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Incidence Rate of Infectious Diseases in Hospitalized Children

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Abstract: _Objective: The incidence of infectious diseases among hospitalized children remains high. This study describes the environmental health indicator diseases and differences between gender and age of the affected children. Patients & Methods: A review of hospitalization and death causes among children admitted to the Child Teaching Hospital for Pediatrics in Baghdad, Iraq was performed. Medical records of children admitted throughout three years period were collected for demographics data and statistical analysis using Chi-square test. Results: A total of 4,272 admissions and 309 deaths were recorded. Infectious diseases remain the primary cause of hospitalization among children and frequently lead to death; which recorded (56%) followed by acute respiratory diseases (35.5%). Conclusion: Health interventional programs such as integrated management of childhood illnesses and primary health care system as well as intensification of immunization programs would most likely lead to minimize the incidence of infectious diseases in children._

Keywords: Incidence, Infectious diseases, Hospitalized children

1. Introduction

Iraq has a young population; 45% are under the age of 15 years, and those below 5 years of age constitute 17% of the population (3.9 million); two-thirds of the population lives in urban areas [1].Over the past decade, a number of initiatives have been developed to improve the health of the global pediatric population. One such initiative is the Children's Environmental Health-Indicator Diseases of the World Health Organization (WHO), which promotes the study of five health-indicator diseases to better understand the relationship between children's health and their surrounding environments. The five health-indicator diseases provide a useful framework for studying the burden of pediatric disease in developing countries and include perinatal disease, acute respiratory illness, diarrheal disease, insect-borne infections, and physical injuries [2]. These diseases affect approximately 8.5 million children less than 15 years of age each year in developing countries.

Approximately 90% of the deaths from these diseases occur in children less than one year of age [2]. Although numerous studies of these diseases in developing countries have been conducted, only scant information exists about child-health indicator diseases in Iraq. Child mortality is a critical measure of the wellbeing of children and a good proxy indicator of the overall level of development. Several generations of Iraqi children born since the early 1980s have faced adverse conditions which affected their nutrition, health, and mortality rates negatively. Knowledge of the causes of child mortality in Iraq is necessary to draw up strategies and plans to reduce child mortality in order to reach the global millennium development goals [3].This study describes the Children's Environmental Health-Indicator Diseases and differences between gender and age of those affected among children in Child Teaching Hospital for Pediatrics.

2. Patients and Methods

Hospital records over a three years period from January 1st, 2007 through December 31st, 2009 were obtained from Central Child Teaching Hospital of Pediatrics (CCTH), one of the two main pediatric hospitals in Baghdad-Iraq. This hospital provides immediate care for children and hospitalization. The case files of all children aged one day to 15 years admitted into the pediatric ward were recorded. Surgical cases were excluded from the study. Data extracted from the patient chart included: age, gender, patients residency, principal diagnosis and cause of death. The principal diagnosis was based on the final assessment by the managing unit. It was based on presenting clinical features, with or without the results of laboratory tests. For instance, patients with pneumonia were diagnosed based on either clinically or by chest radiographs or both. Diagnosis of meningitis was based on the clinical features, with or without positive culture or abnormal biochemical analysis. The cause of death documented after weekly case-fatality review was considered as the final cause of death. Data collected was entered into a spread sheet using SPSS 15.0 for windows® statistical software which was also used for analysis. Descriptive statistics was used to analyze the obtained data. Chi-squareanalyses were conducted to examinedifferences in categoricalvariables. A Pvalueof 0.05 indicatedstatisticalsignificance.

3. Results

During the three years of reviews, 4,272 children (age range= < 1–15 years) were admitted to CCTH. A total of 3,963 survived and 309 died. Of the 3,963 survivors, 79% were (<1-4) years of age, 58% were male (Table 1).

Table 1: Age and sex distribution among hospitalized and deceased children

Characteristics	Hospitalized No. (%)	Deaths No. (%)
Total	3,963 (93%)	309 (7%)
Age (years) (<1- 4) (5-15)	3,137 (79%) 826 (21%)	269 (87%) 40 (13%)
Gender Male Female	2,303 (58%) 1,660 (42%)	150 (48%) 159 (52%)

Diagnoses in surviving children
The distribution of diagnoses in the children surviving until discharge were *Perinatal conditions:* which includes (Respiratory distress, unspecified and Congenital defects) (2%). *Acute respiratory infections (ARIs):* This includes (Bronchopneumonia and Pneumonia) (35.5%).

Diarrheal illness: This includes (Infectious, presumed viral and Non-Infectious) (1.5%). *Infectious diseases:* Which includes four major diseases (Measles, Meningitis, Whooping cough and Chicken pox (56%). Finally *Physical injuries:* This includes (Poisoning ingestion and accidents) (5%) (Table 2).

Table 2: Detailed cause of discharge diagnosis in 3,963 survived patients and 309 deaths at Child Teaching Hospital, 2006-2009.

Indicator No	Causes	Discharge No. (%)	Cause of deaths	Deaths No. (%)
1	**Perinatal condition** Total diagnosis† Respiratory distress Cardiac defects	79 (2%) 39 (49%) 40 (51%)	Total deaths‡ Aspiration Asphyxia	14 (4%) 3 (21%) 11 (79%)
2	**Acute respiratory infection** Total diagnosis Bronchopneumonia Pneumonia	1412 (35.5%) 34 (2%) 1378 (98%)	Total deaths Respiratory failure Pneumonia	194 (63%) 6 (3%) 188 (97%)
3	**Diarrheal illness** Total diagnosis Infectious, presumed viral Non-infectious	57 (1.5%) 36 (63%) 21 (37%)	Total deaths	0
4	**Infectious diseases** Total diagnosis Measles Meningitis Whooping cough Chicken pox Others	2238 (56%) 1041 (47%) 353 (15%) 297 (13%) 268 (12%) 279 (13%)	Total deaths Measles Meningitis Whooping cough Others	98 (32%) 26 (26%) 32 (33%) 7 (7%) 33 (34%)
5	**Physical injuries** Total diagnosis Poisoning Accidents	177 (5%) 134 (76%) 43 (24%)	Total deaths Poison ingestion	3 (1%) 3 (100%)

†For the total diagnosis or deaths, the percentage of each indicator category represents the proportion of their respective totals during the 3 years.
‡For specific discharge or cause of deaths, the percentage represents the proportion of discharges or deaths for the specified disease.

Causes of deaths in children who died:

During the period of review, 309 children died; 87% were 0–4 years of age and 48% were male as shown in (Table 1). The distribution of diagnosis in the childrenwho died was perinatal conditions (4%), ARIs (63%), infectious diseases, (32%) and physical injuries(1%) (Table 2).

Perinatal diseases: Among the 79 children with perinatal diseases who survived, **68%**[*] were male (Table 3). The most common diagnoses were respiratory distress (49%) and Cardiac defects (51%) (Table 3). Younger males weren more likely to be effected (P= 0.001). Among the 14 children who died, **71%**[*] weremale (Table 3). The most common diagnoses were aspiration (21%), and asphyxia (79%) (Table 2).

Acute respiratory tract: Among the 1412 survivors, **95%**[**] were 0–4 years of age (Table 3). The most common diagnoses were bronchopneumonia (not bronchiolitis) (2%) and pneumonia (98%) (Table 2). Young males were more likely to be affected than female (P = 0.000) (Table 3). Of the 194 children who died, **67%**[**] were 0–4 years of age (Table 3). The most common causes of death were pneumonia (97%) and respiratory failure (3%) (Table2). Younger children were more likely to have died (P <0.0001) without a predilection toward either sex (Table 3).

Diarrheal diseases: Among the 57 survivors, **44%**[**] were 0–4 years of age (Table 3). Infectiousdiseases, presumed viral were the most common causes (63%) and non-infectious causes (37%) (Table 2), and younger maleswere affected more than females. There was nosignificant difference in sexes of children who survived ordied (*P* = 0.860) (Table 3).

Infectious diseases: Among the 2238 survivors, **77%**[**] were 0–4 years of age (Table 3). Themost common etiologies were measles (47%), meningitis (viral and bacterial)(15%), whoopingcough (13%)and chickenpox (12%) (Table 2). Among the 98 children who died, **79%**[**] were 0–4 years ofage (Table 3). The most common causes of death were

measles (26%), meningitis(33%) and whoopingcough (7%) (Table 2).Younger children were more likely to have effected and died than older children (P=0.000) (Table 3).

Physical injuries:There were 177 children who were admitted and survived theirinjuries, **32%**[**] of whom were 0–4 years of age (Table 3). The mostcommon etiologies were poisonings (76%) and physical accident (24%) (Table 2). The most common agents involved in poisoningswere unspecified, medicationsand foodpoisoning. Three children died from physical injuries; all of them were0–4 years of age (Table 3).

4. Discussions

Little is known from conventional sources about the epidemiology and causes deaths in children younger than 5 years of age in Iraq. The Civil Registration System, though extensive, records very incomplete information about births and deaths, especially in rural areas. In this study we try to review the diseases and deaths causes in children admitted in CCTH during three years period.

In this study of the total 4,272 admitted patients, there were 57% males and 43% females; 79% were (<1-4) years of age. There was male preponderance and the majority of children death occurred in age group less than one year which reveals the vulnerability of this age to communicable disease. The current study findings are in agreement with a study by George *et al*., (2009), in which in his study reveals that most causes of death occurred in children aged (2 months -2 years) with male preponderance in Nigerian children [4].The distribution of diagnoses in the children surviving until discharge was perinatal conditions (2.0%), acute respiratory infections (35.5%), diarrheal illness (1.5%), infectious diseases (56%), and physical injuries (5.0%). The findings of this study are disagreement with a study conduct in West Jamaica by McCarthy and Evans-Gilbert (2009). The perinatal conditions recorded (7.0%), acute respiratoryinfections (22%), diarrheal illness (10%), infectiousdiseases (15.7%), and physical injuries (2.5%) [5].

In this study the ***perinatal diseases*** were 2%, the current results are in agreement with a study by Awqati*et al*., (2009) [6]; which in her study, the perinatal conditions was 3.2%. This lower percentage can be explained as most of cases were due to cardiac defects which they may be due to either prematurity or genetic factors.

Regarding the ***ARIs*** and infectious diseases: after 1990, there was increased incidence of communicable diseases like respiratory infections and infectious diseases like (measles, mumps, diarrhea, typhoid fever and Leishmaniasis); and the immunization programs were hindered. Pneumonia was one of the most infectious diseases that were reported in Iraq during 2006 (94,994 cases) followed by chicken pox (29,907 cases) and typhoid fever (26,301 cases). The incidence rate of Tuberculosis per 100000 increased from 2% in 2000 to 12.4% in 2006. The incidence rate of Whooping cough was 2.6% and for Measles 0.4, and Mumps 1.38. The number of cases of viral hepatitis was 15,462 according to Ministry of Health statistical reports [7]. In this study the ARIsrecorded 35.5% and the infectious diseases were 56%, these high

percentages are in agreement with above mention results, which require to be aware of the dangerous burdens of ARI which need to monitor the vaccination programs and make sure of the health comprehension of the child mother or the child caretaker about the infectious disease and how to manage them. Researches and experience show that 6 million of the almost 11 million children who die each year which could be saved by low-tech, evidence-based, cost-effective measures such as vaccines, antibiotics, micronutrient supplementation, insecticide-treated bed nets and improved family care and breastfeeding practices [8]**.**

In present study the ***diarrheal illness*** recorded 1.5%; in 1980 diarrheal diseases were among the major killers of under-five children and due to the great achievements of the Control of Diarrheal Diseases programs, a remarkable decline of deaths from diarrhea has been achieved. This success can be attributed to consistent promotion of the standard case management in health facilities, local production and wide use of oral irrigation solution (ORS) and increased awareness among families of how to correctly manage cases at home, with special emphasis on continuing feeding of children during illness. Social marketing of ORS and through community-based interventions has been an important tool of reducing mortality caused by diarrhea [8].

In this study the physical injuries was 5%, our findings are disagree with the findings by McCarthy and Evans-Gilbert (2009) [5]; which in his study the physical injuries was 2.5% since they include only the poisons ingestion like (kerosene and petroleum), as well as disagree with a study by Awqati*et al*.;(2009) [6]; which in her study the, physical injuries recorded 3.3%. This relatively high percentage of food poisoning related to the many exported food products from unreliable origins to the local markets, they are mainly sold in cheap prices and stored in a bad conditions leading to their spoilage.

In this study the four major causes of deaths in children aged less than five years were: Pneumonia, meningitis (bacterial and viral), and measles. The current results are in agreement with a study by Trotman *et al*., (2007)[9], he found that respiratory distress syndrome is the primary cause of admission in hospital of Kingston, Jamaica and only 52% of those ventilated survive but this study disagree with World Health Organization (WHO) Eastern Mediterranean Region (EMRO) estimates of causes of death among children indicate that neonatal deaths constitute 43% among under-five children deaths, followed by pneumonia (21%) and diarrhea (17%) [10].

Regarding meningitis (bacterial and viral), our findings are in agreement with WHO annual report of communicable disease in Iraq (2006), they reported 28% of children under five years old deaths caused by meningitis [11]. Finally measles; our results agree with a study conducted in Bangladesh by Baqui*et al.,* (1998) in which few deaths were identified as due to measles alone (0.7%) [12]. However, the recent study by Awqati*et al.,* (2009) [6] found that measles responsible for 4% of deaths in children aged under five years and she do believe that most mothers/care takers in Iraq are able to diagnose the full-blown picture of measles; it is possible that some mothers may have missed

cases of measles; however this finding could reflect a success story of the National Extended Program of Immunization in Iraq.

5. Conclusions

The Millennium Development Goal for child survival (MDG-4) to reduce childhood mortality between 1990 and 2015 will not be met without substantial reductions of communicable diseases and to follow the strategies in neighboring Iran; in which declining trends in under-five mortality have been accompanied by changes in the underlying causes of death structure; the main cause of child mortality and morbidity has shifted from communicable diseases to injuries as well as the newborn and infant mortality rates have also been continuously decreasing in the past decade because of increased access to primary health care and educational services.

Determining the leading causes of death as accurately as possible and also determining the age groups at greatest risk of death are fundamental steps in making a community diagnosis that is, of determining the most frequent, serious, readily treatable or preventable conditions within the community, and there after planning an effective program to improve child survival. Further intensification of immunization programs is essential to reduce child mortality from measles.

6. Acknowledgments

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Table 3: Total discharges and deaths in children hospitalized at Child TeachingHospital, 2006-2009.

Indicator No	Causes	Discharge No. (%),Chi-squarevalue; P value	Deaths No. (%),Chi-squarevalue; P value
1	**Perinatal diseases** Male vs. Female	54 **(68%)*** vs. 25 (32%),χ^2=10.646; *P*= 0.001	10 **(71%)*** vs. 4 (29%), χ^2=2.571; *P*=0.109
2	**Acute Respiratory Infection** Ages<1-4 years (Male/Female) Ages 5-15 years (Male/Female) Inter-age group (<1-4years/5-15years)	840 **(63%)** vs. 499 (37%),χ^2=86.842; *P=0.00* 44 (60%) vs. 29 (40%), χ^2=3.802; *P=0.079* 1339 **(95%)*** vs. 73 (5%), χ^2=1135.096; *P=0.000*	96 **(67%)*** vs. 48 (33%), χ^2=16.400;*P*=0.0001 35 (70%) vs. 15 (30%), χ^2=8.000; *P*=0.005 144 **(74%)** vs. 50 (26%), χ^2=45.546; *P*= 0.00
3	**Diarrheal diseases** Ages<1-4 years (Male/Female) Ages 5-15 years (Male/Female) Inter-age group (<1-4years/5-15years)	16 **(64%)** vs. 9 (36%), χ^2=1.960; *P*=0.162 18 (56%) vs. 14 (44%), χ^2=0.500; *P*=0.480 25 **(44%)*** vs. 32 (56%),χ^2=0.860; *P*=0.354	0
4	**Infectious diseases** Ages<1-4 years (Male/Female) Ages 5-15 years (Male/Female) Inter-age group (<1-4years/5-15years)	944 **(55%)** vs. 782 (45%), χ^2=15.205; *P*=0.000 285 (56%) vs. 227 (44%), χ^2=6.570; *P*=0.010 1726 **(77%)*** vs. 512 (23%), χ^2=658.533; *P*=0.000	45 **(58%)** vs. 32 (42%), χ^2=2.195; *P*=0.138 16 (76%) vs. 5 (24%), χ^2=5.762; *P*=0.01 77 **(79%)*** vs. 21 (21%), χ^2=32.000; *P*=0.000
5	**Physical injuries** Ages<1-4 years (Male/Female) Ages 5-15 years (Male/Female) Inter-age group (<1-4years/5-15years)	35 **(62.5%)** vs. 21 (37.5%), χ^2=3.500;*P*=0.061 63 (63)vs. 58 (48%), χ^2=0.207;*P*=0649 56 **(32%)*** vs. 121 (68%), χ^2=23.870; *P*=0.000	0 2 (67%) vs. 1 (33%), χ^2=0.333; *P*=0.564 3 **(100%)** vs. 0