Impact of Sudden Infant Death Syndrome Risk Reduction Guidelines on Mothers' Knowledge and Practices and their Infants' Outcome

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Abstract

Background: Sudden Infant Death Syndrome (SIDS) is a challenge for pediatric nurses in the counseling and future management of possible risks. Since there is presently no known technique to ensure protection from SIDS, reducing recognized risk factors is the most effective way to define its prevention. **Aim:** This study aimed to evaluate the impact of SIDS risk reduction guidelines on mothers' knowledge and practices and their infants' outcome. **Method:** A multiple-time series quasi-experimental research design was used. A convenient sample of 180 mothers was included from the Primary Health Care office in Mansoura City, Egypt. Mothers were divided equally into two groups control and study. Two data collection tools were utilized: A Structured Interview Sheet for Mothers and Infants' Outcome Follow-up Sheet. **Results:** Mothers in both groups differed statistically significantly regarding their knowledge, reported practices, and risk reduction practices total mean scores at the second, fourth, and sixth months post-intervention. Furthermore, none of the infants in the study group were exposed to SIDS in the second, fourth, and sixth months after the intervention compared to 1.1%, 1.2%, and 3.4% of them, respectively in the control group. **Conclusion:** In the study group, risk reduction guidelines positively affected mothers' knowledge, reported practices, and their infants' outcome compared to the control group. **Recommendations:** Risk reduction guidelines should be applied for mothers in all pediatric hospitals and primary health care units to decrease the risk of SIDS.

Keywords: Guidelines, Knowledge, Mothers, Practices, and Sudden Infant Death Syndrome.

Introduction

Sudden Infant Death Syndrome (SIDS) is defined by the Centers for Disease Control and Prevention (CDC) as "the sudden, unexpected death of an apparently healthy infant that occurred in the first year of life in which the cause was not apparent before investigation" (CDC, 2021). Sudden Infant Death Syndrome was often thought to be among the most mysterious medical events because there is typically no noise or sign of a struggle. However, researchers now believe that some infants who die from SIDS are thought to have brain defects or abnormalities making them vulnerable to both internal and external influences (Vaidya, Sharma & Maletha, 2023). Due to the several disorders that can coexist with SIDS, its pathophysiology is complicated and poorly understood (Vincent et al., 2023). For the pathophysiology of SIDS, a triple risk model has been developed, requiring the convergence of three risks: an external stressor (s) that may contribute to SIDS, a vulnerable infant, and a critical development stage of homeostatic regulation (Osei-Poku et al., 2023).

According to previous studies, SIDS can affect infants up to one year of age, but most deaths from the condition occur by the end of the sixth month (Moon, Carlin, Hand, Task Force on Sudden Infant Death Syndrome & the Committee on Fetus and Newborn, 2022). The majority of SIDS deaths (~90%) occur in infants between the ages of two and four months (Polavarapu et al., 2022). Males are more likely than females to die from SIDS at a ratio of 3:2 (Bach & Libert, 2022). Sudden Infant Death Syndrome is characterized by the clinical manifestation of an infant's unexpected death mostly during sleep, especially when the infant is sleeping in a recumbent position (Doğan & Yılmaz, 2023). Despite being linked to risk factors, the incidence of SIDS has declined when safe sleeping was implemented (Chang, Vivekanandarajah, Waters & Machaalani, 2023).

Risk factors can be classified as either intrinsic or extrinsic. Extrinsic risk factors are bodily stresses that increase a fragile infant's chance of homeostatic derangement or suffocation (Vaidya et al., 2023). Extrinsic factors are a major game-changer in the incidence of SIDS; for example infant unsafe sleep practices (Ouattara, Tibbits, Toure & Baccaglini, 2022). Intrinsic risk factors such as an infant's inherent vulnerability increase the chance of SIDS, in addition to extrinsic risk factors (Parks, DeSisto, Kortsmit, Bombard & Shapiro-Mendoza, 2023). Intrinsic risk factors include developmental variables such as male sex, potential genetic factors, such as familial SIDS (i.e., a recurrence of SIDS in subsequent siblings), preterm and ethnic group, or race (Vincent et al., 2023).

According to reports in the literature, several additional risk factors, such as the age of the mother, low educational level, intrauterine pathology, difficulties during childbirth, male sex, bottle feeding, exposure to cigarette smoke, high ambient temperature, stress, and the presence of an upper respiratory tract infection, have also been linked to SIDS (Doğan & Yılmaz, 2023; Parks et al., 2023). Most of the risk factors for SIDS are prevalent in developing nations, and lower socio-economic people were found to be at a higher risk (Vaidya et al. 2023). So, to lower the infant mortality rate, it is critical to comprehend how essential each of these

risk factors is in generating SIDS, identify the majority of risk elements connected with SIDS, and describe several means of prevention and intervention (Osei-Poku et al., 2023).

The American Academy of Pediatrics (AAP) publishes guidelines to lower the risk of SIDS, protect infants, raise parents' awareness, provide routine prenatal care for expectant mothers, dispel myths, and create safe sleep environments. These guidelines are essential in lowering and preventing the risk of SIDS, but there is a dearth of recent data on mothers' knowledge of and compliance with these guidelines (Mohamed, Abusaad & El-Agamy, 2023). According to previous studies on SIDS, mothers are more likely to take friends' or family members' bad advice. Mothers may engage in risky behaviors related to SIDS due to cultural differences, informational gaps, or misunderstandings (Moon et al., 2022). Thus, it is critical to assess mothers' knowledge and practices regarding SIDS prevention also to reduce the risk of SIDS, mothers should get comprehensive and crucial training on SIDS prevention at hospitals and primary healthcare facilities (Doğan & Yılmaz, 2023).

Health education is essential for mothers, and nurses are in a strong position to change parents' behavior by demonstrating safe practices and following up with families during the first year of an infant's life to ensure that parents continue to use safe practices at home. There is undoubtedly a moment where the nurse and the infant's parents overlap in terms of SIDS risk reduction (Ellis et al., 2022). Finally, the recommendations from previous studies call for additional research focus on more effective educational campaigns and strategies on SIDS, because the training programs improved the mothers' knowledge of SIDS and preventive practices. Thus, regular health education from all health teams throughout the postnatal period is necessary to improve mothers' knowledge and practices about SIDS prevention (Mohamed et al., 2023).

Significance of the study

Worldwide SIDS is currently the third most common cause of infant mortality, even though it is one of the leading causes of death in the first year of life (Glinge et al., 2023). Despite this, prevention is still a struggle. According to data from 2020, there are around 38.4 deaths from SIDS for every 100,000 live births globally (Vincent et al., 2023).

Statistics on the prevalence of SIDS-related infant deaths in Egypt are not well documented (Elbilgahy Abusaad, Abd El-mouty, El-Sheikh & Fathy, 2019). Further, there are few studies on SIDS in Egypt, which contributes to the lack of understanding about SIDS even in spite of its global acknowledgment. Additionally, there is a lack of awareness and practice among Egyptian mothers in the area of SIDS prevention. In addition, there are insufficient health education initiatives about SIDS for mothers (Ibrahim, Sobeh & Zaghamir, 2023) and there have been few published research in the past 20 years on parent education for SIDS prevention, which would enhance knowledge and guide preventative measures (Parks et al., 2023). Thus, initiatives to raise awareness of SIDS are crucial to lowering its occurrence, and ongoing health education programs are necessary to enhance mothers' understanding of and adherence to SIDS prevention strategies (Vaidya et al., 2023).

Moreover, to our knowledge, SIDS research seems to have lost its way, there is very little information about SIDS from mothers, and only a few studies in Egypt have explored mothers' knowledge and practices about SIDS. The researchers can only hope that with increased maternal knowledge and practices, this may be able to reduce the incidence of SIDS, which may never be eliminated. Therefore, the researchers hope that this article will be seen as constructive research that sheds light on these neglected areas and encourages new thinking, ultimately influencing future SIDS research toward a more productive path and outcome.

Aim of the study

The current study aimed to evaluate the impact of SIDS risk reduction guidelines on mothers' knowledge and practices and their infants' outcome.

Research hypotheses

H1: Mothers who receive the risk reduction guidelines are expected to have higher knowledge and reported practices mean scores than mothers in the control group.

H2: Infants of mothers who receive the risk reduction guidelines are expected to have no SIDS than infants in the control group.

Operational definition

Infants' outcome: It refers to the assessment of infants' mortality (infants' exposure to SIDS) in the second, fourth, and sixth months of their life.

Method

Research design

A multiple-time series quasi-experimental research design was used. Multiple time-series design is used to study changes in variables over time and analyzing the data to identify patterns or changes in the variable of interest. It might also be used to assess a program's effectiveness over time (before and after the implementation of a program) (Handley, Lyles, McCulloch & Cattamanchi, 2018).

Setting

The current study was carried out in the Primary Health Care (PHC) office in Mansoura City, Dakahlia Governorate, Egypt. The PHC office provides multiple basic and essential services. These include health education, child and maternal health care, screening and early detection of diseases, birth and death registration, and expanded programs on immunization. It offers services for infants and children daily except Fridays from 9 am to 2 pm.

Recruitment and eligibility

Mothers and their infants over seven months from September 2023 to March 2024 were assessed before, and at the second, fourth, and sixth months. Mothers of infants were eligible for inclusion in this study regardless of their characteristics if they met the following **inclusion criteria:** must be the primary caregiver of their infants at home, available at the period of data collection and reachable by phone, had an infant whose gestational age was >37 weeks, had an infant aged from birth to less than two months. **The exclusion criteria** were infants who had any congenital / genetic abnormalities, chronic or critical illnesses, infant who was admitted to neonatal intensive care unit for any reason, low birth weight infants, preterm infants, and mothers who had previously attended any educational sessions related to SIDS.

Sample

The study included a purposive sample of 180 mothers and their infants who attended the above-mentioned setting for immunization or screening during the data collection period.

Randomization and allocation

The two equal study groups (control, SIDS risk reduction guidelines intervention) were randomly allocated to the study participants. In each group, there were 90 mothers and their infants. The first 90 mothers and their infants were assigned to the control group. The second 90 mothers and their infants were recruited to intervention group. Matching between the two groups' characteristics was not significant at the beginning of the study.

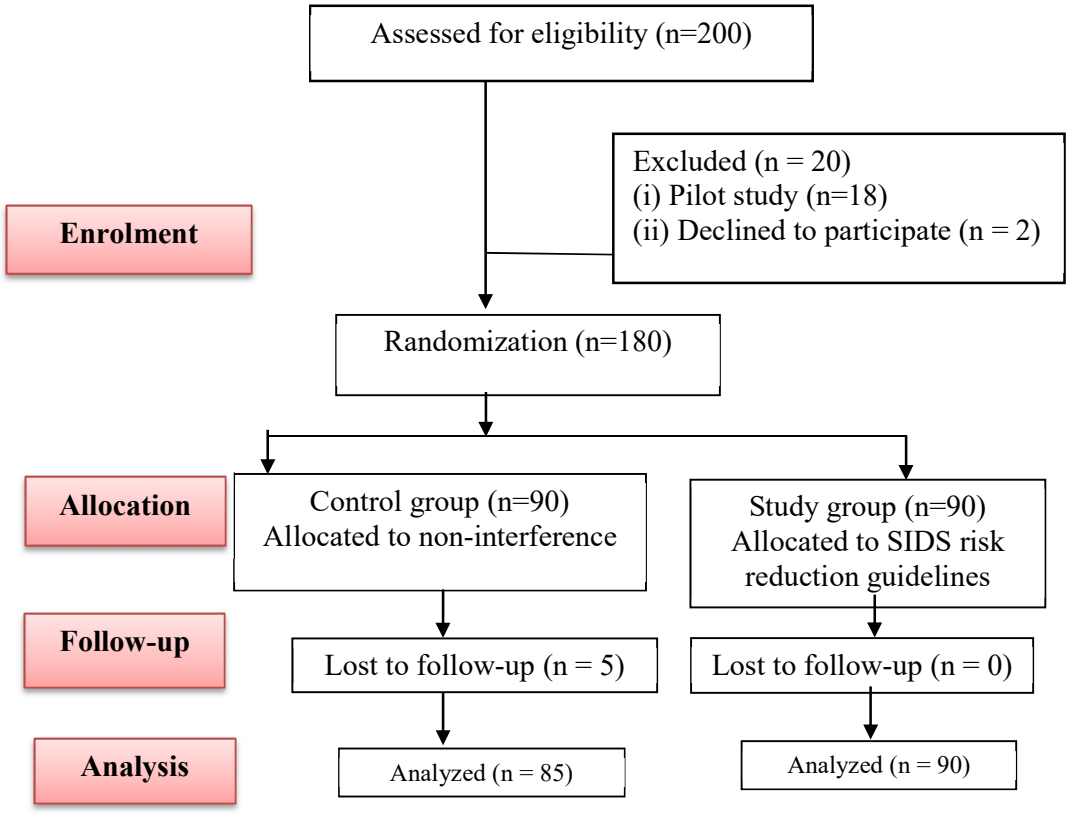


Fig. 1: The process of the study according to the CONSORT Flow diagram

Data collection tools

Tool (1): A Structured Interview Sheet for Mothers: It was developed by the research investigators in simple Arabic language to fit the sample measures and it included questions categorized under six main parts:

Part I: Mothers' Personal Data such as age, level of education, residence, occupation, mode of delivery, type of family, and previous SIDS.

Part II: Infants' Characteristics such as age, gender, season of birth, birth weight, method of feeding, and birth order.

Part III: Sudden Infant Death Risk Factors Identification Sheet: It was made up of questions assessing the subsequent: Sleep position, infant's bedding, sharing a room or a bed with the infant, using a pillow or bumper pads on the infant's bed, covering the infant's face during sleep, using a sleeping bag for the infant, leaving a toy on the infant's bed, placing a toy or blanket on the infant's bed, breastfeeding status, average number of breastfeeding sessions during the day and night, breastfeeding place during the night, placing the infant in his/her bed after breastfeeding during the night, bringing infant to the mother's bed to comfort the infant when cried, placing the infant in his/her bed after comforting him/her, using a pacifier, exposure to smoking, and measuring infant's room temperature.

Part IV: Mothers' Knowledge regarding SIDS: Eight multiple-choice questions were included to assess mothers' knowledge about SIDS such as definition, causes, average age of SIDS, risk factors, signs of infant overheating, ways to prevent infant overheating, ways to prevent infant exposure to smoking, and recommended guidelines that must be followed to prevent SIDS.

Scoring system

Concerning mothers' knowledge, responses were graded according to the following scale: (two grades) for a complete correct response, (one grade) for a correct incomplete response, and (zero) for a wrong response or don't know. Mothers were regarded as having satisfactory knowledge if their percent score was greater than 60% of the total score or unsatisfactory if it was 60% or less.

Part V: Mothers' Reported Practices about SIDS: It was divided into eight domains using the done or not done format to assess mothers' reported practices about sleeping place (3 items), crib characteristics (7 items), sleep position (5 items), room temperature (5 items), smoking (4 items), pacifier (7 items), feeding (3 items), and vaccinations (1 item).

Scoring system

Mothers' reported practices were given a score of one for done practice and zero for not done practice. When the percent score was less than 75% of the overall score, the practices of mothers were deemed incompetent, and when it was greater than 75% of the entire score, they were deemed competent.

Part VI: Mothers' Risk Reduction Practices about SIDS: The research investigators utilized the guidance of the AAP's latest SIDS prevention recommendations and guidelines (APA, 2016). This part consisted of closed-ended and multiple-choice questions. It included items related to recommendations for infant sleep positioning, sleep environment, bed sharing, crib features,

guidelines for maintaining the infant's temperature and his area, smoke exposure prevention, use of pacifiers, feeding (exclusive breastfeeding), and vaccinations.

Scoring system

Mothers' risk reduction practices were given a score of one for a correct response and zero for a wrong response or don't know. When the percent score was 60% or less of the overall score, the practices were considered incompetent; when it was more than 60%, they were considered competent.

Tool (2): Infants' Outcome Follow-up Sheet: It was developed by the research investigators to assess infants' mortality. It included recording of the infants' exposure to SIDS in the first six months of their life.

Validity and reliability

The data collection tools were distributed to three experts in the field of Pediatric Nursing at the Faculty of Nursing, Mansoura University, to verify their content validity. The tools were modified after the experts evaluated the arrangement of the items, their suitability, and the clarity of the sentence. The reliability of the tools was also statistically assessed to verify their internal consistency. The Cronbach's alpha values for mothers' knowledge, reported practices and risk reduction practices were 0.903, 0.893, and 0.897, respectively.

Pilot study

To ensure the study tools' understandability, practicality, and potential data collection issues, a pilot study was conducted on 18 mothers, representing 10% of the main study sample. This pilot allowed for tools' adjustments and refinement. The pilot participants were excluded from the main study sample.

Ethical consideration

An ethical approval was granted from the Research Ethical Committee at the Faculty of Nursing, Mansoura University (Ref No. P. 0516). Official permission was obtained from the director of the PHC office after a thorough explanation of the study's nature, aim, and anticipated outcomes. Before commencing the study, mothers offered formal written consent for their participation following a full explanation of the benefits, procedure, and nature of the study. The study's participants were given the assurance that their participation was entirely voluntary, all information gathered would be treated with the utmost confidentiality, and they could withdraw from the study at any time without any responsibilities.

Procedure

Four key phases, detailed below, structured the study's procedure.

1. Assessment phase:

During the screening or immunization visits in the waiting area, the researcher contacted the mothers of infants who met the inclusion criteria to inform them about the study's nature and goals and obtain their consent to participate. In addition, the researcher recorded the mothers' phone numbers in both groups for future reference. After mothers consented to participate in the study, the researcher allocated them into control and intervention groups as mentioned earlier. The researcher attended the study setting from 9 am to 2 pm, three days per week (Saturdays, Mondays, and Thursdays), to collect the necessary data. The researcher started by introducing herself to all mothers. Each mother in both groups was interviewed individually to

document their personal data, their infants' characteristics, and sudden infant death risk factors, as well as to assess their pre-test SIDS knowledge, reported practices, and risk reduction practices. It took approximately 20 - 30 minutes (tool 1).

2. Planning phase:

The researchers designed a simple, colored Arabic SIDS risk reduction guidelines training manual according to the AAP's (2016) recommendations, the related literature, and based on the findings of the pre-test to address the needs of mothers regarding the prevention of SIDS. It focused on general preventive measures such as safe sleep practices, avoidance of infant's overheating, avoidance of smoking around the infant, prevention of infection, breastfeeding, non-nutritive sucking with the use of a pacifier during sleep, and infants' vaccinations. The researchers planned an orientation session and two sessions to cover the content of the SIDS risk reduction guidelines training manual. The orientation session presented a brief overview of the study. The two sessions included an overview of SIDS, its definition, the average age of SIDS, its risk factors and causes. The third one contained the recommended guidelines that must be followed to prevent SIDS. Moreover, during sessions' planning, the researchers took into account the following:

Sessions' estimated time: The time required for conducting each session was 45 minutes.

Sessions' general and specific objectives: Session's objectives were mentioned clearly for mothers before conducting the session.

3. Teaching methods and materials:

The researcher addressed a variety of teaching materials and methods to address the sessions' content more comprehensively considering the attention span of mothers, such as PowerPoint presentations via the researcher's personal laptop, interactive group discussions, brainstorming, printed colored booklets, handouts and brochures, and audiovisual materials.

4. Implementation phase:

The study started with mothers in the control group who didn't receive any intervention. For mothers in the control group, the researcher interviewed them three times at the 2^{nd}, 4^{th}, and 6^{th} months to assess their knowledge, reported practices, and risk reduction practices (tool 1 parts IV, V, and VI) and note the absence of any mother, and if this happens, the researcher contacts her to find out the reason for the absence. The researcher highlighted that in the second month, one of the mothers in the control group did not attend and when the researcher contacted her, she informed her that her infant had been exposed to SIDS, and thus the number of mothers in the control group became (89). The same situation occurred in the fourth month for another mother, so the number of mothers became (88). With great sadness and sorrow for the researcher, the same situation was repeated with three mothers in the sixth month when their infants were exposed to SIDS so the number of mothers became (85). The researcher recorded the infant's exposure to SIDS (incidence of SIDS) using the tool (2).

For mothers in the study group, the researcher divided them into smaller groups of three to five mothers depending on their availability. The session started

after the mothers had finished their infant vaccinations in the waiting area of the PHC office. During the orientation session, the researcher presented a brief overview of the study to introduce the mothers to the intervention's significance. Each mother was given the SIDS risk reduction guidelines training manual to encourage them to follow up after the session and provide them with a resource to review the content at home as necessary.

- **Sessions' delivery:** Several educational activities using various teaching methods and materials were included in the second and third sessions delivery, as follows:
- At the beginning of each session, the researcher introduced the session's title to the mothers (two minutes).
- The researcher asked mothers: what do you know about the session's topic?
- The time allowed for brainstorming is three minutes, and then allowed each mother to list her ideas (five minutes).
- Then the researcher introduced a simple lecture about SIDS according to each session (twenty five minutes).
- At the end of each session, the researcher summarized what was given in the session and conducted an interactive group discussion to receive the mothers' feedback about what was given in the session (ten minutes).

The researcher highlighted the presence of all mothers in the study group with their infants during the data collection period and according to their infants' vaccination schedules.

5. **Evaluation phase:**

The researcher assessed mothers in the study group three times at the 2nd, 4th, and 6th months after the intervention to assess the impact of the risk reduction guidelines and each time the assessment consisted of a half-hour with each mother to assess mothers' post-test levels of knowledge, reported practices and risk reduction practices (tool 1, parts IV, V, and VI, respectively). Furthermore, the researcher recorded infants' incidence of SIDS using the tool (2). Comparisons were made between the two groups.

Statistical analysis

All statistical analyses were performed using SPSS for Windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and expressed as mean ± standard deviation (SD). Categorical data were expressed as numbers and percentages. The chi-square test (or Fisher's exact test when appropriate) was used to compare variables with categorical data. Reliability (internal consistency) testing was calculated for the tools used in the study. Statistical significance was set at $p \leq 0.05$.

Results

Table 1 shows the homogeneity of the studied mothers and the matching between the control and study groups. In addition, there were no statistically significant differences between the two groups for mothers' personal data ($p>0.05$). Moreover, (10.0%) of the mothers in the control group and (6.7%) of them in the study group had previously experienced SIDS.

Table 2 displays that there were no statistically significant differences between the two groups regarding their characteristics ($p>0.05$) indicating the homogeneity of the studied infants and the matching between both groups.

Table 3 reveals that, except for the time spent using a pacifier, there were no statistically significant differences between the two groups regarding all SIDS risk factors before the intervention (p>0.05).

As seen in Figure 1, there was no statistically significant difference between the two groups' pretest scores for mothers' level of satisfactory knowledge of SIDS (p= 0.305). However, concerning mothers' level of satisfactory knowledge at the second, fourth, and sixth months post-intervention, there were statistically significant differences between the two groups (p < 0.001). The same figure illustrates that, at 2nd, 4th & 6th months post-intervention, 82.2%, 91.1%, and 87.8% of mothers in the study group had high level of satisfactory knowledge, compared to 5.6%, 8.9%, and 8.9% of those in the control group.

According to Table 4, there was no statistically significant difference between the two groups regarding their mean total knowledge scores before the intervention (p= 0.427). However, there were significant improvements in the mean total knowledge scores of the study group at the second, fourth and sixth months after the intervention (23.1±6.7, 24.5±5.8 and 23.2±6.6, respectively) compared to the control group (12.4±5.4, 12.9±5.7 and 13.5±6.0, respectively) with a statistically significant difference between the two groups (p<0.001).

Figure 2 highlights that 10.0% of mothers in the control group compared to 6.7% in the study group had competent reported practices before the intervention with no statistically significant difference between the two groups (p = 0.418), while statistically significant differences were found between the two groups at the 2nd, 4th & 6th months after the intervention (p < 0.001). Also, (86.7%, 92.9% & 94.4, respectively) of mothers in the study group had competent reported practices after the intervention implementation compared to (12.2%, 18.9% & 22.2%, respectively) in the control group.

Table 5 shows that there was no statistically significant difference between the two groups regarding their mean total reported practices scores before the intervention (p = 0.213). However, there were significant improvements in the mean total reported practices scores of the study group at the 2nd, 4th & 6th months after the intervention (25.3 ± 5.9, 27.4 ± 3.3 and 29.8 ± 5.2, respectively) compared to those in the control group (14.1 ± 6.2, 14.3 ± 4.9 and 14.8 ± 6.3, respectively) with a statistically significant difference between the two groups (p < 0.001).

Table 6 reports that there was no statistically significant difference between the control and study groups before the intervention regarding their risk reduction practices (p= 0.600), but there was a statistically significant difference between the groups at the second, fourth and sixth months post- intervention (p < 0.001). Also, there was a significant improvement in the study group regarding the competent level of their risk reduction practices at the 2nd, 4th & 6th months post-intervention (81.1%, 87.8% and 90.0%, respectively) compared to (10.1%, 11.4% and 14.1%, respectively) of those in the control group.

Table 7 illustrates that there was no statistically significant difference between the two groups regarding their total risk reduction practices mean scores pre-intervention (p = 0.484). While there were significant improvements in the total risk

reduction practices mean scores of the study group at the 2nd, 4th, and 6th months post-intervention (31.1 ± 5.3, 33.7 ± 3.5, and 35.6 ± 5.3, respectively) compared to the control group (17.6 ± 5.1, 17.3 ± 3.9, and 17.2 ± 3.8, respectively) with a statistically significant difference between the two groups ($p < 0.001$).

Table 8 demonstrates that there was no statistically significant difference between the control and study groups regarding the incidence of SIDS, however, it was also noted that none of the infants in the study group experienced SIDS at the 2nd, 4th, and 6th months after the intervention compared to 1.1%, 1.2% and 3.4% of them in the control group, respectively.

Table 9 proves that in the study group, there were statistically significant associations between mothers' levels of knowledge, reported practices, and risk reduction practices ($p<0.001$). In addition, there were no statistically significant associations between mothers' levels of knowledge, reported practices, and risk reduction practices in the control group ($p>0.05$).

Table 10 indicates that in the study group, there was a statistically significant association between mothers' age and their risk reduction practices ($p = 0.036$). Moreover, there was a statistically significant association between mothers' educational level and their knowledge, reported practices and risk reduction practices ($p < 0.001$). There was no a statistically significant association between mothers' age and their knowledge and reported practices in both groups. Further, there were no statistically significant associations between mothers' occupation, residence, mode of delivery, type of family, and previous SIDS with their knowledge, reported practices and risk reduction practices in both groups ($p > 0.05$).

Table (1): Percentage distribution of mothers' personal data in the two groups (n = 180)

Mothers' data	Control (n=90)		Study (n=90)		Chi – Square	
	n	%	n	%	$\chi 2$	p
Age (years)						
< 20	23	25.6	21	23.3		
20 – 30	38	42.2	41	45.6	0.222	0.895
30 – 40	29	32.2	28	31.1		
Mean ±SD	28.5 ±4.5		28.6 ±4.4		0.033	0.973
Educational level						
Do not read or write	6	6.7	8	8.9		
Basic	17	18.9	13	14.4	1.198	0.754
Technical	45	50.0	43	47.8		
University	22	24.4	26	28.9		
Occupation						
Working	43	47.8	48	53.3	0.556	0.456
Housewife	47	52.2	42	46.7		
Residence						
Rural	30	33.3	34	37.8	0.388	0.533
Urban	60	66.7	56	62.2		
Mode of delivery						
Normal	52	57.8	59	65.6	1.152	0.283
Cesarean section	38	42.2	31	34.4		
Type of family						
Nuclear	71	78.9	68	75.6	1.759	0.415
Extended	19	21.1	22	24.4		
Previous SIDS						
No	81	90.0	84	93.3	0.655	0.418
Yes	9	10.0	6	6.7		

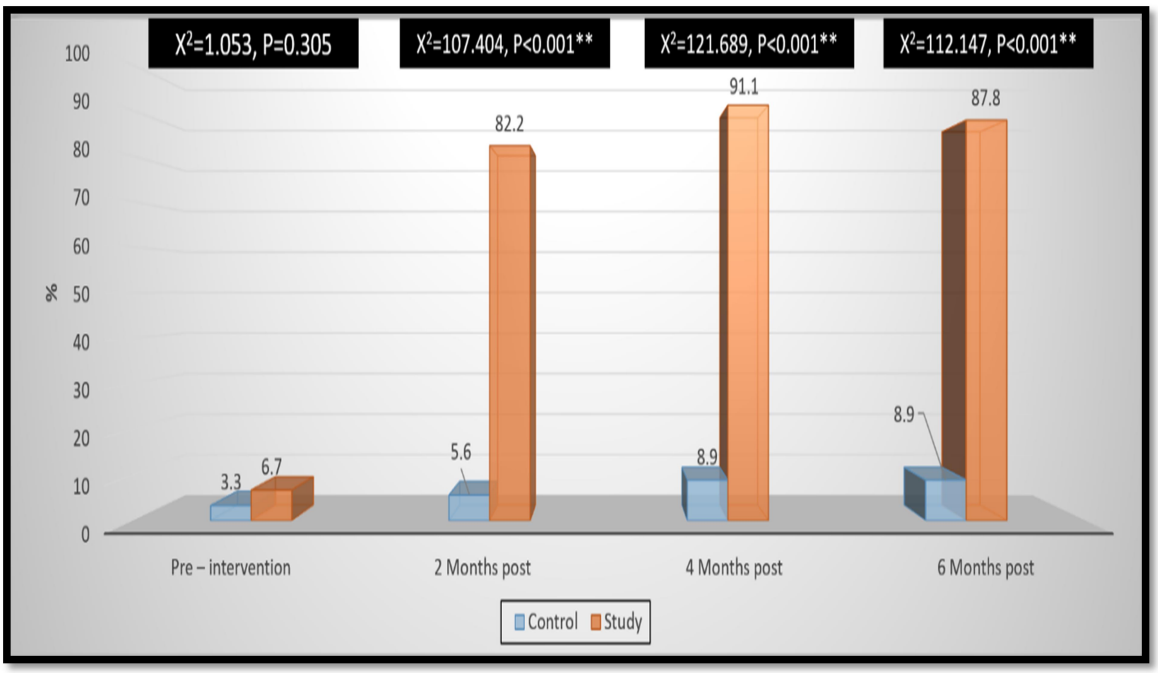
Table (2): Percentage distribution of infants' characteristics in the two groups (n = 180)

Infants' characteristics	Control (n=90)		Study (n=90)		Chi – Square	
	n	%	n	%	$\chi 2$	p
Age (days)						
1 - > 7 days	72	80.0	69	76.7	0.828	0.661
7 – 14 days	18	20.0	21	23.3		
Mean ± SD	5.61 ± 5.091		5.73 ± 5.311		0.0650	0.518
Gender						
Boy	47	52.2	41	45.6	0.800	0.371
Girl	43	47.8	49	54.4		
Weight (Kg)						
2.5 – 3.0	79	87.8	81	90.0	0.284	0.868
> 3.0	11	12.2	9	10.0		
Mean ± SD	2994.44 ± 942.495		2792.22 ± 928.824		1.224	0.096
Birth order						
First	24	26.7	17	18.9		
Second	25	27.8	31	34.4	2.32431	0.507
Third	32	35.6	30	33.3		
Fourth or more	9	10.0	12	13.3		
Season of birth						
Winter	54	60.0	48	53.3	0.814	0.367
Summer	36	40.0	42	46.7		
Method of feeding						
Breastfeeding	69	76.7	74	82.2	0.853	0.653
Bottle feeding	9	10.0	7	7.8		
Breastfeeding and Bottle feeding	12	13.3	9	10.0		

Table (3): Comparison between the two groups regarding the identification of SIDS risk factors pre- intervention (n= 180)

SIDS risk factors	Control (n=90)		Study (n=90)		Chi – Square / Fisher's exact test	
	n	%	n	%	$\chi 2$	p
Sleeping position					1.405	0.704
• Supine	18	20.0	13	14.4		
• Side-lying	22	24.4	20	22.2		
• Prone	3	3.3	4	4.4		
• Side-lying and supine	47	52.2	53	58.9		
Sharing a room with infant	90	100.0	89	98.9	1.006	0.316
Sharing a bed with infant	88	97.8	87	96.7	0.206	0.650
Using a pillow on the infant's bed	52	57.8	48	53.3	0.360	0.549
Covering the infant's face during sleep	3	3.3	5	5.6	0.523	0.469
Using a sleep bag for infant during sleep	13	14.4	15	16.7	0.169	0.681
Leaving a toy on infant's bed	19	21.1	22	24.4	0.284	0.594
Leaving a blanket on infant's bed	29	32.2	26	28.9	0.236	0.627
Placing the infant in his/her bed after breastfeeding during the night	5	5.6	3	3.3	0.523	0.469
Bringing the infant to the mother's bed to comfort him/her when cried	88	97.8	89	98.9	0.339	0.560
Placing the infant on his/her own bed after comforting him/her	5	5.6	2	2.2	1.338	0.247
Using a pacifier for the infant	19	21.1	23	25.6	0.497	0.481
If yes, when do you use it?					6.469	0.039*
- During sleep only	3	15.8	1	4.3		
- During wake only	5	26.3	1	4.3		
- All the time	11	57.9	21	91.3		
Number of smokers in home	53	58.9	59	65.6	0.851	0.356

(*) statistical significant at $p \leq 0.05$



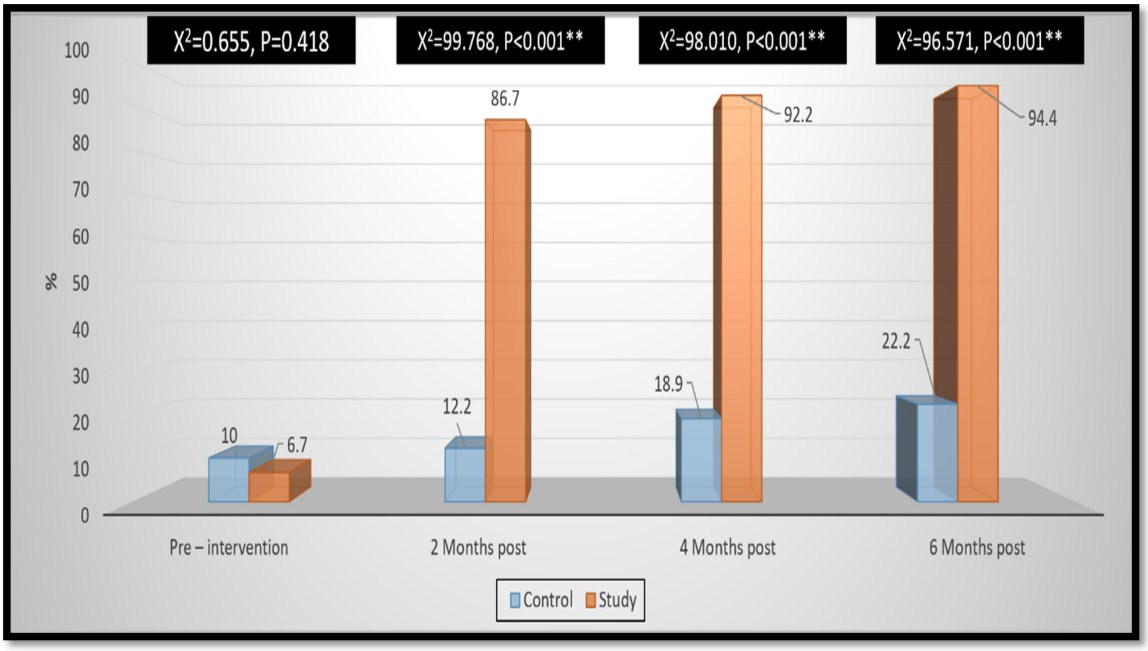
$\chi 2$ = Chi – Square / Fisher's exact test, (*) statistically significant at $p \leq 0.05$

Figure (1): Comparison between mothers' satisfactory knowledge about SIDS in both groups in pre and post intervention

Table (4): Total means scores of mothers' knowledge about SIDS in both groups pre and post- intervention

Mothers' knowledge	Control	Study	Student's T – Test	
	Mean ±SD	Mean ±SD	T	p
Pre – intervention	12.8 ±5.1	13.5 ±5.3	0.796	0.427
2 months post intervention	12.4 ±5.4	23.1 ±6.7	11.713	<0.001**
4 months post intervention	12.9 ±5.7	24.5 ±5.8	13.385	<0.001**
6 months post intervention	13.5 ±6.0	23.2 ±6.6	10.287	<0.001**

(**) statistical significant at $p \leq 0.05$



χ2 = Chi – Square / Fisher's exact test, (*) statistically significant at $p \leq 0.05$

Figure` (2): Comparison between mothers' SIDS competent reported practices in both groups in pre and post intervention

Table (5): Total means scores of mothers' SIDS reported practices in both groups pre and post-intervention

Mothers' reported practices	Control	Study	Student's T – Test	
	Mean ±SD	Mean ±SD	T	p
Pre – intervention	14.0 ±5.1	14.8 ±3.3	1.249	0.213
2 Months post intervention	14.1 ±6.2	25.3 ±5.9	12.414	<0.001**
4 Months post intervention	14.3 ±4.9	27.4 ±3.3	21.036	<0.001**
6 Months post intervention	14.8 ±6.3	29.8 ±5.2	17.420	<0.001**

(**) statistical significant at $p \leq 0.05$

Table (6): Comparison between mothers' SIDS risk reduction practices of both groups in pre and post-intervention

Mothers' risk reduction practices	Control		Study		Chi – Square	
	n	%	n	%	$\chi 2$	p
Pre – intervention	**(n = 90)**		**(n = 90)**			
Incompetent	83	92.2	81	90.0	0.274	0.600
Competent	7	7.8	9	10.0		
2 months post intervention	**(n = 89)**		**(n = 90)**			
Incompetent	80	89.9	17	18.9	88.737	<0.001**
Competent	9	10.1	73	81.1		
4 months post intervention	**(n = 88)**		**(n = 90)**			
Incompetent	78	88.6	11	12.2	99.768	<0.001**
Competent	10	11.4	79	87.8		
6 months post intervention	**(n = 85)**		**(n = 90)**			
Incompetent	73	85.9	9	10.0	105.918	<0.001**
Competent	12	14.1	81	90.0		

(**) statistical significant at $p \leq 0.05$

Table (7): Total means scores of mothers' SIDS risk reduction practices in both groups pre and post-intervention

Mothers' risk reduction practices	Control	Study	Student's T – Test	
	Mean ±SD	Mean ±SD	T	p
Pre – intervention	17.2 ±4.3	17.6 ±3.3	0.700	0.484
2 months post intervention	17.6 ±5.1	31.1 ±5.3	17.412	<0.001**
4 months post intervention	17.3 ±3.9	33.7 ±3.5	29.690	<0.001**
6 months post intervention	17.2 ±3.8	35.6 ±5.3	26.766	<0.001**

(**) statistical significant at $p \leq 0.05$

Table (8): Comparison of infants' outcome in both groups regarding the incidence of SIDS pre and post-intervention

Infant's outcome	Control		Study		Fisher's exact test	
	n	%	n	%	$\chi 2$	p
Pre-intervention	**(n = 90)**		**(n = 90)**			
Yes	9	10.0	6	6.7	0.654	0.418
No	81	90.0	84	93.3		
2 months post intervention	**(n = 90)**		**(n = 90)**			
Yes	1	1.1	0	0.0	1.005	0.315
No	89	98.9	90	100.0		
4 months post intervention	**(n = 89)**		**(n = 90)**			
Yes	1	1.2	0	0.0	1.005	0.315
No	88	98.8	90	100.0		
6 months post intervention	**(n = 88)**		**(n = 90)**			
Yes	3	3.4	0	0.0	3.050	0.080
No	85	96.6	90	100.0		

Table (9): Association between the mothers' SIDS knowledge, reported practices and risk reduction practices in both groups

	Mothers' knowledge			
	Control		Study	
	Fisher's exact test		Fisher's exact test	
	$\chi 2$	p	$\chi 2$	p
Mothers' reported practices	1.186	0.276	38.021	<0.001**
Mothers' risk reduction practices	0.005	0.942	40.058	<0.001**

(**) statistical significant at $p \leq 0.05$

Table (10): Association between the mothers' personal data and their SIDS knowledge, reported practices and risk reduction practices in both groups

	Knowledge				Reported practices				Risk reduction practices			
	Fisher's exact test				Fisher's exact test				Fisher's exact test			
	Control		Study		Control		Study		Control		Study	
	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p
Age	3.966	0.138	3.534	0.171	0.419	0.811	4.019	0.134	0.592	0.744	6.673	0.036 **
Educational level	2.845	0.416	28.936	<0.001**	3.092	0.378	34.290	<0.001**	4.718	0.194	32.673	<0.001**
Occupation	0.372	0.542	0.313	0.576	1.683	0.195	1.513	0.219	0.618	0.432	0.020	0.888
Residence	0.274	0.600	1.499	0.221	3.214	0.073	0.011	0.916	0.433	0.511	0.084	0.772
Mode of delivery	1.683	0.195	1.468	0.226	1.721	0.190	0.072	0.788	0.343	0.558	1.974	0.160
Type of family	1.076	0.584	2.039	0.361	0.850	0.654	0.227	0.893	0.684	0.710	0.915	0.633
Previous SIDS	0.061	0.805	0.118	0.731	0.714	0.398	1.513	0.219	1.538	0.215	0.714	0.398

(**) statistical significant at $p \leq 0.05$

Discussion

Sudden Infant Death Syndrome poses a challenge for pediatric nurses in counseling and managing potential future risks to other family members. To date, the inability to identify infants at risk for SIDS has hampered its prevention. While there is currently nothing that can guarantee protection from SIDS, the most effective way to prevent SIDS described so far is by reducing known environmental risk factors, so the focus should remain on implementing measures that have already been shown to prevent SIDS. Therefore, it is important to educate mothers about recent preventive practices as recommended by the AAP to reduce the risk of SIDS and prevent its occurrence. Therefore, the present study was conducted to evaluate the impact of SIDS risk reduction guidelines on mothers' knowledge, practices, and their infants' outcome.

In the current study, one tenth of mothers in the control group and less than one tenth of them in the study group had previously experienced SIDS. These findings are congruent with a study by Elbilgahy et al., (2019) in Egypt, which examined the effect of a safe sleep intervention program on the prevention of SIDS and discovered that most of mothers reported having no previous experience with SIDS. When comparing the risk of SIDS among siblings of children who died from SIDS to that of the general pediatric population, Glinge et al.'s (2023) nationwide study in Denmark found that having a sibling who died from SIDS was linked to 4-fold increased risk of SIDS. Furthermore, Hajian, Tabasizadeh, Mohamadi, Daliri & Moayyed, (2024) study results revealed that most mothers had no prior history of SIDS. Ali's (2020) research on risk factor promotion and SIDS prevention found that less than two-thirds of mothers in Najran City had no family history of SIDS.

To date, it is not possible to predict which infants are at risk for SIDS. Environmental factors may be risk factors in a genetically susceptible infant. Because shared genetic and/or environmental factors may contribute to the observed clustering of SIDS, the researchers have pointed out the importance of a family history of SIDS when assessing SIDS risk. In addition, identifying infants at risk of SIDS and preventing additional SIDS within families will be impacted by the association between a family history of SIDS and subsequent SIDS.

The results of the current study showed that before the intervention, there were no statistically significant differences between the two groups regarding all SIDS risk factors except for the time of pacifier use. As shown from the study results a higher percentage of mothers in both groups placed their infants in a side or prone position while sleeping, slept in the same room and bed with the infant, used a pillow for the infant while sleeping, left a toy and/or a blanket on the infant's bed, and had smokers in their homes. It was found that the mothers studied had some risky practices, especially regarding the use of a soft bed, sleeping positions, pillow use, and bed sharing, which require the implementation of risk reduction guidelines to enhance the level of mothers' awareness about safe sleep. In addition, to prevent SIDS, it is necessary to eliminate or change the aforementioned modifiable risk factors.

Similarly, Pease, Blair, Ingram & Fleming, (2018) compared participants with infants at a "higher" risk of SIDS with those at a "lower" risk to examine mothers' attitudes toward safer sleep practices and their knowledge of lowering the risks for SIDS via a cross-sectional survey of 400 mothers

was conducted in health visitor-led baby clinics in underprivileged areas of Bristol, UK. They reported that twelve percent of mothers were deemed to be at high risk. Mothers in the high-risk group, in addition to being less likely to breastfeed, were less able to name two or more unprompted correct SIDS risk reduction strategies, and scored lower on prompted safer sleep scenarios overall. Despite 25 years of campaigns, more than half of all mothers surveyed (less than one-third of those in the higher-risk group) identified infant sleep positioning as a strategy for reducing SIDS risk.

One of the most important modifiable factors for a safe sleep environment is keeping the infant in the supine position during all sleep periods. In this study, before the intervention, only a small percentage of the studied mothers in both groups placed their infants in the supine position. Likewise, Sankari et al., (2023) discovered that less than two thirds of the mothers who took part in a cross-sectional survey in Saudi Arabia to assess their SIDS awareness level placed their infants in a supine position while sleep. Before health education, the majority of mothers occasionally placed their infant in a supine posture, according to a study conducted in Egypt by El-deen, Bahgat, Awny & Sharshour, in 2021 to evaluate the effect of educational intervention based on the Health Belief Model on SIDS prevention.

Alanezi, Almusalam & Afify, (2023) reached the same result in their cross-sectional study to examine the knowledge and awareness of SIDS and its associated risk factors among Saudi mothers attending well-baby clinics in Saudi Arabia, reported that more than one-quarter of mothers had the knowledge and practice of the correct behavior for placing their infants to sleep on their back. The current study's findings were consistent with Yildiz's (2021) descriptive study, which included 204 mothers of infants aged 0 to 1 year who visited family health centers to determine their safe sleeping practices. Yildiz's study revealed that more than two-fifth of the mothers placed their infant to sleep in a non-supine position.

Similarly, Cole, Young, Kearney & Thompson, (2020) found that more than one-third of infants slept in a non-supine sleep position at some point during a cross-sectional survey of 3341 primary caregivers in Queensland with infants aged around 3 months. The survey's aim was to describe the contemporary infant care practices used by families in relation to the current public health SIDS prevention program.

In line with Erdoğan &Turan, (2018) who conducted a Turkish study aimed at identifying the risky behaviors of mothers that may put their infants at risk for SIDS and found that more than three-quarters of the mothers put their infants in bed in a non-supine position. According to Özbörü Aşkan, Keskindemirci, Kılıç & Gökçay, (2018) pilot study in Turkey to evaluate of sleep safety in infants and mentioned that more than one-quarter of the infants slept in a supine position. Doğan & Yılmaz, (2023) stated that more than half of mothers placed their infants on a side-sleep position. From the researchers' perspective, the high rate of laying infants in the non-supine position (prone and lateral) may be owing to mothers thinking that the prone position causes infants' comfort and aspiration, the recommendation of the lateral position by health personnel, and the lack of educational programs regarding the safe sleeping position for infants.

It has been reported in the literature that the risk of SIDS is increased when the infant sleeps on a soft bed because of the possibility of choking, compression, and prone positioning. In addition, it has been

noted that pillows, quilts, and other soft materials are dangerous when placed under the infant or left in the sleeping area, and most sleep-related infant deaths result from suffocation involving pillows, quilts, and other materials. In terms of a safe sleeping environment, it is recommended that soft objects such as blankets, pillows, and toys not be kept in the sleeping area due to the risk of infant's entrapment and suffocation (Hajian et al., 2024; Vincent et al., 2023; Moon et al., 2022).

In the current study, a high percentage of mothers used soft beds. Yildiz, (2021) reported that more than two-thirds of mothers used soft beds, three-quarters of them used pillows and about a quarter of mothers put items such as cheesecloths and toys in the infant's bed. El-deen et al., (2021) declared that more than half of mothers occasionally used firm sleep surfaces and more than one-third of them never avoided using bed toys with the infant while they slept. Erdoğan & Turan, (2018) mentioned that half of mothers put their infants to sleep in a soft bed, and more than half of them used a soft mattress. According to Doğan & Yılmaz (2023), more than half of mothers used pillows for their infants, while more than two-thirds of them utilized soft bedding.

According to Sankari et al., (2023), the majority of mothers used a soft mattress cover in their infant's beds, and about more than one-third of them used a duvet for bedding in the summer and nearly two thirds in the winter. Similarly, Cole et al., (2020), nearly two-fifth of infants slept on soft surfaces, with bulky bedding, or with soft items. The researchers think these findings in our study and the literature may be due to mothers' belief that using soft beds provides more comfort for the infant and the mothers' lack of sufficient information about the risks of using soft beds. Moreover, mothers may place materials such as blankets and pillows on the bed to prevent the infant from becoming uncomfortable or falling out of bed.

Furthermore, according to Alanezi et al., (2023), one third and less than one-quarter of the study participants did not cover the infant's head with a quilt and did not use a head cap, respectively. To examine primary infant caregiver awareness of the current national public health safe sleep messages and the relationships between awareness and care practices, Cole et al., (2021) conducted a cross-sectional survey in Queensland, Australia, and mentioned that more than one-quarter of caregivers employed practices that could increase the risk of face or head covering. Yildiz, (2021), reported that less than one-quarter of the mothers covered their infants' heads or faces while sleeping. Because of the possibility of overheating, hypoxia, or rebreathing expired air, covering the head or face during sleep may be risky. From the researchers' point of view, the practice of covering the face of the infant is considered a traditional practice in some cultures to protect babies from surrounding hazards.

In the current study, it was determined that most of the studied mothers in both groups shared a bed with their infants. Due to factors like overheating, rebreathing of air, obstruction of the airway, covering the infant's head, and exposure to cigarette smoke, SIDS caused by bed-sharing in high-risk sleep situations (sofa, armchair, etc.) has been claimed to have increased by 2.8 times in recent years (Hajian et al., 2024). It has been suggested that sharing a room rather than a bed reduces the risk of SIDS by fifty percent (Moon, 2016). The high percentage of room sharing in the current study is a positive finding and we recommend that this practice should be supported.

In previous studies, Yildiz, (2021) revealed that only one-tenth of mothers shared a bed with their infant, and the vast majority of them stated that they slept in the same room. El-deen et al., (2021) indicated that nearly two-fifth of mothers shared a bed and room with their infants whereas more than half of them sometimes shared a room without bed-sharing. Similar to our study, Alanezi et al., (2023) pointed that more than two-fifth of mothers did not share a bed with the infant. In a further study, Erdoğan & Turan, (2018) found that more than one-quarter of mothers shared a bed with their infants. According to the researchers, mothers prefer bed sharing for a variety of cultural and personal reasons, such as breastfeeding and ease of attachment.

In the current study, there was a significant rate of smoking at home as more than half of the studied mothers in both groups reported having smokers in their homes. One of the major risk factors for SIDS is smoking during pregnancy and exposure of the infant to smoking at home. This is because exposure to cigarette smoke negatively affects the infant's stimulation and increases the risk of low birth weight and preterm birth, which are considered risk factors for SIDS (Hajian et al., 2024; Vincent et al., 2023; Moon et al., 2022).

According to Mohamed et al.'s (2021) assessment of mothers' knowledge and practices on SIDS prevention in Egypt, nearly half of the mothers reported that there is smoking in their homes, which is consistent with earlier research. In addition, Yildiz (2021) reported that the rate of smoking at home was 39.2%. Similarly, El-deen et al., (2021) declared that nearly three-quarters of mothers were exposed to secondhand smoke around their infants. Cole et al., (2021), 14% of participants were not smoke-free. Likewise, Elbilgahy et al., (2019) stated that less than one-quarter of mothers said that their husbands smoked at home. The rate of smoking at home was found to be more than two-fifth by Erdoğan & Turan, (2018).

The current study revealed that the majority of infants in both groups were breastfed and there was a statistically significant difference in the amount of time that the two groups used pacifiers. In contrast, El-deen et al., (2021) reported that almost two-thirds of mothers never use pacifiers to their infants during bedtime. Similarly, Sankari et al., (2023) reported that more than two-thirds of mothers used pacifiers to their infants while sleeping. Alanezi et al., (2023) reported that less than one-quarter and more than one-quarter of participants utilized pacifiers and breastfeeding, respectively. Yildiz, (2021) clarified that more than two-fifth of the mothers used pacifiers while putting their infant to sleep. Cole et al., (2021) found that less than one-quarter of infants were not receiving breast milk. Elbilgahy et al., (2019) found that approximately two-thirds of infants were using the pacifier.

Breastfeeding has been reported to have a protective effect against SIDS in addition to numerous benefits for mother and infant health. Although the effect of pacifiers on breastfeeding is controversial, it has been reported to have a protective effect against SIDS because it modulates autonomic control during sleep and maintains an open airway. For safe sleep, pacifier use and continued breastfeeding are recommended. Moreover, all infants in the present study were found to be regularly vaccinated by their mothers. Studies describe that vaccinations may have a protective effect against SIDS and recommend routine vaccinations. Thus, health education can

be provided to mothers regarding the importance of regular vaccinations.

The AAP recommends a safe sleep environment to reduce the risk of all sleep-related deaths. This entails supine positioning, sharing a room but not a bed, using a firm, non-inclined surface, staying away from soft bedding, and avoiding overheating. Further recommendations for SIDS risk reduction include breastfeeding; avoiding exposure to tobacco, alcohol, marijuana, opioids, and illegal drugs, receiving routine vaccinations, and using pacifiers (AAP, 2016). Updated recommendations address bed-sharing, substance use, home cardiorespiratory monitors, tummy time, cardboard box sleeping areas, non-inclined sleep surfaces, and short-term emergency sleep areas. Also, the recommendations include more data to help parents, medical professionals, and non-medical clinicians evaluate the risk of particular bed-sharing scenarios (Moon et al., 2022).

Based on the available data, it can be concluded that environmental risk factors are the most well-established risk factors. However, even though the rate of SIDS has significantly decreased as a result of addressing these environmental risk factors, SIDS is still the primary cause of mortality in the first year of life, and recent plateaus in SIDS rates indicate that other variables may be involved. According to the researchers, it's critical to comprehend the relative contributions of each of these risk factors to SIDS and identify the majority of risk factors associated with the condition and thus identify various preventative and intervention strategies that can lower infant mortality.

According to the current study's findings, before the intervention, there were no statistically significant differences between the two groups' mean scores of their total knowledge, reported practices, and risk reduction practices. In comparison to the control group, the study group's mean scores of their total knowledge, reported practices and risk reduction practices improved significantly in the second, fourth, and sixth months after the intervention, with a statistically significant difference between the two groups.

According to the researchers, the fact that most of the mothers in both groups had never heard of SIDS and had not received any health education about it during pregnancy or after delivery may have contributed to the mothers' unsatisfactory knowledge and incompetent reported practices about SIDS before the intervention. Thus, as suggested by the pre-test results, mothers must receive proper education and guidance on how to provide adequate care for their infants to prevent SIDS. Furthermore, post-intervention findings indicate the effectiveness of health education on raising mothers' levels of knowledge, reported practices, and risk reduction practices. They also confirm the ability of the mothers to remember the acquired knowledge until six months after the intervention. The current study findings support the proposed study hypothesis (1), as mothers who received the risk reduction guidelines had higher mean post-test scores of knowledge and reported practices than mothers in the control group.

In parallel, Ibrahim et al., (2023) conducted a quasi-experimental study in Egypt to assess the effectiveness of an educational program on mothers' knowledge and practices for preventing SIDS. The study revealed that before the program, more than three-quarter of mothers were unaware of SIDS and never heard about the condition. Moreover, over half of them had an unsatisfactory level of SIDS prevention practice before the training. After completing the program,

most of the mothers had sufficient knowledge and experience to avoid SIDS, the training program had a positive impact on their SIDS knowledge and preventive measures practices.

This result is consistent with El-deen et al.'s (2021) findings, which showed that, before health education, all mothers had poor knowledge about SIDS. While, all of and most of mothers had good knowledge immediately and one month after health education, respectively, with a highly significant difference (P-value 0.0001). Additionally, there was a statistically significant difference (P-value 0.0001) in the mean scores for total knowledge before, immediately after, and one month after health educations, which were 18.91±9.78, 56.05±1.56, and 49.15±2.94, respectively. In addition, the mean total practice scores changed immediately after health education compared to before, with a statistically significant difference (P-value 0.0001) and a mean of 7.72 ± 1.85. Furthermore, mothers' total practice means scores changed one month after health education compared to before, with a statistically significant difference (P-value 0.0001) and a mean of 6.73 ± 2.32.

The effectiveness of an educational program on mothers' knowledge and practices for the prevention of SIDS was also assessed in an Egyptian study by Mohamed et al., (2023) on 180 newly delivered mothers in the postnatal unit. The study found that there were statistically significant changes in the overall mothers' knowledge level before and after the program implementation, with most of mothers having good knowledge after the program compared with nearly three-quarter of mothers having poor knowledge before the program execution. Furthermore, a comparison of the total level of reported practices before and after the program's implementation revealed highly statistically significant differences. Before the program's implementation, more than two-fifth of studied mothers had an incompetent level of SIDS practice; however, following its implementation, all of them had a competent level of practice.

The same outcomes were noted in a quasi-experimental study conducted in 2023 by Doğan & Yılmaz, which assessed Turkish mothers' knowledge of SIDS and safe sleep practices. They reported that before the training, mothers had been known to engage in risky behaviors and to put their infants to sleep in unsafe sleep environments. The mothers' mean scores on the pretest, immediate posttest and follow-up one month following the training were 5.65±1.85, 9.89±0.33, and 8.95±1.07, respectively. The mothers' mean pretest, immediate posttest, and follow-up scores one month following the training showed a statistically significant difference ($p<0.05$). They also concluded that the mothers received effective training on SIDS and safe sleep practices.

Comparably, Elbilgahy et al., (2019) noted statistically significant differences in mothers' knowledge of SIDS prevention before and after program implementation. Mothers' knowledge total mean score pre-program was 13.52±3.01, but their post-program total mean score was 17.30 ± 2.47 (P-value <0.0001). Moreover, there were statistically significant differences in mothers' safe sleep reported practices before and after the program implementation. Mothers' reported practice total mean score before the program was 1.561±0.75, while it was 1.651±0.818 after the program.

To encourage pregnant mothers to adhere with SIDS prevention measures, Fraga et al., (2024) carried out a quasi-experimental study. They reported that, before the clinical session, more than half and the

majority of correct answers were obtained. After the session, there was a marked improvement, with the majority and all of them having correct answers, and the progress was statistically significant ($p<0.001$). Moreover, before the intervention, only eighteen pregnant mothers had correctly answered every question on the questionnaire. Post-intervention, forty six women completed all of the questions correctly, confirming that there was a statistically significant difference in replies between the pre-and post-sessions ($p<0.001$). Furthermore, they concluded that health education to establish measures might have a significant influence on the way that care is provided and the SIDS death rate.

In line with the current study findings, Elsobkey, (2018) found that before the implementation of health education, over half of mothers had inadequate knowledge, with a mean total score of 14.1 ± 3. Moreover, following a month of health education implementation, the majority of them showed good knowledge with a mean total score of 22.52 ± 1.09, and there was a statistically significant difference between the pre- and post-health education ($p = 0.001$). As well, only seven percent of mothers had competent reported practices before intervention. One month after the intervention, the vast majority and the majority of mothers had competent practices.

The present study findings align with those of Alzubaidi, Abdullah, Abd Hashem & Ali, (2022) descriptive cross-sectional study aimed at determining the percentage of newborns that sleep well and exploring mothers' knowledge and understanding of SIDS and related risk factors in Al Najaf Provence. They found that the findings of the assessment of the level of awareness regarding the SIDS risk factors were dismal, with more than one-quarter having no awareness, more than half having an insufficient level of awareness, and less than one-quarter having a perfect understanding. Moreover, they concluded that this knowledge gap among mothers in the community highlights the significance of implementing educational interventions and campaigns to raise public awareness of safe sleeping practices and lower other risk factors for SIDS.

Furthermore, according to Ali (2020), over two-thirds of mothers had better knowledge after the program than they had before, particularly about the elements of avoiding co-bedding, overheating, prenatal care, avoiding smoking, and placing infants in the supine position. Compared to before the program, the majority of the mothers had sufficient knowledge about SIDS risk factors and prevention strategies. At $P=0.01$, the difference was very statistically significant. From this point forward, the results of this study would help us promote SIDS and control these risk factors by raising mothers' awareness levels through education.

The results of this study showed that post-intervention, none of the infants in the study group were exposed to SIDS at the 2^{nd}, $4t^{h}$, and 6^{th} months compared to one, one, and three infants, respectively, in the control group with no statistically significant difference between both groups. The researchers stepped up their efforts to identify risk factors and convert them into risk reduction guidelines for mothers. In response to associations between SIDS and risk factors, mother-educational initiatives were successfully implemented, and the SIDS rate dropped dramatically from five cases in the control group to none in the study group. The results of the current study substantiated study hypothesis (2) that infants whose mothers received risk

reduction guidelines did not experience SIDS than those in the control group.

From the researchers' perspective, low levels of satisfactory knowledge and competent practices particularly risk reduction practices were the cause of SIDS in both groups. It's also possible that a lack of educational interventions on SIDS prevention during pregnancy and after delivery contributed to the incidence of SIDS. By contrast, the successful implementation of risk reduction guidelines influenced mothers' knowledge and practices resulting in raising their awareness about SIDS prevention. Consequently, there was no incidence of SIDS among the infants in the study group. Also, we discussed SIDS risk factors and emphasized that prevention of these risk factors, in turn, prevents SIDS. Hence, increasing mothers' knowledge about safe sleep, correcting misconceptions, and designing safe sleep environments are keys to reducing the risk of SIDS by using health promotion strategies.

The current study's findings demonstrated a statistically significant association between mothers' knowledge, reported practices, and risk reduction practices in the study group. We believe that these findings can be explained by the following: practice helps retain knowledge, knowledge is a necessity for practice and awareness of the SIDS serves as a base for preventable practices.

Comparably, Mohamed et al.'s (2023) study showed a significant positive correlation between the mothers' knowledge and their reported practices before and after the implementation of the learning program. As well as, Almahmoud et al., (2024) carried out a descriptive cross-sectional study in various Palestinian rural and urban areas to gauge mothers' knowledge of SIDS and safe infant sleep practices, as well as to investigate any relationships between mothers' knowledge of SIDS and safe infant sleep practices and displayed a positive-moderate correlation between the mothers' awareness and practices.

The findings of the present study showed a statistically significant association between the age of mothers and their risk-reduction practices. Furthermore, a statistically significant association was seen between the mothers' educational level and their knowledge, reported practices, and risk reduction practices. Furthermore, no statistically significant association was found between the age of mothers and their knowledge and reported practices in both groups. Otherwise, there was no statistically significant association between the knowledge, reported practices, and risk reduction practices of mothers in both groups and their personal data (occupation, residence, family type, mode of delivery, and history of SIDS). This finding suggests that when mothers become educated, they will reflect what they know better and become more skilled practitioners than mothers with lower levels of education.

The current study's findings corroborated those of Ali (2020), who discovered an association between mothers' level of university education and their age of less than thirty years old when it came to their understanding of risk factors and preventive practices after enrolling in a post-promoting program with a statistically significant result (P= 0.001). According to Sankari et al., (2023), there was an association between mothers' age and their level of adequate awareness, specifically; mothers who are younger tend to have higher levels of awareness. In a similar vein, Alanezi et al., (2023) discovered that mothers' qualifications were significantly associated with their knowledge of SIDS; however, they also found that mothers'

residence and monthly family income were significantly associated with their knowledge of SIDS.

In accordance with the findings of a study conducted in 2024 by Hajian et al., the mother's age and educational attainment had a substantial impact on how much she knew about SIDS. In addition, they stated that there was no significant relationship between mothers' residence and their level of SIDS awareness. In contrast to the present study findings, they reported that the mother's level of knowledge on SIDS was significantly correlated with her history of prior SIDS. Contrary to the findings of a cross-sectional survey conducted in Saudi Arabia in 2020 by Alzahrani et al., to evaluate mothers' awareness of SIDS, participants from urban areas shown a higher level of understanding. Yildiz, (2021) determined that the level of mothers' education and family type affected their safe sleep practices.

In contrast, a descriptive study conducted in the PHCCs in Holy Karbala City, Iraq, by Abd Ali & Musihb, (2024) to evaluate mothers' behaviors in the prevention of SIDS found no significant correlation between mothers' practices and age ($P>0.05$). Although there was no significant relationship between mothers' practices and their place of residence, or income, our results were consistent with theirs. Furthermore, a highly significant positive relationship was seen between mothers' practices and their educational attainment ($P=0.001$). Harmonious to previous studies, and as reported by several researchers, mothers' employment status was not significantly correlated with their practices, and there was a positive significant correlation between mothers' practices and their degree of education (Antony & Saldanha, 2022; Cole et al., 2022, Osei-Poku et al., 2023).

Finally, the researchers hope that improving mother awareness and practices regarding SIDS may reduce the incidence of SIDS, which may never be completely eradicated. Despite the fact that the origin and causation of SIDS remain unclear, parents and caregivers should be aware that changing particular certain behaviors, practices, and interventions may affect how an event turns out in the end. It is crucial for doctors, nurses, and other healthcare professionals to convey a consistent message according to updated guidelines and address the worries and misconceptions of parents and caregivers regarding SIDS.

Conclusion

Based on the findings of the current study, it can be concluded that the SIDS risk reduction guidelines had a positive effect on improving the SIDS total mean scores of mothers in the study group's knowledge, reported practices, and risk reduction practices compared to those in the control group. In addition, no cases of SIDS occurred among infants in the study group compared to five cases in the control group during the first six months of infant life.

Recommendations

Based on the findings and the foregoing conclusion of the current study, the following recommendations are suggested:

1. Develop comprehensive health promotion strategies to raise mothers' awareness about SIDS risk factors and its preventive measures.
2. Repetition of the present study intervention in similar settings to confirm its beneficial effects and to further improve its content and process.
3. Improving antenatal and postnatal care services as training sessions and educational classes should be planned for mothers for reducing the risk and thus prevention and early management of SIDS.

4. Illustrated educational materials as booklet, simple manuals and posters should be made available in the PHC facilities to guide mothers to correct their knowledge and practices.
5. All health staff should be provided with basic and continuing education and upgrading of information of SIDS.
6. Increase community awareness of SIDS and introduce it in all pediatric hospitals, Maternal and Child Health (MCH), and PHC centers.

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