

Epidemiology of acute diarrheal diseases among children under 5 years of age in Tehran, Iran

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ABSTRACT

Background: Acute diarrhea is the fifth leading cause of death due to infectious diseases and responsible for 16.2% of the infectious disease burden in Iran. This study assessed the incidence and some determinants of acute diarrheal diseases in Tehran, the capital of Iran.

Patients and methods: Using cluster sampling, a population based survey was conducted among 2095 children aged 6 to 60 months in the southern districts of Tehran during May 2005. The incidence of acute diarrhea during the past 2 weeks, the duration and frequency of diarrhea, acute diarrhea in siblings and socioeconomic determinants were gathered by a questionnaire.

Results: Totally, 10.3% of children experienced new onset of diarrhea during the past two weeks with the average number of episodes of 2.8 per child. Half of the cases were 6-18 months of age ($p < 0.001$). The mean (\pm standard deviation) duration of disease was 4.5 ± 2.1 days and the frequency of diarrhea was 5.1 ± 5 episodes per day. In 9.1% of the families, other cases of concurrent acute diarrhea were reported in siblings (OR=1.29, 95%CI:0.67-2.47). The mean age of the mothers was 31 ± 7.5 years. Less than 4% of the parents were illiterate.

Conclusion: Childhood acute diarrhea remains a public health concern in Tehran. Improving the environmental sanitation and personal hygiene and raising the socioeconomic status of the population will contribute to the elimination of the underlying causes of acute diarrhea.

Keywords: Acute diarrhea, Epidemiology, Children, Iran.

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INTRODUCTION

Worldwide, 1.5 billion cases of diarrhea occur each year, accountable for 1.5-2.5 million deaths yearly (1), more than %20 of all mortalities (2). Acute diarrhea is still a leading cause of illness and death among children under 5 years of age in developing countries (3). In Iran it has been estimated that diarrhea is responsible for 18 million

cases of illness (4,5), 12 million medical visits, 1 million hospital admissions (6,7), and 516 deaths in children younger than 5 years of age (8). Acute diarrhea is the fifth leading cause of death due to infectious diseases (1) and responsible for 16.2% of infectious diseases burden in Iran (9).

Tehran with a population of approximately 7 million and an area of roughly seventy thousand hectares is located in a region geologically known as Alluvial and bounded by the Alborz mountain range in the north and Varamin valley in the south.

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In Tehran, sewage disposal is conducted by absorption wells, city brooks, natural ravines, septic tanks and local sewerage network and treatment plants. The high rate of population growth during recent years, increased residential and industrial sewerage, and increment in the underground water level and the sewage water especially in the southern districts of Tehran have augmented contamination and evoked bio-environmental crises, for which numerous infectious diseases are expected (10). One study revealed that the incidence of acute diarrhea in Tehran was not only higher when compared with the whole country but also more than other urban areas of the country (11).

Despite the widespread use of oral rehydration therapy, the incidence of acute diarrheal diseases has not declined, although these efforts tend to decrease severity of acute diarrheal episodes and sharply reduce the number of subsequent deaths; this indicates that the causative agents of acute diarrhea and their environmental sources are still with us. On average, children under 5 years of age suffer 3 episodes of acute diarrhea per year (12).

Many cases of acute diarrhea may be treated at home or may recover without any treatment. On the other hand, the reporting system in health facilities is likely to be incomplete, so the incidence reported based on these data could be underestimated.

The aim of the present study was to conduct a household survey to assess the disease and measure the magnitude of the problem by collecting current and reliable information on the incidence and some determinants of acute diarrheal diseases among children aged 6 to 60 months in the southern districts of Tehran, the capital of Iran.

PATIENTS and METHODS

For this cross-sectional study, 2095 children aged 6 to 60 months residing in four southern districts of Tehran with a total approximate

population of 1.1 million were surveyed. The sample size was pessimistically calculated based on estimates of the acute diarrhea incidence (18%) during the past two weeks (13,14) and type I error of 5%, smallest significant difference of 2% and design effect of 0.4. Sampling was conducted in two stages, random and cluster sampling. In the first stage, head clusters were selected randomly. To achieve true randomization, 100 clusters were selected in the chosen districts based on their postal code. Hence, the whole population had an equal chance to enter the study since each residential unit is attributed to only one postal code. During the second stage, in selected clusters, the first house of each cluster was considered as the first sample and sampling was continued to reach the proper sample size in each cluster, 20 children aged 6-60 months.

Data were collected by interviewing mothers and prepared questionnaires were completed by trained female medical students. Parents' age, literacy level and occupation, number of children aged 6 to 60 months and their age and gender, the acute diarrhea incidence during the past two weeks, number of acute diarrheal defecations per day, duration of acute diarrhea and coverage of insurance services were asked. Finally, the incidence rate of acute diarrheal diseases during the past two weeks was calculated among children aged 6 to 60 months and its association with sociodemographic, environmental and domestic factors was evaluated.

In this study, acute diarrhea was defined as the passage of loose or watery stools at least 3 times a day, lasting less than 14 days (15).

Data were analyzed using SPSS software (version 11.5, SPSS Inc., USA) and chi square and t-test were used, when appropriate.

RESULTS

The study population included 1033 (49.3%) boys and 1062 (50.7%) girls with the mean age of 31.0 ± 15.5 months (table 1).

Table 1. Distribution of children based on sex and age

Sex	Age groups (months)					Total
	6-12	13-24	25-36	37-48	49-60	
Male	157	208	201	242	254	1062
(%)	(7.5)	(9.9)	(9.6)	(11.6)	(12.1)	(50.7)
Female	161	226	196	191	259	1033
(%)	(7.7)	(10.8)	(9.4)	(9.1)	(12.4)	(49.3)
Total	318	434	397	433	513	2095
(%)	(15.2)	(20.7)	(18.9)	(20.7)	(24.5)	(100)

Totally, 10.3% of children suffered from new onset of acute diarrhea during the past 2 weeks. The incidence of acute diarrheal diseases and its variation according to sex and age are presented in table 2.

Table 2. Incidence of acute diarrheal diseases and its variation according to sex and age

Sex	Age groups (months)					Total
	6-12	13-24	25-36	37-48	49-60	
Male	28	33	18	17	14	110
(%)	(17.8)	(15.9)	(9.0)	(7.0)	(5.5)	(10.4)
Female	37	34	17	11	7	106
(%)	(23.0)	(15.0)	(8.7)	(5.8)	(2.7)	(10.3)
Total	65	67	35	28	21	216
(%)	(20.4)	(15.4)	(8.8)	(6.5)	(4.1)	(10.3)

The average number of yearly episodes of acute diarrheal disease was calculated 2.8 episodes per child.

The incidence rate of acute diarrhea decreased significantly with age ($p < 0.001$). The rate was highest (30.1%) in children aged 6-12 months. More than half of the cases were in the first two age groups, aged 6-24 months. The incidence rate was lowest among children aged 49-60 months.

Nearly half of the children with diarrheal diseases were girls, however, sex was not significantly associated with the incidence rate of acute diarrhea. Nevertheless, age group specific rates were significantly differed between boys and girls ($p < 0.001$).

The mean duration of acute diarrhea was 4.5 ± 2.1 days and the average number of defecations per day was 5.1 ± 5.0 . Totally, 9.1% of families reported one or two more concurrent cases

of acute diarrhea in children under 5 years old. The odd's ratio for second child acute diarrhea was 1.29 (0.67- 2.47).

The mean age of mothers was 31.0 ± 7.5 years (a range, 16-57 years old). Only 1.3% of mothers were under 20, however, more than 50% aged 20-30 years. Most of the fathers aged 20-40 years. There was no significant correlation between the parents' age and acute diarrheal diseases (NS). Maternal educational level was as follow: more than 39% had high school diploma or higher, 37% had secondary level education (guidance school), 19% had primary school and 4.7% were illiterate (NS). Totally, 94% of the mothers were householder, however, 23% of the fathers were employed by the government, 17% were workers, 3% were unemployed and 53% were working in the private sector. Similarly, there was no significant correlation between the parents' occupation and acute diarrheal diseases. Ninety eight percent of mothers were living with their husbands, while only 2% were living alone because of their husband's death or divorce. The maternal marital status was not significantly correlated with acute diarrheal diseases.

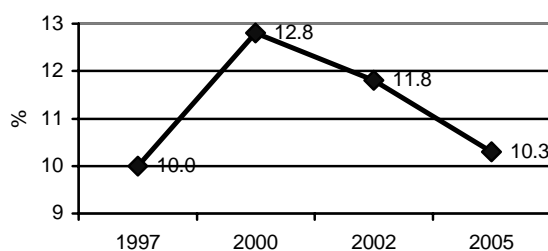
Only 16.3% of children who lacked sewage system coverage were affected by acute diarrheal diseases, on the other hand, 10.4% of the cases had sewage coverage. Sewage coverage had no significant correlation with the incidence of acute diarrhea (NS). Sixty nine percent of the children were covered by at least one insurance company. Nearly, half of the families were home-owners. There was no significant correlation between acute diarrhea incidence and insurance coverage or home ownership (NS).

DISCUSSION

Our results revealed that the incidence of acute diarrheal disease among children aged 6-60 months in southern districts of Tehran was 10.3% and each child had about three episodes of diarrhea each

year. The World Health Organization started the Acute Diarrheal Disease Control Program (DDCP) in 1980 in order to decrease acute diarrheal mortality and morbidity among young children in developing countries. Acute respiratory infections and acute diarrheal diseases are among the major causes of morbidity and mortality among children under 5 years of age. Kosek et al in their report of the global burden of acute diarrheal diseases found that despite improving trends in mortality rates, there was no concurrent decrease in morbidity rates attributed to acute diarrhea (10). In Iran, the trend of acute diarrheal diseases shows that the incidence of acute diarrheal diseases has not decreased during the recent decade. Although there was a little variation in the acute diarrheal diseases incidence in different years, the mortality rate has decreased dramatically during this period, and now acute diarrhea is the fifth leading cause of death among infectious diseases. The acute diarrhea incidence in Tehran has been reported between 10-12.8% during the past 10 years (11-14). The trend of acute diarrheal diseases in Tehran during 1997-2006 is shown in figure 1.

Figurer 1. The trend of acute diarrheal diseases in Tehran between 1997 and 2006.



Three episodes of diarrhea per child each year is in accordance with the previous report of the Ministry of Health and Medical Education in corporation with UNICEF (16).

Persistent high rates of morbidity of acute diarrheal diseases are of concern because early childhood acute diarrhea may have long-term

effects on linear growth and physical and cognitive function (15-17).

The odds ratio for second child acute diarrhea was 1.29 (0.67- 2.47), so recent acute diarrhea in children under 5 years of age is not considered as a risk for other children in the family.

The National Acute Diarrheal Disease Control Program (NDDCP) began its activity in Iran after the reform in the health sector and the establishment of the Ministry of Health and Medical Education. The program coverage in rural areas was satisfactory, however, in urban areas service providing was passive and especially in suburban areas the coverage was rather unsatisfactory.

In the Eastern Mediterranean Region (EMRO), Iran has a relatively favorable condition in terms of controlling acute diarrheal diseases in comparison with other countries. Acute diarrheal diseases remain the leading cause of morbidity among infants and young children in Egypt, where, the incidence of acute diarrheal diseases in the previous 2 weeks in children under 5 years old was reported to be 14.3-23.6% in 1994-2005 (7,18).

Differences in the estimated incidences of acute diarrheal diseases in children under 5 years old might be due to differences in recall abilities of mothers, differences in mothers' perceptions of acute diarrhea, and differences in methodology and times at which the studies were carried out.

In Jordan, maternal age, but not father's age, was significantly correlated with acute diarrhea morbidity. Acute diarrhea was more likely to occur among children of younger mothers, less than 25 years, perhaps because of their inexperience with childcare. Father's age may have been less important because they were less likely to be involved in childcare (7).

El-Gilany found that childhood acute diarrhea morbidity decreased significantly with higher educational levels of the parents in Egypt. Meanwhile, education was reflected in child bearing and child health care practices during

illness. Educated parents married later, delayed the onset of childbearing and had fewer children than less educated parents.

Similar associations have been previously reported from Egypt and Zaire, although this was not true for Saudi Arabia or Nigeria. Acute diarrhea morbidity was significantly lower among children of mothers who worked outside the home and professional or semi-professional fathers. Nevertheless, controversies exist between different studies (7,19-22). In our study, there was no association between education, parents' age and their occupation with acute diarrheal diseases incidence.

Apart from the first 6 months of life when maternally acquired immunity and breastfeeding without supplementation played a protective role, acute diarrhea morbidity decreased significantly with the child's age. The incidence of acute diarrhea was highest at children aged 6–24 months and declined thereafter. This finding is in accordance with El-Gilany's report and might be the result of the decline in maternally acquired antibodies and the introduction of weaning foods that are potentially contaminated. In addition, crawling usually begins at this age and the risk of ingesting contaminated materials is high, especially in unhygienic environments (7). This difference was confirmed when the acute diarrhea incidence was adjusted based on sex distribution in age groups. By this way, the difference in distribution of samples in defined age groups was omitted and certainty of the results was increased.

Sex difference was not associated with the incidence of acute diarrhea. Boys and girls were probably equally exposed, as the risk factors associated with acute diarrhea are environmental and sociodemographic, rather than biological (7,16,19,22). Availability of a sewage system does not necessarily mean a low incidence in acute diarrheal diseases. The causes of acute diarrheal diseases are multifactorial. Contact with human excreta can be primary, when defecating, or

secondary due to contact with released sewage in children's playing sites and passages. Undoubtedly, individual sanitation and the supervision role of the parents are the most powerful tools in controlling primary or secondary contact with sewage, however, children confrontation with released sewage material seems to be uncontrollable in the studied districts. Therefore, the authorities should pay further attention to environmental conditions and sewage system.

Alteration in social, economical and cultural conditions requires time and money. Therefore, childhood acute diarrheal diseases remain a public health concern in Tehran and all over the eastern Mediterranean region for the next coming years. Improvement of environmental sanitation and domestic hygiene and raising the socioeconomic status of the population will contribute to the elimination of the underlying causes of acute diarrhea.

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