td>Gastroenteritis patients (outbreak)</td>
<td>Malachite green negative staining and nested-PCR</td>
<td>All*</td>
<td>25</td>
</tr>
<tr>
<td>Egypt</td>
<td>Adult immunocompetent diarrhoeal patients</td>
<td>Modified Ziehl–Neelsen stain, sandwich ELISA, nested-PCR</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>Egypt</td>
<td>Haemodialysis patients</td>
<td>Cold modified Ziehl–Neelsen staining</td>
<td>40</td>
<td>13</td>
</tr>
</tbody>
</table>

PCR = polymerase chain reaction.
ELISA = enzyme-linked immunosorbent assay.
*Cryptosporidium detected in all outbreak cases.
immunofluorescence, which showed the highest sensitivity and specificity, 100% and 98%, respectively. A higher incidence rate was recorded during the rainy season (January–May). Also, C. parvum was detected in the stools of 4 among the 7 paediatric oncology patients, suggesting an association of immune status as a risk factor (14). Overall, these results concur with previous studies which indicated that contaminated drinking water is a main source for the infection as well as the increased incidence rate among rural areas (17,19,20).

Molecular epidemiology has been extensively studied in the current decade to inspect common and new genotypes of Cryptosporidium spp. in Jordan for a better understanding of the pathogen distribution, pathogenesis and transmission. Hijjawi et al. (21) genotyped 44 Cryptosporidium isolates from Jordanian children at the 18S rRNA locus and identified 4 Cryptosporidium spp.: C. parvum (n = 22), C. hominis (n = 20), C. meleagridis (n = 1) and C. canis (n = 1). Furthermore, subtyping for 29 isolates at the 60-kDa glycoprotein (GP60) locus revealed several rare and novel subtypes indicating unique endemcity and transmission of Cryptosporidium in Jordan. The same study showed that quantitative polymerase chain reaction (qPCR) increased the sensitivity of detection and confirmed the prevalence of the infection at up to 19% instead of the 1.8% that was obtained using microscopy.

Another genotyping study expanded the targeted populations to include several kinds of animals besides humans since associations of animals as a probable risk factor for cryptosporidiosis was postulated previously (16,19). A total of 284 stool samples from Jordanian cattle, sheep, goats and chickens and 48 human stool samples were screened via 18S-qPCR and lectin locus-specific qPCR. The age of the humans sampled ranged from 10 months to 56 years and all were immunocompetent, hospitalized with a history of diarrhoea, abdominal pain and gastroenteritis. Cryptosporidium DNA was amplified in 37/284 (13.0%) of animal and 4/48 (8.3%) of human samples. Speciation revealed 6 different Cryptosporidium species, including C. xiao, C. andersoni, C. ryanae, C. parvum, and C. baileyi. The study identified several novel and previously existing subtypes for C. parvum isolates at the 60-kDa glycoprotein (gp60) obtained from humans and animals (18).

Another genetic study was done in 2017 and assessed the prevalence and genotypes of Cryptosporidium among paediatric oncology and non-oncology patients (10). In brief, Hijjawi et al. reported a statistically significantly higher prevalence of cryptosporidiosis (14.4%; 23 out of 160) among symptomatic paediatric oncology patients than symptomatic paediatric nononcology patients (5.1%; 7 out of 137) using the modified acid-fast stain (10). All microscopy-positive stools were introduced for DNA extraction and were genotyped at species and subtype levels using the 18S and gp60 loci, respectively. Cryptosporidium parvum was identified in all samples. Clustering of the same subtype (IIaA17G2R1) was noticed in almost all species from the 2 patient groups, suggesting the existence of a cryptosporidiosis outbreak during sampling. That study confirmed that chemotherapy and immunosuppression are considered risk factors for cryptosporidiosis as suggested previously (14).

The last published paper for cryptosporidiosis in Jordan was in October 2019 (12). This described the prevalence of cryptosporidiosis among haemodialysis patients from different areas. In that study a total of 133 stool samples were collected and screened for Cryptosporidium oocysts using formalin–ether concentration and a modified acid-fast staining technique. Cryptosporidium oocysts were recovered in 15/133 (11%) of the patients with higher positivity incidence reported in males and in rural villages. The age of the patients ranged from 25 to 80 (mean 57.8; standard deviation 12.2) years and the most frequently reported symptoms were gastrointestinal symptoms. The study ensured the importance of modified acid-fast stain as a primary screening method and has recommended increasing the awareness of this parasite in this population group, and to include patients with kidney transplantation as well (12).

Reports for cryptosporidiosis from Jordan among different population groups relatively concurs with those from neighbouring and countries and other countries in the Region, which reflects the endemcity of this parasite and the need for more extensive epidemiological studies. Table 1 summarizes selected studies on cryptosporidiosis, highlighting the status of cryptosporidiosis in other Mediterranean countries and illustrating the diversity of diagnostic methods applied as well as the variation in the prevalence among these countries, all of which indicates the relative harmony between these reports and the results and methods reported in Jordan.

**Conclusion**

Cryptosporidiosis is still neglected in Jordan as indicated by the low number of studies over the last 3 decades and the prevalence is diverse depending the applied diagnostic test and the socioeconomic status.

**Recommendations**

Extensive studies on cryptosporidiosis in Jordan should be conducted and may include patients with the following inclusion criteria: kidney transplantation, autoimmune disorders, immunocompetent and immunocompromised children and adults, gastroenteritis, low socioeconomic status, from rural areas of different locations in Jordan, and people depending on groundwater for drinking. Modified acid-fast staining is informative and less expensive as a diagnostic screening tool in Jordan. Development, validation, and evaluation of Cryptosporidium–stool antigen immunoassay might be successful in increasing the specificity and sensitivity of detection and in reducing the costs in comparison with PCR. Finally, gp60 genotyping is important to investigate and track suspected common-source Cryptosporidium outbreaks.

**Funding:** None.

**Competing interests:** None declared.
Bilan de la situation de la cryptosporidiose en Jordanie

Résumé

Contexte : Cryptosporidium est un parasite intestinal d'origine hydrique qui provoque des diarrhées et que l'on retrouve dans les pays à revenu faible et intermédiaire du monde entier. Des rapports provenant de pays méditerranéens ont mis en évidence les taux de prévalence de la cryptosporidiose chez les enfants appartenant à divers groupes d’âge, les personnes atteintes de cancer ou d’insuffisance rénale chronique et les personnes ayant subi une hémodialyse ou une greffe d’organe. La coloration acido-résistante modifiée d’une préparation de selles concentrées reste à ce jour le principal test diagnostique utilisé pour le dépistage de l’infection. Peu d’études sur la cryptosporidiose ont été réalisées en Jordanie au cours des trois dernières décennies.

Objectifs : La présente étude visait à examiner la situation de la cryptosporidiose en Jordanie et à suivre les mises à jour récentes concernant cette infection à protozoaire émergente dans différents groupes de population.

Méthodes : Dans la présente étude, une recherche a été réalisée en ligne sur les bases de données Google Scholar et PubMed. Les mots clés suivants ont été utilisés : Jordanie, cryptosporidiose et Cryptosporidium. L’objectif était de recenser les études réalisées sur ce parasite en Jordanie.


Conclusion : La cryptosporidiose est encore négligée en Jordanie, comme l’indique le faible nombre d’études réalisées au cours des trois dernières décennies. La prévalence varie par ailleurs selon le test diagnostique utilisé et le statut socio-économique.
References


Implementing the Health Early Warning System based on syndromic and event-based surveillance at the 2019 Hajj

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Abstract

Background: During the 2019 Hajj, the Ministry of Health in Saudi Arabia implemented for the first time a health early warning system for rapid detection and response to health threats.

Aims: This study aimed to describe the early warning findings at the Hajj to highlight the pattern of health risks and the potential benefits of the disease surveillance system.

Methods: Using syndromic surveillance and event-based surveillance data, the health early warning system generated automated alarms for public health events, triggered alerts for rapid epidemiological investigations and facilitated the monitoring of health events.

Results: During the deployment period (4 July–31 August 2019), a total of 121 automated alarms were generated, of which 2 events (heat-related illnesses and injuries/trauma) were confirmed by the response teams.

Conclusion: The surveillance system potentially improved the timeliness and situational awareness for health events, including non-infectious threats. In the context of the current COVID-19 pandemic, a health early warning system could enhance case detection and facilitate monitoring of the disease geographical spread and the effectiveness of control measures.

Keywords: syndromic surveillance, event-based surveillance, early warning, Hajj, mass gathering, pilgrim

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Background

In August 2019, 2,489,406 Muslim pilgrims, of which 74.5% were international pilgrims, performed the 2019 (1440) Hajj in Makkah, Saudi Arabia. Over half (55.6%) of all pilgrims were males, and 9.2% of pilgrims were Saudi nationals (excludes non-Saudi residents) (1).

Disease prevention and control remains a national, regional and international public health priority during Hajj (2,3). Among various interventions, the deployment of enhanced disease surveillance system is recommended for mass gatherings to facilitate rapid detection and response to health threats (4). A case-based infectious diseases surveillance system, which uses an electronic portal for rapid data management, is deployed for Hajj (5). However, the focus on specific infectious threat is a recognized limitation of the surveillance system (6).

Syndromic and event-based surveillance (EBS) systems complement routine case-based surveillance systems in mass gatherings settings (4,7). By using data that precede diagnostic confirmation, syndromic surveillance facilitates prompt detection of existing threats, improves the surveillance for emerging diseases and provides an opportunity for rapid response (4,8). Event-based surveillance also ensures timeliness through pre-diagnostic data analysis; it captures unstructured data from diverse settings, including health care, media and community settings, to trigger public health alert and response (9).

The systematic real-time (or near real-time) reporting of both syndromic surveillance and EBS data thus provides an opportunity for early warning, especially in an international mass gathering context where timely detection and response is required for prompt risk mitigation and prevention. In addition, the ongoing systematic collection and analysis of surveillance data could improve situational awareness, provide reassurance of the absence of public health threats and guide continuing public health decision making (4,7). Given these potential benefits, the Ministry of Health in Saudi Arabia implemented a health early warning system (HEWS) during the 2019 (1440) Hajj. The health early warning system used both syndromic and EBS data to rapidly detect potential public health threats, triggered corresponding alerts for rapid epidemiological investigations and monitored the trend of confirmed health events during the 2019 (1440) Hajj. This study aims to describe the early warning findings at the Hajj to highlight the pattern of health risks and the potential benefits of the disease surveillance system.
Methods
This study is a descriptive analysis of surveillance data from the HEWS implementation processes during the 2019 Hajj. The projected target coverage of HEWS is at least 80% of health facilities (hospitals and primary health centres), but coverage was limited to only Ministry of Health hospitals in 2019. The included syndromes and events were identified through an international technical consultation organized by the World Health Organization (WHO) and the Ministry of Health (Table 1). A web-based electronic solution, which was anchored on an existing information exchange and data analytic tool, was developed for HEWS data management. Relevant data were pooled from hospital electronic medical records (EMRs) and integrated in a central database to provide a unified data source.

The raw data, including the International Classification of Diseases (ICD) 10 provisional diagnosis, were extracted and read periodically (hourly) from the central database, and then applied with the defined logic for priority syndromes and events to generate automated alarm on the HEWS dashboards. Additionally, a hotline was established for the report of public health events directly to the Command Centre. Initial alarm thresholds were set based on the benchmarks in a WHO regional syndromic surveillance system and the moving average statistical algorithms (8). Each alarm was reviewed by two epidemiologists before an alert was issued for field investigation. Response was integrated with those of the pre-existing enhanced infectious disease surveillance system for Hajj (5,6). The dissemination of this surveillance finding is approved by the Saudi Ministry of Health surveillance team. Supplementary data will only be shared on request after a review by the surveillance team.

Results
The surveillance data was reported from the emergency and outpatient departments of 16 Ministry of Health hospitals. A total of 409,098 consultations (62.18% among non-pilgrims) were reported during the deployment period. The number of daily consultations peaked during the period of Hajj rites (9–14 August 2019), and 80.2% of the total consultations during this period were among pilgrims (Figure 1).

Males represented 54.4% of all consultations and 62.8% of those among pilgrims. The proportion of consultations for each age group of pilgrims were 50% (45-64 years), 29.6% (25-44 years), 14.9% (≥ 65 years) and 4.9% (≤ 24 years).

During the deployment period, 121 automated alarms were generated for the following syndromes: acute febrile syndrome without rash (60), severe acute respiratory infections (18), acute febrile syndrome with neurological manifestation (14), acute febrile syndrome with rash (10), heat-related illnesses (HRI) (10), acute jaundice syndrome (7), and chemical injuries (2). Of these, 49 field investigations were conducted and an additional alert was issued for trauma/injuries based on analysis of a hotline-generated event, in the aftermath of an unexpected heavy rainfall in the Hajj areas.

The response team confirmed two health events (HRI and trauma/injuries) as depicted in Figure 2. The suspected HRI cases included citizens of 56 countries. Furthermore, females represented 46.7% of suspected HRI cases and the majority (79%) were reported from Arafat and Mina hospitals. The trauma/injury cases mostly involved males (66.7%), and the age group distribution of cases were <15 years (2.08%), 15–24 years (12.5%), 25–44 years (36.45%), 45–64 years (29.16%), >64 years (9.37%) and missing (10.41%). The peak daily mean response time (period between a public health alert and report of event status by investigation teams) was 3.44 hours and the lowest daily mean response time was 1.47 hours. No other priority syndromes or health events were detected by HEWS and no cases of priority diseases were reported by the pre-existing surveillance system from the HEWS reporting sites.

Discussion
The health early warning system improved the timeliness of reporting and detected two non-infectious health risks during the 2019 Hajj. The development and linkage of HEWS with pre-existing data management technolo-

Table 1: List of priority syndromes and events

<table>
<thead>
<tr>
<th>Syndromes</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute febrile syndrome without rash</td>
<td>Food poisoning</td>
</tr>
<tr>
<td>Acute febrile syndrome with rash</td>
<td>Heat-related illness</td>
</tr>
<tr>
<td>Acute febrile syndrome with neurological manifestation</td>
<td>Chemical, biological, radiological and nuclear emergencies</td>
</tr>
<tr>
<td>Acute jaundice syndrome</td>
<td>Trauma/injuries</td>
</tr>
<tr>
<td>Acute flaccid paralysis (AFP)</td>
<td>Cluster of cases or unusual health events</td>
</tr>
<tr>
<td>Acute haemorrhagic fever</td>
<td>Detection of unusual pathogens</td>
</tr>
<tr>
<td>Severe acute respiratory infections</td>
<td>–</td>
</tr>
<tr>
<td>Acute respiratory distress syndrome</td>
<td>–</td>
</tr>
<tr>
<td>Acute watery diarrhoea</td>
<td>–</td>
</tr>
<tr>
<td>Acute bloody diarrhoea</td>
<td>–</td>
</tr>
</tbody>
</table>
gy within the Ministry of Health promoted the effective use of available resources. In addition, the use of secondary data captured primarily for clinical consultation purposes ensured that additional data collection tasks were not assigned to already over-burdened health-care professionals in Hajj. Similar principles informed the

**Figure 1** Graphical representation of the total number of consultations and reporting sites

**Figure 2** Epi-curve of confirmed priority health events during the 2019 Hajj
use of existing data in other mass gatherings syndromic surveillance systems (10,11). Electronic data management is fast becoming an integral part of most early warning systems due to the benefits of promoting timeliness of reporting, and minimizing the significant manpower needs and human errors that are often associated with manual data management (10).

The number of automated alarms increased with daily consultation rates, and nearly half of all generated alarms were made for acute febrile syndrome. Indeed, fever unspecified was among the leading ICD 10 provisional diagnosis at the 2019 Hajj, and the variation in number of cases had no major public health implication. Since a missed event in the Hajj could have profound health security impacts, the setting of HEWS notification thresholds favoured increased sensitivity of the system and by implication the number of false alarms. Anticipating the stretch of field response resources, the dashboard verification of automated alarms reduced the number of investigation alerts by more than half.

The detected health events (HRI and injuries) were monitored and controlled with appropriate mitigating measures, including redeployment of manpower resources. While the number of suspected HRI cases declined sharply after an initial peak on the Day of Arafat (11 August) due to an unexpected heavy rainfall, more pilgrims were injured from falls on the wet slippery surfaces. In contrast to sporting mass gatherings where injuries often arise from athletic activities, the risk of injuries in the Hajj is predominantly heightened by crowd-related incidents (3,12). Heat-related illnesses are among the leading causes of morbidity and mortality at the Hajj, when the pilgrimage is held during the summer months (13–15). The HEWS surveillance finding is consistent with historical data regarding the geographical distribution of HRI cases during Hajj (13,14). A plausible reason for the high HRI disease burden in Mina and Arafat is the intensified physical exertion and increased exposure of pilgrims to hot weather as they perform the required Hajj rites in mostly open and unsheltered areas.

In future Hajj seasons, HEWS aims to capture data from at least 80% of all health facilities and incorporate non-facility based reporting sites, such as internet and social media platforms and over-the-counter drug sales records. Studies have shown that non-health facility based data collection improves the timeliness of syndromic surveillance systems (9,16). Conceivably, the cooperation of countries sending pilgrims to the Hajj, especially countries setting up clinics to assist in providing care for their own pilgrims, is needed for the integration of their health clinics to the HEWS database. To achieve this, the Ministry of Health would set interoperability standards and ensure that data sharing occurs in a highly secured virtual environment. Under the International Health Regulation (IHR 2005), countries ought to implement and maintain functional EBS and indicator-based surveillance systems to meet the target for enhanced surveillance capacity (17). Expanding HEWS as a national disease surveillance system would contribute to meeting this global health security target.

Limitations

As a limitation, the periodic (hourly) data extraction from the central database rendered HEWS a near real-time surveillance system. In non-mass gatherings settings, this hourly time-lag may be nearly insignificant. However, in reality some pilgrims depart from the health facility within one hour of their arrival for a consultation visit. In a crowded setting where pilgrims are constantly mobile and have no stable addresses, identifying cases before they depart from the health-care facility is both logistically desirable and risks mitigating during response. However, nearly all response feedbacks were received within the stipulated period (6 hours) to guide ongoing decision-making, primarily due to the linkage of HEWS with the response resources of the pre-existing surveillance system. Preliminary validation reports showing around 10–20% of missing data in the central database may have compromised the quality of HEWS data. The finding of incomplete entries by physicians is consistent with those of other similar disease surveillance systems (10,18). Additionally, potential public health threats, particularly less severe cases presenting to primary health centres, could have been missed since the system coverage was limited to 16 Ministry of Health hospitals in the Hajj areas. However, there were no reports of any major health threats from the pre-existing infectious disease surveillance system, which had a broader coverage.

Conclusion

This study provides valuable insight into the benefits of an early warning system in an international mass gathering context, with prevalent global health security risks. It potentially improves timeliness and the situational awareness for health events, including non-infectious threats. In the context of the current COVID-19 pandemic, HEWS could enhance case detection and facilitate monitoring of the disease geographical spread and the effectiveness of control measures.

Funding: None.

Competing interests: None declared.
Mise en œuvre du système d'alerte sanitaire précoce basé sur la surveillance syndromique et fondée sur les événements lors du Hadj de l'année 2019

Résumé
Contexte : Au cours du Hadj de l’année 2019, le Ministère de la Santé d’Arabie saoudite a mis en place pour la première fois un système d’alerte précoce en matière de santé pour une détection des menaces sanitaires et une riposte rapides face à celles-ci.

Objectifs : La présente étude avait pour objectif de présenter les résultats de l’alerte précoce lors du Hadj afin de mettre en évidence le schéma des risques sanitaires et les avantages potentiels du système de surveillance des maladies.

Méthode : À l’aide de la surveillance syndromique et des données de surveillance basée sur les événements, le système d’alerte sanitaire précoce a généré des alarmes automatisées pour les événements de santé publique, a déclenché des alertes des événements de santé publique, et a facilité le suivi des événements de santé.

Résultats : Au cours de la période de déploiement (4 juillet-31 août 2019), un total de 121 alarmes automatiques ont été générées, dont deux événements (maladies et blessures/traitements liés à la chaleur) ont été confirmés par les équipes d’intervention.

Conclusions : Le système de surveillance a potentiellement amélioré la notification en temps voulu des événements de santé et la connaissance des situations concernant ces événements, y compris les menaces non infectieuses. Dans le contexte de la pandémie actuelle de COVID-19, un système d’alerte précoce permettrait d’améliorer la détection des cas et de faciliter le suivi de la propagation géographique de la maladie ainsi que l’efficacité des mesures de lutte.

References


Elimination of neglected tropical diseases under preventive chemotherapy programmes in the Eastern Mediterranean Region


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Introduction

The World Health Organization (WHO) global and regional preventive chemotherapy programmes have made a number of key accomplishments. These include the elimination of lymphatic filariasis as a public health problem in Yemen and the establishment of public–private partnerships to facilitate progress towards the elimination and control of neglected tropical diseases (NTDs) (1). More than 1 billion people had been treated globally in 2018 for at least one of five NTDs targeted for control and elimination, with over 1.7 billion treatments distributed to populations in need through mass drug administration (MDA) and a regional coverage of preventive chemotherapy of 21.4% (2).

As an important step in paving the way to end the epidemics of NTDs by 2030, the 18th meeting of the Regional Programme Review Group (RPRG) on elimination of neglected tropical diseases under preventive chemotherapy programmes in the WHO Eastern Mediterranean Region was convened by the WHO Regional Office for the Eastern Mediterranean in Sharm El Sheikh, Egypt, 9–11 December 2019 (3). The meeting was attended by the members of the RPRG, representatives from the ministries of health of Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia and Yemen. Representatives of partner organizations, including the Expanded Special Project for Elimination of Neglected Tropical Diseases (ESPEN), Mectizan Donation Program, Sightsavers and United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) also attended the meeting.

The objectives of the meeting were to:
• review country-specific progress made during 2018 and 2019 by preventive chemotherapy programmes for NTDs to track the progress made towards achieving the NTD milestones and targets included in the roadmap for WHO’s work in the Eastern Mediterranean Region, discuss challenges in implementation and identify solutions;
• update participants on the current situation, innovations and challenges for control and elimination of NTDs, with a focus on lymphatic filariasis, schistosomiasis, onchocerciasis, soil-transmitted helminthiasis and trachoma in the Region;
• present the WHO NTD roadmap 2030 and discuss its adaptation to country context and the development of country-specific NTD plans for 2021–2030; and
• discuss country-specific plans of action for 2020, including drug requirements, to provide input and recommendations on their funding, design and implementation.

Summary of discussions

A global update on NTDs was presented along with progress towards achieving NTD targets in the Eastern Mediterranean Region (EMR). In 2017, the size of the population in the EMR requiring interventions against NTDs was estimated at 10 million less than in 2016, mainly due to the reduction of soil-transmitted helminthiasis prevalence in some areas of Sudan as indicated by a prevalence survey conducted in 2017. In addition, The Egyptian Ministry of Health and Population has accelerated elimination of schistosomiasis (commonly known as bilharziasis) by earmarking an equivalent of US$ 2 million a year for a period of five years (4).

The NTD Roadmap 2021–2030 was presented, which is a high-level global strategy that will set the overall direction for the fight against NTDs, tailored to a diverse set of audiences. The content of the roadmap was outlined, including the milestones for overarching and cross-cutting targets, the disease-specific targets and an analysis of those areas requiring strengthening across multiple diseases.

The process of validation of trachoma elimination as a public health problem was discussed. In addition, the WHO Joint Application Package for preventive chemotherapy was presented and common mistakes, challenges and shortfalls when preparing the Joint Reporting Forms and Joint Request for Selected Medicines were explained.

Recommendations

To WHO
• Providing technical support and capacity-building to countries for developing/updating NTD elimination and control plans and for their implementation;

WHO events addressing public health priorities

- assisting countries to identify local research priorities for overcoming operational challenges;
- advocating for NTD programmes and resource mobilization initiatives with senior health and finance ministry officials to ensure the allocation of resources from domestic funding and partners;
- maintaining annual RPRG/programme managers’ meetings to provide an opportunity for Member States to obtain new information, learn best practices and share experiences with all stakeholders, including donors; and
- facilitating cross-border collaboration and coordination between neighbouring countries and regions, where appropriate.

**To Member States**

- Strengthening national NTD control/elimination programmes and having focal persons at national and subnational levels to coordinate activities;
- establishing a multisectoral coordination mechanism/committee for NTDs, including representation from relevant sectors and stakeholders, such as the finance, education and water, sanitation and hygiene sectors;
- integrating NTD interventions within existing health programmes that receive substantial funding support; and
- developing a compelling evidence-based investment case that NTD elimination and control supporting inclusion within national health plans and policy.

**References**

Members of the WHO Regional Committee for the Eastern Mediterranean

La Revue de Santé de la Méditerranée Orientale
EST une revue de santé officielle publiée par le Bureau régional de l’Organisation mondiale de la Santé pour la Méditerranée orientale. Elle offre une tribune pour la présentation et la promotion de nouvelles politiques et initiatives dans le domaine de la santé publique et des services de santé ainsi qu’à l’échange d’idées, de concepts, de données épidémiologiques, de résultats de recherches et d’autres informations, se rapportant plus particulièrement à la Région de la Méditerranée orientale. Elle s’adresse à tous les professionnels de la santé, aux membres des instituts médicaux et autres instituts de formation médico-sanitaire, aux ONG, Centres collaborateurs de l’OMS et personnes concernées au sein et hors de la Région.

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