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Original Article

Risk Factors of Acute Respiratory Infections in Children in Tripoli, Libya

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Abstract

Introduction: Acute respiratory infections (ARIs) are the most frequent infections of childhood. They continue to be the most common leading cause of acute illnesses and account for many hospital admissions worldwide. **Objectives:** We determined the ARIs among children admitted to the Pediatric Department at Tripoli University Hospital over a period of 3 months. **Patients and Methods:** In this cross-sectional study on risk factors of ARIs among children <5 years old, diagnosis was based on clinical features according to WHO guideline criteria. A pro forma was used to collect information from the child's mother, including sociodemographic factors, clinical profile, perinatal history, family history of atopy or other associated medical problems, nutritional factors, environmental factors, and type of respiratory tract infection. **Results:** A total of 200 children with different respiratory illnesses admitted to the Pediatric Department were included. In this study, severe pneumonia was the most common illness; the age of the admitted cases ranged from 21 days to 4.5 years; 56.5% were boys and urban residents account for 76% from the total. Nearly 53% of the cases were from families with low income, and 3.5% of the participated children in this study had missed doses of the immunization schedule. In 88% of the cases, cough was the main presenting symptom followed by shortness of breath in 83.5%. Almost 58.5% of the children had a positive family history of atopy, and only 8% of cases were exclusively breastfed for their first 6 months of age. **Conclusions:** Lower respiratory infections are more prevalent among children under the age of 5. Younger age, male gender, urban residence, positive family history of atopy, lack of breastfeeding, and indoor air smoke were the common risk factors for ARIs.

Keywords: Acute respiratory infections, children, Libya, lower respiratory infections, Tripoli, upper respiratory infections

Introduction

Acute respiratory infections (ARIs) are the most frequent infections in childhood worldwide. They continue to be the leading cause of acute illnesses

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and account for many hospital admissions.[1,2] The incidence of ARI in children below 5 years of age is estimated as 0.29 and 0.05 episodes per child per year in developing and industrialized countries, respectively. These values translate into 151 million and 5 million new episodes each year, respectively.[3] Globally, ARI is responsible for about 2 million deaths each year,[2] representing 20% of all deaths of children aged <5 years.[4] Pneumonia is responsible for about 21% of all deaths in children aged <5.[5] The very young, and the immunocompromised children, are the most at risk of fatal respiratory disease.[6]

ARIs comprise upper respiratory infections (URIs) and lower respiratory infections (LRIs).[7] URI involves airways from the nostril to the vocal cords, including the paranasal sinuses and middle ear. They are very common, although rarely fatal, and are a source of considerable morbidity; especially in young children, they are the most frequent respiratory complaint which accounts for about 9% of all consultations in primary care.[8] LRI affects the airway from the trachea, bronchi, bronchioles and alveoli.[9] Worldwide, LRI represents a significant cause of morbidity among children,[10] and is a common cause of mortality in developing countries. It accounts for 5% of all respiratory infections; pneumonia and bronchiolitis are the most common LRIs in children.[11]

For health-care providers, the proportion of ARI in under 5 children is considered a critical indicator for intervention coverage and care provision. It enables monitoring the progress toward child survival-related millennium development goals and strategies.[12] There is limited information on the frequency and risk factors of ARIs in Libya. We have, therefore, conducted this cross-sectional study to document the burden of ACI in Tripoli and ascertain its risk factors.

Patients and Methods

Objectives

We aimed (a) to determine the type of ARIs among children below 5 years of age who were admitted to the Department of Pediatrics, Tripoli University Hospital (TUH) and (b) to ascertain the most common risk factors of ARIs related to age, gender, nationality, residence, birth characteristic, breastfeeding, socioeconomic factors, associated medical conditions, and exposure to a person with respiratory symptoms within 1 week before illness.

Patient selection

The study included children <5 years of age who presented to the Pediatric Department of TUH, with clinical features suggestive of ARIs, for example, fever, cough, sore throat, runny nose, and signs of respiratory distress, including an increase in breathing rate and chest indrawing. The patients underwent a clinical diagnosis of URIs or LRIs as per the WHO guideline criteria.[13]

Methods

This was a cross-sectional study. An interview questionnaire was used to collect information from the child's mother. It was divided into three parts: Part A included general information about the child, including age, gender, nationality, residence, and presenting complaints. Part B covered the prenatal, natal, and postnatal history of the child, including a history of any disease or complications during pregnancy, gestational age (preterm, term, and postdate), mode of delivery, birth weight, history of resuscitation, or admission to the neonatal unit. It also captured feeding history that whether the child breastfed or not, duration of breastfeeding and age at weaning, vaccination (up to date, missed, and not vaccinated), development (healthy or delayed), and any associated medical condition (such as congenital heart diseases, asthma, gastroesophageal reflux, and gastroenteritis). Finally, Part 3 comprised information about social history, including consanguinity, family history of asthma or atopy, history of genetic diseases in the family, educational level of parents, occupation of parents, family income, type of family, size of family, whether the child lives with both parents, single parent, foster care, the main form of child care (mother, nursemaid, and nursery), the smoking habit of parent, and information about housing condition, including ventilation, exposure to dampness or mold, presence of air conditioner system, number of rooms, number of persons per room, and a history of exposure to a person with respiratory

symptoms within 1 week before the illness. After the questionnaire had been completed, the participating children were examined for weight, height, respiratory rate, and chest indrawing.

Statistical analysis

The collected data were analyzed using SPSS, software (SPSS, Inc., Chicago, IL, USA). Descriptive analysis was used to characterize data using mean (standard deviation) or frequency (percentage) as appropriate for continuous variables and categorical variables, respectively.

Results

Demographic characteristics

The mean age of the admitted children was 9.7 months, ranging from 21 days to 4.5 years. Nearly 13% of the children were aged <2 months and 59.5% were between 2 and 12 months. The remaining 27.5% of the children were between 12 and 60 months. There were more males (56.5%) than females (43.5%). The patients were mostly native Libyans (97.5%). Urban residents made more than three-quarters (76%). The educational level in most of the mothers and fathers was secondary [Table 1]. Majority of the mothers (63.5%) were homemakers, whereas 32% of the fathers were self-employed [Table 1]. Almost 80.5% of the children had a nuclear type of family, 53% of cases were coming from a family dependent on social support and had a monthly income <450 Libyan dinars, and 3.5% of the children missed some doses of their immunization schedules.

Clinical profiles

Children presented with different respiratory complaints. Cough was the main presenting complaint and the most frequent one as reported by 176 (88%) children followed by shortness of breath by 167 (83.5%) and fever by 137 children (68.5%). Half of the patients (99; 49.5%) had a history of recurrent respiratory infections (i.e., had a previous ARI within the past year). Thirteen children (6.5%) reported a history of allergy, 18 children (9%) was on chronic medication use, and 129 children (73%) had lower chest indrawing on physical examination [Table 2]. Fifty-five children presented with severe pneumonia, 52 had moderate pneumonia, and 51 had bronchiolitis [Table 2].

Table 1: The highest formal education and occupation of parents are shown for mothers and fathers separately

Characteristics	Mother*	Father*
Level of formal education		
Illiterate	3 (1.5)	1 (0.5)
Primary	36 (18.0)	30 (15.0)
Secondary	95 (47.5)	109 (54.5)
High	66 (33.o)	60 (30.0)
Occupation		
Physician	4 (2.0)	3 (1.5)
Teacher	45 (22.5)	18 (9.0)
Engineer	2 (1.0)	11 (5.5)
Employee (civil servant)	None	52 (26.0)
Self-employed	None	64 (32.0)
Nurse	8 (4.0)	None
Homemaker	127 (63.5)	NA
Others	14 (7)	51 (25.5)
Unemployed	-	1 (0.5)

*Results are presented as absolute and relative frequencies i.e., *n* (%).
NA: Not available

Table 2: Clinical characteristics of the children*

	n (%)
Presenting complaints	
Cough	176 (88.0)
Sore throat	75 (37.5)
Runny nose	80 (40.0)
Wheezing	63 (31.5)
Shortness of breath	167 (83.5)
Fever	137 (68.5)
Poor feeding	33 (26.5)
Past medical history	
Allergy	13 (6.5)
Chronic drug use	18 (9.0)
Recurrent respiratory illness in the last year	99 (49.5)
Physical examination findings	
Delayed development	22 (11.0)
High respiratory rate	129 (64.5)
Chest indrawing	146 (73)
Types of respiratory tract infections**	
Cough and cold (no pneumonia)	35 (17.5)
Bronchiolitis	4 (2.0)
Pneumonia	51 (25.0)
Severe pneumonia	52 (26.0)
Whooping cough	55 (27.5)
Cough and cold with exacerbated asthma	3 (1.5)

*Results are presented as absolute and relative frequencies, i.e., *n* (%),
**Frequencies are not mutually exclusive

Risk factors

Perinatal history

Anemia of pregnancy was reported in mothers of 11.5% of the children, followed by pregnancy-induced hypertension in 6.5% and urinary tract infections in 5% of children. Fifteen children (7.5%) were

preterm, and 26 (13%) were postdate. Fifty-four children (27%) were delivered by cesarean section, 17 (8.5%) had a birth injury, 37 (18.5%) had a history of admission to the neonatal unit, and 22 (11%) had a low birth [Table 3].

Medical and family history

No other problems were evident in 111 (55.5%) children. Gastroenteritis was the most prevalent associated medical condition (13.5%) followed by bronchial asthma (6%), congenital heart disease (5.5%), and gastroesophageal reflux disease (5%) [Table 4]. Thirty-nine percent of the children had consanguineous parents. Family history of atopy (58.5%) and genetic disease (7.5%) were reported [Table 4].

Nutritional and environmental factors

Seventeen children (8.5%) did not receive breastfeeding at all; 27.5% were breastfed for <4 months and 67 children (33.5%) started their weaning before the age of 6 months [Table 5]. History of exposure to a person with respiratory symptoms 1 week before the illness was reported in 79 children (39.5%). In addition, an overcrowding index >3 people per room was reported in 34.5%, and indoor parents' smoking was reported in 31.5% of cases. Thirty-one children were cared for by a nursemaid [Table 5].

Table 3: Risk factors identified from the history of antenatal complications, duration and mode of delivery, and early postnatal complications

Risk factors	*n* (%)
History of antenatal complications	
None	131 (65.5)
Anemia	22 (11.5)
Pregnancy-associated hypertension	13 (6.5)
Urinary tract infection	10 (5.0)
Diabetes mellitus	4 (2.0)
Antenatal bleeding	4 (2.0)
Premature rupture of membranes	3 (1.5)
Others	13 (6.5)
Duration of pregnancy and mode of birth	
Term	159 (79.5)
Preterm	15 (7.5)
Post date	26 (13.0)
Normal vaginal delivery	146 (73.0)
Cesarean section	54 (27.0)
Postnatal history	
History of birth injury	17 (8.5)
History of admission to the neonatal unit	37 (18.5)
Birth weight (g)	
Normal	172 (86.0)
Low	22 (11.0)
High	5 (2.5)

Results are presented as absolute and relative frequencies, i.e., *n* (%)

Table 4: Frequency of relevant positive family history and personal history of related illnesses

	n (%)
Family history (positive)	
Consanguinity	78 (39.0)
Atopy	177 (58.5)
Genetic disease	15 (7.5)
History of other illnesses	
None	111 (55.5)
Gastroesophageal reflux	10 (5.0)
Congenital heart disease	11 (5.5)
Down's syndrome	8 (4.0)
Bronchial asthma	12 (6.0)
Gastroenteritis	27 (13.5)
Cerebral palsy	5 (2.5)
Others	16 (8.0)

Results are presented as absolute and relative frequencies, i.e., *n* (%)

Discussion

The present study reports on a fairly large number of patients (200 children) admitted with varying respiratory infections. Thirty-five (17.5%) children had cough and cold with no pneumonia, three (1.5%) had cough and cold with exacerbated asthma, four (2%) had whooping cough, and the remaining 158 (79%) were diagnosed with LRIs. Severe pneumonia was identified in 55 (27.5%) children, 52 (26%) had mild and moderate pneumonia, and bronchiolitis was identified in 51 (25%) children. LRIs were the most prevalent in these children since children as the study was based on those who were already admitted to hospital because of severe infection or comorbidity. These results are predictably at a variance with a study that explored the magnitude of ARIs and the risk factors associated with 1200 prescriptions from forty primary health-care centers.[7] URIs accounted for two-thirds (65.8%) and pneumonia (<1%) accounted for the total ARI cases.[7]

Almost all our patients had a previous attack of ARIs. Furthermore, signs of respiratory distress were present in a large proportions of patients reflected in raised respiratory rate (2/3rd) or chest indrawing (3/4th). Cough was the chief

Table 5: Details of nutritional factors and environmental conditions

Variables	Results, *n* (%)*
Nutritional status	
Breastfeeding	
Never	17 (8.5)
<4 months	55 (27.5)
≥4 months	41 (20.5)
Age at weaning	
<6 months	67 (33.5)
≥6 months	54 (27)
Still not weaned	79 (39.5)
Current feeding	
Breast only	16 (8)
Breast and bottle	38 (19)
Bottle feeding	23 (11.5)
Mixed	80 (40)
Family diet	43 (21.5)
Environmental conditions	
House ventilation: Good/poor	191 (95.5)/9 (9.5)
Exposure to dampness: Yes/no	41 (20.5)/159 (79.5)
Crowding index: ≤ 3/>3	131 (65.5)/69 (34.5)
Second-hand smoking	
None	85 (42.5)
Indoor	63 (31.5.)
Outdoor	52 (26.0)
Child care	
Mother	134 (67)
Nursemaid	62 (31)
Nursery	4 (2)
Recent contact history**: Yes/no	79 (39.5)/121 (60.5)

*Results are presented as absolute and relative frequencies, i.e., *n* (%), **Contact with somebody with respiratory complaints within the previous week

complaint (88%), followed by shortness of breath (83.5%) and fever (68.5%). Consistent risk factors included younger age, male sex, urban residence, family history of atopy, lack of breastfeeding, and indoor air smoke. The age distribution in the present study is concordant with a study from Yemen and Pakistan.[14,15] In addition, another study from Denmark showed that hospitalization for ARIs decreases as age increases.[16] In the present study, there was a slight male predominance, which is in agreement with previous studies.[16,17] However, another Danish study found that boys were hospitalized more often than girls, but the reverse is seen in adolescents and young adults.[18] All these studies lend support to the notion that gender plays a role in the susceptibility for respiratory infections in early childhood.[7,16-19] We have noticed more ARIs from urban areas than rural areas, which is in agreement with some previous studies but not others.[7,20]

We found a positive family history of atopy in most children with ARIs, which is in agreement with previous studies.[20,21] Acute gastroenteritis was the most common associated medical illness. Diarrhea has been shown previously to contribute substantially to the burden of acute LRIs in malnourished child populations.[22] However, the relevance of other observed coexisting medical conditions depicted in Table 4 is not clear. Previous studies found inconsistent findings.[14,23,24] Whereas Al-Sonboli *et al*.[14] found that prematurity, chronic lung disease, or congenital heart disease were not associated with the severity of ARIs caused by respiratory syncytial virus (RSV) or Human metapneumovirus (HMPV). Bulkow *et al*.[23] found that the underlying medical condition, primarily prematurity, was associated with approximately 6-fold increased risk of hospitalization for RSV infection. Furthermore, Cunningham *et al*.[24] found that although premature infants with broncho-pulmonary dysplasia (BPD) had a higher incidence of re-hospitalization than those without BPD, premature infants without BPD had a 10-fold increase in re-hospitalization over matched full-term infants.

Numerous previous studies confirm a protective role of breastfeeding against respiratory infections,[25-29] and this role mainly in the long term, as the outcomes, is often measured after 6 months of age, or even at 1, 2, or 6 years, showing a persistent protective effect even after breastfeeding has been stopped. Protection seems to be time dependent: in a large cohort of infants in the UK,[26] those who were breastfed for <4 months had a higher risk of hospitalization for infectious diseases in the first year of life than those who were breastfed for >4 months. Besides, infants who were breastfed for 4–6 months showed a higher risk of pneumonia and recurrent otitis media than those who were breastfed for 6 months or longer.[28,29] Our findings also support the notion that breastfeeding has a protective effect against respiratory infection.

The role of exposure to environmental tobacco smoke (i.e., passive smoking) is not clear. Some studies suggest that exposure to ETS is a significant

risk factor for ARIs, especially LRIs, and others found it controversial. Smoking by parents or grandparents did not emerge as a significant risk factor for ARIs.[24] Whereas, some workers demonstrated fairly convincingly a role of ETS as an essential risk factor for the development of severe RSV disease leading to hospitalization.[18,20,30] In contrast, others found that parental smoking is a significantly higher in patients with ARIs compared to those without ARIs.[19] In the present study, exposure to ETS has a role in ARIs if the percentage of indoor smoke was greater than that of outdoor smoking exposure.

In the present study, an overcrowding index of >3 persons per room was detected in over one-third of the children, showing the importance of the overcrowding index as a risk factor for ARIs. Many previous studies[19,22,23,31] have demonstrated that the overcrowding index is a risk factor for ARIs. The household crowding index of 2 or more was associated with an increased risk of RSV hospitalization.[23] Furthermore, infant death due to LRIs was associated in other reports with large families, household crowding, and contact with older siblings.[31]

Forty percent of children in the present study had a positive history of exposure to a person with respiratory symptoms. There was uncertainty in the role of this factor in ARIs if we compare the above percent to the percent of children with ARIs (60%) who did not report the history of exposure (as reported by their mothers). Exposure to a relative with ARI increases the severity of RSV and HMPV infection and URI in sibling, which were reported as significant contributors of acute LRIs in children below 5 years of age.[14,24]

In the present study, several socioeconomic factors such as parent education, family income, inappropriate immunization for age, low birth weight, poor house ventilation, and presence of dampness at home do not seem to have a role in the risk of ARI in under 5 children. Boor *et al*.[31] reported that the educational level of parents was negatively associated with the occurrence of severe acute LRIs in under 5 children. Incomplete immunization for age was associated with an increased risk of acute LRIs.[14,15,17] In the present study, children who had ARIs with missed doses of immunization schedule constituted only 3.5%.

Low birth weight has been shown to be associated with markedly increased risk for LRI death among all racial groups.[32] In the present study, children with low birth weight constituted 11% and those with very low birth weight constituted 0.5% in agreement with previous reports of a inverse relationship between bronchiolitis and increasing birth weight.[20] Many studies concur that children are at an increased risk for ARIs, especially the young ones.[6,32] However, in our study, only four children attend nursery perhaps because use of daycare center is not a common practice in our society.

The relationship between the socioeconomic status remain unsettle. It has been shown by workers from Kuwait that children from low and medium socioeconomic status groups tend to have higher respiratory morbidity than those in the higher group.[33] However, a study of the under 5-year-old children in Iraqsuggested that ARIs were negatively associated with lower socioeconomic status.[34] Our study's results are in concordance with those of the former but at variance with those of the latter study perhaps as most of the children in our study belong to families with low income and that children from families with better income could have been admitted to private care facilities, but this could not be confirmed in this study.

Conclusions

The present study revealed that children under the age of five are at an increased risk for LRI. In addition, increased risk of ARI is associated with male sex, urban residence, positive family history of atopy, lack of breastfeeding, and exposure to indoor air smoke. Future studies should focus on the impact of known modifiable risk factors and also attempt to identify additional risk factors contributing to ARIs. Improvement in maternal health education, smoking cessation, and promotion of exclusive breastfeeding in the

first 4 months may help reduce the incidence of ARI. Educating the caregivers or parents about the prevention and control of ARI illnesses is strongly recommended. Repeating this study after review of the national expanded program of immunization and wider use of seasonal influenza vaccine is recommended.

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Author contribution

All authors participated in the conception and conduct of the study. They all had access to all the data and their analysis. ST drafted the manuscript. All authors revised the manuscript critically for intellectual content and approved its final version.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Compliance with ethical principles

The study was conducted in accordance with the Declaration of Helsinki (2013). The Hospital's Scientific Committee approved the study. All participating mothers provided informed consent before proceeding to the survey questions. Data were downloaded and analyzed anonymously.

References

1. Lissaure T, Clayen G. Respiratory system. Illustrated Text Book of Pediatric. 3rd ed. London: MOSBY Elsevier; 2007. p. 261-5.
2. Kieny MP, Girard MP. Human vaccine research and development: An overview. Vaccine 2005;23:5705-7.
3. Williams BG, Gouws E, Boschi-pinto C, Bryce J, Dye C. Estimates at world-wide distribution of child deaths from acute respiratory infection. Lancet Infect Dis 2002;2:25-32.
4. Scott JA, Brooks WA, Peiris JS, Holtzman D, Mulhollan EK. Pneumonia research to reduce childhood mortality in the developing world. J Clin Invest 2008;118:1291-300.
5. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. Bull World Health Organ 2008;86:408-16.
6. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS; Bellagio Child Survival Study Group. How many child deaths can we prevent this year? Lancet 2003;362:65-71.
7. EL-Gilany AH. Acute respiratory infections in primary health care centers in Northern Saudi Arabia. Eastern Mediterranean Health J 2000;6:955-60.
8. Bourke SJ. Lecture Notes. Respiratory Medicine. 7th ed. Upper Respiratory Tract Infection and Influenza. UK; Blackwell Publishing; 2007. p. 47-50.
9. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet 2003;361:2226-34.
10. Park K. Text Book of Preventive and Social Medicine. 19th ed. Ch. 1. Epidemiology of Communicable Disease. India: Banarsidas Bhanot; 2007. p. 142-47.
11. Peter JH, John H. Respiratory disorders. In: Neil M, Peter JH, Rosalind LS, Stuart L, Far A, Rneil S. Text Book Pediatrics. 7th ed. Edinburgh: Churchill Living Stone; 2008. p. 715-22.
12. Schellenberg JA, Victora CG, Mushi A, de Savigny D, Schellenberg D, Mshinda H, *et al*. Inequities among the very poor: Health care for children in rural southern Tanzania. Lancet 2003;361:561-6.
13. Abubakar A, Malik M, Pebody RG, Elkholy AA, Khan W, A Bellos A. *et al*. Burden of acute respiratory disease of epidemic and pandemic potential in the WHO Eastern Mediterranean Region: A literature review. East Mediterr Health J. 2016;22(7):513-526.
14. Al-Sonboli N, Hart CA, Al-Ghbari N, Al-Ansi A, Ashoor O, Cuevas LE. Hum meta pneumovirus and respiratory syncytial virus Disease in children, Yemen. Emerg Infect Dis 2006;12:1437-39.
15. Fatmi Z, White F. A comparison of 'cough and cold' and pneumonia: Risk factors for pneumonia in children under 5 years revisited. Int J Infect Dis 2002;6:294-301.
16. Kamper J, Jan W, Jacob S, Morten G, Christine SB. Population-based study of the impact of child care attendance on hospitalizations for acute respiratory infections. Pediatrics 2006;118:1439-46.
17. Campanella N. Infectious diseases and natural disasters: The effects of Hurricane Mitch over Villanueva municipal area, Nicaragua. Public Health Rev. 1999;27(4):311-9.
18. Jensen-Fangel S, Mohey R, Johnsen SP, Andersen PL, Sørensen HT, Ostergaard L. Gender differences in hospitalization rates for respiratory tract infections in Danish youth. Scand J Infect Dis 2004;36:31-6.
19. Rahman MM, Rahman AM. Prevalence of acute respiratory tract infection and its risk factors in under five children. Bangladesh Med Res Counc Bull 1997;23:47-50.
20. Carroll KN, Gebretsadik T, Griffin MR, Wu P, Dupont WD, Mitchel EF, *et al*. Increasing burden and risk factors for bronchiolitis-related medical visits in infants enrolled in a state health care insurance plan. Pediatrics 2008;122:58-64.
21. Simoes EA. Maternal smoking, Asthma, and Bronchiolitis: Clear- cut association or equivocal evidence? Denver, Colorado. Pediatrics 2007;119:1210-2.
22. Schmidt WP, Cairncross S, Barreto ML, Clasen T, Genser B. Recent diarrhoeal illness and risk of lower respiratory infection in children under the age of 5 years. Int J Epidemiol 2009;38:766-72.
23. Bulkow LR, Singleton RJ, Karron RA, Harrison LH. Alaska RSV Study Group. Risk factors for severe RSV infection among Alaska Native children. Pediatrics. 2002;109(2):210-6.
24. Cunningham CK, McMillan JA, Gross SJ. Rehospitalization for respiratory illness in infants of less than 32 weeks' gestation. Pediatrics. 1991;88(3):527-32.
25. Dixon DL. The role of human milk immunomodulators in protecting against viral bronchiolitis and development of chronic wheezing illness. Children (Basel) 2015;2:289-304.
26. Quigley MA, Carson C, Sacker A, Kelly Y. Exclusive breastfeeding duration and infant infection. Eur J Clin Nutr 2016;70:1420-7.
27. Lamberti LM, Zakarija-Grković I, Fischer Walker CL, Theodoratou E, Nair H, Campbell H, *et al*. Breastfeeding for reducing the risk of pneumonia morbidity and mortality in children under two: A systematic literature review and meta-analysis. BMC Public Health 2013;13:S18.
28. Paricio Talayero JM, Lizán-García M, Otero Puime A, Benlloch Muncharaz MJ, Beseler Soto B, Sánchez-Palomares M, *et al*. Full breastfeeding and hospitalization as a result of infections in the first year of life. Pediatrics 2006;118:e92-99.
29. Chantry CJ. Full breastfeeding duration and associated decrease in respiratory tract infection in US Children. Pediatrics 2006;117:425-32.
30. Singleton RJ, Elisabeth AW, Dana LH, Krista YC, Christopher DP, Joseph AH, *et al*. Risk factors for lower respiratory tract infection death among infants in the United States, 1999-2004. Pediatrics 2009;124:e768-76.
31. Broor S, Pandey BR, Ghosh M, Maitreyi RS, TanuSinghal R, Kabra SK. Risk factors for severe acute lower respiratory tract infection in under-five children. Indian Pediatrics 2001;38:1361-9.

32. Forssell G. Hakansson A, Mansson N. Risk factors for resp tract infections in children aged 2-Years, Sweden. Scand J Primary Health Care 2001;19:122-12.
33. Sha NM, Sha MA, Radovanovic Z. Social class and morbidity differences among Kuwaiti children. J Health Popul Devctries 1999;2:58-69.
34. Siziya S, Muula AS, Rudatsikira E. Diarrhoea and acute respiratory infections prevalence and risk factors among under-five children in Iraq in 2000. Ital J Pediatr 2009;35:8. doi: 10.1186/1824-7288-35-8.