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RESEARCH ARTICLE

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

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ABSTRACT

Background and aims: Yemen has made notable progress in dropping child mortality over the past four decades. In spite of this, 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). Alternatively, patterns and causes of child morbidity in Yemen have not been well inspected. 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 June 2020 and ending on 26 August 2020. 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, central nervous system diseases (CNS) (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: Causes of morbidity, children, Sana'a, trends, Yemen.

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INTRODUCTION

The world has completed significant development in reducing child morbidity and mortality over the past four decades¹⁻⁴. Several factors, for instance applying high-impact child survival interventions, strengthening the health system, progresses 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}. Nevertheless, 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 might

remain be higher compared to the morbidity and mortality rates of many 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. On the other hand, many LMICs, including Yemen, have brittle health management information systems and deficient vital record 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 country on the peninsula, and resides in 527,970 square kilometers (203,850 square miles). The coast extends for about 2,000 km (1,200 mi).⁹ It is bounded 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, with the islands of Socotra in the Guardafui Channel. Yemen integrates to the group of least developed countries¹⁰, referring to the many “severe structural obstacles to sustainable development”¹¹. In 2019, the United Nations described Yemen as the country most in need of humanitarian aid, with around 24 million people out of a total of 28.5 million, or 85% of its population, in need of urgent aid¹². 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 Republic¹³. 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 GDP¹⁴. 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 people¹⁴. 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-existent¹⁴.

Data sources

Data were collected from private children Health Center in Sana'a (Sam Medical Center). The data was collected and analyzed in 4 months, starting on 15 June 2020 and ending on 26 August 2020, where the handwritten information (registers) was transferred and tabulated for the past forty years, as the center is considered one of the oldest private centers specialized in child care. 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 using EPI-Inf version 6 computing software. The study included 8,861 clinically diagnosed cases, of which 4,833 were males and 4,028 were females, and the ages ranged from birth to 16 years.

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

Years range	Number of cases	%	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 Campbell¹⁵ and Richardson¹⁶ for comparing proportions. *Ref= used as a reference for comparison. <0.05 = significant

RESULTS

Eight thousand eight hundred and sixty-one children were diagnosed with health diseases and disorders. There was a significant increase in morbidity rates in the periods 1986-1995 where 30.1% of cases were identified, followed by 2016-2018 (25.9%) and these rates were significant where $P < 0.001$. 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% and these high rates were statistically significant comparing to other age groups ($p < 0.001$). 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).

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

		Cases	%	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 Campbell¹⁵ and Richardson¹⁶ for comparing proportions. *Ref= used as a reference for comparison. <0.05 = significant.

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

Diseases	Cases	%	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
CNS	273	3.1	NS
Hematological disorder	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 Campbell¹⁵ and Richardson¹⁶ for comparing proportions. NS= no significant P value >0.05. CNS=Central Nervous system diseases, UTI=Urinary tract infections, NS= no significant (p <0.05)

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 diarrheal diseases, respiratory infection 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 of 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 pneumonia, malaria, diarrhea and other diseases were

performed through the pioneering of HEP (Health Equivalency Program) 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 for instance the malaria control program and immunization 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 induction of artemisinin combination therapy (ACT) and insecticide-treated bed nets (ITN)¹⁹.

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

URTI= upper respiratory tract infections, LRTI= Lower respiratory tract infections, TB= Tuberculosis

Improved immunization coverage also be a factor to the significant decrease in measles mortality (>75%) over the past 40 years. Other immunizations coverage 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 development faster than the rate of development during the previous era. Doing so require targeting behavioral risk factors such as unsafe sanitation, unsafe water supplies, and household air pollution to decrease or eradicate deaths from diarrheal disease and LRI. Alternatively, other risk factors for child mortality, such as maternal illiteracy and bad practices²² will be focused on behavior change communication by the higher education institution. With the decrease 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 restricted accesses in the health system such as poor quality of care and a shortage of well-trained health workers in tangential 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 might be remaining 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.

LIMITATION OF THE STUDY

The current study does have some limitations. Firstly, the data we used is single center data which is why the results are geographically limited. Secondly, there are no clear diagnostic criteria for the different types of diseases included in the study. However, this study used a broad source of data time and applied rigorous methodology to validate the data.

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.

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