Burden of Childhood Infectious Diseases in the Arab World

Mohamed Lemine Cheikh Brahim AHMED and Jorg Heukelbach

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Abstract

Infectious diseases are leading causes of morbidity and mortality among children under 5 years of age in the developing world, with varying degrees of burden throughout the regions. The Arab world consists of 22 countries with different levels of health financing and availability of human resources. This chapter reviews the burden of infectious diseases in the Arab world, with a focus on pneumonia and diarrheal diseases in children under 5 years of age, and is based on data published during the last 27 years.

M. L. C. B. AHMED (✉)
The Mauritanian Association for Scientific Research Development (AMDRS) and Unity of Molecular Epidemiology and Diversity of Microorganisms, Department of Biology, Faculty of Sciences and Techniques, University of Nouakchott El-Asriya, Nouakchott, Mauritania
e-mail: lemine1987@hotmail.fr

J. Heukelbach
Department of Community Health, School of Medicine,
Federal University of Ceará, Fortaleza, CE, Brazil

I. Laher (ed.), *Handbook of Healthcare in the Arab World*,
https://doi.org/10.1007/978-3-319-74365-3_115-1

Keywords
Infectious diseases · Childhood · Arab world

Introduction

Infectious diseases are the leading cause of global morbidity and mortality. This group of diseases causes approximately 15 million deaths worldwide every year (Abat et al. 2016). A large proportion of the infectious diseases are preventable and/or treatable with sample interventions, but due to weak health system infrastructures in many developing countries, the delivery of interventions to affected populations has been proven to be very difficult (Bhutta et al. 2014). In 1990, the global death toll from infectious diseases in children aged 0–59 months was 6.5 million, while in 2016, the number of deaths in children aged 0–59 months was reduced to about two million (Naghavi et al, 2017). Pneumonia, diarrhea, and malaria were classified as the top three causes of death in humans, especially in low- and middle-income countries (Bagherian et al. 2017). They account for more than 50% of all postneonatal deaths in the Arab region (Akseer et al. 2015).

Given the high morbidity and mortality caused by these diseases, the World Health Organization (WHO) recommended introducing available vaccines to reduce the disease burden. Consequently, some countries have reduced child mortality by more than half, with reductions in deaths due to pneumonia and diarrhea contributing to 40% of the overall reduction (Bhutta et al. 2013). Despite such decreases, these diseases are still the major causes of postnatal child deaths, health service attendance, and hospital admissions (Bhutta et al. 2014).

Infectious diseases in children have significant impact not only on the children but also on the families and society, and intensified and integrated efforts are needed to reduce the disease burden. This chapter describes the burden of infectious diseases in the Arab world, with focus on pneumonia and diarrheal diseases among children under 5 years of age, from 1990 to 2017.

Childhood Infectious Diseases in Arab Countries

Definition

Infectious diseases are caused by pathogenic microorganisms such as bacteria, fungi, parasites, and viruses that can be transmitted from person to person or from animals to humans, by insects or by ingesting contaminated food and water (Hofman 2016).

Geography

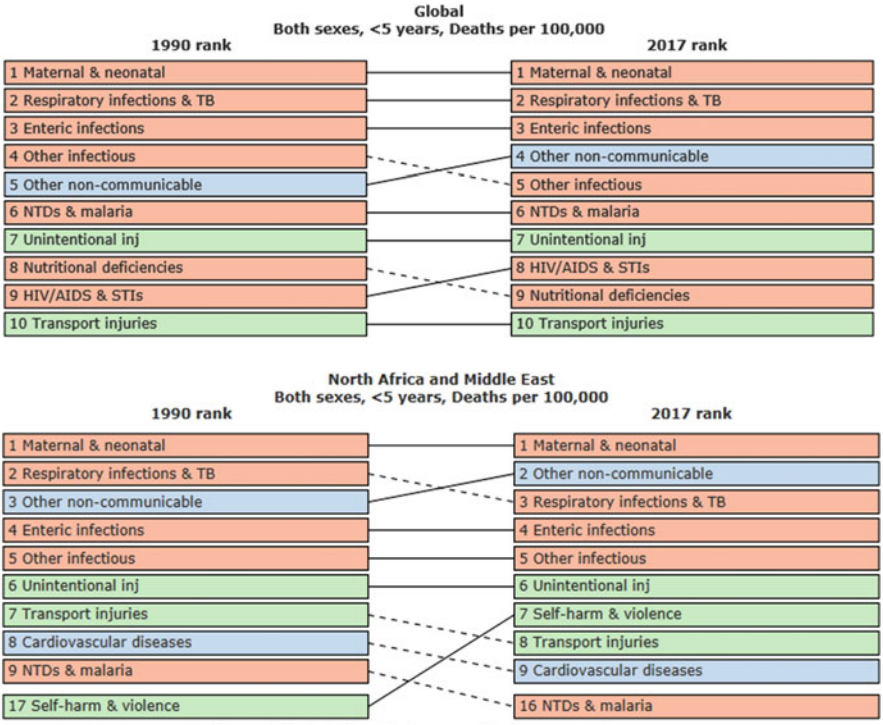
The Arab world has a unique geography, with more than 400 million inhabitants. There are 22 Arab diverse states with 3 categories according to their gross national income, namely, low-income countries (LICs; Comoros, Djibouti, Mauritania, Yemen, and Somalia), middle-income countries (MICs; Algeria, Egypt, Iraq, Jordan, Morocco, Libya, Palestine, Soudan, Syria, and Tunisia), and high-income countries (HICs; Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates) (Mokdad et al. 2014).

Political instability, inadequate health services, and outbreaks of infectious diseases are common in many Arab countries (Sweileh et al. 2015). Different types of infectious disease, such as polio, pneumonia, and diarrhea, have become a health problem for governments in the Arabic region. There were many outbreaks of infectious diseases in the past years, such as outbreaks of polio in Syria (Arie 2013) and of cholera in Iraq and Soudan (Kur et al. 2009; Khwaif et al. 2010). Several outbreaks attributed to Middle East Respiratory Syndrome (MERS), caused by a corona virus, have mainly been reported from Saudi Arabia (Memish et al. 2014; Al-Ahdal et al. 2012).

The high-income Arab countries, as compared to middle- and low-income Arab countries, have given high priority to the development of health-care services at all levels. As a consequence, the quality of services has greatly improved in recent decades in HICs (Albejaidi 2010). According to the WHO, the health-care system in the region such as Saudi Arabia (ranked 26th) and United Arab Emirates (ranked 27th) comes before many other international health-care systems such as Canada (ranked 30th) and Australia (ranked 32nd) (WHO 2000). However, a number of issues still pose challenges, such as changing patterns of diseases, availability of highly skilled human resources, and practical policies development (Almalki et al. 2011).

Major Child Killers

Three infectious diseases were ranked as the top causes of deaths worldwide in 2016: lower respiratory infections (three million deaths), diarrheal diseases (1.4 million deaths), and tuberculosis (1.3 million, Liu et al. 2016). They also constitute a major health and socioeconomic challenge in many Arab countries, especially, among children aged 0–5 years. Between 1990 and 2017, pneumonia and diarrheal diseases were always in the top 10 of causes of death in the Arab region (GBD 2017).



Source: GBD compare: https://vizhub.healthdata.org/gbd-compare/.

Childhood Pneumonia in the Arab World

Pneumonia kills more children than any other infectious disease, accounting for almost 1/5 of deaths among children worldwide (Wardlaw et al. 2006). In the Arab region, the mortality rates in hospitalized children vary between 10% and 25% (Al-Muhairi et al. 2016), while the etiological agents and their incidences vary between these countries.

Childhood Pneumonia in High-Income Arab Countries

Several studies from Arab HICs indicate that childhood pneumonia continues being an important health problem also in these subgroup countries. A cross-sectional study was carried out in the King Khalid University Hospital in Riyadh, Saudi Arabia, on a total of 1429 Saudi children under 5 years of age admitted to the hospital between 1993 and 1996 with complaints suggestive of acute respiratory infections. There were 58% of cases with bronchiolitis, and 26% had bronchopneumonia. There was a significant association between bronchiolitis and lower age group 0–6 months, and respiratory syncytial virus was the major causative agent

of bronchiolitis (Bakir et al. 1998). Another more recent study including 2266 children under 5 years of age with respiratory infections admitted to the King Abdulaziz Medical City in Riyadh, Saudi Arabia, between 2014 and 2015 showed that the most frequent respiratory infections were recorded among children aged 1–5 years with 44.7%, with rhinovirus, adenovirus, and respiratory syncytial virus (RSV) as the most common pathogens (Eifan et al. 2017). A study conducted in Najran between 2012 and 2013 showed also that the frequency of single viral pathogens detected was 56%, viral coinfection was 7%, and mixed viral and bacterial pathogen was 11% (Al-Ayed et al. 2014). A study conducted on 390 children in Kuwait found 50% of children with bronchiolitis, 37% with pneumonia, and 13% with croup; RSV was the most common viral agent (Hijazi et al. 1997). A retrospective study conducted in Qatar described that 85% of children had at least one virus, and RSV was the most common agent (Janahi et al. 2017).

Childhood Pneumonia in Middle-Income Arab Countries

Similar to Arab HICs, childhood pneumonia is an important cause of morbidity and mortality in Arab MICs. For example, a study conducted on 401 children in Algeria showed that 49% of children with viral infection and syncytial respiratory virus were very frequent among children aged 6–12 months, while the parainfluenza virus type 3 was diagnosed mostly during the second year of life (Kadi et al. 1990). A study conducted in Cairo, Egypt, found that 60% of children under 5 years of age had a viral infection and more than 10% a coinfection with two or more viruses. In fact, RSV is the most common viral etiology especially among children aged 0–6 months (Shafik et al. 2012).

Among 372 Tunisian children hospitalized in the Farhat Hached University Hospital, Sousse, Tunisia, between 2013 and 2014, viral pathogens were detected in 92%, with rhinovirus and RSV being the most frequently detected viruses (Brini et al. 2017). Among 700 children hospitalized in the Children Hospital, Rabat, Morocco, respiratory viral viruses were detected in 92%; rhinovirus, RSV, and adenovirus were the most commonly detected viruses (Jroundi et al. 2014).

Childhood Pneumonia in Low-Income Arab Countries

There are very limited data on childhood pneumonia in Arab LICs. In a survey conducted on 604 Yemeni children less than 2 years of age with acute respiratory infections, RSV was the most common agent (40%) (Al-Sonboli et al. 2005). Another study from Yemen showed that respiratory viruses, particularly RSV, were commonly associated with hospitalization for acute respiratory infection among children (Hofman 2016). In Mauritania, respiratory disease was associated with 18% of all hospitalizations and 16% of all deaths among children hospitalized in a referral hospital in Nouakchott (Ahmed et al. 2018).

Childhood Diarrhea in the Arab World

In 2015, diarrhea infections caused nearly 526,000 deaths among children under 5 years of age (Liu et al. 2016). Viral pathogens, especially rotavirus, are the leading cause of diarrhea associated hospitalizations among children under 5 of age throughout the world (Tate et al. 2016). In the Arabic region, diarrhea-associated deaths ranged from 1 per 100,000 children under 5 years of age in high-income Arab countries such as Bahrain and Oman to 471 per 100,000 in low-income Arab countries such as Somalia and Yemen (Khalil et al. 2016).

Childhood Diarrhea in High-Income Arab Countries

A study conducted in Jeddah (Saudi Arabia) between 1995 and 1996 found that rotavirus was detected in 35% of the hospitalized children and 6% of the pediatric outpatients. *Escherichia coli* was identified in 13% and Giardia in 3% of cases (El-Sheikh and El-Assouli 2001). In 2000, 25% of children had diarrheal disease in Jeddah, Saudi Arabia (Al Braiken et al. 2003). A population-based prevalence study conducted in randomly selected children suffering from acute diarrhea in Makkah, Saudi Arabia, in 2008, found that 33% had viral infection (rotavirus was the major agent with 22% followed by adenovirus with 7%), 5% were of bacterial origins (*Salmonella* species were the major cause), and 1% was found as a parasitic cause (*Giardia lamblia*) (Johargy et al. 2010). A descriptive study conducted in Najran, Saudi Arabia, showed that 22% of children had viral pathogens, and rotavirus was the major cause with 17%; 11% of children were positive for bacterial pathogens, and 1% had parasitical pathogens (AlAyed et al. 2013). A study conducted in a tertiary care hospital in Riyadh, Saudi Arabia, showed that 32% had rotavirus and the majority of rotavirus cases were among children under 2 years of age (Aly et al. 2015).

Results from surveillance of rotavirus in Oman showed that rotavirus was detected in 49% of children hospitalized for acute gastroenteritis. The majority of these cases occurred among children aged 7–17 months (Al Awaidy et al. 2009). Another study from Oman showed that a bacterial etiology was detected in 15% of children admitted for diarrhea to Ibri regional referral hospital in Dhahira, Oman, with *Shigella* sp. as the major agent pathogen (Patel et al. 2008).

A study conducted in Al Ain, United Arab Emirates, detected rotavirus in 21% of cases in all age group, with a predominance in 7–12-month-olds (Ijaz et al. 1994). Similar results were found in another study conducted in a tertiary hospital in the United Arab Emirates, in 2006 (Kurdi et al. 2007). In general, annual mortality rate due to rotavirus was less than 10 per 100,000 children in these countries (Howidi et al. 2012).

Childhood Diarrhea in Middle-Income Arab Countries

According to a cross-sectional study conducted in Fayoum, Egypt, 46% of children presenting with diarrhea had detectable enteric pathogens. Bacterial pathogens were detected in 25%, rotavirus in 21%, and cryptosporidium in 15% of cases (El-Mohamady et al. 2006).

In Irbid, Jordan, enteropathogens were detected in 66% of cases of acute diarrhea among children under 5 years of age. A single enteric pathogen was detected in 51%, rotavirus, and several types of diarrheagenic *E. coli* were the most frequently detected among children (Youssef et al. 2000). The etiology of diarrheal diseases in Libya was found in a study conducted in Zliten; rotavirus was detected in 27%, *Salmonella* in 13.6%, and cryptosporidium in 13% (Ali et al. 2005). In Soudan, viral pathogens were detected in 14%; rotavirus was the major agent followed by adenovirus (Elhag et al. 2013). In Gaza, Palestine, rotavirus was detected in 28% of cases, *Entamoeba* sp. in 15%, and *Shigella* sp. in 6% (Abu-Elamreen et al. 2008). In Morocco, the overall rates of rotavirus and norovirus infections were 26.6% and 16%, respectively. Mixed viral infections were detected in 3% (El Qazoui et al. 2014).

Childhood Diarrhea in Low-Income Arab Countries

Diarrheal diseases are the leading causes of morbidity and mortality among children in Arab LICs countries. Outbreaks occur periodically and may have devastating consequences. However, systematic data are scarce. According to UNICEF, an outbreak of diarrhea and cholera declared in Yemen in 2016 has been the worst outbreak worldwide, with more than 550,000 suspected cases and 2000 associated deaths; more than half of the suspected cases were among children aged 0–5 years. According to a recent study conducted on the etiology of diarrhea in Yemen, rotavirus was associated with 45% of diarrhea cases, and the most prevalent genotypes were G2P[4] (Al-Badani et al. 2014). In Mauritania, diarrhea was associated with 22% of all hospitalizations and 14% of all deaths among children hospitalized in a referral hospital in Nouakchott (Ahmed et al. 2018).

Infectious Diseases and Malnutrition

Over the past 27 years, the Arab world has made great progress in reducing the number of deaths from infectious diseases. Despite the progress, substantial burden of infectious diseases and nutritional causes persist in the Arab LICs.

The risk of death by infectious diseases among children aged 0–5 years is extremely increased in the case of malnutrition. Malnutrition is particularly fatal in combination with pneumonia, diarrhea, malaria, and measles. In addition, infection and micronutrient deficiencies can induce immunodeficiency in healthy children, increasing susceptibility to diarrhea and other infectious diseases. This can lead to a vicious cycle of repeated infections, reduced immunity, and deteriorating nutritional status. A malnourished child has more severe disease episodes and more complications. Diarrheal diseases associated with malnutrition are probably the commonest cause of death in young children and may also increase the risk of pneumonia by causing micronutrient loss, stress on the immune system, and dehydration.

Infectious Diseases and Health Systems in the Arab World

Health systems in most Arab countries are still oriented toward curative and episode-based care, and most investments are made in tertiary care-oriented services, rather than public health services focusing on prevention. Reorientation of this strategy is needed toward outreach, management and prevention of diseases, health education, management of comorbidity, and patient self-management. Many of the Arab countries, particularly low- and middle-income countries, need to increase universal health coverage to guarantee access to health care and improve health outcomes. In these countries, demographic and social factors have a major effect on health outcomes. Major issues in the region include mother education and prevention of early marriage and teenage pregnancies. Integrated and interdisciplinary efforts should be made to increase health education and decrease health disparities, involving community and religious leaders in health prevention and promotion.

Conclusions

Infectious diseases, such as pneumonia and diarrhea, are still the leading causes of morbidity and mortality among children in the Arab world. They account for more than 50% of all deaths among children in the region. The highest burdens of these infectious diseases are reported from LICs and MICs. Effective interventions could prevent about 2/3 of deaths. The lack of success in delivering these interventions is responsible for the high morbidity and mortality of these diseases in both low- and middle-income Arab countries. The high-income Arab countries have invested heavily in their health systems to improve the quality of health-care services and to reduce the burden of infectious diseases. Despite these efforts, they still face many challenges, including family education, human resource development, and the increased demands for health-care services. These challenges apply as well for the Arab LICs and MICs.

Especially LICs often only have a fragmented health system, with limited access of the population to health care, insufficient primary health-care services, and low awareness of the population in relation to the urgency of health conditions. For example, in Nouakchott, Mauritania, less than 44% of diseased children were presented to a health-care facility, while only 26% of households had access to safe drinking water and 70% to improved latrines (Ahmed et al. 2018).

Despite these difficulties, many countries have implemented effectively vaccine programs aiming at the reduction of fatal cases of diarrheal and respiratory diseases. Due to the high relevance of viral pathogens for pneumonia and diarrhea in the Arab region, there is in fact a need to roll out free rotavirus and PCV13 vaccine through government immunization programmers, to assure the access for children who are in the most urgent need. An integrated action involving health prevention and treatment is needed to reduce the multiple causes of infectious diseases in children, as well as the establishment of systematic surveillance systems

to monitor trends of infectious diseases burden, detect outbreaks at an early state, and evaluate the effectiveness of interventions.

Malnutrition and undernutrition are key shared risk factors for childhood morbidity and mortality associated with pneumonia and diarrheal diseases, especially in LICs and MICs. Interventions to improve childhood nutrition should be prioritized in these countries, such as Yemen, Mauritania, Soudan, Somalia, and Syria, and included systematically in health and vaccine programs.

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