

## Sudden Infant Death Syndrome: Risk Factors and the Relationship between Them

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### Abstract

#### Introduction

Infant mortality is often used as a standard measure of a population's health. Sudden Infant Death Syndrome (SIDS) remains the leading cause of death between one month and one year of age. Until cause of SIDS is unknown, the best strategy to decrease SIDS is programming to decrease facing with risk factors. The aim of this study was to find the SIDS risk factors among families during their child care in Iran. The study is the first in Iran to examine the risk factors of SIDS.

#### Material and Methods

In the observational cross-sectional study, 878 mother-infant pairs who visited governmental health clinics were included by convenience sampling. The inclusion criteria were: all mother-infant pairs which infants <1 year old. Data was collected by face-to-face interview using a self-structured questionnaire contains: SIDS risk factors: 1-parental related risk factors; 2- infant related risk factors; and 3- sleep environment related risk factors. Chi-square, linear regression, and ANOVA were used for analysis.

#### Results

Of 878 cases, 291 (33.15) % of parents were under 20 year, 310 (35.3%) of infants were 6 to 9 months and 504 (57.4%) were female. Most common risk factors of SIDS were determined: co-sleeping (92.03%), bed sharing (49.31%), side lying position (47.49%) and non-exclusive breastfeeding (45.5%). A significant relationship was found between bed-sharing and head covering ( $P<0.05$ ); bed-sharing and prone position ( $P<0.05$ ); bed-sharing and breastfeeding (under 4 months) ( $P<0.05$ ); mothers' age and co-sleeping ( $P<0.05$ ) mothers' age and prone position ( $P<0.05$ ).

#### Conclusion

On the basis of this study, SIDS risk factors were common during child care in Iran. This study showed most risk factors were associated with parental education level and maternal age. Hence, with using of this study, we can prevention of SIDS through enhancing level of parental awareness by education. Moreover, since risk factors of SIDS are association with each other, by controlling of each symptom can be controlling of another symptoms.

**Key Words:** Bed-sharing, Breastfeeding, Infant, SIDS, Smoking.

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## Introduction

Sudden infant death syndrome (SIDS) is defined as the sudden death of any infant under one year of age which remains unexplained after a thorough case investigation, including complete post-mortem examination, review of clinical history, and examination of death scene(1). SIDS is the most severe crisis which parents had ever experienced, taking their families an average of 8.3 months to regain the level of family organization that they had held prior to the death, and taking individual parents an average of 15.9 months to regain the level of personal happiness they had held prior to the death (2).

SIDS is the most common cause of death in infants aged 1 month to 1 year, although its incidence has shown a progressive decline since 1992. In that year, the incidence of SIDS was 1.2 cases per 1000 live births; in 2004, the incidence had dropped to 0.51. The incidence per 1000 live births in many Asian countries is 0.04. Japan has a rate of 0.09, and Hong Kong has a rate of approximately 0.2. Some Scandinavian countries have rates in the range of 0.1 (the Netherlands) to 0.6. In Italy, the incidence is 0.7. Prior to recommendation of the supine sleeping position, the United Kingdom had an incidence of 3.5 cases per 1000 live births (now reduced to 0.41 and New Zealand had an incidence of approximately 4.5 (now 0.8) (3). No single factor or condition has been identified as the cause of SIDS. In fact, SIDS may have a variety of different causes in individual infants (4). Almost three decades ago; Congress passed landmark legislation that gave the National Institute of Child Health and Human Development (NICHD) responsibility for SIDS research. Since then, Institute-supported multidisciplinary teams of medical and scientific investigators have focused on five major areas in SIDS research: (1) the brain and

homeostatic control, (2) autonomic development and function, (3) infant care and the sleep environment, (4) infection and immunity, and (5) genetics (4).

Several factors can increase a baby's risk of SIDS. These risk factors are include: Parental smoking (5-7), prone and side sleep position, don't use of breast feeding, inadequate prenatal care, bed-sharing and co-sleeping (8), maternal age younger than 21 years, history of recent disease in the infant, soft pillow or sofa in the infants bed, premature infants (9), maternal education(10), and low social class.

A result of study in south west region of England showed Of the SIDS infants, 54% died while co-sleeping compared with 20% among both control groups, also many of the SIDS infants had co-slept in a hazardous environment (6). Infant mortality (deaths of live born infants during the first year of life) is often used as a standard measure of a population's health (4). Until cause of SIDS is unknown, the best strategy to decrease SIDS is programming to decrease facing with risk factors. In Iran, there is no detailed information about SIDS and its risk factors, so the study was carried out to find the SIDS risk factors and the Relationship between them in Iranian families during child care.

## Materials and Methods

In this observational cross-sectional study, 878 mother-infant pairs attending government health center were included by convenience sampling. According to statistical consultant and statistical sampling formula with  $\alpha = 0.05$ ,  $p = 0.29$ ,  $d = 0.03$  and  $z = 1.98$ , the number of sample was estimated to be 878. The sample size was estimated to be 878.

$$N = \frac{z^2 \left(1 - \frac{\alpha}{2}\right) p(1-p)}{d^2} = \frac{1.98^2 \left(1 - \frac{0.05}{2}\right) 0.29(1-0.29)}{0.03^2} \approx 878$$

The inclusion criteria were as follows:

- All mother-infant pairs attending government health center which infants <1 year old,
- Mothers had to be able to speak and read Persian.

Eight health centers of the four sides of the city and 1 health center of the city center were considered. Approximately, sampling was 12 percent from each health center. Sampling was conducted over a period of 2 years (February 2011 to February 2013). During this period, 1,286 patients were evaluated, of whom 963 patients met the inclusion criteria and were invited.

Consents were obtained from 878 patients who were enrolled in the study. Data was collected by a self-structured questionnaire contains SIDS risk factors: 1- Parental related risk factors (8 item) 2- Infant related risk factors (9 item) 3- Sleep environment related risk factors (6 item). The questionnaire was developed based on the literatures. Cronbach's alpha coefficient was determined 0.83. The validity of this instrument was obtained through content validity. Researchers refer to health centers and explain the nature and purpose of the study and after obtaining informed consent from the mother, the questionnaires were completed through face-to-face interviews with them.

This study was approved in the Ethics Committee of the Ahvaz Jundishapur University of Medical Sciences, Iran (Ethic code=Eth: 91s.22). Ethical considerations were considered in accordance with the Helsinki Declaration.

#### *Data analysis*

Descriptive statistics, Chi-square test, liner regression, and ANOVA tests were used for analysis.

Data was analyzed using SPSS version 17 (Chicago, IL, USA). P value <0.05 was considered significant.

#### **Results**

Information about parents, infants and sleep environmental infants are shown in (Tables 1, 2 and 3) respectively. Of 878 cases, 291(33.15) % of parents were under 20 years, 310 (35.3%) of infants were 6 to 9 months and 504(57.4%) were female.

Of fathers and mothers, 271(30.86 %) and 46(5.23%) were smokers during pregnancy, respectively. Level of education among 485(55.23%) of mothers and 560(63.76%) of fathers were under high school (Table.1).

Of infants, 57(6.49%) were Low birth weight (LBW) less than 2500 g) and 7.51 % were premature (gestational age< 37 week). Of all infants, 54.5% were exclusive breastfeeding (Table.2).

Co-sleeping (92.03%), bed-sharing (49.31%), side lying position (47.49%), soft pillow (35.3%), prone position (14.92 %), and head covering (11.73%) were reported during child care (Table.3).

A significant relationship were found between bed sharing and head covering (P=0.001); bed sharing and prone position (R= -0.337, P=0.001); bed sharing and breastfeeding (under 4 months) (P=0.001); bed sharing and parental smoking (P=0.024); prone position and parental smoking (P=0.001); mothers' level of education and smoking (P=0.008); mothers' age and co-sleeping (P=0.038); mothers' age and prone position (P=0.001); and also between mothers' occupation and co-sleeping (P=0.001).

There was no significant correlation between bed sharing and soft pillow (P >0.05); and co-sleeping with soft pillow (P>0.05).

**Table 1:** Parental factors

Variables	Number (%)
Maternal age, years	
≥ 20	587(66.85)
< 20	291(33.15)
Maternal education	
Less than high school	485(55.23)
High school	315(35.87)
College	87(8.88)
Maternal smoking	
During pregnancy	46(5.23)
After birth	21(2.39)
Paternal smoking	
During pregnancy	271(30.86)
After birth	271(30.86)

**Table 2:** Infant factors

Variables	Number (%)
Gender	
Male	374(42.60)
Female	504(57.40)
Age	
<3 months	193(21.98)
3-6 months	204(23.23)
6-9 months	310(35.30)
9-12 months	171(19.47)
Birth weight < 2500g	57(6.49)
Gestational age	
≤37 weeks	66(7.51)
>37 weeks	812(92.48)
Twins birth	0
Usual infant feeding (age< 6 months)	
Exclusive breastfeeding	216(54.4%)
Breastfeeding and formula feeding	56(14.10%)
Exclusive formula feeding	125 (31.5%)
Infant health status at birth	
Healthy	840(95.68%)
Unhealthy	38(4.32%)
Positive family history of SIDS	9(1.02)

**Table 3:** Infant sleep environmental factors

Variables	Number (%)
Co –sleeping	808(93.03)
Bed sharing	433(49.3)
Usual infant sleep position	
Prone	131(14.92)
Side	417(47.49)
Supine	230(37.58)
Type of pillow	
Soft	310(35.3)
Ordinary	568(64.69)
Head covering	103(11.73%)
Room temperature in winter	
Hot	43(4.89%)
Warm	260(29.61%)
The average	575(65.48)

## Discussion

In our study, the most risk factor was co-sleeping (92.03%). In the study by Venemann et al., co-sleeping was found in 43.6% of control group (11). Also, in the study by Fu and et al., the most common risk factor (48.6%) was co-sleeping (12). Co-sleeping in our community was more common than western countries.

In our study bed sharing was present in 49.31% of infants. In the study by Aneez et al. bed sharing was 44 % (13). In the study by Fu and et al., 32.5 % of infants were bed share. Also, in the other study by Fu et al., about half of the infants (47.4 %) were bed share (14). In the study by Ateah et al. 72% of infants were bed-sharing (15). In the survey conducted by Ramos, 63% of mothers supported bed-sharing (16). In studies from England (17), USA (18), and New Zealand (19), bed sharing was seen in 43-47% of subjects. In the study by Tan and et al., this risk factor was present in 73.5% (20). In these studies, the similar results can be seen, except in Tan et al. study (20). Although these studies were conducted in different countries with different level of socio-economic status, similar results were seen.

In our study, breastfeeding had significant correlation with bed-sharing. In the study by Blair and Hall, similar result was found (21). In the study by Tan and colleagues, breastfeeding were significantly associated with bed-sharing (20). In the studies which were carried out among low income African-American mothers, there was no significant correlation between breastfeeding and bed-sharing (18, 22). Although our subjects have not high income, there was difference between our study and studies conducted among low income subjects (18, 22). It may be due to difference in religion or social behavior.

Our findings showed that bed-sharing had a significant correlation with paternal smoking. There is no evidence to support

our finding as mentioned in Tan et al. study (20). In the study by Fu et al., authors did not find an association between bed-sharing and smoking (23).

There was significant correlation between mother's age and co-sleeping. In the Tan et al. study, younger mother had no correlation with bed-sharing (20). Significant correlation was found among occupation of mother and co-sleeping. Similar result was found in Tan et al. study (20). McCoy et al. reported similar finding (24). Of mothers, 63.76% had education level less than high school. In Fu et al. study, the ratio of mother who had education level less than high school was about 18.7-20.6% (23). In a cohort study, Lahr found bed-sharing was most prevalent in families with annual income <\$30 000(25). Low income may be the cause of high bed-sharing in our study.

Prone and side laying position was present in 14.92%, and 47.49% of cases respectively. In the study by Pinho et al., in control group, prone position (5.7 %) and side lying position (73.4 %), in case group, prone position (6%) and side lying position (75.7%) (1). Results of the cohort study by Alm between years 1992-2003 showed prone sleeping decreased from 31.8% to 5.6% and supine sleeping increased from 35.3% to 47.3% (26).

Parental smoking, in particular maternal smoking during pregnancy and following birth, was a strong predictor of SIDS-risk in multiple studies (19). In our study father smoking before and after birth was 30.86%. Maternal smoking during pregnancy was 5.23% and after birth were 2.39% that are less than other countries. In the study by Blair and et al, mother smoking was 14% (9). In the review study by Mitchell and et al , in case group, maternal smoking in high socio-economic 42%, middle 59%, low 76% and in control group, maternal smoking in high socio-economic 12%, middle 33%, low 49%

was reported (20). So, social and cultural differences are more effective in smoking.

Also Lack of breast milk is a risk factor for SIDS. In our study 45.5 % of infants had exclusive breast milk. In the study by Pinho and colleagues, 43.7% of living control group and 36.4 % of SIDS infants had exclusive breast milk (1). Weight less than 2,500 g (LBW) is another risk factor for SIDS. In our study, 6.49% of infants were LBW. In our study, 7.51% of infants were premature (GA< 37 week).

Use of pillows and comforters has been shown to increase the risk of prone death, particularly when the infant's face is covered (27). In our study, head covering and soft pillow were present in 11.73% and 35.3% of subjects respectively. The proportion of sudden infant death syndrome cases in which infants were found with their head covered was 15.6% in the New Zealand study and 28.1% in the German study (28).

In our study, 33.4 % of mothers were under 20 years. While in the study by Blair, 24.8% of mothers in SIDS infant group vs. 15.87% in control group were under 21 year (9). The rate of mothers who < 20 was higher than Blair et al. study (9).

A significant relationship was found between bed sharing and prone position and parental smoking. Thus, parental smoking was more bed shared and their infants more used prone position. Based on the study results by Scragg, infant bed sharing is associated with a significantly raised risk of the sudden infant death syndrome, particularly among infants of mothers who smoke (5). In our study, Bed sharing was associated with head covering that can raise the SIDS risk. Also, breastfeeding was associated with bed sharing in infant under age 4. According to several literatures, breastfeeding was associated with bed-sharing (20, 21, 29). Our study showed with increasing maternal education, smoking and prone

position were less. Also mothers less than 20 years were more co –slept and prone position were more in infants mothers under 20 years. Housekeeper mothers were more co slept. Between bed sharing and prone position was found negative significant relationship, thus, in bed sharing was less prone position between bed sharing and soft pillow and co-sleeping and soft pillow was not significant relationship.

### **Conclusion**

This study showed, most common risk factors were co-sleeping and bed-sharing. Hence, controlling these risk factors is necessary. On the basis of this study, SIDS risk factors were common during child care in Iran. This study showed most risk factors were associated with parental education level and maternal age. Hence, with using of this study, we can prevention of SIDS through enhancing level of parental awareness by education. Moreover, since risk factors of SIDS are association with each other, by controlling of each symptom can be controlling of another symptoms. Further studies to identify risk factors and incidence of SIDS in different regions country are recommended.

### **Abbreviation**

Sudden Infant Death Syndrome (SIDS), Low Birth Weight (LBW), Gram (g), Number (N), Percent (%).

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### **Conflict of Interest**

The authors declare no conflict of interest.

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