

Causes and Risk Factors of Hospitalization Among Infants Less than Six Months Old in Tehran

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Abstract

Background: Hospitalization exposes young infants to a high-risk environment. The aim of this study was to identify the reasons and risk factors associated with infant hospitalization.

Methods: Healthy infants of 6 to 24 months of age were recruited from outpatient clinics of university hospitals. Data collected from parents by trained personnel. Risk factors were compared between children hospitalized between 1 - 6 months of life (Group A), with those without hospitalization history (group B).

Results: A total of 1046 infants were participated in this study. Mean age was 13.3 months and 49.9% were females; 192 infants had been hospitalized as neonates, and 121 from 1 to 6 months. The Most common reasons for admission during the infancy period were proven or presumed sepsis, and respiratory (36.3%) or gastrointestinal problems (33%). There was a significant difference in hospitalization rate among infants in whom breastfeeding was discontinued before three months in comparison with those breastfed for at least three months, (30.1% vs. 8.1%, respectively, $P = 0.000$). This condition were similar for breast discontinuation from three to six months and after six months (24.1% vs. 8%, $P = 0.000$). Also, low birth weight, university education and maternal education less than nine years were statistically significant between group A and B.

Conclusions: Based on our data, low birth weight, discontinuation of breastfeeding and low levels of maternal education are identified as risk factors for infant hospitalization.

Keywords: Infant, Hospitalization, Educational Status, Maternal, Low Birth Weight, Breastfeeding

1. Background

Hospitalization of young infants creates high cost and stress for families; in addition, breastfeeding of babies may also be disrupted. The hospital environment is known as a high-risk environment for children. One of the most common complications following hospitalization of children is nosocomial infection, which in many cases, caused by antibiotic-resistant bacteria (1, 2). Numerous studies have revealed that many hospitalized infants are infected with rotavirus as a secondary infection (3-5). Other pathogens identified as risk factors for nosocomial infections include methicillin-resistant *Staphylococcus aureus* and gram-negative bacteria such as *E.coli* and *Klebsiella* (6, 7). In some studies regarding metapneumovirus infection, *Salmonella* species and fungal infections have also been reported (2, 8-10). Studies indicate that the nosocomial infection has a higher prevalence in infants under one-year-old and those who had been hospitalized for more than 10 days (11).

In addition, admission of people in hospital, imposes heavy costs to the healthcare system, occupies hospital

beds and increases staff workload. In these circumstances, the insurance companies will have to pay more toward healthcare expenses. But the new strategy on healthcare systems in developed countries is based on preference of outpatient treatment of children and avoidance of hospitalization.

2. Objectives

We conducted this study in order to determine the reasons and risk factors associated with infant hospitalization after the neonatal period, as a means to find the preventive factors.

3. Methods

The study was descriptive, analytical and prospective. The populations studied were infants who were admitted to hospital or attended the clinics for immunization, growth monitoring and treatment of common diseases. Study was conducted in two major referral hospitals in

Tehran; Taleghani educational hospital and Mofid children's hospital, affiliated with Shahid Beheshti University of Medical Sciences, Tehran, Iran.

The inclusion criteria were as follows: we gather the data from children parents whose children, aged 6 to 24 months were admitted during the first 6 months of life. Children with chronic diseases, congenital abnormalities or severe malnutrition, were excluded. Face-to-face interviews were performed with the children parents by trained personnel and the required information was collected in accordance with the pre-determined questions in the questionnaire. Questions were as follows: baseline characteristics such as age, sex, birth order, birth weight, method of delivery, method of feeding in the first six months of life, a history of acute or chronic illness, and parental characteristics such as age, education level, occupation and smoking habits. History of hospitalization in infancy period, between one and six months and the causes of hospitalization were also recorded.

The children were divided into 2 groups: Those who had a history of hospitalization from one to six months of life were included in the study group (group A), and those who did not have such history were considered as the control group (group B). In addition, because the hospitalization in neonatal period is less influenced by postnatal environmental factors, infants who hospitalized in the neonatal period were not included in the study group.

Our data were compared between the experimental group A and B. Statistical analysis was done using SPSS software version 18 for windows, chi-square test was used for qualitative variables. $P < 0.05$ was considered statistically significant.

4. Results

In this study the sample consists of 1046 infants aged 6 -24 months. The number and proportion of boys 524 (51.1%) and girls 522 (49.9%) were roughly equivalent. Mean age of the infants was 13.3 months and 648 infants were the first child. Mean birth weight was 3.1kg and 66 (6.3%) infants had less than 2.5 kg birth weight. 581(55.5%) infants were born by cesarean section. Mean mother's age was 26.58 ± 5.14 years old by average 10.9 ± 4 years of schooling. 188 (18%) of mothers were employed. Mean education level of fathers was 11.73 ± 4.1 years. 293 infants were exposed to cigarette smoke due to parent smoking (father in all and mother in 4 cases). In 158 (15%) cases, breastfeeding was disrupted before the age of six months and in 93 (8.3%) cases before the age of three months. Only 35 cases attended kindergarten.

Totally, 328 infants had a history of hospitalization (group A), 313 cases were hospitalized before the age of six

Table 1. Causes of Admission in Neonatal and Infancy Period

Cause of Hospitalization	No. (%), (n = 121)
Gastroenteritis	44 (36.36)
Respiratory system infection	40 (33.05)
UTI	12 (10)
Surgery	11 (9.16)
Convulsion	7 (5.83)
Meningitis	2 (1.66)
Osteomyelitis	1 (0.83)
Sepsis	1 (0.83)
Gastro esophageal	1 (0.83)
Chronic constipation	1 (0.83)
Anemia	1 (0.83)

months, 192 cases in neonate period and 121 cases from 1 to 6 months. Table 1 shows the most common causes of hospitalization in the infancy period. There was a significant difference in the rate of hospitalization between infants in whom breastfeeding duration was less than three months in comparison with those breastfed for at least three months, (23.14% vs. 7.02% respectively, $P < 0.001$); also for breastfeeding discontinuation between 3 to 6 months and after 6 months, (31.4% vs. 12.6%, $P < 0.001$) (Table 2). In total, 12.4% of mothers in group A were college educated compared with 26.7% in group B, also the numbers of mothers with less than nine years schooling in group A (39.6%) was more than group B (28.4%) ($P = 0.013$). Father's education level in group B was higher than group A ($P = 0.006$). Infants with less than 2.5 kg birth weight in group A were less than that of in group B (12.4% and 5.5%, respectively $P = 0.003$) (Table 2).

5. Discussion

More than 29% of our study's population had been hospitalized at least once before the age of six months. Hospitalization of young infants causes physical and psychological complications as well as an economic burden for families. The most common causes of hospitalization in infants older than one month were respiratory and gastrointestinal infections which is consistent with other relative studies (12). Infections, especially respiratory and gastrointestinal, were the leading cause of hospitalization and the risk of infection increase in preterm infants due to immature immune system (13). The possibility of acquiring lower tract infections could be diminished by exclusive breastfeeding and increase in birth weight (14).

Table 2. Comparison of the Children Who Were Hospitalized at the Age of 1 to 6 Months^a

Variable	Group A, (n = 121)	Group B, (n = 925)	P Value
Percent of boys	56.1	49.29	0.153
First child	54.54	62.9	0.074
Birth by cesarean section	55.7	55.56	0.968
Birth weight under 2500 gr	12.4	5.51	0.003
History of hospitalization in neonatal period	16.5	18.6	0.581
Stopped breast-feeding before 3 month	23.14	7.02	< 0.001
Stopped breast-feeding at 3 to 6 month	31.4	12.6	< 0.001
Father smokers	27.96	28.35	0.93
Mother age under 21 years	14	13.4	0.185
Maternal education: more than 12 years	12.4	26.7	0.001
Father education: more than 12 years	22.5	34.3	0.006
Maternal education: under 9 years	39.66	28.43	0.011
Employed mothers	9.91	19.1	0.013

^aGroup A, children with history of hospitalization from one to six months of age; Group B, children without history of hospitalization from one to six month of age.

Of course in recent studies it was reported that hospitalization because of diarrheal diseases, after routine use of rotavirus vaccine was decreased. In a study in New York in 2008, a 40% reduction in the rate of infant hospitalization aged 1 - 23 months caused by diarrheal diseases was shown compared with the years before vaccination (15). In a report from Kenya, the number of admissions of infants less than one-year-old was higher than other age groups, in which the most common cause was pneumonia. In the above-mentioned study, 20% of pneumonia infections in infants were due to respiratory syncytial virus (RSV) prevalence (16).

Although breastfeeding disruption before the age of six months is known as a risk factor, there are conflicting evidence about this issue. A Meta-analysis study by Bachrach et al. indicates that mother's milk has a protective role against hospitalization caused by infectious diseases. Chen et al., emphasize that breastfeeding has a protective effect only against non-gastrointestinal (GI) infections; without any impact on GI related infections. Preterm cessation of mother's milk by increasing the rate of morbidity and mortality in infants imposes heavy costs to the healthcare system (17, 18). Comparing infants who received pure mother's milk for three months to non-breastfed infants, it is estimated that for each 1000 non-breastfed infants, 2033 visit for infants, 212 days of hospitalization and 606 prescriptions for diarrheal and respiratory infections will be added (19).

An extensive study on 9424 infants, performed in Peru, Ghana and India shows that rate of mortality and hospital-

ization in non-breast fed infant is significantly higher than the infants receiving mother milk as main nutrition (predominant breastfeeding). Results of recent study indicate that the difference in mortality and morbidity between the infant with exclusive and predominant breastfeeding is not considerable (20). It has been reported that breastfeeding has a protective effect against pneumonia and hospitalization only in girl infants (21). Our study showed that discontinuation of breastfeeding before six months has a considerable effect on hospitalization of infant compared with infants who received mother's milk more than six months. In some regions of Africa where the annual monsoon rains are as a predisposing factors for GI infection and diarrheal disease in infants, it has been indicated that the highest rate of mortality has been found in infants who were not breastfed (22). A study in Iran revealed that infants did not breastfeed exclusively when mothers had not enough breastfeeding experience (23).

Based on the findings of a statistical survey, children with smoking mothers are at higher risk and GARD (gastroesophageal reflux disease) known as an important cause of their admission (24). In our study, four mothers were smokers and the rate of admission in infants with smoking fathers are higher but the difference was not statistically significant. Prematurity and low birth weights are effective on hospitalization in infancy period, as it is proven in our study (25). During the 10 years investigation in NSW, Australia, on all births with different gestational age, it has been revealed that hospitalization rate significantly increased in preterm birth infants compared with those of

full term also this rate was significantly higher among infants born preterm at each year of age up to 6 years (26).

Some studies demonstrate that hospitalization in boys is more common than in girls, however, in our study there was not any significant difference (27, 28).

Mother's age and low financial status are effective on neonatal hospitalization. In a previous study, significant relationship between mother's age and neonate hospitalization was reported (29). But the birth order is effective in this case, which means that with the second child and more, correlation between mother age and hospitalization is considerable; especially when the mother is 20 - 22 years old (30). In our study, there was not such correlation. As the level of education in parents, both mother and father in the group that has been hospitalized before six months was significantly lower than the control group but Mother's education level has a remarkable effect on children's health. WHO has called the maternal education as an important factor that effect the family's health level especially on young infant's health. Various factors in educated mothers are effective in infants' health for instance, they are more conversant about health principles, timely immunization of children and referring to healthcare centers promptly when observing worrying signs (31).

5.1. Conclusion

This study is an exploratory study and the results are useful for generation of some new hypothesis. Study findings regarding the most common cause of infant hospitalization aged between 1 - 6 months being gastroenteritis diseases. Since the routine use of rotavirus vaccination in early infancy has led to a significant decrease in infant hospitalization in other countries, we speculate that implementing this vaccine in the routine immunization program may help to decrease the rate of infant hospitalization, if epidemiologic studies support the use of vaccine. The significant correlation between the early cessation of breastfeeding and increase in the possibility of hospitalization require an extensive research on the reasons of breastfeeding cessation. In addition, elimination of the possible causes and more support for breastfeeding mothers must be taken into consideration. The effect of low birth weight in infant's hospitalization and even after infancy urges on taking care of pregnant women to prevent preterm labor. Finally, high number of low educated mothers in relation with infants in group A and conversely low number of mothers with university education in this group revealed that maternal education has a crucial role in the improvement of their children's health.

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Footnotes

Authors' Contribution: Study concept and design: Farideh Shiva; acquisition of data: Farideh Shiva; analysis and interpretation of data: Farideh Shiva; drafting of the manuscript: Anahita Sanaei Dashti and Hossein Hosseini Khorami; critical revision of the manuscript: Farideh Shiva and Anahita Sanaei Dashti; study supervision: Farideh Shiva.

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