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Effect of Preventive Updating Guidelines on Improving Nurses' Knowledge and Practice toward Sudden Infant Death Syndrome in Neonatal Intensive Care Unit

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Abstract: Sudden infant death syndrome (SIDS) is the leading cause of death among healthy born babies worldwide. Its causes are still vague, but its risk can be minimized by performing some simple active interventions. In Egypt, the Ministry of Health and Population has presented limited attention to SIDS and no real data are available on the practice of nurses on this topic. This study explored for nurses' knowledge and practice about SIDS and how to reduce its risks. **Therefore**, this study aimed at evaluating the effect of the preventive updating guideline on improving nurses' knowledge and practice toward sudden infant death syndrome in Neonatal intensive care unit (NICU). **Method:** A quasi-experimental design (one group pre and post) was utilized in this study. **Setting:** The study was carried out in NICU affiliated to Mansoura University Children's Hospital (MUCH), Mansoura city, Egypt. **Subjects:** The subjects of the study comprised of all nurses working and providing direct nursing care for neonate in NICU. **Tools:** A Self-administering questionnaire was used throughout the study phases for evaluating nurses' knowledge and observational checklist was used to assess nurses' practice concerning recommendations from the American Academy of Pediatrics (AAP) and Safe Sleep Practices (SSP). **Results:** It was showed a significant increase from pre-to post implementation in nurses' knowledge and practice of AAP updating guideline for SIDS prevention ($p < 0.001$), in addition to, total nurses' knowledge score raised among 95 % of nurses to a good score. Moreover, total nurses' practices scores improved among 88.3 % of nurses to satisfactory score. **Conclusion:** This study concluded that there was an improvement in the nurses' knowledge and practice after implementation of preventive updating guidelines towards SIDS in NICU. **Recommendations:** Educational planned guidelines about SIDS prevention is highly recommended to be applied in the Neonatal Intensive Care Unit and other pediatric departments. In addition to continuous monitoring for nurses' feedback about their best practices to prevent SIDS in NICU.

Keywords: Sudden Infant Death Syndrome (SIDS), preventive updating guideline, knowledge, practice, Neonatal intensive care unit (NICU).

INTRODUCTION

Sudden infant death syndrome (SIDS) was initially proposed in 1969 to emphasize the attention on some of infants with similar clinical features whose unexpectedly death in the postnatal period (Beckwith, 2003 and Duncan & Byard, 2018). Today, SIDS refers to death in a seemingly healthy infant younger than one year of age whose death remains unexplained after investigation of the case, including a complete autopsy, review of medical and clinical history, and investigation into the scene of death (Centers for Disease Control and Prevention, 2013; Pretorius & Rew, 2018). It is the leading cause of death among healthy born infants in the developed countries, with rates ranging from 0.06 to 0.87 per 1000 healthy newborns (Centraal, 2015; Mathewset al., 2015). Approximately 95% of SIDS deaths occur in the first six months of life with a peak incidence in infants aged between 2 to 4 months (Fleming et al., 2015 and Ball et al., 2012). It is usually occur during infant sleep period or in the transition between sleep and wakefulness (Kinney and Thach, 2009). This led to the application of the terms "cot" or "crib" death; however, these terms are rarely used today. While there are distinctive features associated with the syndrome, there are no diagnostic features that can be attributed to a SIDS death. Indeed, application of the term relies on a process of elimination and when no known cause of death or contributing factors can

be determined, the term SIDS is usually applied. Thus, while the debate continues regarding the definition and use of the term SIDS, and no one definition has been universally accepted, one certainty persists is that SIDS (Duncan & Byard, 2018).

The cause of SIDS is unknown but several risk factors have been suggested as increased hazard of SIDS, which includes low birth weight, male gender, younger maternal age and multiparity (American Academy of Pediatrics, 2011). Several modifiable behaviors have been related to an elevating risk of SIDS; sleeping prone position, cradle sharing, lack of breastfeeding, and maternal cigarette smoking (Athanasakis et al., 2011; Stremmler & Wolfson, 2017 and National Sleep Foundation, 2019).

The term "sleep together" is defined by using some to encompass a variety of sleeping environments, ranging from sharing a bed in the presence of a cradle or an infant's bed in a mother's bedroom. Although the causes of SIDS have not yet been clarified, many infective, endocrine, toxic, metabolic, nutritional, respiratory, cardiac, and neurologic disorders have been proposed (Krous et al. 2004; Horne, Hauck & Moon, 2015). The "three-risk model" of SIDS has been suggested, incorporating external stresses that affect a vulnerable infant during a critical segment of development Apoptotic neuro-degeneration can alter nervous

coordination and cardiorespiratory function, which leads to SIDS (Trachtenberg et al., 2012;Paine, Jacques &Sebire,

2014;Muhammad et al., 2018).

Triple Risk Model to Explain SIDS

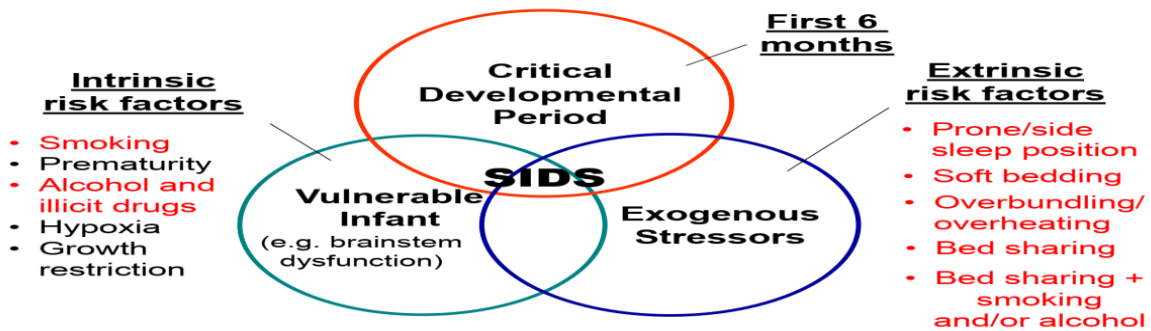


Figure (1): The triple-risk model for Sudden Infant Death Syndrome. (Trachtenberg et al., 2012).

Some of these factors, such as premature birth or low birth weight, cannot be changed but other environmental factors can be modified to prevent SIDS, which includes sleeping position, sleeping environment, and infants ‘care. So the American Academy of Pediatrics (AAP) has improved suggestions for SIDS prevention and addressed Safe Sleep Practice (SSP) in newborn nurseries and Neonatal Intensive Care Units(NICUs)(American Academy of Pediatrics, 2014). The health care provider’s adherences to apply SSP guidelines is very important care to hospitalized infants (Moon, 2011; Shadman et al., 2016).

Nurses in nurseries and NICUs are in a unique position to shape its right role and train caregivers on SIDS prevention. The American Academy of Pediatrics (2011) reviews that health care professionals, including nurses in daycareand NICU assist and educate mother and father on guidelines for risk reduction of SIDS (Carlins& Collins, 2007; American Academy of Pediatrics, 2011).The nursing role modeling of infant care is an essential factor in treating infant as soon as they are discharged (Levy Raydo and Reu-Donlon, 2005).According to the survey, the nurses do not demonstrate total compliance with the AAP's positioning guidelines; nor do they systematically model the correct care related to SIDS prevention (Bullock et al., 2004; Bartlow et al., 2016 and Agency for Healthcare Research and Quality, 2019).

Study significance:

Sudden Infant Death Syndrome (SIDS) is the leading reason of death amongst healthy born infants in developed countries. Sudden infant death syndrome causes are not yet clear, but it is viable to implement some active interventions in order to minimize its risk. In Egypt, little attention used to be paid to SIDS and there were no actual data on the practice of nurses on this topic (De Luca et al., 2017).So, this study was undertaken to improve nurses’ knowledge and practice through developing and implementing updating guidelines about SIDS prevention.

Aim of the study:

This study was done for evaluating the effect of preventive updating guidelines on improving nurses' knowledge and

practice toward sudden infant death syndrome in NICU through:

- Assessing nurses' knowledge and practice pre implementation of preventiveupdating guidelines toward SIDS in NICU.
- Implementing preventive updatingguidelines towardsSIDS in NICU.
- Evaluating the effect of implementing preventiveupdating guidelines on nurses' knowledge and practice toward SIDS in NICU.

Research Hypothesis:

Nurses expected to have good knowledge and competent practice toward prevention of SIDS in NICU after the guidelines implementation.

Subject and Methods:

Study design:

The study design was a quasi-experimental design (one group pre and post study).

Setting:

This study was carried out in NICU affiliated to Mansoura University Children’s Hospital (MUCHs), Mansoura city, Egypt.

Subjects and sampling:

The subjects of the study comprised of all nurses working and providing direct nursing care for neonate in NICU and who willing to participate in the study regardless of their age, qualification and years of experience (n=60).

Data collection tools:

Three tools were used in data collection:

- I- **The first tool** was "Self-administrated demographic and occupational characteristics questionnaire". It was developed by the researchers after reviewing related literature and previous studies relevant to the problem. This questionnaire was used to assess demographic and occupational characteristics of NICU nurses such as age, sex, qualification, experience years, and the number of attending educational lectures about SIDS.
- II- **The second tool** "Self-administered knowledge assessment questionnaire" was a valid content. It was consisted of 22 questions (17 questions were adapted from Bullock et al., (2004) which were relevant to the

scope of this study and 5 questions developed by researchers). This questionnaire was designed to assess NICU nurses' knowledge regarding definition of SIDS, physical factors associated with SIDS, Risk factors of SIDS that linked to mothers risk, sleep environmental factors, knowledge about updating AAP guidelines about SIDS, benefits of putting infant on supine position, ...etc. The total knowledge score was categorized into poor score = less than 60% of the total score, fair score = 60 to 75% of the total score and better score = more than 75 % of the total score.

III- The third tool was "Observation checklist for infant's positioning and safe sleep environment ". This checklist was divided into two parts; infant's positioning and safe sleep environment practices as correct position, crib objects and type of soft objects. It was adapted from an original checklist of **Bartlow et al., (2016)** based on the AAP guidelines. The checklist's scores were categorized into satisfactory practice that equal $\geq 75\%$ of the total score and unsatisfactory practice that equal 75% of the total score.

The second and third tools were translated using the back-translation method. The translations were carried out by independent translators. The translations were compared with original form (tool II and III). The final version of translations was revised and modified by a committee which consisted of experts in nursing research.

Validity and reliability:

The tools were revised by seven experts in the pediatric nursing and neonatal medicine fields to test its content validity. The modifications were done on the tools according to their opinions. The reliability of both tools was test using Alpha Cronbach's coefficient test, the alpha reliability of tool II was ($\alpha = 0.74$ and tool III was ($\alpha = 0.72$).

Pilot study:

It was performed on 10% of nurses (6) in order to assess the tools' clarity and applicability and the modifications were done accordingly.

Ethical considerations:

An ethical approval was attained from the Faculty of Nursing Research Ethical Committee, Mansoura University. An official approval was obtained from the director of Mansoura University Children's Hospital (MUCHs) for conducting the study.

Then, oral consents were obtained from the nurses after complete description of the study aim and process by the authors to obtain their acceptance for participation. Nurses were informed that their participation in the study is voluntary; they have the right to withdraw from the study at any time without giving any reason. Confidentiality of the information collected and anonymity were assured for the nurses.

Field of work:

The actual field work started from May, 2018 and ended on July, 2018. This period consumed for data collection was governed by the availability time for both the researchers and the study respondents.

Intervention: Done Through Four stages

Stage one: Preliminary assessment stage:

- **This stage** was concerned about assessing NICU nurses' knowledge and practice about SIDS and its risk factors using tool (I & II)

Stage two: guidelines development:

- According to the preliminary assessment results, that indicated poor in nurses' knowledge and practice toward SIDS and after reviewed literatures, this intended guidelines were developed and it based on **Updated recommendations for a safe infant sleeping environment, (2016)**.
- The preventive updating guidelines were in a form of Arabic language to be easy understood for the nurses. The contents of the guidelines model has information about SIDS as definition, physical factors associated with SIDS, risk factors and environmental factors, knowledge about updating AAP guidelines about SIDS, benefits of putting infant on supine position ...etc. It also contains practices about infant positioning and practice safe sleeping environment.

Stage three: Implementation of the preventive updating guidelines:

- The contents of the preventive updating guidelines were given over three educational sessions, divided to one theoretical session and two practical.
- The researchers introduced themselves and explain the study aim and process, the nurses' roles during their participation.
- Then every nurse was subjected to the following: determine their knowledge about SIDS and its prevention (using tool II). The times allowed for nurses was 15-20 minutes to fill the questionnaire, the time for each session ranged from 20-30 minutes in the morning shift depending up on their available time. The researchers divided the nurses into small groups for discussion (5 nurses into each group).
- The planned guidelines implemented through observations of 60 infants and their nursery environments for approximately 5 to 10 minutes; Observations implemented at randomly selected times (using tool II) based on the AAP guidelines. The researchers observed the nurses' practice including infants' positions and the elements inside the infants' cradle such as; wrapping the blanket around the infant, number of blankets used, and the extra materials in the cradle. Empty cradles were now not regarded as an observation.
- Different teaching methods were used during the application of preventive bundle guidelines such as: brainstorming, group discussion, demonstration and re-demonstration, poster, video film, as well as booklet were used as teaching media.

Stage four: Evaluation of the preventive updating guidelines:

- The intended guidelines evaluation was achieved by conducting post-test knowledge after 2 months regarding the meaning of SIDS and factors affecting it. Furthermore, post-test practice concerning infant's positioning and safe sleep environment by using tools II and III.

Data analysis:

The data collection was coded and analyzed through the statistical package of social sciences (SPSS) version 20. After complete entry, the data was scanned for errors and the normality was tested by the Kolmogorov-Smirnov test. After data analysis, Numerical variables were expressed as mean, standard deviation, frequencies, and percentages. Paired sample t-test was used for pre-post comparisons (before and after implementation of the updating guidelines about SIDS prevention). The results were expressed with a 95% confidence interval. Wilcoxon signed rank test also used to assessing change after repeated measurement. The

level of significance selected for this study was P less than 0.05 and 0.001

RESULTS

Table (1) reflected that 86.7% of NICU nurses were female, 28.3% of them were between 30-40 years old. Nearly less half of the studied nurses had bachelor degree in nursing and had less five years of experience in pediatric departments (46.7% for each). Moreover, the majority of the study nurses didn't attended any educational lectures about SIDS (86.7%).

Table (1); Demographic and occupational characteristics of the studied nurses

Nurses' demographic and occupational characteristics		No=60	
		No.	%
Gender	Male	8	13.3
	Female	52	86.7
Age in year	<20ys	5	8.3
	20-<30ys	33	55
	30-<40ys	17	28.3
	≥40ys	5	8.3
Educational Level	Diploma	6	10
	Technical education	16	26.7
	Bachelor Degree	28	46.7
	Higher studies	10	16.7
Experience years in pediatric departments	<5ys	28	46.7
	5-<10ys	12	20
	10-<15ys	10	16.7
	≥15ys	10	16.7
	Mean ± SD	13.33 ± 3.97	
Attendance of educational lectures about SIDS	Yes	8	13.3
	No	52	86.7

Table (2) reveals that 33.3% of the studied nurses correctly defined SIDS before guidelines implementation compared to 96.7% after guidelines implementation. In relation to physical factors that associated with SIDS, 46.7% of nurses were able to identify all physical factors like congenital anomalies, low birth weight, before the implementation, while all of them identified these factors completely post implementation of preventive guidelines (100%). Concerning risk factors of SIDS that linked to mothers, 16.7% of nurses enumerate factors completely pre-

implementation, in contrast to 100% at post preventive guidelines implementation. less than one third of nurses (31.7%) completely recognized risk factors linked to sleep environment that increase SIDS before the implementation, comparing with (86.7%) post implementation of preventive guidelines. The same table also demonstrated that there were highly statistically significant differences regarding nurses' knowledge about SIDS definition and its risk factors in pre and post implementation of preventive guidelines (**p < 0.001**)

Table (2); Nurses' knowledge about SIDS definition and its risk factors in pre and post implementation of preventive guidelines

Items of General Knowledge	Total number of nurses = 60				Test of significance.	
	Pre		Post		z	P
	No.	%	No.	%		
Knowing the definition of sudden infant death syndrome						
Correct	20	33.3	58	96.7	5.92	.000**
Incorrect	40	66.7	2	3.3		
Physical factors associated with SIDS						
Brain defects	30	50	0	0.0	5.50	.000**
Low birth weight	2	3.3	0	0.0		
All of the above	28	46.7	60	100		
Risk Factors of SIDS that linked to mothers						
Age less than 20 years old	40	66.7	0	0.0	6.58	.000**
Smoking	10	16.7	0	0.0		
All of the above	10	16.7	60	100		
Sleep Environmental Factors that increase SIDS						
Sleeping on the abdomen or side	14	23.3	6	10	3.90	.000**
Sleeping with parents	8	13.3	0	0.0		
Increase child temperature	19	31.7	2	3.3		
All of the above	19	31.7	52	86.7		

** High statistically significant at p < 0.001

Table (3), this table demonstrated that there were highly statistically significant differences regarding nurses' knowledge about SIDS risk factors that linked to infants in pre and post implementation of preventive guidelines. Forty percent of nurses mentioned sleeping on the abdomen as a risk factor of SIDS in the pre-implementation phase, compared to more than three quarters of nurses

(78.3%) in the post implementation phase. Also, 26.7% & 20% of nurses reported that smoking mother and negative smoking mother, respectively were risk factors of SIDS in the pre-implementation phase, compared to the majority of nurses in the post implementation phase (93.3% & 90% respectively).

Table (3); Nurses' knowledge about SIDS risk factors that linked to infants in pre and post implementation of preventive guidelines

Items of General Knowledge	Total number of nurses = 60				Test of significance	
	pre		Post		z	P
	No.	%	No.	%		
The risk factors of sudden infant death syndrome						
Sleeping on the abdomen						
Know	24	40	47	78.3	4.13	.000**
Don't know	36	60	13	21.7		
Smoking mother						
Know	16	26.7	56	93.3	6.32	.000**
Don't know	44	73.3	4	6.7		
Negative smoking mother						
Know	12	20	54	90	6.19	.000**
Don't know	48	80	6	10		
Underdeveloped children						
Know	20	33.3	59	98.3	6.24	.000**
Don't know	40	66.7	1	1.7		
Low Birth Weight						
Know	20	33.3	56	93.3	5.69	.000**
Don't know	40	66.7	4	6.7		

Table (4) demonstrated that there were highly statistically significant differences about Nurses' general knowledge regarding updating American academy of pediatrics guidelines about SIDS prevention in pre and post implementation. It was noticed that before guidelines implementation, about 70% of the studied nurses knew sleeping positions associated with SIDS compared to 98.3% after guidelines implementation.

In relation to nurses' knowledge about updating AAP guidelines about SIDS, 86.7% of nurses didn't know AAP guidelines pre-implementation stage, in contrast to 98.3% at post implementation. Concerning to recommended sleeping

position according to AAP guidelines, 60% of nurses knew the recommended position in the pre-implementation phase, compared to the majority of nurses (96.7%) in the post implementation phase.

Moreover, seventy percent of nurses knew that they had an important role of giving parents' education about infant safe sleeping position in the pre-implementation phase, compared to the majority in the post implementation phase. According to nurses' general knowledge about benefits of putting infant on supine position, 46.7% of the nurses knew benefits of supine position in pretest and this percent increase to 100% at post implementation.

Table (4); Nurses' general knowledge regarding updating American academy of paediatrics guidelines about SIDS prevention

Items of General Knowledge	Total number of nurses = 60				Test of sig.	
	Pre		Post		z	P
	No.	%	No.	%		
Sleeping positions that associated with SIDS					1.96	.05
Completely know	42	70	59	98.3		
Incompletely know	14	23	1	1.7		
Don't know	4	6.6	0	0.0		
Updating American academy of paediatrics guidelines about SIDS					7.14	.000**
Know	8	13.3	59	98.3		
Don't know	52	86.7	1	1.7		
Recommended sleeping position according to American academy of paediatrics guidelines					4.43	.000**
Know	36	60	58	96.7		
Don't know	24	40	2	3.3		
Benefits of putting infant on supine position					6.12	.000**
Know	28	46.7	60	100		
Don't know	32	53.3	0	0.0		
Nurses' had an important role of giving parents' education about infant safe sleeping position					3.90	.000**
Know	42	70	59	98.3		
Don't know	18	30	1	1.7		

Table (5) illustrated that 88.3% the studied nurses showed poor level of knowledge related to up-dated recommendations about SIDS prevention during preliminary stage with overall mean of 6.71±2.17, comparing with intervention stage, 95% showed good knowledge level with overall mean of 18.18 ± 1.20. By comparing means in **table (5)**, results from assessment revealed significant increase

from pre-to post intervention in knowledge of guideline for SIDS prevention (p<0.001), moreover, total nurses' knowledge score raised between 95 % of nurses in good. This table recognized that there were highly statistically significant differences regarding nurses' total knowledge score before and after implementation of preventive updating guidelines.

Table (5); Comparison of the studied nurses' total knowledge score pre and post implementation of preventive updating guidelines about SIDS

Items of general Knowledge	Total number of nurses =60				Paired t –test	
	Pre		Post		t	P
	No.	%	No.	%		
Total knowledge score					32.79	0.000**
Poor (<60%)	53	88.3	00	00		
Fair (60-75%)	7	11.7	3	5		
Good (>75%)	00	00	57	95		
Mean ± SD	6.71±2.17		18.18 ± 1.20			

Regarding infant positioning (table 6) showed that, 80% of nurses did not placed infants in correct position pre guidelines implementation and this percent decreased to

8.3% post guidelines implementation with highly statistically significant difference. In relation to nurses' practice toward infant's position the same table also portrays

that only 20% of the studied nurses placed the infants in supine position pre the implementation of the guidelines and this percent improved to 85% post guidelines implementation.

Regarding types of soft object that observed in the infants' cribs it was presented that blankets, towels, gloves, onesies,

and wide diapers were found in 75%, 80%, 40%, 21.7% and 70%, of infants' cribs pre the guidelines implementation, respectively. Post guidelines implementation these percentages decreased to 5%, 3.3%, 1.7%, 0.0% and 5%, respectively and the differences were highly statistically significant.

Table (6); Comparison between pre and post general practice of Infant Positioning after updating guidelines implementation about SIDS

Items of General practice	Total number of nurses = 60					
	pre		Post		Test of sig.	
	No.	%	No.	%	z	P
Completely adherent (correct position and no objects)						
Yes	12	20	55	91.7	6.58	.000**
No	48	80	5	8.3		
Position						
Supine	12	20	51	85	5.54	.000**
Prone	21	35	3	5		
Right lateral	17	28.3	3	5		
Left lateral	10	16.7	3	5		
Crib objects						
None	12	20	58	96.7	6.59	.000**
1 object	45	75	2	3.3		
2 objects	3	5	00	00		
3 objects	00	00	00	00		
Other	00	00	00	00		
Type of soft objects						
None	00	00	49	81.7	6.40	.000**
Blankets	45	75	3	5		
Toys	36	60	2	3.3		
Towels	48	80	2	3.3		
Gloves	24	40	1	1.7		
Onesies	13	21.7	00	00		
Wide diapers	42	70	3	5		

Table (7) illustrated that 91.7% the studied nurses showed unsatisfactory practice relative to the positioning of infant and the environment of safe sleep recommendations about SIDS prevention during preliminary stage with overall mean of 0.633 ± 0.990 , comparing with intervention stage, 88.3%

shows satisfactory practice with overall mean of 3.555 ± 0.699 By comparing Pre implementation, results from assessment revealed significant increase from pre to post implementation in practice of infant's positioning and safe sleep environment recommendations about SIDS prevention ($p < 0.001$).

Table (7); Total nurses' practices score pre and post implementation of preventive updating guidelines about SIDS

Items of nurses performance	Total number of nurses =60					
	Pre -implementation		Post-implementation		Test of significance	
	No.	%	No.	%	T	P
Total studied nurses' practice score						
Satisfactory ($\geq 75\%$)	5	8.3	53	88.3	19.830	0.000**
Unsatisfactory ($< 75\%$)	55	91.7	7	11.7		
Mean \pm SD	0.633 \pm 0.990		3.555 \pm 0.699			

DISCUSSION

Sudden infant death syndrome, or SIDS, is infant deaths that cannot be explained after a thorough case investigation, including a scene investigation, autopsy, and review of the clinical history. While the cause of SIDS related deaths is not always clear, possible explanations include suffocation, asphyxia, and entrapment (**American Academy of Pediatrics, 2011**). Sudden Infant Death Syndrome is the leading reason of death amongst healthy born infants in developed countries. Its causes are not yet clear, but it is viable to implement some active interventions in order to minimize the risk (**De Luca et al., 2017**).

Based on the primary assessment, NICU's observations and preliminary results suggest that regardless of considerable research and published literature on the topic, updating guidelines regarding SIDS prevention were not implemented systematically. Therefore, this study was done for evaluating the effect of preventive updating guidelines on improving nurses' knowledge and practice towards sudden infant death syndrome in NICU.

The demographic characteristics of the present study reflected that slightly more than half of the studied nurses were between 20-30 years old. This result was supported by **Efe, et al., (2012)** who reported that more than half of the nurses were between the ages of 21 and 35 years old. Also the findings of this study showed that the highest percentage of the studied nurses did not attend a specific educational course about SIDS (**table 1**). These findings were similar to **De Luca et al. (2017)** who identified that nurses had insufficient training about SIDS.

The AAP policy statement on "SIDS and other sleep-related infant deaths stated that expansion of recommendations for a safe infant sleeping environment" is evidence-based and considered the "gold standard" for nurse endorsement within their practice (**American Academy of Pediatrics, 2011**). It was found in the current study that less than one third of the studied nurses completely recognize risk factor that linked to sleep environment as low birth weight, prone position and sharing the bed with parents before the implementation of intended guidelines (**table 2**). The findings of the current study were supported by **Aris et al., (2006)** and **Bartlow et al., (2016)** who reported that there were lack in nurses' knowledge about sleep environmental factors. In contrary to the current finding by **Dowling et al., (2015)** who stated that the majority of nurses were able to correctly identify risk factors that linked to SIDS.

The current finding showed that almost of nurses didn't know AAP guidelines about SIDS during the pre-implementation stage (**table 4**). The current result was strong supported by **McMullen et al., (2016)** who reported that nurses did not know AAP SIDS reduction recommendations in the pre-test. In contrary to **Bullock et al., (2004)**; **Efe et al., (2012)** and **Bartlow et al., (2016)** who found that the majority of nurses knew the AAP recommendations.

The present study represented that, seventy percent of nurses knew that they had important role toward parents' education

about infant safe sleeping position in the pre-implementation phase, compared to the majority in the post implementation phase (**table 4**). These results in the same line with **Linneman, (2016)** who mentioned that nurses expressed the belief that they were the most appropriate professional group to educate parents on the matter of SIDS.

Placing an infant to sleep on his back is a simple and important risk reduction strategy against SIDS (**Grazel et al., 2010**). The current study illustrated that more than half of the nurses did not know benefits of putting infant on supine position in pretest (**Table 4**). These findings inconsistent with **Price et al., (2008)** who stated that thirty-six of percent nurses had poor knowledge about SIDS as they mentioned that supine position leads to increase aspiration.

Concerning Recommended sleeping position according to American academy of pediatrics guidelines, the current study showed that less than two thirds of nurses reported that the recommended sleeping position according to AAP guidelines was infants' supine position that decreasing risk of SIDS during pre implementation stage. These results were inconsistent with the previous study conducted by **Bartlow, (2016)** who found more than one quarter of nurses stated that there is no association between sleep position and SIDS.

The present results revealed significant improvement in nurses' knowledge of AAP updated guideline for SIDS prevention from pre to post guidelines implementation ($p < 0.001$), moreover, total nurses' knowledge score raised among the majority of nurses (95%) to have a good score (**table 5**). These results were in the same line with **Rowe et al., (2016)** who found a significant increase from pre to post intervention on knowledge of the AAP guidelines ($p < 0.001$).

The finding of the present study revealed that, soft items such as blanket, toys and towels found in the majority of current infants' cribs at pre implementation phase (**Table 6**). This finding come in the same line with **Grazel et al., (2010)** who stated that almost half of the nurses used positioning objects in cribs and more than half the nurses placed blankets over the head of the crib. In addition to **Dowling et al., (2015)** reported that the majority of nurses in NICU report using extra objects in crib to position infant.

The current results represented significant improvement from pre to post guidelines implementation in the practices score regarding updating guidelines for prevention of SIDS ($p < 0.001$) (**table 7**). The current results supported by **Gelfer et al., (2013)** who demonstrated that staff education and the implementation of policies supporting can bring substantial changes in practice by providing a knowledge base and organizational support to nurses.

Similarly, **Grazel et al., (2010)** cited that nurses sometimes have problem in implementation of safe sleep practices related to infant condition, comfort needs and parental request. With educational and organizational support, these obstacles can be overcome to provide safe sleep practices and model guidelines for parents and families.

On the other hand, the study results were contradicted by **Bullock et al., (2004); Tablizo et al. (2007) and Bartlow. (2016)** who stated that despite the informed knowledge of the guidelines and correct identification of the AAP recommendation, only one third of infants observed fully applied the AAP guidelines, including the sleeping position and the cradle environment.

CONCLUSION

This study concluded that there was an improvement in the nurses' knowledge and practice after implementation of preventive updating guidelines towards SIDS in NICU.

RECOMMENDATIONS

Based on the previous findings, the following recommendations are suggested:

- [1]. Continuous education for nurses to improve their knowledge and practice about the SIDS risk reduction measures.
- [2]. Educational planned guidelines about SIDS prevention are highly recommended to be applied in the NICUs and other pediatric departments.
- [3]. Continuous monitoring for nurses' feedback about their best practices to prevent SIDS in NICU.

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