

TRENDS AND CAUSES OF MORBIDITY AMONG CHILDREN IN THE CITY OF SANA'A, YEMEN 1978-2018: FINDINGS OF SINGLE CHILDREN'S HEALTH CENTER

ABSTRACT

Background and aims: Yemen has made remarkable progress in reducing child mortality over the past four decades. However, due to political instability and the foreign aggression on the country in the past ten years, the incidence of diseases and deaths escalated. The mortality rate of children under the age of 5 in Yemen is still high compared to many low and middle countries (LMIC). On the other hand, patterns and causes of child morbidity in Yemen have not been well investigated. The aim of this study was to investigate the trend of morbidity and causes of disease among children ≤ 16 years old in Sana'a city, Yemen from 1978 to 2018 based on data from a single child health center.

Subjects and methods: Data was collected from a private children Health Center in Sana'a. Data collection and analysis was performed for 4 months starting from 15/6/2020 a. The records included clinical and laboratory investigations for children who visited the out-patient clinic of the medical center. The study included 8,861 clinical diagnosed cases, 4,833 males and 4,028 females, between the ages of less than one year and 16 years. The frequency distribution of the different variables and the ratios of cases containing data on these variables were analyzed and their significance (P-value) was calculated using Chi-squared "N-1" test.

Results: Between 1978 and 2018, respiratory diseases were the most common accounting for 44.3% of the total causes, followed by gastrointestinal diseases (30.3%), and other diseases such as skin diseases, nutritional disorders, and urinary tract infections by 5.2%, 3.9% and 3.9 % respectively. In addition, CNC disease (3.1%), hematology (1.7%), and heart disease (1.33%) were rare childhood diseases.

Conclusions: Respiratory diseases and gastrointestinal diseases remain among the main causes of children's diseases in Sana'a, Yemen. These findings call for better newborn and child recovery and survival interventions that focus on the key factors that lead to childhood disease.

Keywords: Trends, causes of morbidity, children, Sana'a, Yemen.

INTRODUCTION

The world has made significant progress in reducing child morbidity and mortality over the past four decades¹⁻⁴. Several factors, such as implementing high-impact child survival interventions, strengthening the health system, improvements in maternal education and family income, commitments of policymakers and donors, and setting Millennium Development Goals (MDGs) have contributed to child reduction global death rate¹. Many countries in the world, including Yemen at the top of the list, have made insufficient or modest progress towards achieving MDG 4^{1, 4, 5}. In Yemen, the under-five mortality rate has decreased significantly over the past forty years, and the country has achieved the Millennium Development Goal (MDG) of child survival^{4,5}. However, due to the aggression of foreign countries and siege on Yemen that began 6 years ago, child mortality rate has risen to a higher level than what was reported 40 years ago, in which, a child dies every 10 minutes from malnutrition and infectious diseases. Therefore, Yemen remains higher compared to the morbidity and mortality rates in many low and middle income countries (LMIC)^{6,7}. Evidence-based assessment of child morbidity and the causes of childhood disease is known to provide a basis for planning national health strategies and tracking progress towards child survival goals⁴. However, many low- and middle-income countries, including Yemen, have fragile health management information systems and incomplete vital registration to monitor trends and risk factors for child disease and mortality⁸. Therefore, it is necessary to systematically investigate the causes of childhood illnesses to guide policy makers to intervene to keep the child alive and prevent childhood diseases. The aim of this study was to investigate the trend of child morbidity in Yemen over the past forty years using data from a private health center. The results of this study can serve as part of the criteria for tracking child survival goals during the era of the Sustainable Development Goals (SDGs) and the health sector transformation plan in Yemen.

METHODS

Settings: Yemen is a country located at the southern tip of the Arabian Peninsula in western Asia. It is the second largest sovereign Arab state on the peninsula, and occupies 527,970 square kilometers (203,850 square miles). The coastline stretches for about 2,000 km (1,200 mi).⁹ It is bordered on the north by the Kingdom of Saudi Arabia, on the west by the Red Sea, on the south by the Gulf of Aden and the Guardafui Channel, and to the east by Oman. The territory of Yemen includes more than 200 islands, including the islands of Socotra in the Guardafui Channel. Yemen belongs to the group of least developed countries¹⁰,

referring to the many “severe structural obstacles to sustainable development”.¹¹ In 2019, the United Nations reported that Yemen was the country most in need of humanitarian aid, about 24 million people out of a total of 28.5 million, or 85% of its population.¹² As of 2020, the country ranked first in the Fragile States Index,¹³ and the second worst in the Global Hunger Index, being surpassed only by the Central African Republic.¹³ Despite the significant progress Yemen has made in expanding and improving the healthcare system over the past decades, the system remains severely underdeveloped. Total spending on healthcare in 2002 was 3.7 percent of GDP.¹⁴ In the same year, per capita spending on healthcare was very low, compared to other Middle Eastern countries - \$ 58 according to UN statistics and \$ 23 according to the World Health Organization. According to the World Bank, the number of doctors in Yemen increased at a rate of more than 7 percent between 1995 and 2000, but as of 2004 there were still only three doctors for every 10,000 people. In 2003, Yemen had only 0.6 beds per 1,000 people.¹⁴ Health care services are especially scarce in rural areas. Health services cover only 25 percent of rural areas, compared to 80 percent of urban areas. Emergency services, such as the ambulance service and blood banks, are non-existent.¹⁴

Data sources

Data were collected from a private children Health Center in Sana'a (Sam Medical Center). Data was collected and analyzed in 4 months starting on 15/6/2020. The records included clinical and laboratory data of out-patient clinic visitors who were seeking treatment in the medical center. The frequency distribution of the different variables and the ratios of cases containing data on these variables were analyzed and their significance (P-value) was calculated using Chi-squared "N-1" test as recommended by Campbell¹⁵ and Richardson (2011)¹⁶ to compare proportions. The study included 8,861 clinical diagnosed cases, 4,833 males and 4,028 females, between the ages of less than one year and 16 years.

RESULTS

Eight thousand, eight hundred and sixty one children were diagnosed with health conditions. There was a significant increase in morbidity in the periods 1986-1995 where 30.1% of cases were identified, followed by 2016-2018 (25.9%) ($p < 0.001$). The results of Table 1 show that the disease rate decreased in 1996-2005 by 13.8%, then in 2006-2015 to 9.1% and then increased to 25.9% in 2016-2018 and the differences were statistically significant ($p < 0.001$) (Table 1). When age groups of the children were considered, most of diseased children were in children under 1 year of age in which counts 42% of the total, followed by age group 1-5 years in which the rate was 41.3% ($p < 0.001$). However in older children the rates were decreased to 13.2% in age group 6-10 year, more decreased to 3.3% in age group 11-15 years, and the lowest rate (0.19%) was in age group ≤ 16 Years The trend of decreasing disease with age was statistically significant ($P < 0.001$) (Table 2). When the sex of the children was taken into account, male patients were more prevalent at a significant rate equal to 54.5% compared to 45.5% of females, and this difference was statistically significant ($P < 0.001$) (Table 2). The predominant illnesses that occurred in sick children were respiratory disease (44.3%) ($p < 0.001$), followed by gastrointestinal disease (30.0%) ($p < 0.001$), while other diseases were 5.5% or less (Table 3). When looking at respiratory diseases, most respiratory infections were upper respiratory tract infections accounting for 78.7% of total respiratory infections, while LRTI accounted for only 19.9%. There was a detectable prevalence of pulmonary tuberculosis among children of 1.02% (40 cases) (Table 4).

DISCUSSION

In the current study, the predominant illnesses affecting sick children were respiratory disease (44.3%) ($p < 0.001$), followed by gastrointestinal disease (30.0%) ($p < 0.001$) (Table 3). This finding is similar to that reported in low-income countries such as Ethiopia, where respiratory infection, diarrheal diseases and neonatal syndromes remained the main causes of morbidity and mortality in children, especially under the age of five¹⁷. This high rate of disease among children in Yemen may be the result of widespread child wasting, underweight, stunting, unsafe sanitation and unsafe water supplies⁷. These risk factors were also the main risk factors for under-five child morbidity and mortality in low-income countries, but they all improved significantly during the MDG era in other countries while in Yemen these risk factors were reintroduced again in the 2016-2018 period (Table 2) because of the Saudi and Emirati aggression.

Table 1 results show that the disease rate decreased in 1996-2005 by 13.8%, then in 2006-2015 to 9.1%. This decrease may be due to child survival interventions at the community level such as immunization and community management for major diseases such as malaria, pneumonia, diarrhea and other diseases were performed through the pioneering of HEP in the period from 1978 to 2015 years, and the effect of high-impact interventions such as insecticide-treated nets (ITN) and immunizations¹⁸. The HEP includes trained and paid health extension workers who provide basic primary health care services at the community level. The HEP has improved health care practices for mothers and newborns and can contribute to reducing morbidity and mortality rates among children in Yemen¹⁸. The contribution of development partners in

support of high-impact child survival interventions such as immunization and the malaria control program can contribute significantly to reducing child morbidity in 1996-2005 (13.8%), and in 2006-2015 (9.1%). For example, malaria incidence and mortality in Yemen have decreased dramatically after the introduction of artemisinin combination therapy (ACT) and insecticide-treated bed nets (ITN)¹⁹.

Improved immunization coverage also contributed to the significant decrease in measles mortality (> 75%) over the past 40 years. Coverage of other immunizations for children in Yemen, such as the pentavalent vaccine, pneumococcal, and rotavirus vaccines, has also improved recently²⁰. Finally, the rapid social and economic development, waning of war, and political stability in Yemen from 1980 to 2009 could have had a significant impact on child survival²¹. Yemen must address the many environmental, behavioral and health bottlenecks to achieve continuous child survival goals during the SDG era. Reaching the SDG target of under-five mortality of less than 25 deaths per 1,000 will require continual improvement faster than the rate of improvement during the previous era. Doing so will require targeting behavioral risk factors such as unsafe sanitation, unsafe water supplies, and household air pollution to reduce or eliminate deaths from diarrheal disease and LRI. On the other hand, other risk factors for child mortality, such as maternal illiteracy and bad practices,²² will be addressed through behavior change communication by the higher education institution. With the reduction of infectious diseases, neonatal syndromes have emerged as the leading cause of death for children in Yemen. This could be due to low coverage (16%) of institutional connectivity and many bottlenecks in the health system such as poor quality of care and a shortage of well-trained health workforce in peripheral health facilities. Integrated neonatal interventions^{23, 24} such as neonatal care at home, higher institutional childbirth coverage, and better management of neonatal syndromes in all health facilities through trained health workers can help achieve the goal of neonatal deaths during the SDG era.

In the current study, malnutrition accounted for 3.9% of childhood diseases (Table 3), and this confirms that malnutrition as a cause of death and a risk factor for other diseases remains a major health problem in Yemen, especially in the past six years²⁵. Many factors associated with malnutrition such as food insecurity and poor infant and child feeding practices²⁶ need to be addressed through multi-sectoral approaches through community engagement and other sectors such as education and agriculture.

CONCLUSION

Respiratory diseases and gastrointestinal diseases remain among the main causes of children's diseases in Sana'a, Yemen. These findings call for better newborn and child recovery and survival interventions that focus on the key factors that lead to childhood disease.

CONFLICT OF INTEREST

"No conflict of interest associated with this work".

AUTHOR'S CONTRIBUTION

The first author presented the data and the first and second authors analyzed the data and wrote, revised and edited the paper.

REFERENCES

1. Wang H, Liddell CA, Coates MM, Mooney MD, Levitz CE, Schumacher AE, Apfel H, Iannarone M, Phillips B, Lofgren KT, *et al.* Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 2014;384(9947):957–79.
2. USAID. Child survival: call to action. Ending preventable child deaths. 2014. <http://5thbday.usaid.gov/pages/responsesub/roadmap.pdf> (Accessed 4 Nov 2020).
3. UNICEF. Committing to the child survival: A promise renewed. Progress report 2013. 2013. https://www.unicef.org/publications/index_70354.html. (Accessed on 4 Nov 2020).
4. World Health Organization. Levels and trends of child mortality. WHO; 2015. http://www.who.int/maternal_child_adolescent/documents/levels_trends_child_mortality_2015/en/ (Accessed on 4 Nov 2020).
- 5- Al-Shamahy HA, Hanash SHA, Rabbad IA, *et al.* Hepatitis B Vaccine Coverage and the Immune Response in Children under ten years old in Sana'a, Yemen. *Sultan Qaboos Univ Med J.* 2011; 11(1): 77–82.
- 6- World Health Organization, UNICEF, UNFPA The World Bank. Trends in maternal mortality 1990 to 2008, estimates developed by WHO, UNICEF, UNFPA and the world bank, WHO Press 2010, Geneva, Switzerland.

- 7-United Nations Development Programme. Human development report 2015. Work for human development. New York: United Nations; 2015.
- 8- GBD 2015 Eastern Mediterranean Region Collaborators, Mokdad AH. Danger ahead: the burden of diseases, injuries, and risk factors in the eastern Mediterranean region, 1990–2015. *Int J Public Health*. 2017;1–13.
- 9- McLaughlin, Daniel. Yemen. Bradt Travel Guides 2008. p. 3. ISBN 978-1-84162-212-5.
- 10- United Nations. LDCs at a Glance | Department of Economic and Social Affairs". Economic Analysis & Policy Division | Dept of Economic & Social Affairs | United Nations. 25 May 2008. Retrieved 4 Nov 2020.
- 11- United Nations . "Least Developed Countries (LDCs) | Department of Economic and Social Affairs". Economic Analysis & Policy Division | Dept of Economic & Social Affairs | United Nations. 23 September 2010. Retrieved 4 Nov 2020.
- 12- United Nations . "Yemen: 2019 Humanitarian Needs Overview [EN/AR]". Relief Web. United Nations Office for the Coordination of Humanitarian Affairs (OCHA). 14 February 2019. Retrieved 3 Nov 2020.
- 13- Fragile states index. "Global Data | Fragile States Index". fragilestatesindex.org. Retrieved 29 July 2020.
- 14- Library of Congress Federal Research Division. Yemen country profile. (December 2006). This article incorporates text from this source, which is in the public domain.
- 15- Campbell I. Chi-squared and Fisher-Irwin tests of two-by-two tables with small sample recommendations. *Statistics in Medicine* 2007; 26:3661-3675.
- 16- Richardson JTE. The analysis of 2 x 2 contingency tables - Yet again. *Statistics in Medicine* 2011; 30:890.
- 17- Deribew A, Tessema GA, Deribe K. Trends, causes, and risk factors of mortality among children under 5 in Ethiopia, 1990– 2013: findings from the Global Burden of Disease Study 2013. *Population Health Metrics* 2016; 14:42. DOI 10.1186/s12963-016-0112-2.
- 18- United Nations Children's Fund. Yemen situation report. 2012. Available from: <http://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20Yemen%20SitRep%20-%20April%202012.pdf> [Cited 4 Nov 2020].
- 19- Al Rukeimi AD, Al Shamahy HA, *et al.* Association of *Cytomegalo-Virus* and *Rubella Virus* Infections in Pregnant Women with bad Obstetric History. *W J Gynecol Women's Health* 2019; 2(3):1-5. DOI: 10.33552/WJGWH.2019.02.000538.
- 20- United Nations Children's Fund. Malnutrition amongst children in Yemen at an all-time high, warns UNICEF. 2016; Available from: https://www.unicef.org/media/media_93868.html [Cited 4 Nov 2020].
- 21- El Bcheraoui, C., Jumaan, A.O., Collison, M.L. *et al.* Health in Yemen: losing ground in war time. *Global Health* 2018; 14 (42):4-9. <https://doi.org/10.1186/s12992-018-0354-9>
- 22- World Health Organization. Yemen electronic disease early warning system weekly report. Geneva: World Health Organization; 2017.
- 23- Al Rukeimi AAD, Al Shaibani E M, Al Shamahy HA, Al Hadad AM, Al Tabreezi HM, *et al.* Uterine Rupture and Associated Factors During Labor Amongst Women Delivered in Saudi Hajjah Hospital in Hajjah City North West Yemen. *W J Gynecol Women's Health* 2018; 1(2):1-8. WJGWH.MS.ID.000508.
- 24- Bang AT, Bang RA, Baitule SB, Reddy MH, Deshmukh MD. Effect of home based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet*. 1999;354(9194):1955–61.
- 25- World Food Program, Food and Agriculture Organization of the United Nations, United Nations Children's Fund, Yemen Food Security and Agriculture Cluster, Yemen Ministry of Public Health. Yemen emergency food security and nutrition assessment (EFSNA) – 2016, preliminary results for public release. 2016. Available from: http://reliefweb.int/sites/reliefweb.int/files/resources/efsna_-_preliminary_results_public_final1.pdf
- 26- Getahun Z, Urga K, Genebo T, Nigatu A. Review of the status of malnutrition and trends in Ethiopia. *Ethiopian Journal of Health Development* 2001;15(2):55–74.

Table 1: The distribution of diagnosed cases of children by years.

Years range	No	%	Significant level
1976-1985	1866	21.1%	<0.001
1986-1995	2671	30.1%	<0.001
1996-2005	1224	13.8%	<0.001
*2006-2015	803	9.1%	Ref
2016-2018	2297	25.9%	<0.001
Total	8861	100	

P value was calculated uses the "N-1" Chi-squared test as recommended by Campbell [15] and Richardson [16] for comparing proportions.

Table 2: The distribution of diagnosed cases of children by gender and age

		No	%	Significant level
Age groups	< 1 Year	3721	42%	<0.001
	1-5 Years	3656	41.3%	<0.001
	6-10 Years	1173	13.2%	<0.001
	11-15 Years	294	3.3%	Ref
	≤16 Years	17	0.19%	<0.001
Gender	Male	4833	54.5%	
	Female	4028	45.5%	<0.001
Total		8861	100%	

P value was calculated uses the "N-1" Chi-squared test as recommended by Campbell [15] and Richardson [16] for comparing proportions.

Reviewer Copy

Table 3: The distribution of different diseases among children, 1976- 2018

Diseases	No	%	Significant level
Respiratory	3924	44.3%	<0.001
Gastro Intestinal	2687	30.3%	<0.001
Childhood infectious	486	5.5%	<0.001
Skin	458	5.2%	Ref
Nutritional Disorders	346	3.9%	NS
UTI	345	3.9%	NS
CNC	273	3.1%	NS
Blood	149	1.7%	NS
Heart	118	1.33%	NS
Others	75	0.46%	NS
Total	8861	100%	

P value was calculated uses the "N-1" Chi-squared test as recommended by Campbell [15] and Richardson [16] for comparing proportions.

NS= no significant P value >0.05

Table 4 : The distribution of different respiratory diseases among children in Sana'a city from 1978-2018.

Respiratory diseases	No.	Percent
URTI	3087	78.7%
LRTI	782	19.9%
Pulmonary TB	40	1.02%
Stridor	15	0.38%
Total	3924	100%