

## Factors Affecting the Rate of Pediatric Pneumonia in Developing Countries: a Review and Literature Study

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### Abstract

#### Introduction

Millions of children less than 5 years old die from pneumonia globally and about 70-75% of these deaths occur in infants. Persian and English articles of International and National databases such as "WHO, Scopus and the Cochrane, Pub Med, Science Direct, Wiley, Google Scholar, SID, Iran Medex, Magiran, Med Lib and Iran Doc" were searched from 1970 to 2014.

#### Result

The risk factors such as low birth weight, malnutrition, lack of breast feeding, micronutrient deficiencies, smoking tobacco, kindergarten and maternal education were the most important factors affecting the rate of pneumonia in developing countries.

#### Conclusion

Actions such as nutritional interventions, develop effective strategies on abstinence of smoking, promote the knowledge and practice of mothers about proper care of infants could have a significant effect on the reduction of morbidity and mortality of pneumonia in the infants.

**Key Words:** Infant, Developing Countries, Pediatric, Pneumonia,

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## 1-Introduction

According to the World Health Organization (WHO) in 2013, 6.3 million children under the age of five died in the world (from the end of the neonatal period and through the first five years of life) and pneumonia is one of the most important causes of child death. 99% of these deaths occur in developing countries and infections are causes 70% of deaths (1, 2).

Among childhood diseases, acute respiratory infections is the most common diseases in young children throughout the world and the first cause of mortality in children under 5 years in developing countries, so that 1/3 to 1/4 of deaths are due to acute respiratory infections in children under 5 years, mainly (29%) is due to pneumonia (3, 4).

Most children under 5 years in developed and developing countries, 4 to 6 times per year are affected to acute respiratory infections. Annually, approximately 3 million children under 5 years die of pneumonia. Pneumonia that is acute lowers respiratory tract infection and the most fatal infection of respiratory tract, appropriating more than 75 percent of deaths due to acute respiratory infections in children in developing countries (5, 6).

Various factors are considered in the etiology of pneumonia and generally etiology of this disease is complex and in many cases, the pathogens remain unknown. To reach valid conclusions, there are always problems. Some methods, especially in bacterial infection do not have the scientific confidence or have difficulty in obtaining the necessary samples. Cover all of pathogens may require a wide range of laboratory methods with high costs.

Simultaneous with the start of complementary feeding (about 6 months),

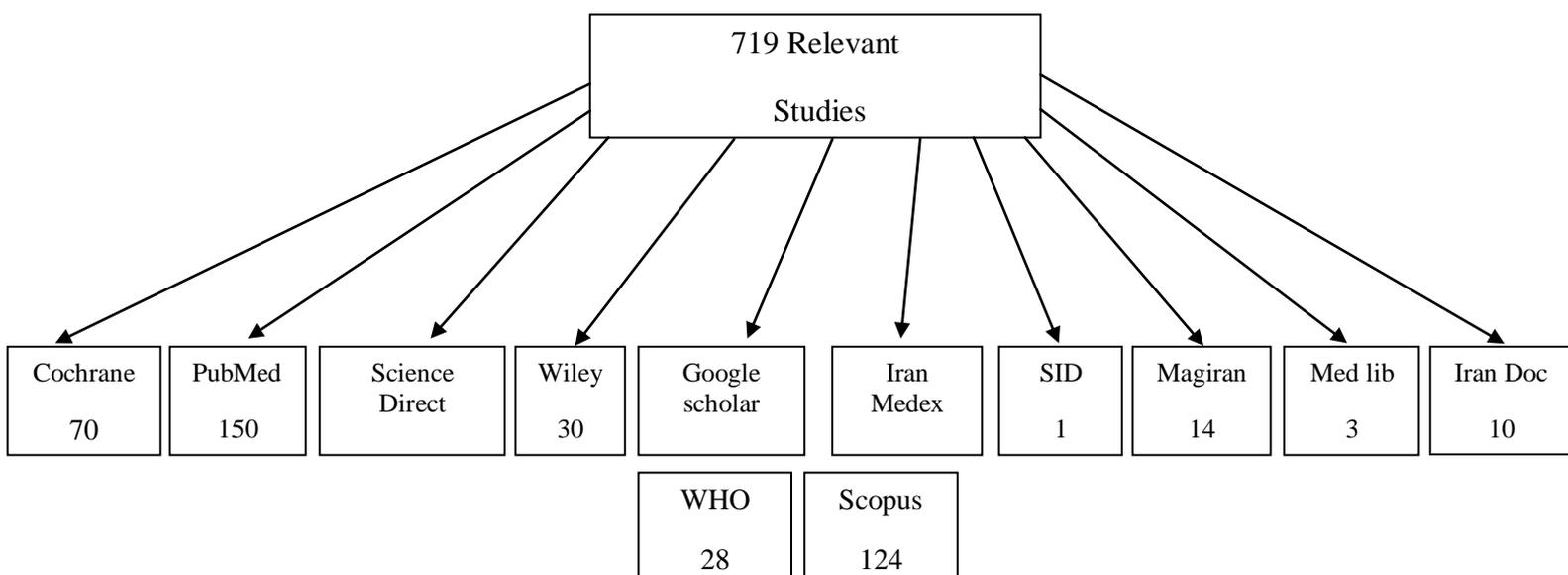
due to reduce the received immunoglobulin of the mother and the lack of active safety in infants, the chances of infant infection increased (7).

Anatomically short distance from the trachea to the bronchi and bronchiole, facilitate the risk of transmitting pathogens. Pneumonia, regardless of the high cost of health care (diagnosis, hospitalization and treatment), impaired child growth and to be considered important factor in malnutrition and mortality infants. This study aimed to determine the factors affecting the rate of pneumonia, according to studies conducted in developing countries.

## 2-Materials and Methods

Current review evaluated the factors affecting the rate of pediatric pneumonia in developing countries. The word of a developing country (called a less developed country or underdeveloped country) became in the 1960s the more common way to characterize countries, especially in the context of policy discussions on transferring real resources from richer (developed) to poorer (developing) countries and it is a nation with an underdeveloped industrial base, and a low Human Development Index (HDI) relative to other countries (8, 9).

International and National databases such as "WHO, Scopus and the Cochrane, Pub Med, Science Direct, Wiley, Google Scholar, SID, Iran Medex, Magiran, Med Lib and Iran Doc" were searched using key words "Pneumonia, Infant, Pediatric and developing Countries" from 1970-2014. The data collected independently by two authors. After the initial screening and exclude some articles, 62 studies were consistent and were analyzed.



**Fig.1:** Literature search

### 3-Results

#### 3-1: Nutritional Factors and Their Mechanism of Action

##### 3-1-1: Low Birth Weight (LBW)

Numerous studies referred to the role of low birth weight in infants suffering from acute infections of the lower respiratory tract (10, 11).

It is estimated that 19 percent of the children who are born in developing countries, have low birth weight (weighing less than 2,500 grams) that the average prevalence is of 10% in the Middle East and North Africa up to 34 percent in South Asia(12). The two main mechanisms that children with low birth weight put at risk of respiratory infections include low immunity level and defects in lung function. Also, these children also have limited iron, zinc and copper resources (13-15).

In 6% of studies that have been conducted in developing countries, the relationship shows between birth weight and infant mortality due to pneumonia or acute infection of the lower respiratory tract. A strong correlation exists between

decreased mortality from pneumonia with increasing birth weight (16-19).

##### 1.1.

##### 3-1-2: Protein-Energy Malnutrition

Refers to conditions that result from inadequate intake or consumption of energy or protein in the diet and usually is associated with a deficiency of certain vitamins and minerals. This problem is often caused by infectious diseases of childhood like diarrhea and pneumonia (20, 21).

In developing countries, underweight (weight below the proportional weight for age) is as a valid predictor of child malnutrition, so that LBW children are the children, who have inadequate dietary intake or recurrent infections diagnosed.

The prevalence of malnutrition is from 11 percent in North America to 60 percent in South Asia. It is estimated that about 36 percent of children less than 5 year in developing countries, have lower weight than 2 standard deviations in comparison with reference standards. Children with malnutrition have deficient immune responses; consequently these childhood infections are more severe in these children (12, 22, 23).

Studies show children who their weight is less than 70% appropriate weight for their age, compared to other children, increased an 8 times risk of mortality from pneumonia for them (24).

### **3-1-3: Lack of Breast Feeding**

Breastfeeding can protect children against the risk of lower respiratory infections. In fact, breast milk cause passive protection against pathogens.

Breast milk contains specific elements such as lymphocytes and antibodies, secretory Immunoglobulin A (IgA) and non-specific elements, including phagocytes, macrophages, lactoferrin, lysozyme, lactoperoxidase, oligosaccharides, bifidus factor, C3 and C4 complements that protect infant against infectious diseases, especially against two factors causing death, the diarrhea and acute respiratory infections that cannot be prevented by public vaccination (25-27).

Studies show that the protective effect of breast milk against lower respiratory tract infections, change does not with change of age infants (28). Estimated to be complete or partial breast-feeding resulted in a 50% reduction in mortality from acute respiratory tract infections in children fewer than 18 months (7).

### **3-1-4: Vitamin A deficiency**

Studies have shown vitamin A deficiency, increased susceptibility to infection and lead to abnormalities in epithelial cells and cells of the immune system (29-31). The role of vitamin A in the growth and development of cells and tissues (especially in respiratory epithelial cells and lung tissue) is essential. In lung tissue, alveolar cells of type II, are exclusively responsible for the synthesis and secretion of surfactant (32, 33).

According to WHO estimation, about 250 million children are at risk of vitamin A deficiency in the world. Vitamin A deficiency with acute respiratory infections

has a close relationship (34, 35). Several studies have shown that vitamin A deficiency is associated with inflammation and infection in children and the severity of the infection (36-39).

### **1.2. 3-1-5: Vitamin D deficiency**

Vitamin D has participate in many biological processes, including bone metabolism (intestinal calcium absorption), modulate immune responses and the regulation of cell proliferation and differentiation (induction of differentiation of monocytes and preventing the proliferation of lymphocytes, secrete cytokines such as interleukin-2, interferon- $\gamma$  and interleukin-12) (40, 41).

Studies have been conducted in developing countries show the relationship between nutritional rickets (rickets due to vitamin D deficiency) and pneumonia in children. In Iran, 43 percent of the 200 children were admitted to Children's Medical Center that were diagnosed with of radiologic rickets, were also suffering from bronchopneumonia (42).

Therefore, vitamin D deficiency may be an important factor predicts pneumonia in children less than 5 years in developing countries (41-43).

### **3-2: Inhalation of tobacco smoke**

The passive smoking is a risk factor of developing respiratory tract infections in children. Passive smoking in children leads to suppression of phagocytic function and cilia cell activity, increase the likelihood of adherence of bacteria to the epithelium of respiratory tract and cause bacterial colonies.

Studies shows in the worldwide, per 10,000 children happen between 500–2500 additional hospitalizations and between 1,000 to 5,000 additional diagnoses, as result from respiratory infections can be directly attributed to parental smoking (43, 44).

In several studies, researchers concluded that children exposed to parental smoking were more likely to develop wheezing breath sounds (asthma) and chronic cough, and also at higher risk of pneumonia and other respiratory diseases. In many studies, have been found a strong link between maternal smoking and child with acute respiratory infections (45-47).

### **3-3: Kindergarten**

In recent years in many countries, close to 50 percent of mothers of infants work out of home, therefore, increased need for Day Care Center provide care for children of the mother working hours. Until 1974, it was thought that these centers have no effect on the health of the infant. However, recent reports indicate that there is an association between the use of these centers and pediatric infectious diseases (48-50).

It seems a large population and a high ratio of children to caregivers in these centers, as well as characteristics such as age and nutritional status of children has a role in getting children of infectious diseases.

Studies show that the risk of infectious diseases in children was taken care in the kindergarten compared with children who were care in the home, is 2 more times and the most recurrent diseases was the risk of acute respiratory infection (51-54). To determine ways to reduce acute respiratory infections in kindergarten, the quality of care in these locations should be analyzed deeper.

### **3-4: Maternal education**

Children's health is greatly influenced by lifestyle and behavior of the parents, especially the mother's education. Studies have shown that some of parental characteristics such as education services are effective on understanding of them of the importance of the disease, its severity and use of health services.

In this regard, the role of mother in health promotion and disease prevention, assistance in early diagnosis and patient care is vital (55-57).

Mother competence in playing its role is as the most important factors in predicting children's health. Previous studies have shown that maternal behavior in seeking medical care for diseases of children is affected by factors such as socio-economic status, mother's knowledge and beliefs about the cause and severity of the disease and their traditional beliefs. Mother's education level has an undeniable and important impact on children's health that it has been emphasized in several studies (58-61).

## **4- Discussion**

Pneumonia as an acute infection of the lower respiratory tract is the most common fatal infection of the respiratory tract in children, especially in infants. The risk of pneumonia in children in developing countries is 3 to 6 times higher than other children. Not only outbreak of pneumonia, but also the mortality rate of this disease is higher in developing countries (5, 62, 63).

Various surveys have shown the nature and importance of pneumonia, many predisposing factors of pneumonia, arising from incorrect caring of infants in family and inadequate knowledge and awareness of mothers about proper infant care practices to this disease that exacerbating the problem (64).

Findings showed that factors such as low birth weight and its impact and relationship with infection of the lower respiratory tract, the impact of malnutrition on children's impaired immune responses in developing countries and the prevalence of childhood infectious diseases such as diarrhea and pneumonia, lack of breast feeding and its impact on the reduction of passive safety defects in children, micronutrient deficiencies such as vitamin

D and vitamin A and its effect on the immune response of children in this countries, the vulnerability of children at risk passive smoking arising from parental smoking, the effect of attend in kindergarten and type of care in this places on prevalence of disease and important effect of maternal education as primary caregiver on the quality of proper care that provide to children, were the most important factors affecting the rate of pneumonia in developing countries.

### 5- Conclusion

Since in the world, pneumonia is still the leading cause of children mortality and its impact on impaired of child growth and development cannot be overlooked, the importance of planning and training effective strategies to prevent and reduce the incidence of pneumonia, should not be forgotten particularly in developing countries. Many of these predisposing factors for infant pneumonia could be prevented through effective education (65).

However, the training program for the prevention of pneumonia in infancy is a time-consuming and costly, but according to the long term effect of this disease on growth and development and mortality of infants, spend time and money to prevent irreversible effects seem logical and cost effective.

In this regard, actions such as nutritional interventions (breast feeding, vitamin A supplementation for underweight and malnourished children, correct use of drops of vitamin A and vitamin D, observance the correct points in the supplementary feeding of children), develop effective strategies on abstinence of smoking, promote the knowledge and practice of mothers about proper care of infants, could have a significant effect on the reduction of morbidity and mortality of pneumonia in the infants.

**6- Conflict of interest:** None.

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