# Corona-Virus

To enhance response activities and prioritization of resources to tackle the threat of Coronavirus Disease 2019 (COVID-19), the World Health Organization Regional Office for the Eastern Mediterranean has conducted an analysis of the risk of introduction of the virus into its Member States, as well as their capacity to manage a COVID-19 outbreak. Countries in the Region have been working on developing and enhancing their preparedness and response capacities as required under International Health Regulations (2005) since they came into force in 2007.

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# Coronavirus Disease 2019 outbreak: preparedness and readiness of countries in the Eastern Mediterranean Region

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On 31 December 2019, a cluster of acute respiratory illness was reported from China and later confirmed as novel coronavirus on 7 January 2020 (*1*). This virus is the same member of the coronavirus family that caused the severe acute respiratory syndrome (SARS-CoV) reported in China 2003, and Middle East respiratory syndrome (MERS-CoV) reported in Saudi Arabia in 2012. The initial cases have been linked to a live seafood market in Wuhan, China, and the specific animal source is yet to be determined (*2*). The detection of this new virus in humans without knowing the source of the infection has raised greatly heightened concerns not only in China, but also internationally. To date, the outbreak has spread to most provinces in China and 25 other countries within a relatively short period. Consequent to its spread, Dr Tedros Ghebreyesus, Director General of the World Health Organization (WHO), declared the outbreak a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 (*3*).

As of 15 February 2020, a total of 50 580 cases and 1526 deaths were reported in China and another 25 countries. However, 99% of cases and 99.9% of deaths are centered in China (*4*). So far, the number of confirmed cases and associated deaths by the coronavirus disease outbreak has surpassed overall cases and deaths from the SARS epidemic.

As the situation evolves, many details regarding the epidemiological profile of Coronavirus Disease 2019 (COVID-19) have yet to be elucidated. Current information indicates that cases present with symptoms of an acute respiratory illness, such as cough, fever and difficulty breathing, and these symptoms range from mild to severe. Human-to-human transmission among close contacts has occurred, including in health care workers, although large nosocomial outbreaks have been avoided so far. Significant knowledge gaps remain regarding: 1) clinical course; 2) route of transmission other than contact and droplet; 3) period of infectiousness and asymptomatic transmission; 4) tertiary and quaternary transmission; and 5) vaccines and therapeutic agents, including whether antiviral agents may have a role, as possible improvement with oseltamivir and antiretrovirals has been noted in some cases (*5*). Sources have indicated that the COVID-19 shares 88–96% of its genome with

coronavirus originating in bats, but there is possibly an intermediate host, as was the case with SARS and MERS-CoV (*6,7*).

In the Eastern Mediterranean Region, as of 15 February 2020, eight cases were reported from the United Arab Emirates (UAE), of which six cases belong to two families and one case was reported from Egypt.

The incident management system has been activated at the WHO Regional Office for the Eastern Mediterranean (WHO/EMRO) in Cairo, Egypt, in order to better coordinate and support the preparedness, readiness and response activities at country and regional levels. WHO has categorized the risk of the COVID-19 outbreak globally as high, including the Eastern Mediterranean Region, because of the direct and indirect international travel from to and from China. In addition, many countries in the Region are experiencing or recovering from complex emergencies with fragile health systems.

To enhance response activities and prioritization of resources, WHO/EMRO has conducted an analysis of the risk of introduction of the virus into its countries, as well as their capacity to manage a COVID-19 outbreak. Countries in the Region have been working on developing and enhancing their preparedness and response capacities as required under IHR (2005) since they came into force in 2007 (*8*). The implementation of national action plans for health security, which were developed following the conduct of joint external evaluation in 18 countries between 2016 and 2019, is ongoing but with varied rates of progress among countries (*9,10*). WHO is actively offering support to accelerate operational readiness for COVID-19 in countries.

In addition, the Organization is strengthening laboratory diagnostic capacities by providing essential supplies and technical guidance to national laboratories. Currently, there is no vaccine or cure for the COVID-19; however, WHO/EMRO is advising health ministries on the appropriate management of patients who are diagnosed with the virus, as well as providing guidance on infection prevention and control to prevent spread within health facilities. Through the WHO regional logistics hub in Dubai, supplies have been pre-positioned and procurement initiated for personal protective

equipment and laboratory supplies to support COVID-19 preparedness and response efforts in countries.

Via its event-based surveillance, WHO is also detecting media signals related to COVID-19 and verifying them with the concerned countries. Furthermore, countries have been advised to report to WHO any COVID-19 suspected or confirmed cases in a timely manner, and COVID-19 verifications and reporting are effectively implemented through the national IHR focal points and existing influenza surveillance platforms (11).

While evidence shows that body temperature detection as an entry screening measure for travellers may not be effective, since travellers may be incubating the disease or concealing symptoms, many countries in the Region are implementing such screening. Meanwhile, WHO is advising countries on how to improve their effectiveness by disseminating health updates and collecting data on passengers' exposure history when arrive directly or indirectly from China.

WHO has advised against unnecessary restrictions on travel and trade. However, countries in the Region have assessed the risk of importation of COVID-19 and its onwards transmission in order to inform their decision. While some countries have made no changes, other countries have put additional measures that may significantly interfere with travel and trade. For the latter, WHO is working with such countries in order to share justification of these measures in accordance with Article 43 of the IHR (2005). Additionally, a number of countries have decided to repatriate their nationals from China, who are subsequently kept in quarantine for 2 weeks in order to minimize the likelihood of transmission. WHO is working with these countries to prepare them for containment, including active surveillance, early detection, isolation and case management, contact tracing, as highlighted in the statement of the IHR emergency committee (12).

To date, WHO is leading global efforts to minimize the threat of COVID-19 and addressing the knowledge gaps through research and innovation to develop vaccines, therapeutics and diagnostics. The COVID-19 outbreak is another test of whether countries in the Eastern Mediterranean Region are adequately prepared for the prevention, detection and management of another public health emergency. Therefore, it is important for countries in the Region to continue their efforts to implement IHR (2005) capacities and allocate needed resources so that coordinated, timely and effective actions are evident to prevent importation of cases and potential local transmission. The continued success by WHO in preventing, detecting and containing this outbreak depends upon sustained global solidarity, especially in transparency and information sharing, in order to best understand the extent of the outbreak and its potential for further spread and any resultant consequences.

## References

1. World Health Organization. Novel coronavirus (2019-nCoV). Situation report 1. Geneva: World Health Organization; 2020 (https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn)

2. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. New Engl J Med. 29 Jan. 2020:1–9.

3. World Health Organization. WHO Director-General's statement on IHR Emergency Committee on novel coronavirus (2019-nCoV). Geneva: World Health Organization; 2020 (https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-2019-ncov)

4. World Health Organization. Novel coronavirus (2019-nCoV). Situation Report 19. Geneva: World Health Organization; 2020 Geneva: World Health Organization; 2020 (https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200215-sitrep-26-covid-19.pdf?sfvrsn=a4cc6787_22)

5. Wongcha-um, Panu. Cocktail of flu, HIV drugs appears to help fight coronavirus: Thai Doctors. Thomson Reuters, 3 February 2020 (https://www.reuters.com/article/us-china-health-thailand/cocktail-of-flu-hiv-drugs-appears-to-help-fight-coronavirus-thai-doctors-idUSKBN1ZW0GQ, accessed 4 February 2020)

6. Zhou P, Yang X, Wang X, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature, 3 Feb. 2020, doi:10.1038/s41586-020-2012-7 (epub ahead of print).

7. Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. The Lancet, 29 Jan. 2020:1–10.

8. Mahjour J, Alwan A. Emerging infections and global health security: the case (again) for strengthening all-hazards preparedness and response under IHR-2005. East Mediterr Health J. 2014;20(10):587–588 (http://www.emro.who.int/emhj-vol-20-2014/volume-20-issue-10/editorial-emerging-infections-and-global-health-security-the-case-again-for-strengthening-all-hazards-preparedness-and-response-under-ihr-2005.html)

9. Samhouri D, Ijaz K, Rashidian A, Chungong S, Flahault A, Babich SM, et al. Analysis of Joint External Evaluations in the Eastern Mediterranean Region. East Mediterr Health J. 2018;24(5):477–87 (http://applications.emro.who.int/emhj/v24/05/EMHJ_2018_24_05_477_487.pdf)

10. Samhouri D, Ijaz K, Thieren M, Flahault A, Babich SM, Jafari H, et al. WHO Joint External evaluations in the Eastern Mediterranean Region, 2016–17. Health Secur. 2018;16(1):69–76 (https://www.ncbi.nlm.nih.gov/pubmed/29406822)

11. Enhancing influenza surveillance in the Eastern Mediterranean Region: Eastern Mediterranean Acute Respiratory Infection Surveillance (EMARIS) network – third inter-country meeting. East Mediterr Health J. 2016;22(7):560–561

12. World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Geneva: World Health Organization; 2020 (https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)

# Harnessing the power of advocacy to improve seasonal influenza vaccination coverage in the Eastern Mediterranean Region

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Seasonal influenza causes considerable morbidity and mortality worldwide (1). The whole population is at risk, but the threat is higher in older people, pregnant women, children, individuals with underlying comorbidities, and healthcare workers as they are susceptible to severe complications from influenza (2). Influenza vaccines are safe and effective in reducing severe outcomes of influenza infections (1). However, to be effective at the population level, high vaccination rates need to be achieved.

Many countries in the Eastern Mediterranean Region (EMR) of the World Health Organization (WHO) have implemented vaccination policies for influenza (3). However, the vaccination rates in EMRO remain very low with less than 20 doses distributed per 1000 population as compared to 45, 112, 275 doses in the Western Pacific, Europe, and Americas WHO regions, respectively (4). The exact reasons for the low vaccination rates in EMR are not well understood but are multifaceted and include misperceptions and erroneous interpretations of the efficacy and safety of the vaccine, and the threat that influenza poses to health (5–8). Additionally, the lack of regional capacity for vaccine production and so reliance on imported vaccine supplies may be a hurdle for increasing vaccine availability and distribution (4).

In this article, we describe examples of various advocacy approaches that have been shown to enhance influenza vaccine uptake. Such approaches among other initiatives and activities such as virus surveillance and burden studies can be implemented in the EMR to improve influenza awareness and vaccine uptake. Vaccine advocacy might be best characterized as the "promotion" of the best scientific knowledge, moral attitudes, and public health practices to improve immunization rates (9).

Health care workers are an important primary group to be targeted by advocacy campaigns; first, because of their risk for and role in the transmission of influenza in their practice areas and, second, because of their influence on vaccine awareness and acceptance by their patients. Influenza vaccination rates among healthcare workers in two hospitals in Qatar were doubled during the 2014/2015 season following a comprehensive campaign that comprised parallel interventions including promotional and educational tools and resources, leadership engagement, and enhanced vaccine accessibility (10). Nonetheless, simple approaches such as educational sessions and posters targeting vaccine misconceptions and improving vaccine accessibility proved useful by nearly tripling the vaccination rates among healthcare workers at a university hospital in Geneva (11). Another study found that substantial improvements in vaccination rates among nurses can be achieved by merely improving accessibility to the vaccine (12).

Another approach to improve vaccine acceptance among employees, particularly healthcare workers, is through offering gift incentives to vaccinators such as movie tickets and health books. Such incentives coupled with free and conveniently accessible vaccines and peer-advocacy resulted in substantial improvement in the vaccination rate (>75%) among healthcare workers at a major hospital in the United States of America (USA) (13). Another hospital included influenza vaccination as one of the indicators qualifying employees for monetary bonuses which led to increased vaccination rates, from 32% in 2004/2005 to 84.2% in 2005/2006 (14).

Pregnant women are a priority group for vaccination, but vaccination rates among this risk group are reportedly low in the EMR (7). A randomized clinical trial revealed that brief one-on-one education of pregnant women on vaccine safety and availability as well as the potential complications from influenza substantially improved vaccine acceptance and coverage in this risk group (15). This type of advocacy and education is likely to prove effective among other risk groups.

At the level of the general population, mass media campaigns provide effective means for vaccine advocacy. A study in the USA investigated the effect of mass media coverage of influenza-related topics on influenza vaccination timing and rates among the elderly (16). Influenza-related reports in various media sources were found to positively influence influenza vaccination by shifting the timing of vaccination earlier and increasing coverage (16). Similarly, expanded media coverage of influenza illness and the vaccine was associated with improvement in vaccination rates

among children with asthma (17).

In resource-limited settings, advocacy through social media, short message service (SMS) or emails are alternative, low-cost means of improving vaccination rates through sharing educational information or reminders for vaccination. A randomized controlled trial found that influenza vaccine coverage among high-risk patients assigned to receive an SMS vaccination reminder showed improved vaccination rates compared with the control group (18). Similar findings were reported for high-risk general practice patients in the United Kingdom and among pregnant women in New York city who received SMS vaccine reminders (19,20). Phone and mail reminders effectively improved vaccination rates among people with hypertension who did not seek early seasonal influenza vaccination (21).

In conclusion, despite the good progress made in EMR in areas related to influenza vaccination, challenges remain, which highlight the need for effective communication and strong advocacy initiatives to lead the way to improve vaccine uptake and to meet public health immunization goals. Reliable information and a good understanding of the current influenza immunization practices, behaviors and policies in the Region are the mainstays of a successful advocacy campaign. Collecting regional data on influenza vaccination as well as understanding the causes of vaccine hesitancy among the target population are critical to designing evidence-based interventions. Moreover, the availability of local and regional surveillance and burden data at country and regional levels provide compelling evidence to educate the health sector and the public about influenza and the importance of vaccination. Nevertheless, every country should decide the type and number of interventions to be implemented in an advocacy campaign based on the local data and available resources.

# References

1.  World Health Organization. Influenza (Seasonal) [Internet]. Geneva: World Health Organization; 2018 (http://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal), accessed 28 April 2018).

2.  World Health Organization. Vaccines against influenza: WHO position paper: November 2012 [Internet]. Geneva: World Health Organization; 2018 (http://www.who.int/immunization/policy/position_papers/influenza/en/, accesswed 28 March 2018).

3.  Hirve S, Lambach P, Paget J, Vandemaele K, Fitzner J, Zhang W. Seasonal influenza vaccine policy, use and effectiveness in the tropics and subtropics - a systematic literature review. Influenza Other Respir Viruses. 2016;10(4):254–67.

4.  Palache A, Abelin A, Hollingsworth R, Cracknell W, Jacobs C, Tsai T, et al. Survey of distribution of seasonal influenza vaccine doses in 201 countries (2004–2015): The 2003 World Health Assembly resolution on seasonal influenza vaccination coverage and the 2009 influenza pandemic have had very little impact on improving influenza control and pandemic preparedness. Vaccine. 2017 Aug 24;35(36):4681–6.

5.  El Khoury G, Salameh P. Influenza Vaccination: A cross-sectional survey of knowledge, attitude and practices among the Lebanese adult population. Int J Environ Res Public Health. 2015 Dec 5;12(12):15486–97.

6.  Abu-Rish EY, Elayeh ER, Mousa LA, Butanji YK, Albsoul-Younes AM. Knowledge, awareness and practices towards seasonal influenza and its vaccine: implications for future vaccination campaigns in Jordan. Fam Pract. 2016;33(6):690–7.

7.  Zaraket H, Melhem N, Malik M, Khan WM, Dbaibo G, Abubakar A. Review of seasonal influenza vaccination in the Eastern Mediterranean Region: Policies, use and barriers. J Infect Public Health. 2019;12(4):472–478

8.  Khowaja ZA, Soomro MI, Pirzada AK, Yoosuf MA, Kumar V. Awareness of the Pandemic H1N1 Influenza global outbreak 2009 among medical students in Karachi, Pakistan. J Infect Dev Ctries. 2011 Mar 21;5(3):151–5.

9.  Balinska MA. What is vaccine advocacy?: Proposal for a definition and action. Vaccine. 2004 Mar 29;22(11):1335–42.

10. Mustafa M, Al-Khal A, Al Maslamani M, Al Soub H. Improving influenza vaccination rates of healthcare workers: a multi-pronged approach in Qatar. East Mediterr Health J. 2017;Jun 14;23(4):303–10.

11. Harbarth S, Siegrist CA, Schira JC, Wunderli W, Pittet D. Influenza immunization: improving compliance of healthcare workers. Infect Control Hosp Epidemiol. 1998 May;19(5):337–42.

12. Kung YM. A quality improvement project to increase influenza vaccination in healthcare personnel at a university health center. J Am Assoc Nurse Pract. 2014 Mar 1;26(3):148–54.

13. Centers for Disease Control and Prevention (CDC). Interventions to increase influenza vaccination of health-care workers–California and Minnesota. MMWR Morb Mortal Wkly Rep. 2005 Mar 4;54(8):196–9.

14. Mayoryk SA, Levy SM. Incentive Program Increases Employee Influenza Vaccine Compliance at a Chronic Hospital/Long-Term Care Facility. Am J Infect Control. 2006 Jun 1;34(5):E49.

15. Wong VWY, Fong DYT, Lok KYW, Wong JYH, Sing C, Choi AY-Y, et al. Brief education to promote maternal influenza vaccine uptake: A randomized controlled trial. Vaccine. 2016 17;34(44):5243–50.

16. Yoo B-K, Holland ML, Bhattacharya J, Phelps CE, Szilagyi PG. Effects of mass media coverage on timing and annual receipt of influenza vaccination among Medicare elderly. Health Serv Res. 2010 Oct;45(5 Pt 1):1287–309.

17. Gnanasekaran SK, Finkelstein JA, Hohman K, O'Brien M, Kruskal B, Lieu T. Parental perspectives on influenza vaccination among children with asthma. Public Health Rep Wash DC 1974. 2006 Apr;121(2):181–8.

18. Regan AK, Bloomfield L, Peters I, Effler PV. Randomized Controlled Trial of Text Message Reminders for Increasing Influenza Vaccination. Ann Fam Med. 2017 Nov;15(6):507–14.

19. Herrett E, Williamson E, Staa T van, Ranopa M, Free C, Chadborn T, et al. Text messaging reminders for influenza vaccine in primary care: a cluster randomised controlled trial (TXT4FLUJAB). BMJ Open. 2016 Feb 1;6(2):e010069.

20. Mazzoni SE, Brewer SE, Pyrzanowski JL, Durfee MJ, Dickinson LM, Barnard JG, et al. Effect of a multi-modal intervention on immunization rates in obstetrics and gynecology clinics. Am J Obstet Gynecol. 2016;214(5):617.e1-7.

21. Minor DS, Eubanks JT, Butler KR, Wofford MR, Penman AD, Replogle WH. Improving influenza vaccination rates by targeting individuals not seeking early seasonal vaccination. Am J Med. 2010 Nov;123(11):1031–5.

# Macrolide-resistant *Mycoplasma pneumoniae* in adults with community acquired pneumonia: challenges and risks

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Sir,

*Mycoplasma pneumoniae* is an important atypical microorganism that causes community-acquired pneumonia (*1*). These atypical microorganisms are responsible for 7–20% of community-acquired pneumonia cases, yet β-lactam agents are not effective against *M. pneumoniae* because it lacks a rigid cell wall. Currently, macrolides are considered as first line agents to treat atypical community-acquired pneumonia due to *M. pneumoniae*, while respiratory fluoroquinolones (such as levofloxacin), and tetracyclines are alternative treatment options (*2*). However, macrolide-resistant *M. pneumoniae* is growing globally and the prevalence rate shows variations across countries and regions. Epidemiologic studies have shown that the macrolide-resistant *M. pneumoniae* rate is between 0% and 15% in the United States of America, while reaching 100% in Asia, with resistance more dominant in low and middle-income countries (*3*).

Moreover, for some countries there has been little or no macrolide-resistant *M. pneumoniae* reporting, including the Islamic Republic of Iran, where studies determining the prevalence of community-acquired pneumonia due to *M. pneumoniae* and macrolide-resistant *M. pneumoniae* incidence remain scarce. Research by Arfaatabar et al. indicated that the frequency of *M. pneumoniae* among patients with atypical community-acquired pneumonia was reported to be high (*4*). Study by Noori et al. estimated the macrolide-resistant *M. pneumoniae* incidence to be almost 57% (*5*). In clinical practice, characteristics of macrolide-resistant *M. pneumonia* and macrolide-susceptible *M. pneumonia* are similar (*6*). In addition, polymerase chain reaction is not a routine diagnostic method for community-acquired pneumonia in some low and middle-income countries.

Perhaps for these reasons, most physicians are accustomed to prescribe levofloxacin as the first line empiric regimen in adults with atypical community-acquired pneumonia. Tuberculosis is common in the Region, thus the risk for the emergence of resistance to this valuable antibiotic exists if physicians use this agent inappropriately. Another aspect that is important to be clarified is the clinical relevance of macrolide-resistant *M. pneumoniae* in adults with community-acquired pneumonia. In the study by Cardinale et al. (*7*), which was done in a paediatric population, authors concluded alternative agents such as fluoroquinolones should be used if symptoms persist or in the case of clinical deterioration. According to another study by Lee et al. (*6*), the authors suggested that fluoroquinolones may be considered as an alternative agent when patients remain febrile or chest X-ray imaging shows deterioration at least 48–72 hours after macrolide initiation.

Detection of macrolide-resistant *M. pneumoniae* should be considered if patients did not respond to the macrolide regimen (*6*). However, an important point is to remind that macrolides are bacteriostatic (as opposed to fluoroquinolones that are bactericidal) and breakthrough infection might occur especially in those immunocompromised (*8*). Therefore, further evidence regarding these challenges is needed in low and middle-income countries. The conduct of well-designed studies to determine the prevalence of community-acquired pneumonia due to *M. pneumoniae* and macrolide-resistant *M. pneumoniae* rate is emphasized. The minimal inhibitory concentration of antibiotics against *M. pneumoniae* can be determined in such studies, which is beneficial for clinical practice. These studies can also aim to assess the fluoroquinolone-resistant *M. pneumoniae* rate in an in-vitro situation, thus improving the selection of an appropriate antibiotic regimen according to in-vitro studies, clinical efficacy and related adverse effects.

## References

1.  Bartlett JG, Mundy LM. Community-acquired pneumonia. N Engl J Med. 1995 Dec 14;333(24):1618-24.

2.  Waites KB, Xiao L, Liu Y, Balish MF, Atkinson TP. Mycoplasma pneumoniae from the respiratory tract and beyond. Clin Microbiol Rev. 2017 Jul 1;30(3):747-809.

3.   Pereyre S, Goret J, Bébéar C. Mycoplasma pneumoniae: current Knowledge on macrolide resistance and treatment. Front Microbiol. 2016;7:974. doi:10.3389/fmicb.2016.00974

4.   Arfaatabar M, Aminharati F, Azimi G, Ashtari A, Pourbakhsh SA, Masoorian E, et al. High frequency of Mycoplasma pneumoniae among patients with atypical pneumonia in Tehran, Iran. Germs. 2018;8(3):126–133. doi:10.18683/germs.2018.1139.

5.   Noori Goodarzi N, Pourmand MR, Arfaatabar M, Azimi G, Masoorian E, Rahimi Foroushani A, et al. First detection and characterization of macrolide-resistant Mycoplasma pneumoniae from people with community-acquired pneumonia in Iran. Microb Drug Resist. 2019 Sep 23. doi: 10.1089/mdr.2019.0223. [Epub ahead of print]

6.   Lee H, Yun KW, Lee HJ, Choi EH. Antimicrobial therapy of macrolide-resistant Mycoplasma pneumoniae pneumonia in children. Expert review of anti-infective therapy. 2018;Jan 2;16(1):23–34.

7.   Cardinale F, Chironna M, Chinellato I, Principi N, Esposito S. Clinical relevance of Mycoplasma pneumoniae macrolide resistance in children. J Clin Microbiol. 2013 Feb 1;51(2):723-4.

8.   Alishlash AS, Atkinson TP, Schlappi C, Leal SM Jr, Waites KB, Xiao L. Mycoplasma pneumoniae carriage with de novo macrolide-resistance and breakthrough pneumonia. Pediatrics. 2019 Oct;144(4):e20191642. doi: 10.1542/peds.2019-1642. Epub 2019 Sep 5.

# Analysis of life expectancy across countries using a decision tree

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## Abstract

**Background:** It is important to identify variables that influence life expectancy in order to develop strategies to improve health care systems and thereby increase life expectancy.

**Aims:** In this study, a decision tree was built using a chi-square automatic interaction detector technique in order to identify variables influencing life expectancy at birth.

**Methods:** Data were taken from the databases of the World Bank, World Health Organization and World Life Expectancy. Data from 166 countries for the year 2013 were extracted for 25 selected input variables related to mortality, health and the environment, child health, economy and demography in order to build the decision tree.

**Results:** Of the 25 variables, nine had a significant influence on life expectancy: percentage of the population using improved sanitation facilities; death rates per 100 000 population for HIV/AIDS, liver disease, stroke and coronary heart disease; percentage of the urban population using improved drinking-water sources; total fertility rate (births per woman); public health expenditure (percent of government expenditure); and health expenditure per capita.

**Conclusions:** Improving these variables may result in significant increases in life expectancy and quality of life. At the country level, appropriate strategies can be developed to improve the quality and performance of health care systems.

Keywords: life expectancy, decision trees, public health

## Introduction

Life expectancy is the probable remaining life time of an individual after a specific age. Life expectancy at birth is the number of years, on average, a newborn can expect to live if the existing mortality rates continue to apply (*1*).

It is important to identify variables that influence and predict the life expectancy of the population of a country in order to develop appropriate strategies to improve the quality and performance of health care systems and thereby increase life expectancy.

Research to estimate life expectancy focuses on modelling life expectancy using time series or cross-sectional data based on trends in health and mortality observed in the population, as well as social, economic and environmental factors of the countries. Many studies have been conducted to estimate life expectancy going back to 1662 with an analysis to create a warning system for the onset, spread and decline of bubonic plague in London (*2–13*). Various modelling techniques have been used including an autoregressive integrated moving average (ARIMA) model (*5*), a novel model based on log mortality rate changes rather than levels (*2*), Bayesian spatiotemporal models (*6*), a model with a new survival function (*7*), Pollard's actuarial method of decomposing life expectancy (*12*) and extreme bounds analysis (*13*).

The determinants of life expectancy in Turkey (social, economic and environmental factors) were investigated using time series data (*4*). The study concluded that while the availability of food and nutrition and health expenditure were the main determinant factors, smoking was the most important cause of death.

In this study, we aimed to build a decision tree using a chi-square automatic interaction detector (CHAID) technique to identify influential variables on life expectancy at birth.

## Methods

### Data sources

The data sources of this study are the databases of the World Bank, World Health Organization (WHO) and World Life Expectancy (*14–16*). World Life Expectancy is a free web portal developed by a private media company (*16*). The World Bank data meet Open Data best practices and the established standards of professional data communities (*17*). WHO provides access to health-related statistics for its 194 Member States with its Global Health Observatory data repository (*18*). Although the datasets are not always the same as official national estimates, they represent the best estimates of WHO using methodologies for specific indicators that aim for comparability across countries and time (*18*). Using these databases, data from 166 countries for the year 2013 were extracted for 25 selected input variables in order to build the decision tree to explain life expectancy at birth. The variables

were grouped into five categories related to mortality, health and environment, child health, economy and demography (Box 1).

## Decision tree

The decision tree technique is an intuitive data mining tool that is capable of handling heterogeneous data by defining explicit rules for classification (19). The technique splits the data to determine the most significant predictor recursively that yields the best separation at the current level. The aim is to divide data into homogenous sublevels. The decision tree is transparent and has easy to understand solutions provided by the algorithm which helps focus on the entire data (20).

A tree diagram is a useful tool to visualize the structure of a decision tree. Each path from the root node to one of the leaf nodes in the decision tree provides a rule for classification. Therefore, it is easy to interpret the rules from a decision tree. Other advantages of decision trees are: (i) they do not require any particular probability distributions for variables and work with both discrete and continuous variables, (ii) they are not affected by collinearity and (iii) they are insensitive to outliers in the data set. However, decision trees suffer from problems of statistical reliability and generalizability. They can also bias classification choices because of sequential variable evaluation. A reduced data set is evaluated after each split in the decision tree which introduces bias.

## Chi-square automatic interaction detector

We built a decision tree using a CHAID technique. The target variable was life expectancy at birth (LIFEX), and the 25 selected variables were used as the input variables of the decision tree.

CHAID is a popular decision tree technique that was described in 1975 and formalized in 1980 (19). The algorithm works on nodes to build a hierarchical tree. It decides the most significant predictor to split the data iteratively using the chi-square test. CHAID contains several components on a decision tree. The root node, at the top of the hierarchy, involves the dependent or target variable. In our study, life expectancy at birth stayed at the root as the target variable to be explained by the input variables. Parent nodes are the nodes that are composed by dividing the root node by the most significant predictor. In our study, access to sanitation facilities appeared to be the most significant predictor that divided the data into five nodes. The child nodes are the successor nodes for parent nodes on the decision tree. The terminal nodes, also called leaf nodes, are the final nodes on the decision tree.

The steps of the CHAID algorithm are explained in Data mining and statistics for decision making (19). CHAID makes use of the chi-square test by merging classes that do not have significantly different effects on the target variable, and then chooses the best split and decides whether it is worth performing any additional splits on a node (21). Four steps of CHAID are for merging the categories and the last step is for node splitting (19).

1) For each input variable with more than two categories, the chi-square test is done to group the categories by cross-tabulating them with the categories of the target variable. In subcross-tabulations, the pair of categories of the input variable with the smallest chi-square value (the largest $P$-value) is selected and compared with the chosen threshold (default value is $\alpha = 0.05$). If the chi-square is not significant ($P$-value greater than the chosen threshold), the two categories are merged.

2) Step 1 is repeated until all the pairs of categories have a significant chi-square ($P$-value less than the chosen threshold) or until there are only two categories remaining for each input variable.

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**Box 1 Variables selected to build the decision tree**

*Mortality-related variables:*

Death rates per 100 000 population for all cancers (CANCER), coronary heart disease (CHD), stroke (STROKE), HIV/AIDS (HIV_AIDS), lung disease (LUNGD), kidney disease (KD), hypertension (HTEN), liver disease (LIVERD), alcohol use (ALCOHOL), drug use (DRUG), and road traffic accidents (RTA)

*Health and environment-related variables:*

Percentage of the urban population using improved drinking-water sources (DWS_U), percentage of the rural population using improved drinking-water sources (DWS_R), percentage of the population using improved sanitation facilities (SF), carbon dioxide emissions as metric tons per capita (CO2), forest area as percentage of land (FOREST), and food safety as a percent of the average of all indicators that reflect the level of performance or achievement of the International Health Regulations Food Safety (FOOD)

*Child health-related variables:*

Measles immunization (ImMeasles), and diphtheria, pertussis and tetanus immunization (ImDPT) as the percent of children immunized aged 12–23 months

*Economy-related variables:*

Total health expenditure as a percent of gross domestic product (HEoGDP), public health expenditure as a percent of total health expenditure (HEoTHE), public health expenditure as a percent of government expenditure (HEoGE), and health expenditure in US$ per capita (HEpC)

*Demography-related variables:*

Total fertility rate as births per woman (FR) and population growth as annual percent (PG)

3) If the input variable is nominal and has missing values, the set of missing values is considered to be a category and treated in the same way as the others. If the input variable is ordinal or quantitative, the missing values category is merged with another category with the closest chi-square after the end of the preceding merger processes.

4) The *P*-value associated with the chi-square of the best table obtained when the merging process stops is multiplied by the Bonferroni correction (adjusted *P*-value) in order to prevent the over-evaluation of the significance of the multiple-category variables.

5) When the categories have been grouped optimally for each input variable and the adjusted *P*-value has been calculated, CHAID selects the variable for which the chi-square is most significant (the one for which the adjusted *P*-value is smallest). If the adjusted *P*-value is less than the chosen threshold for the split (default value is α = 0.05), the node is divided into a number of child nodes equal to the number of categories of the variable after grouping, otherwise the node is not divided.

## Results

Using the CHAID decision tree technique, of all the 25 input variables analysed, nine were identified as the most significant variables affecting life expectancy at birth. These variables were: percentage of the population using improved sanitation facilities; death rates per 100 000 population for HIV/AIDS, liver disease, stroke and coronary heart disease; percentage of the urban population using improved drinking-water sources; total fertility rate as births per woman; public health expenditure as a percent of government expenditure; and health expenditure as US$ per capita.

As seen in Figure 1, the percentage of the population using improved sanitation facilities was the best first split. The percentage of population using improved sanitation facilities divides the entire group of countries into five groups in terms of life expectancy (Table 1). If the percentage of the population using improved sanitation facilities is at most 59%, this group includes 51 countries and their average life expectancy is 60.564 years (Node 1), whereas if the percentage of the population using improved sanitation facilities is more than 99%, this group includes 20 countries and their average life expectancy sis 80.664 years (Node 5). Based on the World Bank's classification of countries by region and income level, Node 1 contains 27 low-income countries and 24 middle-income countries from sub-Saharan Africa, South Asia, Middle East and North Africa, Latin America and Caribbean, and East Asia and Pacific regions. Node 5 contains 19 high-income countries and one middle-income country from Middle East and North Africa, East Asia and Pacific, Europe and Central Asia, and North America regions. Among the Member States of the WHO Eastern Mediterranean Region, four countries are in Node 1 (Sudan, Afghanistan, Djibouti and Yemen), one country is in Node 2 (Pakistan), seven

are in Node 3 (Egypt, Islamic Republic of Iran, Iraq, Lebanon, Morocco, Syria and Tunisia), six are in Node 4 (Jordan, Libya, Bahrain, Oman, Qatar and United Arab Emirates) and two countries are in Node 5 (Kuwait and Saudi Arabia).

The CHAID procedure takes each of these five groups and finds the variable that best splits each group. From the root node to the leaf nodes, 166 countries were divided into 26 mutually exclusive groups. The group with the lowest life expectancy (55.667 years) included countries in sub-Saharan Africa. These countries are Angola, Burundi, Central African Republic, Chad, Democratic Republic of the Congo, Guinea, Guinea-Bissau, Liberia, Malawi, Sierra Leone, Togo, Uganda, which are on the list of least developed countries and Cameroon, the Congo, Côte d'Ivoire, Ghana, Nigeria, Kingdom of Eswatini and Zambia which are middle-income countries. For this group, the decision tree gave the following rule: SF ≤ 59% of the population *and* HIV_AIDS > 48.87 deaths per 100 000 population *and* LIVERD > 24.34 deaths per 100 000 population *then* LIFEX is predicted as 55.667 years.

The group with the highest life expectancy of 82.442 years included Australia, Canada, Cyprus, Israel, Italy, Japan, Malta, New Zealand, Singapore, Spain and Switzerland which are all high-income countries. For this group the decision tree gave the following rule: SF > 99% of the population *and* DWS_U > 99% *and* LIVERD ≤ 7.1 deaths per 100 000 population *then* LIFEX is predicted as 82.442 years.

The groups with life expectancy less than 60 years include countries in the sub-Saharan Africa region which are mostly least developed countries. If life expectancy is about 70 years, groups contain middle-income countries. If life expectancy is more than 81 years, high-income countries are included which are Austria, Portugal and the Republic of Korea. For this group, the decision rule is: SF > 99% of population *and* DWS_U > 99% *and* LIVERD > 7.1 deaths per 100 000 population *and* FR ≤ 1.4 births per woman *then* LIFEX is predicted as 81.3 years.

For the group including high-income countries Belgium and Denmark, fertility rate also has an effect and the decision rule is: SF > 99% *and* DWS_U > 99% *and* LIVERD > 7.1 deaths per 100 000 population *and* FR > 1.4 births per woman *then* LIFEX is predicted as 80.2 years

This life expectancy is lower than the previous group. Higher fertility rates cause an increase in the population and since the available resources and infrastructure will therefore be shared by more individuals, the quality of life and life expectancy will be adversely affected.

Table 2 shows the groupings of Member States of the WHO Eastern Mediterranean Region for the three lowest and highest life expectancy predictions. Decision rules indicate that an increase in the percentage of the population using improved sanitation facilities will increase life expectancy. Of the mortality-related variables, the death rates for HIV/AIDS, liver disease, stroke and coronary heart disease significantly influence life expectancy for these countries. Economy-related

**Figure 1 Decision tree for life expectancy at birth**
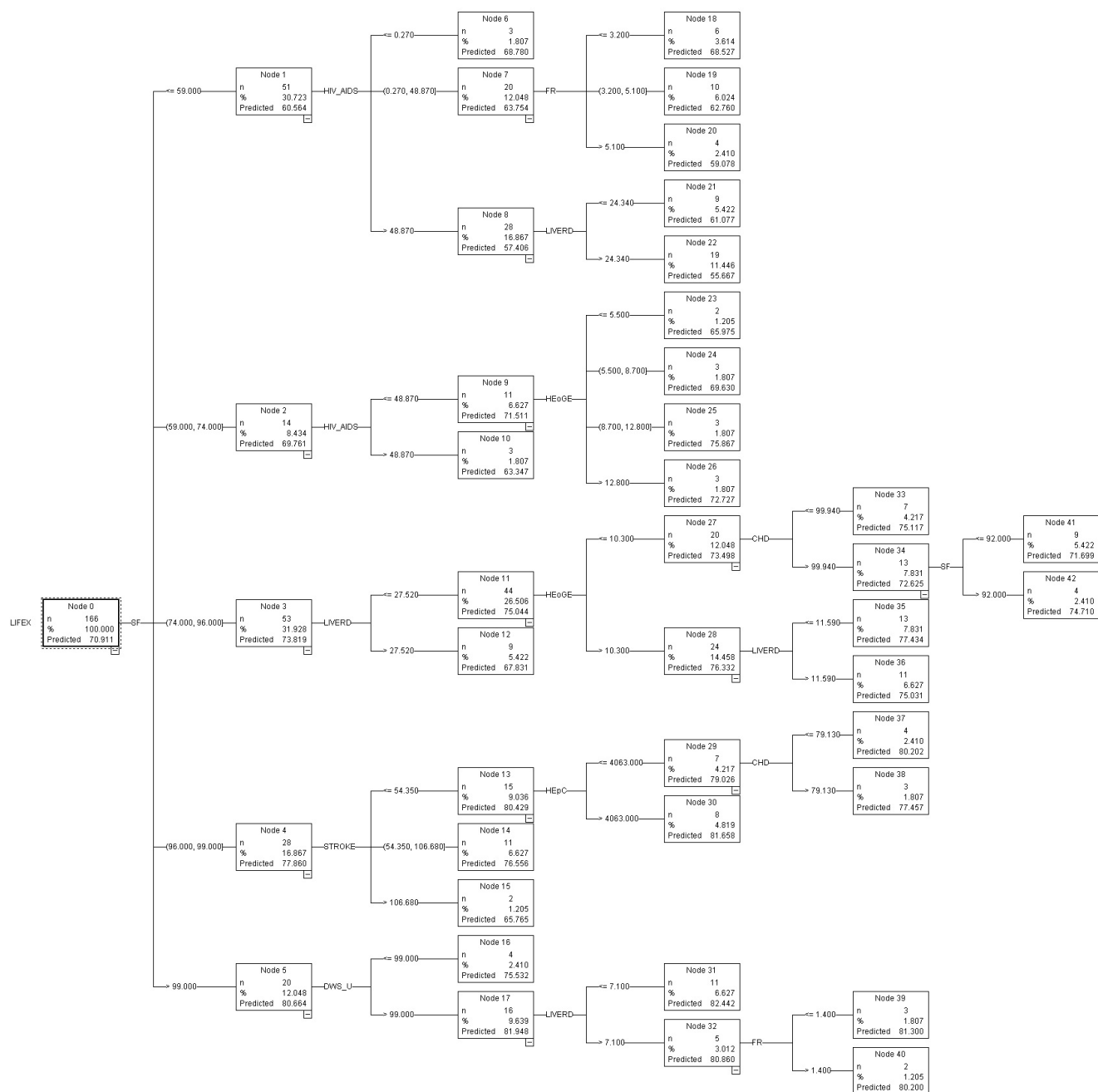


LIFEX: life expectancy at birth; SF: percentage of the population using improved sanitation facilities; HIV_AIDS: death rate per 100 000 population for HIV/AIDS; LIVERD: death rate per 100 000 population for liver disease; STROKE: death rate per 100 000 population for STROKE; DWS_U: percentage of the urban population using improved drinking-water sources; FR: total fertility rate as births per woman; HeoGE: public health expenditure as a percent of government expenditure; HepC: health expenditure in US$ per capita; CHD: death rate per 100 000 population for coronary heart disease.

variables are also important and it is clear that more government spending on public health will result in increased life expectancy. Since decision rules for high-income countries with high life expectancy indicate that the percentage of the urban population using improved drinking-water sources is very high for these countries, this variable should also be taken into consideration by countries of the Eastern Mediterranean Region in order to increase life expectancy.

## Discussion

The results of this study are consistent with those of previous studies. Research using extreme bound analysis identified eight variables as robust predictors for life expectancy: improved water sources, poverty headcount rate, adolescent fertility rate, labour participation rate, health aid, share of pregnant women receiving prenatal care, and the Country Policy and Institutional Assessment gender equality index (*10*). Other research ascertained

**Table 1 Groups of countries according to percentage of the population using improved sanitation facilities (SF)**

|  |  | Node 1 SF ≤ 59% | Node 2 59% < SF ≤ 74% | Node 3 74% < SF ≤ 96% | Node 4 96% < SF ≤ 99% | Node 5 SF > 99% |
|---|---|---|---|---|---|---|
| Number of countries |  | 51 | 14 | 53 | 28 | 20 |
| Life expectancy (years) |  | 60.564 | 69.761 | 73.819 | 77.86 | 80.664 |
| **Region** | **Income level** | **Countries in the node[a]** | | | | |
| Sub-Saharan Africa | Low income | Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Senegal, Sierra Leone, United Republic of Tanzania, Togo, Uganda | Rwanda |  |  |  |
|  | Middle income | Angola, Cameroon, Republic of Congo, Côte d'Ivoire, Gabon, Ghana, Kenya, Lesotho, Mauritania, Nigeria, **Sudan**, Kingdom of Eswatini, Zambia | Botswana, Cabo Verde, South Africa | Equatorial Guinea, Mauritius |  |  |
| South Asia | Low income | **Afghanistan**, Nepal |  |  |  |  |
|  | Middle income | Bangladesh, Bhutan, India | **Pakistan** | Sri Lanka | Maldives |  |
| Middle East and North Africa | Middle income | **Djibouti, Yemen** |  | Algeria, **Egypt, Iran (Islamic Republic of), Iraq, Lebanon, Morocco, Syrian Arab Republic, Tunisia** | **Jordan, Libya** |  |
|  | High income |  |  |  | **Bahrain, Oman, Qatar, United Arab Emirates** | Israel, **Kuwait**, Malta, **Saudi Arabia** |
| Latin America and Caribbean | Low income | Haiti |  |  |  |  |
|  | Middle income | Bolivia (Plurinational State of) | El Salvador, Guatemala, Nicaragua, Panama | Argentina, Belize, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guyana, Honduras, Jamaica, Mexico, Paraguay, Peru, Suriname, Venezuela (Bolivarian Republic of) |  |  |
|  | High income |  |  | Bahamas, Barbados, Trinidad and Tobago, Uruguay | Chile |  |

**Table 1 Groups of countries according to percentage of the population using improved sanitation facilities (SF)** *(concluded)*

| Region | Income level | Countries in the node[a] | | | |
|---|---|---|---|---|---|
| East Asia and Pacific | Middle income | Cambodia, Mongolia, Papua New Guinea, Solomon Islands, Timor-Leste | China, Indonesia, Lao People's Democratic Republic, Philippines | Fiji, Malaysia, Myanmar, Thailand, Viet Nam | |
| | High income | | | | Australia, Japan, New Zealand, Singapore, Republic of Korea |
| Europe and Central Asia | Middle income | | Russian Federation | Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, North Macedonia, Moldova, Romania, Tajikistan, Turkey, Ukraine | Croatia, Kazakhstan, Serbia, Turkmenistan | Uzbekistan |
| | High income | | | Ireland, Latvia, Lithuania | Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Luxembourg, Netherlands, Norway, Poland, Slovakia, Slovenia, Sweden, the United Kingdom | Austria, Belgium, Cyprus, Denmark, Italy, Portugal, Spain, Switzerland |
| North America | High income | | | | Canada, United States of America |

[a]*Member States of the World Health Organization Eastern Mediterranean Region are in bold text.*

that falling tobacco use for men and a decrease in cardiovascular disease mortality for both men and women were the main factors contributing to increase in life expectancy in older age in high-income countries (*11*). The findings indicated that progress in the improvement rate in older age mortality has been slower in low- and middle-income countries because of continuing communicable disease epidemics, such as HIV/AIDS and tuberculosis, and the growing epidemic of noncommunicable diseases. A recent study concluded that decrease in deaths from cardiovascular disease was the most important contributor to the change in life expectancy (*12*), while another identified the most influential determinants of longer life expectancy at birth in low-income countries were HIV prevalence among children, gender equality, agricultural production, political stability, improved water source, improved sanitation facilities, good governance, primary school enrolment, increased private health expenditure and overseas development assistance, and control of armed conflict and HIV prevalence among men (*13*).

In our study, the percentage of the population using improved sanitation facilities was the most significant variable affecting life expectancy. The difference between the groups of countries in the decision tree with the highest life expectancy (node 5) and the lowest life expectancy (node 1) was about 20 years, which indicates that improved sanitation facilities increases life expectancy. A comprehensive study on sanitation and health supports this finding (*22*); it stated that 2.6 billion people in the world do not have adequate sanitation and inadequate sanitation causes about 10% of global diseases.

HIV/AIDS was the next significant variable in grouping the countries with a low percentage of the population having improved sanitation facilities (nodes 1 and 2). Most of the countries in these groups (63%) (nodes 6, 7 and 8 under node 1, and nodes 9 and 10 under node 2; Figure 1) are low- and middle-income sub-Saharan countries (Figure 1 and Table 1). Sub-Saharan Africa accounts for 71% of the global burden of HIV infection, although it is home to only 12% of the global population (*23*). Policies directed at preventive actions and treatment programmes will help reduce deaths from HIV/AIDS and increase life expectancy. Similarly, policies directed at reducing deaths from liver disease, stroke and coronary heart disease, which were also identified as influential variables, will have positive effects on life expectancy. The decision rules generated by the CHAID decision tree technique provide easy interpretation of differences between groups of countries and hence can be used in strategy development.

A limitation of this study is that only 25 variables related to mortality, health and environment, child health, economy, and demography, were included whereas other

**Table 2 Member States of the World Health Organization Eastern Mediterranean Region with lowest and highest life expectancy**

| Member State at the node | Other countries at the node | Node | Decision rule for the node | Predicted life expectancy for the node (years) |
|---|---|---|---|---|
| Djibouti | Ethiopia, Gabon, Haiti, Kenya, Lesotho, Mozambique, Namibia, United Republic of Tanzania | 21 | SF ≤ 59% of population *and* HIV¬_AIDS > 48.87 deaths per 100 000 population *and* LIVERD ≤ 24.34 deaths per 100 000 population | 61.077 |
| Afghanistan, Sudan, Yemen | Benin, Comoros, Eritrea, Madagascar, Mauritania, Papua New Guinea, Senegal | 19 | SF ≤ 59% of population *and* 0.27 < HIV¬_AIDS ≤ 48.87 deaths per 100 000 population *and* 3.2 < FR ≤ 5.1 births per woman | 62.760 |
| Pakistan | Lao People's Democratic Republic | 23 | 59 < SF ≤ 74% of population *and* HIV¬_AIDS ≤ 48.87 deaths per 100 000 population *and* HeoGE ≤ 5.5% of government expenditure | 65.975 |
| Iran (Islamic Republic of), Lebanon, Tunisia | Bahamas, Barbados, Colombia, Costa Rica, Cuba, Ireland, North Macedonia, Suriname, Turkey, Uruguay | 35 | 74 < SF ≤ 96% of population *and* LIVERD ≤ 27.52 deaths per 100 000 population *and* HEoGE > 10.3% of government expenditure *and* LIVERD ≤ 11.59 deaths per 100 000 population | 77.434 |
| Bahrain | Czechia, Estonia | 38 | 96 < SF ≤ 99% of population *and* STROKE ≤54.35 deaths per 100 000 population *and* HEpC ≤ US$ 4063 per capita *and* CHD > 79.13 deaths per 100 000 population | 77.457 |
| Qatar | Chile, Slovenia, United Kingdom | 37 | 96 < SF ≤ 99% of population *and* STROKE ≤ 54.35 deaths per 100 000 population *and* HEpC ≤ US$ 4063 dollars per capita *and* CHD ≤ 79.13 deaths per 100 000 population | 80.202 |

*SF: percentage of the population using improved sanitation facilities; HIV¬_AIDS: death rate per 100 000 population for HIV/AIDS; LIVERD: death rate per 100 000 population for liver disease; FR: total fertility rate as births per woman; HeoGE: public health expenditure as a percent of government expenditure; STROKE: death rate per 100 000 population for stroke; HepC: health expenditure in US$ per capita; CHD: death rate per 100 000 population for coronary heart disease.*

variables that were not considered may also influence life expectancy at birth, such as level of education and employment by education level.

In addition, we used cross-sectional data for 2013 without gender segregation. Taking account of different years and gender in the analysis requires the construction of separate decision trees which might result in different decision rules for classification. However, since the results of our study are consistent with those of the similar previous studies, decision trees are proposed as an effective method for the analysis of life expectancy and for health research in general. The most important variables identified by our study can also be used as input variables in other similar studies.

## Conclusion

Based on our CHAID decisions tree analysis, life expectancy at birth varied greatly between countries. Our results indicate that the factors significantly affecting life expectancy at birth are: (i) mortality-related variables – death rates per 100 000 population for HIV/AIDS, liver disease, stroke and coronary heart disease; (ii) health and environment-related variables – percentage of the

population using improved sanitation facilities and percentage of the urban population using improved drinking-water sources; (iii) economy-related variables – public health expenditure as a percent of government expenditure and health expenditure in US$ per capita; and (iv) demography-related variables – total fertility rate as births per woman. Because high-income countries have improved these factors substantially, their populations have longer life expectancy than people in low- and middle-income countries.

Targeting the variables found to influence life expectancy may result in significant increases in life expectancy and quality of life. At the country level, appropriate strategies can be developed to improve the quality and performance of health care systems. Efforts to improve life expectancy may require budget allocation and/or appropriate regulations.

For future work, new input variables can be added to the analysis and another decision tree technique, such as classification and regression tree, can be applied.

# Analyse de l'espérance de vie dans différents pays au moyen d'un arbre de décision

## Résumé

**Contexte** : Il est important d'identifier les variables influençant l'espérance de vie pour mettre au point des stratégies d'amélioration des systèmes de santé et faire ainsi augmenter l'espérance de vie.

**Objectifs** : Dans la présente étude, un arbre de décision a été établi à l'aide d'une technique automatique de détection des interactions selon le test du khi-carré, afin d'identifier les variables influençant l'espérance de vie à la naissance.

**Méthodes** : Les données provenaient des bases de données de la Banque mondiale, de l'Organisation mondiale de la Santé et du portail Web « World Life Expectancy ». Les données de 166 pays pour l'année 2013 ont été extraites par rapport à une sélection de 25 variables d'entrée liées à la mortalité, la santé et l'environnement, la santé de l'enfant, l'économie et la démographie, afin d'établir l'arbre de décision.

**Résultats** : Neuf des 25 variables avaient une influence importante sur l'espérance de vie : le pourcentage de la population ayant accès à des installations sanitaires améliorées ; le taux de mortalité pour 100 000 habitants lié au VIH/sida, aux maladies hépatiques, aux accidents vasculaires cérébraux et aux coronaropathies ; le pourcentage de la population urbaine ayant accès à des sources d'eau de boisson améliorées ; le taux de fécondité total (naissances par femme) ; les dépenses publiques de santé (pourcentage des dépenses publiques) ; et les dépenses de santé par habitant.

**Conclusions** : L'amélioration de ces variables pourrait se traduire par des augmentations significatives de l'espérance de vie et de la qualité de vie. À l'échelle des pays, des stratégies appropriées peuvent être mises au point pour améliorer la qualité et le fonctionnement des systèmes de santé.

## تحليل مأمول العمر على مستوى البلدان باستخدام شجرة القرارات

لكنور كارجان، باهار سنار أوجلو، أوزالب فاي فايفاي

### الخلاصة

**الخلفية:** من المهم تحديد المتغيرات التي تؤثر على مأمول العمر حتى يتسنى إعداد الاستراتيجيات اللازمة لتحسين نظم الرعاية الصحية، ومن ثَم، زيادة معدل مأمول العمر.

**الأهداف:** في هذه الدراسة، بُنيت شجرة قرارات باستخدام طريقة $\chi^2$ لكاشف التفاعل التلقائي لتحديد المتغيرات المؤثرة على مأمول العمر عند الميلاد.

**طرق البحث:** أُخذت بيانات من قواعد بيانات البنك الدولي ومنظمة الصحة العالمية وموقع «World Life Expectancy» كذلك استُخرجت بيانات من ١٦٦ بلداً لعام ٢٠١٣ بشأن ٢٥ متغيراً من متغيرات المدخلات المُختارة والمرتبطة بالوفاة، والصحة، والبيئة، وصحة الطفل، والاقتصاد، والسكانية، وذلك لاستخدامها في بناء شجرة القرارات.

**النتائج:** من بين المتغيرات الخمسة والعشرين، كان لتسعة منها تأثيرٌ كبيرٌ على مأمول العمر: نسبة السكان التي تستخدم مرافق إصحاح مُحسَّنة؛ ومعدلات الوفيات لكل ١٠٠٠٠٠ نسمة بسبب فيروس العوز المناعي البشري/ الإيدز، وأمراض الكبد، والسكتات الدماغية، وأمراض القلب التاجية؛ ونسبة سكان المناطق الحضرية الذين يستخدمون مصادر مُحسَّنة لمياه الشرب؛ ومعدل الخصوبة الكُلِّي (عدد الولادات لكل سيدة)؛ ونفقات الصحة العامة (نسبة النفقات الحكومية)، والنفقات الصحية للفرد.

**الاستنتاجات:** قد يؤدي تحسين المتغيرات إلى تحقيق زيادة مأمول العمر وتحسين جودة الحياة بصورة كبيرة. وعلى المستوى القُطري، يمكن إعداد استراتيجيات ملائمة لتحسين جودة نُظم الرعاية الصحية ومستوى أدائها.

## References

1. WHO statistical information system [online database]. Life expectancy at birth. Geneva: World Health Organization; 2016 (https://www.who.int/whosis/whostat2006DefinitionsAndMetadata.pdf, accessed 4 January 2016).

2. Mitchell D, Brockett P, Mendoza-Arriaga R, Muthuraman K. Modeling and forecasting mortality rates. Insur Math Econ. 2013;52(2):275–85.

3. Kinsella K, Velkoff V. Life expectancy and changing mortality. Aging Clin Exp Res. 2002;5(14):322–32.

4. Halicioglu F. Modeling life expectancy in Turkey. Econ Model. 2011;28(5):2075–82.

5. Torri T, Vaupel JW. Forecasting life expectancy in an international context. Int J Forecas. 2012;28(2):519–31.

6. Bennett JE, Li G, Foreman K, Best N, Kontis V, Pearson C, et al. The future of life expectancy and life expectancy inequalities in England and Wales: Bayesian spatiotemporal forecasting. Lancet. 2015;386(9989):163–70.

7. Wong CH, Tsui AK. Forecasting life expectancy: evidence from a new survival function. Insur Math Econ. 2015;65:208–26.

8.	Lee RD, Carter LR. Modeling and forecasting US mortality. J Am Stat Assoc. 1992;87(419):659–71.

9.	Bongaarts J. Long-range trends in adult mortality: models and projection methods. Demography. 2005;42(1):23–49.

10.	Carmignani F, Shankar S, Tan EJ, Tang KK. Identifying covariates of population health using extreme bound analysis. Eur J Health Econ. 2014;15(5):515–31.

11.	Mathers CD, Stevens GA, Boerma T, White RA, Tobias MI. Causes of international increases in older age life expectancy. Lancet. 2015;385(9967):540–8.

12.	Klenk J, Keil U, Jaensch A, Christiansen MC, Nagel G. Changes in life expectancy 1950–2010: contributions from age-and disease-specific mortality in selected countries. Popul Health Metr. 2016;14(1):20–30.

13.	Hauck K, Martin S, Smith PC. Priorities for action on the social determinants of health: Empirical evidence on the strongest associations with life expectancy in 54 low-income countries, 1990–2012. Soc Sci Med. 2016;167:88–98.

14.	World Bank. Data [online database] Washington (DC): World Bank; 2013 (https://databank.worldbank.org/source/world-development-indicators, accessed 27 June 2019).

15.	Global Health Observatory data repository. World Health Statistics [online database]. Geneva: World Health Organization; 2013 (https://apps.who.int/gho/data/node.main.1?lang=en, accessed 4 January 2016).

16.	World Life Expectancy Map [online database]. World Life Expectancy; 2013 (http://www.worldlifeexpectancy.com/world-life-expectancy-map, accessed 4 January 2016)

17.	World Bank. Data. Supply and quality of data. Washington (DC): World Bank; 2018 (http://opendatatoolkit.worldbank.org/en/supply.html, accessed 26 March 2018).

18.	Global health observatory resources. About the observatory. Geneva: World Health Organization; 2018 (http://apps.who.int/gho/data/node.resources, accessed 26 March 2018).

19.	Tufféry S. Data mining and statistics for decision making. Chichester: John Wiley & Sons Ltd; 2011: 325–7.

20.	Tsiptsis KK, Chorianopoulos A. Data mining techniques in CRM: inside customer segmentation. Chichester: John Wiley & Sons Ltd; 2009.

21.	Berry MJA, Linoff GS. Data mining techniques: for marketing, sales, and customer relationship management, second edition. Indianapolis, Wiley Publishing, Inc.; 2004.

22.	Mara D, Lane J, Scott B, Trouba D. Sanitation and health. PLoS Med. 2010;7(11):e1000363.

23.	Kharsany AB, Karim QA. HIV infection and AIDS in Sub-Saharan Africa: current status, challenges and opportunities. Open AIDS J. 2016;10:34–48.

# An outbreak of measles in gold miners in River Nile State, Sudan, 2011

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## Abstract

**Background:** Despite the wide use of vaccination, measles outbreaks still occur.

**Aims:** This study assessed cases notified during a measles outbreak in northern Sudan in 2011 and the response of the health authorities to contain the outbreak.

**Methods:** The records of all measles cases reported to the River Nile State health ministry in 2011 from the Abu Hamad locality, a gold-mining area, were reviewed together with the actions of the health authorities at the time of the outbreak. Seventeen gold-mining clusters were included. Data on demographic, clinical, geographic and chronological characteristics of the cases were extracted.

**Results:** The outbreak occurred from 27 January to 3 May 2011 with the peak in epidemiological week 9. A total of 445 measles cases were recorded, giving an incidence of 27.1 per 10 000 of the mining and resident population. Most cases (87.4%) were aged between 15 and 34 years. High fever was the most common symptom (99.3% of the cases), followed by conjunctivitis (80.4%); haemorrhage was recorded in 29.4%. Most cases (84.9%) were unvaccinated. Six deaths occurred (case fatality: 1.3%); two from cerebral coma and four from haemorrhagic shock. Severity of disease was significantly associated with place of origin of the cases (*P* = 0.003).

**Conclusion:** The measles outbreak in the gold-mining areas in Abu Hamad had serious consequences attributed to poor environmental conditions, overcrowding, poor nutrition and lack of vaccination. The health authority response helped end the outbreak. The local health authority should consider the gold-mining areas as a potential risk to public health in their future plans.

Keywords: measles, disease outbreaks, mining, Sudan

## Introduction

Measles is a serious infectious disease affecting all age groups, particularly children under 5 years (*1–3*). An individual with measles can spread the infection to healthy contacts a few days before and after the onset of the rash. Once recovered from measles, immunity is life-long (*4,5*). A suspected outbreak of measles is defined as "the occurrence of five or more reported suspected cases of measles in one month per 100 000 population living in a geographical area (e.g. district/block)" (*6*). A confirmed measles outbreak is defined as "the occurrence of three or more confirmed measles cases (at least two of which should be laboratory-confirmed; IgM positive) in a health facility/district/block (approximate catchment population of 100 000) in a month" (*6*).

The measles vaccine is one of the best public health strategies to reduce morbidity and mortality caused by measles. During 2000–2017, the annual reported measles incidence decreased 83%, from 145 to 25 cases per million population (*7*) and the estimated number of measles cases and deaths declined by 80% (*7–10*). Despite global immunization efforts, outbreaks in developed and developing countries have been recorded, which are attributed to pockets of a population where vaccination coverage is low (*11,12*).

A well-established case surveillance system can ensure early detection, investigation and confirmation of every suspected measles case in a community (*13*). Detection of an outbreak relies on the ability of the responsible authority to recognize an increase in measles cases significantly above the number normally expected. Response to measles outbreaks includes immunization, case management and raising public awareness (*14*).

Sudan is a sub-Saharan African country with a population of 33 419 000 people (2011 census) (*15*). The country started measles vaccination in 1985 (*16*). A measles elimination programme was adopted at both the national level and state levels. During 2004, River Nile State implemented four strategies to eliminate measles through catch-up and follow-up vaccination campaigns which achieved 100% coverage. A second dose

of the measles vaccine was introduced in 2012 and is recommended to be given at 18 months of age (17). Sudan adopted the guidelines of the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) for childhood immunization, and immunization coverage reached 85% of children aged one year in 2012 (18). As with other complications of measles, the risk of death is highest in children and young adults (19).

The aim of this report was to review the notified cases of measles during a measles outbreak that occurred in the traditional (non-organized, rural) gold-mining areas in Abu Hamad, River Nile State, north Sudan in 2011 and document the response of the health authority.

Documentation of this outbreak is important because of its occurrence in an unusual setting. The gold miners worked in remote and poor areas where essential health services are lacking, and there is constant movement in and out of the areas. Most of the miners came from the western part of Sudan where vaccination rates are low. These factors may disturb the measles herd immunity. Some of the cases presented with haemorrhagic symptoms which are rarely reported in the literature during the measles outbreak. This report also documents the interventions taken to contain the outbreak. In light of the outbreak, it is important that the local health authority consider the gold-mining areas as one of the potential risks for public health in their future plans.

## Methods

### Study setting

River Nile State is in the northern part of Sudan and covers an area of 122 123 km². It has a population of 1 190 578 (2010) (15). The state borders Egypt in the north, Northern and North Darfur States in the west, Red Sea and Kassala states in the east and Khartoum State in the south. River Nile State has six localities (Abu Hamad, Berber, Atbara, Ad Damar, Shendi and Al Matamma). Abu Hamad was the most affected by the 2011 measles outbreak, especially those working in gold mining. Abu Hamad is in the northern part of the state and has a population for 69 056 (5.5% of the total population of River Nile State), in addition to an estimated 95 029 gold miners who come from different parts of Sudan or neighbouring countries. According to the River Nile State unpublished EPI report, 2011–2012, the age distribution of the Abu Hamad population was as follows: 9.4% were < 1 year, 17.3% were 1–5 years, 34.6% were 6–15 years and 38.7% were > 15 years.

The gold-mining areas are located in the desert far from the urban areas on the banks of the River Nile. At the time of the outbreak, there were 17 gold-mining areas, the biggest of which was Gabgaba where most of the measles cases were reported. The area is characterized by overcrowding, poor health infrastructure and poor hygiene facilities. All these factors have a negative impact on the public health (20).

The River Nile State health system provides both curative and preventive health services through the public and private sector. The public health facilities for River Nile State include 33 hospitals and 318 primary health care centres as well as three military and two police hospitals (21). The private health facilities include three hospitals and five health centres. In Abu Hamad locality, there is one public sector hospital, 10 public sector primary health care centres and one private health care centre.

Sudan has a good surveillance system for infectious diseases. The Federal Ministry of Health has a well-established Expanded Programme on Immunization (EPI) that provides vaccination services free of charge to all the population. This programme has had a system of case-based and laboratory-based surveillance to monitor measles cases and deaths since 2006. Good-quality surveillance has been maintained in 30 sentinel sites.

During this outbreak, the health ministry of River Nile State, with support from the Federal Ministry of Health, monitored and coordinated the outbreak control activities in Abu Hamad locality, mainly in the gold-mining areas where the outbreak occurred.

### Surveillance and case definition of measles

In Sudan, measles is a disease that requires mandatory notification. The local health authorities report suspected and confirmed measles cases to the Federal Ministry of Health monthly. During the 2011 outbreak, this procedure was modified within a few days of onset of measles in the index case on 1 February 2011. Physicians and medical assistants working in both public and private sectors in the state were notified through official letters and mobile telephone numbers and were asked to report suspected measles cases to both the local health authorities and the State health ministry within 24 hours. Local health authority personnel made an epidemiological investigation of suspected cases including laboratory investigations and contact-tracing.

A suspected measles case was defined as any person within the Abu Hamad locality with a fever (≥ 38 °C), generalized rash and at least one of the following symptoms: cough, coryza or conjunctivitis during the period 27 January to 3 May 2011. A confirmed case was defined either as a laboratory-confirmed case or a case with an epidemiological link to a confirmed case (22). Line listing was done which included the demographic and clinical characteristics of each suspected case, vaccination history, date of onset of symptoms and outcome. For calculation of the cumulative measles incidence rate, we divided the number of suspected cases reported through the surveillance system during the outbreak period (2011) by the estimated population of Abu Hamad locality plus the estimated number of miners and multiplied by 10 000 (23). A daily bulletin was prepared and sent to the Federal Ministry of Health with information on age, sex, case fatality rate and control measures implemented. The data from these bulletins were used for our report. The Federal

Ministry of Health and the WHO country office in Khartoum sent a mission with experts from EPI, the epidemiology department of the Federal Ministry of Health and the national public health laboratory. Together with the State health ministry team, they visited Abu Hamad hospital and some of the gold-mining areas. An action plan was put in place to contain the outbreak. All outbreak investigation steps and control activities were supported by the Federal Ministry of Health.

## Statistical analysis

Data were cleaned and entered into Microsoft Excel and then converted to SPSS, version 21. The chi-squared test was used to compare associations between proportions, such as the deaths, and other variables, e.g. age, symptoms and workplace. A $P$-value ≤ 0.05 was considered statistically significant.

## Ethical considerations

Ethical approval was obtained from the Ethical Committee of the College of Medicine, Nile Valley University and State Ministry of Health. All personal data were kept confidential and used only for the purpose of the study.

# Results

## Epidemiological characteristics

The outbreak occurred mainly in 17 gold-mining areas of Abu Hamad locality and lasted from 31 January to 3 May 2011. A total of 445 cases were reported, giving an incidence of 27.1 per 10 000 of the mining and resident population. Of the 445 cases, 25 were suspected cases that had no epidemiological links, 22 were laboratory-confirmed cases and an epidemiological link was found in 398 cases.

The male to female ratio of cases was 27: 1. The mean age of cases was 25.5 (standard deviation 7.4) years, and young adults aged 15–34 years were the most affected age group, 389 (87.4%) (Table1). The place of origin of the cases differed; most had migrated from other states of Sudan (mostly North Kordofan State in western Sudan), and a few cases were from neighbouring countries such as Eritrea and Ethiopia (Table 1). Gabgaba, which is the biggest of the gold-mining areas in the locality, had the greatest proportion of cases, 133 (29.9%) and Al Galah and Al Gouz had the fewest, with one case (0.2%) each (Table 1).

Of the 445 notified cases, 378 (85%) were unvaccinated (Table 2). A statistically significant association was found between age group and vaccination status ($P < 0.001$) (Figure 1).

## Clinical presentation

Table 2 shows the symptoms, complications and haemorrhagic symptoms of measles cases. About a third of the cases (35.7%) experienced loss of consciousness and two (0.4%) went into a coma. No statistically significant correlation was found between age and clinical characteristics of the patients ($P > 0.05$).

**Table 1 Sociodemographic characteristics of notified measles cases, Sudan, 2011**

| Characteristic | No. | % (n = 445) |
|---|---|---|
| *Sex* | | |
| Male | 429 | 96.4 |
| Female | 16 | 3.6 |
| *Age group (years)* | | |
| < 1 | 1 | 0.2 |
| 1–4 | 1 | 0.2 |
| 5–14 | 13 | 2.9 |
| 15–24 | 197 | 44.3 |
| 25–34 | 192 | 43.1 |
| 35–44 | 28 | 6.3 |
| ≥ 45 | 13 | 2.9 |
| *Place of origin (n=423)* | | |
| North Kordofan State | 203 | 48.0 |
| River Nile State | 51 | 12.1 |
| South Darfur State | 46 | 10.9 |
| North Darfur State | 28 | 6.6 |
| Khartoum State | 25 | 5.9 |
| El Gezira State | 20 | 4.7 |
| Kassala State | 9 | 2.1 |
| West Darfur State | 9 | 2.1 |
| Northern State | 7 | 1.7 |
| Sennar State | 6 | 1.4 |
| Gedaref State | 5 | 1.2 |
| South Kordofan State | 4 | 0.9 |
| Ethiopia | 4 | 0.9 |
| West Kordofan State | 2 | 0.5 |
| Eritrea | 2 | 0.5 |
| Blue Nile State | 1 | 0.2 |
| Red Sea State | 1 | 0.2 |
| *Residence in gold-mining area* | | |
| Gabgaba | 133 | 29.9 |
| Twaheen | 101 | 22.7 |
| Namira | 72 | 16.2 |
| Alkhala | 34 | 7.6 |
| Aldahab company | 21 | 4.7 |
| Shalateen | 21 | 4.7 |
| Abu Hamad town | 15 | 3.4 |
| Alnabia | 15 | 3.4 |
| Kurgus | 9 | 2.0 |
| Egypt border | 7 | 1.6 |
| Atbara | 3 | 0.7 |
| Umserah | 4 | 0.9 |
| Wadi Arab | 3 | 0.7 |
| Hourse Naseb | 3 | 0.7 |
| Al Hush | 2 | 0.4 |
| Al Galah | 1 | 0.2 |
| Al Gouz | 1 | 0.2 |

**Table 2 Clinical characteristics and complications of notified measles cases (n = 445), Sudan, 2011**

| Characteristic | Yes | | No | |
|---|---|---|---|---|
| | No. | % | No. | % |
| *Symptoms* | | | | |
| Fever | 442 | 99.3 | 3 | 0.7 |
| Conjunctivitis | 358 | 80.4 | 87 | 19.6 |
| Arthralgia | 348 | 78.2 | 97 | 21.8 |
| Myalgia | 275 | 61.8 | 170 | 38.2 |
| Backache | 337 | 75.7 | 108 | 24.3 |
| Anorexia | 432 | 97.1 | 13 | 2.9 |
| Headache | 365 | 82.0 | 80 | 18.0 |
| *Complications* | | | | |
| Pneumonia | 376 | 84.5 | 69 | 15.5 |
| Blurring of vision | 337 | 75.7 | 108 | 24.3 |
| Loss of consciousness | 159 | 35.7 | 286 | 64.3 |
| Coma | 2 | 0.4 | 443 | 99.6 |
| *Haemorrhagic symptoms[a]* | | | | |
| Haematemesis | 131 | 29.4 | 314 | 70.6 |
| Melena | 107 | 24.0 | 338 | 76.0 |
| Haemoptysis | 103 | 23.1 | 342 | 76.9 |
| Epistaxis | 97 | 21.8 | 348 | 78.2 |
| Haematuria | 32 | 7.2 | 413 | 92.8 |

| Characteristic | No. | % |
|---|---|---|
| *Vaccination status* | | |
| Vaccinated | 67 | 15.1 |
| Not vaccinated | 378 | 84.9 |
| *Sample taken* | | |
| No | 4 | 0.9 |
| Yes | 29 | 6.5 |
| Unknown | 412 | 92.6 |
| *Outcome* | | |
| Survived | 439 | 98.7 |
| Died | 6 | 1.3 |

*[a]Multiple answers were possible.*

Of the 445 cases, 186 (41.8%) were admitted to hospital and the average length stay was 5 days. Routine laboratory investigations were done for all cases admitted to hospital, including haematological and biochemical tests. The blood samples were tested by ELISA. For samples that were not conclusive, then real-time polymerase chain reaction was done. These tests are done in the National Public Health Laboratory at Khartoum. Specific tests for measles (real-time polymerase chain reaction and IgM) were conducted for only 29 cases (Table 2). This was because of the scarcity of laboratory resources so priority was for well-prepared samples – bad packing of samples and maintenance of the cold chain during transportation were challenges. The measles tests gave positive results for 76% (22/29) of the cases tested. All cases admitted to hospital were managed based on their symptoms. Most of the patients recovered and were discharged. However,

six cases died between 16 and 28 February 2011, all of whom were males, giving an overall case fatality rate of 1.3%. Four of the six patients who died were unvaccinated. The highest case fatality rate was in the age group ≥ 45 years (7.7%), followed by children aged 1–14 years (6.7%), then adult's aged 35–44 years (3.6 %), and finally young adults aged 15–34 years (0.8%).

The severity of measles was strongly associated with outcome, gold-mining area and place of origin. Two measles cases went into a coma and died; one of these cases was younger than 14 years and the second was in the age group 25–34 years (P < 0.001). Four measles cases with haemorrhage died (P = 0.014). The highest numbers of reported cases were from Gabgaba and these case were also the most severe (P = 0.015). A statistically significant association was found between severity of disease and place of origin of the cases (P = 0.003).

## Measles outbreak

The first reported case (index case) was a 33-year-old Sudanese national. He had migrated from the western part of Sudan for work and worked mainly in Gabgaba. He felt sick on 27 January 2011 and was admitted to hospital on 28 January with a skin rash, fever, conjunctivitis, cough, headache, anorexia, myalgia and backache. He was unvaccinated. Analysis of routine data allowed an additional case to be identified that had been notified in the same place. Many of the measles cases (n = 133) came from the same mining area (Gabgaba) as the index case. This measles outbreak spread rapidly in large areas because of overcrowding, poor environmental conditions and malnutrition. The outbreak started in epidemiological week 4 and ended in week 18, 2011 (Figure 2). The highest number of cases (peak) was reported on 1 March (week 9) and then the numbers continued to decline until 3 May 2011 (week 18) after isolation of cases and implementation of other control measures (Figure 3).

## Outbreak response

In response to the clusters of measles cases, active tracing of susceptible contacts was done by the local health authority. An outbreak investigation was launched at the gold-mining areas in Abu Hamad locality especially in areas reporting many cases (Table 1). A public awareness campaign was implemented at the most seriously affected places (during week 9 until week 18). This campaign was done with media support. Physicians were urged to play their part, and the telephone numbers of the state epidemiology director and state EPI coordinator were made available to physicians for further information or any kind of support. In addition, mobile cinema shows were used to raise awareness, lectures were given and pamphlets were distributed to the public mainly in the markets and areas where people gather. The key messages included early reporting to the hospital any cases of skin rash, fever, haemorrhage or any unexplained sign or symptom, avoidance of overcrowded areas, the importance of vaccination, and the importance of early diagnosis to prevent complications.
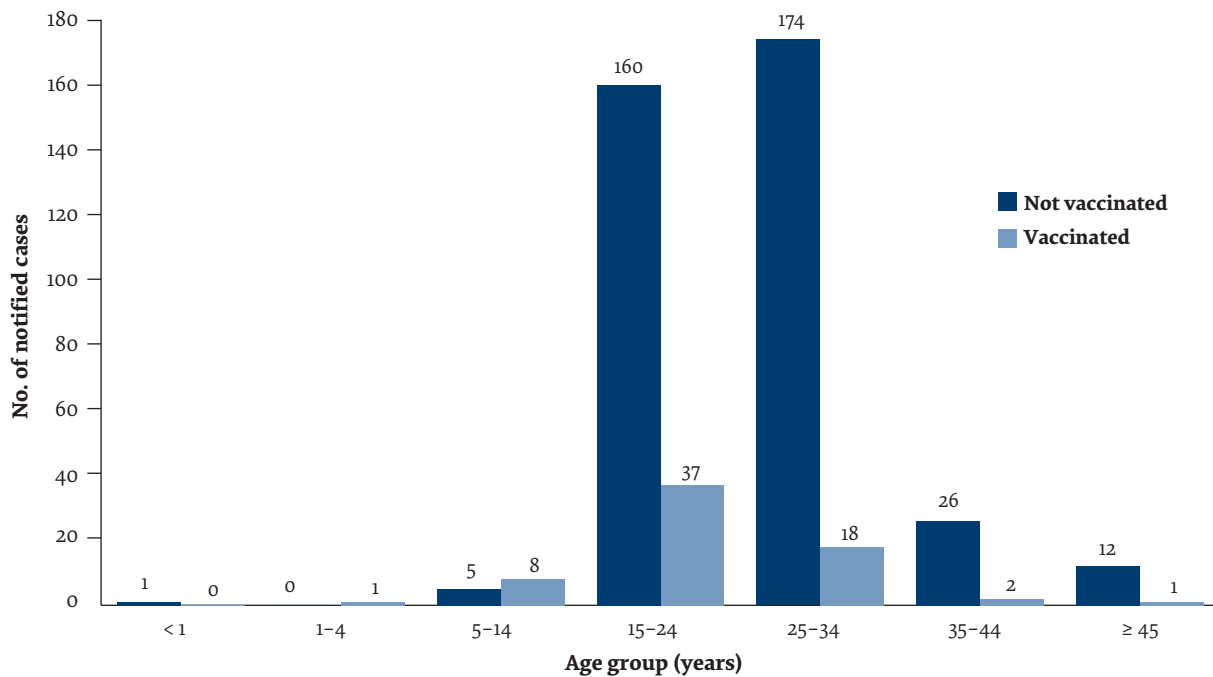
Figure 1 **Age distribution of notified measles cases according to vaccination status, Sudan, 2011 (*n* = 445, *P* < 0.001)**

In addition, a vaccination campaign was conducted by the health authorities following confirmation of the measles outbreak. The campaign had two parts depending on the targeted groups. The main campaign targeted the gold-mining areas where miners were distributed over a very large area in the desert. For this part, well-prepared mobile teams were needed. The second part of the campaign targeted the urban community of Abu Hamad. The targeted population for the vaccination campaign was 95 029 people.

Vaccination coverage was 67.6%, which was less than expected because the gold miners were often moving and the population itself changed. All suspected and confirmed cases were managed free of charge as is the usual practice in the case of outbreaks.

## Discussion

The measles outbreak in 2011 occurred in gold miners in Abu Hamad locality in River Nile State with 445 cases reported from the end of January to 1 May. This outbreak
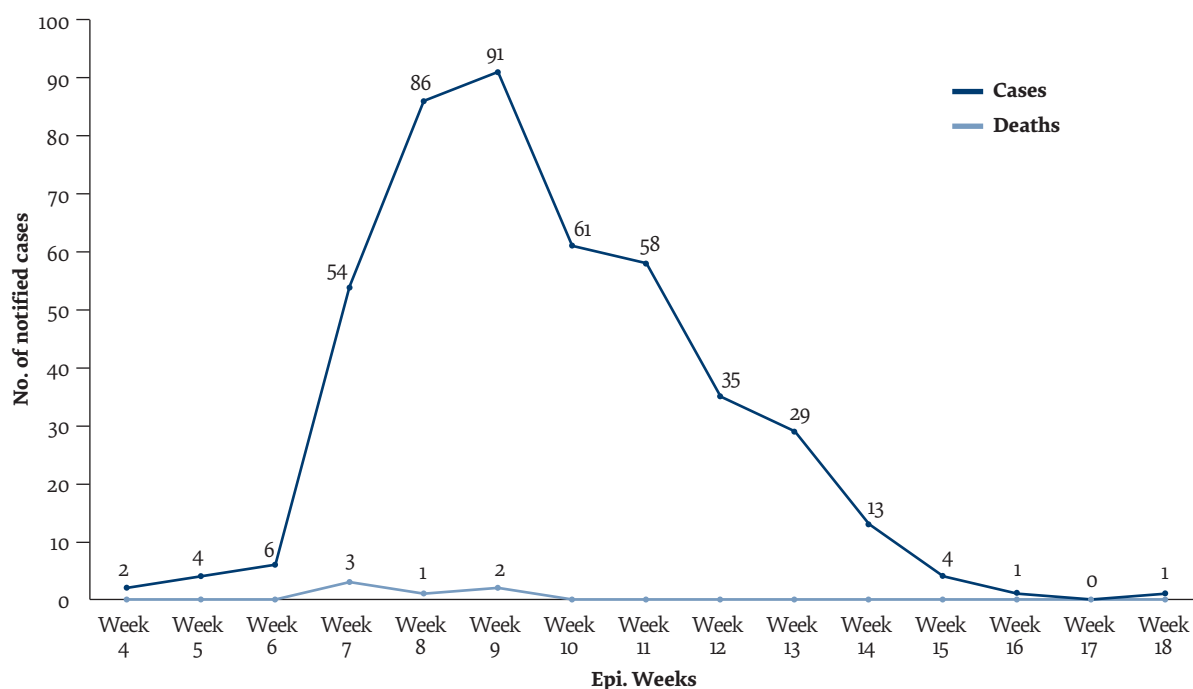


Figure 2 **Trend of measles cases and deaths over the epidemiological weeks of the outbreak, Sudan, 2011**
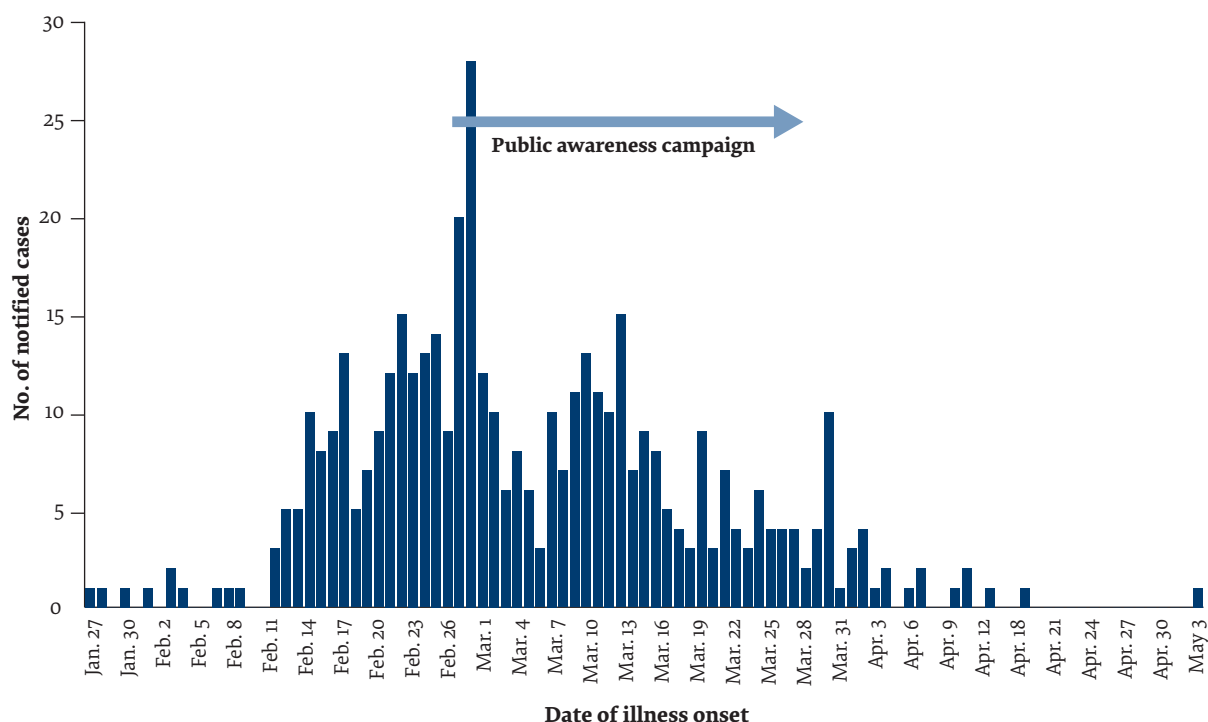
**Figure 3 Epidemiological curve of cases during the measles outbreak, Sudan, 2011**

occurred mainly among young adult men from different geographical and demographic backgrounds who lived in crowded housing in the gold-mining region. Quite a large proportion of the cases had haemorrhagic symptoms suggesting a severe form of measles (haemorrhagic measles) characterized by dark, haemorrhagic skin eruptions, which is generally rare (19).

Because of the widespread use of measles vaccination, the incidence of measles has fallen worldwide (24). However, measles continues to circulate in many countries and remains one of the leading killers of children globally (9). In the 2011 outbreak in Sudan, the case fatality rate (1.3%) was significantly associated with age (P < 0.001) with the highest rate in those more than 45 years (7.7%). This shifting of measles deaths to the older age group could be because the affected population was mostly gold miners. This upward shift is consistent with an outbreak that occurred in Bavaria, Germany in 2007 (25). This can be explained by non-vaccination or suboptimal measles vaccination coverage and a delay in implementing follow-up supplementary immunization activities (26). Moreover, migration of young people from areas with low vaccination coverage to the gold-mining areas can threaten herd immunity and increase the likelihood of infectious disease outbreaks (4,14). Nonetheless, about 15% of the measles cases in the 2011 outbreak were vaccinated but scientists are still not entirely sure why certain individuals who are fully vaccinated get the measles. However, due to biological and environmental factors, individuals' immune systems can respond differently.

Geographically the outbreak of measles occurred in rural areas, mainly in the gold-mining areas, rather than the urban areas of Abu Hamad locality. The association between severity of disease and place of origin could be due to the low immunization status of individuals from these areas compared with those coming from and living in North Sudan.

Outbreaks affecting young adults and older people pose several challenges for control because these individuals are highly mobile, especially in gold-mining areas, and they have more social contacts beyond their family than young children. This explains the rapid progression of this outbreak. Despite the efforts of the local health authority to implement isolation measures, raise awareness of the community, and publicize advice to the population to check and update their vaccination status, the outbreak lasted for 14 weeks (epidemiological weeks 4 to 18). Because of logistics and financial issues, it took longer for local health authorities to put in place sufficient control measure, so the response was delayed. Two supplementary vaccination campaigns were carried out, which is in line with WHO recommendations which strongly advise supplementary immunization activities during outbreaks in closed communities or institutions (27). A study in Africa showed that mass vaccination campaigns could slow epidemic spread of a disease even in urban settings (28).

In the 2011 outbreak in Sudan, 85% of the cases were unvaccinated which may be because of many contributing factors such as poor accessibility of health facilities, complex logistics, weak health systems, lack of government funding, civil unrest and displaced persons, especially in the eastern states of Sudan as most cases came from these areas.

There were some limitations to the data available. The vaccination status of cases was based on patient recall; therefore, recall bias might have occurred. The available line list did not provide full information on duration of hospital admission which would have been useful for reporting further complications that occurred for cases.

## Conclusion

The measles outbreak in the gold-mining areas of Abu Hamad locality was associated with serious consequences which could be attributed to poor environmental conditions, overcrowding, poor nutrition and lack of vaccination. The health authority response helped bring the epidemic to an end.

## Flambée de rougeole chez des mineurs d'or de l'État du Nil (Soudan) en 2011

### Résumé

**Contexte** : Malgré le recours généralisé à la vaccination, des flambées de rougeole surviennent toujours.

**Objectifs** : La présente étude a évalué les cas notifiés lors d'une flambée de rougeole dans le nord du Soudan en 2011 ainsi que la réaction des autorités sanitaires pour endiguer cette flambée

**Méthodes** : Les dossiers de l'ensemble des cas de rougeole notifiés au ministère de la Santé de l'État du Nil en 2011 par la localité d'Abu Hamad, zone d'exploitation minière aurifère, ainsi que les mesures d'intervention des autorités sanitaires au moment de la flambée, ont été examinés. Au total, 17 groupements de mines d'or ont été inclus. Des données sur les caractéristiques démographiques, cliniques, géographiques et chronologiques ont été extraites.

**Résultats** : La flambée est survenue du 27 janvier au 3 mai 2011, le pic ayant été atteint durant la neuvième semaine épidémiologique. Au total, 445 cas de rougeole ont été enregistrés, soit une incidence de 46,8 pour 10 000 parmi la population de mineurs. La majorité des cas (87 %) étaient âgés de 15 à 34 ans. Une forte fièvre était le symptôme le plus courant (99,3 % des cas), suivi par une conjonctivite (80,4 %). Une hémorragie a été rapportée dans 29,4 % des cas. La plupart des cas (84,9 %) n'étaient pas vaccinés. Six décès sont survenus (taux de létalité : 1,3 %) ; deux étaient dus à un coma cérébral et quatre à un choc hémorragique. Une relation statistiquement significative a été constatée entre la sévérité de la maladie et l'origine géographique des cas (*p* = 0,003).

**Conclusions** : La flambée de rougeole dans les zones d'exploitation minière aurifère de la localité d'Abu Hamad était associée à de graves conséquences, dues à des conditions environnementales défavorables, à la promiscuité, à une mauvaise alimentation et à une vaccination insuffisante. L'intervention des autorités sanitaires a permis d'enrayer la flambée.

## وباء الحصبة في صفوف عمال مناجم الذهب في ولاية نهر النيل، السودان، ٢٠١١

أمل سُليمان، وديع المدهون، سُفيان نور، أحمد المبارك، سارة بشارة، ميساء عثمان، هيثم عوض الله، محمد أحمد

### الخلاصة

الخلفية: على الرغم من استعمال اللقاح المضاد للحصبة على نطاق واسع، فما زالت أوبئة الحصبة تحدث.

الأهداف: قدَّرت الدراسة الحالات المبلغ عنها أثناء أوبئة الحصبة في شمال السودان في عام ٢٠١١، واستجابة السلطات الصحية لاحتواء هذا الوباء.

طرق البحث: رُوجِعَتْ سجلات حالات الحصبة التي أُبلغت إلى وزارة الصحة بولاية نهر النيل في عام ٢٠١١ من محلية «أبو حمد» وهي منطقة للتنجيم عن الذهب، واستُعرضت الإجراءات التي اتخذتها السلطات الصحية وقت حدوث الوباء. وأدرجت المجموعات المعنية بتعدين الذهب بإجمالي ١٧ مجموعةً. واستُخرجت البيانات المتعلقة بالخصائص السكانية، والسريرية، والجغرافية، والزمنية.

النتائج: وقع الوباء في الفترة من ٢٧ يناير/ كانون الثاني إلى ٣ مايو/ أيار ٢٠١١ ووصلت إلى ذروتها في الأسبوع التاسع. وسُجل ما مجموعه ٤٤٥ حالة حصبة، بواقع ٤٦,٨ حالة لكل ١٠٠٠٠ نسمة من السكان العاملين في التعدين. وتراوحت أعمار معظم الحالات (٨٧٪) بين ١٥ و ٣٤ عاماً. وكانت الحمى المرتفعة هي أكثر الأعراض الشائعة (٩٩,٣٪ من الحالات) يليها التهاب الملتحمة (٨٠, ٤٪). وسُجلت حالات نزيف في ٤, ٢٩٪

من المرضى. ولم تكن معظم الحالات قد تلقت التطعيم (٨٤٫٩٪). ووقعت ٦ وفيات (معدل إماتة الحالات: ١٫٣٪)؛ اثنتان منها بسبب الغيبوبة الدماغية، وأربع بسبب الصدمة النزفيَّة. ووُجد رابط قوي بين وخامة المرض والمكان الأصلي لظهور هذه الحالات (القيمة الاحتمالية = ٠٫٠٠٣).

**الاستنتاج**: ارتبط ظهور فاشية الحصبة في مناطق تعدين الذهب في «أبو حمد» بعواقب خطيرة بسبب الظروف البيئية السيئة، والاكتظاظ، وسوء التغذية، وعدم توافر التطعيمات. وقد ساعدت استجابة السلطة الصحية في إنهاء الوباء.

## References

1. Global eradication of measles: report by the Secretariat. Geneva: World Health Organization; 2010.

2. Shakoor S, Mir F, Zaidi A, Zafar A. Hospital preparedness in community measles outbreaks challenges and recommendations for low-resource settings. Emerg Health Threats J. 2015; 8:24173. https://doi.org/10.3402/ehtj.v8.24173

3. Measles vaccines: WHO position paper – April 2017? Wkly Epidemiol Rec. 2017;92(17):205–27.

4. Liu F, Enanoria W, Zipprich J, Blumberg S, Harriman K, Ackley S, et al. The role of vaccination coverage, individual behaviors, and the public health response in the control of measles epidemics: an agent-based simulation for California. BMC Public Health. 2015;15:447. https://doi.org/10.1186/s12889-015-1766-6

5. Gastanaduy PA, Redd SB, Clemmons NS, Lee AD, Hickman CJ, Rota PA, et al. In: Roush SW, McIntyre L, Baldy LM, editors. Manual for the surveillance of vaccine-preventable diseases. Sixth edition. Atlanta (GA): Centers for Disease Control and Prevention; 2013:1–21 (http://www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.pdf, accessed 23 December 2016).

6. Part II. Definitions. In: Response to measles outbreaks in measles mortality reduction settings: immunization, vaccines and biologicals. Geneva: World Health Organization; 2009:5–7 (https://apps.who.int/iris/bitstream/handle/10665/70047/WHO_IVB_09.03_eng.pdf?sequence=1, accessed 18 June 2019).

7. Dabbagh A, Laws RL, Steulet C, Dumolard L, Mulders MN, Kretsinger K, et al. Progress toward regional measles elimination—worldwide, 2000–2017. MMWR Morb Mortal Wkly Rep. 2018;67:1323–9. http:// doi.org/10.15585/mmwr.mm6747a6

8. Meeting of the International Task Force for Disease Eradication, November 2015. Wkly Epidemiol Rec. 2016;91(6):61–72.

9. Measles. Fact sheet. Geneva: World Health Organization; July 2017. (https://www.who.int/news-room/fact-sheets/detail/measles, accessed 2 July 2019).

10. Measles vaccines: WHO position paper – April 2017. Wkly Epidemiol Rec. 2017;92(17):205–27.

11. Curtale F, Perrelli F, Mantovani J, Atti MC, Filia A, Nicoletti L, et al. Description of two measles outbreaks in the Lazio Region, Italy (2006–2007). Importance of pockets of low vaccine coverage in sustaining the infection. BMC Infect Dis. 2010;10:62. https://doi.org/10.1186/1471-2334-10-62

12. Sugerman DE, Barskey AE, Delea MG, Ortega-Sanchez IR, Bi D, Ralston KJ, et al. Measles outbreak in a highly vaccinated population, San Diego, 2008: role of the intentionally under vaccinated. Pediatrics. 2010; 125(4):747–55. https://doi.org/10.1542/peds.2009-1653

13. Guidelines for measles and rubella outbreak investigation and response in the WHO European Region. Copenhagen: World Health Organization Regional Office for Europe; 2013 (http://www.euro.who.int/__data/assets/pdf_file/0003/217164/Outbreak-Guidelines-updated.pdf, accessed: 20 October 2017).

14. WHO guidelines for epidemic preparedness and response to measles outbreaks. Geneva: World Health Organization; 1999 (https://www.who.int/csr/resources/publications/measles/whocdscsrisr991.pdf?ua=1, accessed 18 June 2019).

15. Sudan household survey, second round 2010. Summary report 2011. Khartoum: National Ministry of Health & Central Bureau of Statistics; 2011 (https://reliefweb.int/sites/reliefweb.int/files/resources/MICS4_Sudan_2010.pdf, accessed 20 December 2016).

16. Coronado F, Musa N, El Tayeb EA, Haithami S, Dabbagh A, Mahoney F, et al. Retrospective measles outbreak investigation: Sudan, 2004. J Trop Pediatr. 2006;52(5):329–34. https://doi.org/10.1093/tropej/fmlo26

17. Sudan: WHO and UNICEF estimates of immunization coverage: 2016 revision (http://data.unicef.org/wpcontent/uploads/country_profiles/Sudan/immunization_country_profiles/immunization_sdn.pdf, accessed 19 October 2017).

18. Sudan: WHO statistical profile. Geneva: World Health Organization; January 2015 (https://www.who.int/gho/countries/sdn.pdf?ua=1, accessed 10 October 2017).

19. Measles. In: Hamborsky J, Kroger A, Wolfe S, editors. Epidemiology and prevention of vaccine-preventable diseases. The pink book: course textbook, 13th edition. Atlanta: Centers for Disease Control and Prevention; 2015 (https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/meas.pdf, accessed 10 October 2017).

20. Wadi EIA, Alredaisy SMAH. Socioeconomic and environmental implications of traditional gold mining in Sudan: the case of Barber Locality, River Nile State. Am Based Res J. 2015;4(7):1–11. https://doi.org/10.5281/zenodo.3429115

21. Annual health statistical report 2015. Khartoum: Ministry of Health; 2015 (http://www.fmoh.gov.sd/yearlyReports/Annual2015.pdf, accessed 24 December 2016).

22. Measles. Disease surveillance. World Health Organization Regional Office of Eastern Mediterranean [webpage] (http://www.emro.who.int/health-topics/measles/disease-surveillance.html, accessed 24 December 2016).

23. Principal of epidemiology in public health practice, third edition. An introduction to applied epidemiology and biostatistics. Atlanta (GA): Centers for Disease Control and Prevention; 2006.

24. Dabbagh A, Patel MK, Dumolard L, Gacic-Dobo M, Mulders MN, Okwo-Bele JM, et al. Progress toward regional measles elimination — worldwide, 2000–2016.Wkly Epidemiol Rec. 2017;66(42):1148–53.

25. Wichmann O, Siedler A, Sagebiel D, Hellenbrand W, Santibanez S, Mankertz A, et al. Further efforts needed to achieve measles elimination in Germany: results of an outbreak investigation. Bull World Health Organ. 2009;87(2):108–15. https://doi.org/10.2471/blt.07.050187

26. Hersh BS, Tambini G, Nogueira AC, Carrasco P, de Quadros CA. Review of regional measles surveillance data in the Americas, 1996–99. Lancet. 2000;355(9219):1943–8. https://doi.org/10.1016/S0140-6736(00)02325-4

27. Measles vaccines: WHO position paper, April 2017 – Recommendations. Vaccine. 2019;37(2):219–222. https://doi.org/10.1016/j.vaccine.2017.07.066

28. Grais RF, Conlan AJ, Ferrari MJ, Djibo A, Le Menach A, Bjørnstad ON, et al. Time is of the essence: exploring a measles outbreak response vaccination in Niamey, Niger. J R Soc Interface. 2008;5(18):67–74. https://doi.org/10.1098/rsif.2007.1038

# Indirect estimation of child mortality using 2011 census data in the Islamic Republic of Iran

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## Abstract

**Background** Child mortality rates are considered to be one of the key indicators of child health.

**Aims** The main objective of this research was to calculate child mortality rates (CMRs) indirectly, using census data, and to investigate using spatial pattern analysis the presence of any clustering patterns among provincial regions.

**Methods** The Trussell version of the Brass method and Coale–Demeny West model were used to estimate CMRs and life expectancy (LE) at birth. The analyses were performed using the QFive program of MORTPAK 4 software. For cluster analysis, local and global Moran's $I$ indexes were measured.

**Results** Infant mortality rate, under-5 mortality rate, 1–4 mortality rate and LE at birth were estimated as 21.9, 26, 4.1 (deaths per 1000 live births) and 72.1 years, respectively. Global Moran's $I$ index was calculated as 0.09, 0.09, 0.08 and 0.12, respectively.

**Conclusion** Special attention must be paid in provinces with high clusters regarding the evaluation of public health programmes, and the cause of failure of these programmes in reduction of childhood mortality indices.

Keywords: child mortality rate, infant mortality rate, spatial clustering, Islamic Republic of Iran, life expectancy.

## Introduction

For several decades, increasing attention has been paid to child mortality as a health indicator and as one of the Human Development Indices (*1,2*). In 2000, the member countries of the United Nations agreed on the Millennium Development Goals (MDGs) for reducing the under-5 mortality rate (U5MR) by two thirds between 1990 and 2015 – known as the MDG 4 target (*3*). Globally, the number of under-5 deaths has declined from 12.7 million in 1990 to 5.9 million in 2015. The U5MR has dramatically decreased from 91 per 1000 live births in 1990 to 43 in 2015.

The United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) tries to update annual estimates (*4*); however, with the end of the MDG era, the international community has attempted to develop a new framework – Sustainable Development Goals (SDGs) (*5,6*). SDGs propose a new commitment: by 2030, reducing neonatal mortality as low as 12 deaths per 1000 live births and U5MR as low as 25 deaths per 1000 live births (*6*).

Calculation of U5MR precisely is a key element in policy-making to develop different health strategies (*7*). In case of inaccessibility of incidence and prevalence data, mortality rates could be used to recognize vulnerable populations. Vital status registry systems and direct and indirect estimates based on sampling or census data are regarded as the main source of mortality rates

(*8*). Most developing countries have insufficient vital status registry systems to gather all deaths and births. In essence, most child mortality information is collected retrospectively from women of childbearing age (15–49 years) using census data and household surveys (*1*). In the Islamic Republic of Iran, like other developing countries, there is a lack of precise mortality data (*9*). These limitations necessitate using indirect methods such as the Brass method and its Trussell and Palloni–Heligman versions (*10,11*).

The present study tried to detect clustering patterns of low or high incidence in any of these health indices among the geographic regions of the Islamic Republic of Iran, which is important from the viewpoint of public health (*12*). We aimed (1) to calculate child mortality rates (CMRs) indirectly using the Brass method (Trussell version) and census data, and (2) to recognize any clustering patterns among provincial regions by applying spatial pattern analysis. Hopefully, our results will pave the way for evidence-based decision-making.

## Methods

### Data and Brass method

We used a random sample of 2011 census data from the Statistical Center of Iran. The census data collection

procedure is explained elsewhere (*13*). Stratified random sampling was adopted based on every urban–rural district and sampling fraction estimated as 2% for every district. The indices can be estimated directly or indirectly. The indirect method needs less information (*7,14*), and we used that method for calculating the indices. Therefore, we needed information such as number of children ever born (CEB), number of children surviving (CS) and mother's age, which is available in the census data. In case CEB and CS were missing, we replaced them with the mean CEB and mean CS for each maternal age group (*15*). The Trussell version of the Brass method was used for the Coale–Demeny West model to estimate CMRs and life expectancy (LE) at birth (Appendix 1) (*10*). This model is the most suitable for the Iranian population. The analyses were performed by QFive program of MORTPAK 4 software (UN software package for mortality measurements) (*16*).

The precise estimation of mortality depends on maternal age. In the indirect method, according to the estimated mortality rates for women in the different age groups from 15 to 45 years, CMRs are estimated (*15*). The estimates for women aged 20–24, 25–29 and 30–34 years are more accurate. Women aged 15–19 years usually underestimate reporting of children who are not born alive (*15,17*). In recent years in the Islamic Republic of Iran, because of changes in the reproduction pattern of younger women, the estimated probabilities for the younger age groups that are closer to the census year are not accurate. Therefore, we set aside these estimates and used the estimated mortality rates for the age group of 30–34 years.

## Spatial clustering

After calculating the childhood mortality indicators and LE for all 31 provinces, we plotted the results using a geographic information system to visualize the distribution of the above-mentioned indices across the country. We measured Global Moran's *I* and its local index Anselin local Moran's *I* to evaluate wethere there was any clustering or outliers among the provinces regarding the calculated indices (Appendix 2). Local Moran's *I*, is one of the Local Indicators of Spatial Association. This index shows the presence of clusters that are defined as accumulation of similar values – high or low. It is classified into 5 categories. The first category, Not Significant, denotes areas that are not significant at a default significance level of 0.05 and are not part of any clusters; High–High indicates clusters of high values surrounded by high values; Low–Low indicates clusters of low values surrounded by low values; Low–High denotes clusters of low values surrounded by high values; and High–Low denotes clusters of high values surrounded by low values. To measure Local Moran's *I* index, Inverse Distance as conceptualization of spatial relationships and Euclidean Distance as distance method were chosen.

Moreover, as a measure of spatial autocorrelation, we calculated Global Moran's *I* index. Generally, a positive Global Moran's *I* Index value indicates clustering, while a negative value indicates dispersion. It ranges from +1 to –1. Like the Local Moran's *I* index, Inverse Distance and Euclidean Distance were used as distance method and conceptualization of spatial relationships, respectively.

Finally, for hot spot analysis, Getis–Ord Gi index was measured. Fixed Distance Band as conceptualization of spatial relationships and Euclidean Distance as distance method were used. The Getis–Ord is an indicator of local clustering and assesses the presence of hot spots and cold spots.

## Results

### Indirect estimation of IMR, U5MR, 1–4 mortality rate (1–4MR) and LE at birth

Table 1 shows the population statistics by age groups. Using 2011 census data and estimation of women aged 30–34, IMR, U5MR, 1–4MR and LE (life expectancy) at birth ($e_0$) were estimated as 21.9, 26, 4.1 deaths per 1000 live births and 72.1 years, respectively. IMR, U5MR, 1–4MR and LE at birth are shown in Table 2, which were calculated using the indirect method of QFive program of MORTPAK 4 software. The maximum childhood mortality – IMR, U5MR and 1–4MR –were calculated as 44.2, 57 and 12.8 per 1000 live births, respectively, in women aged 15–19 years. It should be noted that sex ratio of CEB (female to male) was 1.058. Child survival was estimated as 94.07%. Female and male survival was calculated as 95.17% and 94.83%, respectively.

Western and Southeastern Islamic Republic of Iran (including Sistan and Baloochestan, South Khorasan, Hamedan, West Azarbaijan, and Kordestan) had the maximum values for 1–4MR, IMR and U5MR, while the central and northern regions (including Tehran, Qom and Mazandaran) had the minimum values. Conversely, LE had minimum values in the west and southeast and maximum values in the centre and north (Figures 1A, 2A, 3A, 4A).

### Spatial clustering

Table 3 presents Global Moran's *I* index value for childhood mortality indices and LE ($e_0$). The highest clustering

**Table 1 Population statistics to calculate childhood mortality[a] in 2011**

| Maternal age group (yr) | Women of childbearing age | Children ever born | Children surviving |
|---|---|---|---|
| 15–19 | 3 152 384 | 196 772 | 188 445 |
| 20–24 | 4 086 388 | 1 579 252 | 1 522 163 |
| 25–29 | 432 238 | 3 751 230 | 3 647 051 |
| 30–34 | 3 443 474 | 5 189 562 | 5 057 633 |
| 35–39 | 2 723 759 | 6 079 475 | 5 883 362 |
| 40–44 | 2 414 373 | 7 033 094 | 6 757 567 |
| 45–49 | 1 995 606 | 7 320 756 | 6 961 305 |
| **Total** | **22 138 222** | **31 150 141** | **30 017 526** |

*[a]Indices including under-5 mortality rate, infant mortality rate and 1–4 mortality rate.*

**Table 2 IMR, U5MR, 1–4MR per 1000 live births and LE at birth (years) using indirect method[a] in women of childbearing age, 2011**

| Maternal age group (yr) | Childhood mortality | | | | |
|---|---|---|---|---|---|
| | Reference time) | IMR | U5MR | 1–4MR | LE ($e_0$) |
| 15–19 | 2010.9 | 44.2 | 57 | 12.8 | 66.1 |
| 20–24 | 2009.6 | 34.6 | 43 | 8.4 | 68.4 |
| 25–29 | 2007.6 | 24.9 | 29.8 | 4.9 | 71.1 |
| 30–34 | 2005.2 | 21.9 | 26 | 4.1 | 72.1 |
| 35–39 | 2002.5 | 25.8 | 31 | 5.2 | 70.8 |
| 40–44 | 1999.7 | 28.7 | 34.9 | 6.2 | 69.9 |
| 45–49 | 1996.7 | 31.9 | 39.3 | 7.4 | 69.1 |

[a]*Trussell version of Brass method*

*IMR = infant mortality rate; LE (eo) = life expectancy at birth; U5MR = under-5 mortality rate.*

(Global Moran's *I* index = 0.12) was observed for LE ($e_0$), while the lowest clustering – the highest dispersion – was estimated for 1–4MR (Global Moran's *I* index = 0.08). All Global Moran's *I* index values were statistically insignificant except for LE ($e_0$).

Figures 1B, 2B, 3B and 4B show clustering analysis using the Anselin Local Moran's *I* method. Clustering for many provinces was not significant. The maps for both indices of U5MR and 1–4MR show the same pattern. High–High clustering was noted for Lorestan, Kermanshah, Kordestan and West Azarbaijan Provinces, and a High–Low outlier for Fras. Regarding IMR, Lorestan, Kordestan, Kermanshah, West Azarbaijan, East Azarbaijan, Hamedan and Markazi Provinces were High–High clusters, whereas Fras and Bushehr were High–Low outliers. For LE ($e_0$), for provinces including Tehran, Qom, Qazvin, Gilan, Mazandaran, Markazi, Lorestan, Kermanshah, Zanjan, Alborz, Hemedan and Esfahan Provinces High–High clusters were estimated, and High–Low outliers for Fars and Bushehr.

Figures 5, 6, 7 and 8 show hot and cold spots for childhood mortality indices and LE at birth. Generally, IMR and U5MR showed the same pattern. Sistan and Baloochestan Province was observed as a hot spot, while Mazandaran and Qom Provinces were observed as cold spots. Regarding 1–4MR, Sistan and Baloochestan and South Khorasan Provinces were hot spots. Lastly,

**Table 3 Global Moran's *I* index value for childhood mortality indices and life expectancy**

| Index | Moran's *I* | SD | P* |
|---|---|---|---|
| 1–4 mortality rate | 0.08 | 0.07 | 0.11 |
| IMR | 0.09 | 0.07 | 0.08 |
| U5MR | 0.09 | 0.07 | 0.09 |
| LE (e0) | 0.12 | 0.07 | 0.03 |

*Data for 31 provinces*

*\*significance level at P < 0.05*

*IMR = infant mortality rate; LE (eo) = life expectancy at birth; SD = standard deviation; U5MR = under-5 mortality rate.*

**Figure 1 Maps depicting 1–4 mortality rate across 31 provinces of Islamic Republic of Iran, 2011. A. Estimated distribution of 1–4 mortality rate. B. Cluster and outlier analysis (Anselin Local Moran's *I*).**
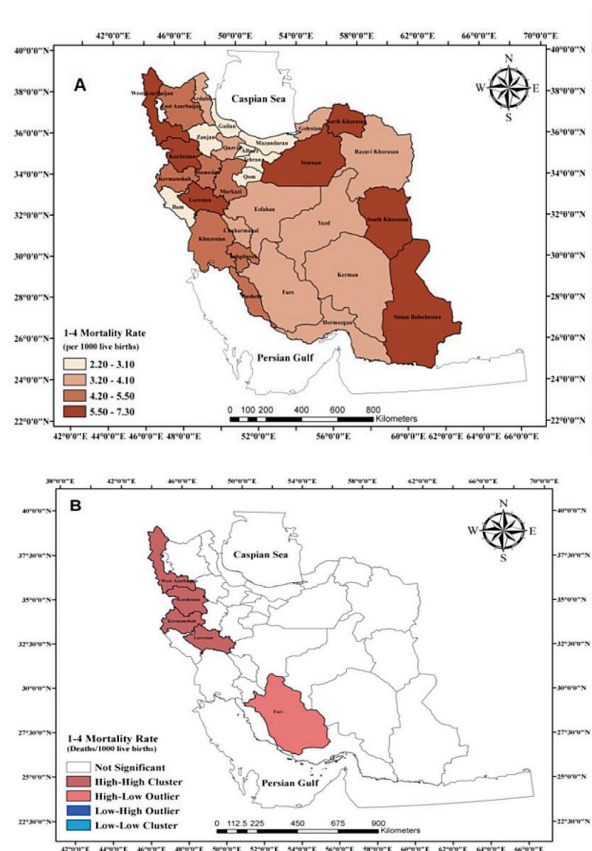


**Figure 2 Maps depicting infant mortality rate across 31 provinces of Islamic Republic of Iran, 2011. A. Estimated distribution of infant mortality rate. B. Cluster and outlier analysis (Anselin Local Moran's *I*).**
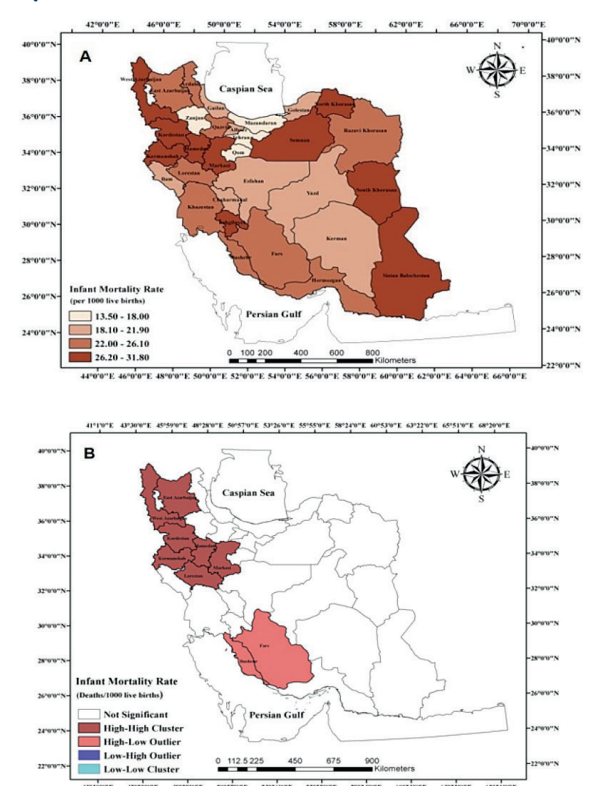
**Maps depicting under-5 mortality rate across 31 provinces of Islamic Republic of Iran, 2011. A. Estimated distribution of under-5 mortality rate. B. Cluster and outlier analysis (Anselin Local Moran's I).**
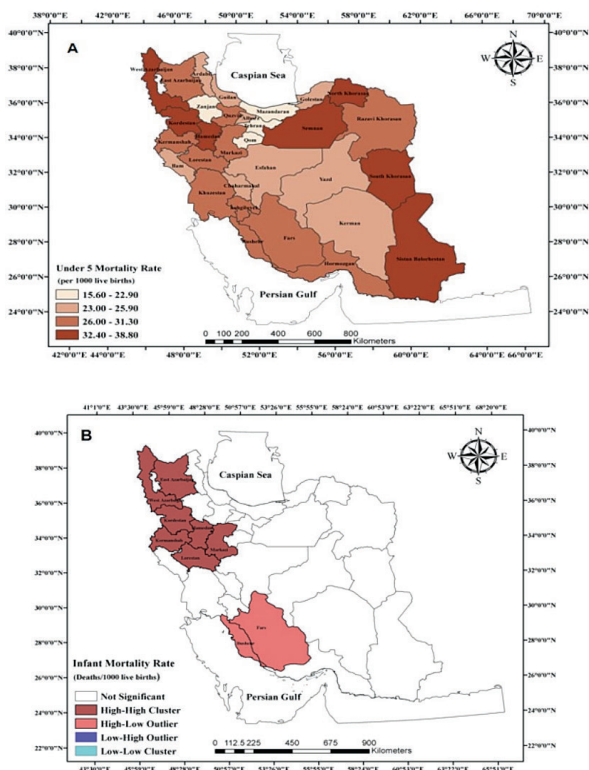


**Maps depicting life expectancy across 31 provinces of Islamic Republic of Iran, 2011. A. Estimated distribution of life expectancy. B. Cluster and outlier analysis (Anselin Local Moran's I).**
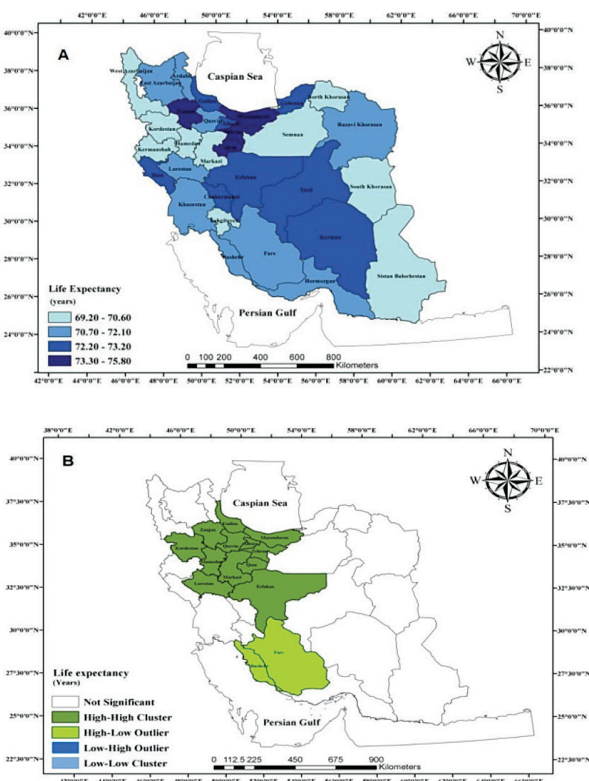


concerning LE (e0), Mazandaran and Qom Provinces were observed as hot spots; that is, provinces with the highest LE.

## Discussion

In this study we tried to calculate CMRs indirectly using the Brass method (Trussell version) using census data, and to recognize any clustering regions using spatial pattern analysis. IMR, U5MR, 1–4MR and LE ($e_0$) were estimated as 21.9, 26 and 4.1 deaths per 1000 live births and 72.1 years, respectively. Additionally, the western and northwestern regions showed High–High clusters for all indicators. Also, southeastern regions were observed as hot spots.

We used estimated values for women aged 30–34 years. Vapattanawong et al. also used this age group to estimate more precise CMRs (18). As mentioned before, reporting by women in older age groups suffers from low precision, and women in lower age groups usually underestimate death. However, in recent years in the Islamic Republic of Iran, because of changes in the reproductive pattern of younger women, the estimated probabilities for the younger age groups that are closer to the census year, are not accurate.

Across 31 provinces of the Islamic Republic of Iran, the gap between the maximum and minimum values shows a high variation in child mortality indicators and LE ($e_0$) and was 18, 23.5 and 5.1 deaths per 1000 live births and 6.6 years for IMR, U5MR, 1–4MR and LE ($e_0$), respectively.

Numerous studies have worked on spatial patterns of child mortality (19–23). However, we could not find any related studies in the Islamic Republic of Iran. In addition, little research has been conducted on child mortality using the Brass method in the Islamic Republic of Iran (9).

Mohammadi et al., using the summary birth history data from 4 data sources (3 censuses and Demographic and Health Survey), tried to estimate U5MR trends for all Iranian provinces during 1990–2015. Their estimations for 1990, 2000, 2010 and 2015 were 63.6, 38.8, 24.9 and 19.4 deaths per 1000 live births. Our estimate (in 2011) is similar to their result in 2010: 26 versus 24.9 deaths per 1000 live births. They calculated the highest and the lowest CMRs as 47 and 8.9 per 1000 live births for South Khorasan and Mazandaran Provinces. Similarly, we estimated U5MR for those provinces as the high and low mortality rates, respectively (24). Susuman used the Brass method (Trussell version) to calculate CMR in Ethiopia, which has gradually declined (17). Lee et al., used the indirect Brass method to calculate IMR and U5MR in Vietnam and showed that they have reduced significantly during 1986–2010 (25).

We suggest more studies to investigate the links between the aforementioned indicators and their probable causes. Social inequality might be a major cause of variation in infant mortality, which could be analysed appropriately using measures of segregation

(26). Hashemi-Nazari et al. used a multilevel study on Iranian census data to estimate the effect of socioeconomic segregation on infant mortality and found controversial results. There was a negative association with education level, marital status and presence of a bathroom in the house, but a positive relation with age group, size of house, and ownership of a motorcycle (27). Kumar et al. studied geospatial analysis of U5MR in some states of India. They reported that health programme initiatives had a pivotal role in reducing U5MR, even after adjusting for different variables such as population density, annual rainfall and average annual temperature (28). Singh et al. worked on geospatial analysis of IMR and U5MR in India. They believed that IMR and U5MR were higher in underprivileged regions in terms of child nutrition and female literacy. They also observed that, although, the effect of economic status on child malnutrition and child survival is weakening, the effect of maternal education is growing stronger (23). Gemperli et al. usedspatial analysis to identify the causes of geographic differences in IMR in Mali, using a Markov Chain Monte Carlo simulation. The results proved that maternal education, birth order and interval, infant sex, residence and mother's age had an important impact on IMR (19).

Vapattanawong et al. analysed 2 censuses using the Trussell version of the Brass indirect method by economic strata to measure changes in child mortality. The changes were not equal by different economic strata. In fact, the poorer parts of the population had a greater reduction in U5MR (18). El-khorazaty estimated child mortality for Bahrain, Egypt, Jordan, Kuwait, Syrian Arab Republic and United Arab Emirates using the Brass–Trussell methodology and Coale–Demeny West model life tables. These countries were not homogeneous in term of child mortality, reflecting disparities in health programmes, standards of living, and quality of life (29).

We concede a few limitations that were related to the assumptions of the indirect Brass method. This method can result in overestimation of child mortality. According to international estimation by the United Nations Children's Fund, child mortality in 2011 for the Islamic Republic of Iran was estimated as 18.4 (16.2–20.9) deaths per 1000 live births (30), while our estimate was 26 deaths per 1000 live births. In the Islamic Republic of Iran, U5MR has remarkably declined and was estimated as 58, 35 and 16 deaths per 1000 live births in 1990, 2000 and 2015, respectively. The annual rate of reduction was measured as 5.2% and considered sufficient to achieve MDG 4. In the Islamic Republic of Iran, MDG target for 2015 was defined as 19 deaths per 1000 live births (1). A further limitation was that the Brass method makes some demographic assumptions, such as stability of births and deaths, no relation between child death and mother's age, and accurate reporting of CEB and CS (31). Concerning the first assumption we used the estimated mortality rates for the maternal age group of 30–34 years, which has more stable production rates.

**Figure 5** **Hot spot analysis for 1–4 mortality rate across 31 provinces of Islamic Republic of Iran, 2011**
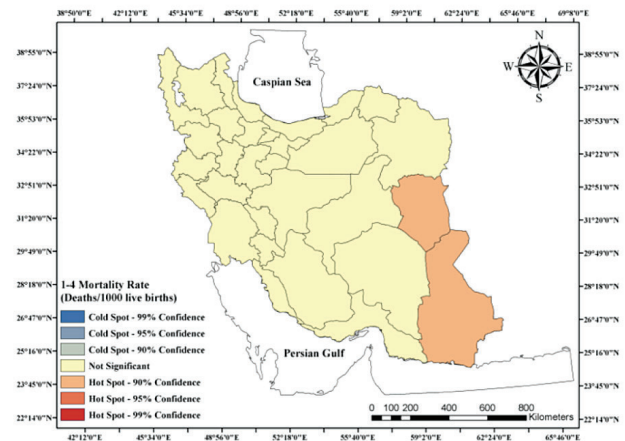


**Figure 6** **Hot spot analysis for infant mortality rate across 31 provinces of Islamic Republic of Iran, 2011**
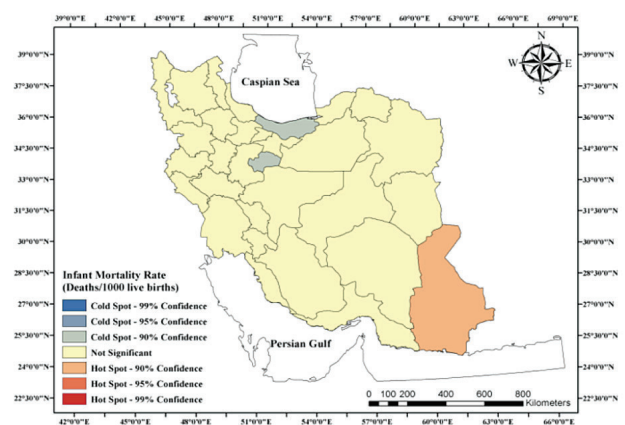


**Figure 7** **Hot spot analysis for under-5 mortality rate across 31 provinces of Islamic Republic of Iran, 2011**
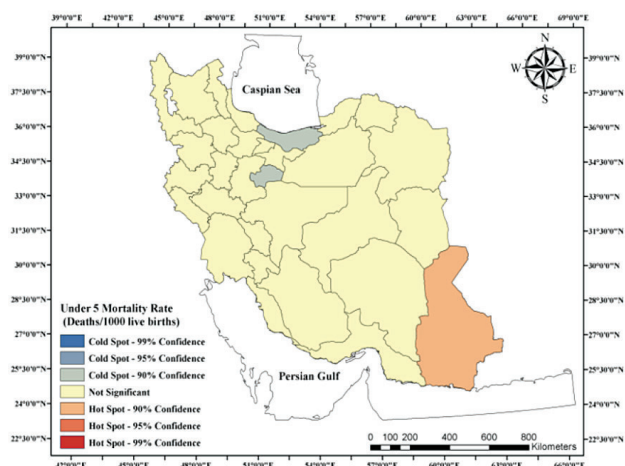
**Figure 8 Hot spot analysis for life expectancy at birth across 31 provinces of Islamic Republic of Iran, 2011**
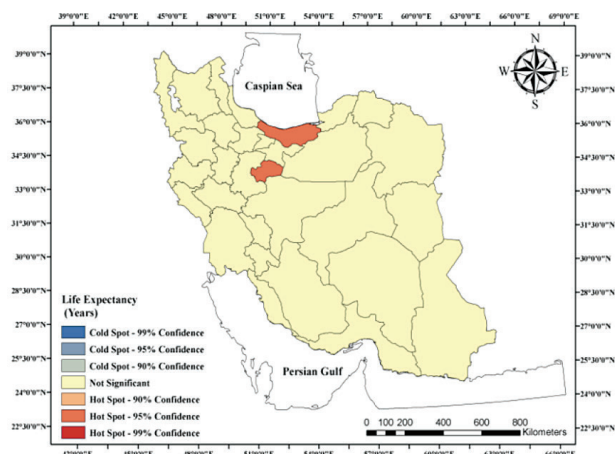


The main advantages of the study was using census data and spatial analysis tools for assessment of clustering patterns in CMRs and LE ($e_0$).

## Conclusion

According to our finding, the western and northwestern regions of the Islamic Republic of Iran (including Lorestan, Kermanshah, Kordestan, and West Azarbaijan) were among the provinces with the highest CMRs, which formed a High–High cluster for IMR, U5MR, 1–4MR and LE. Special attention must be paid in these provinces regarding the evaluation of public health programmes, the cause of failure of these programmes in reducing childhood mortality indices, and the need for design and implementation of new public health programmes.

## Acknowledgements

## Appendix 1

In this appendix, we describe the estimations process using the Trussell indirect method.

*Step 1: Calculating CEB for all age groups (i)*

This ratio could be calculated by division of CEB in each age group *(i)* by number of women in the same age group *(i)*

$P_i$= CEB$_i$/ FP$_I$, where FP$_I$ is fertility proportion

*Step 2: Calculating proportion of children deceased (CD) to CEB for each age group, $D_i$*

This ratio shows what proportion of CEB have died for each age group of women

$D_i$= CD$_i$/ CEB$_i$

If during census CS have been questioned instead of CD, then the ratio is calculated as

$D_i$= 1-CS$_i$/ CEB$_i$

*Step 3: Estimation of K$_i$ coefficients*

To estimating $q_i$ (death probability up to age *x*) it should be modified calculating of D$_i$. Therefore, we used a coefficient called *K*

$$K_i = a(i) + b(i) \left( \frac{P(19-15)}{P(20-24)} \right) + c(i) \left( \frac{P(20-24)}{P(25-29)} \right)$$

The coefficients of *a(i)*, *b(i)* and *c(i)* were estimated by a simulated regression analysis. These coefficients were estimated for all age groups and for 4 regions of Coale–Demeny life tables.

*Step 4: Estimation of death probability up to age x*

$q_i$ is estimated for each age group i using $D_i$ and $K_i$

$q_i$= K$_i$ D$_i$

*Step 5: Defining reference time to death occurrence*

If death rate is changing at same rate, estimated *q* based on census was linked to a definite time in the past. This reference time has a gap of few years from census year

$$t_i = e(i) + f(i)\left(\frac{P(19-15)}{P(20-24)}\right) + g(i)\left(\frac{P(20-24)}{P(25-29)}\right)$$

The coefficients *e(i)*, *f(i)* and *g(i)* were calculated using the Trussell method for each group of women and based on death pattern of Coale–Demeny.

## Appendix 2

In this appendix, we describe 2 equations for calculating Moran's *I* index.

Moran's *I* define as:

(1) $\quad I_i = \frac{x_i - \bar{x}}{S_i^2} \sum_{j=1, j \neq i}^{n} w_{i,j}(x_i - \bar{x})$

Where $w_{i,j}$ is the spatial weight between features *i* and *j*, *n* is equal to the total number of features, and $S_o$ is the aggregate of all the spatial weights:

(2) $\quad S_o = \sum_{i=1}^{n} \sum_{j=1}^{n} w_{i,j}$

## Estimation indirecte de la mortalité juvénile à l'aide des données du recensement de 2011 en République islamique d'Iran

### Résumé

**Contexte** : Les taux de mortalité juvénile sont considérés comme l'un des indicateurs clés de la santé de l'enfant.

**Objectifs** : La présente recherche visait principalement à calculer les taux de mortalité juvénile de façon indirecte, à partir des données du recensement. Elle avait aussi pour objectif de rechercher la présence de tendances de regroupement dans les régions provinciales au moyen d'une analyse de la structure spatiale.

**Méthodes** : La version de Trussell du modèle de Brass et le modèle Ouest des tables de Coale et Demeny ont été utilisés pour estimer les taux de mortalité juvénile et l'espérance de vie à la naissance. Les analyses ont été réalisées à l'aide du programme QFive du logiciel MORTPAK 4. Pour l'analyse en grappes, les indices de Moran local et global ont été mesurés.

**Résultats** : Le taux de mortalité infantile, le taux de mortalité des moins de 5 ans, le taux de mortalité des enfants de 1 à 4 ans et l'espérance de vie à la naissance ont été estimés à 21,9, 26, 4,1 (décès pour 1 000 naissances vivantes) et 72,1 ans, respectivement. L'indice global de Moran I a été calculé à 0,09, 0,09, 0,08 et 0,12, respectivement.

**Conclusions** : Une attention particulière doit être portée aux provinces présentant des grappes importantes en ce qui concerne l'évaluation des programmes de santé publique et la cause de l'échec de ces derniers en termes de réduction des taux de mortalité juvénile.

## التقدير غير المباشر لوفيات الأطفال باستخدام بيانات تعداد السكان لعام ٢٠١١ في جمهورية إيران الإسلامية

ياسر مخيري، سيد رياحي، إلهه رفيعي، زهرا اسدكل، سيد هاشمي نظرى

### الخلاصة

**الخلفية**: يُعتبر معدل وفيات الأطفال أحد المؤشرات الرئيسية لصحة الأطفال.

**الأهداف**: كان الهدف الأساسي من هذا البحث هو حساب معدلات وفيات الأطفال بطريقة غير مباشرة، باستخدام بيانات تعداد السكان، والاستقصاء بشأن وجود أنماط التكتل على مستوى المناطق الإقليمية باستخدام تحليل النمط المكاني.

**طرق البحث**: استُخدمت نسخة تروسل الخاصة بطريقة براس ونموذج كول – ديمنى وست لتقدير معدلات وفيات الأطفال ومأمول العمر عند الميلاد. ولقد أجريت التحليلات باستخدام برنامج QFive لبرمجيات MORTPAK٤. ولتحليل التكتلات، قِيسَت مؤشرات موران I المحلية والعالمية.

**النتائج**: قُدِّر معدل وفيات الرضّع، ووفيات الأطفال أقل من ٥ سنوات، ومعدل وفيات الأطفال من عمر سنة إلى ٤ سنوات ومأمول العمر عند الميلاد بما مقداره ٩، ٢١، و٢٦، و١ , ٤ (الوفيات لكل ١٠٠٠ مولود حيٍّ) و ٢ , ٧٢ عاماً على التوالي. وجاءت نتائج حساب مؤشر موران I العالمي ٠٩ , ٠، و٠٩ , ٠، و٠٨ , ٠، و١٢ , ٠ على التوالي.

**الاستنتاج**: يجب إيلاء عناية خاصة في الأقاليم ذات التكتلات المرتفعة في ما يتعلق بتقييم برامج الصحة العامة، وسبب إخفاق هذه البرامج في خفض مؤشرات وفيات الأطفال.

# References

1. United Nations Department of Economic Affairs, Population Division. Level and trends in child mortality. Estimates developed by the UN Inter-agency Group for Child Mortality Estimation. New York: United Nations; 2015 (https://www.un.org/en/development/desa/population/publications/mortality/child-mortality-report-2015.asp, accessed 2 July 2019).

2. United Nations Development Programme (UNDP). Human Development Report 2010: The Real Wealth of Nations. New York: UNDP; 2010.

3. Garcia-Moreno C, Heise L, Jansen HA, Ellsberg M, Watts C. Violence against women. Science. 2005;310(5752):1282–3. http://dx.doi.org/10.1126/science.1121400 PMID:16311321

4. Oestergaard MZ, Inoue M, Yoshida S, Mahanani WR, Gore FM, Cousens S, et al. United Nations Inter-Agency Group for Child Mortality Estimation and the Child Health Epidemiology Reference Group. Neonatal mortality levels for 193 countries in 2009 with trends since 1990: a systematic analysis of progress, projections, and priorities. PLoS Med. 2011 Aug;8(8):e1001080. http://dx.doi.org/10.1371/journal.pmed.1001080 PMID:21918640

5. Robert KW, Parris TM, Leiserowitz AA. What is sustainable development? Goals, indicators, values, and practice. Environment Sci Policy Sustain Dev. 2005;47(3):8–21. https://doi.org/10.1080/00139157.2005.10524444

6. Sachs JD. From millennium development goals to sustainable development goals. The Lancet. 2012 Jun 9;379(9832):2206–11. https://doi.org/10.1016/S0140-6736(12)60685-0

7. Silva R. Child mortality estimation: consistency of under-five mortality rate estimates using full birth histories and summary birth histories. PLoS Med. 2012;9(8):e1001296. http://dx.doi.org/10.1371/journal.pmed.1001296 PMID:22952436

8. World development indicators 2013. Washington, DC: World Bank; 2013 (http://documents.worldbank.org/curated/en/449421468331173478/pdf/768240PUB0EPI00IC00PUB0DATE04012013.pdf, accessed 2 July 2019).

9. Khosravi A, Taylor R, Naghavi M, Lopez AD. Mortality in the Islamic Republic of Iran, 1964–2004. Bulletin of the World Health Organization. 2007 Aug;85(8):607–14. http://dx.doi.org/10.2471/blt.06.038802 PMID:17768519

10. United Nations Department of International Economic and Social Affairs. Population Studies No. 107. Step-by-step guide to the estimation of child mortality 1990. New York: UN; 1990 (https://www.un.org/en/development/desa/population/publications/pdf/mortality/stepguide_childmort.pdf, accessed 2 July 2019).

11. Hill K, Trussell J. Further developments in indirect mortality estimation. Population Studies. 1977 Jul;31(2):313–34. http://dx.doi.org/10.1080/00324728.1977.10410432 PMID:22077841

12. Robinson T. Spatial statistics and geographical information systems in epidemiology and public health. Adv Parasitol. 2000;47:81–128. PMID:10997205

13. Populations and housing censuses 2011. Tehran: Statistical Center of Iran (https://www.amar.org.ir/english/Population-and-Housing-Censuses, accessed 2 July 2019).

14. Rajaratnam JK, Tran LN, Lopez AD, Murray CJL. Measuring under-five mortality: validation of new low-cost methods. PLoS Med. 2010 Apr 13;7(4):e1000253. http://dx.doi.org/10.1371/journal.pmed.1000253 PMID:20405055

15. Mirzaei M. [A discourse on applied demography]. Tehran University; 2006 (in Persian).

16. Hinde A. Book Reviews: MORTPAK for Windows. Version 4.0. The United Nations software package for demographic measurement. Popul Stud. 2005;59(2):263–4. http://dx.doi.org/10.1080/00324720500099876

17. Susuman AS. Child Mortality Rate in Ethiopia. Iranian J Public Health. 2012;41(3):9–19. PMID:23113145

18. Vapattanawong P, Hogan MC, Hanvoravongchai P, Gakidou E, Vos T, Lopez AD, et al. Reductions in child mortality levels and inequalities in Thailand: analysis of two censuses. Lancet. 2007 Mar 10;369(9564):850–5. http://dx.doi.org/10.1016/S0140-6736(07)60413-9 PMID:17350454

19. Gemperli A, Vounatsou P, Kleinschmidt I, Bagayoko M, Lengeler C, Smith T. Spatial patterns of infant mortality in Mali: the effect of malaria endemicity. Am J Epidemiol. 2004 Jan 1;159(1):64–72. http://dx.doi.org/10.1093/aje/kwh001 PMID:14693661

20. Balk D, Pullum T, Storeygard A, Greenwell F, Neuman M. A spatial analysis of childhood mortality in West Africa. Population Space Place. 2004;10(3):175–216. http://dx.doi.org/10.1002/psp.328

21. Binka FN, Indome F, Smith T. Impact of spatial distribution of permethrin-impregnated bed nets on child mortality in rural northern Ghana. Am J Trop Med Hyg. 1998 Jul;59(1):80–5. http://dx.doi.org/10.4269/ajtmh.1998.59.80 PMID:9684633

22. Kandala N-B, Ghilagaber G. A geo-additive Bayesian discrete-time survival model and its application to spatial analysis of childhood mortality in Malawi. Quality Quantity. 2006 Dec;40(6):935–57. https://doi.org/10.1007/s11135-005-3268-6

23. Singh A, Pathak PK, Chauhan RK, Pan W. Infant and child mortality in India in the last two decades: a geospatial analysis. PLoS One. 2011;6(11):e26856. http://dx.doi.org/10.1371/journal.pone.0026856 PMID:22073208

24. Mohammadi Y, Parsaeian M, Mehdipour P, Khosravi A, Larijani B, Sheidaei A, et al. Measuring Iran's success in achieving Millennium Development Goal 4: a systematic analysis of under-5 mortality at national and subnational levels from 1990 to 2015. Lancet Global Health. 2017 May 1;5(5):e537–44. https://doi.org/10.1016/S2214-109X(17)30105-5

25. Lee H-Y, Do DV, Choi S, Trinh OTH, To KG. Trends and determinants of infant and under-five childhood mortality in Vietnam, 1986–2011. Global Health Action. 2016 Feb 29;9(1):29312. http://dx.doi.org/10.3402/gha.v9.29312 PMID:26950560

26.  Hashemi Nazari SS, Mahmoodi M, Holakouie Naieni K. Residential Segregation of Socioeconomic variables and health indices in Iran. Int J Prev Med. 2012 Jul;4(7):767–76. PMID:24049595

27.  Nazari SH, Mahmoodi M, Mansournia M, Naieni KH. Residential segregation and infant mortality: a multilevel study using Iranian census data. Iranian J Public Health. 2012;41(4):69–79. PMID:23113167

28.  Kumar C, Singh PK, Rai RK. Under-five mortality in high focus states in India: a district level geospatial analysis. PLoS One. 2012;7(5):e37515. http://dx.doi.org/10.1371/journal.pone.0037515 PMID:22629412

29.  El-Khorazaty M. Indirect mortality estimates for children under five in six Arab countries. Popul Bull ESCWA. 1992(41–42):53–105. PMID:12290057

30.  Child mortality in Iran 2011. UN Inter-agency Group for Child Mortality Estimation (http://www.childmortality.org/index.php?r=site/graph&ID=IRN_Iran, accessed 2 July 2019).

31.  Nanda J, Adak DK, Bharati P. An assessment of infant and child mortality by social group and place of residence in districts of Orissa. Asian Pacific J Trop Dis. 2012 Dec;2:S242–53.

# Teachers' perspectives on nutrition education in boys' public high schools in Riyadh, Saudi Arabia

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## Abstract

**Background:** Nutrition education in school may positively affect students' eating behaviour. Teachers need to be empowered to teach nutrition, but no studies have investigated teachers' views on this topic in Saudi Arabia.

**Aims:** This study investigated the perspective of teachers on nutrition education and their confidence in teaching it in boys' public high schools in Riyadh, Saudi Arabia.

**Methods:** In 2015, 80 boys' public high schools were randomly selected from four areas of Riyadh, and 80 teachers (biological sciences, physical education and health education teachers) were interviewed using a validated questionnaire. A Fisher exact test was run to test the relationship between teachers' perspective and confidence level, and their subject taught.

**Results:** Almost all the teachers (98%) agreed that the health education curriculum should be taught as a core subject for high-school students. Most of the teachers (89%) were interested in teaching nutrition. However, 64% indicated that they did not have adequate nutrition curricular materials and 70% considered that they had not received adequate training on nutrition education. However, 89% were confident that their students would be interested in nutrition and that such education would change their dietary behaviour. Science and health education teachers were more interested in teaching nutrition and were more confident in their ability to do so than physical education teachers ($P < 0.05$).

**Conclusions:** Most of the teachers were interested in teaching nutrition but barriers existed, such as lack of training and teaching materials, which affected teachers' confidence in delivering nutrition education in their curricula.

Keywords: diet, health education, schools, teachers, Saudi Arabia

## Introduction

The prevalence of childhood obesity has been growing on a global scale. It is steadily affecting many low- and middle-income countries, particularly in urban areas (*1*). In 2010, a national Saudi Arabian study recruited 9317 Saudi Arabian children aged five to 18 years from primary health care centres and measured their weight and height (*2*). The study found that 23.1% of the children were overweight and 9.3% were obese.

Obesity is considered a complex disease because several factors can increase its risk. Nutrition education and knowledge is one factor as it can influence food choices. Four cross-sectional studies investigated the effect of dietary behaviour on the weight and health of Saudi Arabian school students (*3–6*). They all found a negative relationship between educational level and the consumption of processed and energy-dense foods. These studies recommended providing sustainable nutrition education programmes for both students and their parents. They also suggest that policy-makers target schools by including nutrition-related topics in school the curriculum.

In Saudi Arabia, only a few studies have examined students' knowledge about nutrition and eating habits.

In Al-Khobar, in the eastern region, most teenagers were found to have little knowledge about energy-dense foods, such as foods high in saturated fat, and nutrient-dense foods, such as those rich in fibre (*7*). The students indicated that their main source of nutrition information was the media, and their least likely source was primary health care centres (*7*). In Jeddah, in the western region, women's knowledge of food groups correlated negatively with their education level (*8*). The study also found a difference between women's food preferences and food group knowledge, especially on fruits, vegetables, dairy products and fat consumption (*8*). Studies conducted in central, eastern and western regions of Saudi Arabia found a trend among adolescents of skipping breakfast and consuming more foods high in sugar and fat rather than fibre and nutrient-dense foods such as fruits and vegetables (*4,9–12*). In Riyadh, in the central region, the mean intake per week of fruits and vegetables among adolescents aged 14–19 years was reported to be 2.82 and 3.79 respectively (*9*). In addition, the mean intake per week of sugar-sweetened drinks and sweets was 4.74 and 3.62 respectively. Another study in Riyadh showed that only 0.99% of girls aged 12–17 years liked to eating fruits and vegetables, while 36.63% and 39.6% of them preferred chocolate and chips respectively (*11*). Therefore, nutrition

education in schools could be an effective tool to increase students' knowledge about healthy and unhealthy foods, which may improve their dietary behaviour.

Health education may positively affect people's lifestyle. As far as we know, no experimental studies have been conducted on young people to test this hypothesis in Saudi Arabia. However, a study conducted in Al-Qassim province in Saudi Arabia showed that health education sessions at primary health care centres increased consumption of fish and fresh vegetables among adults (13). In addition, after the health education sessions, participants were more likely to exercise and less likely to smoke (13). Similar positive effects of health education may also be found with young people. A study conducted in the United States of America suggests that empowering teachers could positively affect students' health outcomes (14). This can be through increasing teachers' self-efficacy for delivering nutrition education (14). Therefore, having teachers assigned for health or/ and nutrition education as role models is essential. In Saudi Arabia, nutrition is taught as part of an elective health education curriculum. In addition, science and physical education teachers may teach some topics on nutrition.

This study aimed investigate the perspective of teachers (science, health education and physical education teachers) about nutrition education and their confidence in teaching nutrition in public high schools for boys in Riyadh, Saudi Arabia.

## Methods

This study was conducted in 80 boys' public high schools in Riyadh city in October 2015: 20 schools each were randomly selected from the north, south, east and west parts of the city. Riyadh has 120 boys' public high schools, so our sample represents 66.7% of the total. With this sample size and 95% confidence interval, the margin of error would be 6%. Ethical approval to conduct the study was obtained from the Human Research Protection Program at Texas Tech University, United States of America. The teachers gave their verbal consent to participate.

Two research assistants were trained by the lead investigator to collect data. We approached the principals of the schools and asked them to nominate teachers who taught nutrition within the subject they taught. We then contacted the teachers and selected one who was willing to participate in the study from each school. Thus, 80 teachers from the selected schools were interviewed using a questionnaire about their perception of nutrition education and their confidence in delivering nutrition education to students. The questionnaire was designed from valid questionnaires used in a previous study (15). Some questions in the questionnaire were included in order to be relevant to the Saudi Arabian dietary guidelines. The questionnaire was pretested for face validity. The teachers' perception and confidence level about nutrition education were measured using a four-point Likert scale which range from strongly disagree or

not at all confident to strongly agree or very confident.

SPSS, version 22 software was used to analyse the results. The Fisher exact test was used to test differences between teachers' perspective and confidence level and their demographic variables. The Fisher exact test was used to test the relationship between teachers' perspectives and confidence levels, and their main subject taught (sciences, health education and physical education). A P-value less than 0.05 was considered statistically significant.

## Results

A total of 80 teachers from 80 schools completed the questionnaire. Demographic characteristics of the teachers are shown in Table 1. Most of the teacher were aged between 30 and 40 years (61%) and had a bachelor's degree (86%). Almost half (49%) of the teachers taught biological sciences, 33% were physical education teachers and 19% were health education teachers. Almost two third of the teachers (65%) had teaching experience of more than six years. However, all the health education teachers (15 teachers) had less than three years' experience because the health education curriculum, designed by the Saudi Arabian Ministry of Education, had been newly introduced in boys' public high schools. The health education curriculum was taught in 19% of the selected schools.

About three quarters (74%) of the teachers reported that they taught nutrition in their classes. Of those who taught nutrition, 27% taught it in their classes every day, 24% taught it weekly and 19% every two weeks, while 5% taught nutrition in their classes once a semester, 6% once

**Table 1 Characteristics of the teachers**

| Characteristic | No. (%) (n = 80) |
|---|---|
| *Age (years)* | |
| < 30 | 6 (8) |
| 30–40 | 49 (61) |
| 41–50 | 24 (30) |
| > 50 | 1 (1) |
| *Education level* | |
| Bachelor's degree | 69 (86) |
| Diploma | 5 (6) |
| Master's degree | 6 (8) |
| *Main subject taught* | |
| Biological sciences | 39 (49) |
| Physical education | 26 (33) |
| Health education | 15 (19) |
| *Years of experience* | |
| < 3 | 20 (25) |
| 35 | 8 (10) |
| 6–10 | 15 (19) |
| 11–15 | 17 (21) |
| > 15 | 20 (25) |

a month, 4% once per year and 15% taught it when needed. The teachers reported that they taught the following subjects: micro- and macro-nutrients (59%), food pyramid (23%) and diet-related diseases (19%).

With regard to teachers' perception of nutrition education, 89% of the teachers were interested in teaching nutrition and 98% agreed that a health education curriculum, which include topics on nutrition, should be taught as a core subject for students. However, 64% of the teachers reported that adequate nutrition curricular materials were not available to them and 80% said that the materials available were not appealing to their students as they were outdated. Almost three quarters of the teachers (71%) were interested in arranging nutrition activities with nutrition specialists. Most of the teachers (78%) reported that the school canteen did not offer healthy food for students. Most of the teachers (73%) were aware of the American food pyramid, but only 36% were aware of the Saudi Arabian food palm, and 38% were aware of the dietary guidelines produced by the Saudi Arabian Ministry of Health.

As regards teachers' confidence level about nutrition education, 70% of the teachers reported that overall they were not confident in teaching nutrition because they had not received adequate training. Just over half of the teachers (52%) reported that they were confident in teaching the American food pyramid and the Saudi Arabian food palm, and 40% were confident in teaching the food groups. Half of the teachers (50%) reported that they were confident in teaching the dietary guidelines for Saudi Arabians, and 73% were confident in teaching their students about eating a balanced diet. The majority of the teachers (86%) were confident in teaching about foods high in fat, sugar and salt, and 80% were confident in teaching their students to reduce their intake of these kinds of food. About two thirds of the teachers (64%) were confident in teaching about foods high in fibre, vitamins, and minerals, and 85% were confident in teaching their students to increase their consumption of these kinds of food. Most of the teachers (86%) were confident in

raising their students' interest about nutrition and 89% were confident that their students would be interested in nutrition after teaching it. The majority of the teachers (84%) were confident that teaching nutrition would increase their students' knowledge and 89% were confident that teaching nutrition would improve their students' eating behaviour.

There was a statistically significant relationship between teachers' perspectives of teaching nutrition (based on four statements) and their main subject taught (Table 2) but not for any other statements. In addition, a significant relationship was found between teachers' confidence levels about teaching nutrition (based on four statements) and their main subject taught (Table 3). Overall, science and health education teachers were more interested in teaching nutrition and were more confident in their ability to do so than physical education teachers.

## Discussion

The purpose of this study was to investigate the teachers' perspectives and confidence levels about teaching nutrition in their classes at boys' public high schools in Riyadh. The results showed that most of the teachers considered healthy food choices an important nutrition topic and they tried to influence the food choices made by their students. Topics related to food choices such as nutrients in food and the food pyramid were taught by most of the teachers. Therefore, the teachers were confident teaching topics related to food choices. Similar findings were found in a previous study conducted in the United States of America (16). Although the Saudi food palm and dietary guidelines for Saudi Arabians were produced by the Saudi Arabian Ministry of Health in 2012 to be used in nutrition education, few teachers in our study were aware of the Saudi food palm (36%) and the dietary guideline for Saudis (38%). Therefore, increasing teachers' awareness of the Saudi food palm and the dietary guideline for Saudis is required.

**Table 2 Teachers' perspectives on teaching nutrition, according to their main subject taught**

| Main subject taught | The students in my class prefer other subjects to nutrition | | | | | Adequate nutrition curricular materials are available to me | | | | | I think I have had adequate training from qualified people on nutrition education | | | | | I am aware of the food pyramid | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SA | A | D | SD | Fisher exact test | SA | A | D | SD | Fisher exact test | SA | A | D | SD | Fisher exact test | SA | A | D | SD | Fisher exact test |
| Biological sciences | 2 | 17 | 15 | 5 | 12.9, P = 0.024 | 3 | 11 | 20 | 5 | 25.5, P < 0.001 | 2 | 11 | 23 | 3 | 12.9, P = 0.024 | 8 | 27 | 2 | 2 | 24.1, P < 0.001 |
| Physical education | 3 | 14 | 9 | 0 | | 2 | 1 | 17 | 6 | | 2 | 2 | 15 | 7 | | 0 | 10 | 10 | 6 | |
| Health education | 0 | 2 | 11 | 2 | | 0 | 12 | 2 | 1 | | 0 | 7 | 8 | 0 | | 1 | 12 | 2 | 0 | |

*SA: strongly agree; A: agree, D: disagree, SD: strongly disagree.*

**Table 3 Teachers' confidence in teaching nutrition according to their main subject taught**

| Main subject taught | I understand nutrition concepts well enough to teach them to my students | | | | | I can do a good job teaching students what the food pyramid is | | | | | I can do a good job teaching students about reducing fat, sugar, and salt in their diet | | | | | I can do a good job teaching students about increasing fruits, vegetables, and grains in their diet | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VC | C | NC | NAAC | Fisher exact test | VC | C | NC | NAAC | Fisher exact test | VC | C | NC | NAAC | Fisher exact test | VC | C | NC | NAAC | Fisher exact test |
| Biological sciences | 4 | 19 | 14 | 2 | 18.7, P = 0.002 | 7 | 20 | 11 | 1 | 21.8, P < 0.001 | 13 | 25 | 1 | 0 | 34.1, P < 0.001 | 17 | 21 | 1 | 0 | 27.3, P < 0.001 |
| Physical education | 0 | 6 | 14 | 6 | | 1 | 3 | 19 | 3 | | 1 | 10 | 14 | 1 | | 1 | 14 | 10 | 1 | |
| Health education | 1 | 12 | 2 | 0 | | 2 | 9 | 4 | 0 | | 3 | 12 | 0 | 0 | | 4 | 11 | 0 | 0 | |

*VC: very confident, C: confident, NC: not confident, NAAC: not at all confident.*

The present study found that most of the teachers (89%) were interested in teaching nutrition and tried to incorporate nutrition activities in their classes. These elements indicated that teachers in boys' public high schools in Saudi Arabia could be motivated to teach nutrition. On the other hand, our study showed that lack of teaching materials and lack of training could be barriers to teaching nutrition. Almost two third of teachers reported that adequate nutrition materials were not available, and 80% reported the material available was not appealing to their students. Most of the teachers reported that healthy foods were not available in their school canteen. Most teachers (70%) were not confident in teaching nutrition as they had not received adequate training. The aforementioned motivational elements and barriers were identified by two previous qualitative studies conducted in United States of America and South Africa (17,18). The researchers found that the schools environment and teachers' perceptions play an important role in addressing issues that weaken the influence of nutrition education on students' eating habits.

With regard to the relationship between teachers' perspectives and confidence levels, and the main subject they taught, science teachers and health education teachers had more a positive perspective and greater confidence about teaching nutrition compared with physical education teachers. However, the present study showed that science teachers and health education teachers reported that they received more training and understood the concepts well enough to teach them compared with physical education teachers. Together with an earlier American study, these results indicate that adequate training on nutrition and a good knowledge of the subject will increase teachers' confidence levels (16).

In conclusion, as far as we know, this study is the first to investigate the perceptions and confidence levels of teachers in boys' public high schools in Saudi Arabia. Because of the small sample size, the results cannot be generalized beyond boys' public high schools in Riyadh, Saudi Arabia. The study found some motivational issues and barriers to teaching nutrition among the teachers, and further qualitative studies are required to investigate these issues further among teachers in Saudi Arabia. The present study found that the health education curriculum was newly taught in boys' public high schools as all health education teachers had less than three years' experience. Tailored questionnaires on the new curriculum should be developed to assess its usefulness, and focus group interviews conducted with teachers to get their insight on the new curriculum.

## Points de vue des enseignants sur l'éducation et l'enseignement en matière de la nutrition dans les écoles secondaires publiques de garçons à Riyadh (Arabie saoudite)

### Résumé

**Contexte** : L'éducation nutritionnelle à l'école peut avoir un effet positif sur le comportement alimentaire des élèves. Les enseignants devraient être habilités à dispenser un enseignement sur la nutrition, mais aucune étude ne s'est intéressée à leurs points de vue concernant ce sujet en Arabie saoudite.

**Objectifs** : La présente étude s'est intéressée au point de vue des enseignants sur l'éducation nutritionnelle et à leur degré de confiance pour enseigner la nutrition dans les écoles secondaires publiques de garçons à Riyadh.

**Méthodes** : En 2015, 80 écoles secondaires publiques de garçons ont été sélectionnées aléatoirement dans quatre secteurs de Riyadh, et 80 enseignants (biologie, éducation physique et éducation sanitaire) ont été interrogés au moyen d'un

questionnaire validé. Un test exact de Fisher a été réalisé pour évaluer la relation entre le point de vue et le niveau de confiance des enseignants, et la matière enseignée.

**Résultats** : Presque tous les enseignants (98 %) s'accordaient pour affirmer que le programme d'éducation sanitaire devrait être enseigné en tant que matière principale aux élèves du secondaire. La plupart des enseignants (89 %) étaient intéressés par l'enseignement de la nutrition. Cependant, 64 % d'entre eux ont indiqué ne pas posséder les supports adéquats pour dispenser les programmes sur la nutrition et 70 % considéraient ne pas avoir reçu la formation adéquate en matière d'éducation nutritionnelle. Par ailleurs, 89 % étaient certains que leurs élèves s'intéresseraient à la nutrition et qu'une éducation nutritionnelle modifierait le comportement alimentaire de ces derniers. Les enseignants en sciences et en éducation sanitaire étaient davantage intéressés par l'enseignement de la nutrition et plus confiants en leur capacité d'y parvenir que les enseignants en éducation physique ($p < 0,05$).

**Conclusions** : La plupart des enseignants étaient intéressés par l'enseignement de la nutrition, tout en notant des obstacles tels que le manque de formation et de supports d'enseignement, à l'origine d'une baisse de leur niveau de confiance pour intégrer l'éducation nutritionnelle à leurs programmes.

## آراء المدرسين بشأن التثقيف الغذائي، وإذكاء الوعي بشأنه في المدارس الثانوية العامة للبنين في الرياض، المملكة العربية السعودية

خالد الدبيان

### الخلاصة

**الخلفية:** قد يكون للتثقيف الغذائي في المدارس تأثيرٌ إيجابيٌّ على السلوك الغذائي للطلاب. وينبغي تمكين المدرسين ليصبحوا قادرين على إذكاء الوعي بشأن التغذية، ولكن لم تُجرَ أي دراسات للوقوف على آراء المدرسين حول هذا الموضوع في المملكة العربية السعودية.

**الأهداف:** تناولت هذه الدراسة بالبحث رأي المدرسين بشأن التثقيف الغذائي وثقتهم في أنهم يستطيعون إذكاء الوعي بشأنه في المدارس الثانوية العامة للبنين في الرياض.

**طرق البحث:** في عام ٢٠١٥، اختيرت ٨٠ مدرسةً اختياراً عشوائياً من بين المدارس الثانوية العامة للبنين من أربع مناطق بالرياض، وأُجريت مقابلات مع ٨٠ مدرساً (مدرسي العلوم البيولوجية، والتربية البدنية، والتثقيف الصحي) باستخدام استبيان مُتحقَّق منه. كذلك عُقد اختبار فيشر الدقيق لفحص العلاقة بين رأي المدرسين ومستوى الثقة، وبين المادة التي يدرسونها.

**النتائج:** اتفق كل المدرسين تقريباً (٩٨٪) على ضرورة تدريس منهج التثقيف الصحي بوصفه مادة أساسية لطلاب المدارس الثانوية. وأبدى معظم المدرسين (٨٩٪) اهتماماً بإذكاء الوعي بشأن التغذية. ولكن، أوضح ٦٤٪ أنه ليس لديهم مواد كافية خاصة بمناهج التغذية، ورأى ٧٠٪ أنهم لم يتلقوا تدريباً كافياً حول التثقيف الغذائي. إلا أن ٨٩٪ من المدرسين كانوا واثقين من أن الطلاب سيهتمون بموضوع التغذية وأن تثقيفهم في هذا الشأن سيؤدي إلى تغيير سلوكهم الغذائي. وأبدى مدرسو العلوم والتثقيف الصحي اهتماماً أكبر بالتوعية بشأن التغذية وكانوا أكثر ثقة في قدرتهم على فعل ذلك مقارنةً بمدرسي التربية البدنية (القيمة الاحتمالية > ٠,٠٥).

**الاستنتاجات:** أبدى معظم المدرسين اهتماماً بالتوعية بشأن التغذية، لكنهم أشاروا إلى وجود بعض العقبات، مثل عدم توافر التدريب أو مواد التدريس، وهو ما يؤثر على ثقة المدرسين في قدرتهم على تحقيق التثقيف الغذائي ضمن المناهج التي يدرسونها.

## References

1. Population-based approaches to childhood obesity prevention. Geneva: World Health Organization; 2012

2. El Mouzan MI, Foster PJ, Al Herbish AS, Al Salloum AA, Al Omer AA, Qurachi MM, et al. Prevalence of overweight and obesity in Saudi children and adolescents. Ann Saudi Med. 2010;30(3):203–8. https://doi.org/10.4103/0256-4947.62833

3. Al-Saeed WY, Al-Dawood KM, Bukhari IA, Bahnassy A. Prevalence and socioeconomic risk factors of obesity among urban female students in Al-Khobar city, Eastern Saudi Arabia, 2003. Obes Rev. 2007;8(2):93–9. https://doi.org/10.1111/j.1467-789X.2006.00287.x

4. Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. Eur J Nutr. 2008;47(6):310–8. https://doi.org/10.1007/s00394-008-0727-6

5. Farghaly NF, Ghazali BM, Al-Wabel HM, Sadek AA, Abbag FI. Life style and nutrition and their impact on health of Saudi school students in Abha, Southwestern region of Saudi Arabia. Saudi Med J. 2007;28(3):415–21.

6. Mahfouz AA, Shatoor AS, Khan MY, Daffalla AA, Mostafa OA, Hassanein MA. Nutrition, physical activity, and gender risks for adolescent obesity in Southwestern Saudi Arabia. Saudi J Gastroenterol. 2011;17(5):318–22. https://doi.org/10.4103/1319-3767.84486

7.   Al-Almaie S. Knowledge of healthy diets among adolescents in eastern Saudi Arabia. Ann Saudi Med. 2005;25(4):294–8. https://doi.org/10.5144/0256-4947.2005.294

8.   Bakhotmah BA. Nutritional knowledge and desire to change of food preferences among Saudi women in Jeddah, Saudi Arabia. Ecol Food Nutr. 2012;51(4):313–28. https://doi.org/10.1080/03670244.2012.691388

9.   Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. Int J Behav Nutr Phys Act. 2011;8:140. https://doi.org/10.1186/1479-5868-8-140

10.  Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC Public Health. 2012;12:354. https://doi.org/10.1186/1471-2458-12-354

11.  Al-Muammar MN, El-Shafie M, Feroze S. Association between dietary habits and body mass index of adolescent females in intermediate schools in Riyadh, Saudi Arabia. East Mediterr Health J. 2014;20(1):39–45.

12.  Collison KS, Zaidi MZ, Subhani SN, Al-Rubeaan K, Shoukri M, Al-Mohanna FA. Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. BMC Public Health. 2010;10:234. https://doi.org/10.1186/1471-2458-10-234

13.  Midhet FM, Sharaf FK. Impact of health education on lifestyles in central Saudi Arabia. Saudi Med J. 2011;32(1):71–6.

14.  Snelling AM, Ernst J, Belson SI.. Teachers as role models in solving childhood obesity. J Pediatr Biochem. 2013;3(1):55–60. https://doi.org/10.3233/JPB-120074

15.  Murimi M, Colvin J, Liner K, Guin J. Methodology to evaluate outcomes of the team nutrition initiative in schools. Louisiana Tech University; 2006 (http://naldc.nal.usda.gov/download/32793/PDF, accessed 26 June 2019).

16.  Murimi MW, Sample AD, Guthrie J, Landry D. Nutrition education in Team Nutrition middle schools: Teachers' perceptions of important topics to be taught and teaching curriculum used. J Child Nutr Manage. 2007;2(31):1–12.

17.  Mita SC, Li E, Goodell LS. A qualitative investigation of teachers' information, motivation, and behavioral skills for increasing fruit and vegetable consumption in preschoolers. J Nutr Educ Behav. 2013;45(6):793–9. https://doi.org/10.1016/j.jneb.2013.05.001

18.  Kupolati MD, Gericke GJ, MacIntyre UE. Teachers' perceptions of school nutrition education's influence on eating behaviours of learners in the Bronkhorstspruit District. S Afr J Educ. 2015;35(2):1–10. https://doi.org/ 10.15700/saje.v35n2a1049

# Hearing testing in autistic spectrum disorder: is it unnecessary in low and middle-income countries?

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## Abstract

**Background:** In low and middle-income countries where the health care is in a weakened state, spending money on unaffordable and probably unnecessary investigations might be substituted by a reliable, simple and more informative tool that can deal with the problem.

**Aims:** To examine current medical practice of measuring auditory brainstem response for all children with autistic spectrum disorder, and assess the value of this test in these children and its applicability in low and middle-income countries such as Libya.

**Methods:** We reviewed the medical records of all children with autistic spectrum disorder who presented to neurodevelopment clinics of Al-Khadra Teaching Hospital, Tripoli, Libya between January 2010 and December 2014.

**Results:** In 71 of 2368 children with autistic spectrum disorder, the family were concerned about their children's hearing and reaction to loud noises. Auditory brainstem response confirmed that 26 of these 71 children had sensorineural hearing loss.

**Conclusion:** We consider auditory brainstem response measurement to be unnecessary in children with autistic spectrum disorder without clinical signs suggesting hearing impairment and without any parental concerns about hearing.

Keywords: auditory brainstem response, autistic spectrum disorder, children, developing countries, hearing test

## Introduction

Mental illness is the leading cause of disability worldwide, according to the World Health Organization. Most low- and middle-income countries including Africa have only 1 child psychiatrist for every 1–4 million people and this probably applies also to neurodevelopmental pediatricians and neurologists (1).

As stated in the report of the Commission on Social Determinants of Health (2): "Poverty is not only lack of income. The implication, both of the social gradient in health and the poor health of the poorest of the poor, is that health inequity is caused by the unequal distribution of income, goods, and services and of the consequent chance of leading a flourishing life. This is not in any sense a 'natural' phenomenon."

The assessment and management of children with autistic spectrum disorder (ASD) is governed by codes of practice. The need for new recommendations is re-examined at regular intervals in the medical literature. However, despite the prevalence of ASD, agreement over management remains disputed; in particular, the need for hearing tests. According to the fifth edition of Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-5) (3), ASD is a lifelong developmental disability defined by diagnostic criteria that include deficits in social communication and interaction, and restricted, repetitive patterns of behaviour, interests or activities.

A 2014 survey of parents by the government of the United States of America (USA) suggested that 1 in 45 children, aged 3–17 years had been diagnosed with ASD (4). This is notably higher than the official government estimate of 1 in 68 American children with autism, as stated by National Centre for Health Statistics.

In Libya, a prospective hospital-based study of all children referred to a neurodevelopment clinic between 2005 and 2009 for ASD assessment showed a prevalence of 1 in 300 (5). In another study that was carried out in 2011, 15 085 children were seen and 200 aged 2–13 years were referred for ASD assessment. ASD were diagnosed in 83% (166 children) which gave a prevalence of 10:1000 (6, 7). The Libyan health system has been adversely affected since the beginning of the 2011 conflict. Many factors impose serious challenges to the public health sector in Libya such as the insufficiency of health information systems, severe shortage of medical supplies, and loss of health staff, which are mainly caused by the lack of security and interrupted delivery of supplies (8).

The prevalence of ASD in Libya is probably higher or similar to that seen in the USA and United Kingdom of Great Britain and Northern Ireland (UK). No data were available from the Arab countries or other developing countries. The increase in the estimated number of children with autism does not include children who are deaf. According to the Annual Survey of Deaf and Hard of Hearing Children and Youth that was conducted in the

USA by the Gallaudet Research Institute in 2009–2010, 1 in 59 children (specifically those aged 8 years) with hearing loss were also receiving services for autism (*9*). In 2012, Szymanski et al. (*10*) showed that the prevalence of ASD in the USA was considerably higher in children with hearing loss than the reported national estimates of 1 in 91 (*11*) and 1 in 110 (*12*) for hearing children. This is approximately twice what is currently believed to be the national prevalence rate of 1 in 50 (*3*).

On average, a child who is deaf will be diagnosed with autism later in life than a hearing child will be. In 1 study, deaf children were diagnosed an average of 1 year later (*13*). Researchers and educators speculate that the reasons behind delayed diagnosis are the difficulty in distinguishing the characteristics of deafness from those of autism, as well limited resources for parents and educators guiding the identification of autism and deafness. Also, it is possible that deaf children are diagnosed with ASD later because there are few psychological tests that have been devised, or even include considerations for children who are deaf. In fact, there are no approved instruments for making a diagnosis of autism in a child who is deaf (*14*). Some suggest that children with autism have language difficulties because they struggle with converting auditory information to vocal utterances (*15*). Others have suggested that children with autism have severe auditory processing deficits (*16*). Deaf children might be occupied by self-stimulating behaviour and play independently, but this does not mean that the children have ASD but simply that they cannot hear other children. Knowing if the child has hearing impairment is not always apparent. The fact that hearing loss often is not diagnosed until children are 2 or 3 years old – the same time that autism is often diagnosed – increases the difficulty of assessment. Distinctive features of autism may mimic deafness and vice versa. If children cannot hear, they do not respond when called by name, which is often an important item on the checklist for autism, but it is also typical of deafness. Additionally, if children cannot hear, social interaction with peers might be difficult, due to an inability to hear conversation and not because they have autism.

Health care in developing countries varies widely, and those living in urban areas are more likely to receive better healthcare services than those in rural or remote regions. Hospitals and clinics in Africa often find it difficult to employ enough trained medical staff to cope with the number of people needing care. Infrastructure problems have made it difficult to provide services to many people in more remote areas (*17*). Lack of healthcare access by people living in low-income countries may deprive them of early detection and reduce opportunities for early intervention. Diagnostic laboratories are often poorly resourced in developing countries and sparsely distributed and access may be limited by economic or geographical factors. Weak and poorly resourced healthcare systems in many developing countries are detrimental to socioeconomic development (*17*). Where clinical laboratories are found, they are often under-resourced and electrical and water supplies may be unreliable (*18*). Shortage of skilled technical personnel is also a problem in some countries, particularly in rural areas. Particular diagnostic tests may not be available to the majority of the population due to their high cost or lack of robustness. In addition, some manufacturers may be reluctant to supply countries if the return on their investment is likely to be low, or if it may be difficult to establish effective mechanisms for product distribution or technical support (*19*).

Healthcare systems across developing countries including Libya face a number of formidable challenges. Limited energy resources, inaccessibility to medical facilities, limited government funding, and high costs are placing tremendous strain on the healthcare systems in general and on services for children with special needs in particular. In view of all these difficulties, this study examined the current practice of hearing tests in children with ASD in Tripoli, Libya.

## Methods

### Study design

The study was conducted between 2010 and 2014. A total of 292 633 children attended paediatric clinics for different medical reasons during this period, a diagnosis of ASD was made in 2368 children. In 71 (50 boys and 21 girls) of these children with ASD, ABR confirmed that 26 (19 boys and 7 girls) had sensorineural hearing loss (SNHL). The Neurodevelopment Clinics of Al-Khadra Hospital, Tripoli are dedicated clinics in a tertiary care university hospital and are designated as referral and diagnostic clinics for autism and other neurodevelopmental problems. The hospital is affiliated to the Faculty of Medicine, Tripoli University. There are 3 regular weekly clinics. These clinics are consultant led (AZ), in addition to having 1 registrar, 2 senior house officers, and nurses. The clinics serve Tripoli, its suburbs and other district hospitals. The clinics receive referrals from other regions in Libya and care for children with other neurodevelopmental problems, such as hypotonia and epilepsy. An average of 40 children aged 1 month to 16 years are seen in each session. About 70% of the children attend the clinics for assessment of autism and speech and language disorders.

The inclusion criteria were age 1–16 years; speech and language disorders; and diagnosis of ASD and/or SNHL. The exclusion criteria were: neurometabolic disorders; genetic or infectious disease; chromosomal abnormalities; neurological or neurodegenerative disorders; and major physical abnormalities and congenital malformation.

### Diagnosis of ASD and screening for hearing loss

A range of assessment tools were used to diagnose ASD, including the Modified Checklist for Autism in Toddlers (M-CHAT) (*20*), Reviewed Autism Diagnostic Interview (ADI-R) (*21*) and DSM-4 and 5 (*3*), and as well as observations in various settings and discussions with other professionals.

Auditory brainstem response (ABR) and otoacoustic

emission (OAE) tests were used to screen for hearing loss. OAEs are sounds given off by the inner ear when responding to a sound. If the child's hearing loss is > 25 dB, they do not produce OAEs. All ABRs were acquired with a GSI 37 audio-screener (Grason–Stadler, Eden Prairie, MN, USA), which is a revolutionary hearing screening device that combines the 2-in-1 technology of measurement of OAEs and ABRs. For infants, only 1 sound is presented, which is called the click. If a healthy result is obtained, then the child passes the ABR test. The OAE test measures the reaction that is produced by the inner ear or cochlea. If an emission is produced for sounds that are essential to speech comprehension, then the child passes the test.

All children underwent complete general, neurological and neurodevelopment assessment. The results of the general and neurological examinations were unremarkable but the results of the neurodevelopment assessment were variable and needed to be re-evaluated in a separate session.

For each child, the parent was asked to respond to a brief demographic and social questionnaire covering the child's age, gender, birth order, number of siblings, whether there were 1 or 2 parents at home, and whether the child had received professional psychological help.

The families were asked 5 questions regarding their child's response, or lack of response, to an auditory stimulus, such as their name, by turning their head to maintain eye contact upon hearing it. Do they respond in other ways? Do they change their facial expression or make an eye shift when they hear their name? Do they turn away? Do they respond verbally?

Due to high illiteracy rates among rural parents, questionnaires were approved by a speech and language therapist and were administered through interviews at the clinic. The interviewers were either the registrar or any of the junior doctors attending the clinic who were given instructions by the investigator (AZ) about how to ensure consistency and avoid bias in completing the questionnaires. Due to the high cost of the ABR test, the control results for 700 children (440 boys and 260 girls)

were retrospectively selected from records of children referred to the audiology department with speech and language disorders only, without any neurological and neurodevelopmental disorders.

## Control group

The following criteria were used to choose the control group: age matching with the ASD group; ABR results including all stages performed in ASD children; and details that the neurological and neurodevelopmental examinations were unremarkable had been documented and confirmed by a consultant. All information obtained was entered on specially designed forms and kept in the medical files department. The names of the patients in the control group were not recorded and they were given a code number and sticker.

## Ethical considerations

Parental approval and consent for the study were obtained. All examinations of children with ASD were performed in the presence of their parents. No consent was required for the control group as only patient files were used.

## Statistical analysis

All statistical analyses were conducted using the descriptive tests in SPSS 20 statistical package. The risk of SNHL in the absence of other clinical signs and parental concerns was small (< 1 in 100).

## Results

A total of 292 633 children attended the paediatric outpatient clinics for different medical reasons between 2010 and 2014; among whom 2368 were diagnosed with ASD, giving a prevalence of 8:1000 (0.8%). A total of 2809 children had only learning difficulties but no ASD or hearing deficits.

Among 107 children with SNHL, 26 had ASD. Prevalence of SNHL among children with ASD was 1.1%, while the prevalence of SNHL among all children seen in

**Table 1 Data showing incidence of reaction to loud noises in children with SNHL and ASD**

| | Children with ASD (n = 2368) | Children with SNHL (n = 107) | ASD and SNHL (n = 26) | Learning difficulties (n = 2809) |
|---|---|---|---|---|
| *Medical history* | | | | |
| Eye to eye contact | Nil | 101 (94%) | 5 (20%) | 2695 (96%) |
| Social interaction | Nil | 104 (97%) | 5 (19%) | 2432 (87%) |
| Pretend play skills | Nil | 102 (95%) | 4 (15%) | 1571 (60%) |
| Reaction to sound | 2320 (98%) | 3 (3%) | 5 (18%) | 2634 (94%) |
| No concerns regarding hearing | 2296 (97%) | 6 (8%) | 4 (16%) | 2795 (99%) |
| Social language | 260 (11%) | Nil | 5 (19%) | 2276 (81%) |
| Replay language | 331 (14%) | Nil | 6 (22%) | 2346 (84%) |
| Preferences | 2060 (87%) | Nil | 21 (80%) | Nil |
| Changes in routine | 142 (6%) | Nil | 4 (14%) | 2800 (99%) |
| Range of hearing loss | Nil | 90–110 dB | 90–110 dB | Nil |

*Abbreviations: ASD = autistic spectrum disorder; SNHL = sensorineural hearing loss.*

the Neurodevelopmental Clinic was 0.036%.

Two things are immediately obvious from the data shown in Table 1. The first is the low incidence of reaction to loud noises (3%) in children with SNHL. The second is the high rate of concern regarding hearing among parents of children with SNHL; 92% compared with only 8% of parents who had no concerns regarding their child's hearing. Ninety-seven percent of parents of children with ASD had no concerns regarding hearing, supported by the fact that 98% of those children reacted to sounds and noises. Almost all children with developmental delay reacted to loud noises and their families had no concerns regarding their hearing or behaviour. However, they were concerned about delayed speech and language, which was obviously part of the children's developmental delay and learning difficulties. Only 18% of children with ASD and SNHL reacted to loud noises, and 84% of parents had concerns regarding hearing. All of these children underwent ABR testing at the time of diagnosis. Most of them had other associated features of ASD.

Extrapolation of these data shows that in 71 of 2368 children with ASD, the families were concerned about their children's hearing and reaction to loud noises. ABR testing confirmed that 26 of these 71 children had SNHL. In children with ASD, with no signs and symptoms of hearing impairment and with no parental concerns, routine ABR is unjustified. We showed that relying on parents' observation and concerns was a sensitive (87%) and specific (99%) predictor of SNHL in this group of children, which saved money on unnecessary investigation when resources were limited.

## Discussion

The results of the present study suggest that ABR measurement is unnecessary in children with ASD without clinical signs of hearing impairment and without any parental concerns about hearing. Our study has shown that relying on parents' observation and concerns was a sensitive (87%) and specific (99%) predictor of SNHL in this group of children, which saved money on unnecessary investigation when resources were limited. Routine ABR testing in children with autism is probably unjustified and places a burden on families, as well as causing pain and distress to children.

Only a few studies have investigated the incidence of SNHL and ASD. A dual diagnosis was made in 1–6% of children who were deaf or hard of hearing. Rosenhall and colleagues found that the incidence of SNHL among children with ASD was 1.6% unilateral, 7.9% mild to moderate and 3.5% profound (22). Other studies have found an incidence between 5.3% (23) and 1.7% (24).

Speech and language delays and hearing disorders such as SNHL, hypersensitivity to sound, and otitis media are a few examples of conditions associated with autism (25). The management of children with ASD has changed dramatically over the past 15 years. However, there is still wide variation in practice between clinics and individual neurodevelopment paediatricians in the management of this common yet complex disorder. More than 70% of children in whom ASD is suspected would have undergone unnecessary hearing assessment because of a perceived risk of occult SNHL in this group of children. The available data from our study suggest that this is not justified. The risk of SNHL in the absence of other clinical signs and parental concerns is small (< 1%).

Our study had some limitations. We did not collect information from other audiology services in other regions, which meant that we had no data on interventions provided at these centres. As none of these centres has ABR/auditory steady-state response equipment, we can only assume that children would be diagnosed by subjective means, which would usually take place at an older age. We feel that including data on these children would add weight to our study. We also did not collect data on the interval between diagnosis and initiation of interventions.

There is a need to develop an affordable and reliable tool for hearing assessment in resource-constrained, medically underserved areas of developing countries. There are many obstacles to the supply of proper health services in developing countries, including corruption in the supply of medical and therapeutic products, inconsistency in pricing, and wide fluctuation in quality and safety. Many children have difficulties in accessing essential health care because it is expensive and unaffordable. This situation is compounded by an absence of social security to ensure that poor people get the services they require, poor financial management, and lack of good administration and management. The current conflict in Libya has created new health needs. One critical problem is the lack of primary healthcare facilities, such as local clinics and district hospitals. Violence and general insecurity are making it difficult for children in Libya to reach health facilities and obtain the treatment they need. The lack of qualified personnel is aggravated by the departure of foreign health workers, who used to make up a majority of health staff in the country. There are a lot of important areas that we need to address now, for example, mental health, autism and psychosocial support.

Our suggested practice after diagnosis of ASD in children in whom hearing impairment is suspected follows a "less is more" attitude. Infants are assessed according to local protocols and those without clinical signs suggesting hearing impairment and without any parental concerns are given open appointments. If no concerns are expressed and the children appear well, ABR testing is considered unnecessary. This approach might be applicable to all developing countries where the delivery of effective public health interventions to people in need is compromised and clinics struggle to offer services to local populations, particularly in remote rural areas.

## Test d'audition dans le trouble du spectre de l'autisme : est-il superflu dans les pays à revenu faible et intermédiaire ?

### Résumé

**Contexte** : Dans les pays à revenu faible et intermédiaire où le système de soins de santé est fragilisé, le recours à des tests trop coûteux et probablement superflus pourrait être remplacé par un outil fiable, simple et plus instructif, permettant de s'attaquer au problème.

**Objectifs** : Examiner la pratique médicale en vigueur, qui consiste à mesurer les potentiels évoqués auditifs du tronc cérébral chez tous les enfants atteints d'un trouble du spectre de l'autisme (TSA), et évaluer la pertinence de ce test pour eux, ainsi que son applicabilité dans les pays à revenu faible et intermédiaire comme la Libye.

**Méthodes** : Nous avons passé en revue le dossier médical de tous les enfants atteints d'un TSA qui avaient consulté dans les cliniques de neurodéveloppement de l'Hôpital universitaire Al-Khadra à Tripoli (Libye) entre janvier 2010 et décembre 2014.

**Résultats** : Pour 71 des 2 368 enfants atteints d'un TSA, la famille s'inquiétait de leur audition et de leurs réactions aux bruits forts. Les potentiels évoqués auditifs du tronc cérébral ont confirmé que 26 de ces 71 enfants souffraient d'une surdité neurosensorielle.

**Conclusions** : Nous estimons que les potentiels évoqués auditifs du tronc cérébral sont superflus chez les enfants atteints d'un TSA sans signes cliniques évocateurs d'une déficience auditive et en l'absence d'inquiétudes de la part des parents

## اختبار السمع في اضطراب طيف التوحد: هل هو غير ضروري في البلدان المنخفضة والمتوسطة الدخل؟

عادل زقلام، سماح الكصيك

### الخلاصة

**الخلفية:** في البلدان المنخفضة والمتوسطة الدخل حيث نُظُم الرعاية الصحية الضعيفة، يمكن استخدام أداة موثوق بها، وبسيطة، وتوفر مزيداً من المعلومات للتعامل مع المشكلة بدلاً من إنفاق أموال على استقصاءات لا يمكن تحمُّل تكلفتها، وقد لا يكون ثمة داع لها غالباً.

**الأهداف:** دراسة الممارسة الطبية المُتبعة حالياً لقياس استجابة الجذع الدماغي السمعي لجميع الأطفال المصابين باضطراب طيف التوحد، وتقييم فائدة هذا الاختبار لهؤلاء الأطفال، وإمكانية تطبيقه في البلدان المنخفضة والمتوسطة الدخل، مثل ليبيا.

**طرق البحث:** لقد استعرضنا السجلات الطبية لجميع الأطفال المصابين باضطراب طيف التوحد الذين حضروا إلى عيادات النمو العصبي بمستشفى الخضراء التعليمي، في طرابلس، ليبيا، وذلك في الفترة من يناير/ كانون الثاني ٢٠١٠ وديسمبر/ كانون الأول ٢٠١٤.

**النتائج:** من بين ٢٣٦٨ طفلاً مصاباً باضطراب طيف التوحد، كانت أُسر ٧١ طفلاً منهم متخوفة بشأن حاسة السمع لدى أطفالها وردود أفعالهم تجاه الضوضاء الصاخبة. وقد أكدت نتائج اختبار الجذع الدماغي السمعي الذي أجري على هؤلاء الأطفال (٧١ طفلاً) أن ٢٦ طفلاً منهم كانوا يعانون من فقدان السمع الحسي العصبي.

**الاستنتاج:** نرى عدم ضرورة قياس استجابة الجذع الدماغي السمعي في الأطفال المصابين باضطراب طيف التوحد، ما لم توجد علامات سريرية تدل على ضعف السمع، وما لم يكن لدى الآباء مخاوف بشأن حاسة السمع لدى أبنائهم.

concernant leur audition.

## References

1. Fact file. 10 facts on mental health [website]. World Health Organization; 2017 (https://www.who.int/features/factfiles/mental_health/mental_health_facts/en/, accessed 8 August 2019).

2. Closing the gap in a generation. Health equity through action on the social determinants of health. Commission on Social Determinants of Health Final report. Geneva: World Health Organization; 2008 (https://apps.who.int/iris/bitstream/handle/10665/43943/9789241563703_eng.pdf;jsessionid=1EB988F2175579D786BEB3F6A4EF31FD?sequence=13, accessed 8 August2019).

3. Diagnostic and statistical manual of mental disorders. Fifth edition. Washington DC: American Psychiatric Association; 2013

4.   Zablotsky B, Black LI, Maenner MJ, Schieve LA, Blumberg SJ. Estimated prevalence of autism and other developmental disabilities following questionnaire changes in the 2014 National Health Interview Survey. Nat Health Stat Report. 2015 Nov 13;(87):1–20. PMID:26632847

5.   Zeglam AM, Maouna A. Is there a need for a focused health care service for children with autistic spectrum disorders? A keyhole look at this problem in Tripoli, Libya. Autism. 2012 Jul;16(4):337–9. https://doi.org/10.1177/1362361310393535

6.   Zeglam AM, Maouna AJ. Prevalence of autistic spectrum disorders in Tripoli, Libya: the need for more research and planned services. East Mediterr Health J. 2012 Feb;18(2):184–8. PMID:22571097

7.   Zeglam AM, Al-Bloushi H. Autism today in Libya: is it a tip of an iceberg? (A comparative study). Middle East J Fam Med. 2012 Sep;10(8):34–8.

8.   Libya health profile 2015. Cairo: World Health Organization Regional Office for the Eastern Mediterranean; 2015 (https://apps.who.int/iris/bitstream/handle/10665/254933/EMROPUB_2017_EN_19620.pdf?sequence=1&isAllowed=y, accessed 8 August 2019).

9.   Gallaudet Research Institute. Regional and national summary report of data from the 2009–2010 annual survey of deaf and hard of hearing children and youth. Washington, DC: Gallaudet University; 2010 (https://research.gallaudet.edu/Demographics/2010_National_Summary.pdf, accessed 8 August 2019).

10.  Szymanski CA, Brice PJ, Lam KH, Hotto SA. Deaf children with autism spectrum disorders. J Autism Dev Disord. 2012 Oct;42(10):2027–37. http://dx.doi.org/10.1007/s10803-012-1452-9 PMID:22290585

11.  Kogan MD, Blumberg SJ, Schieve LA, Boyle CA, Perrin JM, Ghandour RM. Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. Pediatrics 2009 Nov;24(5):1395–403. http://dx.doi.org/10.1542/peds.2009-1522 PMID:19805460

12.  CDC releases new data on autism spectrum disorders (ASDs) from multiple communities in the United States [website]. Atlanta: Centers for Disease Control and Prevention; 2014 (https://www.cdc.gov/media/pressrel/2007/r070208.htm, accessed 8 August 2019).

13.  Mandell DS, Novak MM, Zubritsky CD. Factors associated with age of diagnosis among children with autism spectrum disorders. Pediatrics, 2005 Dec;116(6):1480–6. http://dx.doi.org/10.1542/peds.2005-0185 PMID:16322174

14.  Roper L, Arnold P, Monteiro B. Co-occurrence of autism and deafness. Autism. 2003 Sep;7(3):245–53. http://dx.doi.org/10.1177/1362361303007003002 PMID:14516058

15.  Bonvillian J, Nelson N, Ryne J. Sign language and autism. J Autism Dev Disord. 1981 Mar;11(1):125–37. PMID:6927693

16.  Ruttenberg B, Gordon E. Evaluating the communication of the autistic child. J Speech Hearing Disord. 1967 Nov;32(4):314–24. PMID:6074890

17.  The World Health Report 2006: working together for health. Geneva: World Health Organization; 2006 (https://www.who.int/whr/2006/whr06_en.pdf?ua=1, accessed 8 August 2019).

18.  Berkelman R, Cassell G, Specter S, Hamburg M, Klugman K. The "Achilles heel" of global efforts to combat infectious diseases. Clin Infect Dis. 2006 May 15;42(10):1503–4. http://dx.doi.org/10.1086/504494 PMID:16619171

19.  Peeling R, McNerney R. Increasing access to diagnostics through technology transfer and local production. Geneva: World Health Organization; 2011 (https://www.who.int/phi/publications/Increasing_Access_to_Diagnostics_Through_Technology_Transfer.pdf?ua=1, accessed 8 August 2019).

20.  The Modified Checklist for Autism in Toddlers (M-CHAT) [website] (https://m-chat.org, accessed 8 August 2019).

21.  Le Couter A, Lord C, Rutter M. Autism Diagnostic Interview-Revised (ADI-R). Torrance, CA: WPS; 2003.

22.  Rosenhall U, Nordin V, Sandström M, Ahlsén G, Gillberg C. Autism and hearing loss. J Autism Dev Disord. 1999 Oct;29(5):349–57. PMID:10587881

23.  Jure R, Rapin I, Tuchman, RF. Hearing impaired autistic children. Dev Med Child Neurol. 1991 Dec;33(12):1062–72. PMID:1778343

24.  Levy SE, Giarelli E, Lee LC, Schieve LA, Kirby RS, Caniff C, et al. Autism spectrum disorder and co-occurring developmental, psychiatric, and medical conditions among children in multiple populations of the United States. J Dev Behav Pediatr. 2010 May;31(4):267–75. http://dx.doi.org/10.1097/DBP.0b013e3181d5d03b PMID:20431403

25.  Davis R, Stiegler L. Behavioral hearing assessment for children with autism. ASHA Leader. 2010 Apr;15(5):5–6.

# Prevalence and clinical characteristics of diabetes mellitus in Lebanon: a national survey

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## Abstract

**Background:** Diabetes mellitus in all its forms has been rapidly increasing worldwide, especially in the Eastern Mediterranean Region.

**Aims:** This national study aimed to assess the prevalence and clinical aspects of diabetes mellitus in Lebanon with special focus on type 1 (T1DM).

**Methods:** A national multistage, random household sample survey was conducted, using face-to-face interviews with 1 questionnaire per household. A total of 4500 households were selected from all areas based on a pre-existing sampling frame of the Lebanese population.

**Results:** The prevalence of previously diagnosed diabetes mellitus in the surveyed population of 17 832 persons (mean age ~36 years) was 7.95%. The prevalence of T1DM in particular was estimated at 0.1%, or almost 1% of all detected cases of diabetes mellitus. Most persons with diabetes mellitus reported obtaining their usual care from endocrinologists rather than primary healthcare physicians. Delayed performance of haemoglobin A1c test was reported in 25% of 1418 patients. Hypoglycaemic episodes recently occurred in 30% of patients; of whom, at least one third required medical attention, including hospital admission. Diagnosed complications were reported in 22% of cases, with retinopathy being the most common.

**Conclusions:** Prevalence of T1DM in this population was lower than international estimates. Diabetes mellitus management appears to be deficient, based on delays in standard control testing, hypoglycaemic episodes and diabetes mellitus-related complications. Coordination of diabetic care management should be devolved to primary healthcare physicians, who can keep track of the need for referral to various types of diabetes mellitus care.

Keywords: hypercholesterolaemia, hypertension, Middle East, noncommunicable diseases, type 1 diabetes.

## Introduction

Diabetes mellitus (DM) in all its forms has been rapidly increasing worldwide, with particularly higher peaks in the Eastern Mediterranean Region (1). Uncontrolled hyperglycaemia is responsible for a large spectrum of complications in end-stage organs, because of damage caused to vascular endothelia. Damage is maximized by earlier age of onset, delays in diagnosis and treatment, and comorbidity such as hypertension and dyslipidaemia (2). These characteristics have contributed to DM presenting as a pandemic of global dimensions, with major public health implications at all levels of health care.

Public health decision-makers in Lebanon remain largely unaware of the current magnitude of the disease and its complications. The national prevalence of DM in Lebanon has not been updated since 2009 (3), and at that time, the measured prevalence did not include age categories younger than 25 years, and identified all cases globally as type 2 DM (T2DM). In fact, the relative proportions of the two main subtypes, juvenile type 1 DM (T1DM) and maturity T2DM, are still unknown.

Data on T1DM remain scarce even though it is one of the most common endocrine and metabolic conditions in childhood. The prevalence of T1DM, its clinical characteristics, and geographical and demographic distribution are important epidemiological data that are necessary to plan proper preventive and curative strategies that will ensure better lives for children. Based on international assumptions, the relative proportion of T1DM in high-to-medium income countries such as Lebanon is estimated at < 9% of the overall prevalence of DM (4). The International Diabetes Federation (IDF) estimated the prevalence of diabetes in Lebanon in 2015 at 122 (100–152) per 1000, which assumes a T1DM prevalence in the general population of 12.2 (10.0–15.2) per 1000. Based on a total Lebanese population of 4 million, the total number of persons with T1DM should therefore be 48 000 (4). All these numbers are far from what is seen and reported by public health authorities, scientific societies and healthcare professionals in direct contact with persons with DM in Lebanon.

The gap between mathematical estimations derived from complex algorithms and the perceived clinical and epidemiological reality in Lebanon clearly indicates the importance of running a valid assessment of the current status of DM and its subtypes. The present national

household survey aimed to provide accurate national estimates that will close the epidemiological knowledge gap, estimating the relative prevalence of T1DM, and contributing to better projections of the public health burden in Lebanon.

The objectives of the present study were to: (1) determine the prevalence of previously diagnosed DM, and its two main subtypes; (2) determine the prevalence of previously diagnosed hypertension and hypercholesterolaemia; (3) describe the clinical characteristics of management of DM; and (4) describe coping with T1DM in the immediate social environment of affected children.

## Methods

### Study design and target population

This study targeted the entire population of Lebanese nationals of all ages. Sampling was carried out in all Lebanese administrative districts (mouhafazats).

### Sample size and sample selection

In each of the five mohafazats, an equal number of participants was selected, using the basic equation in random sampling:

$$N \geq [(Z_\alpha)^2 \, p(1-p)]/\delta^2 \times \text{(design effect)}$$

where $Z_\alpha$ = 1.96 for a tolerated error α = 0.05; p = estimated prevalence of diabetes in Lebanon (2009) = 8.5% (3); δ = degree of precision expected around the estimation of prevalence = 1%; and design effect = 1.5, to correct for loss of information in the multiple stages of the selection process.

Under these conditions, the minimum number of participants to be selected in each mohafazat was 4481. Given an average of 5 persons per household in Lebanon, a minimum number of 900 households was selected in each mohafazat, with a total of 4500 households in the 5 districts of the country. Beirut was considered with the addition of adjacent areas from Mount Lebanon, to become a single Greater Beirut area. The suburban regions added to Beirut shared socioeconomic and service situations more similar to the capital city than to the rest of Mount Lebanon.

Multistep, random cluster sampling was conducted within each subdistrict (caza) in each mohafazat, using the probability proportional to size approach, based on an existing sampling frame of the Lebanese population, to select a proportional number of households per caza. Households were randomly selected from within buildings, which had previously been selected from city/village blocks. In each household, an interview was conducted with respondents who volunteered to provide data on themselves and on absent household members including children, until full data were obtained for the entire household. Respondents had to be adult (age > 18 years) parents/guardians of minors in the household, to understand Arabic, and be free from any kind of cognitive impairment or difficulties to communicate.

### Questionnaire

The survey was conducted in face-to-face interviews using a specially designed questionnaire. The questionnaire was prepared in English, translated to Arabic and piloted for suitability of the questions. One questionnaire was completed for each household. The questionnaire was composed of 30 factual questions that required no validation, with skip patterns allowing the surveyor to move rapidly to details on DM if present. In case of non-response, the surveyors immediately replaced the household with the next on the list. Replacement was generally conducted within the same block to minimize any selection bias associated with refusal to participate.

### Variables

The outcome of interest was the prevalence of DM, as well as hypertension and hypercholesterolaemia. In each household, all members were listed by age and sex, and their current disease status recorded. The household crowding index was measured in persons/room as a proxy for socioeconomic status (5). The higher the crowding index was, the lower the socioeconomic status. The geographic location of the household was also entered. Disease status was based on whether a person had been formally diagnosed with DM, hypertension and/or hypercholesterolaemia. For the purposes of this survey, subtypes of DM were defined syndromically as follows: T1DM: any patient who started using insulin within the first year following diagnosis, providing diagnosis occurred before age 25 years (6); and T2DM: all other cases.

Following this initial listing, additional variables were explored specifically for persons with DM: (1) time since diagnosis of DM; (2) use of oral antidiabetic drugs, duration of DM and most frequent categories; (3) use of insulin treatment and its duration; (4) management of DM: disease control [last date of haemoglobin A1c (HbA1C) measurement, specialty of the treating physician (endocrinologist, general practitioner/family physician, others), and presence of medical coverage]; (5) disease severity: symptoms of hypoglycaemia experienced in the 4 weeks preceding the survey, level of intervention needed, and number of hospitalizations during the 12 months preceding the survey for conditions related to DM or its complications; and (6) for patients ≤ 18 years with DM: variables assessing the school's awareness of the patients' condition and response to the latest episode of hypoglycaemia.

### Statistical analysis

In the first part of the analysis, national weighted prevalence rates of DM and its 2 subtypes, and of hypertension and hypercholesterolaemia were calculated with their corresponding 95% confidence intervals (CIs). In the second part of the analysis, specific characteristics of DM were described in detail. The $\chi^2$ test was used to assess the significance of differences in the proportion of people with DM between geographical areas (Greater Beirut vs outside Greater Beirut). Data were analysed using SPSS version 23 and Stata version 13.

## Ethical considerations

The aim of the study was clearly presented to respondents at the time of their visit. They were assured of the privacy and confidentiality of their responses and informed that their data would be strictly used for scientific and public health planning purposes. Respondents were asked to sign a consent form to provide data anonymously about themselves and their household members before starting the questionnaire. They were explicitly informed that they had the right to skip any question and/or stop the interview at any time. There was no potential for harm expected in this study. The study was reviewed and obtained ethical clearance from the standing Ethics Committee of the Saint-Joseph University, Campus of Health Sciences, Beirut, Lebanon (reference number: USJ-2016-98).

## Results

Questionnaires were completed by 4500 households across Lebanon (Table 1). In more than two thirds of households, the main respondent was one of the parents. The average number of persons per household was 4, ranging from 1 (in 6% of households) to 15 (only 1 household). The mean crowding index was 1.16 persons/room (standard deviation 0.64). DM was reported in 29% of surveyed households, hypertension in 31% and hypercholesterolaemia in 25%.

The surveyed households provided data on 17 832 persons of various ages (Table 2). Mean age was 35.9 (20.4) years, with almost equal gender distribution. Participants from the metropolitan area of Greater Beirut comprised 27% of the sample. Previous diagnosis of DM was reported by 1418 persons, putting the estimated prevalence at 7.95% (95% CI: 7.55–8.35). Moreover, 1610 persons were receiving treatment for hypertension, and 1314 for hypercholesterolaemia.

**Table 1 Characteristics of surveyed households (n = 4500)**

| Variables | n (%) |
|---|---|
| Mean no. of residents | 3.96 (SD1.77) |
| Households with only 1 person | 278 (6.2%) |
| No. of persons in household | 1–15 |
| Mean household crowding (persons/room)[a] | 1.16 (SD 0.64) |
| Range | 0.1–7 |
| *Geographic distribution (n, %)* | |
| Greater Beirut | 1320 (29.3%) |
| Mount Lebanon | 950 (21.1%) |
| North Lebanon | 920 (20.4%) |
| South Lebanon | 750 (16.7%) |
| Bekaa | 560 (12.5%) |
| *Categories of household respondents* | |
| Fathers | 1670 (37.1%) |
| Mothers | 1626 (36.1%) |
| Others | 1204 (26.8%) |
| *Household prevalence of selected diseases* | |
| Diabetes | 1313 (29.2%) |
| Hypertension | 1406 (31.2%) |
| Hypercholesterolaemia | 1131 (25.1%) |

[a]Higher crowding indicates lower socioeconomic status. SD = standard deviation.

Thus, the prevalence of hypertension was 9.0% and that of hypercholesterolaemia was 7.4%.

The mean age of 1418 persons with DM at the time of survey was 60.3 (13.0) years, with around 7% of patients aged ≤ 40 years (Table 3). There was a higher proportion of males in this group. The distribution of DM prevalence by age groups is shown in Figure 1. The mean age at diagnosis was 49.4 (15.9) years, whereas the

**Figure 1 Prevalence of diabetes by age groups in Lebanon (2016) (n = 17 832)**
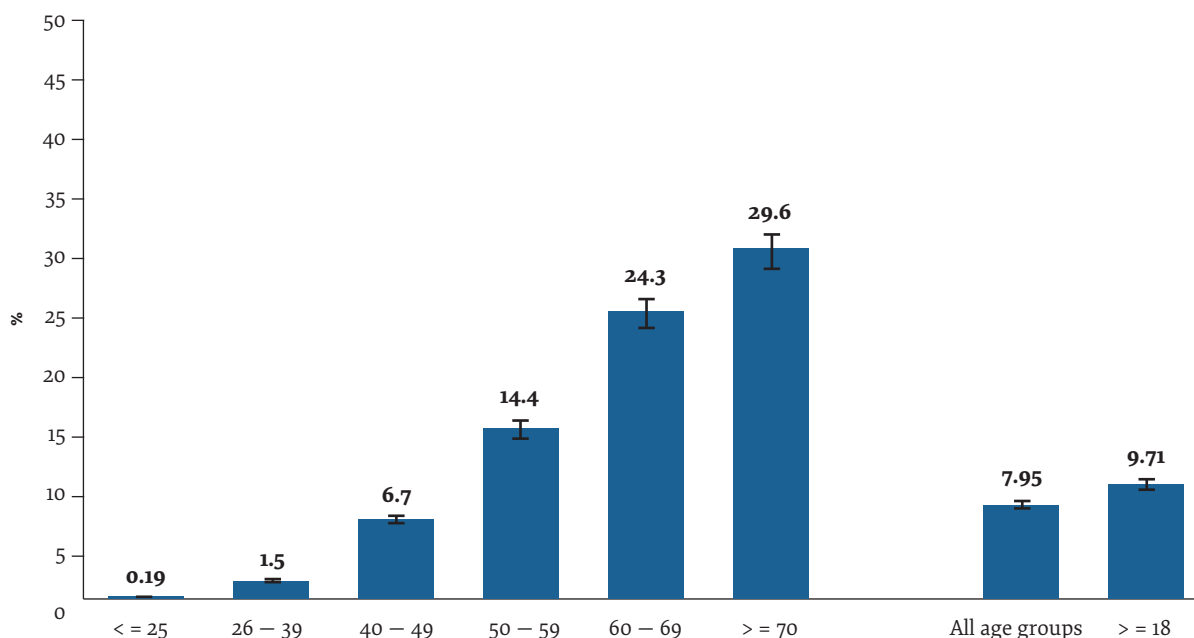
**Table 2 Sociodemographic characteristics of the selected sample and disease prevalence rates (n = 17 832 Lebanese)**

| Variables | n (%) |
|---|---|
| Mean age, years (SD) | 35.9 (20.4) |
| **Sex (n, %)** | |
| Male | 8937 (50.1%) |
| Female | 8895 (49.9%) |
| **Geographic distribution (n, %)** | |
| Greater Beirut (urban/suburban) | 4844 (27.2%) |
| Elsewhere (small towns/rural) | 12 988 (72.8%) |
| **Prevalence of selected diseases (95% CI)** | |
| Diabetes | 7.95 (7.55–8.35) |
| Hypertension | 9.03 (8.61–9.45) |
| Hypercholesterolaemia | 7.37 (6.99–7.75) |

CI = confidence interval; SD = standard deviation.

**Table 3 Characteristics of the sample of persons with diabetes mellitus (n = 1418)[a]**

| Variables | n (%) |
|---|---|
| **Sociodemographic characteristics** | |
| Mean age, years (SD) | 60.3 (13.0) |
| ≤ 40 years | 95 (6.7%) |
| **Sex (n, %)** | |
| Male | 786 (55.4%) |
| Female | 632 (44.6%) |
| Mean age at diagnosis (SD) | 49.4 (15.9) |
| ≤ 25 years (n, %) | 63 (4.5%) |
| ≤ 10 years (n, %) | 17 (1.2%) |
| **Clinical characteristics** | |
| Current use of oral antidiabetic drugs | 1289 (90.9%) |
| Biguanides only | 845 (65.6%) |
| Sulfonylureas only | 282 (21.9%) |
| Biguanides in combination with other types | 255 (19.8%) |
| Others | 70 (5.4%) |
| Current insulin use | 256 (18.1%) |
| **Specialty of the physician most involved in follow-up** | |
| Endocrinologist | 973 (71.1%) |
| General practitioner or family physician | 375 (27.4%) |
| Cardiologist | 20 (1.5%) |
| **Last haemoglobin A1C test** | |
| Within last 6 months | 988 (75.7%) |
| Between 6 months and 1 year | 165 (12.6%) |
| > 1 year | 142 (10.8%) |
| > 2 years | 10 (0.8%) |
| **Recent episodes of hypoglycaemia[b]** | |
| None | 1034 (71.7%) |
| Episodes requiring no help | 187 (13.5%) |
| Episodes requiring medical attention | 115 (8.3%) |
| Episodes requiring hospitalization | 48 (3.5%) |
| Prevalence of complications | 321 (22.6%) |
| **Types of reported complications[c]** | |
| Retinopathy | 148 (10.4%) |
| Coronary heart disease | 88 (6.2%) |
| Peripheral artery disease | 58 (4.1%) |
| Ulcer of lower limb | 41 (2.9%) |
| Stroke | 29 (2.0%) |
| Myocardial infarction | 27 (1.9%) |
| Nephropathy | 22 (1.6%) |
| Amputation of the lower limb | 16 (1.1%) |

[a]18 patients are believed to be patients with type 1 diabetes mellitus.

[b]During the previous 4 weeks preceding the survey.

[c]Not mutually exclusive.

mean duration between time of diagnosis and the survey was 10.9 (9.9) years. Only 18 patients started using insulin within the first year following diagnosis, which occurred before age 25 years, representing 1.3% of the total diabetes caseload. Based on the figures, the prevalence of T1DM was estimated at 0.1% (95% CI: 0.05–0.15). The prevalence of diabetes was significantly higher in Greater Beirut (9.1%) compared to elsewhere (7.3%) (*P* < 0.001), but prevalence did not vary by households' socioeconomic status (data not shown).

One hundred and twenty-nine (9.1%) patients were not using oral antidiabetic drugs at the time of survey (Table 3). The predominant oral drug classes used alone or in combination were biguanides in 1101 cases (85.4%), followed by sulfonylureas in 353 (27.4%). The use of insulin therapy was reported by 256 (18.1%) patients. Fifty-two (3.7%) patients were using neither oral antidiabetic drugs nor insulin at the time of survey. Usual care for DM was obtained mostly from endocrinologists for 973 patients (71.1%). A total of 988 (75.7%) patients had obtained an HbA1C test ≤ 6 months prior to the survey, in concordance with standard international guidelines. The occurrence of at least one hypoglycaemic episode during the 4 weeks preceding the survey was reported in 350 patients (25.3%); of whom, 48 (3.5%) required hospitalization. Overall, 199 patients (14.0%) had been admitted to hospital at least once during the 12 months preceding the survey, with a mean 2.0 (1.8) hospitalizations. Three hundred and twenty-one (22.6%) patients were reported to have DM-related complications at the time of survey, and the most frequent was retinopathy (n = 148; 10.4%).

## Discussion

This national survey conducted in 2016 across Lebanon revealed a previously diagnosed DM prevalence of about 8%. Previous studies had implied that up to 50% of actual persons with DM did not know their disease status (7). A recent study of the prevalence of DM among the adult population residing in the Greater Beirut area reported a prevalence of 12.8% of self-reported DM, 15% of definite DM and 18% of probable DM using combined measurement tools (8). In our study, among the same age group (≥ 18 years), self-reported DM was estimated at 9.7% at the

national level, stratified into 10.8% and 9.3% in the Greater Beirut area and outside it, respectively. Taking into consideration the proportion of undiagnosed DM would put the overall national level of diabetes at around 11%, as previously reported by IDF (4). Most importantly, for the first time in Lebanon, an attempt was made to disaggregate figures for the 2 most frequent clinical types of DM. The prevalence of T1DM, estimated at 0.1%, is reasonable despite being lower than international estimates. In fact, T1DM can rarely go undiagnosed, leading no room for prevalence underestimation. The ratio of T1DM/T2DM is usually higher in developed nations. The IDF 2015 atlas suggests that the ratio is nearer to 1: 9 (4). That study recognized that the ratio had not been assessed clearly for middle-to-low-income countries. While the lower ratio found in Lebanon may be accurate, one should discuss the possible effects of potential biases. In particular, poor management of T1DM in early infancy may lead to premature mortality, thus affecting the prevalence. However, there are no current indications that such may be the case in Lebanon, where infant and child mortality rates have been declining steadily for several decades (9).

As in all national surveys, and despite the best possible randomization, our sample was biased towards lower socioeconomic status. In low-to-middle-income countries, the population with higher socioeconomic status tends to display higher incidence of DM. Therefore, this bias should add to the underestimation of T2DM prevalence. However, in countries in rapid social transition such as Lebanon, the effect of the socioeconomic gradient tends to be less dramatic. In such transitional populations, the higher incidence of DM tends to slowly shift towards lower socioeconomic status. The most accurate and efficient approach to evaluating the real magnitude of DM in a given population remains the establishment of valid registries, with disaggregated data entry for each type of DM, including sociodemographic determinants.

The majority of people with DM identified in our survey reported obtaining their usual care from endocrinologists rather than family or primary healthcare physicians. This situation may have a negative impact on the optimal management of the disease, as specialist visits may sometimes cost 5–6 times more than those to a primary healthcare physician. The cost can become an obstacle, especially since at least 50% of the population in Lebanon has to pay for outpatient health services. This leads to a decrease in regular follow-up visits, and therefore, poor disease  management. Most disturbing

is the occurrence of diagnosed complications in 22% of patients, with retinopathy being reported in almost half of cases. This prevalence was higher that the global figure, estimated at around 35% of persons with DM (10). In the present study, nephropathy was reported in 6.9% of persons with DM compared to 5.5% and 6.74% in other studies from the Republic of Korea and Spain, respectively (11,12). Macrovascular complications seem also to be frequent in this population, similar to the global estimated prevalence of cardiovascular complications at 5–36% (13). These figures could be an underestimation of the real situation of diabetic complications for 2 reasons: having a family member reporting on all the family in the household; and the probability of having an undiagnosed complication at its early stages. Clearly, improvement in diabetes care is currently needed in Lebanon.

A special focus of this survey was to obtain information on coping with T1DM. The assessment of T1DM prevalence was indirectly obtained, using a case definition based on age at diagnosis and first-year treatment using insulin. A total of 18 patients corresponded to the case definition, most of whom were already adults at the time of the survey. Only 2 patients were still children, and that small number obviously could not provide a clear view of daily coping strategies of young T1DM patients.

The current analysis leads to several recommendations with implications for the therapeutic and public health aspects of DM in Lebanon: (1) given the limitations of our study, there is a clear need to start a National Registry that would allow for routine assessment of the incidence, prevalence, determinants and natural history of DM; (2) the relatively low self-reported prevalence highlights the need for continued opportunistic screening campaigns, especially in more rural areas where the figures were significantly lower than in the Greater Beirut metropolitan area; and (3) management of DM should be devolved to primary healthcare physicians, who can act as coordinators of all the various aspects of diabetes care, including regular referrals to endocrinologists as well as to other specialists with important roles in preventing complications.

**Competing interests:** None declared.

## Prévalence et caractéristiques cliniques du diabète au Liban : enquête nationale

### Résumé

**Contexte** : Le nombre des cas du diabète, sous toutes ses formes, a augmenté rapidement dans le monde entier, et en particulier dans la Région de la Méditerranée orientale.

**Objectifs** : Cette enquête nationale visait à évaluer la prévalence et les caractéristiques cliniques du diabète sucré au Liban, en mettant l'accent sur le diabète de type 1.

**Méthodes** : Une enquête nationale par sondage à plusieurs degrés a été menée auprès des ménages sélectionnés de manière aléatoire utilisant des entretiens en présentiel et plus particulièrement.  Au total, 4 500 ménages ont été sélectionnés dans toutes les régions à partir d'un cadre d'echantillonnage de la population libanaise.

**Résultats** : La prévalence d'un diabète déjà diagnostiqué parmi les 17 832 personnes interrogées (âge moyen de 36 ans) était de 7,95 %. La prévalence du diabète de type 1 en particulier a été estimée à 0,1 %, soit près de 1 % de tous les cas de diabète détectés. La plupart des personnes souffrant de diabète ont indiqué être habituellement suivies par un endocrinologue plutôt que par un médecin de soins de santé primaires. Un retard dans la réalisation du test d'hémoglobine A1c a été signalé chez 25 % des 1 418 patients. Des épisodes d'hypoglycémie sont récemment survenus chez 30 % des patients, parmi lesquels un tiers au moins nécessitaient des soins médicaux, y compris une admission à l'hôpital. Des complications ont été diagnostiquées dans 22 % des cas, la rétinopathie étant la plus courante.

**Conclusions** : La prévalence du diabète de type 1 au sein de cette population était inférieure aux estimations internationales. La prise en charge du diabète semble être insuffisante en raison des retards concernant la réalisation des tests de suivi ainsi que des épisodes d'hypoglycémie et des complications liées à la maladie. La coordination de la gestion des soins aux diabétiques devrait être confiée aux médecins de soins de santé primaires, qui peuvent répondre aux besoins des patients en les orientant vers les différents types de soins.

## انتشار داء السُّكَّريّ في لبنان وخصائصه: مسح وطني

إبراهيم بوعرم، سليم أديب

### الخلاصة

**الخلفية:** يتزايد انتشار داء السُّكَّريّ بكل صوره سريعاً في جميع أنحاء العالم، خاصةً في إقليم شرق المتوسط.

**الأهداف:** تمثَّلَ الهدف من هذه الدراسة الوطنية في تقييم انتشار داء السُّكَّريّ وأعراضه السريرية في لبنان، مع التركيز خاصةً على النمط ١ من داء السُّكَّريّ.

**طرق البحث:** أُجري مسح وطني مُتعدد المراحل على عينة عشوائية من الأسر من خلال عقد مقابلات وجهاً لوجه باستخدام استبيان واحد فقط لكل أسرة. وبلغ إجمالي عدد الأسر المُختارة ٤٥٠٠ أسرةٍ من جميع المناطق، استناداً إلى إطار موجود سلفاً لأخذ العينات من السكان اللبنانيين.

**النتائج:** بلغت نسبة انتشار داء السُّكَّريّ الذي شُخِّصَ سابقاً في السكان الذين شملهم المسح والبالغ عددهم ١٧٨٣٢ شخصاً (متوسط العمر هو ٣٦ عاماً تقريباً) ٩٥, ٧٪. وقُدر انتِشار اَلنمط ١ من داء السُّكَّريّ بحوالي ١, ٠٪، أو ١٪ تقريباً من جميع الحالات التي اكتُشفت إصابتها بداء السُّكَّريّ. وأفاد معظم المصابين بداء السُّكَّريّ بأنهم يحصلون على خدمات الرعاية المعتادة من أطباء الغدد الصماء، لا من أطباء الرعاية الصحية الأولية. وأبلغ عن تدنِّي أداء اختبار HbA1C في ٢٥٪ من ١٤١٨ مريضاً. وحدثت مؤخراً نوبات انخفاض السكر في الدَّم لحوالي ٣٠٪ من المرضى؛ واحتاج ثلثهم على الأقل رعاية طبية استلزمت دخول المستشفى. وأبلغ عن وجود مضاعفات لدى ٢٢٪ من الحالات، وكان أكثرها شيوعاً هو اعْتِلال الشَّبَكِيَّة.

**الاستنتاجات:** كان انتشار النمط ١ من داء السُّكَّريّ بين هذه الفئة السكانية أقل من التقديرات الدولية. ويبدو أن هناك قصوراً في علاج داء السُّكَّريّ بسبب التأخر في إجراء الفحوصات الدورية، ونوبات نقص السكر في الدم، والمضاعفات المرتبطة بداء السُّكَّريّ. وينبغي أن تؤول مسؤولية التنسيق بشأن التدبير العلاجي لداء السُّكَّريّ إلى أطباء الرعاية الصحية الأولية، الذين يمكنهم متابعة الحاجة بالإضافة إلى الإحالة للحصول على أنواع مختلفة من خدمات الرعاية الصحية لداء السُّكَّريّ.

### References

1. Abuyassin B, Laher I. Diabetes epidemic sweeping the Arab world. World J Diabetes. 2016 Apr 25; 7(8):165–74. http://dx.doi.org/10.4239/wjd.v7.i8.165 PMID:27114755

2. Fowler MJ. Microvascular and macrovascular complications of diabetes. Clin Diabetes. 2008 Apr; 26(2):77–82. http://dx.doi.org/10.2337/diaclin.26.2.77

3. Costanian C, Bennett K, Hwalla N, Assaad S, Sibai AM. Prevalence, correlates and management of type 2 diabetes mellitus in Lebanon: findings from a national population-based study. Diabetes Res Clin Pract. 2014 Sep;105(3):408–15. http://dx.doi.org/10.1016/j.diabres.2014.06.005 PMID:25005850

4.  Diabetes atlas 2015 (7th edition). Brussels: International Diabetes Federation; 2015.

5.  Melki IS, Beydoun HA, Khogali M, Tamim H, Yunis KA. Household crowding index: a correlate of socioeconomic status and inter-pregnancy spacing in an urban setting. J Epidemiol Community Health 2004 Jun;58(6):476–80. http://dx.doi.org/10.1136/jech.2003.012690 PMID:15143115

6.  American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2010 Jan; 33(Suppl 1):S62–9. http://dx.doi.org/10.2337/dc10-S062 PMID:20042775

7.  Sibai AM and Hwalla N. WHO STEPS chronic disease risk factor surveillance: data book for Lebanon, 2009. American University of Beirut; 2010 (https://www.who.int/ncds/surveillance/steps/2008_STEPS_Lebanon.pdf, accessed 12 June 2019).

8.  Nasrallah MP, Nakhoul NF, Nasreddine L, Mouneimne Y, Abiad MG, Ismaeel H, et al. Prevalence of diabetes in Greater Beirut area: worsening over time. Endocr Pract. 2017 Sep;23(9):1091–100. PMID:28683240

9.  El Kak F, Ammar W. Maternal mortality in Lebanon: a story of success. Beirut: Ministry of Public Health; 2016.

10. Yau JW, Rogers SL, Kawasaki R, Lamoureux EL, Kowalski JW, Bek T, et al. Global prevalence and major risk factors of diabetic retinopathy. Diabetes Care. 2012 Mar;35(3):556–64. http://dx.doi.org/10.2337/dc11-1909 PMID:22301125

11. Lee WJ, Sobrin L, Lee MJ, Kang MH, Seong M, Cho H. The relationship between diabetic retinopathy and diabetic nephropathy in a population-based study in Korea (KNHANES V-2, 3). Invest Ophthalmol Vis Sci. 2014 Sep 9;55(10):6547–53. http://dx.doi.org/10.1167/iovs.14-15001 PMID:25205863

12. Pedro RA, Ramon SA, Marc BB, Juan FB, Isabel MM. Prevalence and relationship between diabetic retinopathy and nephropathy, and its risk factors in the North-East of Spain, a population-based study. Ophthalmic Epidemiol. 2010 Aug;17(4):251–65. http://dx.doi.org/10.3109/09286586.2010.498661 PMID:20642348

13. van Dieren S, Beulens JW, van der Schouw YT, Grobbee DE, Neal B. The global burden of diabetes and its complitions: an emerging pandemic. Eur J Cardiovasc Prev Rehabil. 2010 May;17(Suppl 1):S3–8. http://dx.doi.org/10.1097/01.hjr.0000368191.86614.5a PMID:20489418

# Exposure to violence and its relationship to mental health among young people in Palestine

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## Abstract

**Background:** Exposure to violence is a significant risk factor for the development of psychopathology in young people. Research on the mental health consequences of violence exposure in youth has focused mostly on post-traumatic stress disorder, however, the association with depression and anxiety has also been established. As a result of the longstanding Israeli–Palestinian conflict, young Palestinians are vulnerable to exposure to various types of violence.

**Aims:** We examined psychiatric symptomatology and its relationship to direct and indirect forms of violence exposure.

**Methods:** A representative household survey of 2481 Palestinian youth was conducted in 2014. Self-report measures included psychiatric symptomatology (global distress, depression, anxiety) and violence exposure (personal victimization, witnessed, vicariously heard about).

**Results:** The proportion of elevated symptoms of global distress (46%), depression (55%), and (37%) anxiety was high; 47% had been a personal victim, 71% had witnessed violence, and 69% had heard about violence experienced by someone close to them. In logistic regression analysis, controlling for other bivariate correlates, exposure to any violence event, as well as any of the 3 types of violence exposure, were independently associated with each of the 3 measures of elevated psychiatric symptomatology. Females were 4 times more likely to report elevated psychopathology, despite being less likely to experience each type of violence.

**Conclusions:** These findings suggest the need for services that cater to the mental health needs of youth in settings of high violence exposure, and that gender-specific strategies may be useful.

Keywords: depression, anxiety, violence exposure, youth, Palestine

## Introduction

Exposure to violence is a significant risk factor for the development of psychopathology in children and youth as it has been found to be related to aggression, academic difficulties and symptoms of post-traumatic stress, anxiety and depression (1). Protracted exposure to violence may lead young people to feel as though their safety and that of family and friends is constantly jeopardized (2). Violence exposure can take the form of personal victimization, as a witness to violence, or vicariously hearing about violence from others. While research on nonpolitical violence often makes these distinctions in considering impacts of violence on mental health (1), most research on political conflict has considered only aggregated violence exposure (3). Some research suggests that direct victimization has more detrimental effects on mental health than does the more prevalent witnessing of violence (4,5), but there are nonetheless substantial negative effects of witnessing violence (6).

Research on the mental health consequences of violence exposure in youth, including in the Middle East (7), has focused mostly on post-traumatic stress disorder; however, the associations of violence exposure with depression and anxiety have also been established in the Region, including for the Palestinian territories (8). In a study of nearly 2000 14–17-year-olds in the West Bank and Gaza, children with greater exposure to conflict-related violence had greater post-traumatic distress and more somatic complaints, with girls having more somatic complaints than boys (9). In a study in Gaza that used ratings from parents and teachers of 350 kindergarten students, psychological resilience was negatively associated with exposure to traumatic events (10).

Other studies have found no or only modest correlations between violence exposure and psychiatric symptomatology in youth [see Barber & Schluterman (11) for a review], which suggests the potential for resilience among youth exposed to ongoing violence. The risk and protective factor model of developmental psychopathology (12) highlights ecological and individual factors that either place young people at risk for psychopathology or promote resilience in the face of challenging circumstances. Protective factors help youth cope with the stress of ongoing violence by supporting

self-worth, security of social relations, and sense of control (*13*). Gender differences have also been observed, with females often being exposed to less violence overall compared with males (*14*), but reporting more symptoms of psychological distress, in particular internalized symptoms (e.g. depression) (*15*).

Most studies of adolescents or youth in the Middle East have used school-based samples, which are limited by their focus on school-age children and exclusion of those no longer in school (and thus perhaps more vulnerable). In the present study, we used data from a unique representative household survey of Palestinian youth aged 15–24 years in the West Bank and East Jerusalem to examine the proportion of elevated psychiatric symptomatology, its relationship to various forms of violence exposure (personal victimization, witnessed, vicariously heard about), and identification of variables that may serve either to facilitate psychological resilience or exacerbate the risk of mental health problems.

The longstanding Israeli–Palestinian conflict has eluded resolution for decades, with severe negative implications for the well-being of Palestinian youth and others. While sustained large scale conflict breaks out only periodically, Palestinians in the West Bank, East Jerusalem, and Gaza face continuous risks to physical security and economic well-being. For residents of the West Bank, Israeli occupation has meant the ongoing threat of arrest, beatings, and in some instances home destruction. An ever-changing system of checkpoints and road closures significantly limits the physical mobility of Palestinians across the West Bank (*16*). Political demonstrations against the Occupation are a recurrent aspect of the conflict. Abusive treatment by the Palestinian Authority is also frequently reported (*17*). As a result, young Palestinians in the West Bank (as well as East Jerusalem) are vulnerable to exposure to various types of violence as well as to indirect conflict-related stressors such as economic hardship and constraints to mobility. It is important to understand the relation of these factors to mental health.

## Methods

### Study design

Details of the sampling and survey procedures are provided in a previous paper (*18*). Briefly, this cross-sectional study drew on the 2007 census to obtain a representative sample of youth aged 15–24 years living in the West Bank and East Jerusalem. A stratified 2-stage random sample was obtained in 208 clusters in urban, rural, and refugee camp locations for a total of 2481 youth, almost equally divided among males and females. The objective of the main study was to examine proportion and patterns of health risk behaviours in the context of exposure to trauma and violence.

Recruitment and data collection was carried out in April–July 2014. For minors (under 18 years), verbal

parental informed consent was obtained to conduct the interview. Separate verbal consent was obtained from all youth. Oral rather than written consent was deemed appropriate to the survey content and environment as participants could provide sensitive information without a written record that could potentially identify them. A range of other precautions were taken to ensure participant confidentiality and anonymity. For example, interviewers were strictly instructed to ensure that the youth interview was carried out in a private room or other private area. Female youth were interviewed by females and male youth by males. The study procedures were approved by RAND's Human Subjects Protection Committee. Refusal to participate by parents/household head or youth was low, with 89% of selected participants granting consent to be interviewed.

### Measures

The survey measures were administered in Arabic. Survey items were translated from English to Arabic using standard translation/back-translation methodology. All measures were developed by the study team unless otherwise noted or attribution is cited, and piloted prior to use with the study sample.

Demographic and background characteristics included sex, age, residence (urban, rural, refugee camp), work status, refugee status, school attendance, relationship status, religiosity, and whether or not the mother and father of the interviewee were living. Household resources were captured through ownership of various consumer durables such as a car, television and microwave which were used in a factor analysis to create a household wealth index (*19*), with mean zero and standard deviation 1.0.

Mental health was assessed with the 25-item Hopkins Symptoms Checklist (HSCL-25) (*20*), which is comprised of subscales measuring anxiety and depression (10 and 15 items respectively); the total 25-item scale measures global distress. The HSCL-25 has high internal reliability (Cronbach's alpha = 0.95) and 2-factor structure (*21*). Response options for each item range from 0 "not at all" to 3 "extremely"; responses within each of the 2 subscales, as well as the total scale, were summed and divided by the number of answered items to generate scores for depression, anxiety and global distress. Scores greater than 1.75 on each subscale (or total score) represent elevated symptomatology (*22*).

Exposure to violence was measured with a list of 11 events (Table 1), categorized into 3 types of violence exposure: personally experienced violence (5 events: e.g. beaten up or physically assaulted by soldiers or police, shot by rubber/plastic or real bullets, imprisoned or held by police or other authority); witnessed violence (4 events: e.g. witnessed shooting of close relative or friend, witnessed close relative's/friend's/neighbour's house closure or demolition); and vicarious or heard about violence (2 events: e.g. had a close relative or friend who was killed). Each item elicited a yes/no response as to whether the event was experienced, and if yes, the age

**Table 1 Distribution of demographic, mental health and violence exposure characteristics among the sample of Palestinian youth aged 15–24 years, 2014**

| Characteristic | Total (*n* = 2481) | Males (*n* = 1241) | Females (*n* = 240) | P-value |
|---|---|---|---|---|
| *Demographic and background characteristics* | | | | |
| Mean age (years) | 19.1 | 18.9 | 19.2 | 0.002 |
| Refugee (%) | 26.0 | 25.4 | 26.5 | 0.518 |
| Live in rural location (%) | 26.9 | 26.9 | 26.9 | 0.989 |
| Currently attending school (%) | 63.0 | 60.2 | 64.8 | 0.020 |
| Currently working (%) | 18.5 | 31.0 | 6.0 | < 0.001 |
| Wealth (asset) index (%) | 0.000 | 0.126 | −0.127 | < 0.001 |
| Married or engaged (%) | 17.0 | 4.2 | 29.8 | < 0.001 |
| Very religious (%) | 20.0 | 21.4 | 18.0 | 0.034 |
| Father is alive (%) | 93.7 | 94.0 | 93.4 | 0.505 |
| Mother is alive (%) | 98.5 | 99.1 | 97.8 | 0.009 |
| Has someone to turn to for support (%) | 83.0 | 82.4 | 83.8 | 0.228 |
| Chance of having a good job by age 30 (%) | 48.3 | 54.7 | 41.9 | < 0.001 |
| Currently using tobacco (%) | 40.9 | 55.8 | 26.0 | < 0.001 |
| Has ever used alcohol (%) | 11 | 13.8 | 7.3 | < 0.001 |
| Has attended more than 1 political demonstration or protest (%) | 25 | 29.7 | 20.7 | < 0.001 |
| *Mental health* | | | | |
| Global distress mean | 1.79 | 1.65 | 1.93 | < 0.001 |
| Elevated global distress (%) | 45.7 | 33.2 | 58.2 | < 0.001 |
| Depression mean | 1.88 | 1.73 | 2.02 | < 0.001 |
| Elevated depression (%) | 55.2 | 43.1 | 67.3 | < 0.001 |
| Anxiety mean | 1.67 | 1.54 | 1.80 | < 0.001 |
| Elevated anxiety (%) | 37.0 | 26.5 | 47.7 | < 0.001 |
| *Violence exposure* | | | | |
| Sum of events experienced in lifetime | 2.90 | 3.42 | 2.33 | < 0.001 |
| Had any personal victimization events[a] (%) | 46.7 | 61.6 | 31.9 | < 0.001 |
| Had any witnessed violence events[b] (%) | 70.8 | 78.9 | 62.8 | < 0.001 |
| Had any vicarious violence events[c] (%) | 68.9 | 71.4 | 66.5 | 0.007 |

[a]*Share reporting "yes" to any of 5 events: been beaten up or physically assaulted, though not by police or soldiers; physically assaulted by soldiers or police; shot by rubber/plastic or real bullets; imprisoned or held by police or other authority; had house or family home closed or demolished by Israelis or others.*

[b]*Share reporting "yes" to any of 4 events: directly witnessed beating of close relative; directly witnessed killing of close relative or friend; witnessed shooting of close relative or friend by rubber/plastic or real bullets; directly witnessed a close relative/friend's/neighbours' house closure or demolition*

[c]*Share reporting "yes" to any of 2 events: had a close relative or friend who was killed, though you did not witness it; had a close relative who was imprisoned or held.*

at which it was last experienced was recorded. For each of the 3 violence types, as well as the scale as a whole, a dichotomous variable was created to represent whether any events of that type had been experienced.

The assessment also covered psychosocial characteristics. Social support was measured with a single yes/no item, "If you need help or have a problem or question about anything, is there a specific person that you can go to for help or support or an answer to the question"? Future outlook was measured by respondents' estimation of "the percent chance (0 to 100%) that you will have a good job by the time you are 30 years of age." Fatalism was measured with a 6-item scale adapted from a scale developed by Esparza (23), which has demonstrated good internal reliability (Cronbach's alpha = 0.76), test–retest reliability (*r* = 0.71), and construct

validity. Respondents were asked to indicate their level of agreement with statements (e.g. What happens to me in the future mostly depends on me.) on a scale of 1 "strongly disagree" to 4 "strongly agree"; items framed against fatalism were reverse scored, and then the mean item score was calculated such that higher scores represent greater fatalism. To assess substance use, respondents were asked if they currently use tobacco (cigarettes and waterpipe) or use alcohol, and if they have ever taken an alcoholic drink (all using a yes/no format). Political activism was assessed by asking participants if they had ever attended a political demonstration, and if so, how many times in their lifetime. A binary variable was created to represent whether or not the participant was politically active, defined as having attended at least 2 demonstrations.

**Table 2 Bivariate correlates of elevated symptoms of global distress, depression and anxiety among the sample of Palestinian youth (n = 2481) aged 15–24 years, 2014**

| Variable | Elevated global distress symptoms (%) | | Elevated depression symptoms (%) | | Elevated anxiety symptoms (%) | |
|---|---|---|---|---|---|---|
| | No | Yes | No | Yes | No | Yes |
| Being female | 38.4*** | 63.6*** | 36.5*** | 60.9*** | 41.5*** | 64.3*** |
| Age | 18.7*** | 19.4*** | 18.7*** | 19.4*** | 18.9*** | 19.3*** |
| Refugee | 25.3 | 26.7 | 24.1 | 27.4 | 25.8 | 26.1 |
| Live in rural location | 70.1 | 71.7 | 69.1 | 72.2 | 70.1 | 72.1 |
| Currently attending school | 65.0** | 59.5** | 65.7** | 59.9** | 64.3* | 59.5* |
| Currently working | 19.9* | 16.9* | 20.1 | 17.3 | 20.2** | 15.7** |
| Wealth (asset) index | 0.005 | −0.005 | 0.011 | −0.009 | 0.011 | −0.018 |
| Married or engaged | 13.8*** | 20.8*** | 14.2** | 19.3** | 14.5*** | 21.4*** |
| Very religious | 20.8 | 18.4 | 21.4* | 18.3* | 21.0* | 17.4* |
| Father is alive | 95.6*** | 91.5*** | 95.6** | 92.2** | 95.2*** | 91.3*** |
| Mother is alive | 99.3*** | 97.5*** | 99.2** | 97.9** | 99.2*** | 97.3*** |
| Has someone to turn to for support | 83.4 | 82.8 | 82.8 | 83.4 | 16.9 | 16.7 |
| Fatalism | 2.00*** | 2.08*** | 1.98*** | 2.08*** | 2.01** | 2.08** |
| Chance of having a good job by age 30 years | 51.1*** | 44.9*** | 50.9*** | 46.2*** | 50.4*** | 44.7*** |
| Currently using tobacco | 73.4 | 75.0 | 74.2 | 74.1 | 73.0 | 76.1 |
| Has ever used alcohol | 7.7*** | 14.0*** | 7.3*** | 13.2*** | 8.4*** | 14.2*** |
| Politically active | 21.9*** | 29.2*** | 21.0*** | 28.6*** | 22.6*** | 29.6*** |
| Sum of violence event exposure | 2.56*** | 3.24*** | 2.45*** | 3.22*** | 2.64*** | 3.27*** |
| Any violence exposure | 81.1*** | 89.6*** | 80.2*** | 88.9*** | 82.3*** | 89.5*** |
| Any personally experienced violence | 42.4*** | 51.9*** | 40.9*** | 51.5*** | 42.8*** | 53.3*** |
| Any witnessed violence | 66.9*** | 75.4*** | 65.3*** | 75.2*** | 68.1*** | 75.4*** |
| Any vicarious violence | 63.5*** | 75.4*** | 61.6*** | 74.9*** | 65.7*** | 74.5*** |

*Test for association of covariate and elevated symptomology of global distress, depression and anxiety was performed using chi squared test or 2-tailed independent t-test.*

*\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001.*

## Data analysis

Bivariate statistics (2-tailed, independent t-tests and chi squared tests) were used to examine correlates of the 3 measures of elevated psychiatric symptomatology (global distress, depression, anxiety). Next, logistic regression analyses examined multivariable correlates of these 3 mental health measures, controlling for bivariate correlates at the significance level of $P < 0.05$. The analysis was done using *STATA*, version 13, applying the "Survey" routine, which incorporates the survey design, including the correlations of standard errors within sample clusters.

## Results

### Sample descriptives

Table 1 lists the demographic and background characteristics of the whole sample of 2481 participants, and by sex (1240 females, 1241 males). Mean age was 19.1 years, 18.5% were employed, 63.0% were attending school, 17.0% were married (substantially higher for females than males) and 26.0% were refugees, i.e. descendants of individuals who had lost land or livelihood during the 1948 or 1967 conflicts. Most refugee families do not actually live in refugee camps, which can be rural or urban.

### Elevated psychiatric symptomatology and violence exposure

About half of the overall sample had elevated symptoms of global distress (45.7%) and depression (55.2%), and over one-third (37.0%) had elevated symptoms of anxiety, but all rates were significantly higher among females than males (Table 1). Depression and anxiety were strongly related, with a correlation of the mean scores of 0.73 ($P < 0.001$).

A high level of violence exposure was also observed in the sample: 85.0% of youth experienced at least 1 event in their lifetime, with a mean of 2.9 (SD = 2.1; *median* = 3) events experienced. The mean number of events experienced in the past year alone was 0.95 (SD = 1.29; *median* = 1); 46.7% had been a victim of any personal violence event, 70.8% had witnessed any violence event perpetrated on a relative or close friend, and 68.9% had heard about any violence event experienced by a relative or close friend (Table 1). The most common personally experienced violence was being beaten up or assaulted by someone other than a policeman or soldier (36%), while 12% report being beaten up or assaulted by police and 12% report being imprisoned or held by police. The most common witnessed violence was seeing a relative/friend

**Table 3 Multiple logistic regression analysis of correlates of elevated symptoms of global distress, depression and anxiety (OR and 95% CIs)**

| Variable | Elevated global distress | | Elevated depression | | Elevated anxiety | |
|---|---|---|---|---|---|---|
| | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 1 OR (95% CI) | Model 2 OR (95% CI) |
| Being female | 3.3 (2.6,4.2)** | 4.1 (3.1,5.3)** | 3.5 (2.8,4.4)** | 4.4 (3.5,5.5)** | 2.8 (2.2,3.5)** | 3.3 (2.7,4.2)** |
| Mean age | 1.1 (1.0,1.1)** | 1.1 (1.0,1.1)** | 1.1 (1.0,1.1)** | 1.1 (1.0,1.1)** | 1.0 (1.0,1.0) | 1.0 (1.0,1.1) |
| Currently attending school | 1.0 (0.8,1.3) | 1.0 (0.8,1.3) | 0.9 (0.7,1.1) | 0.9 (0.7,1.2) | 0.8 (0.6,1.1) | 0.9 (0.7,1.2) |
| Currently working | 0.9 (0.7,1.2) | 0.9 (0.7,1.2) | – | – | 0.8 (0.6,1.1) | 0.8 (0.6,1.1) |
| Married or engaged | 0.8 (0.6,1.0)* | 0.7 (0.6,1.0)* | 0.6 (0.5,0.8)** | 0.6 (0.5,0.8)** | 0.9 (0.7,1.2) | 0.9 (0.7,1.2) |
| Very religious | – | – | 0.9 (0.8,1.2) | 0.9 (0.8,1.2) | 0.9 (0.7,1.1) | 0.9 (0.7,1.1) |
| Father is alive | 0.6 (0.4,0.8)** | 0.6 (0.4,0.8)** | 0.6 (0.4,0.9)* | 0.6 (0.4,0.9)* | 0.6 (0.4,0.8)** | 0.6 (0.4,0.8)** |
| Mother is alive | 0.5 (0.2,1.0) | 0.5 (0.2,1.1) | 0.6 (0.3,1.2) | 0.6 (0.3,1.3) | 0.5 (0.2,0.9)* | 0.5 (0.2,1.0) |
| Fatalism | 1.1 (0.9,1.3) | 1.1 (0.9,1.3) | 1.3 (1.1,1.5)** | 1.2 (1.1,1.5)* | 1.1 (0.9,1.3) | 1.1 (0.9,1.3) |
| % chance of having a good job by age 30 | 1.0 (1.0,1.0)** | 1.0 (1.0,1.0)* | 1.0 (1.0,1.0) | 1.0 (1.0,1.0) | 1.0 (1.0,1.0)* | 1.0 (1.0,1.0) |
| Has ever used alcohol | 2.2 (1.7,2.9)** | 2.0 (1.5,2.7)** | 2.0 (1.5,2.7)** | 1.8 (1.4,2.5)** | 2.1 (1.5,2.8)** | 1.9 (1.4, 2.5)** |
| Politically active | 1.5 (1.2,1.8)** | 1.3 (1.1,1.6)* | 1.5 (1.2,1.8)** | 1.3 (1.1,1.6)* | 1.5 (1.2,1.8)** | 1.3 (1.1,1.6)* |
| Overall violence exposure | 2.3 (1.8,3.0)** | | 2.3 (1.8,2.9)** | – | 2.1 (1.6,2.8)** | – |
| Personally experienced violence | – | 1.8 (1.4,2.2)** | – | 1.8 (1.5,2.2)** | – | 1.8 (1.5,2.2)** |
| Witnessed violence | – | 1.4 (1.1,1.7)* | – | 1.4 (1.2,1.8)** | – | 1.3 (1.0,1.7)* |
| Vicarious violence | – | 1.4 (1.2,1.8)** | – | 1.5 (1.2,1.9)** | – | 1.2 (1.0,1.5) |

*P < 0.05, **P < 0.01.

OR = odds ratio; CI = confidence interval.

being beaten (58%) or witnessing a relative/friend being shot (35%). Regarding vicarious violence events, 60% had heard of a relative/friend being imprisoned and 35% had heard of a relative/friend being killed. Male youth reported exposure to more events of violence overall, as well as a greater proportion having experienced each of the 3 types of violence events, compared with females.

## *Relationships between mental health and violence exposure*

Elevated symptoms of global distress, depression and anxiety were each significantly associated in bivariate analysis with the sum of violence exposure events, with exposure to any of the 3 types of violence events, and with a number of other variables (Table 2). Table 3 presents multiple logistic regressions exploring these relationships. First, using any violence exposure event experienced (across all types of violence exposure) as the sole violence independent variable and including other significant bivariate correlates of elevated global distress as controls (Model 1), violence exposure remains independently associated with elevated global distress. In models using 3 variables representing any experience of the 3 types of violence events (personally experienced, witnessed, vicarious) in place of overall violence exposure (Model 2), each of these exposure vari-

ables was independently correlated with elevated global distress. Regressions predicting elevated depression and anxiety were similar, with the exception that experience of vicarious violence exposure was unrelated to elevated anxiety (Table 3).

Among other independent variables in the models, being female was associated with all 3 measures of elevated symptomatology, while being married or engaged was associated with lower odds of elevated global distress and depression (a reversal of the direction of the relationships observed in the bivariate analysis). Factors associated with elevated symptomology included the death of one's father, any history of alcohol use, greater fatalism (associated with elevated depression only), and lower expectations of having a good job by the age of 30 (global distress only).

Similar results were observed in separate regressions for male and female youth, with a few exceptions: among males, witnessed violence exposure and father's death were not independently associated with any of the 3 elevated psychiatric symptomatology measures; among females, being married or engaged, fatalism, older age, and expectations of having a good job were all unrelated to any of the elevated symptomatology measures (full results from these gender-specific analyses are available as supplementary data online).

## Discussion

In this rare, population-based sample of Palestinian youth, high levels of mental health problems were reported, with about half of the sample reporting elevated symptoms of global distress and depression, and one-third reporting elevated anxiety symptoms. Furthermore, nearly half the sample had personally been the victim of violence, and over two-thirds had ever witnessed or heard about violence being perpetrated on a close friend or relative. It should be noted that while much of the reported violence exposure was likely related to the Occupation and conflict, much of it was not, at least not directly. For example, as indicated, the most common personal experience of violence was being beaten by someone other than a soldier or policeman. This is consistent with findings from the sample of high rates of engagement of youth in physical fights with others (18).

Violence exposure was associated with each of the 3 forms of elevated psychopathology (global distress, depression, anxiety), and these mental health measures were associated with each of the 3 types of violence exposure (personally experienced, witnessed, and vicariously heard about). Significantly, these findings suggest that violence does not have to be personally experienced to influence mental health; indirect forms of violence exposure (e.g. witnessed and vicarious exposure) were also independently associated with mental health symptoms. This is consistent with other studies of youth exposure to community violence that were not conducted in conflict settings (5).

Consistent with studies in other environments (4,14), gender differences were observed with regard to both mental health and violence exposure. Female youth reported significantly higher levels of mental health problems, while males reported higher exposure to violence overall and were more likely to have experienced each of the 3 types of violence events. The greater experience of violence among males may reflect gender differences in the contexts into which individuals can, or are willing to, enter, especially in a conservative environment where young females may experience family or social constraints on their movement and young men more often participate in political demonstrations. Additionally, it has been observed that in the face of occupation and conflict, Palestinian society has become more conservative and religious over the last several decades, which likely further dampens young women's independence and mobility (24). Being female was an independent correlate of higher odds of elevated symptoms of global distress, depression and anxiety, suggesting that factors independent of violence exposure contribute to Palestinian female youth experiencing higher levels of depression, anxiety and distress.

Among female youth, all 3 types of violence exposure were associated with elevated psychiatric symptomatology, and the magnitude of the relationship to symptomatology (odds ratio) was similar across each type of violence. In contrast, among males, having personally experienced violence had the strongest effects: odds ratios for global distress, depression and anxiety were at least descriptively higher for personal experience than for vicarious exposure; and witnessed violence exposure was not associated with any of the 3 mental health measures. With male youth being exposed to more violence, they may have a higher threshold for violence contributing to emotional distress, or violence may be normalized in their day-to-day lives, resulting in direct victimization being what is needed to cross this threshold.

Our analysis sought to identify factors in addition to violence exposure that either protect against mental health problems or are risk factors. The regression analysis revealed that for young men, being married or engaged reduced the likelihood of elevated symptoms of distress or depression. The social support that comes from a partner within a committed relationship may be instrumental to psychological well-being and positive coping with a stressful environment. This protective function was not evident among female participants, consistent with other research showing that being married is protective against depression more so for men than women (25). This may reflect gender differences in the demands and stress within marriage and power differentials between men and women in relationships in the Palestinian cultural context. For female youth, a different source of support, having a father who was still alive, was independently associated with lower odds of elevated psychiatric symptomatology, suggesting that family and parents specifically can provide vital sources of support for managing stress (3,7).

Current alcohol use, reported by only 11% of the sample (18), was associated with elevated symptoms of distress, depression and anxiety, which is consistent with evidence demonstrating the comorbidity of substance use and mental health problems (26), including among youth in the Middle East (27). Substance use can be a signal of struggles in coping with stress, and this may be particularly true with substances that are less culturally acceptable, which is the case for alcohol (as opposed to tobacco) in the Palestinian context.

Fatalistic attitudes and beliefs about life, and pessimism regarding one's future (as reflected in lower expectancy for having a good job by age 30) were both associated with elevated symptoms of depression and distress, particularly among males. These findings suggest that mental health among youth is influenced by expectations, outlook and locus of control regarding the future, and this may be particularly true in contexts that are characterized by ongoing exposure to violence. Youth programmes and services need to help their clients see merits in their future and opportunities for success—though this is undoubtedly very challenging given the significant stressors and environmental challenges that Palestinian youth face. However, it should be cautioned that the observed relationships

may not be causal since expectations and outlook may well be conditioned by depression or distress.

Engagement in political activism was also independently associated with higher odds of elevated psychiatric symptomatology. Here too, the cross-sectional nature of the study makes interpretation ambiguous since relationships may be bi-directional. Although experiences of political activity (including frustration with unachieved goals or witnessing violence during protests) may lead to distress, those suffering a greater emotional stress from the protracted conflict may also be more likely to participate in protests.

In addition to the cross-sectional design, the limitations of this study include the reliance on self-reporting of symptom rather than more rigorous clinical interviews to examine mental health status and the presence of psychiatric disorders. Social desirability bias may have influenced participant responses, particularly with regard to mental health problems and substance use, and local gender norms could result in there being a gender differential with regard to candour; for example, males may have been more comfortable disclosing substance use behaviour, and females being more comfortable disclosing symptoms of distress. Our analysis of factors contributing to mental health resilience was hampered by the absence of measures of factors that have been found to be associated with resilience among youth exposed to violence, such as parenting practices, school performance, and coping styles. However, the use of a rare large, representative youth sample does offer important insights into the proportion of, and factors influencing, the mental health of youth with a high exposure to conflict and violence.

In summary, elevated symptoms of depression and anxiety were common in this representative sample of Palestinian youth, as was exposure to violence (both direct and indirect), and violence exposure was independently associated with such symptomatology. Female youth were less exposed to violence, but more likely than their male counterparts to report elevated symptoms of distress, depression and anxiety. Although, as noted, gender differences in candour may be in play, it is also possible that males are more apt to normalize exposure to violence. Youth services in the Palestinian and other Middle East contexts can also be informed by our findings that identify the influences on, or correlates of, mental health such as parental death, alcohol use and outlook and expectations for one's future as these can serve to characterize youth who may be at greater risk for mental health problems and have greater need for support services. Both preventative and therapeutic services related to mental health challenges stemming from violence exposure are needed for youth, and our findings suggest that such services should incorporate mechanisms to enhance social support from family and sense of control over and hope for one's future.

**Competing interests:** None declared.

## Exposition à la violence et liens avec la santé mentale chez les jeunes Palestiniens

### Résumé

**Contexte** : L'exposition à la violence est un facteur de risque significatif pour le développement de psychopathologies chez les jeunes. La recherche sur les conséquences de l'exposition des jeunes à la violence pour leur santé mentale s'est principalement concentrée sur l'état de stress post-traumatique. Cependant, un lien avec la dépression et l'anxiété a également été établi. Du fait de l'ancienneté du conflit israélo-palestinien, les jeunes Palestiniens sont susceptibles d'être exposés à divers types de violence.

**Objectifs** : Nous avons examiné la symptomatologie psychiatrique en lien avec les formes directes et indirectes d'exposition à la violence.

**Méthodes** : Une enquête auprès des ménages a été menée en 2014 dans un échantillon représentatif de 2 481 jeunes Palestiniens. Les critères d'autoévaluation utilisés incluaient la symptomatologie psychiatrique (détresse générale, dépression, anxiété) et l'exposition à la violence (en tant que victime, témoin direct ou indirect).

**Résultats** : La proportion de symptômes aigus de détresse générale (46 %), de dépression (55 %) et d'anxiété (37 %) était élevée ; 47 % des personnes interrogées avaient été personnellement victimes de violence, 71 % avaient été témoins de violences et 69 % avaient entendu le récit de violences subies par une personne proche. Dans l'analyse de régression logistique, l'élimination des autres corrélats bivariés, l'exposition à un acte de violence quelconque, ainsi que chacun des trois types de violence, ont été associés de manière indépendante à chacun des trois critères de symptomatologie psychiatrique aiguë. Les jeunes femmes étaient quatre fois plus nombreuses à signaler des psychopathologies aiguës, en dépit d'un risque moins élevé d'être confrontées à chaque type de violence.

**Conclusions** : Ces résultats suggèrent la nécessité de mettre en place des services répondant aux besoins des jeunes en matière de santé mentale dans un contexte les exposant fortement à la violence. Ils indiquent aussi que des stratégies sexospécifiques pourraient être utiles.

# التعرض للعنف وعلاقة ذلك بالصحة النفسية للشباب الفلسطيني

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## الخلاصة

**الخلفية:** يُعد التعرض للعنف أحد عوامل الخطر الرئيسية المُسبِبة للأمراض النفسية لدى الشباب. ولقد ركزت البحوث التي أُجريت بشأن عواقب التعرض للعنف على الصحة النفسية للشباب في أغلبها على اضطرابات التوتر التالي للصدمات، لكن ثبت أيضاً وجود علاقة بين الاكتئاب وبين الإصابة باضطرابات القلق. ونظراً لطول أمد الصراع الإسرائيلي–الفلسطيني، يتعرض الشباب الفلسطيني لأنواع مختلفة من العنف.

**الأهداف:** لقد فحصنا الأَعْراض النفسية وعلاقتها بالتعرض لصور العنف المختلفة بطريقة مباشرة أو غير مباشرة.

**طرق البحث:** أُجري مسح منزلي ذو طابع تمثيلي شمل ٢٤٨١ شاباً فلسطينياً في عام ٢٠١٤. وتضمنت التبليغ الذاتي للأَعراض النفسية (الضغوط العامة، والاكتئاب، والقلق)، والتعرض للعنف (الإيذاء الشخصي، سواء ما يشهده المرء بنفسه أو ما يسمع به من الآخرين).

**النتائج:** بلغت نسبة الأعراض المتزايدة للضغوط العامة، والاكتئاب ٤٦٪ و٥٥٪ على التوالي؛ كذلك بلغ القلق نسبة مرتفعة وصلت إلى ٣٧٪؛ وقد تعرض ٤٧٪ للإيذاء الشخصي، وشهد ٧١٪ العنف، بينما سمع ٦٩٪ عن العنف الذي تعرض له شخص قريب منهم. وفي تحليل الانحدار اللوجستي، كان هناك ارتباط بشكل مستقل بين التحكم في عوامل الارتباط الثنائية المتغير، والتعرض لأي حادثة عنف، بالإضافة إلى أي نوع من الأنواع الثلاثة للتعرض للعنف وبيَّن كل من التدابير الثلاثة للأعراض النفسية. كما وجد أن احتمال إبلاغ الإناث بالأمراض النفسية يزيد بنحو ٤ مرات، على الرغم من انخفاض احتمال تعرُضهن لكل نوع من أنواع العنف.

**الاستنتاجات:** تُشير هذه النتائج إلى الحاجة إلى خدماتٍ تلبي احتياجات الصحة النفسية للشباب الذين يعيشون في ظل ظروف تتضمن التعرض للعنف بشدة، وقد تكون الاستراتيجيات المحدَّدة وفقاً لنوع الجنس مفيدة.

## References

1. Trickett PK, Durán L, Horn JL. Community violence as it affects child development: issues of definition. Clin Child Fam Psychol Rev. 2003 Dec;6(4):223–36. PMID:14719635

2. Dubow EF, Boxer P, Huesmann LR, Shikaki K, Landau S, Gvirsman SD, et al. Exposure to conflict and violence across contexts: relations to adjustment among Palestinian children. J Clin Child Adolesc Psychol. 2010;39(1):103–16. doi:10.1080/15374410903401153

3. Barber BK. Annual research review: the experience of youth with political conflict–challenging notions of resilience and encouraging research refinement. J Child Psychol Psychiatry. 2013 Apr;54(4):461–73. doi:10.1111/jcpp.12056

4. Mrug S, Loosier PS, Windle M. Violence exposure across multiple contexts: individual and joint effects on adjustment. Am J Orthopsychiatry. 2008 Jan;78(1):70–84. doi:10.1037/0002-9432.78.1.70

5. Fowler PJ, Tompsett CJ, Braciszewski JM, Jacques-Tiura AJ, Baltes BB. Community violence: a meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. Dev Psychopathol. 2009 Winter;21(1):227–59. doi:10.1017/S0954579409000145

6. Singer MI, Miller DB, Guo S, Flannery DJ, Frierson T, Slovak K. Contributors to violent behavior among elementary and middle school children. Pediatrics. 1999 Oct 1;104(4):878–84. doi:10.1542/peds.104.4.878

7. Dubow EF, Huesmann LR, Boxer P, Landau S, Dvir S, Shikaki K, et al. Exposure to political conflict and violence and posttraumatic stress in Middle East youth: Protective factors. J Clin Child Adolesc Psychol. 2012;41(4):402–16. doi:10.1080/15374416.2012.684274

8. Thabet AA, Abed Y, Vostanis P. Comorbidity of PTSD and depression among refugee children during war conflict. J Child Psychol Psychiatry. 2004 Mar 1;45(3):533–42. PMID:15055372

9. Abdeen Z, Qasrawi R, Nabil S, Shaheen M. Psychological reactions to Israeli occupation: Findings from the national study of school-based screening in Palestine. Int J Behavioral Development. 2008 Jul;32(4):290–7. https://doi.org/10.1177/0165025408092220

10. Massad S, Javier Nieto F, Palta M, Smith M, Clark R, et al. Mental health of children in Palestinian kindergartens: resilience and vulnerability. BMC Public Health. 2012 Jan 11;12:27. doi:10.1186/1471-2458-12-27

11. Barber BK, Schluterman JM. An overview of the empirical literature on adolescents and political violence. In: Barber BK, ed. Adolescents and war: how youth deal with political violence. New York: Oxford University Press; 2009.

12. Rutter M. Psychosocial resilience and protective mechanisms. Am J Orthopsychiatry. 1987 Jul;57(3):316-331. doi: 10.1111/j.1939-0025.1987.tb03541.x

13. Weems CF, Overstreet S. An ecological-needs-based perspective of adolescent and youth emotional development in the context of disaster: Lessons from Hurricane Katrina. In: Cherry KE, ed. Natural disasters from a life span developmental perspective: an introduction. Baton Rouge: Springer; 2009:27–44.

14.  Zona K, Milan S. Gender differences in the longitudinal impact of exposure to violence on mental health in urban youth. J Youth Adolesc. 2011 Dec;40(12):1674-90. doi: 10.1007/s10964-011-9649-3

15.  Foster JD, Kuperminc GP, Price AW. Gender differences in posttraumatic stress and related symptoms among inner-city minority youth exposed to community violence. J Youth Adolesc. 2004 Feb 1;33(1):59–69.

16.  Fragmented lives – humanitarian overview 2016, occupied Palestinian territory. Jerusalem: United Nations Office for the Coordination of Humanitarian Affairs; 2017 (http://new.ochaopt.org/sites/default/files/fragmented_lives_2016_english.pdf, accessed 12 July 2019).

17.  Israel/Palestine: events of 2016. New York; Human Rights Watch. (https://www.hrw.org/world-report/2017/country-chapters/israel/palestine, accessed 12 July 2019).

18.  Glick P, Kammash U, Shaheen M, Brown RA, Goutam P, Karam R, et al. Health risk behaviours of Palestinian youth: findings from a representative survey. East Mediterr Health J. 2018;24:127–36. PMID:29748941

19.  Sahn DE, Stifel D. Exploring alternative measures of welfare in the absence of expenditure data. Review of Income and Wealth. 2003 Dec 1;49(4):463–89. https://doi.org/10.1111/j.0034-6586.2003.00100.x

20.  Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L. The Hopkins Symptom Checklist (HSCL). A measure of primary symptom dimensions. Mod Prob Pharmacopsychiatry. 1974;7:79–110. PMID:4607278

21.  Batterham PJ, Sunderland M, Slade T, Calear AL, Carragher N. Assessing distress in the community: psychometric properties and crosswalk comparison of eight measures of psychological distress. Psychol Med. 2018 Jun;48(8):1316–24. doi:10.1017/S0033291717002835

22.  Halepota AA, Wasif SA. Hopkins Symptoms Checklist 25 (HSCL-25) Urdu translation: an instrument for detecting anxiety and depression in torture and trauma victims. J Pak Med Assoc. 2001 Jul;51(7):255–7. PMID:11558218

23.  Esparza OA, Wiebe JS, Quiñones J. Simultaneous development of a multidimensional fatalism measure in English and Spanish. Curr Psychol. 2015 Dec 1;34(4):597–612. doi:10.1007/s12144-014-9272-z

24.  2016–2021 Gender Advocacy Strategy. Ramalllah: Sharek Youth Forum; 2016 (http://sharek.ps/attachment/13/Final_Gender%20Advocacy%20Strategy%20(sm).compressed.pdf, accessed 12 July 2019).

25.  Scott KM, Wells JE, Angermeyer M, Brugha TS, Bromet E, Demyttenaere K, et al. Gender and the relationship between marital status and first onset of mood, anxiety and substance use disorders. Psychol Med. 2010 Sep;40(9):1495-505. doi: 10.1017/S0033291709991942

26.  Chan YF, Dennis ML, Funk RR. Prevalence and comorbidity of major internalizing and externalizing problems among adolescents and adults presenting to substance abuse treatment. J Subst Abuse Treat. 2008 Jan 31;34(1):14–24. doi:10.1016/j.jsat.2006.12.031

27.  Ismayilova L, Hmoud O, Alkhasawneh E, Shaw S, El-Bassel N. Depressive symptoms among Jordanian youth: results of a national survey. Community Ment Health J. 2013 Feb;49(1):133–40. doi:10.1007/s10597-012-9529-7

# Hand hygiene initiative: comparative study of pre- and postintervention outcomes

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## Abstract

**Background:** Adequate hand hygiene is considered the most effective measure to reduce transmission of nosocomial pathogens.

**Aims:** To determine the effectiveness of infection control intervention to improve compliance with hand hygiene in the Emergency Department, Al-Leith General Hospital, Saudi Arabia, and evaluate bacterial load on hands as a possible indicator of improvement.

**Methods:** The study consisted of 3 phases: Phase I, measurement of basal hand hygiene compliance level; Phase II, multimodal hand hygiene educational programme was initiated; and Phase III, hand hygiene compliance level was measured again. Data were collected by direct observation of healthcare workers in the emergency department between October 2016 and March 2017, using the standardized World Health Organization method for direct observation, "Five Moments for Hand Hygiene". The intervention comprised health education sessions using direct personal contact. Hands of healthcare workers were sampled during Phases I and III by sterile bag method, and bacterial load was determined.

**Results:** A total of 1374 opportunities for hand hygiene were observed during the triphase study. Implementation of the interventional hand hygiene educational programme significantly improved compliance with hand hygiene guidelines from 30.7% to 45.5% ($P < 0.01$). Log10 bacterial load per hand dropped from 4.97 (standard deviation = 0.32) to 4.57 (0.47) ($P < 0.05$).

**Conclusions:** Hand hygiene educational programmes were effective in improving compliance in the emergency department, and bacterial load on hands of healthcare workers could be used as an indicator of improvement in hand hygiene compliance.

Keywords: bacterial load, compliance, Five Moments for Hand Hygiene, hand hygiene, infection

## Introduction

Healthcare-associated infections (HAIs) are acquired during treatment for another condition and are not present or incubating at the time of admission, and they carry a significant burden of illness and financial costs (*1*). Approximately 7% of hospitalized patients in industrialized nations and 10% in low- and middle-income countries are affected (*2*).

Hand hygiene is among the most important measures to prevent transmission and acquisition of HAIs (*3*). Despite recognition of the crucial role of hand hygiene in reducing infection rates, compliance rates among healthcare workers remain low (*4*). In a systematic review of 96 studies from industrialized nations, the overall average compliance was 40% (*5*).

According to the World Health Organization (WHO) the multimodal "Clean Care Is Safer Care" strategy and the "Five Moments for Hand Hygiene" concept should be performed (1) before touching a patient; (2) before aseptic procedures; (3) after risk of body fluid exposure; (4) after touching a patient; and (5) after touching patients' surroundings (*6,7*).

The emergency department has special environmental conditions that may interfere with proper hand hygiene compliance, including crowding, use of nontraditional care areas such as hallways, frequent interruptions to care delivery, and close proximity of patients, who are often separated only by curtains (*8,9*). Few other studies have assessed the efficacy of hand hygiene interventions in emergency departments (*10–13*), and yet fewer have used the WHO "Five Moments for Hand Hygiene". Other studies have used alternative methods (*9*). Due to the rapid turnover in emergency departments, it is difficult to measure HAI rates as an indicator of improvement. HAIs, by definition, develop after at least 48 hours of hospitalization, and most emergency cases are discharged on the same day.

The aim of this study was to determine the effectiveness of infection control intervention to improve compliance with hand hygiene in the Emergency Department, Al-Leith General Hospital, Saudi Arabia.

We also evaluated bacterial load on hands as a possible indicator of improvement of hand hygiene compliance.

## Methods

### Study setting

The study was conducted in the Emergency Department at Al-Leith General Hospital, Saudi Arabia, between October 2016 and March 2017. Al-Leith General Hospital is a secondary level hospital with a total capacity of 65 beds. This work was approved by the Bioethics Committee, Health Sciences College at Alith, Umm Al-Qura University.

### Study design

This was an interventional study that consisted of 3 phases: Phase I, the basal hand hygiene compliance level was measured by direct observation; Phase II, a hand hygiene educational programme was offered to healthcare staff working in the hospital emergency department; and Phase III, hand hygiene compliance level was measured again to determine the effect of the intervention.

### Observations and calculations

Data were obtained from 40 observation sessions; 20 in Phase I and 20 in Phase III. Each observational session was ~20 minutes. The timings of the observation sessions were randomly distributed throughout the day and night. Observations were conducted by trained volunteer students. All professional healthcare providers and students who were working in the emergency department were included in the study. Healthcare workers were divided into 3 professional categories: (1) nurse/nurse student; (2) medical doctor/medical student; and (3) other healthcare workers (therapists/technicians/dietitians/dentists/students).

Counting of hand hygiene opportunities and hand hygiene actions was based on the WHO Five Moments of Hand Hygiene concept: (1) before touching a patient; (2) before clean/aseptic procedure; (3) after risk of body fluid exposure; (4) after touching a patient; and (5) after touching patients' surroundings (6,14,15).

A hand hygiene opportunity is defined as a moment during healthcare activities when hand hygiene is required, regardless of the number of indications. Several indications may arise simultaneously, creating a single opportunity and requiring a single hand hygiene action (15). Accepted hand hygiene actions include healthcare workers performing alcohol-based hand rubbing or handwashing with soap and water. Hand hygiene compliance was calculated by dividing the number of performed hand disinfections by the number of hand hygiene opportunities. Analyses were stratified by professional group.

$$\text{Compliance (\%)} = \frac{\text{Actions}}{\text{Opportunities}} \times 100$$

### Training of auditors

In October 2016, volunteer students were recruited as hand hygiene auditors after a detailed training process. Training included prepared PowerPoint presentations and educational video of actual healthcare workers performing patient care tasks (16). During video watching, the students were asked to observe and report hand hygiene opportunities and actions using the actual observation form that would be used in the study. Later, students were engaged in inter-rater reliability testing, in which a series of hand hygiene practices were co-observed in the emergency department, and disagreements were discussed and resolved according to WHO hand hygiene training tools (16).

### Phase I (preintervention: November–December 2016)

Phase I is referred to as baseline assessment. Hand hygiene compliance rate in the emergency department was determined for the above-mentioned Five Moments of Hand Hygiene by trained assessors. Potential opportunities for hand hygiene were recorded along with the actual number of episodes of hand hygiene. Recording was performed on a special observation form. Observations were done at random times without prior announcement. Observers acted as unobtrusively as possible but disclosed their task readily on enquiry. Observation sessions lasted 20 (5) minutes.

### Phase II (intervention: January 2017)

Phase II was the interventional phase. This was a multimodal intervention that was conducted in the form of health education sessions using direct personal contact by volunteer students; educational lectures that included a live demonstration of hand hygiene techniques; posters that demonstrated the Five Moments of Hand Hygiene; and other posters that emphasized the importance of hand hygiene (e.g., Hand Hygiene Saves Lives). The posters were placed at strategic sites within the emergency department, ensuring availability of alcohol-based hand cleaners and personal protective equipment at all patient care areas. An additional component of the intervention was feedback, which consisted of announcing the compliance results from Phase I to the emergency department staff.

### Phase III (postintervention: February–March 2017)

After the educational interventions, hand hygiene compliance was measured again using the same methods followed in Phase I.

### Determining hand bacterial load

It is difficult to monitor HAI rates among emergency department patients because of the short stays involved. Therefore, we introduced measurement of bacterial load on hands of healthcare workers as an alternative to measure the benefit obtained by improvement in hand hygiene compliance rates. Fifty samples were taken from hands of healthcare workers during Phase I, and another 50 samples were taken during Phase III. Samples were

taken from the dominant hand in both phases because hand microbiomes differ between dominant and non-dominant hands (17). The sampling method was a modified sterile bag adopted from the method used by Larson et al. (18). Sterile peptone water (50 ml) was poured into sterile polyethylene bags, after which, the hand of the healthcare worker was inserted, the bag opening was secured at the wrist with a tourniquet, and the hand was uniformly massaged for 1 minute by the research staff through the wall of the bag. The solution was mixed in the bag and 0.05-ml aliquots of each sampling solution were plated on tryptic soy agar plates (Merck, Darmstadt, Germany). Inocula were spread with bent glass rods. Plates were incubated at 37°C under aerobic conditions for 24 hours, and colony-forming units (CFU) were counted, and bacterial load was calculated and expressed as CFU/hand. Bacterial load on hands was compared using the log10-transformed bacterial count.

### Statistical analysis

The data were tabulated, coded and analysed using SPSS for Windows version 20.0. Compliance rates at baseline and follow-up, overall, for the different professional categories, and for different hand hygiene indications were compared using the $\chi^2$ test. Paired t test was done to test the significance of the difference in mean CFU counts between Phases I and III. $P < 0.05$ was considered significant.

## Results

There were 1374 hand hygiene opportunities during the study. Nurses had the largest number of opportunities (87.92%) in comparison to other professional groups (Table 1). Profession-specific analysis revealed that hand hygiene compliance increased significantly in physicians (187% of baseline) and nurses (147% of baseline) (both $P < 0.01$). The compliance of the other healthcare workers can be considered unchanged since the variation was insignificant ($P = 0.926$). The total number of hand hygiene actions significantly increased from 203/662 (30.66%) in Phase I to 324/712 (45.51%) in Phase III ($P < 0.01$) (Table 2).

Compliance results revealed that indication-specific differences ranged from 12.21% (Indication 2) to 48.84% (Indication 4) at baseline (Tables 3 and 4). Compliance before patient contact and before aseptic tasks (Indications 1 and 2) was lower compared to that after patient contact (Indications 3–5). Significant improvements were seen only for Indications 1, 2 and 5. The greatest improvement was seen for Indication 2 (279% of baseline; $P < 0.01$), and the lowest for Indication 5 (137% of baseline; $P = 0.018$).

Bacterial load on hands of healthcare workers was measured in Phases I and III (Figure 1). In phase I before intervention average log CFU/hand was 4.97 (0.32). In Phase III log CFU/hand was significantly increased to 4.57 (0.47) ($P < 0.001$).

**Table 1 Hand hygiene opportunities according to health care worker professional group**

| Professional group | Phase I | | Phase III | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Nurses | 582 | 87.92 | 566 | 79.49 | 1148 | 83.55 |
| Physicians | 71 | 10.73 | 127 | 17.84 | 198 | 14.41 |
| Other | 9 | 1.36 | 19 | 2.67 | 28 | 2.04 |
| **Total** | **662** | **100.0** | **712** | **100.0** | **1374** | **100.0** |

## Discussion

The emergency department is an indispensable component of the current healthcare system; nevertheless, it may have special environmental conditions that interfere with proper hand hygiene compliance. Although there have been many interventional studies of hand hygiene, published data from Saudi Arabia are limited and show contradicting results (19,20). Hand hygiene among healthcare workers remains low and there is room for improvement.

In this study, the educational intervention was associated with a significant increase in compliance rate (30.66 to 45.51%). This result is similar to previous studies showing that educational interventions improve hand hygiene compliance (21,22). A few studies have reported hand hygiene compliance rates in Saudi Arabia (13,19,20, 23,24). Our pre- and postintervention compliance rates (30.66% and 45.51%, respectively) are inferior to an overall compliance rate of 50.3% reported previously in Saudi Arabia (13). The lower rate in our study may have been because it was conducted in the emergency department, which had unique environmental conditions that impeded proper application of hand hygiene. In another study conducted in Saudi Arabia, the compliance rate was 62.5% (19) but the method of calculation was based on classifying healthcare workers as compliant or noncompliant, which is a flawed method, because compliance varies in the same person over time. The international consensus is to measure compliance per opportunity rather than per person. A third study conducted in intensive care units in a Saudi hospital reported a compliance rate of 59% (23). In a systematic review of 96 studies on hand hygiene, compliance levels in non-intensive care settings were 50–60% (5), which is superior to the levels obtained in our study. The relatively low level of postintervention compliance (45.5%) is comparable to that in other studies performed in the emergency department. This was evident in a study performed in emergency departments where compliance reached 45% after 2 successive interventions (21).

The relatively low hand hygiene compliance rate in this study (<50%) could be attributed to laxity of the pre-existing infection control programme in the study hospital. For example, essential infection control activities

**Table 2 Hand hygiene compliance rates according to professional group**

| Professional group | Phase I | | | Phase III | | | P* |
|---|---|---|---|---|---|---|---|
| | Opportunities | HH Action | Compliance (%) | Opportunities | HH Action | Compliance (%) | |
| Nurses | 582 | 183 | 31.44 | 566 | 261 | 46.11 | < 0.001 |
| Physicians | 71 | 17 | 23.94 | 127 | 57 | 44.88 | 0.004 |
| Other | 9 | 3 | 33.33 | 19 | 6 | 31.58 | 0.926 |
| **Total** | **662ᵃ** | **203** | **30.66** | **712** | **324** | **45.51** | **< 0.001** |

*Calculated by χ² test.

ᵃSum of indications is not equal to the sum of opportunities because 1 opportunity may cover 2 overlapping indications.

such as surveillance and auditing were performed irregularly and were merely performed as paperwork. It could also be attributed to the special characteristics of the study settings in the emergency department, as mentioned before. The absence of leadership engagement in this study could also have been partially responsible for the modest improvement. Effective leadership involvement can improve hand hygiene compliance (25,26). Continuing efforts and further interventions are needed to address such issues.

Our results show that physicians had less compliance for hand hygiene than nurses had (23.9% vs 31.4% in Phase I, respectively). This result is in accordance with other local and international studies (13,27). Previous studies have shown that physicians in general show poor compliance with infection control standards (28). This was evident in a study conducted in Saudi Arabia in which adherence rates were reported as 60% for nurses and 20% for physicians at the completion of a hand hygiene improvement campaign (13). It is noticeable that although physicians' compliance level was inferior to that of nurses, they showed a higher level of improvement in Phase III.

Our study showed that most hand hygiene opportunities were encountered by nurses (1148/1374; 83.6%). This represents an opportunity to target nurses by tailored educational programmes to foster hand hygiene compliance improvements among such an influential

**Table 3 Hand hygiene opportunities according to WHO Five Moments for Hand Hygiene**

| Hand hygiene encounter | Phase I | | Phase III | |
|---|---|---|---|---|
| | n | % | n | % |
| 1. Before touching a patient | 117 | 17.38 | 116 | 16.11 |
| 2. Before aseptic procedures | 172 | 25.56 | 217 | 30.14 |
| 3. After body fluid exposure risk | 87 | 12.93 | 106 | 14.72 |
| 4. After touching a patient | 172 | 25.56 | 137 | 19.03 |
| 5. After touching patient surroundings | 125 | 18.57 | 144 | 20.00 |
| **Total** | **673ᵃ** | **100.0** | **720** | **100.0** |

ᵃNumber of opportunities according to Five Moments for Hand Hygiene is larger than according to healthcare worker professional group due to the fact that an opportunity may be counted twice for 2 indications and once for 1 HCW if 2 indications overlapped.

group. It has been shown that the level of knowledge and compliance with hand hygiene practice differs significantly among nurses according to years of service; the highest level of knowledge was achieved by nurses with < 1 year of service, while the highest compliance level was achieved by more experienced nurses (16–20 years of service). The same study showed that higher levels of nurse education (receiving post-basic course) was associated with increased hand hygiene compliance (29). These finding reflects that hand hygiene education should be continuous and target not only newly recruited nurses, but also those with more experience. Other strategies, beside nurse education, that were proved to positively influence hand hygiene compliance include those aimed at social influence within teams and enhanced leadership (30).

Although hand hygiene compliance levels improved in physicians and nurses, there was no significant change in the other groups, which included technicians, therapists and radiologists. However, the number of observed opportunities for this group in Phase I was relatively small, which was reflected in their statistical results. The compliance rate in this group could also have been affected by the difficulty in targeting such a group in educational activities, which were held using a variety of methods, but mainly by interpersonal communication in the emergency department. Therefore, we can speculate that the chance of receiving an educational session is increased by the average period spent by the personnel in the emergency department. Educational and motivational programmes adapted to specific groups of health personnel are needed to address such a situation.

In this study, the compliance rate before patient contact (23.93%) was lower than after patient contact (48.84%). Similar results have been reported in other local (23) and international (21) studies. This is a phenomenon worth mentioning, because, paradoxically, situations that pose more risk of infection to patients are associated with less hand hygiene compliance from healthcare workers. Hand hygiene before patient contact and before aseptic tasks (Indications 1 and 2) plays a major role in controlling HAIs and avoiding cross-transmission of multiresistant bacteria, thus compliance with these 2 indications is a cornerstone in infection control (6). These 2 indications also showed the highest percentage of improvement after intervention; Indication 2, in particular, showed

**Table 4 Indication specific hand hygiene compliance rates according to the WHO Five Moments for Hand Hygiene**

| Hand hygiene indication | Phase I | | | Phase III | | | P* |
|---|---|---|---|---|---|---|---|
| | Opportunities | HH Action | Compliance (%) | Opportunities | HH Action | Compliance (%) | |
| 1. Before touching a patient | 117 | 28 | 23.93 | 116 | 53 | 45.69 | < 0.001 |
| 2. Before aseptic procedures | 172 | 21 | 12.21 | 217 | 74 | 34.10 | 0.004 |
| 3. After body fluid exposure risk | 87 | 27 | 31.03 | 106 | 43 | 40.57 | 0.926 |
| 4. After touching a patient | 172 | 84 | 48.84 | 137 | 81 | 59.12 | < 0.001 |
| 5. After touching patient surroundings | 125 | 48 | 38.40 | 144 | 76 | 52.78 | 0.02 |

*Calculated by χ² test.

more than double improvement (12.21% to 34.1%). The ignorance of Indication 2 (before aseptic procedure) may have been due to an incorrect assumption that performing hand hygiene before patient contact was enough, and this misconception could be corrected by administering proper hand hygiene education.

The difficulty in targeting particular groups of health personnel, the need to improve the modest adherence to hand hygiene in emergency departments, as well as the need to achieve sustainable improvement, all impose challenging demands on healthcare organizations to develop and maintain an innovative and multidisciplinary approach to improve adherence to hand hygiene. Successful and sustained hand hygiene improvement can be achieved by implementing multiple actions to tackle different obstacles and behavioural barriers. WHO has proposed a multimodal strategy that includes 5 key components: (1) supportive infrastructure; (2) training and education; (3) evaluation and feedback; (4) reminders in the workplace; and (5) creating an institutional safety awareness climate (31). All these elements were implemented in the present study.

Suggestions for further improvements to be implemented include patient participation and leadership involvement. These components were missing from the current study. Patient participation has been shown to be effective in improving compliance (32) and is increasingly recognized as an important item to be included in multimodal strategies to improve hand hygiene adherence (33). Leadership involvement was also absent from our study. Absence of leadership has been linked with loss of sustainable change in hand hygiene compliance (34). Other studies have shown that inclusion of administrative leadership is linked with improvements in hand hygiene compliance rates and most importantly with enhanced sustainability of such improvements (25, 26).

Measurement of HAI rates as an indicator of improved hand hygiene in emergency departments is difficult due to rapid patient turnover rate. This study attempted to evaluate bacterial hand load as an indicator of improvement after infection control intervention. It has

been demonstrated previously that there are significant differences in mean CFU counts before and after handwashing according to frequency of hand washing; bacterial counts tend to decrease with increasing frequency of hand washing (35). We tried to use bacterial load on healthcare workers' hands as an indirect indicator of overall hand hygiene compliance. The average bacterial load per hand decreased significantly, which suggests that average bacterial load on hands of healthcare workers can be used as an objective measurement for overall hand hygiene compliance. Although bacterial load count tends to show great variability from person to person and from time to time, we showed that change in the average count may be used as an indicator for overall compliance. It is difficult to prove the validity of this method due to natural variability of bacterial count

**Figure 1 Box and whisker plots showing bacterial load on hands of healthcare workers measured during Phases I and III.**
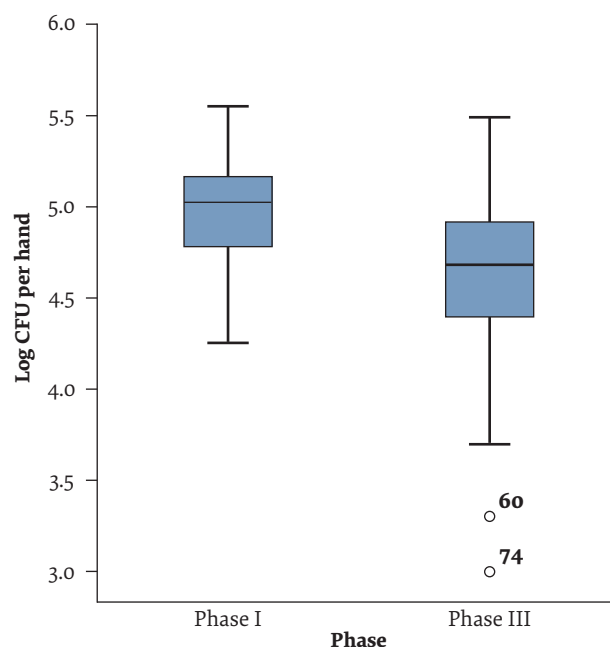
on hands of healthcare personnel throughout the day. This is evident in Figure 1, which shows a wide range of bacterial counts in both phases of the study. Further research is needed to enhance the validity of this method to be used in clinical scenarios.

The limitations of our study included the lack of leadership and patient involvement. We measured short-term improvement, and repeated measurement of sustained improvement over the long term was not performed.

### Conclusion

Educational intervention was effective in improving hand hygiene compliance. Average bacterial load on hands of healthcare workers may be used as an additional indicator of overall compliance with hand hygiene procedures, especially in rapid patient turnover areas such as emergency departments.

## Initiative en faveur de l'hygiène des mains : étude comparative des résultats pré- et post-intervention

### Résumé

**Contexte** : Une hygiène des mains adéquate est considérée comme la mesure la plus efficace pour réduire la transmission des agents pathogènes nosocomiaux.

**Objectifs** : Déterminer l'efficacité d'une intervention visant à améliorer le respect des règles d'hygiène des mains pour la lutte contre les infections au service des urgences de l'Hôpital général d'Al-Leith, en Arabie saoudite, et évaluer la charge bactérienne sur les mains comme indicateur d'amélioration possible.

**Méthodes** : L'étude s'est déroulée en trois phases : Phase I, évaluation du niveau de conformité avec les règles de base d'hygiène des mains ; Phase II, lancement d'un programme multimodal d'éducation en matière d'hygiène des mains ; et Phase III, nouvelle évaluation du niveau de conformité avec les règles de base d'hygiène des mains. Les données collectées découlent de l'observation directe du personnel soignant du service des urgences entre octobre 2016 et mars 2017, en utilisant la méthode d'observation directe standardisée de l'Organisation mondiale de la Santé, les « 5 indications pour l'hygiène des mains ». L'intervention comprenait des sessions d'éducation pour la santé avec contact personnel direct. Des échantillons ont été prélevés sur les mains du personnel soignant durant les Phases I et III selon la méthode du sac stérile afin de déterminer la charge bactérienne.

**Résultats** : Au total, l'observation a permis de relever 1 374 opportunités d'amélioration de l'hygiène des mains durant l'étude en trois phases. La mise en œuvre du programme interventionnel d'éducation en matière d'hygiène des mains a permis d'améliorer de manière significative la conformité avec les règles d'hygiène des mains, qui est passée de 30,7 % à 45,5 % ($p < 0,01$). La charge bactérienne logarithmique (log10) par main a chuté, passant de 4,97 (écart type = 0,32) à 4,57 (0,47) ($p < 0,05$).

**Conclusions** : Les programmes d'éducation en matière d'hygiène des mains se sont avérés efficaces pour améliorer la conformité dans le service des urgences. La charge bactérienne sur les mains des agents de soins de santé pourrait servir d'indicateur d'amélioration du degré de conformité avec les règles d'hygiène des mains.

## مبادرة نظافة الأيدي: دراسة مقارنة للمخرجات قبل التدخل وبعده

محمد فؤاد، شريف الطاهر

### الخلاصة

**الخلفية:** تُعد نظافة الأيدي الكافية أكثر التدابير فعالية للحد من انتقال الجراثيم المستشفوية.

**الأهداف:** تحديد مدى فعالية التدخل بشأن مكافحة العدوى لتحسين الالتزام بنظافة الأيدي في قسم الطوارئ، بمستشفى الليث العام، في المملكة العربية السعودية، وتحديد كمية الجراثيم على الأيدي بوصفها مؤشراً محتملاً لمستوى التحسن.

**طرق البحث:** تكونت الدراسة من ٣ مراحل: المرحلة الأولى: قياس المستوى القاعدي للالتزام بنظافة الأيدي؛ والمرحلة الثانية: بدء تنفيذ برنامج متعدد النماذج حول نظافة الأيدي؛ والمرحلة الثالثة: قياس مستوى نظافة الأيدي مجدداً. وجُمعت البيانات من خلال الملاحظة المباشرة للعاملين في مجال الرعاية الصحية في قسم الطوارئ في الفترة من أكتوبر/ تشرين الأول ٢٠١٦ وحتى مارس/ آذار ٢٠١٧، باستخدام طريقة منظمة الصحة العالمية الموحدة للملاحظة المباشرة، «اللحظات الخمس لنظافة اليدين». وقد اشتمل التدخل على جلسات تثقيفية عن الصحة من خلال التواصل الشخصي المباشر. وأخذت عينات من أيدي العاملين في مجال الرعاية الصحية خلال المرحلتين الأولى والثالثة باستخدام الكيس المعقم، وتحددت كمية الجراثيم.

**النتائج:** بلغ إجمالي فرص نظافة الأيدي ١٣٧٤ فرصةً رُصِدت أثناء الدراسة المكونة من ٣ مراحل. وأدى تنفيذ البرنامج التثقيفي التدخلي لنظافة الأيدي إلى زيادة الالتزام بصورة كبيرة بالمبادئ التوجيهية الخاصة بنظافة الأيدي، إذ ارتفعت من ٧ ,٣٠٪ إلى ٥ ,٤٥٪ (القيمة الاحتمالية ٠١ , ٠).

وشهد اللوغاريتم العشري كمية الجراثيم لكل يد انخفاضاً من ٩٧ , ٤ (الانحراف المعياري = ٣٢ , ٠) إلى ٥٧ , ٤ (القيمة الاحتمالية > ٠٥ , ٠).

**الاستنتاجات:** أثبتت البرامج التثقيفية المعنية بنظافة الأيدي فعاليتها في زيادة الالتزام في قسم الطوارئ، ويمكن استخدام كمية الجراثيم الموجودة على أيدي العاملين في مجال الرعاية الصحية بوصفها مؤشراً على تحسُّن الالتزام بنظافة الأيدي.

# References

1. Pittet D, Allegranzi B, Storr J, Donaldson L. 'Clean Care is Safer Care': the Global Patient Safety Challenge 2005–2006. Int J Infect Dis. 2006 Nov;10(6):419–24. http://dx.doi.org/10.1016/j.ijid.2006.06.001  PMID:16914344

2. Report on the burden of endemic health care-associated infection worldwide. Geneva: World Health Organization; 2011 (https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf;jsessionid=A1D9102FBF66AFA2A8EAA1EE40898CBE?sequence=1, accessed 13 August 2019).

3. Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Infect Control Hosp Epidemiol. 2002 Dec;23(12 Suppl):S3–40. http://dx.doi.org/10.1086/503164  PMID:12515399

4. Mukerji A, Narciso J, Moore C, McGeer A, Kelly E, Shah V. An observational study of the hand hygiene initiative: a comparison of preintervention and postintervention outcomes. BMJ Open. 2013 3(5). http://dx.doi.org/10.1136/bmjopen-2013-003018  PMID:23793705

5. Erasmus V, Daha TJ, Brug H, Richardus JH, Behrendt MD, Vos MC, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. Infect Control Hosp Epidemiol. 2010 Mar;31(3):283–94. http://dx.doi.org/10.1086/650451  PMID:20088678

6. WHO guidelines on hand hygiene in health care : first global patient safety challenge : clean care is safer care. Geneva: World Health Organization; 2009 (https://apps.who.int/iris/bitstream/handle/10665/44102/9789241597906_eng.pdf?sequence=1, accessed 13 August 2019).

7. Pittet D, Allegranzi B, Sax H, Bertinato L, Concia E, Cookson B. Considerations for a WHO European strategy on healthcare-associated infection, surveillance, and control. Lancet Infect Dis. 2005 Apr;5(4):242–50. http://dx.doi.org/10.1016/s1473-3099(05)70055-4 PMID:15792742

8. Carter EJ, Wyer P, Giglio J, Jia H, Nelson G, Kauari VE, et al. Environmental factors and their association with emergency department hand hygiene compliance: an observational study. BMJ Qual Saf. 2016 May;25(5):372–8. http://dx.doi.org/10.1136/bmjqs-2015-004081  PMID:26232494

9. Carter EJ, Pouch SM, Larson EL. Common infection control practices in the emergency department: a literature review. American Journal of Infection Control. 2014 Sep;42(9):957–62. http://dx.doi.org/10.1016/j.ajic.2014.01.026 PMID:25179326

10. Haas JP, Larson EL. Impact of wearable alcohol gel dispensers on hand hygiene in an emergency department. Acad Emerg Med. 2008 Apr;15(4):393-6. 10.1111/j.1553-2712.2008.00045.x PMID:18370997

11. Saint S, Conti A, Bartoloni A, Virgili G, Mannelli F, Fumagalli S, et al. Improving healthcare worker hand hygiene adherence before patient contact: a before-and-after five-unit multimodal intervention in Tuscany. Qual Saf Health Care. 2009 Dec;18(6):429–33. http://dx.doi.org/10.1136/qshc.2009.032771 PMID:19955452

12. Saint S, Bartoloni A, Virgili G, Mannelli F, Fumagalli S, di Martino P, et al. Marked variability in adherence to hand hygiene: a 5-unit observational study in Tuscany. Am J Infect Control. 2009 May;37(4):306–10. http://dx.doi.org/10.1016/j.ajic.2008.08.004 PMID:19135761

13. Bukhari SZ, Hussain WM, Banjar A, Almaimani WH, Karima TM, Fatani MI. Hand hygiene compliance rate among healthcare professionals. Saudi Med J. 2011 May;32(5):515–9.  PMID:21556474

14. Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. 'My five moments for hand hygiene': a user-centred design approach to understand, train, monitor and report hand hygiene. J Hosp Infect. 2007 Sep;67(1):9-21. http://dx.doi.org/10.1016/j.jhin.2007.06.004  PMID:17719685

15. Hand hygiene technical reference manual: to be used by health-care workers, trainers and observers of hand hygiene practices Geneva: World Health Organization; 2009 (https://apps.who.int/iris/bitstream/handle/10665/44196/9789241598606_eng.pdf?sequence=1&isAllowed=y, accessed 13 August 2019).

16. Tools for training and education. Geneva: World Health Organization; 2012 (https://www.who.int/gpsc/5may/tools/training_education/en/, accessed 13 August 2019).

17. Fierer N, Hamady M, Lauber CL, Knight R. The influence of sex, handedness, and washing on the diversity of hand surface bacteria. Proc Natl Acad Sci U S A. 2008 Nov18;18;105(46):17994–9. http://dx.doi.org/10.1073/pnas.0807920105 PMID:19004758

18. Larson EL, Strom MS, Evans CA. Analysis of three variables in sampling solutions used to assay bacteria of hands: type of solution, use of antiseptic neutralizers, and solution temperature. J Clin Microbiol. 1980 Sep;12(3):355–60. PMID:7012171

19. Abdraboh SN, Milaat W, Ramadan IK, Al-Sayes FM, Bahy KM. Hand hygiene and health care associated infection: an intervention study. Am J Med Med Sci. 2016;6(1):7–15 http://dx.doi.org/10.5923/j.ajmms.20160601.02

20. Basurrah MM, Madani TA. Handwashing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia. Scand J Infect Dis. 2006;38(8):620–4. http://dx.doi.org/10.1080/00365540600617025 PMID:16857605

21. Scheithauer S, Kamerseder V, Petersen P, Brokmann JC, Lopez-Gonzalez L-A, Mach C, et al. Improving hand hygiene compliance in the emergency department: getting to the point. BMC Infect Dis. 2013 Aug 7;13(1):367. http://dx.doi.org/10.1186/1471-2334-13-367

22. Creedon SA. Healthcare workers' hand decontamination practices: compliance with recommended guidelines. J Adv Nurs. 2005 Aug;51(3):208–16. http://dx.doi.org/10.1111/j.1365-2648.2005.03490.x PMID:16033588

23. Mahfouz AA, El Gamal MN, Al-Azraqi TA. Hand hygiene non-compliance among intensive care unit health care workers in Aseer Central Hospital, south-western Saudi Arabia. International Journal of Infectious Diseases. 2013 Sep;17(9):e729-e32. http://dx.doi.org/10.1016/j.ijid.2013.02.025 PMID:23602356

24. ALSofiani AM, AlOmari F, AlQarny M. Knowledge and practice of hand hygiene among healthcare workers at Armed Forces Military Hospitals, Taif, Saudi Arabia. Int J Med Sci Public Health, 2015;5(6):1282–91. http://dx.doi.org/10.5455/ijmsph.2016.15042016439

25. Midturi JK, Narasimhan A, Barnett T, Sodek J, Schreier W, Barnett J, et al. A successful multifaceted strategy to improve hand hygiene compliance rates. Am J Infect Control. 2015 May 1;43(5):533–6. http://dx.doi.org/10.1016/j.ajic.2015.01.024 PMID:25769618

26. Staines A, Amherdt I, Lecureux E, Petignat C, Eggimann P, Schwab M, et al. Hand Hygiene Improvement and Sustainability: Assessing a Breakthrough Collaborative in Western Switzerland. Infect Control Hosp Epidemiol. 2017 Dec;38(12):1420–27. http://dx.doi.org/10.1017/ice.2017.180 PMID:28899451

27. Han K, Dou FM, Zhang LJ, Zhu BP. [Compliance on hand-hygiene among healthcare providers working at secondary and tertiary general hospitals in Chengdu]. Zhonghua Liu Xing Bing Xue Za Zhi. 2011 Nov;32(11):1139–42 (in Chinese). PMID:22336552

28. Venier AG, Zaro-Goni D, Pefau M, Hauray J, Nunes J, Cadot C, et al. Performance of hand hygiene in 214 healthcare facilities in South-Western France. J Hosp Infect. 2009 Mar;71(3):280–82. http://dx.doi.org/10.1016/j.jhin.2008.11.020 PMID:19162370

29. Ho SE, Ho CC, Hng SH, Liu CY, Jaafar MZ, Lim B. Nurses compliance to hand hygiene practice and knowledge at Klang Valley hospital. Clin Ter. 2013;164(5):407–11. http://dx.doi.org/10.7417/ct.2013.1604 PMID:24217826

30. Huis A, Holleman G, van Achterberg T, Grol R, Schoonhoven L, Hulscher M. Explaining the effects of two different strategies for promoting hand hygiene in hospital nurses: a process evaluation alongside a cluster randomised controlled trial. Implementation Sci. 2013 Apr 8;Article number 41. https://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-8-41

31. A guide to the implementation of the WHO multimodal hand hygiene improvement strategy. Geneva: World Health Organization; 2009 (https://apps.who.int/iris/handle/10665/70030, accessed13 August 2019).

32. McGuckin M, Waterman R, Porten L, Bello S, Caruso M, Juzaitis B, et al. Patient education model for increasing handwashing compliance. Am J Infect Control. 1999 Aug;27(4):309–14. PMID:10433668

33. Lastinger A, Gomez K, Manegold E, Khakoo R. Use of a patient empowerment tool for hand hygiene. Am J Infect Control. 2017 Aug 1;45(8):824–29. http://dx.doi.org/10.1016/j.ajic.2017.02.010 PMID:28768590

34. Lieber SR, Mantengoli E, Saint S, Fowler KE, Fumagalli C, Bartolozzi D, et al. The effect of leadership on hand hygiene: assessing hand hygiene adherence prior to patient contact in 2 infectious disease units in Tuscany. Infect Control Hosp Epidemiol. 2014 Mar;35(3):313–6. http://dx.doi.org/10.1086/675296 PMID:24521600

35. Larson E. Effects of handwashing agent, handwashing frequency, and clinical area on hand flora. American Journal of Infection Control. Am J Infect Control. 1984 Apr;12(2):76–82 https://doi.org/10.1016/0196-6553(84)90020-8 PMID:6563870

# Actuarial cost and fiscal impact of expanding the Jordan Civil Insurance Programme for health coverage to vulnerable citizens

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## Abstract

**Background:** Achieving universal health coverage is a strategic goal for the Government of Jordan. Estimating the cost of expanding health coverage to vulnerable Jordanians under the Civil Insurance Programme (CIP) is an important step towards achieving this goal.

**Aims:** This study aimed to estimate the cost and fiscal impact of expanding health insurance coverage to vulnerable Jordanians.

**Methods:** We identified and quantified vulnerable Jordanians and estimated their utilization and cost of health services provided at Ministry of Health facilities using allocation and macrocosting approaches. We calculated the annual actuarial cost per person and the fiscal impact of the expansion.

**Results:** It was estimated that 4.9% of Jordanians were vulnerable. On average, a vulnerable Jordanian used 1.25 ambulatory visits and 0.027 admissions fewer annually than a person insured by CIP. The annual cost (US$ 79 million) and fiscal impact (US$ 73 million) of expanding coverage to vulnerable Jordanians were due to more ambulatory services (20%) and hospitalizations (80%).

**Conclusion:** A combination of additional resources and improvement in system efficiencies may fund this expansion.

Keywords: Universal health coverage; vulnerable population; actuarial cost; financial impact; macro-costing; hospital admissions; ambulatory visits; Jordan

## Introduction

Ensuring access to quality, safe, effective and affordable essential healthcare services is a strategic goal for the Government of Jordan (*1,2*), and providing health coverage to vulnerable Jordanians is a critical step to achieving universal health coverage (*3*). Jordan's policies build on evidence from the international literature around the benefits of universal health coverage, particularly for low-income people (*4*). A recent model projected 97 million lives could be saved during 2016–2030 across 67 low- and middle-income countries from achieving universal health coverage and related policies (*5*).

In 2015, 63.4% of Jordanians had some kind of formal health insurance, 31.9% were uninsured, and 4.7% were uninsured but protected through a royal decree (*6*). The public sector covers 52.1% of Jordanians, which comprises the Civil Insurance Programme (CIP) (26.4% of Jordanians), Royal Medical Services (24.1%), and university hospitals (1.6%). The private sector covers 7.9% of the population. The United Nations Relief and Works Agency (UNRWA) covers the primary healthcare costs of 1.6% of the population, while other agencies, such as professional unions, cover 1.6%, and those covered from outside Jordan comprise 0.3% (*1*).

Lack of formal health insurance coverage does not mean that those not formally insured are completely without financial protection. All residents can benefit from the subsided healthcare services provided at the Ministry of Health (MoH) facilities (*1*). Children enrolled at public schools receive healthcare through the school health programme, and most Jordanians who lack formal insurance coverage or means to pay for healthcare may receive medical assistance through the Royal Court and other agencies.

The CIP is a semiautonomous fund managed by the MoH and provides health coverage for 41.7% of Jordanians with formal health insurance. The CIP covers all government officials and their dependents for care at MoH facilities and other public and private facilities, based on a grading system structured according to the government officials' level and years of service (*7*). In recent years, the Government of Jordan took bold steps toward expanding health coverage. All children under 6 years of age, persons aged ≥ 70 years, and citizens residing in the least fortunate and remote areas were exempt from user fees for health services provided at MoH facilities (*6*).

The CIP issues an insurance card to citizens classified as low income by the Ministry of Social Development;

those eligible for safety net benefits; families whose head of household has ≥ 75% disability; families in which 1 member is an organ donor; and blood donors. Optional paid membership in the CIP is available for all citizens who wish to be enrolled and are not already covered, including pregnant women and those aged ≥ 65 years. The premium progressively increases with age (*1*). Despite these measures, vulnerable Jordanians may face limitations in accessing care, particularly for specialized services. This article should help Jordan, and other countries in the region, to estimate the cost of expanding their health insurance programmes to cover vulnerable populations.

The objective of this study was to estimate the cost and fiscal impact of expanding health insurance coverage to vulnerable Jordanians to assist the Government of Jordan in moving toward universal health coverage. Specifically, we estimated the annual actuarial cost of covering a vulnerable Jordanian through the CIP and the fiscal impact on the Government of Jordan of expanding coverage to this vulnerable population in 2016. For the purpose of this study, vulnerable Jordanians were defined as individuals in households with US$ 1438 or less annual overall expenditure per household member, and lack health protection. This segment of the population is at high risk of falling below the poverty line, and possibly crossing in and out of poverty intermittently (*8*).

## Methods

### Study design

We derived the person-level cost of expanding health coverage for 2016 by multiplying utilization data obtained from the Jordan Healthcare Utilization and Expenditure Survey 2010 (*9*) times the unit costs of the corresponding healthcare services. We derived unit costs from the Jordanian National Health Accounts 2009–2016 (*10–15*), MoH statistics (*16–22*), 3 Delphi panels of MoH experts from the 12 governorates in Jordan, and CIP expenditure. We then estimated the actuarial cost of expanding health coverage to uninsured Jordanians and the fiscal impact of expanding health coverage to vulnerable Jordanians.

### Annual utilization rate

We used the Jordan Healthcare Utilization and Expenditure Survey 2010 (*9*) to estimate the number of annual per capita ambulatory visits at MoH facilities and at other healthcare providers facilities, and the annual per capita admission rates at MoH hospitals and at hospitals run by other providers for Jordanians with CIP coverage and those with no insurance coverage. To estimate the expected increase in demand from an expansion of health insurance, we assumed, as justified below, that uninsured vulnerable Jordanians would have a similar healthcare utilization pattern to those covered under the CIP. The difference between utilization rates of those with CIP coverage and uninsured Jordanians was the expected increase in per capita ambulatory visits and hospital admissions for uninsured Jordanians if they were offered the CIP expansion coverage.

### Cost of services

To estimate the person-level cost to the Government of Jordan, which funds both the MoH and CIP, we estimated the cost of an ambulatory service (health centre, outpatient visit, or emergency room visit) and a hospital admission sought at MoH facilities or other providers contracted by the CIP. Based on expert opinion from the first Delphi panel, we used the expenditure allocation approach to estimate the cost of providing healthcare services at MoH facilities after allocating central management and training costs to MoH centres and hospitals. A report by Shepard et al. (2017) provides more details (*7*). We included all expenditure incurred at MoH facilities regardless of the source of finance (*11–15*).

To estimate the average unit costs of services provided at MoH hospitals, we used the macro costing approach with relative values from the international literature to derive the cost per inpatient bed day and cost per outpatient visit (*10,23,24*), as described previously (*7*). This approach helped us pool the cost among populations regardless of their health status. We used the MoH annual statistical reports to obtain the MoH hospitals' statistics for 2009–2015 (*16–22*).

For care provided at health centres, we excluded expenditure on public health activities (e.g., environmental health and health promotion activities) based on the second Delphi panel's estimates. We converted vaccination services provided during the national vaccination campaigns into equivalent health centre visits using an adjustment factor obtained from the third Delphi panel (one vaccination service equals 0.205 curative visits). We then calculated the cost of a curative visit to a MoH health centre by dividing the total annual cost by the number of visits.

We used a weighted average to estimate the cost of any ambulatory service provided at the MoH facilities (both health centres and outpatients clinics at MOH hospitals). We adjusted the unit costs to 2016 Jordanian dinars (JD) from the original years using gross domestic product per capita, averaged the resulting 7 years' values as our best estimate of unit costs, and then converted the cost to 2016 US dollars (1 JD = US$ 1.41) (*25*).

To estimate the CIP expenditure for services provided outside MoH facilities, we obtained the annual CIP expenditure on primary and secondary care received outside MoH facilities using the National Health Accounts data and derived the cost per enrolee by dividing these aggregate costs by the number of CIP enrolees by setting (i.e., primary care or hospital) (*11–15*).

### Annual actuarial cost per person

The Government of Jordan subsidizes MoH services to all residents. We collected and analysed patient charges from Al-Bashier Hospital, one of the major MoH hospitals, which showed that, for an outpatient visit, the Government of Jordan covers 97% and 73% of direct medical costs of outpatient services provided to individuals with CIP insurance and uninsured Jordanians, respectively.

For an admission at this MoH hospital, the Government of Jordan covers 100% and 64% of services provided to individuals with CIP insurance and uninsured Jordanians, respectively (16–22). These allocations were similar to estimates from the second Delphi panel of MoH officials.

We defined the actuarial cost as the cost that an insurer would incur in covering the economic cost of expected healthcare utilization. We estimated this actuarial cost per person for a Jordanian covered under the CIP programme and for an uninsured Jordanian by multiplying the products of the unit cost of each type of service (ambulatory visits and admissions) by its utilization rate. We then estimated the differences in the actuarial cost between CIP enrolees and uninsured Jordanians. This difference was the additional cost per person to the Government of Jordan associated with expanding the CIP to cover uninsured vulnerable Jordanians, adjusting for the current level of Government subsidies for healthcare services offered at MoH facilities.

### Fiscal impact to the Government of Jordan

The fiscal impact is the net cost to the Government of Jordan after adjusting for costs already being incurred by the MoH for the current use of MoH services by uninsured Jordanians and changes in CIP revenue collected at MoH facilities. We estimated the aggregate fiscal impact under the proposed CIP expansion as the individual fiscal impact multiplied by the size of the population to be covered.

### Sensitivity analysis

We used probabilistic sensitivity analysis to address the uncertainties in our cost estimates. We used the normal distribution to estimate the cost of providing healthcare services at MoH facilities, and CIP expenditures per CIP beneficiary for healthcare services provided outside MoH facilities. The mean and standard deviation (SD) of this distribution were calculated from the average unit costs of an ambulatory visit, admission, and CIP expenditure for care provided outside MoH facilities in 2009–2017. For each sensitivity analysis, we performed 1000 Monte Carlo simulations with independent drawing for each parameter. We calculated 95% confidence intervals (CIs) of overall costs of ambulatory visits, admissions, and CIP expenditures for care provided outside MoH facilities based on the Monte Carlo simulations. The 95% CIs of components separated between those covered by the CIP and uninsured were based on the SDs in the Jordan Healthcare Utilization and Expenditure Survey 2010 (9). We considered the variation in utilization for overall costs as negligible because of the large sample size (59 000 individuals) in the survey (9).

## Results

The annual per capita utilization rates [mean (SD)] for a CIP beneficiary were 4.44 (13.51) for ambulatory visits, of which, 1.46 (4.11) occurred at MoH facilities, and 0.084 (2.984) admissions, of which, 0.049 (0.606) occurred at MoH hospitals and 0.035 (0.408) outside MoH hospitals.

The annual per capita utilization rates for an uninsured Jordanian were 3.17 (12.56) for ambulatory visits, of which, 0.44 (2.36) occurred at MoH facilities, and 0.045 (1.394) admissions, of which, 0.049 (0.606) occurred at MoH hospitals. On average, CIP beneficiaries used 1.02 (4.74) more ambulatory visits and had 0.027 (0.664) more hospital admissions at MoH facilities per person per year compared to uninsured Jordanians. They also had 0.25 (17.66) more annual ambulatory visits and 0.012 (0.493) more admissions to other health providers compared to the uninsured Jordanians (9). While these SDs are several times the corresponding means, the standard errors of the means for the groups and differences between them are small due to the number of individuals (59 000) in the underlying survey.

The average unit cost of a visit at MoH health centre and MoH hospital ambulatory visit (outpatient and emergency) was US$ 11.61 (3.85) and US$ 55.49 (5.22), respectively. The weighted average of an ambulatory visit at MoH facilities (hospitals and health centres) was US$ 23.12 (4.21). The average cost of an admission at MoH facilities was US$ 541.02 (52.44). CIP expenditure per CIP beneficiary for services provided outside MoH facilities was US$ 5.67 (1.05) for ambulatory care and US$ 166.07 (34.31) for admissions.

The total annual actuarial cost per CIP enrolee was US$ 240.80 (95% CI) (US$ 163.11–304.86). This cost included the entire cost of inputs for producing health services at MoH facilities and acquiring services from other healthcare providers. The actuarial cost to the CIP to provide coverage to an uninsured Jordanian was US$ 43.50 (US$ 29.67–47.26) for services provided at MoH facilities and US$ 171.74 (US$ 103.32–243.03) for services provided by other providers. The additional actuarial cost per uninsured Jordanian was US$ 215.22 (US$ 143.67–283.20) (Table 1).

Revenue from services provided at MoH facilities varied by insurance status. The annual per capita out-of-pocket payment by an uninsured Jordanian for an ambulatory visit was US$ 11.33 (US$ 10.17–12.49) compared to US$ 2.92 (US$ 1.53–4.31) for those covered by the CIP. The annual per capita out-of-pocket payment by uninsured Jordanians for admissions at MoH hospitals was US$ 9.04 (US$ 7.75–10.33] compared to US$ 1.57 (US$ 1.16–1.98) for those covered by the CIP.

Expansion of health coverage to uninsured Jordanians would reduce CIP revenues by US$ 8.41 (US$ 6.60–10.22) per person to be covered from ambulatory services and US$ 7.47 (US$ 6.12–8.82) from inpatient revenue, with an overall revenue loss of US$ 15.88 (US$ 12.72–19.04) per person to be covered.

We derived the fiscal impact by combining the expected loss in revenue per person to the CIP with the actuarial cost. The overall cost to the Government of Jordan or fiscal impact was US$ 223.20 (US$ 159.55–299.08) per person to be covered (Figure 1). The aggregate cost for 326 082 vulnerable Jordanians would be US$ 73 million (US$ 52–98 million). This cost could be broken down by settings as 20% due to ambulatory services

**Table 1 Current cost paid by Government of Jordan for Jordanians with CIP coverage and uninsured Jordanians, and estimated additional cost if uninsured Jordanians were offered coverage through CIP**

| Benefit setting | CIP enrolees | | | Uninsured | | | Differences | | |
|---|---|---|---|---|---|---|---|---|---|
| | Ambulatory | Admissions | Both | Ambulatory | Admissions | Both | Ambulatory | Admissions | Both |
| MoH facilities | 42.05 | 27.02 | 69.06 | 13.23 | 12.34 | 25.58 | 28.82 | 14.68 | 43.50 |
| Outside MoH | 5.67 | 166.07 | 171.74 | 0.00 | 0.00 | 0.00 | 5.67 | 166.07 | 171.74 |
| **Total** | **47.71** | **193.09** | **240.80** | **13.23** | **12.34** | **25.58** | **34.49** | **180.73** | **215.22** |

*Results are per person in 2016 in US$. CIP = Civil Insurance Programme; MoH = Ministry of Health.*

and 80% to inpatient services, and by origin to 94% due to actuarial cost of additional services and 6% loss of revenue to the CIP.

## Discussion

We found that expanding the CIP to uninsured vulnerable Jordanians would cost US$ 241 per person per year or US$ 79 million per year under a scheme similar to that offered to government officials. Our results suggest that the Government of Jordan could expand coverage to vulnerable Jordanians under the CIP with an annual additional cost of US$ 223.20 per person. The aggregate cost and aggregate additional cost would be US$ 79 million and US$ 73 million, respectively. This expansion would be affordable and represent only 3.5% of public sector health expenditure in Jordan (15), and would reduce the percentage of Jordanians who lack health coverage from 32% to 27% (6). By providing coverage for 1 in 6 uninsured Jordanians – likely the neediest – this policy would be a positive step towards universal coverage.

While expanding coverage might require additional resources for the MoH facilities to maintain and improve service capacity and quality, the expansion may also improve efficiency of the health system and even reduce overall health expenditure at the national level, if planned and implemented appropriately. Currently, all Jordanian

citizens can benefit from the highly subsided services provided at MoH facilities (1), and most Jordanians who lack formal insurance coverage or means to pay for health care can receive medical assistance through the Royal Court and other agencies. In 2013, the Royal Court paid US$ 254 million to treat 110 000 cases, mostly outside the MoH facilities (average of US$ 2307 per case). While this system helps avert catastrophic expenditure, its absence of active management, lack of review of the care plan or its cost, and the perverse incentive of covering only uninsured Jordanians undermine efforts to expand health coverage in a systematic way.

Moving forward, the Government of Jordan and MoH should consider several options to fund this expansion of CIP coverage. Rechannelling funds from the Royal Court to the CIP should be considered to cover vulnerable Jordanians and establish contract mechanisms with other health providers for services provided outside the MoH to uninsured Jordanians. Funding CIP expansion to vulnerable Jordanians would amount to 29% of the Royal Court expenditure in 2013. Another funding source might be the international community. Jordan has been covering the health care of Syrian refugees in Jordan for > 5 years, and the international community should consider assisting the Government of Jordan in its quest to achieve universal health coverage, to mitigate any potential tension between citizens and refugees due to shrinking resources. Additionally, the Government of Jordan might consider earmarking some of the sin taxes on tobacco and sweetened drinks to the MoH. Moreover, improving MoH system efficiency might generate some savings that could be used to cover this vulnerable population (26). These efficiencies might include developing and implementing guidelines to deal with chronic diseases and cancer, and utilizing the mid-level workforce to conduct outreach activities and patient follow-up.

This study had several limitations. First, our estimate was based on a comparison between Jordanians insured under the CIP and uninsured Jordanians. We assumed these two groups had similar needs. Two offsetting factors might support this assumption: it is possible that the uninsured population is in poorer health and, if insured, would use more services, incurring higher costs than those estimated here. However, vulnerable Jordanians might have more challenges in accessing services, which would lead to lower utilization. We examined the

**Figure 1 Cost of providing insurance to vulnerable Jordanians, combining the net costs of services plus loss of current revenues, per person in 2016 (US$)**
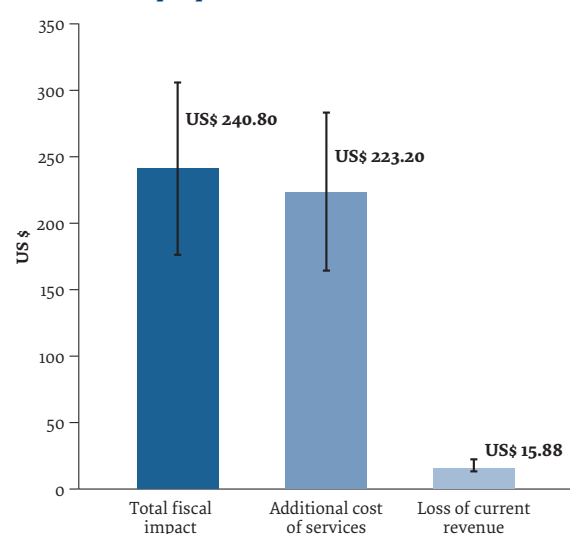
enrolment of those with low incomes under the CIP and their utilization of MoH services in 2011–2015. We found that only 11% of those on low incomes were covered by the CIP and their utilization rate was high, an annual 7 visits per low-income person enrolled, suggesting that those who need care applied and obtained coverage. Second, our utilization data were from 2010. While major changes at the health-system level did occur due to the subsequent influx of Syrian refugees, it is unlikely that individual health-seeking behaviour changed for the Jordanian population. We analysed the utilization rate at MoH centres for those with CIP coverage and those categorized as having low incomes in 2009–2014 and found a consistent rate of utilization. Finally, the current analysis was based on the current level of Government subsidies and donor support for healthcare services offered at MoH facilities. Future policy changes that increase out-of-pocket costs could lower utilization, while improved quality of care could result in higher utilization.

### Conclusion

We estimated the cost of expanding healthcare coverage to vulnerable Jordanians to assist the Government of Jordan in achieving its goal of universal health coverage. The cost of expanding healthcare coverage for vulnerable Jordanians was US$ 223.20 per person newly covered per year. A combination of additional resources and improvement in system efficiencies could fund this expansion.

## Coût actuariel et impact fiscal de l'élargissement du Programme jordanien d'assurance civile à la couverture sanitaire des citoyens vulnérables

### Résumé

**Contexte** : La mise en place d'une couverture sanitaire universelle est un objectif stratégique pour le Gouvernement jordanien. L'estimation du coût de l'élargissement de la couverture sanitaire aux Jordaniens vulnérables dans le cadre du Programme d'assurance civile (CIP) est une étape importante dans la réalisation de cet objectif.

**Objectifs** : La présente étude visait à estimer le coût et l'impact fiscal de l'élargissement de la couverture d'assurance maladie aux Jordaniens vulnérables.

**Méthodes** : Nous avons identifié et quantifié les Jordaniens vulnérables, puis estimé leurs utilisations et le coût des services de santé fournis dans les établissements du ministère de la Santé au moyen d'approches basées sur l'allocation de crédit et l'estimation du coût par macro-éléments. Nous avons calculé le coût actuariel annuel par personne et l'impact fiscal de l'élargissement du programme.

**Résultats** : Selon les estimations, 4,9 % des Jordaniens étaient vulnérables. En moyenne, un Jordanien vulnérable effectuait 1,25 visite ambulatoire et avait 0,027 hospitalisation de moins par an qu'une personne couverte par le CIP. Le coût annuel (USD 79 millions) et l'impact fiscal (USD 73 millions) de l'élargissement de la couverture aux Jordaniens vulnérables étaient dus à l'augmentation des services ambulatoires (20 %) et des hospitalisations (80 %).

**Conclusion** : L'association de ressources supplémentaires et d'une amélioration de l'efficacité du système pourrait permettre de financer cet élargissement du programme.

## التكلفة الأكتوارية والأثر المالي للتوسع في برنامج التأمين الصحي المدني الأردني لتحقيق التغطية الصحية للفئات المستضعفة من المواطنين.

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### الخلاصة

**الخلفية:** تحقيق التغطية الصحية الشاملة هدف استراتيجي لحكومة الأردن. ويتعين تقدير تكلفة التوسع في التغطية الصحية لتشمل الفئات المستضعفة بين المواطنين الأردنيين في إطار برنامج التأمين الصحي المدني بوصفها خطوة مهمة تجاه بلوغ هذا الهدف.

**الأهداف:** الهدف من هذه الدراسة هو تقدير تكلفة الأثر المالي لتوسع تغطية التأمين الصحي ليشمل الفئات المستضعفة من المواطنين الأردنيين.

**طرق البحث:** قمنا بتحديد وحصر الفئة المستضعفة من المواطنين الأردنيين، وقدَّرنا حجم استخدامهم للخدمات الصحية المقدمة في المرافق التابعة لوزارة الصحة وتكلفتها، وذلك باتباع نهجَي التخصيص وحساب التكاليف الكلية. وحَسَبنا كذلك التكلفة الأكتوارية السنوية للشخص والأثر المالي للتوسع.

**النتائج:** قُدرت نسبة الفئات المستضعفة بين المواطنين الأردنيين بحوالي ٤٫٩ ٪. وفي المتوسط، تلقى المواطن الأردني من الفئات المستضعفة ١٫٢٥ زيارة لأحد المرافق الصحية والإسعافية، وقدر متوسط الإدخال إلى المستشفى بحوالي ٠٫٠٢٧ مرة، وهو معدل أقل سنوياً من الشخص المشمول

بالتأمين الصحي في إطار برنامج التأمين الصحي المدني. وبلغت التكلفة السنوية (٧٩ مليون دولار أمريكي) وبلغ الأثر المالي (٧٣ مليون دولار أمريكي) للتوسع في التغطية الصحية لتشمل الفئات المستضعفة من المواطنين الأردنيين لتوفير مزيدٍ من الخدمات الإسعافية (٢٠٪) وإدخال المستشفيات (٨٠٪).

**الاستنتاج:** يمكن تمويل عملية التوسع من خلال الجمع بين توفير موارد إضافية وتحسين كفاءات النظام.

# References

1. The national strategy for health sector in Jordan 2016–2020. Amman: High Health Council; 2016 (http://www.nationalplanning-cycles.org/sites/default/files/planning_cycle_repository/jordan/national_strategy_for_health_sector_2016-2020_jordan.pdf, accessed 10 August 2019).

2. Jordan 2025: a national vision and strategy. Amman: Ministry of Planning and International Cooperation; 2015 (http://inform.gov.jo/Portals/0/Report%20PDFs/0.%20General/jo2025part1.pdf, accessed 10 August 2019).

3. Transforming our world: the 2030 Agenda for Sustainable Development. Geneva: United Nations; 2015 (https://sustainabledevelopment.un.org/post2015/transformingourworld, accessed 10 August 2019).

4. Moreno-Serra R, Smith PC. Does progress towards universal health coverage improve population health? Lancet. 2012 Sep 8;380(9845):917–23. http://dx.doi.org/10.1016/S0140-6736(12)61039-3 PMID:22959388

5. Stenberg K, Hanssen O, Edejer TT, Bertram M, Brindley C, Meshreky A, et al. Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. Lancet Glob Health. 2017 Sep 1;5(9):e875–87. http://dx.doi.org/10.1016/S2214-109X(17)30263-2 PMID:28728918

6. General population and housing census 2015. Main results. Amman: Department of Statistics; 2016 (http://dosweb.dos.gov.jo/wp-content/uploads/2017/08/Census2015_Eng.pdf, accessed 10 August 2019).

7. Shepard D, Halasa-Rappel Y, Al-Halaseh I, Fardous T, Jrasat M, Abu-Shaer M. Health care cost study at Ministry of Health and the cost and financial impact of expanding the Civil Insurance Program to vulnerable Jordanians and Syrian refugees. Amman: UNICEF Jordan Country Office, 2017.

8. Background document for the national poverty reduction strategy. Hashemite Kingdom of Jordan. The Earth Institute, Columbia University; 2012 (http://www.mop.gov.jo/EchoBusV3.0/SystemAssets/97742757-5f15-492a-8246-603d0abee8b2.pdf, accessed 10 August 2019).

9. Department of Statistics, Jordanian Ministry of Health. Jordan healthcare utilization and expenditure survey 2010. Amman: Ministry of Health; 2010.

10. Adam T, Evans DB, Ying B, Murray CJ. Variability in costs across hospital wards. A study of Chinese hospitals. PLoS One. 2014 May 29;9(5):e97874. http://dx.doi.org/10.1371/journal.pone.0097874 PMID:24874566

11. Jordan national health accounts 2009. Technical report no. 3. Amman: High Health Council; 2012.

12. Jordan national health accounts 2010–2011. Technical report no. 4. Amman: High Health Council; 2013.

13. Jordan national health accounts 2012. Technical report no. 5. Amman: High Health Council; 2014.

14. Jordan national health accounts 2013. Technical report no. 6. Amman: High Health Council; 2016.

15. Jordan national health accounts 2014–2015. Unpublished.

16. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2009.

17. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2010.

18. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2011.

19. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2012.

20. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2013.

21. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2014.

22. Department of Statistics and Information. Annual statistical report. Amman: Ministry of Health; 2015.

23. Shepard DS, Hodgkin D, Anthony YE. Analysis of hospital costs: a manual for managers. Geneva: World Health Organization; 2000 (https://apps.who.int/iris/bitstream/handle/10665/42197/9241545283.pdf?sequence=1&isAllowed=y, accessed 10 August 2010).

24. Adam T, Evans DB. Determinants of variation in the cost of inpatient stays versus outpatient visits in hospitals: a multi-country analysis. Soc Sci Med. 2006 Oct;63(7):1700–10. http://dx.doi.org/10.1016/j.socscimed.2006.04.023 PMID:16769168

25. Department of Statistics. Jordan Gross National Product 1999 through 2016.

26. Towards universal health coverage: a comprehensive review of the health financing system in Jordan. Report no: ACS9635. Washington, DC: World Bank; 2014.

# Addiction, childhood experiences and nurse's role in prevention: a qualitative study

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## Abstract

**Background:** Parenting approach and early childhood experiences are thought to be two important factors in the initiation of substance use.

**Aims:** We aimed to explore the nurse's role in the prevention of childhood addiction.

**Methods:** In this qualitative study we conducted in-depth interviews with young men and women who were either in treatment for their addiction or were active drug users as well as with family members and nurses. The data analysis followed Strauss and Corbin's constant comparison method.

**Results:** The data analysis revealed six categories: traumatic events during childhood, inappropriate parenting approach, Lack of knowledge and a tolerant attitude toward drug use, turning a blind eye on the threat of drug use, nurses' poor experience of drug use prevention, and the lack of a clear definition of the nurse's role in prevention of drug use.

**Conclusions:** Nurses who work with young people and their families have a special opportunity for prevention, early detection and timely intervention for drug dependency.

Keywords: addiction, prevention, childhood, parenting, qualitative study.

## Introduction

Substance abuse and addiction are preventable disorders that interfere with normal healthy functioning, contributing to physical and behavioural health problems, injuries, lost income and productivity, and family dysfunction (1). Drug abuse and dependency pose a major public health threat and continue to endanger the health and socioeconomic fabric of societies around the world (2,3), especially affecting teenagers and young adults (4). The transition period from mid to late adolescence into early adulthood is identified as a high risk period for drug use. Young people's involvement with negative behaviour during this period may become habituated and develop into lifetime patterns (5).

Opium consumption gradually became prevalent in the Islamic Republic of Iran. According to the United Nations Office on Drugs and Crime (UNODC) the country is suffering from the second most severe addiction to opioids, and the highest rate of heroin and opium addiction per head of population in the world: 20% of the Iranian population aged 15–60 years is involved in drug abuse, and 1 in 17 is a regular user. The annual opium consumption is 450 metric tons UNODC estimates. Other figures indicate that more than 4 million of the 70 million population are addicted to substances, 69.0–94.6% of whom are dependent on raw opium, and about 83% of opioid-dependent individuals who sought treatment services in 2009 were addicted to opium (6).

It has been reported that varied etiological reasons may contribute to the initiation and continuation of drug use, including genetic and social factors (7), family relationships and poor parenting practices (8). While substance use generally begins during the adolescent years, there are known biological, psychological, social and environmental factors that contribute to the risk that begin accumulating as early as the prenatal period. This creates opportunities to intervene very early in an individual's life and thereby prevent substance use disorders (and, along with them, a range of other related behavioural problems) long before they would normally manifest themselves (1).

Research into nurse practitioners and alcohol and drug services has suggested that collaborative care involving nurses could lead to better patient access to help and decrease waiting times and longer consultation times. It also suggested that patient satisfaction outcomes are similar when a drug or alcohol intervention is provided by nurse practitioners or physicians (9). Nurses are recognized as key agents in addressing drug use at the individual, family and community levels. They are one of the largest groups of professionals working in drug misuse (10).

It has been suggested that to achieve more effective drug use interventions, it is better to focus on probable reasons and motivational factors underlying drug and alcohol misuse (11). This is one of the compelling reasons as to why the experiences and the point of view of the

drug users need to be better understood by people who are involved in the planning services for, and in the care of, these patients. Minimal involvement of Iranian nurses in the field of addictions was actually the major concern of the authors in choosing the subject of addiction for the research topic.

This study aimed to explore the role of nurses in prevention of childhood addiction in Tehran. Therefore, we tried to draw attention to the potential contribution that nurses can make in addressing a major public health problem like addiction in countries such as the Islamic Republic of Iran by building on the results of a qualitative inquiry that explored the early childhood experiences of young drug users.

## Methods

### Design

We used a qualitative method to explore the role of nurses in prevention of childhood addiction. Because of their capacity to explore human behaviours, qualitative methods are well-suited to demystifying the facts about drug use with more accurate information that reflects the daily experiences of substance users' lives (12). Face-to-face, semi-structured interviews were held with participants. Interview questions were open-ended to allow participants to thoroughly describe their opinions, perceptions, and experiences on the nurses' involvement in prevention of addiction. The following questions were asked of the nurses and youth respectively: "Have you ever had the experience of providing care for a young adult or youth who were addicted or were suspicious to any type of drug abuse? If yes, what did you do?" "When was the first time that you were exposed to illegal drugs?" "And tell me about the condition and the reaction of people around you?" "Have you ever had the experience of being helped by a health care worker?"

Subject selection in qualitative research is purposeful; participants are selected who can best inform the research questions and enhance understanding of the phenomenon under study (13). As saturation determines the greater part of qualitative sample size (14), we continued the sampling process till new data did not shed any further light on the issue under investigation. We chose participants of different sex, age and socioeconomic and educational background. The participants were recruited purposefully with the help of staff from medical treatment centres and nongovernmental organizations that aim to help addicts. We also used snowball sampling and from public parks where users gathered.

The participants we interviewed were addicted men and women aged 18–35 years. Since addiction is a complex phenomenon which does not happens overnight, they were asked to talk about their childhood experiences, their relationship with their families, when and how they came to know about drugs, their first drug use experience and the conditions and the environment in which the first drug use took place. Participants were also asked to talk about the probable training and preventive health programmes they undertook during their childhood periods regarding drugs and drug use, and they were asked if any nurses or teachers gave them any information on drugs and addiction. Based on the theoretical sampling, the researchers were guided to interview with nurses and participants family members. In the interviews with the nurses they were asked about their experiences on the prevention of the addiction. The interviews lasted between 30 minutes and 150 minutes over 1–2 sessions. They were audio taped and then transcribed. The qualitative data analysis software MAXQDA-10 was used to manage and analyse the data.

In order to get maximum diversity, some interviews had to be conducted in public places like parks where drug users gather.

During the research process from data collection to analysis and reporting of findings, in order to comply with research ethics, an informed consent form was completed by all participants. Participants were asked to agree to the recording of their interviews and the anonymous use of the information. All participants agreed to the anonymous use of information by the research team, therefore any information that would expose the participants was removed. The participants were assured that the information would be kept confidential and audio recordings would be erased after the end of the study and they were informed of their right to withdraw at any time.

### Data analysis

The data analysis followed Strauss and Corbin's constant comparison method (15). Transcribed interviews were coded by the first author in agreement with the co-investigators, and then the codes were hierarchically organized and revised and repeatedly compared across the data to form the main categories until saturation had been reached and no further themes emerged. Concepts were analysed through the frequent, precise and meticulous reading of the transcripts. All possible meanings of the data were considered and meaning labels assigned. High-level concepts were assigned as categories/themes. During the interviews and data analysis, effective contextual factors in the process of the nurses' experiences in the prevention of addiction, e.g. participants' reactions, were taken into consideration.

By reviewing and comparing the categories and subcategories in terms of their features and dimensions, they were reduced to more-abstract categories. Using memos, prolonged engagement with informants and reflexivity on the data and categories which emerged from analysing the contextual factors, we constantly compared the data.

Credibility was enhanced through member checking, validation of emerging themes in subsequent participant interviews and debriefing with expert supervisors. Prolonged engagements with participants, peer checking and maximum variation in sampling were used for validation and credibility of the data. Four interviews

with family members and 20 interviews with nurses confirmed the emergent themes.

This study was granted ethical approval by the research committee of the School of Nursing and Midwifery of Tehran University of Medical Sciences. Informed consent was obtained from all participants.

## Results

The data were collected between April 2009 and December 2012, through 44 individual in-depth interviews. Twenty interviews were conducted with drug-dependent young people (10 male, 10 female). Fifteen of these participants were in treatment for their opiate addiction and the rest were actively using at the time of the study. Four interviews were conducted with family members of the participants and 20 interviews were conducted with nurses (Table 1).

Our analysis revealed the following themes related to the childhood experiences and parenting style.

**Traumatic events during childhood:** Traumatic events in early childhood were a shared experience for the majority of participants, and included physical, sexual and emotional abuse, exposure to parental violence in early childhood, and other family problems such as family breakdown and parental addiction.

- I left the house since I hated my stepmother, she used to beat me up, especially when I lost my dad. I had no reason for staying there, I went to the streets without having money. There I saw a young man asking me to go with him and there was the beginning of the story, he introduced me to the drugs. (Participant 3)

- I had so many problems with my family and no-one in the school knew about it. I couldn't study since my mind was occupied with all those problems, my grades were low and my teacher used to make me feel unworthy. (Participant 2)

- I was about 9 years old; my father was a truck driver and consequently rarely at home. My mother was a user, and I couldn't bear seeing her buying the drugs. That is why I thought I should cover up for her and purchase her drug from the drug seller. This was how it all began. (Participant 14)

**Inappropriate parenting approach:** Subcategories like disconnection between parents and their child, living in 2 different worlds, parents' high expectations for their children and inappropriate punishment were considered under the main category of "inappropriate parenting approach".

- I had everything in my life, but there was a lack of understanding between us; we were well provided for by our parents, but our relationship was not deep, we were living in let's say parallel lives. (Participant 20)

- It was my parents fault; they forced me to hide the truth because they always expected me to stay as their idealized child but not a real one. (Participant 9)

- None of our family members have the habit of using drugs or alcoholic beverages. As parents, we were

never thought about probability of addiction among our children. (Participant 23)

- Our children never asked about illegal drugs and we were thinking that exposing them to these issues might raise their curiosity. (Participant 23)

**Lack of knowledge and tolerant attitude toward drug use:** A tolerant parental attitude toward drug using was frequently mentioned by participants. It was interesting to hear that opium was considered an acceptable painkiller for a range of pain-related symptoms. Perhaps, lack of knowledge along with a tolerant attitude towards drug use made them prone to addiction.

- I had a chronic back pain and my brother recommended me to use opium. He said, "It is safer and less dangerous than the chemical painkillers." He told me only one puff is enough. I really didn't know that it was an addictive drug. That experience made me think that occasional use is OK. (Participant 12)

**Turning a blind eye to the threat of drug use:** Based on our interviews, none of the participants had experienced any kind of training programmes related to prevention of drug use or addiction in their schools, family or communities; it was like society had turned a blind eye to the threat of drug use among youth.

- They never taught us anything about the hazards of drugs and drug use, I don't know why, but it was like that; our teachers thought no danger would threaten us. (Participant 17)

- We were so engaged with the problems we had in our family, we were on the verge of divorce with my husband, and he was a drug user, so for a long time we neglected our children. (Participant 42)

**Nurses and drug use prevention:** We also interviewed 20 nurses and took their experiences regarding drug use prevention among youth. The analysis revealed that nurses are not involved in the field of addiction prevention. The result of our analysis of interviews with the nurses also revealed a number of themes:

The first theme was "low experience about drug use prevention." Nurses noted that there was no training programme regarding the prevention of addiction in their curriculum. The second theme was "the lack of a clear definition of nurses' role in prevention of drug use." They explained that nurses were mainly trapped in the hospitals and clinics and their fundamental role was taking care of patients, not informing the youth of the hazards of drugs and the prevention of addiction.

- Concerning drug use prevention among teens, in fact, there is no structured programme for training us in our nursing curriculum. Also, there is no clear definition of the role of nurses in the prevention of drug use among youths. (Participant 38)

- We don't have a school nurse in our country. The school nurse could have a great role in the early recognition and prevention of any deviation among

Table 1 **Characteristics of participants, (n = 44)**

| No. | Participant | Age (years) | Sex | Marital status | No. of children | Education level | Job experience (years) |
|---|---|---|---|---|---|---|---|
| 1 | Young person | 23 | Male | Single | – | High school | – |
| 2 | Young person | 32 | Male | Single | – | PhD student | – |
| 3 | Young person | 18 | Female | Single | – | High school | – |
| 4 | Young person | 21 | Male | Single | – | Middle school | – |
| 5 | Young person | 31 | Female | Married | 1 | High school | – |
| 6 | Young person | 35 | Male | Married | 2 | Primary school | – |
| 7 | Young person | 35 | Female | Divorced | 1 | Middle school | – |
| 8 | Young person | 19 | Male | Single | – | High school | – |
| 9 | Young person | 21 | Female | Divorced | – | High school | – |
| 10 | Young person | 20 | Female | Single | – | High school | – |
| 11 | Young person | 33 | Male | Married | 1 | Bachelor's degree | – |
| 12 | Young person | 26 | Male | Married | – | Primary school | – |
| 13 | Young person | 28 | Male | Married | – | Middle school | – |
| 14 | Young person | 23 | Female | Single | – | High school | – |
| 15 | Young person | 25 | Female | Married | 1 | Primary school | – |
| 16 | Young person | 23 | Male | Single | – | Middle school | – |
| 17 | Young person | 18 | Male | Single | – | High school | – |
| 18 | Young person | 20 | Female | Single | – | Primary school | – |
| 19 | Young person | 31 | Female | Married | 2 | High school | – |
| 20 | Young person | 30 | Female | Married | 1 | Bachelor's degree | – |
| 21 | Nurse | 20 | Female | Single | – | Bachelor's degree | 1 |
| 22 | Nurse | 28 | Female | Single | – | Master's degree | 4 |
| 23 | Nurse | 43 | Female | Married | 3 | Bachelor's degree | 15 |
| 24 | Nurse | 21 | Female | Single | – | Bachelor's degree | 1 |
| 25 | Nurse | 50 | Male | Married | 2 | Bachelor's degree | 15 |
| 26 | Nurse | 45 | Male | Married | 1 | Bachelor's degree | 15 |
| 27 | Nurse | 36 | Female | Married | 1 | Bachelor's degree | 10 |
| 28 | Nurse | 33 | Female | Single | – | Master's degree | 10 |
| 29 | Nurse | 35 | Female | Married | 1 | Bachelor's degree | 10 |
| 30 | Nurse | 28 | Female | Single | – | Master's degree | 4 |
| 31 | Nurse | 34 | Male | Married | 2 | Bachelor's degree | 10 |
| 32 | Nurse | 24 | Female | Single | – | Bachelor's degree | 2 |
| 33 | Nurse | 26 | Female | Single | – | Bachelor's degree | 3 |
| 34 | Nurse | 42 | Female | Married | 3 | Bachelor's degree | 15 |
| 35 | Nurse | 34 | Female | Divorced | 1 | Bachelor's degree | 10 |
| 36 | Nurse | 29 | Female | Single | – | Master's degree | 15 |
| 37 | Nurse | 26 | Female | Single | – | Bachelor's degree | 2 |
| 38 | Nurse | 22 | Male | Single | – | Bachelor's degree | 1 |
| 39 | Nurse | 29 | Female | Divorced | – | Bachelor's degree | 5 |
| 40 | Nurse | 28 | Female | Single | – | Bachelor's degree | 5 |
| 41 | Mother | 53 | Female | Married | 3 | High school | – |
| 42 | Mother | 55 | Female | Divorced | 4 | Primary school | – |
| 43 | Mother | 60 | Female | Married | 5 | Primary school | – |
| 44 | Father | 63 | Male | Married | 4 | High school | – |

kids. They can be in a special position for recognizing children who are susceptible to drug use. (Participant 32)

- I have never thought about my role in the prevention of addiction, nobody has told me before that this is one of your roles. (Participant 36)

## Discussion

The period of early childhood has a critical influence on the later life of individuals (16,17). Our study gives an explicit account of early childhood experiences and its influence on the process of developing drug dependency among young Iranian adults, as described by the study participants. Most of our participants talked about traumatic childhood experiences. This finding is in line with the results of other studies that link physical, sexual and emotional abuse, and inter-parental violence to a sense of humiliation, degradation and low self-respect, lack of security and drug use (18–21).

An appropriate nursing assessment involving a child ought to include an extensive assessment of the family and their circumstances. This would provide a significant opportunity to recognize vulnerable children, to identify risk factors and to identify suitable interventions and referral for necessary services. Families are likely to be at ease with nurses functioning in these roles (22).

Nurses have a pivotal role in child protection and prevention of child abuse and neglect. Advanced practice nurses and those who work in primary care and community resource settings can provide health assessments for susceptible families and recognize risk factors for potential child abuse and neglect. The focus of their work should be directed toward the prediction of potential abuse rather than limited to recognizing abuse that has already happened (22).

Parenting dynamics and its influence on children's behaviour also emerged as an important theme in this study. The majority of the participants were from dysfunctional and broken homes. Some studies have found that adolescents living in dysfunctional families are at a greater risk of drug use (19). The primary socialization theory argues that normative and deviant behaviours are mostly shaped and established during the period from infancy to young adulthood (23). Living in dysfunctional families might lead to lower supervision and protection, fewer opportunities for parental involvement with a child's life, and a greater influence of peers (24).

It is reported that the major obstacles to providing support and timely interventions for at-risk families and individuals include a lack of time and skills, short appointments and long waiting lists for consultations. In fact, some families have learnt that problems must be really critical before they seek support. In this regard, community and school nurses should be considered as among the most appropriately placed health care workers to support families with experience of violence and drug and alcohol abuse problems (16). In our study, no school nurses were involved with the student's problems.

Satisfactory growth and development in children can be dramatically improved by the swift resolution of any parenting difficulties (16). It is documented that the physical and mental health needs of children whose parents are active drug users are greater than for those children whose parents are not drug users (25). Some of the reports by the participants of our study concur with the suggestion that their health care needs, along with emotional needs, were not met by their immediate family. Studies confirm that in communities where young people do not receive consistent, suitable health care, school nurses can provide a cost–effective solution to meeting this need, resulting in a positive impact on the health and educational performance of students (26).

The participants in our study mostly received information about drug use from their friends rather than families, school teachers or nurses. While studies suggest that there is a positive effect from having a conversation with children regarding drugs and highlighting the importance of conveying the information they require (27), the findings of a study in the south of Iran confirms that important organizations like the Ministry of Education do not play a role in youth education and teaching how to avoid drug use as effectively as they should (28). If they are given the correct information by their families, teachers or nurses, children will be less likely to rely on misinformation from friends or from those who try to attract them into illicit drug use (5,27,29). Nurses could replace traditional methods of drug use prevention with morally neutral information which is based on scientific facts (30).

It is clear that school and community nurses can provide unique and significant services for children, adolescents and their families; however, in developing countries such as the Islamic Republic of Iran, nurses are mostly placed in hospitals and clinics. Our data analysis guided us to talk with the nurses. The majority of participants blamed health care workers for not having an active role in the prevention of addiction. Therefore, engaging nurses in the field of addiction prevention, training them in this regard, increasing their knowledge and changing their attitude towards their role in addiction prevention were among the findings of this research.

One of the limitations of this study is that it depends on the participants self-reporting. The participants might blame others, especially their families for their problems and addiction. For this reason, we attempted to conduct all interviews in a private context that was appropriate to the conditions of the participants.

## Conclusion

### Contribution of nurses

Our findings highlight the potential contribution that the nursing profession can offer to those children who are at risk of developing substance use problems. In particular, nurses could perform an important role in relation to children and their families in early detection and timely intervention regarding susceptible and high-risk individuals. We suggest that Iranian nurses, and nurses around

the world, should be more sensitive to the issue of drug dependency and the determinants of drug use by young people, and should improve their knowledge about appropriate prevention strategies.

Although substance use has become a significant public health problem in the Islamic Republic of Iran, Iranian nurses are minimally involved in this important issue and it is appropriate for them to promote their involvement in the prevention and management of drug- and alcohol-related problems. We recommend conducting research on the experience of parents of young drug users. Furthermore, conducting research on young people who resist using drugs could also prove valuable.

### Implications for nursing and health policy

To realize this potential, upskilling of the nursing workforce is essential. Inclusion of subjects on substance use disorders in nursing curricula would enable graduates to better deal with this major public health problem. It is also important to create avenues through which nurses can specialize in this field and provide a more holistic and inclusive service.

These significant aims could be addressed through the allocation of more space for this subject in nursing curricula; the consideration of addiction-related professional development courses for nurses who work in schools or are in close contact with children, adolescents, young people, and their families and communities; and the support of nurses interested in specializing in this subject by funding a postgraduate degree.

## Expériences en matière d'addiction chez l'enfant et rôle du personnel infirmier dans la prévention : étude qualitative

### Résumé

**Contexte** : On pense que l'approche parentale et les expériences vécues dans la petite enfance sont deux facteurs majeurs quant à l'initiation de la consommation de drogues.

**Objectifs** : La présente étude visait à examiner le rôle du personnel infirmier dans la prévention de l'addiction chez l'enfant.

**Méthodes** : Dans le cadre de cette étude qualitative, nous avons mené des entretiens approfondis avec de jeunes hommes et femmes qui suivaient un traitement pour leur addiction ou qui étaient des consommateurs de drogues actifs, ainsi qu'avec des membres de leurs familles et des infirmiers. La méthode comparative continue de Strauss et Corbin a été suivie pour l'analyse des données obtenues.

**Résultats** : L'analyse des données a mis en évidence six catégories : les événements traumatiques vécus durant l'enfance, une approche parentale inadaptée, la méconnaissance et une certaine tolérance vis-à-vis de la consommation de drogues, le fait d'ignorer la menace que représente la consommation de drogues, le manque d'expérience du personnel infirmier en matière de prévention de la consommation de drogues et l'absence de définition claire quant au rôle des infirmiers dans la prévention de la consommation de drogues.

**Conclusions** : Les personnels infirmiers qui travaillent auprès des jeunes et de leurs familles ont un potentiel particulier en matière de prévention, de détection précoce et d'intervention rapide pour lutter contre la dépendance aux drogues.

## الإدمان: تجارب الطفولة ودور الممرضات في الوقاية: دراسة كيفية

جيلا ميرلاشاري، جهانفر جهانباني، جمال الدين بكجانى

### الخلاصة

**الخلفية**: يُعتقد أن النهج الأبوي وتجارب الطفولة المبكرة من أهم العوامل التي قد تُسهم في بدء تعاطي المخدرات.

**الأهداف**: هدفنا إلى استكشاف الدور الذي يمكن أن تضطلع به الممرضات للوقاية من الإدمان في مرحلة الطفولة.

**طرق البحث**: في هذه الدراسة الكيفية، أجرينا مقابلات مُعَمَّقة مع الشباب من الرجال والنساء الذين كانوا يتلقون علاجاً من الإدمان، أو الذين كانوا يتعاطون المخدرات، كما أجرينا مقابلات مُعَمَّقة مع أفراد الأسرة والممرضات. واستُخدمت مقاربة شتراوس وكوربين لتحليل البيانات.

**النتائج**: كشف تحليل البيانات عن ست فئات: الأحداث الصادمة خلال مرحلة الطفولة، والنهج الأبوي غير الملائم، وغياب المعرفة والتساهل إزاء تعاطي المخدرات، وغض البصر عن أخطار تعاطي المخدرات، وقلة خبرة الممرضات فيما يتعلق بالوقاية من تعاطي المخدرات، وغياب تعريف واضح لدور الممرضات في الوقاية من تعاطي المخدرات.

**الاستنتاجات**: لدى الممرضات التي تعمل مع الشباب والأسر فرصة خاصة لتحقيق الوقاية، والكشف المبكر والتدخل في الوقت المناسب بخصوص إدمان المخدرات.

# References

1. National Institute on Drug Abuse. Principles of substance abuse prevention for early childhood: a research-based guide. National Institutes of Health; US Department of Health and Human Services: 2016.

2. Rassool GH, Rawaf S. Predictors of educational outcomes of undergraduate nursing students in alcohol and drug education. Nurse Educ Today. 2008;28(6):691–701. PMID:18166248

3. Mirlashari J, Demirkol A, Salsali M, Rafiey H, Jahanbani J. Society and its influences on drug use among young individuals in Tehran, Iran. J Addict Nurs. 2013;24(2):116–21. PMID:24621490; doi:10.1097/JAN.0b013e31826f6846

4. Bryant J. Developing a substance abuse prevention program for parents and youth [thesis]. Madison New Jersey: Drew University; 2008.

5. Miller-Day M. Talking to youth about drugs: what do late adolescents say about parental strategies? Family Relations. 2008;57(1):1–12.

6. Zarghami M. Iranian common attitude toward opium consumption. Iranian J Psychiatry Behav Sci. 2015;9(2). PMID:26288642

7. Haber PS, Demirkol A, Lange K, Murnion B. Management of injecting drug users admitted to hospital. Lancet. 2009;374(9697):1284–93. doi:10.1016/S0140-6736(09)61036-9.

8. Sanders MR. Community-based parenting and family support interventions and the prevention of drug abuse. Addict Behav. 2000;25(6):929–42. PMID:11125780

9. Ling S. Nurse practitioners in drug and alcohol: where are they? Australian J Adv Nurs. 2009;26(4):64.

10. Clancy C, Oyefeso A, Ghodse H. Role development and career stages in addiction nursing: an exploratory study. J Adv Nurs. 2007;57(2):161–71. PMID:17214752; doi:10.1111/j.1365-2648.2006.04088.x

11. Mushquash CJ, Comeau N, Stewart SH. An alcohol abuse early intervention approach with Mi'kmaq adolescents. First Peoples Child & Family Rev. 2007;3(2):17–26.

12. Neale J, Allen D, Coombes L. Qualitative research methods within the addictions. Addiction. 2005;100(11):1584–93. PMID:16277621

13. Creswell JW. Research design: qualitative, quantitative, and mixed methods approaches. Thousand Oaks: SAGE Publications; 2009.

14. Mason M. Sample size and saturation in PhD studies using qualitative interviews. Forum: Qual Soc Res Sozialforschung. 2010;11(3). doi:http://dx.doi.org/10.17169/fqs-11.3.1428

15. Corbin J, Strauss A. Basics of qualitative research: techniques and procedures for developing grounded theory. Thousand Oaks: Sage; 2008.

16. Häggman-Laitila A. Early support needs of Finnish families with small children. J Adv Nurs. 2003;41(6):595–606. PMID:12622868

17. Mirlashari J, Demirkol A, Salsali M, Rafiey H, Jahanbani J. Early childhood experiences, parenting and the process of drug dependency among young people in Tehran, Iran. Drug Alcohol Rev. 2012;31(4):461–8. doi: 10.1111/j.1465-3362.2011.00384.x

18. Magor-Blatch L. Child deaths and statutory services: families and substance use: building a resource for recovery. Communities, Children and Families Australia. 2007;3(1):33.

19. Pournaghash-Tehrani S, Feizabadi Z. Predictability of physical and psychological violence by early adverse childhood experiences. J Family Violence. 2009;24(6):417–22.

20. Kelley ML, Klostermann K, Doane AN, Mignone T, Lam WK, Fals-Stewart W, et al. The case for examining and treating the combined effects of parental drug use and interparental violence on children in their homes. Aggress Violent Behav. 2010;15(1):76–82. PMID:20161505

21. Shin SH, Hong HG, Hazen AL. Childhood sexual abuse and adolescent substance use: A latent class analysis. Drug Alcohol Depend. 2010;109(1):226–35. doi:10.1016/j.drugalcdep.2010.01.013

22. Adams BL. Assessment of child abuse risk factors by advanced practice nurses. Pediatr Nurs. 2004;31(6):498–502. PMID:16411545

23. Cubbins LA, Klepinger DH. Childhood family, ethnicity, and drug use over the life course. J Marriage Fam. 2007;69(3):810–30.

24. Eitle D. The moderating effects of peer substance use on the family structure–adolescent substance use association: quantity versus quality of parenting. Addict Behav. 2005;30(5):963–80. doi:10.1016/j.addbeh.2004.09.015

25. Gance-Cleveland B, Mays MZ. School-based support groups for adolescents with a substance-abusing parent. J Am Psychiatr Nurses Assoc. 2008;14(4):297–309. PMID:21665773

26. Fritsch K, Heckert KA. Working together: health promoting schools and school nurses. Asian Nurs Res. 2007;1(3):147–52. PMID:25030882

27. Kennett J. Talking to your kids. Meanjin. 2002;61(2):34–41.

28. Nakhaee N, Jadidi N. Why do some teens turn to drugs? A focus group study of drug users' experiences. J Addicts Nurs. 2009;20(4):203–8. doi:10.3109/10884600903291158

29. Laoniramai P, Laosee OC, Somrongthong R, Wongchalee S, Sitthi-Amorn C. Factors affecting the experiences of drug use by adolescents in a Bangkok slum. Southeast Asian J Trop Med Public Health. 2005 Jul;36(4):1014-9. PMID:16295561

30. Guzys D, Kendall S. Advocating for a harm-minimization approach to drug education in Australian schools. J Sch Nurs. 2006;22(5):259–63. PMID:17172197

# Survival rates of patients with breast cancer in countries in the Eastern Mediterranean Region: a systematic review and meta-analysis

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## Abstract

**Background:** Breast cancer is the fourth leading cause of death and disability in the Eastern Mediterranean Region (EMR); although the incidence is lower than in the developed regions, there has been an increasing trend in recent decades.

**Aims:** Our aim was to calculate the pooled survival rate of patients with breast cancer in the EMR.

**Methods:** We searched electronic databases from 1946 to 19 January 2018, without language restrictions. We used a random effect model to estimate pooled 1-, 3-, 5- and 10-year survival rates for patients with breast cancer. Chi-squared and $I^2$ index were used to assess between-study heterogeneity. Subgroup analysis and meta-regression were used to investigate the potential source of heterogeneity.

**Results:** We found 80 articles eligible for inclusion in our review. The pooled 1-, 3-, 5- and 10-year survival rates in women with breast cancer in the EMR were 0.95, 0.80, 0.71, and 0.56, respectively. The $I^2$ index indicated considerable between-study heterogeneity (all $I^2 > 50\%$). The 5-year survival rate in the male subgroup was 0.63. The 5-year survival rate of women with breast cancer in age groups ≤ 39, 40–64, and 65+ years were 0.74, 0.76 and 0.58, respectively. There was a statistically significant association between the Human Development Index (β = 9, $P = 0.01$) and decade of study (β = 8.2, $P = 0.04$) and 5-year survival rate.

**Conclusions:** The survival rate of women with breast cancer in those countries in the EMR which have better health care systems improved in the past decade; women aged 40–64 years had the best survival rate.

Keywords: review, breast cancer, survival rate, Eastern Mediterranean Region, meta-analysis

## Introduction

Breast cancer is among the 4 most common cancers in the world (1). It is the leading cause of death among women in developed countries and the second commonest cause of death in developing countries (2,3). In 2015, among women, an estimated 321 840 new cases of invasive breast cancer were projected (4). In the WHO Eastern Mediterranean Region (EMR), breast cancer is the fourth leading cause of death and disability (1,3,5) and the number one cancer in 16 of the 22 countries in the Region (6). The age-standardized incidence of breast cancer in this Region is 12–50 per 100 000 in women, with the lowest incidence in the Islamic Republic of Iran and Pakistan (3). Although the incidence in this Region is lower than in the developed regions, there has been an increasing trend in recent decades (10,11).

The EMR comprises 22 countries with varied ethnicity and cultures (7). The women in this Region generally have poor knowledge about screening methods for breast cancer (6). In Bahrain, Egypt, the Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Oman, Saudi Arabia and Tunisia, breast cancer is usually diagnosed in women under age 50 years, i.e. younger than in other parts of the world (6).

An important factor that affects survival is the disease stage at diagnosis, ranging from ≥ 80% in North America, Sweden and Japan to around 60% in middle-income countries and < 40% in low-income countries (7). In the EMR, patients with breast cancer are usually diagnosed for the first time at stages 2 and 3 (3,6). The difference in survival between developed and developing countries may be due to delays in diagnosis.

The aim of this study is to determine survival of patients with breast cancer by age, stage of disease and overall in the EMR by systematic review and meta-analysis.

## Methods

### Reporting guidelines

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines was used to carry out and report this systematic review and meta-analysis (8).

### Study selection

We used the following inclusion and exclusion criteria to select relevant articles in this meta-analysis. All

observational cohort studies that reported the survival rate of women with primary invasive breast cancer in different study populations in the EMR were included with no restriction for language, age, ethnicity or religion. We excluded articles that reported the survival rate after relapse. Letters to the editor, review articles and meeting abstracts were also excluded. Where we found several publications from the same study population, we choose the most recent one to include in our study. To select the relevant articles from the search results, 2 reviewers (KM and MK) independently screened the studies by title, abstract and full text; in the case of disagreement between the 2 reviewers, they entered into discussion and if required a 3rd investigator became involved to resolve the question.

### Search strategy

A systematic search was carried out by 2 reviewers (KM and MK) independently in several electronic databases such as Medline/PubMed, Web of Science, Scopus, and Google Scholar covering material published from 1946 to 19 January 2018. The search strategy was made using the MeSH subject headings and free text words like ("breast neoplasms" [MeSH] or "breast cancer" or "breast carcinoma" or "breast tumour" or "breast malignant") AND ("survival" or "survival analysis" or "survival rate" or "life table" or "Kaplan Meier " or "proportional hazard model" or "hazard ratio" or "Cox model" or " Cox regression") AND ("cohort" or "prospective" or "retrospective" or "follow-up" or "longitude"). To identify additional relevant studies, we reviewed the reference lists of all included studies. To manage and screen eligible searched studies, we used EndNote X7 citation manager.

### Quality assessment

To assess the quality of each eligible study and risk of bias we used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (9). We used several items from this checklist: define the source of participant selection, explain the eligibility criteria, explain about follow-up and how to address the missing data, clearly define how to measure the outcome and explain about the size of the study. The studies were classified into 3 groups based on this checklist. If the studies attained more than 80% of the total score, they were classified as high quality, 60–79% of total score as intermediate quality and 30–59% of total score as low quality. Two authors (KM and MK) independently investigated the quality of each study. The agreements between reviewers were assessed by weighted Kappa (86%).

### Data extraction

For each eligible study, the variables were extracted on a prespecified sheet in Microsoft Excel 2010 as follows: first author name, year of publication, period of study, country of origin, source of data, study design, median follow-up time, sample size, mean age, gender frequency, type of survival, 1-, 3-, 5- and 10-year survival rates and 95% confidence interval (CI). Data extraction was performed independently by 2 reviewers (KM and MK).

Disagreement was resolved by discussion between the 2 reviewers and if required, a senior investigator solved the discrepancies.

### Statistical analysis

We investigated statistical heterogeneity using the Q test at the 5% significance level ($P < 0.05$) and $I^2$ index. According to the significant between-study heterogeneity ($P < 0.05$), random effect models was used. Because some studies did not report the standard error and 95% confidence interval (CI), we also used binomial distribution to estimate the variance and 95% CIl of all included studies.

To estimate the pooled survival rate we used metan and metaprop commands. The metaprop command was specific to binomial data and for proportions near boundaries (in this instance, 100% at 1-year survival or 0% at stage IV), which allows computation of exact binomial and score test-based CIs by allowing Freeman–Tukey double arcsine transformation to stabilize the variances (10).

To investigate the potential source of heterogeneity we used subgroup analyses based on sex, age and stage at diagnosis, ethnicity, Human Development Index (HDI) and decade of study. We also conducted subgroup analysis based on the level of development, income and health outcome, so all 22 countries were categorized into 3 subgroups. Group 1 includes countries that are developed in the past decade, Group 2 includes middle-income countries and Group 3 includes countries less developed than the others in the Region, e.g. Afghanistan (11,12).

Meta-regression was used based on decade of study, HDI, ethnicity, and sample size to find the source of heterogeneity. Publication bias was not assessed, because the probability of survival rate as a proportion is always a positive number and if we see asymmetry in a funnel plot, it is not due to publication bias.

We used EndNote X7 to manage the records and review the results of the systematic search and Microsoft Excel 2010 to prepare the data extraction sheet. We used Stata 11 to perform statistical analysis.

## Results

### Study characteristics

The initial search identified 1292 articles up to 19th January 2018. After removing duplicates and screening by title, abstract and full text, 80 eligible articles remained in our systematic review and meta-analysis. A flow diagram of selection process according to the PRISMA flowchart is shown in Figure 1.

The characteristics of these 80 studies are summarized in Table 1. These articles come from 12 countries in the EMR. Half of the studies were conducted in the Islamic Republic of Iran ($n$ = 40); 12 articles were exclusively conducted on men and 68 on women. Also, 6 studies were exclusively conducted on women under 39 years. The total sample size from the 80 studies was 42 328, of whom 41 603 (98.2%) were female.

**Figure 1 PRISMA flow diagram showing the different phases involved in the search process**
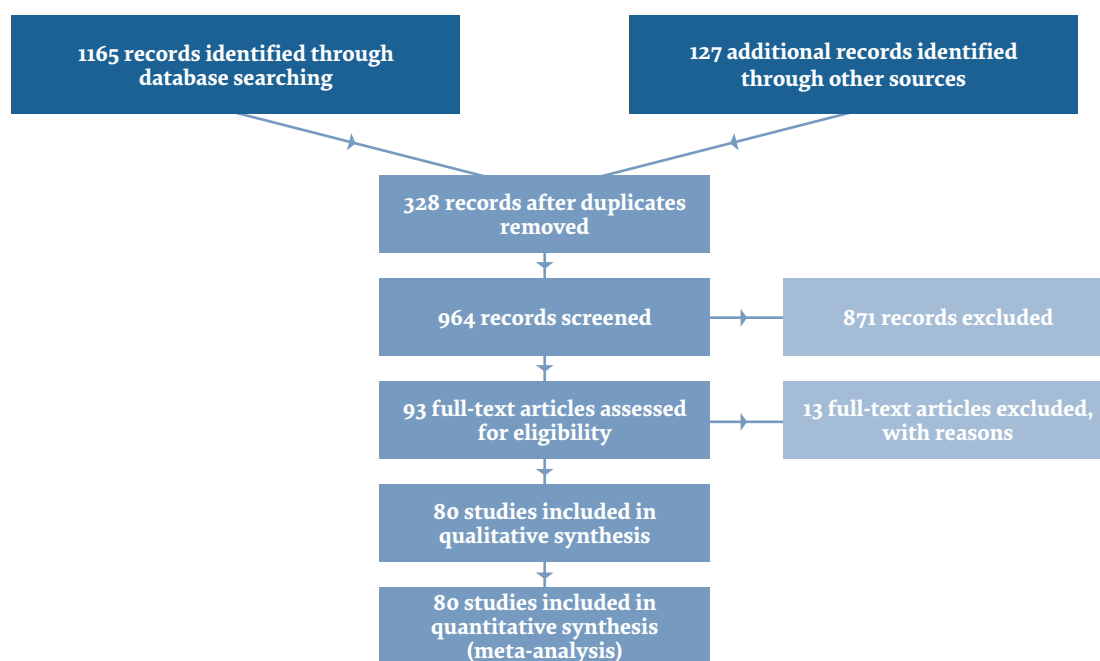


## Pooled survival rate

The pooled 1-, 3-, 5- and 10-year survival rate of women with breast cancer in the EMR were 0.95 (95% CI: 0.93–0.96), 0.80 (95% CI: 0.76–0.84), 0.71 (95% CI: 0.68–0.73) and 0.56 (95% CI: 0.48–0.63), respectively. We saw considerable heterogeneity in 1-year ($P < 0.001$, $I^2 = 92.83$), 3-year ($P < 0.001$, $I^2 = 96.38$), 5-year ($P < 0.001$, $I^2 = 92.24$) and 10-year ($P < 0.001$, $I^2 = 97.33$) survival rates among women with breast cancer.

## Subgroup analysis

The results of the subgroup analyses are shown in Table 2. The pooled 5-year survival rate in women was 0.71 (95% CI: 0.68–0.73) and in men was 0.63 (95% CI: 0.59–0.67). In the age subgroups, the 5-year survival rates for women with breast cancer aged < 39, 40–64, and 65+ years were 0.74 (95% CI: 0.68–0.80), 0.76 (95% CI: 0.66–0.85) and 0.58 (95% CI: 0.46–0.69) respectively.

## Meta-regression

To determine any potential source of bias, we covered the variables sample size, HDI, decade of study and ethnicity as independent variables and survival rate as a dependent variable in meta-regression. In the univariable model, there was a statistically significant association between HDI ($\beta = 9.0$, $P = 0.012$) and decade of study ($\beta = 8.2$, $P = 0.048$) and 5-year survival rate. The 5-year survival rate increased with the decade of study (Table 3).

## Discussion

The aim of this study was to estimate the survival rate of women with breast cancer in the EMR. From the meta-analysis, the 1-, 3-, 5- and 10-year survival rates were 0.95 (95% CI: 0.93–0.96), 0.80 (95% CI: 0.76–0.84), 0.71 (95% CI: 0.68–0.73) and 0.56 (95% CI, 0.48–0.63) respectively.

The 1-year survival rate in a 2009 study from England (96%) and Australia (98.1%) is consistent with the results of our study (*13*). The 1- and 3-year survival rates were reported in a 2014 study from China as 76.0–83.1% and 51.5–74.1%, respectively (*14*). In a 2004 study conducted in India, the 1- and 3-year survival rates were 76% and 51.5% respectively (*15*). Our findings indicate that the 1-year survival rates in the EMR are similar to those in some developed countries and better than in some developing countries such as India.

In a 2015–2016 report from the American Cancer Society the 5- and 10-year relative survival rates were 89% and 83% respectively (*16*). In a study conducted in European countries in 2013, the 5-year relative survival rate was 69–84% (*17*). On the other hand, in a 2010 study conducted in developing countries, the 5-year relative survival rate varied from 52% in India to 82% in China (*18*). Comparing with our findings, the 5- and 10-year survival rates in the EMR were lower than in the high-income countries and similar to those in the developing countries.

An important factor that may account for the differences in survival rates among women with breast cancer in the EMR might be the (lack of) improvement of the health systems in some countries; a poorly developed health system can result in late diagnosis and improper treatment of patients with advanced cancer. Additionally, the lack of a population-based cancer registry in some countries may result in insufficient surveillance and a failure in monitoring any control programme. False beliefs and low levels of knowledge and awareness in some populations in the Region are other likely reasons for these differences (*1,5,19*). Survival data in the EMR depend on good registries. Some countries do have data, some have data but the quality is not known, and some

**Table 1 Characteristics of studies on survival of breast cancer in the Eastern Mediterranean Region included in the meta-analysis**

| First author (reference no.) | Year | Country | Time span | Sex | Mean (SD) age | Sample size | Median follow-up (months) | Survival rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1-year | 3-year | 5-year | 10-year |
| Abdollahi A (45) | 2017 | Iran | 2004–2011 | Female | 54.8 (11.4) | 1329 | 4 | 0.96 | 0.78 | 0.66 | – |
| Al-Moundhri M (46) | 2004 | Oman | 1996–2002 | Female | 48.5 (10.8) | 150 | 35.6 | – | – | 0.67 | – |
| Abahssain H (24) | 2010 | Morocco | 2003–2007 | Female | 32 | 427 | 32.2 | – | 0.81 | – | – |
| Abdelkrim SB (47) | 2015 | Tunisia | 1993–2013 | Female | 23.7 | 25 | NR | – | 0.95 | 0.85 | 0.75 |
| Aghili M (48) | 2013 | Iran | 2007–2002 | Female | 9.6 (50.4) | 107 | 38.24 | – | – | 0.83 | – |
| Ahmed SB (49) | 2002 | Tunisia | 1998–1990 | Female | 50 | 729 | NR | – | – | 0.51 | – |
| Akbari ME (50) | 2011 | Iran | 2002–2010 | Female | 49.8 | 258 | 144 | – | – | 0.88 | 0.81 |
| Akbari ME (51) | 2008 | Iran | 1994–2007 | Female | 53.24 (12.41) | 435 | 50.5 | – | – | 0.81 | 0.77 |
| Akbari ME (52) | 2006 | Iran | 1996–1998 | Female | 48 (11.5) | 154 | 60 | – | – | 0.77 | – |
| Al-Idrissi HY (53) | 1992 | Saudi Arabia | 1981–1990 | Female | 40 | 130 | 46 | – | – | 0.76 | – |
| Alaoui SK (54) | 2016 | Morocco | 2007–1998 | Male | 61 | 140 | 91.1 | – | – | 0.68 | – |
| Amirifard N (41) | 2016 | Iran | 2016–2010 | Male | 49.2 (17.0) | 17 | 30 | – | – | 0.64 | – |
| Arkoob K (32) | 2010 | Jordan | 1979–1989 | Female | 50.2 (12.4) | 838 | 60 | 0.92 | 0.70 | 0.59 | – |
| Aziz Z (55) | 2008 | Pakistan | 2005–1996 | Female | 45 | 525 | 100 | – | – | 0.72 | 0.61 |
| Babai Gh (56) | 2005 | Iran | 1993–1991 | Female | NR | 176 | NR | 0.94 | 0.76 | 0.61 | – |
| Babai Gh (56) | 2005 | Iran | 1993–1991 | Male | NR | 10 | NR | 0.90 | 0.70 | 0.58 | – |
| Baghestani A (57) | 2015 | Iran | 1998–2013 | Female | 48.13 (10.7) | 366 | 120 | 0.93 | 0.75 | 0.52 | – |
| Baghestani A (57) | 2015 | Iran | 1992–2012 | Female | 48.37 (10.9) | 438 | 253 | 0.98 | – | – | – |
| Bakkach I (58) | 2017 | Morocco | 2015–2010 | Female | 36 | 82 | 27.4 | – | – | 0.89 | – |
| Ben Gobrane H (59) | 2007 | Tunisia | 2003–1994 | Female | 49.7 | 470 | 51.9 | – | – | 0.61 | – |
| Bhatti AB (60) | 2014 | Pakistan | 2009–1997 | Female | 43.2 | 443 | 49 | – | – | 0.83 | – |
| Bhatti AB (61) | 2015 | Pakistan | 2009–1997 | Female | 42 | 902 | 51 | – | – | – | 0.70 |
| Bouzid N (62) | 2013 | Tunisia | 2007–1995 | Female | 31.3 | 124 | 48.5 | – | – | 0.68 | – |
| Derkaoui T (63) | 2016 | Morocco | 2015–2010 | Female | 46 | 279 | NR | – | – | 0.71 | – |
| Dhiab TB (64) | 2005 | Tunisia | 1999–1979 | Male | 26 | 123 | 65 | – | – | 0.62 | – |

**Table 1 Characteristics of studies on survival of breast cancer in the Eastern Mediterranean Region included in the meta-analysis** *(continued)*

| First author (reference no.) | Year | Country | Time span | Sex | Mean (SD) age | Sample size | Median follow-up (months) | Survival rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1-year | 3-year | 5-year | 10-year |
| El Amine Elhadj O (65) | 2017 | Tunisia | 2013–2004 | Female | 46.8 | 30 | 65 | – | 0.49 | 0.34 | – |
| El Mistiri M (66) | 2015 | Libya | 2003–2005 | Female | NR | 365 | NR | – | – | 0.56 | – |
| El-Baradie M (67) | 2012 | Egypt | 1999–2009 | Male | 58 | 123 | 38 | – | | 0.62 | – |
| El-Beshbeshi W (68) | 2012 | Egypt | 2002–2009 | Male | 57.7 | 37 | 9 | – | | 0.61 | – |
| El-Habbash MM (69) | 2009 | Libya | 2008–1990 | Male | 61 | 22 | NR | – | – | 0.57 | – |
| Elshafiey M (70) | 2011 | Egypt | 2000–2002 | Male | 59 | 32 | 58 | – | 0.78 | 0.65 | 0.57 |
| Fakhro AE (71) | 1999 | Bahrain | 1982–1994 | Female | 50.1 | 93 | NR | – | – | 0.64 | 0.36 |
| Fallahzadeh H (72) | 2014 | Iran | 2002–2007 | Female | 48.2 (11.7) | 200 | 60 | 0.95 | 0.82 | 0.7 | – |
| Faradmal J (73) | 2016 | Iran | 2000–2011 | Female | 47.02 (10.7) | 522 | 54.13 | 0.90 | 0.73 | 0.62 | – |
| Fardmal J (74) | 2014 | Iran | 2004–2011 | Female | 46.06 (10.82) | 542 | NR | 0.97 | 0.58 | 0.68 | 0.31 |
| Fayaz MS (75) | 2014 | Kuwait | 2009–1999 | Female | 11.7 (48.0) | 363 | 41.9 | – | 0.83 | 0.81 | – |
| Fazeli Z (76) | 2014 | Iran | 2007–2011 | Female | 50.28 (1.36) | 400 | NR | 0.98 | 0.92 | 0.87 | – |
| Haghighat Sh (77) | 2013 | Iran | 1997–2006 | Female | 46.3 (11.05) | 623 | 86.3 | – | – | 0.87 | – |
| Hajihosseini M (78) | 2015 | Iran | 1995–2013 | Female | 47.1 (10.7) | 529 | NR | – | – | 0.68 | – |
| Hamadeh RR (79) | 2014 | Bahrain | 2000–2010 | Female | 50.9 | 1005 | NR | 0.84 | – | 0.63 | 0.49 |
| Hamdan NA (80) | 2011 | Saudi Arabia | 1994–1996 | Female | NR | 298 | 57 | 0.95 | 0.80 | 0.61 | – |
| Heydari ST (81) | 2009 | Iran | 2001–2006 | Female | 46.5 (11.7) | 877 | NR | 0.97 | – | 0.67 | 0.45 |
| Hoseini M (82) | 2017 | Iran | 2015–2001 | Female | 47.1 | 140 | NR | – | – | 0.80 | 0.65 |
| Ibrahim EM (83) | 1998 | Saudi Arabia | 1985–1995 | Female | 42 (10.5) | 292 | 62 (8.9) | – | – | – | 0.55 |
| Iqbal J (84) | 2010 | Pakistan | 1997–2006 | Female | 45 | 200 | 90 | – | – | 0.52 | 0.31 |
| Jamy O (85) | 2015 | Pakistan | 1986–2009 | Male | 52 | 19 | NR | – | – | 0.61 | – |
| Kallel M (86) | 2015 | Tunisia | 2002–2008 | Female | 31.7 | 83 | 75 | – | – | 0.67 | – |
| Karimi A (87) | 2016 | Iran | 2006–2014 | Female | 46.1 (10.81) | 229 | 81 | 0.96 | – | 0.75 | – |
| Khanfir A (88) | 2006 | Tunisia | 2002–1995 | Female | 31.5 | 72 | NR | – | – | 0.57 | – |
| Kumar S (89) | 2016 | Pakistan | 2008–1999 | Female | 48 | 845 | 29 | – | – | 0.75 | – |

**Table 1 Characteristics of studies on survival of breast cancer in the Eastern Mediterranean Region included in the meta-analysis (concluded)**

| First author (reference no.) | Year | Country | Time span | Sex | Mean (SD) age | Sample size | Median follow-up (months) | Survival rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1-year | 3-year | 5-year | 10-year |
| Kumar SH (90) | 2011 | Oman | 2003–2008 | Female | 47.1 (12.88) | 119 | 54 | – | – | 0.78 | – |
| Mechita NB (91) | 2016 | Morocco | 2008–2005 | Female | 51.1 (11.2) | 628 | NR | 0.97 | 0.89 | 0.81 | – |
| Moghadami Fard Z (92) | 2012 | Iran | 2005–2007 | Female | 51.3 (11.2) | 133 | 63 | – | – | 0.72 | – |
| El Mongy M (93) | 2010 | Egypt | 2003–1993 | Female | 9.74 (7.14) | 1009 | 68 | – | 0.96 | 0.91 | – |
| Mosavi-Naieni M (94) | 2009 | Iran | 1997–2005 | Female | 49.6 (11.2) | 242 | NR | 1 | 0.94 | 0.89 | – |
| Mousavi SM (95) | 2008 | Iran | 2001–1998 | Female | 12.5 (51.3) | 2358 | 60 | – | – | 0.50 | – |
| Movahedi M (96) | 2012 | Iran | 2001–2006 | Female | 49.84 (12.36) | 5975 | 88.2 | – | – | 0.72 | – |
| Movahedi M (96) | 2012 | Iran | 2001–2006 | Male | 49.84 (12.36) | 172 | 88.2 | – | – | 0.6 | – |
| Payandeh M (97) | 2015 | Iran | 2001–2014 | Female | 49.6 (12.6) | 950 | NR | – | 0.82 | 0.72 | 0.64 |
| Raeisi Shahraki H (98) | 2015 | Iran | 1989–2008 | Male | 59.6 (12.8) | 50 | 140 | – | 0.92 | 0.77 | 0.26 |
| Rais G (99) | 2012 | Morocco | 2008–2007 | Female | 46 | 152 | 46 | – | – | 0.76 | – |
| Rajaeefard AR (100) | 2009 | Iran | 1994–2003 | Female | NR | 310 | 60 | 0.97 | 0.82 | 0.7 | 0.53 |
| Rampisheh Z (101) | 2014 | Iran | 2001–2013 | Female | 51.26 (13.87) | 300 | 65 | 0.95 | 0.78 | 0.68 | – |
| Ravichandran K (102) | 2005 | Saudi Arabia | 1994–1996 | Female | 48.3 (14.5) | 316 | 55.2 | 0.94 | 0.79 | 0.60 | – |
| Rezaianzadeh A (103) | 2009 | Iran | 2000–2005 | Female | 47 | 1148 | 34 | – | 0.76 | 0.58 | – |
| Salehi A (104) | 2011 | Iran | 1989–2008 | Male | 60.3 (12.7) | 56 | 60 | – | 0.83 | 0.66 | 0.45 |
| Sedehi M (105) | 2013 | Iran | 2002–2007 | Female | NR | 159 | NR | 0.83 | 0.67 | 0.51 | – |
| Shawky H (106) | 2013 | Egypt | 2000–2010 | Male | 52.8 | 29 | 53 | – | – | 0.71 | – |
| Soliman AA (107) | 2014 | Egypt | 2000–2007 | Male | 58 | 69 | NR | – | – | 0.46 | – |
| Vahdaninia M (108) | 2003 | Iran | 1997 | Female | 47.2 (13.5) | 128 | 60 | 0.93 | 0.75 | 0.62 | – |
| Vostokolaei FA (109) | 2012 | Iran | 1999–2001 | Female | 46 (12) | 1500 | 60 | – | – | 0.72 | – |
| Yaghmaei S (110) | 2008 | Iran | 1991–2002 | Female | 51.5 (14.0) | 50 | NR | 0.87 | 0.62 | 0.58 | 0.47 |
| Zanti K (111) | 2014 | Morocco | 2009–2004 | Female | 30.62 | 74 | NR | – | 0.88 | – | – |
| Zare N (112) | 2012 | Iran | 2005–2001 | Female | 47 | 1148 | 34 | – | – | 0.56 | – |
| Ziaei JE (113) | 2013 | Iran | 1997–2008 | Female | 48 | 271 | 120 | 0.96 | 0.86 | 0.81 | 0.76 |

*SD = standard deviation.*

**Table 2 Subgroup analysis for 1-, 3-, 5- and 10-year survival rates of women with breast cancer in the Eastern Mediterranean Region (EMR), 1946–2018**

| Category/ subgroup | Survival rate (95% confidence interval) | | | |
|---|---|---|---|---|
| | **1-year** | **3-year** | **5-year** | **10-year** |
| *Sex* | | | | |
| Female | 0.95 (0.93–0.96) | 0.80 (0.76–0.84) | 0.71 (0.68–0.73) | 0.56 (0.48–0.63) |
| Male | – | 0.84 (0.75–0.92) | 0.63 (0.59–0.67) | 0.41 (0.25–0.59) |
| *Decade of study* | | | | |
| 1990–1999 | 0.93 (0.92–0.94) | 0.76 (0.71–0.80) | 0.63 (0.58–0.68) | 0.50 (0.45–0.55) |
| 2000–2009 | 0.96 (0.93–0.98) | 0.84 (0.77–0.89) | 0.72 (0.68–0.75) | 0.58 (0.47–0.69) |
| 2010–2018 | 0.95 (0.91–0.97) | 0.77 (0.70–0.84) | 0.72 (0.67–0.76) | 0.56 (0.42–0.69) |
| *Stage at diagnosis* | | | | |
| I | – | – | 0.90 (0.81–0.97) | – |
| II | – | – | 0.77 (0.71–0.83) | – |
| III | – | – | 0.57 (0.49–0.64) | – |
| IV | – | – | 0.37 (0.19–0.57) | – |
| *Age (years)* | | | | |
| Under 39 | – | – | 0.74 (0.68–0.80) | – |
| 40–64 | – | – | 0.76 (0.66–0.85) | – |
| 65+ | – | – | 0.58 (0.46–0.69) | – |
| *Ethnicity* | | | | |
| Arab | 0.93 (0.88–0.97) | 0.83 (0.75–0.90) | 0.69 (0.62–0.75) | 0.51 (0.42–0.60) |
| Other | 0.95 (0.94–0.97) | 0.78 (0.74–0.82) | 0.71 (0.69–0.74) | 0.57 (0.47–0.66) |
| *Human Development Index* | | | | |
| Very high | 0.91 (0.83–0.97) | 0.81 (0.78–0.83) | 0.68 (0.60–0.75) | 0.48 (0.40–0.56) |
| High | 0.95 (0.94–0.97) | 0.78 (0.74–0.82) | 0.69 (0.66–0.72) | 0.59 (0.48–0.71) |
| Medium | 0.97 (0.95–0.98) | 0.89 (0.80–0.96) | 0.82 (0.73–0.90) | – |
| Low | – | – | 0.73 (0.64–0.80) | 0.54 (0.35–0.73) |
| *EMR country grouping[a]* | | | | |
| Group 1 | 0.91 (0.83–0.97) | 0.80 (0.77–0.82) | 0.70 (0.64–0.75) | 0.48 (0.40–0.56) |
| Group 2 | 0.96 (0.94–0.97) | 0.78 (0.73–0.83) | 0.68 (0.66–0.71) | 0.54 (0.44–0.64) |
| Group 3 | – | – | 0.67 (0.57–0.77) | 0.58 (0.43–0.72) |

[a]All 22 countries in the Region are categorized into 3 groups based on level of development and income. Group 1: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. Group 2: Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Libya, Morocco, occupied Palestinian territory, Syrian Arab Republic and Tunisia. Group 3: Afghanistan, Djibouti, Pakistan, Somalia, Sudan and Yemen.

low-income countries have no published papers on survival. Consequently, our results actually represent the pooled survival rates of patients with breast cancer in those countries in the EMR which have better health care systems.

The results of the subgroup analysis indicated that women with breast cancer who were younger than 39 years may have the lowest survival rate. The highest survival rate was in those aged 40–64 years. In a study from Sweden in 2009 the 5-year survival rates in women aged 20–34, 35–39, 40–49 and 50–69 years were 74.7%, 83.8%, 88.3% and 87.8% respectively (20), which was consistent with the result of our study. Also, the results from a 2016 study in Canada (21) and a 2017 Iranian study (22) confirm our findings. Some research has reported that the age of onset of breast cancer in women of the EMR and also Asian women is lower than their European

and American counterpart (23). Breast cancer is a rare disease in young women, however the clinical and pathological outcomes are more aggressive than in older patients (20,21). Several studies have indicated that age is a significant predictor of survival in patients with breast cancer. A number of factors may affect the survival rates in women with breast cancer, e.g. late presentation and diagnosis at an advanced stage, more aggressive tumours in young women (20,24,25), and hormonal, immunological and biological differences between younger and older women (26,27). This hormonal difference in young women may result in more rapidly growing tumour and thus reduced survival rates (26,28). Also younger women with breast cancer may have more recurrence than other age groups (26).

One of the most important prognostic factors for survival of patients with breast cancer is stage at

**Table 3 Meta-regression analysis for assessing the effect of suspected variables on the pooled 1-, 3-, 5- and 10-year's survival rate for women with breast cancer in the Eastern Mediterranean Region, 1946–2018**

| Survival | Variable | Univariable model | | | Multivariable model | | |
|---|---|---|---|---|---|---|---|
| | | β | SE | P-value | β | SE | P-value |
| 1-year | Sample size | 2.7 | 2.4 | 0.281 | −0.7 | 2.3 | 0.761 |
| | HDI | 3.1 | 4.8 | 0.525 | 11.8 | 5.2 | 0.032 |
| | Decade of study | 3.1 | 3.0 | 0.763 | −5.9 | 3.2 | 0.091 |
| | Ethnicity | 4.4 | 2.2 | 0.068 | 9.7 | 3.1 | 0.007 |
| 3-year | Sample size | −1.9 | 4.6 | 0.612 | −1.3 | 4.3 | 0.752 |
| | HDI | 11.8 | 4.8 | 0.028 | 11.0 | 7.5 | 0.134 |
| | Decade of study | 4.0 | 5.0 | 0.482 | 1.5 | 6.0 | 0.823 |
| | Ethnicity | −4.2 | 4.1 | 0.329 | −0.6 | 5.9 | 0.914 |
| 5-year | Sample size | 3.6 | 3.1 | 0.234 | 3.0 | 2.9 | 0.325 |
| | HDI | 9.0 | 3.6 | 0.012 | 8.1 | 3.7 | 0.036 |
| | Decade of study | 8.2 | 3.9 | 0.048 | 5.4 | 4.1 | 0.179 |
| | Ethnicity | 2.9 | 3.0 | 0.397 | 2.2 | 9.9 | 0.425 |
| 10-year | Sample size | −2.7 | 9.2 | 0.752 | −0.6 | 11.0 | 0.981 |
| | HDI | −1.0 | 10.3 | 0.952 | −3.0 | 11.0 | 0.834 |
| | Decade of study | 10.5 | 12.1 | 0.443 | 11.0 | 20.0 | 0.516 |
| | Ethnicity | 5.5 | 9.6 | 0.526 | −0.3 | 37.7 | 0.327 |

*SE = standard error.*

*HDI = Human Development Index.*

diagnosis. The result of our study indicated that the 5-year survival rate of women with breast cancer in the EMR ranged from 90% for stage I to 37% for stage IV. In a 2016 report from the American Cancer Society the 5-year relative survival rate was between 99% at the local stage and 26% at the distant stage (*16*), similar to our findings. Also, a study from India in 2004 reported that the 5-year survival rate was from 69.7% at the local stage to 4% at the distant metastasised stage (*15*), which was much lower than our finding in the EMR. In developing region like the EMR, patients with breast cancer are usually diagnosed at an advanced stage due to the limited health care facilities, lack of awareness, and social barriers and cultural beliefs that can result in reduced survival (*2*).

Our findings indicated that the survival rate for women of all ages with breast cancer was better in the most recent decade. The 5-year survival rate in women in the EMR increased from 63% in 1990–1999 to 72% in 2010–2018. The result of studies conducted in Canada (*29*) and in England (*13*) confirm our findings. This progress may be due to the screening programmes and cancer prevention and control strategies in the countries of the Region (*1,30*).

The survival rate of women with breast cancer in the Arab populations was lower than in the non-Arab populations in this Region. In a 2016 meta-analysis conducted in the Islamic Republic of Iran, the pooled 1-, 3-, 5- and 10-year survival rates in women were 95%, 80%, 69% and 55% respectively (*31*) and in a study from Jordan in 2010 the 1-, 3- and 5-year survival rates were 91%, 70% and 59% respectively (*32*), confirming the result of our study. The results of some studies indicate that Arab

women with breast cancer may have a worse prognosis than other populations (*33,34*). The reasons for this may be the young age of women at presentation and also late diagnosis (*34*). Also some studies noted that the proportion of negative estrogen and progesterone receptors in Arab women with breast cancer was high, which can lead to poor survival (*33,35,36*).

In our meta-analysis we found that the 5-year survival rate in women was better than in men. Several studies indicate that sex is not an independent significant predictor for breast cancer survival (*37–39*) and the differences in survival may be due to the similarity between breast cancer in men and postmenopausal breast cancer in women (*37,40*). Some studies note that male breast cancer was diagnosed approximately 5–10 years later than in women (*41,42*). Also because of the general dearth of breast cancer screening programmes foe males, they are usually diagnosed at a later stage than women (*42,43*). In some studies, the risk of local and regional recurrence in male breast cancer has been higher than women (*42,44*).

We found that the 5-year survival rate in the very high HDI subgroup was much lower than in the low HDI subgroup. In the medium and low HDI subgroups we have countries such as Afghanistan, Djibouti, Iraq, Palestine, Sudan, Somalia and Syrian Arab Republic but we did not have any relevant study about the survival rate for breast cancer in these countries, so the pooled survival rate in these subgroups are concluded from only a few countries, and therefore we should expect this bias.

One of the main limitations of this review is that, from the 22 countries in the EMR, we only have studies from

12 countries. So the estimate of the pooled survival rate in this Region can be representative of survival of only those countries which have a better health care system.

## Conclusion

Although the search targeted all EMR countries, our results represented countries in the EMR with better health care systems, because the countries with no published papers on survival are mainly low income countries. The survival rate of women in the countries in the EMR which have better health care systems is between the rates in the developed and developing regions. We found that, as in other parts of the world, survival rate have improved in recent decades. Although the survival rate will further improve owing to the implementation of screening and control programmes, we need more informative programmes to improve the awareness among females about the early sign and symptoms of this disease.

## Taux de survie des patients atteints de cancer du sein dans les pays de la Région de la Méditerranée orientale : analyse systématique et méta-analyse

### Résumé

**Contexte** : Le cancer du sein est la quatrième cause de mortalité et d'incapacité dans la Région de la Méditerranée orientale ; bien que son incidence soit moindre que dans les régions développées, la tendance a été à la hausse au cours des dernières décennies.

**Objectif** : La présente étude avait pour objectif de calculer le taux de survie combiné des patients atteints de cancer du sein dans la Région de la Méditerranée orientale.

**Méthodes** : Nous avons effectué des recherches dans les bases de données électroniques de 1946 au 19 janvier 2018, sans restriction de langue. Un modèle à effet aléatoire a été utilisé pour estimer les taux de survie combinés à 1, 3, 5 et 10 ans pour les patients atteints de cancer du sein. Le test $\chi^2$ et l'indice $I^2$ ont été utilisés pour évaluer l'hétérogénéité entre les études. Une analyse de sous-groupe et une méta-régression ont été utilisées pour étudier la source potentielle d'hétérogénéité.

**Résultats** : Nous avons trouvé 80 articles éligibles pour être inclus dans notre analyse. Les taux de survie combinés à 1, 3, 5 et 10 ans chez les femmes atteintes de cancer du sein dans la Région de la Méditerranée orientale étaient respectivement de 0,95 ; 0,80 ; 0,71 et 0,56. L'indice $I^2$ a mis en évidence une hétérogénéité considérable entre les études (toutes ayant rapporté un indice $I^2$ supérieur à 50 %). Le taux de survie à 5 ans dans le sous-groupe masculin était de 0,63. Le taux de survie à 5 ans chez les femmes atteintes de cancer du sein dans les tranches d'âge inférieur ou égal à 39, compris entre 40 et 64 ans et des plus de 65 ans étaient respectivement de 0,74 ; 0,76 et 0,58. Une corrélation statistiquement significative a été relevée entre l'indice de développement humain ($\beta$ = 9, $p$ = 0,01), la décennie de l'étude ($\beta$ = 8,2, $p$ = 0,04) et le taux de survie à 5 ans.

**Conclusions** : Le taux de survie des femmes atteintes de cancer du sein dans les pays de la Région de la Méditerranée orientale qui ont les meilleurs systèmes de santé s'est amélioré au cours de la dernière décennie. Les femmes dont l'âge était compris entre 40 et 64 ans avaient le meilleur taux de survie.

## معدلات نجاة المرضى المصابين بسرطان الثدي في إقليم شرق المتوسط: استعراض منهجي وتحليل تلوي

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### الخلاصة

**الخلفية**: سرطان الثدي هو رابع سبب رئيسي للوفاة والعجز في إقليم شرق المتوسط؛ وأصبح هناك اتجاه متزايد للإصابة بسرطان الثدي، على الرغم من أن معدل الإصابة به لا يزال أقل من المعدلات السائدة في الأقاليم المتقدمة.

**الأهداف**: تمثَّلَ هدفنا في حساب معدل النجاة المُجمَّعة للمرضى المصابين بسرطان الثدي في إقليم شرق المتوسط.

**طرق البحث**: بحثنا في قواعد البيانات الإلكترونية في الفترة من عام ١٩٤٦ إلى ١٩ يناير/ كانون الثاني ٢٠١٨، بدون أي قيود لغوية. وقد استخدمنا نموذجاً عشوائياً فعالاً لتقدير معدلات النجاة المُجمَّعة على مدار سنة واحدة، و٣ سنوات، و٥ سنوات و١٠ سنوات للمرضى المصابين بسرطان الثدي. واستُخدم اختبار ٢$\chi$ ومؤشر $I^2$ لتقييم التباين بين الدراسات. كذلك استُخدم تحليل المجموعات الفرعية والتحوُّف التلوي لتحرِّي المصدر المُحتمل للتباين.

**النتائج**: وجدنا أن هناك ٨٠ مقالاً صالحاً للإدراج ضمن المراجعة. وبلغت معدلات النجاة المُجمَّعة على مدار سنة واحدة، و٣ سنوات، و٥ سنوات و١٠ سنوات بين النساء المصابات بسرطان الثدي في إقليم شرق المتوسط المتوسط ٠,٩٥، و٠,٨٠، و٠,٧١، و٠,٥٦ على التوالي. وبيَّن مؤشر $I^2$ وجود

تباين لا يُستهان به بين الدراسات (كل مؤشرات $I^2 > 50$ ٪). وعلى مدار ٥ سنوات، بلغ معدل النجاة في الفئة الفرعية من الرجال ٠ , ٦٣، بينما بلغ في النساء المصابات بسرطان الثدي في الفئات العمرية ٣٩ ≥، و٦٤-٤٠، وأكبر من ٦٥ سنة ٧٤ , ٠، و٧٦ , ٠، و٥٨ , ٠ على التوالي. وكان هناك ارتباط إحصائي قوي بين مؤشر التنمية (٩= β، والقيمة الاحتمالية = ٠١ , ٠) والدراسة مدة ١٠ سنوات (٢ , ٨= β، والقيمة الاحتمالية = ٠٤ , ٠)، ومعدل النجاة على مدار ٥ سنوات.

**الاستنتاجات:** تحسَّنَ على مدار العَقْد الماضي معدل نجاة النساء المصابات بسرطان الثدي في بلدان إقليم شرق المتوسط التي لديها نُظم رعاية صحية أفضل، وكانت أفضل معدلات النجاة بين النساء التي تتراوح أعمارهن بين ٦٤-٤٠ عاماً.

## References

1. Organization WH. Strategy for cancer prevention and control in the Eastern Mediterranean Region 2009–2013. 2010.

2. Garcia M, Jemal A, Ward E, Center M, Hao Y, Siegel R, et al. Global cancer facts & figures, 3rd ed. Atlanta: American Cancer Society; 2015.

3. Khatib OM, Modjtabai A. Guidelines for the early detection and screening of breast cancer. Cairo: World Health Organization, Regional Office for the Eastern Mediterranean; 2006.

4. Breast cancer facts & figures 2015–2016. Atlanta: American Cancer Society; 2015.

5. Omar S, Alieldin N, Khatib O. Cancer magnitude, challenges and control in the Eastern Mediterranean Region. East Mediterr Health J. 2007 Nov–Dec;13(6):1486–96. PMID:18341198

6. Namiranian N, Moradi-Lakeh M, Razavi-Ratki SK, Doayie M, Nojomi M. Risk factors of breast cancer in the Eastern Mediterranean Region: a systematic review and meta-analysis. Asian Pac J Cancer Prev. 2014;15(21):9535–41. doi:10.7314/apjcp.2014.15.21.9535

7. Sarvi F, Nadali A, Khodadost M, Moghaddam MK, Sadeghifar M. Application of Poisson Hidden Markov model to predict number of PM2. 5 exceedance days in Tehran during 2016–2017. Avicenna J Environ Health Engineer. 2017 Jun;4(1).

8. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev. 2015 Jan 1;4:1. doi:10.1186/2046-4053-4-1.

9. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. nt J Surg. 2014 Dec;12(12):1495–9. doi:10.1016/j.ijsu.2014.07.013

10. Nyaga VN, Arbyn M, Aerts M. Metaprop: a Stata command to perform meta-analysis of binomial data. Arch Public Health. 2014 Nov 10;72(1):39. doi:10.1186/2049-3258-72-39

11. Lyons G, Sankaranarayanan R, Millar AB, Slama S. Scaling up cancer care in the WHO Eastern Mediterranean Region. Eastern Mediterranean Health Journal. 2018;24(1):104–10. PMID:29658627

12. Health systems strengthening in countries of the Eastern Mediterranean Region: challenges, priorities and options for future action. Cairo: World Health Organization, Regional Office for the Eastern Mediterranean; 2012.

13. Woods LM, Rachet B, O'Connell D, Lawrence G, Tracey E, Willmore A, et al. Large differences in patterns of breast cancer survival between Australia and England: a comparative study using cancer registry data. Int J Cancer. 2009 May;124(10):2391–9. doi:10.1002/ijc.24233

14. Zhu J, Chen JG, Chen YS, Zhang YH, Ding LL, Chen TY. Female breast cancer survival in Qidong, China, 1972–2011: a population-based study. BMC Cancer. 2014 May 6;14:318. doi:10.1186/1471-2407-14-318

15. Yeole BB, Kumar AVR, Kurkure A, Sunny L. Population-based survival from cancers of breast, cervix and ovary in women in Mumbai, India. Asian Pac J Cancer Prev. 2004;5(3):308–15. PMID:15373712

16. Breast cancer facts & figures 2015–2016. Atlanta: American Cancer Society, Inc; 2015.

17. Allemani C, Sant M, Weir HK, Richardson LC, Baili P, Storm H, et al. Breast cancer survival in the US and Europe: A CONCORD high-resolution study. Int J Cancer. 2013 Mar 1;132(5):1170–81. doi:10.1002/ijc.27725

18. Sankaranarayanan R, Swaminathan R, Brenner H, Chen K, Chia KS, Chen JG, et al. Cancer survival in Africa, Asia, and Central America: a population-based study. Lancet Oncol. 2010 Feb;11(2):165–73. doi:10.1016/S1470-2045(09)70335-3

19. Khatib O, Aljurf M. Cancer prevention and control in the Eastern Mediterranean region: the need for a public health approach. Hematol Oncol Stem Cell Ther. 2008 Jan-Mar;1(1):44–52. PMID:20063528

20. Fredholm H, Eaker S, Frisell J, Holmberg L, Fredriksson I, Lindman H. Breast cancer in young women: poor survival despite intensive treatment. PLoS One. 2009 Nov 11;4(11):e7695. doi:10.1371/journal.pone.0007695

21. Brenner DR, Brockton NT, Kotsopoulos J, Cotterchio M, Boucher BA, Courneya KS, et al. Breast cancer survival among young women: a review of the role of modifiable lifestyle factors. Cancer Causes Control. 2016 Apr;27(4):459–72. doi:10.1007/s10552-016-0726-5.

22.  Nematolahi S, Ayatollahi SMT. A comparison of breast cancer survival among young, middle-aged, and elderly patients in southern Iran using Cox and empirical Bayesian additive hazard models. Epidemiol Health. 2017 Oct 16;39:e2017043. doi:10.4178/epih.e2017043

23.  Mousavi-Jarrrahi SH, Kasaeian A, Mansori K, Ranjbaran M, Khodadost M, Mosavi-Jarrahi A. Addressing the younger age at onset in breast cancer patients in Asia: an age-period-cohort analysis of fifty years of quality data from the international agency for research on cancer. ISRN Oncol. 2013 Sep 2;2013:429862. doi:10.1155/2013/429862

24.  Abahssain H, Lalya I, Zahra EL M'Rabet F, Ismaili N, Razine R, Tazi MA, et al. Breast cancer in Moroccan young women: a retrospective study. BMC research notes. 2010;3(1):286.

25.  Nemoto T, Vana J, Bedwani RN, Baker HW, McGregor FH, Murphy GP. Management and survival of female breast cancer: results of a national survey by the American College of Surgeons. Cancer. 1980;45(12):2917–24.

26.  Jayasinghe UW, Taylor R, Boyages J. Is age at diagnosis an independent prognostic factor for survival following breast cancer? ANZ journal of surgery. 2005;75(9):762–7.

27.  Oussama M, Kh MA. Guidelines for the early detection and screening of breast cancer. Cairo: World Health Organization Regional Office for the Eastern Mediterranean. 2006:24–6 (https://apps.who.int/iris/bitstream/handle/10665/119811/dsa701.pdf?sequence=1&isAllowed=y, accessed 7 Octover 2019)

28.  Coleman MP, Quaresma M, Berrino F, Lutz J-M, De Angelis R, Capocaccia R, et al. Cancer survival in five continents: a worldwide population-based study (CONCORD). Lancet Oncol. 2008 Aug;9(8):730–56. doi:10.1016/S1470-2045(08)70179-7

29.  Kachuri L, De P, Ellison L, Semenciw R, Advisory Committee on Canadian Cancer Statistics. Cancer incidence, mortality and survival trends in Canada, 1970–2007. Chronic Dis Inj Can. 2013 Mar;33(2):69–80 PMID:23470172

30.  Miller AB. Screening for breast cancer in the Eastern Mediterranean Region East Mediterr Health J. 2010 Oct;16(10):1022–4. PMID:21222416

31.  Rahimzadeh M, Pourhoseingholi MA, Kavehie B. Survival rates for breast cancer in Iranian patients: a meta-analysis. Asian Pac J Cancer Prev. 2016;17(4):2223–7. doi:10.7314/apjcp.2016.17.4.2223

32.  Arkoob K, Al-Nsour M, Al-Nemry O, Al-Hajawi B. Epidemiology of breast cancer in women in Jordan: patient characteristics and survival analysis. East Mediterr Health J. 2010 Oct;16(10):1032–8. PMID:21222418

33.  Majid RA, Mohammed HA, Hassan HA, Abdulmahdi WA, Rashid RM, Hughson MD. A population-based study of Kurdish breast cancer in northern Iraq: hormone receptor and HER2 status. A comparison with Arabic women and United States SEER data. BMC Women's Health. 2012;12(1):16. doi:10.1186/1472-6874-12-16

34.  Nissan A, Spira RM, Hamburger T, Badrriyah M, Prus D, Cohen T, et al. Clinical profile of breast cancer in Arab and Jewish women in the Jerusalem area. The Am J Surg. 2004 Jul;188(1):62–7. doi:10.1016/j.amjsurg.2003.11.039

35.  Al Tamimi DM, Shawarby MA, Ahmed A, Hassan AK, AlOdaini AA. Protein expression profile and prevalence pattern of the molecular classes of breast cancer-a Saudi population based study. BMC Cancer. 2010 May 21;10:223. doi:10.1186/1471-2407-10-223

36.  Sughayer MA, Al-Khawaja MM, Massarweh S, Al-Masri M. Prevalence of hormone receptors and HER2/neu in breast cancer cases in Jordan. Pathol Oncol Res. 2006;12(2):83–6. doi:PAOR.2006.12.2.0083

37.  Hill TD, Khamis HJ, Tyczynski JE. Comparison of male and female breast cancer incidence trends, tumor characteristics, and survival. Ann Epidemiol. 2005;15(10):773–80. doi:10.1016/j.annepidem.2005.01.001

38.  Levi F, Randimbison L, La Vecchia C. Breast cancer survival in relation to sex and age. Oncology. 1992;49(6):413–7.

39.  Willsher PC, Leach IH, Ellis IO, Bourke JB, Blamey RW, Robertson JF. A comparison outcome of male breast cancer with female breast cancer. Am J Surg. 1997;173(3):185–8. doi:10.1016/s0002-9610(97)89592-x

40.  Anderson WF, Althuis MD, Brinton LA, Devesa SS. Is male breast cancer similar or different than female breast cancer? Breast Cancer Res Treat. 2004;83(1):77–86.

41.  Amirifard N, Sadeghi E. Breast cancer in men: a report from the Department of Radiation Oncology in Kermanshah Province, Iran. Asian Pac J Cancer Prev. 2016;17(5):2593–6. PMID:27268636

42.  Scott-Conner C, Jochimsen P, Menck H, Winchester D. An analysis of male and female breast cancer treatment and survival among demographically identical pairs of patients. Surgery. 1999;126(4):775–81. PMID:10520928

43.  Bezwoda WR, Hesdorffer C, Dansey R, de Moor N, Derman DP, Browde S, et al. Breast cancer in men. Clinical features, hormone receptor status, and response to therapy. Cancer. 1987;60(6):1337–40. doi:10.1002/1097-0142(19870915)60:6<1337::aid-cncr2820600629>3.0.co;2-c

44.  Wagner JL, Thomas CR, Koh WJ, Rudolph RH. Carcinoma of the male breast: update 1994. Med Pediatr Oncol. 1995;24(2):123–32. doi:10.1002/mpo.2950240213

45.  Abdollahi A, Zadeh HS, Akbari M, Tahmasbi S, Talei A, Hassanzadeh J. Investigation of prognostic factors and survival without recurrence in patients with breast cancer. Adv Biomed Res. 2017 Apr 17;6:42. doi:10.4103/2277-9175.204595

46.  Al-Moundhri M, Al-Bahrani B, Pervez I, Ganguly S, Nirmala V, Al-Madhani A, et al. The outcome of treatment of breast cancer in a developing country–Oman. Breast. 2004;13(2):139–45. doi:10.1016/j.breast.2003.10.001.

47.  Abdelkrim SB, Fathallah K, Rouatbi R, Ayachi M, Hmissa S, Mokni M. OM. Breast cancer in very young women aged 25 year-old or below in the center of Tunisia and Review of the Literature. Pathol Oncol Res. 2015;21(3):553–61. doi:10.1007/s12253-015-9944-5

48. Aghili M, Lashkari M, Farrokhpey AH, Izadi S. Triple-negative breast cancer survival in Iranian patients. Acta Med Iran. 2013 Sep 9;51(8):560–6. PMID:24026994

49. Ahmed SB, Aloulou S, Bibi M, Landolsi A, Nouira M, Fatma LB, et al. Pronostic du cancer du sein chez les femmes tunisiennes: analyse d'une série hospitalière de 729 patientes [Breast cancer prognosis in Tunisian women: analysis of a hospital series of 729 patients]. Santé Publique. 2002;14(3):231–41. PMID:12564048

50. Akbari ME, Mozaffar M, Heidari A, Zirakzadeh H, Akbari A, Akbari M, et al. Recurrence and survival effect in breast conserving surgery: what are the predictive and/or prognostic factors? Iran J Cancer Prev. 2011;4(2):49–54.

51. Akbari ME, Khayamzadeh M, Khoshnevis S, Nafisi N, Akbari A. Five and ten years survival in breast cancer patients mastectomies vs. breast conserving surgeries personal experience. Iran J Cancer Prev. 2012;1(2):53–6.

52. Akbari M, Mirzaei H, Soori H. 5 year survival of breast cancer in Shohada-e-Tajrish and Jorjani hospitals. Hakim Resh J. 2006;9(2):39–44.

53. Al Idrissi HY, Ibrahim EM, Kurashi NY, Sowayan SA. Breast cancer in a low risk population. The influence of age and menstrual status on disease pattern and survival in Saudi Arabia. Int J Cancer. 1992;52(1):48–51. doi:10.1002/ijc.2910520111

54. Alaoui SK, Debbagh A, Sbitti Y, Errihani H, Ichou M. [Male breast cancer in Morocco: Epidemiology and prognostic factors. A report of 140 cases]. Gynecol Obstet Fertil. 2016 Nov;44(11):636–40 (in French). doi: 10.1016/j.gyobfe.2016.08.009

55. Aziz Z, Iqbal J, Akram M. Predictive and prognostic factors associated with survival outcomes in patients with stage I–III breast cancer: A report from a developing country. Asia Pacific J Clin Oncol. 2008;4(2):81–90. doi:10.1111/j.1743-7563.2008.00152.x

56. Babaie GR, Feyzi A, Keshavarz M. The effect of various therapeutic and surgical methods on the survival of patients with breast cancer. Daneshvar Medicine. 2005;13(59):19–28.

57. Baghestani A, Moghaddam S, Majd H, Akbari M, Nafissi N, Gohari K. Survival analysis of patients with breast cancer using Weibull Parametric Model. Asian Pac J Cancer Prev. 2015;16(18):8567–71. PMID:26745118

58. Bakkach J, Mansouri M, Derkaoui T, Loudiyi A, Fihri M, Hassani S, et al. Clinicopathologic and prognostic features of breast cancer in young women: a series from North of Morocco. BMC Womens Health. 2017 Nov 9;17(1):106. doi:10.1186/s12905-017-0456-1

59. Ben Gobrane H, Fakhfakh R, Rahal K, Ben Ayed F, Maalej M, Ben Abdallah M, et al. [Breast cancer prognosis in Salah Azaiez Institute of Cancer, Tunis] East Mediterr Health J. 2007;13(2):309–18 (in French). PMID:17684853

60. Bhatti A, Khan AI, Siddiqui N, Muzaffar N, Syed AA, Shah MA, et al. Outcomes of triple-negative versus non-triple-negative breast cancers managed with breast-conserving therapy. Asian Pac J Cancer Prev. 2014;15(6):2577–81. doi:10.7314/apjcp.2014.15.6.2577

61. Bhatti ABH, Jamshed A, Shah MA, Khan A. Breast conservative therapy in Pakistani women: Prognostic factors for locoregional recurrence and overall survival. J Cancer Res Ther. 2015 Apr–Jun;11(2):300–4. doi:10.4103/0973-1482.140828

62. Bouzid N, Lahmar R, Tebra S, Bouaouina N. [Breast cancer in woman younger than 35 years in Tunisia: retrospective study about 124 cases]. Gynecol Obstet Fertil. 2013 Jun;41(6):356-60 (in French). doi:10.1016/j.gyobfe.2013.05.002

63. Derkaoui T, Bakkach J, Mansouri M, Loudiyi A, Fihri M, Alaoui FZ, et al. Triple negative breast cancer in North of Morocco: clinicopathologic and prognostic features. BMC Women's Health. 2016;16(1):68. doi:10.1186/s12905-016-0346-y

64. Dhiab B, Bouzid T, Gamoudi A, Hassouna B, Khomsi F, Boussen H, et al. [Male breast cancer: about 123 cases collected at the Institute Salah-Azaiz of Tunis from 1979 to 1999]. Bull Cancer. 2005;92(3):281–5 (in French). PMID:15820923

65. El Amine EO, Nasri M, Thabet S, Ben HJ, Goucha A, Rahal K, et al. Primary breast sarcomas: About 30 cases treated at Salah-Azaiez institute in Tunisia. Cancer Radiother. 2017 Feb;21(1):45–50 (in French). doi:10.1016/j.canrad.2016.09.011

66. El Mistiri M, Salati M, Marcheselli L, Attia A, Habil S, Alhomri F, et al. Cancer incidence, mortality, and survival in Eastern Libya: updated report from the Benghazi Cancer Registry. Ann Epidemiol. 2015;25(8):564–8. https://doi.org/10.1016/j.annepidem.2015.03.012

67. El-Baradie M, Salama A, Khorshid O, Ismail H, Attia G, Bahnassy AA. Egyptian male breast carcinoma: patients' hormonal profile, management and outcome. Chinese-German J Clin Oncol. 2012;11(2):89–98.

68. El-Beshbeshi W, Abo-Elnaga EM. Male breast cancer: 10-year experience at mansoura university hospital in Egypt. Cancer Biol Med. 2012 Mar;9(1):23–8. doi:10.3969/j.issn.2095-3941.2012.01.004

69. El-Habbash MM, Alwindi AA. Male breast cancer in Tripoli, Libya. Saudi Med J. 2009;30(8):1060–2. PMID:19668888

70. Elshafiey MM, Zeeneldin AA, Elsebai HI, Moneer M, Mohamed DB, Gouda I, et al. Epidemiology and management of breast carcinoma in Egyptian males: Experience of a single Cancer Institute. J Egypt Natl Canc Inst. 2011 Sep;23(3):115–22. doi:10.1016/j.jnci.2011.10.001

71. Fakhro A. Breast cancer: patient characteristics and survival analysis at Salmaniya medical complex, Bahrain. East Mediter Health J. 1999;5(3):430–9. https://apps.who.int/iris/handle/10665/118724

72. Fallahzadeh H, Momayyezi M, Akhundzardeini R, Zarezardeini S. Five year survival of women with breast cancer in Yazd. Asian Pac J Cancer Prev. 2014;15(16):6597–601. doi:10.7314/apjcp.2014.15.16.6597

73. Faradmal J, Roshanaei G, Mafi M, Sadighi-Pashaki A, Karami M. Application of censored quantile regression to determine overall survival related factors in breast cancer. J Res Health Sci. 2016;16(1):36–40. PMID:27061995

74. Fardmal J, Mafi M, Sadighi-Pashaki A, Karami M, Roshanaei G. Factors affecting survival in breast cancer patients referred to the Darol Aitam-e Mahdieh Center. J Zanjan University Med Sci Health Serv. 2014;22(93):105-15.

75. Fayaz MS, El-Sherify MS, El-Basmy A, Zlouf SA, Nazmy N, George T, et al. Clinicopathological features and prognosis of triple negative breast cancer in Kuwait: A comparative/perspective analysis. Rep Pract Oncol Radiother. 2013 Sep 26;19(3):173–81. doi:10.1016/j.rpor.2013.08.007

76. Fazeli Z, Najafian ZM, Eshrati B, Almasi Ha. Five-year evaluation of epidemiological, geographical distribution and survival analysis of breast cancer in Markazi Province, Arak Med Univ J. 2014;16(80):72–9.

77. Haghighat S. Survival rate and its correlated factors in breast cancer patients referred to Breast Cancer Research Center. Iran J Breast Dis. 2014;6(3):28–36.

78. Hajihosseini M, Faradmal J, Sadighi-Pashaki A. Survival analysis of breast cancer patients after surgery with an intermediate event: application of illness-death model. Iran J Public Health. 2015;44(12):1677–84. PMID:26811819

79. Hamadeh RR, Abulfatih NM, Fekri MA, Al-Mehza HE. Epidemiology of breast cancer among Bahraini women: data from the Bahrain Cancer Registry. Sultan Qaboos Univ Med J. 2014;14(2):e176-82. PMID:24790739

80. Hamdan N, Ravichandran K, Dyab A. Breast cancer survival in Riyadh, Saudi Arabia, 1994   1996. IARC Sci Publ. 2011;(162):179–81. PMID:21675422

81. Heydari ST, Mehrabani D, Tabei S, Azarpira N, Vakili M. Survival of breast cancer in southern Iran. Iran J Cancer Prev. 2009;2(1):51–4.

82. Hoseini M, Bahrampour A, Mirzaee M. Comparison of Weibull and Lognormal cure models with Cox in the survival analysis of breast cancer patients in Rafsanjan. J Res Health Sci. 2017 Feb 16;17(1):e00369. PMID:28413171

83. Ibrahim EM, Al-Mulhim FA, Al-Amri A, Al-Muhanna FA, Ezzat AA, Stuart RK, et al. Breast cancer in the eastern province of Saudi Arabia. Med Oncol. 1998 Dec;15(4):241–7. PMID:9951687

84. Iqbal J, Bano K, Saeed A, Akram M, Aziz Z. Survival of women with locally advanced breast cancer at a teaching hospital in Lahore. J Pak Med Assoc. 2010;60(9):721. PMID:21381576

85. Jamy O, Rafiq A, Laghari A, Chawla T. Male breast cancer: a 24 year experience of a tertiary care hospital in Pakistan. Asian Pac J Cancer Prev. 2015;16(4):1559–63. doi:10.7314/apjcp.2015.16.4.1559

86. Kallel M, Elloumi F, Khabir A, Ghorbal L, Chaabouni S, Amouri H, et al. Breast cancer in young women in southern Tunisia: Anatomical study and clinical prognostic factors: About a series of 83 patients. Rep Pract Oncol Radiother. 2015 May-Jun;20(3):155–60. doi:10.1016/j.rpor.2015.01.007

87. Karimi A, Delpisheh A, Sayehmiri K. Application of accelerated failure time models for breast cancer patients' survival in Kurdistan Province of Iran. J Cancer Res Ther. 2016 Jul-Sep;12(3):1184–8. doi:10.4103/0973-1482.168966

88. Khanfir A, Frikha M, Kallel F, Meziou M, Trabelsi K, Boudawara T, et al. [Breast cancer in young women in the south of Tunisia]. Cancer Radiother. 2006;10(8):565–71 (in French). doi:10.1016/j.canrad.2006.09.115

89. Kumar S, Shaikh A, Rashid Y, Masood N, Mohammed A, Malik U, et al. Presenting features, treatment patterns and outcomes of patients with breast cancer in Pakistan: Experience at a university hospital. Indian J Cancer. 2016 Apr-Jun;53(2):230–4. doi:10.4103/0019-509X.197728

90. Kumar S, Burney IA, Al-Ajmi A, Al-Moundhri MS. Changing trends of breast cancer survival in sultanate of Oman. J Oncol. 2011:316243. doi:10.1155/2011/316243

91. Mechita NB, Tazi MA, Er-Raki A, Mrabet M, Saadi A, Benjaafar N, et al. [Survival rate for breast cancer in Rabat (Morocco) 2005-2008]. Pan Afr Med J. 2016 Nov 11;25:144 (in French). doi:10.11604/pamj.2016.25.144.10402

92. Moghadami Fard Z, Gohari M. Survival analysis of patients with breast cancer using the Aalen's additive hazard model. J North Khorasan Univ Med Sci. 2012;3(5):171–9.

93. El Mongy M, El Hossieny H, Haggag F, Fathy R. Clinico-pathological study and treatment results of 1009 operable breast cancer cases: Experience of NCI Cairo University, Egypt. Chinese-German J Clin Oncol. 2010;9(7):409–15.

94. Mosavi-Naeini S, Mofid B, Mohebbi H, Mehmannavaz M, Khoshini S. [Comparison of regional recurrence, metastasis and survival rate between two surgical methods in the treatment of breast cancer stage I and II]. Kowsar Med J. 2009;14(2):89–94 (in Farsi).

95. Mousavi SM, Mohagheghi MA, Mousavi-Jerrahi A, Nahvijou A, Seddighi Z. Outcome of breast cancer in Iran: a study of Tehran Cancer Registry data. Asian Pac J Cancer Prev. 2008 Apr–Jun;9(2):275–8. PMID:18712973

96. Movahedi M, Haghighat S, Khayamzadeh M, Moradi A, Ghanbari-Motlagh A, Mirzaei H, et al. Survival rate of breast cancer based on geographical variation in iran, a national study. Iran Red Cresc Med J. 2012;14(12):798.

97. Payandeh M, Sadeghi M, Sadeghi E, Aeinfar M. Clinicopathology figures and long-term effects of tamoxifen plus radiation on survival of women with invasive ductal carcinoma and triple negative breast cancer. Asian Pac J Cancer Prev. 2015;16(12):4863–7. doi:10.7314/apjcp.2015.16.12.4863

98. Shahraki HR, Salehi A, Zare N. Survival prognostic factors of male breast cancer in Southern Iran: a LASSO-Cox regression approach. Asian Pac J Cancer Prev. 2015;16(15):6773–7. doi:10.7314/apjcp.2015.16.15.6773

99. Rais G, Raissouni S, Aitelhaj M, Rais F, Naciri S, Khoyaali S, et al. Triple negative breast cancer in Moroccan women: clinico-

pathological and therapeutic study at the National Institute of Oncology. BMC Women's Health. 2012;12(1):35. doi:10.1186/1472-6874-12-35

100. Rajaeefard A, Baneshi M, Talei A, Mehrabani D. Survival models in breast cancer patients. Iran Red Cresc Med J. 2009;11(3):295–300.

101. Rampisheh Z, Motamed N, Amiri M, Ostovar A, Azarnoush A, Bahramian F, et al. Breast cancer survival rate according to data of cancer registry and death registry systems in Bushehr province, 2001–2013. Iran South Med J. 2015;18(4):729–37.

102. Ravichandran K, Hamdan NA, Dyab A. Population based survival of female breast cancer cases in Riyadh Region, Saudi Arabia. Asian Pac J Cancer Prev. 2005;6(1):72–6. PMID:15780037

103. Rezaianzadeh A, Peacock J, Reidpath D, Talei A, Hosseini SV, Mehrabani D. Survival analysis of 1148 women diagnosed with breast cancer in Southern Iran. BMC Cancer. 2009 Jun 5;9:168. doi:10.1186/1471-2407-9-168.

104. Salehi A, Zeraati H, Mohammad K, Mahmoudi M, Talei A, Ghaderi A, et al. Survival of male breast cancer in Fars, South of Iran. Iran Red Cresc Med J. 2011;13(2):99.

105. Sedehi M, Amani F, Momeni DF. Analysis of survival data of patient with breast cancer using artificial neural network and cox regression models. J Zabol Univ Med Sci Health Serv. 2014;5(4):24–32.

106. Shawky H, Younes SG, Sadaka E, Elgohary SE-D, Sallam FA. Male breast cancer–a 10-year review of 29 cases at Tanta University Hospital. Life Sci J. 2013;10(1)

107. Soliman AA, Denewer AT, El-Sadda W, Abdel-Aty AH, Refky B. A retrospective analysis of survival and prognostic factors of male breast cancer from a single center. BMC Cancer. 2014 Mar 28;14:227. doi:10.1186/1471-2407-14-227

108. Vahdaninia M, Harirchi AM, Montazeri A. [Five years survival rate in women with breast cancer referring to Imam Khomeini Hospital: a prospective study]. Payesh Health Monitor. 2003;2(2):141–8 (in Farsi).

109. 1Vostakolaei FA, Broeders MJ, Rostami N, Van Dijck JA, Feuth T, Kiemeney LA, et al. Age at diagnosis and breast cancer survival in Iran. Int J Breast Cancer. 2012;2012:517976. doi:10.1155/2012/517976

110. Yaghmaei S, Bani Hashemi G, Ghorbani R. Survival rate following treatment of primary breast cancer in Semnan, Iran (1991–2002). Koomesh. 2008;9(2):111–6.

111. Znati K, Bennis S, Abbass F, Akasbi Y, Chbani L, Elfatemi H, et al. Breast cancer in young patient in Morocco. Gynecol Obstet Fertil. 2014 Mar;42(3):149–54. doi:10.1016/j.gyobfe.2011.08.014

112. Zare N, Doostfatemeh M, Rezaianzadeh A. Modeling of breast cancer prognostic factors using a parametric log-logistic model in Fars province, Southern Iran. Asian Pac J Cancer Prev. 2012;13(4):1533–7. doi:10.7314/APJCP.2012.13.4.1533

113. Ziaei JE, Sanaat Z, Asvadi I, Dastgiri S, Pourzand A, Vaez J. Survival analysis of breast cancer patients in northwest Iran. Asian Pac J Cancer Prev. 2013;14(1):39–42. doi:10.7314/APJCP.2013.14.1.39

# Language barriers to studying medicine in English: perceptions of final-year medical students at the Arabian Gulf University

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## Abstract

**Background:** English is the language of instructions in many medical schools in the Arab world. Its use may create a language barrier and adversely affect an individual's learning and later professional life.

**Aims:** This study examined the views of final-year Arab medical students of a language barrier and its effect on their learning and academic performance, and their language preference for medial education.

**Methods:** All final-year medical students (n = 142, 62% females) at the Arabian Gulf University, Bahrain, were invited to respond to a self-completed questionnaire. Differences in responses according to English proficiency and sex were assessed.

**Results:** Of the 142 students, 99 (70%) responded. Most students did not feel a language barrier irrespective of their proficiency in English ($P$ = 0.088). Most respondents did not think that language issues made studying more difficult, although there was a significant difference in responses between students considered proficient in English and those less proficient ($P$ = 0.005). Most students (82%) were not aware or were not sure of medical terms in Arabic, but 66% were confident that they would be able to communicate with patients in Arabic. About half of the students (51%) supported medicine being taught only in English and 36% supported teaching in Arabic and English.

**Conclusions:** Most students thought that learning in English did not affect their academic learning and performance. However, a good proportion supported being taught medicine in Arabic and English.

Keywords: language, learning, medical education, academic performance, Arab world

## Introduction

All medical schools in countries of the Gulf Cooperation Council (GCC), including the Arabian Gulf University in Bahrain, use English as language of instructions for teaching undergraduate medical students whose first language is Arabic (*1*). The use of a second language for medical education may create a language barrier particularly for students for whom the second language was not taught or practised much during the first few years of their school education (*2,3*). The most vulnerable students are those accepted for admission to medical colleges from governmental schools where teaching is mainly done in Arabic. Indeed, it has been reported that language difficulties were considered the second most important problem faced by medical students during their first year of study in a Saudi Arabian medical school (*4*).

The reason why a language barrier adversely affects learning is related to the limitation of working memory when learning is carried out in a second language (*5*). In addition, brain activation and information processing are more complex when teaching is conducted in a second language (*6*). An investigation into the sequence of activation of different parts of the prefrontal cortex in response to first (native) and second languages found that the anterior part of the right dorsolateral prefrontal cortex and the left superior temporal gyrus were activated when tasks were executed in the native language (*5*). However, when the same tasks were performed in the second language, the posterior part of the right dorsolateral prefrontal cortex and the left inferior temporal gyrus were activated. The left inferior temporal gyrus are shown to have lower proficiency in working memory and are therefore expected to result in superficial learning (*5*).

Students accepted for admission to the College of Medicine and Medical Sciences of the Arabian Gulf University in Bahrain are required to achieve excellent scores in high school, pass a written science test and undergo an interview (*6*). Since English is the language of instruction in the college, accepted students must pass a stringent English test before starting the preclinical phase of the programme (*6*). Candidates who have inadequate English skills are admitted to a foundation programme where they receive intensive English teaching over one academic year. Those who successfully pass the English test are directly admitted to the first year of the medical programme.

In this study, we examined perceptions of final-year medical students at the Arabian Gulf University of a potential language barrier and its effect on their academic performance and ability to adapt and manage the difficulties of the language barrier during the different phases of the medical programme.

## Methods

### Study design and setting

This was a cross-sectional study which conducted from January to March 2017 at the Arabian Gulf University in Bahrain.

### Participants

All participants were final-year medical students (sixth year of study) during the academic year 2016–2017. Participants were expected to graduate at the end of that academic year. All students in the target cohort were Arabs from different GCC countries. They had all gone through the same admission process and experienced the same curriculum, which was almost completely taught in English.

All 142 medical students (62% females) were invited to respond to a self-administered questionnaire. The students were approached in person by the investigators at the university and were asked to complete a hard copy of the questionnaire. Information was collected on student's sociodemographic data, language of school education and admission to the foundation year before starting the medical programme. Information on the possible effects of language difficulties on students' adaptation and ability to manage the difficulties of the language barrier and academic achievement in the different phases of the programme was sought. The survey used a five-point Likert scale to record responses on a number of statements (strongly disagree, disagree, not sure, agree and strongly agree). A pilot study was done with 10 students in their fifth-year of study, to validate the questionnaire. In order to categorize participants according to their proficiency in English, we relied on whether they had done a foundation year. Students who had done the foundation programme were considered to have inadequate proficiency in English; those who had not were considered to have adequate proficiency in English. We assessed the association between students' responses to the different items of the questionnaire and their placement on the foundation programme.

### Statistical analysis

SPSS, version 23 was used for statistical analysis. The association between placement in the foundation year, as a measure of participants' proficiency in English, and responses to the survey questions was assessed by the Pearson chi-squared test. Differences between male and female responses were assessed using the Mann–Whitney test.

### Ethical considerations

Ethical approval for this study was obtained from the Research and Ethics Committee at the Arabian Gulf University. Prior to participation, written informed consent was obtained from the students.

## Results

Of the 142 final-year students, 99 (70%) responded (56 females and 37 males; 6 did not indicate their gender). The participants came from four GCC countries: Saudi Arabia, Kuwait, Bahrain and Oman. Most participating students had not done the foundation year (78%), although for 81%, their teaching materials during school were in Arabic (Table 1).

Table 2 shows the students' perception of a language barrier during their medical education programme. Most students did not feel language barrier during their study. This finding was not significantly associated with their proficiency in English ($P = 0.088$). However, while most students did not think that the language barrier made studying more difficult, there was a statistically significant difference in the responses between students who had done a foundation year and those who had not ($P = 0.005$). The majority of the students did not believe that learning in English made studying less enjoyable, made adapting to studying medicine more difficult, or adversely affected their participation in class activities or examination performance; there was a statically significant difference in the responses between students who had done a foundation year and those who had not ($P < 0.05$ for all these items). Most of the students were either not aware of medical terms in Arabic or not sure of them (47% and 35% respectively) but most were confident to take a medical history from patients in Arabic (72%) and

**Table 1 Characteristics of the participating students at the Arabian Gulf University and their exposure to English**

| Characteristic | No. (%) |
|---|---|
| *Sex (n = 93)* | |
| Male | 37 (40) |
| Female | 56 (60) |
| *Teaching materials during school education were mainly in (n = 99):* | |
| Arabic | 80 (81) |
| English | 19 (19) |
| *I did a foundation year at the Arabian Gulf University (n = 99):* | |
| Yes | 22 (22) |
| No | 77 (78) |
| *Nationality (n = 97)* | |
| Saudi Arabia | 35 (36) |
| Kuwait | 31 (32) |
| Bahrain | 29 (30) |
| Oman | 2 (2) |
| United Arab Emirates | 0 (0) |
| Qatar | 0 (0) |

Table 2 Association between medical students' perception of a language barrier during their medical education and their proficiency in English

| Item | Agree | | | Disagree | | | Not sure | | | P-value[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | No foundation year | Foundation year | Total | No foundation year | Foundation year | Total | No foundation year | Foundation year | Total | |
| I felt a language barrier during my study | 10 | 48 | 58 | 11 | 20 | 31 | 1 | 9 | 10 | 0.088 |
| Language barrier made studying more difficult | 10 | 54 | 64 | 11 | 13 | 24 | 1 | 10 | 11 | 0.005 |
| Language barrier made understanding subjects more difficult | 18 | 46 | 64 | 3 | 21 | 24 | 1 | 10 | 11 | 0.157 |
| Language barrier made retaining information more difficult | 17 | 41 | 58 | 3 | 22 | 25 | 2 | 14 | 16 | 0.131 |
| Language barrier made adapting to study medicine more difficult | 13 | 65 | 78 | 6 | 8 | 14 | 3 | 4 | 7 | 0.038 |
| Language barrier made studying medicine less enjoyable | 13 | 67 | 80 | 6 | 3 | 9 | 3 | 7 | 10 | 0.002 |
| Language barrier affected my participation in class activities | 14 | 65 | 79 | 6 | 5 | 11 | 2 | 7 | 9 | 0.023 |
| Language barrier affected my performance in exams | 10 | 58 | 68 | 8 | 9 | 17 | 4 | 10 | 14 | 0.013 |
| I'm confident of my knowledge of medical terms in Arabic | 13 | 34 | 47 | 4 | 13 | 17 | 5 | 30 | 35 | 0.351 |
| I'm confident to take a medical history in Arabic | 4 | 12 | 16 | 18 | 53 | 71 | 0 | 12 | 12 | 0.142 |
| After graduation, I'm confident I will be able to communicate with patients in Arabic about their diseases and therapy | 3 | 10 | 13 | 13 | 52 | 65 | 5 | 15 | 20 | 0.882 |
| To facilitate learning, I translate information from English to Arabic | 7 | 47 | 54 | 12 | 21 | 33 | 3 | 9 | 12 | 0.038 |
| I support teaching medical terms in Arabic and English | 9 | 22 | 31 | 7 | 40 | 47 | 6 | 15 | 21 | 0.249 |
| I support teaching medicine in Arabic and English | 11 | 29 | 40 | 7 | 29 | 36 | 4 | 18 | 22 | 0.606 |
| I support teaching medicine in English only | 7 | 18 | 25 | 11 | 40 | 51 | 4 | 19 | 23 | 0.668 |
| I support teaching medicine in Arabic only | 19 | 70 | 89 | 3 | 1 | 4 | 4 | 2 | 6 | 0.017 |

aP-values were calculated using the Pearson chi-squared test and shows the association with placement in the foundation year.

to communicate with patients in Arabic (66%) (Table 2). No statistically significant differences were found between males and females in their response to the questions.

Regarding the students' preferred language of instruction, 51% of them supported learning medicine in English only with no statistically significant difference in responses between students who had done a foundation year and those who had not (*P* = 0.668). Females were more in favour of learning medicine in English than males (*P* = 0.026). However, 36% and 47% of the students respectively supported the teaching of medicine and medical terminology in both Arabic and English, with no statistically significant difference in responses between students who had done a foundation year and those who had not (*P* = 0.606 and 0.249 respectively). Females were less receptive to learning medical terms in Arabic and English than males (*P* = 0.042). A small minority of the participants would prefer to learn medicine exclusively in Arabic with a statistically significant difference in responses between students who had done a foundation year and those who had not (*P* = 0.017).

## Discussion

In various educational settings, when the language of instructions is different from the learner's mother tongue, the potential language barrier may adversely affect an individual's learning and professional life (*7*). This issue is of particular relevance to Arab countries since medical students whose first language is Arabic are taught medicine in English or French. By using a self-administered questionnaire, this study aimed to investigate the perception of final-year medical students of language difficulties at the Arabian Gulf University. Overall, our findings showed that most participants did not think that learning medicine in a second language affected their ability to manage the academic programme. Interestingly, however, just over a third of the students supported an approach where Arabic is combined with English in teaching. The latter observation may indicate that the students still believed in the importance of using Arabic in medical education, regardless of their English language skills and feeling of the language barrier.

Most of the students did not feel any language barrier. This finding was expected because most of them had not been required to do the foundation programme, indicating that their English skills were adequate. However, the association between feeling language barrier and students' English proficiency was not statistically significant. Similarly, while only a small percentage of participants thought that language issues affected their studies and performance in exams, this was significantly associated with English proficiency. A study in Egypt explored the perspectives of staff and students from years 1 to 6 on language barriers in medical education (*8*). Similar to our findings, 56.3% of the students did not consider using English an obstacle. Our finding that the students did not consider language

a barrier was unexpected, since most them had been admitted to the college from governmental schools where Arabic is the teaching language. We believe that since these students were asked about their perceptions after six years of studying in English, they might have overcome the language difficulties over these years.

Most participants either did not know or were not sure if they knew medical terms in Arabic. Despite this, most of them felt confident to take a medical history from patients in Arabic and communicate with Arabic-speaking patients in their native language. These findings are contradictory since the students need to know medical terms in the patients' language in order to ask them questions while taking a medical history and also when they have explain the diagnosis or treatment to the patients. A study conducted in Egypt found that 70.6% of students preferred to learn how to taking a medical history in Arabic (*8*). Another study examined the confidence of medical students in communicating with Arabic-speaking patients after receiving training on communication skills in English (*9*). Only a quarter of the students were confident to take medical history in Arabic (*9*). Knowledge of medical terms in a patient's native language is an essential component of the doctor–patient interaction. Medical graduates who have been educated in a foreign language may face difficulties in communicating with their patients in their mother tongue.

When we explored students' preferred language of instruction, almost all of them rejected the suggestion of learning medicine exclusively in Arabic, although there was a statistically significant difference in responses between those who had done a foundation year and those who had not. Students' reluctance to learn medicine totally in Arabic is somewhat expected given the expected difficulties when they attempt international examinations. Previous attempts to deliver medical education completely in Arabic have faced difficulties (*10*). About half of the students supported learning medicine in English only while about a third supported a bilingual approach. Females were more likely to support learning medicine in English only and were less in favour of learning medical terms in both Arabic and English. The observed gender difference in preferred language of instruction is difficult to explain. Support of English only or a bilingual approach was not significantly associated with proficiency in English. Students' support of learning medicine in both Arabic and English may indicate their understanding of the importance of being competent in both Arabic and English terminology, perhaps to help them communicate with their patients in the future. These data indicate that a good proportion of the students preferred a bilingual approach that would allow them to learn medicine in their mother tongue and at the same time would not deprive them of learning in English, which is the most widely used language internationally.

Our study has some limitations. Firstly, some of the findings were contradictory. It would have been possible

to explain these observations if a focus group discussion had been held where the participants could have explained more about their perceptions. Secondly, although the response rate of 70% was adequate, the investigators were not able to collect data on the views of the remaining 30%. Refusal to participate in this study might be related to the student's language proficiency. That is, those students who did not agree to participate might have done so because their English was good. Thirdly, we considered placement in the foundation year as evidence that the student had poor English skills. Other more objective evidence might be more robust, such as scores in international English language proficiency exams.

## Conclusions

We examined the perceptions of final-year medical students of the effect of studying medicine in English on their academic adaptation. Our findings showed that most of the students did not feel language barrier during their studies. Almost all of them rejected complete "Arabization" of medical education. However, a good proportion supported using Arabic for teaching medicine along with English. The findings of our study may help prompt medical schools in the Arab World to discuss the feasibility of also using Arabic in medical education as well as English.

## Barrières linguistiques aux études de médecine en anglais : perception des étudiants de dernière année de médecine à l'Université du Golfe arabique

### Résumé

**Contexte** : L'anglais est la langue d'enseignement de nombreuses écoles de médecine du monde arabe. Son utilisation pourrait créer une barrière linguistique et avoir une incidence négative sur l'apprentissage lors des études, et plus tard, sur la vie professionnelle.

**Objectifs** : La présente étude a examiné la perception des étudiants arabes inscrits en dernière année de médecine d'une éventuelle barrière linguistique et de son effet sur leur apprentissage et leurs résultats universitaires ainsi que leur préférence linguistique pour l'enseignement de la médecine.

**Méthodes** : Tous les étudiants de dernière année de médecine (*n* = 142, 62 % de femmes) à l'Université du Golfe arabique (Bahreïn) ont été invités à répondre à un questionnaire d'auto-évaluation. Les différences de réponses selon le niveau d'anglais et le sexe ont été évaluées.

**Résultats** : Sur les 142 étudiants, 99 (70 %) ont répondu au questionnaire. La plupart des étudiants ne percevaient pas de barrière linguistique, indépendamment de leur niveau d'anglais (*p* = 0,088). La majorité des personnes interrogées ne pensaient pas que les problèmes linguistiques rendaient l'apprentissage plus difficile, malgré un contraste significatif dans les réponses entre les étudiants considérés comme avancés en anglais et ceux qui l'étaient moins (*p*= 0,005). La plupart des étudiants (82 %) ne connaissaient pas ou n'étaient pas sûrs des termes médicaux en arabe, mais 66 % d'entre eux pensaient néanmoins être en mesure de communiquer avec les patients en arabe. Près de la moitié des étudiants (51 %) approuvaient l'anglais comme langue exclusive d'apprentissage de la médecine, tandis que 36 % étaient en faveur d'un apprentissage en arabe et en anglais.

**Conclusions** : La plupart des étudiants estimaient que l'enseignement en anglais était sans incidence sur leur apprentissage et leurs résultats universitaires. Cependant, une proportion non négligeable était en faveur d'un enseignement de la médecine en arabe et en anglais.

## آراء طلاب الطب في السنة النهائية في جامعة الخليج العربي بشأن الحواجز اللغوية التي تعوق دراسة الطب باللغة الإنجليزية

ياسين تيّم، أحمد الشمري، نوف البلوي، مروة شريف

### الخلاصة

الخلفية: تُستخدم اللغة الإنجليزية في التدريس في كثير من كليات الطب في العالم العربي، وقد يؤدي ذلك إلى إيجاد حاجز لُغوي، وهو ما يؤثر سلباً على قدرة الفرد على التعلم ويؤثر لاحقاً على حياته المهنية.

**الأهداف:** تناولت هذه الدراسة آراء الطلاب العرب في السنة النهائية بكلية الطب بشأن الحاجز اللغوي وتأثيره على تحصيلهم وأدائهم الأكاديمي، وبشأن اللغة التي يفضلونها في التعليم الطبي.

**طرق البحث:** دُعي جميع طلاب السنة النهائية بكلية الطب في جامعة الخليج العربي (العدد = 62، 142٪ منهم من الإناث) للإجابة عن استبيان يُملأ ذاتياً. وقُيِّم التباين في الإجابات وفقاً لدرجة إتقان الإنجليزية ونوع الجنس.

**النتائج:** من بين الطلاب البالغ عددهم 142 طالباً، أجاب عن الاستبيان 99 طالباً (70٪). ولم يشعر معظم الطلاب بحاجز لغوي، بغض النظر عن مدى إتقانهم للغة الإنجليزية (القيمة الاحتمالية = 0.088). ولم ير معظم المستجيبين أن مشكلة اللغة تجعل الدراسة أصعب، وذلك على الرغم من وجود تباين واضح في إجابات الطلاب الذين يُعتبرون ماهرين في اللغة الإنجليزية وبين الطلاب الأقل مهارة (القيمة الاحتمالية = 0.005). ولم يكن معظم الطلاب (82٪) على علم بالمصطلحات الطبية باللغة العربية أو على الأقل لم يكونوا متأكدين منها، بينما رأى 66٪ أنهم سيكونون قادرين على التواصل مع المرضى باللغة العربية. ودعم نصف الطلاب (51٪) تدريس الطب باللغة الإنجليزية فقط، بينما دعم 36٪ منهم تدريس الطب باللغتين العربية و الإنجليزية.

**الاستنتاجات:** رأى معظم الطلاب أن التعلم باللغة الإنجليزية لم يؤثر على تحصيلهم وأدائهم أكاديمياً. وعلى الرغم من ذلك، دعمت نسبة لا بأس بها تدريس الطب باللغتين العربية و الإنجليزية.

# References

1. Hamdy H, Telmesani AW, Al Wardy N, Abdel-Khalek N, Carruthers G, Hassan F, et al. Undergraduate medical education in the Gulf Cooperation Council: a multi-countries study (Part 1). Med Teach. 2010;32(3):219–24. https://doi.org/10.3109/01421590903389108

2. Holtzman KZ, Swanson DB, Ouyang W, Dillon GF, Boulet JR. International variation in performance by clinical discipline and task on the United States medical licensing examination step 2 clinical knowledge component. Acad Med. 2014;89(11):1558–62. https://doi.org/10.1097/ACM.0000000000000488

3. Mann C, Canny B, Lindley J, Rajan R. The influence of language family on academic performance in year 1 and 2 MBBS students. Med Educ. 2010;44(8):786–94. https://doi.org/10.1111/j.1365-2923.2010.03711.x

4. Almoallim H, Aldahlawi S, Alqahtani E, Alqurashi S, Munshi A. Difficulties facing first-year medical students at Umm Alqura University in Saudi Arabia. East Mediterr Health J. 2012;16(12):1272–7.

5. Kim JJ, Kim MS, Lee JS, Lee DS, Lee MC, Kwon JS. Dissociation of working memory processing associated with native and second languages: PET investigation. Neuroimage. 2002;15(4):879–91. https://doi.org/10.1006/nimg.2001.1025

6. Alnasir FA, Jaradat AA. The effectiveness of AGU-MCAT in predicting medical student performance in year one of the College of Medicine of the Arabian Gulf University. Educ Health (Abingdon). 2011;24(2):447.

7. Henderson D, McGrath PD, Patton MA. Experience of clinical supervisors of international medical graduates in an Australian district hospital. Aust Health Rev. 2017;(4):365–71. https://doi.org/10.1071/AH15094

8. Sabbour SM, Dewedar SA, Kandil SK. Language barriers in medical education and attitudes towards Arabization of medicine: student and staff perspectives. East Mediterr Health J. 2012;16(12):1263–71.

9. Mirza DM, Hashim MJ. Communication skills training in English alone can leave Arab medical students unconfident with patient communication in their native language. Educ Health (Abingdon). 2010;23(2):450.

10. Mahmdani AA, Abdel Rahman SH. Evaluating the impact of Arabization on medical students' acquisition, Gezira University, Sudan. East Mediterr Health J. 2006;12(Suppl 2):S223–9.

# Planning for the global interactive Robson platform in the Eastern Mediterranean Region[1]

## Introduction

Improved understanding of caesarean section rates has been hindered by the lack of a consistent, internationally accepted classification system to monitor and compare rates. To address this, the World Health Organization (WHO) proposed the adoption of the Robson classification system (1), designed to facilitate comparison and analysis of caesarean section rates within and between different facilities, and across countries and regions. WHO has also developed an interactive online platform in which facilities worldwide can upload data according to the Robson classification system (2). In this context, the WHO Regional Office for the Eastern Mediterranean held an informal consultative meeting on testing and adopting planning for the global interactive Robson platform in the Eastern Mediterranean Region in Cairo, Egypt, from 4 to 5 September 2019 (3). The meeting was attended by 30 participants from six countries (Egypt, Islamic Republic of Iran, Lebanon, Morocco, Pakistan and Syrian Arab Republic), as well as staff from the United Nations Population Fund (UNFPA) Regional Office for the Arab States and from WHO headquarters, Regional Office and country offices. The objectives of the consultation were to:

- discuss components of the caesarean section global interactive platform newly developed by WHO;
- debate approaches for adopting the use of the caesarean section online platform at the health facility and ministry of health levels; and
- determine the mechanisms needed to ensure caesarean section comparative analysis using caesarean section data collection.

## Summary of discussions

The role of litigation in reducing unnecessary caesarean section was noted, as was the need for training protocols for normal vaginal deliveries and surveillance systems using disaggregated data to monitor the use of caesarean section, and pre-requisites were identified for adopting the Robson classification system, including obstetrics guidelines, clinical review and audits. Good practices in countries were shared, highlighting training components, mapping of caesarean section, operational research, and preparing the health information system for the monitoring and evaluation of caesarean section use, using the Robson classification system. There was consensus on the importance of adopting a standardized approach and having a single platform for all countries for data related to caesarean section to facilitate access to country data and allow comparative analysis and learning exchange.

There was also discussion on the role of the mass media in improving the use of the Robson classification system, and agreement on the importance of sensitizing the public to the benefits of normal vaginal delivery, and of adopting a communication plan to improve the knowledge, attitudes and practices of health care providers and women.

## Recommendations

### To WHO

- Raising the awareness of concerned parties (policy-makers, programme managers and professionals) on the benefits of the Robson classification system and the global online platform for optimizing the use of caesarean section.
- Strengthening and enforcing regulations and policies related to caesarean section and the application of the Robson classification system.

### To Member States

- Involving obstetricians/gynaecologists, midwives and information officers in implementing the Robson classification system global online platform.
- Ensuring training of trainers on the Robson classification system for the public and private sectors and disseminating related guides and tools.
- Establishing caesarean section committees, at the hospital level, to ensure the implementation of the Robson classification system in line with a "quality of care" approach.
- Implementing the Robson classification system online platform, at the hospital level, and ensuring adequate primary and comparative analysis and interpretation of data for appropriate action.

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[1]　This report is based on the proceedings of the Informal consultative meeting on testing and adopting planning for the global interactive Robson platform in the Eastern Mediterranean Region, 4–5 September 2019, Cairo, Egypt (http://applications.emro.who.int/docs/IMR-WRH-109-2019-EN.df?ua=1).

- Considering the linkages and possible integration of the platform with other existing digital health information systems .

- Strengthening the response to the high use of caesarean section, including adoption of WHO guidelines on non-clinical interventions to reduce unnecessary caesarean section.

## References

1. World Health Organization. The Robson classification implementation manual. Geneva: World Health Organization; 2017 (https://www.who.int/reproductivehealth/topics/maternal_perinatal/robson-classification-implementation/en/).

2. World Health Organization. A systematic review of the Robson Classification for caesarean section. Geneva: World Health Organization; 2020 (https://www.who.int/reproductivehealth/topics/maternal_perinatal/robson-classification/en/).

3. World Health Organization Regional Office for the Eastern Mediterranean (WHO/EMRO). Informal consultative meeting on testing and adopting planning for the global interactive Robson platform in the Eastern Mediterranean Region. Cairo: WHO/EMRO; 2019 (http://applications.emro.who.int/docs/IMR-WRH-109-2019-EN.pdf?ua=1).

# Dr Peter Salama



It is with immense sadness to commemorate the death of our dear colleague Dr Peter Salama, Executive Director of the World Health Organization (WHO) Division for Universal Health Coverage – Life Course, who passed away suddenly on 23 January 2020 at the age of 51. A prominent Australian public health expert with family roots extending from the Eastern Mediterranean Region.

Dr Salama joined WHO in 2016 as Executive Director of the Health Emergencies programme before leading WHO's work on Universal Health Coverage globally. All through his work, Dr Salama focused on those most in need particularly in war-torn places where health services had collapsed. In the last six months, and together with the EM regional colleagues, he co-led two high-level missions to Palestine and Somalia in support of building resilient health systems. He has constantly focused on translating evidence into action and always aspired to remain connected with the field as he gained more senior and executive positions. The regional office will honor his legacy by continuing the work he started and extending it to other countries in the region so no one is left behind.

Pete was a role model for many and loved by those who had the chance to work with him. "Pete embodied everything that is best about WHO and the United Nations – professionalism, commitment and compassion," said Dr Tedros Adhanom Ghebreyesus, WHO Director-General.

Before joining WHO, Dr Salama was Regional Director for the Middle East and North Africa at UNICEF. Dr Salama led UNICEF's global response to Ebola, served as its Representative in Ethiopia and Zimbabwe (2009–2015), Chief of Global Health and Principal Advisor on HIV/AIDS in New York (2004–2009), and Chief of Health and Nutrition in Afghanistan (2002–2004). He had also worked with Médecins Sans Frontières and Concern Worldwide in several countries in Asia and sub-Saharan Africa.

In spite of all his multiple skills and accomplishments, Pete was above all a family man. He had a remarkable ability to achieve balance in his busy professional and personal lives. For him, family always came first. Dr Salama leaves behind his wife and three young sons, to whom the Organization extends its most profound sympathies and condolences.

## الدكتور بيتر سلامة

نتذكر ببالغ الأسى والحزن وفاة الدكتور بيتر سلامة، المدير التنفيذي لشعبة التغطية الصحية الشاملة لمنظمة الصحة الصحة العالمية (في جميع مراحل الحياة) الذي وافته المنية فجأةً في ٢٤ يناير/ كانون الثاني ٢٠٢٠ عن عمر ناهز ٥١ عاماً. وكان الدكتور سلامة أحد العلماء الاستراليين البارزين في علم الصحة العامة، وقد انضم للعمل بالمنظمة في عام ٢٠١٦ وشغل منصب المدير التنفيذي لبرنامج الطوارئ الصحية حتى عام ٢٠١٩، وقاد البحوث التي أُجريَت حول الوفيات الناجمة عن فيروس العَوَز المناعي البشري والأمراض المتوقّاة باللقاحات والحروب، وكذلك البحوث عن العنف.

وقال الدكتور تيدروس أدحانوم غيبريسوس، المدير العام للمنظمة «لقد جسَّد بيتر الأفضل من كل ما تدعو إليه المنظمة والأمم المتحدة – الاحترافية والالتزام والرحمة. إن قلوبنا يعتصرها الألم».

وقبل الانضمام إلى المنظمة، شغل الدكتور سلامة منصب المدير الإقليمي لمكتب الشرق الأوسط وشمال أفريقيا لليونيسف. وقاد وقتها استجابة اليونيسف العالمية لمواجهة الإيبولا، وعمل ممثلاً لليونيسف في إثيوبيا وزيمبابوي (٢٠٠٩-٢٠١٥)، ومدير الصحة الدولية والمستشار الرئيسي المعني بفيروس العَوَز المناعي البشري/الإيدز في نيويورك (٢٠٠٤-٢٠٠٩)، وشغل منصب مدير الصحة والتغذية في أفغانستان (٢٠٠٢-٢٠٠٤). وعمل كذلك مع منظمة أطباء بلا حدود ومنظمة كونسيرن وورلدوايد في عدد من البلدان في آسيا وأفريقيا جنوب الصحراء.

رحل الدكتور سلامة وترك زوجته وأطفاله الثلاثة، وتتقدَّم المنظمة إليهم جميعاً بخالص العزاء والمواساة.

# Eastern Mediterranean Health Journal reviewers' panel, 2019

The Eastern Mediterranean Health Journal extends sincere thanks to the following experts for their generous and invaluable assistance in the review of papers considered for publication during 2019.

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**Arranged in alphabetical order according to the family name**

# Guidelines for authors

1. Papers submitted for publication to the Eastern Mediterranean Health Journal (EMHJ) must not have been published, accepted for publication or currently be under consideration for publication elsewhere. The World Health Organization (WHO) Regional Office for the Eastern Mediterranean reserves all rights of reproduction and republication of material that appears in the EMHJ.

2. Papers submitted for publication to the EMHJ should conform with the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (http://www.icmje.org/icmje-recommendations.pdf) of the International Committee of Medical Journal Editors (ICMJE).

3. **Ethical considerations:** Where applicable, a statement must be included indicating approval for the study was granted by the ethics committee/institutional review board of the relevant institution. Authors should verify where appropriate that all persons on whom research has been carried out have given their voluntary, informed, written consent, and where participants (living or dead) were unable to give such consent, that surrogate consent was obtained. Authors may be asked to supply such consent forms. Conflicts of interest: Authors will be asked to provide details of any competing interests and funding. Please see the ICMJE Recommendations.

4. **Reporting guidelines:** EMHJ encourages and recommends authors to adhere to the best research protocols available and follow established reporting guidelines. Reporting guidelines are available at the EQUATOR Network (http://www.equator-network.org/). The key guidelines for research in the field of public health are: CONSORT (guidelines for reporting randomized trials); STROBE (guidelines for reporting observational studies); PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses); STARD (Standards for Reporting of Diagnostic Accuracy); COREQ (Consolidated criteria for reporting qualitative research); CARE (guideline for clinical case report) as well as the COCHRANE handbook (for systematic reviews of interventions). Links to these sites and other useful resources are available under "Useful resources for authors and reviewers" (http://www.emro.who.int/emh-journal/links/).

5. Following WHO and ICMJE recommendations, EMHJ requires registration of clinical trials in a public trials registry as a condition of consideration for publication. Authors are recommended to register in one of the clinical trials registries certified by WHO and ICMJE which are available at the International Clinical Trials Registry Platform (http://www.who.int/ictrp/en/).

6. **Submission:** Original papers written in Arabic, English or French may be submitted for consideration through our online submission system. Instructions on submitting a manuscript through the online system and access to the system can be found on our website at: http://www.emro.who.int/emh-journal/authors/ and by clicking on Editorial Manager.

7. Abstracts of papers accepted for publication will be translated into all three languages. To ensure the correct spelling of authors' names to accompany the Arabic abstract, authors writing in English or French but whose mother tongue is written using Arabic characters should provide their full names in Arabic script along with transliterations in English or French.

8. Manuscripts should be prepared in word processed format (preferably Microsoft Word) double-spaced, single column, preferably using Times New Roman script, font size 12.

9. All papers considered for publication will be peer reviewed. The Editorial Board reserves the right to accept or reject any paper based on the reviewers' comments, scientific rigor and suitability for the journal. Papers are accepted on the understanding that they are subject to statistical and editorial revision as deemed necessary, including abridgement of the text and omission of tabular or graphic material.

10. **Topics:** The subject of the paper should pertain to public health or a related biomedical or technical subject within the field of interest of the WHO, and should have particular relevance to the Eastern Mediterranean Region.

11. The title of the paper should be as concise as possible, preferably not more than 15 words. All authors should have made material contribution to the design, analysis or writing of the study and have approved the final version submitted. No change in authorship will be permitted after the paper has been accepted for publication and any change before this must be agreed by all authors listed. Authors may be asked to verify their contribution. Names of other contributors may be included in the acknowledgements. Please see the ICMJE Recommendations for authorship and contributorship.

12. **Structured abstracts:** Submissions should include a structured abstract in this format: Background; Aims; Methods; Results; and Conclusion. The structure can be flexible if a paper warrants it and a justification offered by the author at submission.

13. **Research articles:** Papers reporting original research findings should follow this format: Background, Objectives; Methods; Results; Discussion and Conclusion. The text of Research articles and Reports should not exceed 3000 words (excluding references). A structured abstract should not exceed 250 words (see note 12). The maximum number of references permitted is 35 and must include DOIs if available. The number of tables and figures should not exceed 5.

14. **Review articles:** (i.e. critical assessments of research on topics of relevance to public health in the Region). These should contain sections dealing with objectives, sources, methods of selection, compilation and interpretation of data and conclusions. The text should not exceed 3000 words (excluding the accompanying abstract, references, tables and figures), and should be accompanied by an abstract of not more than 250 words (see note 12). The number of tables and figures should not exceed 5.

15. **Reports:** (i.e. papers reporting on projects of public health relevance to the Eastern Mediterranean Region). Manuscript specifications (length, references, tables/figures) are the same as a research article, but abstract length should not exceed 150 words.

16. **Short research communications:** Articles which do not constitute a complete research study but are of particular relevance or importance to public health issues in the Region may be considered for publication. The text should not exceed 1500 words (excluding references), and should be accompanied by a structured abstract (see note 12) of not more than 150 words. The number of tables and figures should not exceed 3.

17. **Commentaries:** (i.e. papers reporting on research/ issues of public health relevance to the Eastern Mediterranean Region). Manuscript specifications (references, tables/figures) are the same as a short research communication, but maximum length is 1000 words. The abstract (unstructured) for submissions purposes should not exceed 150 words, and the abstract should mirror the 1st paragraph of the submission.

18. **Case reports:** Only reports of cases of an unusual nature are considered for publication. Text should include an Introduction, the Report of the case(s) and a Discussion. The text should not exceed 1500 words and the number of references kept to a minimum. The abstract should not exceed 150 words.

19. **Letters to the Editor:** Letters commenting on published articles are welcome. Letters will be sent to the authors of the original article for their comments, and these will be published along with the letter. The text of letters should not exceed 500 words.

20. **Editorials:** Editorials are commissioned; unsolicited submissions are not normally received. If commissioned, editorial length is 800 words and supported by 8–10 references.

21. **References:** In-text citations of published works should be limited to essential up-to-date references. These should be numbered separately as they occur in the text with sequential Arabic numerals in parentheses, e.g. (1,5–8). These references should appear in a numbered list on a separate page after the Discussion. They should contain the following elements as appropriate: name(s) and initial(s) of author(s); title of paper or book in its original language plus translation; for research articles, abbreviated name of journal plus volume number and page range; for books and other texts, place of publication (city and country) and name of publisher (commercial or institutional); and date of publication and DOI number; for texts published exclusively on the Internet, exact URL of the page cited and date when last accessed. For texts with up to 6 authors, all authors must be named. For texts with more than 6 authors, the first 6 authors should be named followed by "et al". The following are examples of the Journal's preferred style:

Book:
Al Hamza B, Smith A. The fifth sign of identity. Cairo: American University Press; 1990.
Journal article:
Rehmani R, Elzubair AG, Al Maani M, Chaudary IY, Al Qarni A, Khasshogi T et al. Population-based health survey in eastern region of Saudi Arabia. East Mediterr Health J. 2013; 19(5):417–25.
Document:
Al-Itneen M, ed. The principles of uncertainty. Geneva: World Health Organization; 1985 (WHO/DOC/537).
Thesis
Smith S. Use of healthcare services by the elderly with the introduction of technical innovations. London: Drake University; 2013.
Web text:
Child growth standards. Geneva: World Health Organization; 2006 (http://www.who.int/childgrowth/en/, accessed 8 October 2008).

22. Figures and tables with appropriate captions should each be on a separate page and numbered sequentially with Arabic numerals. Each figure and table must be referred to in the text. Where appropriate, sources should be given. If any figures, tables or other materials have been copied from other sources, authors have the sole responsibility for securing the necessary permission. In order to avoid layout problems in final production, tables and figures should be limited as far as possible. Figures must be supplied in a format which can be edited, preferably Microsoft Excel format, and figures derived from data must be accompanied by those data, e.g. Excel data sheet, to enable redrawing if necessary. Photographs and illustrations should also be sent as separate files. The preferred format is JPG or TIFF; resolution should be minimum 300 dpi.

23. Submissions that do not comply with these guidelines will be returned to the authors for correction before being considered for publication.

## دلائل إرشادية للمؤلفين

١.  ينبغي للأبحاث المقدَّمة للنشر في المجلة الصحية لشرق المتوسط ألا تكون قد نشرت أو قُبلت للنشر أو تكون محلاً للنظر في نشرها في مكان آخر. ويحتفظ المكتبَ الإقليمي لمنظمة الصحة العالمية لشرق المتوسط بجميع حقوق إعادة إنتاج المواد التي تُنشر في المجلة الصحية لشرق المتوسط أو إعادة نشرها.

٢.  ينبغي للأبحاث المقدَّمة للنشر في المجلة الصحية لشرق المتوسط أن تلبِّي التوصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية التي أصدرتها اللجنة الدولية لمحرري المجلات الطبية.

٣.  اعتبارات البُعد الأخلاقي: بحسب الاقتضاء يجب إرفاق البحث المقدَّم للنشر في المجلة الصحية لشرق المتوسط بما يفيد الموافقة على الدراسة من جانب لجنة الأخلاقيات/ مجلس المراجعة المؤسسية في المؤسسة ذات الصلة بالبحث، كما يجب على المؤلفين التأكد، حيثما كان ذلك مناسباً، من أن جميع الأشخاص الذين شملهم البحث قد قدموا موافقة كتابية طوعية مستنيرة، وعندما يتعذر ذلك على المشاركين في البحث (سواءً الأحياء منهم أو الأموات)، يجب على المؤلفين الحصول على موافقة بديلة. وقد يُطلب من المؤلفين تقديم نماذج هذه الموافقات. تضارب المصالح: سيطلب من المؤلفين تقديم معلومات تفصيلية حول أي تضارب في المصالح وحول التمويل. يُرْجَى الاطلاع على توصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية.

٤.  دلائل إرشادية حول إعداد التقارير: تشجع المجلة الصحية لشرق المتوسط المؤلفين وتوصيهم بالالتزام بأفضل بروتوكولات البحوث المتاحة، واتباع الدلائل الإرشادية المعتمدة في إعداد التقارير، ويمكن الاطلاع على الدلائل الإرشادية حول كتابة التقارير على شبكة EQUATOR (http://www.equator-network.org). وتتمثَّل الدلائل الإرشادية الرئيسية للبحوث في ميدان الصحة العامة فيما يلي: المعايير المجمَّعة لكتابة التقارير حول الدراسات (CONSORT) وهي الدلائل الإرشادية لإعداد التقارير حول الدراسات المعشّاة، وSTROBE وهي الدلائل الإرشادية حول كتابة التقارير للدراسات المعتمدة على الملاحظة، والمكونات المفضلة في كتابة تقارير المراجعات المنهجية والتحليل البعدي PRISMA ومعايير إعداد التقارير حول الدقة التشخيصية STARD، والمعايير المجمَّعة لكتابة التقارير حول البحوث النوعية COREQ، وكتيب كوكرين COCHRANE (للمراجعات المنهجية للتدخلات). والروابط إلى تلك المواقع وغيرها من المصادر المفيدة متاحة على الرابط "المصادر المفيدة للمؤلفين والمراجعين" (http://www.emro.who.int/emh-journal/links).

٥.  وفقاً لتوصيات منظمة الصحة العالمية وتوصيات اللجنة الدولية لمحرري المجلات الطبية، فإن المجلة الصحية لشرق المتوسط تطلب تسجيل الدراسات السريرية (الإكلينيكية) في سجل للدراسات العامة كشرطٍ للنظر في نشرها، ويُوصَى المؤلفون بالتسجيل في أحد سجلات الدراسات السريرية المشهود لها من قِبَل منظمة الصحة العالمية واللجنة الدولية لمحرري المجلات الطبية، وتتوافر هذه السجلات على البوابة الدولية لسجل للدراسات السريرية (http://www.who.int/ictrp/en).

٦.  تقديم الأبحاث: يمكن تقديم الأبحاث الأصلية المكتوبة باللغة العربية أو الإنجليزية أو الفرنسية للنظر فيها وذلك من خلال نظام التقديم عبر الإنترنت الخاص بالمجلة الصحية لشرق المتوسط. ويمكن الاطلاع على التعليمات حول تقديم مخطوط البحث عبر نظام التقديم على الإنترنت والدخول على ذلك النظام على موقع المجلة الصحية لشرق المتوسط على الإنترنت، وهو (http://www.emro.who.int/emh/emh-journal/authors) ثم الضغط على أيقونة Editorial Manager.

٧.  سوف تُترجم ملخصات الأبحاث التي قُبلت للنشر إلى اللغات الثلاث، ومن أجل ضمان الكتابة الصحيحة لأسماء المؤلفين في سياق الملخص بالعربية، فإن على المؤلفين الذين كتبوا بحوثهم بالإنجليزية أو الفرنسية ولكن لغتهم الأم تكتب بالحروف العربية أن يكتبوا أسماءهم بالحروف العربية مع مقابلاتها باللغة الإنجليزية أو بالفرنسية.

٨.  يجب إعداد المخطوطة باستخدام برامج معالجة الكلمات (ويفضل برنامج ميكروسوفت – وورد) وأن تكتب بفواصل مضاعفة بين الأسطر وفي عمود واحد ويفضل استخدام الخط Times New Roman وأن يكون حجم الخط ١٢.

٩.  تخضع جميع الأبحاث التي تقدم للنشر لمراجعة الزملاء، وتحتفظ هيئة التحرير بحق قبول أو رفض أي ورقة استناداً إلى الملاحظات التي يبديها المراجعون، وإلى السلامة العلمية، وإلى ملاءمة البحث للمجلة. ومن المتفق عليه أن قبول الأبحاث يستند إلى مراجعتها إحصائياً وتحريرياً وفق ما تقتضيه الحاجة، ويتضمن ذلك اختصار النص وحذف بعض الجداول أو الرسوم البيانية.

١٠.  المواضيع يجب أن يكون موضوع البحث له صلة بالصحة العامة أو بأي مادة تقنية أو طبية حيوية في مجال يحظى باهتمام منظمة الصحة العالمية وله أهمية خاصة لإقليم شرق المتوسط.

١١.  ينبغي لعنوان البحث أن يكون مختصراً على قدر المستطاع، ويفضل ألا يزيد على ١٥ كلمة. وينبغي لجميع المؤلفين أن يكونوا قد أسهموا مساهمة مادية في تصميم الدراسة أو تحليلها أو كتابتها، وأن يكونوا قد وافقوا على النسخة النهائية المقدمة. ولن يسمح بأي تغيير في ما يتعلق بتأليف الورقة بعد قبولها للنشر، كما يجب أن يحظى كل تغيير على موافقة مسبقة من جميع المؤلفين المذكورة أسماؤهم. وقد يطلب من المؤلفين إثبات إسهاماتهم، كما يمكن إدراج أسماء مساهمين آخرين في عبارات الشكر، ويُرْجَى النظر في توصيات حول السلوكيات والإبلاغ والتحرير والنشر للأعمال العلمية في المجلات الطبية حول التأليف والإسهام.

١٢.  الملخصات: يجب أن تحتوي الأبحاث المقدمة على ملخص منظم على النحو التالي: معلومات أساسية، والأهداف، والطرق، والنتائج، والاستنتاجات. ومن الممكن أن يكون التنظيم مرناً إذا اقتضى البحث ذلك، وساق المؤلف تبريراً لذلك وقت تقديم البحث.

١٣.  مقالات البحوث: يجب أن تقيد الأبحاث التي تتضمن الإبلاغ عن نتائج أصلية بالتنسيق التالي: المعلومات الأساسية، والأهداف، والطرق، والنتائج، والمناقشة، والاستنتاجات. ويجب ألا تتجاوز مقالات البحوث والتقارير ٣٠٠٠ كلمة (دون أن يتضمن ذلك المراجع). ويجب ألا يتجاوز الملخص المنظم ٢٥٠ كلمة (انظر البند

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

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

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

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

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

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

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

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

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

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

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

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

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

# Directives à l'intention des auteurs

1. Les articles soumis pour publication à *La Revue de Santé de la Méditerranée orientale* ne doivent pas avoir été publiés, avoir été acceptés pour publication dans d'autres revues ou être en cours d'examen par d'autres revues. Le Bureau régional de l'Organisation mondiale de la Santé (OMS) pour la Méditerranée orientale se réserve tous les droits de reproduction et de republication des matériels qui paraissent dans *La Revue de Santé de la Méditerranée orientale.*

2. Les articles soumis pour publication à *La Revue de Santé de la Méditerranée orientale* doivent être conformes aux Recommandations pour la conduite, la présentation, la rédaction et la publication des travaux de recherche soumis à des revues médicales (http://www.icmje.org/recommendations/translations/french2015.pdf) de l'*International Committee of Medical Journal Editors* (Comité international des éditeurs de revues médicales, ICMJE).

3. **Considérations éthiques** : Le cas échéant, une déclaration devra être incluse, indiquant que le Comité d'éthique ou le Comité d'examen institutionnel de l'organisme concerné a donné son accord à l'étude. Les auteurs doivent vérifier, le cas échéant, que toutes les personnes sur lesquelles la recherche porte ont donné leur consentement volontaire et informé par écrit et que si certains participants (en vie ou décédés) n'ont pas pu le donner, un consentement de substitution a été obtenu. Il peut être demandé aux auteurs de fournir ce type de formulaire de consentement. Conflits d'intérêts : Il sera demandé aux auteurs de préciser tout conflit d'intérêts et financement. Veuillez vous reporter aux recommandations de l'ICMJE.

4. **Directives de présentation** : La Revue de Santé de la Méditerranée orientale encourage les auteurs à respecter les meilleurs protocoles de recherche disponibles et leur recommande de suivre les directives de présentation établies. Les directives de présentation sont disponibles sur le site Web du réseau EQUATOR (http://www.equator‑network.org/). Les principales directives pour la recherche en santé publique sont les suivantes : directives CONSORT (essais randomisés) ; directives STROBE (études observationnelles) ; directives PRISMA (revues systématiques et méta‑analyses) ; directives STARD (normes de présentation de rapports concernant l'exactitude de diagnostic) ; critères COREQ (recherche qualitative) ; directives CARE (publication de cas cliniques) et le manuel COCHRANE (pour les revues systématiques des interventions). Les liens vers ces sites Web et d'autres ressources utiles sont disponibles sous la rubrique « Ressources à l'intention des auteurs et des réviseurs » à l'adresse suivante : http://www.emro.who.int/fr/emh‑journal/links/.

5. Suite aux recommandations de l'OMS et de l'ICMJE, *La Revue de Santé de la Méditerranée orientale* impose comme condition de publication que les essais cliniques soient enregistrés auprès du registre public des essais cliniques. Il est recommandé aux auteurs d'enregistrer leurs essais dans un des registres des essais cliniques certifiés par l'OMS et l'ICMJE disponibles dans la base de données du Système d'enregistrement international des essais cliniques (http://www.who.int/ictrp/fr/).

6. **Soumission** : Les articles originaux rédigés en anglais, arabe ou en français peuvent être soumis pour examen en utilisant notre système en ligne. Les instructions relatives à la soumission d'un manuscrit en utilisant le système en ligne sont disponibles en anglais sur notre site Web accessibles à l'adresse suivante : http://www.emro.who.int/emh‑journal/authors/, et en cliquant sur « Editorial Manager ».

7. Les résumés des articles acceptés pour publication seront traduits dans les trois langues. Pour assurer que les noms des auteurs soient correctement écrits dans les résumés en arabe, les auteurs rédigeant en anglais ou en français mais dont la langue maternelle s'écrit en caractères arabes doivent fournir leur nom complet en écriture arabe avec une translittération de leur nom en anglais ou en français.

8. Les manuscrits doivent être préparés en format traitement de texte (Microsoft Word, de préférence), avec double interlignage, mise en page d'une seule colonne, police Times New Roman, taille de caractère 12.

9. Tous les articles dont la publication est envisagée seront revus par des pairs. Le Comité de rédaction se réserve le droit d'accepter ou de refuser tout article, sur la base des commentaires des réviseurs, de la rigueur scientifique et de la pertinence de l'article pour La Revue. Les articles sont acceptés sous réserve de la révision statistique et rédactionnelle dont ils feront l'objet, comme jugé nécessaire, ce qui peut amener à abréger le texte et à supprimer certaines données présentées sous forme de tableaux ou de graphiques.

10. **Sujets** : Le sujet de l'article doit concerner la santé publique ou un autre sujet biomédical ou technique connexe faisant partie du champ d'intérêt de l'OMS, et se rapporter plus particulièrement à la Région de la Méditerranée orientale ou revêtir une importance particulière pour celle‑ci.

11. Le titre de l'article doit être aussi concis que possible, et de préférence ne pas dépasser 15 mots. Tous les auteurs devraient avoir apporté une contribution importante à la conception, à l'analyse ou à la rédaction de l'étude et avoir approuvé la version finale soumise. Aucun changement dans les noms des auteurs ne sera autorisé après l'acceptation de l'article pour publication; avant cette acceptation, tout changement doit être accepté par l'ensemble des auteurs figurant dans la liste. Une vérification de leur contribution peut être demandée aux auteurs. Les noms d'autres contributeurs peuvent être inclus

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

12. **Résumés structurés** : Les articles soumis devraient inclure un résumé structuré organisé selon les titres suivants : Contexte ; Objectifs ; Méthodes ; Résultats ; et Conclusion. La structure peut être ajustée selon les besoins de l'article et si l'auteur fournit une justification au moment de la soumission.

13. **Articles de recherche** : Les articles présentant des résultats de recherche originale devront suivre le format suivant : Contexte ; Objectifs ; Méthodes ; Résultats ; Analyse ; Discussion et Conclusion. Le texte des articles et des rapports de recherche ne doit pas excéder 3 000 mots (références exclues). Un résumé structuré ne doit pas dépasser 250 mots (voir paragraphe 12). Le nombre maximal de références autorisées est de 35 et les identifiants d'objet numérique (DOI) doivent être inclus le cas échéant. Le texte ne doit pas comporter plus de cinq tableaux ou figures.

14. **Articles d'analyse** : il s'agit d'évaluations critiques d'études de recherche sur des sujets pertinents concernant la santé publique dans la Région. Ils doivent être composés de paragraphes traitant des objectifs, des sources, des méthodes de sélection, de la compilation et de l'interprétation des données et des conclusions. Le texte ne doit pas excéder 3000 mots (résumé, références, tableaux et figures exclus) et doit être accompagné d'un résumé de 250 mots au maximum (voir paragraphe 12). Le nombre maximal de tableaux et de figures autorisé est de 5.

15. **Rapports** : il s'agit d'articles présentant des projets pertinents de santé publique dans la Région de la Méditerranée orientale. Le format des manuscrits (longueur, références, tableaux et figures) est le même que pour les articles de recherche mais la longueur des résumés ne doit pas excéder 150 mots.

16. **Brèves communications de recherche** : Les articles ne constituant pas une étude de recherche complète, mais présentant un intérêt ou revêtant une importance particulière pour les questions de santé publique dans la Région peuvent être examinés pour publication. Le texte ne doit pas excéder 1 500 mots (références exclues) et doit être accompagné d'un résumé de 150 mots au maximum. Le nombre maximal de tableaux et de figures est de 3.

17. **Commentaires :** (par ex. les articles rendant compte de la recherche/des questions pertinentes pour la santé publique dans la Région de la Méditerranée orientale). Les spécifications des manuscrits (références, tableaux/figures) sont les mêmes que pour une brève communication de recherche, mais le texte ne doit pas excéder 1000 mots au maximun. Le résumé (non structuré) ayant pour objectif d'être soumis à proposition ne devrait pas dépasser 150 mots ; ce résumé doit refléter le contenu du premier paragraphe de la soumission.

18. **Études de cas** : Seules les études de cas inhabituels seront examinées pour publication. Le texte doit comprendre une introduction, un exposé du/des cas et une discussion. Il ne doit pas excéder 1 500 mots et le nombre de références doit être minimal. Il n'est pas nécessaire de fournir un résumé.

19. **Lettres à la rédaction** : Les lettres commentant des articles publiés sont les bienvenues. Elles seront envoyées aux auteurs de l'article afin qu'ils fournissent leurs commentaires, qui seront publiés aux côtés de la lettre. Le texte des lettres ne doit pas dépasser 500 mots.

20. **Editoriaux :** Les éditoriaux sont réalisés sur commande ; les soumissions non sollicitées ne sont généralement pas acceptées. Lorsqu'ils font l'objet d'une commande, les éditoriaux comprennent 800 mots et huit à dix références.

21. **Références** : Les citations dans le texte de travaux publiés doivent être limitées aux références essentielles récentes. Elles doivent être numérotées séparément à l'aide de chiffres arabes indiqués entre crochets, par exemple (1,5‑8). Les références doivent figurer sous forme de liste numérotée sur une page séparée après la partie « Discussion ». Elles doivent contenir les éléments suivants, selon le cas : nom(s) et initiales du ou des auteurs ; titre de l'article ou de l'ouvrage dans sa langue originale ainsi que sa traduction ; pour les articles de recherche, le nom abrégé de la revue ainsi que le numéro du volume et les pages concernées ; pour les ouvrages et autres textes, le lieu de publication (ville et pays) et le nom de la maison d'édition (commerciale ou institutionnelle) ; la date de publication et l'identifiant d'objet numérique (DOI) ; pour les textes publiées exclusivement sur Internet, l'URL exact de la page citée et la date du dernier accès. Lorsque les textes comptent moins de six auteurs, tous les auteurs doivent être nommés. Lorsque les textes comptent plus de six auteurs, seul les noms des six premiers auteurs sont mentionnés, suivis de « et al. ». Exemples du style préféré de La Revue :

Livre :
Al Hamza B, Smith A. The fifth sign of identity. Cairo, American University Press, 1990.
Article de revue :
Rehmani R, Elzubair AG, Al Maani M, Chaudary IY, Al Qarni A, Khasshogi T et al. Population‑based health survey in eastern region of Saudi Arabia. East Mediterr Health J. 2013; 19(5):417–25.
Document :
Al‑Itneen M, ed. The principles of uncertainty. Geneva, World Health Organization, 1985 (WHO/DOC/537).
Thèse :
Smith S. Use of healthcare services by the elderly with the introduction of technical innovations.

London: Drake University; 2013.

Texte Web :

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

22. Les figures et les tableaux accompagnés des légendes appropriées doivent être placés chacun sur une feuille séparée, numérotés en chiffres arabes selon leur ordre. Chaque figure et chaque tableau doivent être référencés dans le texte, et le cas échéant, les sources doivent être indiquées. Si des figures, tableaux ou d'autres matériels ont été copiés d'autres sources, les auteurs portent l'entière responsabilité d'obtenir les autorisations nécessaires. Afin d'éviter les problèmes de mise en page lors de la production finale, le nombre de tableaux et de figures doit être aussi limité que possible. Les figures doivent être fournies dans un format permettant les modifications, de préférence Microsoft Excel, et celles qui sont établies à partir de données doivent être accompagnées de ces données, sur une fiche technique Excel par exemple, pour permettre une recomposition, le cas échéant. Les photographies et illustrations doivent être envoyées dans des fichiers séparés. Les formats préférés sont JPG et TIFF, et la résolution des images doit être de 300 dpi au minimum.

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