# Effect of an Evidence-Based Program on Infants' PURPLE Crying and Shaken Baby Syndrome among Nurses

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## Abstract

**Background:** Shaken baby syndrome (SBS) is the most common cause of death or serious neurological injury resulting in life-long disability among infants and young children less than 5 years of age. **The study aimed to** evaluate the effect of an evidence-based prevention program for nurses on the period of PURPLE crying in infants and shaken baby syndrome. **Study design:** A quasi-experimental (pre-post-test) research design was used to achieve the aim of this study. **Sample:** A convenient sample was selected of 100 pediatric nurses from (PICU &NICU) and outpatient pediatric clinic in Assiut University Children's Hospital.. **Tools:** Three tools were used to collect the needed data. Tool one: It was composed of three parts: Part one: Personal data of studied nurses. Part two: Shaken infant syndrome knowledge assessment questionnaire. Part three: It was included a nurse's knowledge assessment questionnaire on the PURPLE Crying Period. Tool Two: Nurses' thoughts and attitudes about shaken baby syndrome hazards. Tool Three: Scale of Infant Crying Knowledge. **Results:** 65 % of nurses had a satisfactory level of knowledge about the period of PURPLE crying in infants which increases to 96% post-test. in the pre-test, 73% of nurses had appropriate beliefs and attitudes regarding shaken baby syndrome hazard while in the post-test most of the nurses (89%) had appropriate believes and attitudes with a highly statistically significant difference between the nurses believes and attitudes in pre and posttest (*P*=0.004). **Conclusion:** Implementation of an Evidence-Based prevention program had a positive effect on understanding the period of PURPLE crying in infants which reduced the hazards of Shaken Baby Syndrome in infants. **Recommendations:** Nurses should teach parents and give them a booklet about the period of PURPLE crying and practices to prevent hazards of shaken baby syndrome on the infants discharge from PICU or NICU.

**Keywords:** Evidence-Based Program, Infants, Nurses, PURPLE Crying & Shaken Baby Syndrome.

## Introduction

Shaken baby syndrome (SBS) has recently been a popular topic of discussion and a major health concern for young children. Shaken baby syndrome is the most prevalent cause of mortality or major neurological injury in newborns and young children under the age of five, resulting in common life-long disability. It is a community health problem as well as a violation. Almost all SBS victims experience severe weeping and health repercussions, and at least one out of every four infants forcefully shaken dies as a result of this type of child maltreatment**(Younis & Zaid, 2020)**.

Shaken Baby Syndrome (SBS), is a common cause of child death and is completely avoidable **(Barr,2012).** When a new infant is born to first-time parents, a strategy to prevent SBS through appropriate and thorough teaching is needed. There is a great deal of untapped potential in caregiver education **(Barr etal., 2009)**. Many caregivers are unaware that prolonged and inconsolable newborn screaming is usual in healthy babies. Caregivers are typically unprepared to deal with prolonged crying eruptions. The problem can be addressed by educating caregivers and new parents about typical newborn crying, the dangers of shaking a kid, and coping skills **(Barr et al., 2009)**.
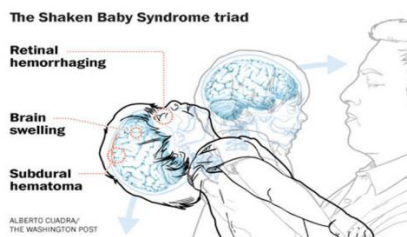


**Fig. 1:** Shaken baby syndrome 'is child abuse. Adopted from **(Younis & Zaid, 2020)**

The identification of infants "particularly at risk" has been sought to prevent the shaken baby syndrome. Single parenthood, drug addiction, and domestic abuse have all been linked to an increased risk of shaken infant syndrome. Shaken infant syndrome is linked to a variety of social and environmental issues, including low income, a lack of social support, inadequate prenatal care, lower marital satisfaction, and poor family functioning. Male gender, history of prematurity, excessive crying, developmental delay, and feeding issues have all been identified as risk factors in infants. Young age is also a significant risk factor, particularly in the case of children **(Ornstein et al., 2016)**.

Evidence suggests that shaken baby syndrome increased during the PURPLE Crying Period. Because the majority of crying happens in the evening and night, newborn crying and sleeping issues have been grouped. Caregivers may find it difficult to cope with early infant crying. The length of crying bouts as well as the unsoothable aspects of the weeping have been linked to caregiver frustration and self-rating. The convergence of multiple lines of evidence has led to shaken baby syndrome prevention efforts that focus on the predictable period of increased crying behavior in infancy, during which all infants go through a stage in their development of increased crying beginning around 2 weeks of age, peaking at 6 weeks of age, and then decreasing **(Ornstein et al., 2016).**
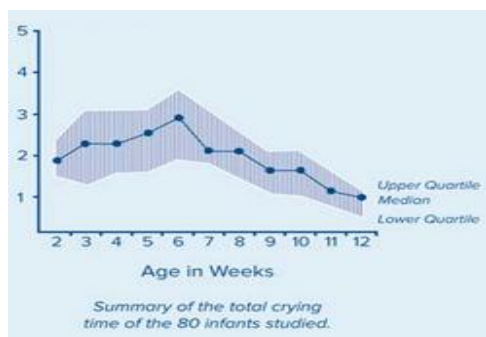


Fig. 2: Normal crying curve for babies. Adopted from **(Younis & Zaid, 2020)**

**The Period of PURPLE Crying Program was established by** Dr. Ron Barr and others in 2012 in response to research identifying normal infant crying as a trigger for shaking. Fifty-three programs, known as the Period of PURPLE Crying, were created based on research on normal newborn crying and its link to AHT. Nearly forty focus groups with parents were held in two countries during the creation of the program **(National Center on Shaken Baby Syndrome,2012).**

The Purple Period Crying is children's educational program that focuses on the characteristics of normal infant crying. The goal of this program is for newborns to be able to be discharged from the hospital, go home, and grow up in a safe and aware environment without being damaged in any way, especially from a shaking injury caused by crying disorders.

The program materials also emphasize the significance of sharing program knowledge with all the infant's caretakers and that babies should never be shaken. Each of the letters in the word PURPLE refers to a characteristic of infant crying: **P** -Peak of Crying-Crying peaks after the second month, and it starts to drop; **U**- Unexpected-Crying appears and disappears without warning, for no apparent reason; **R**- Resists Soothing-Crying persists despite caregivers' best efforts; **P**-Infants that have a pain-like face appear to be in agony even when they are not; **L**- Long-Lasting Crying-Crying for 30-40 minutes and up to 5 hours or more; **E**- Crying in the Evening-Crying is more frequent in the late afternoon and nightfall.

Health experts have been skilled to give this system and reply to queries from mothers and fathers. Parents and caregivers need to be educated about the "Period of PURPLE Crying" program **(Nocera et al., 2016).** In addition, because Shaken Baby Syndrome is relevant to nursing practice, pediatric nurses play a vital role in teaching new parents in hospital and primary care settings. It can be avoided by teaching youngsters that crying is a normal part of life for any infant, baby, or toddler and that they should never be shaken because of it. Furthermore, because a shaking injury is life-threatening, receiving prompt medical attention is vital for survival. **(Brubaker-vincent, 2016).**

**The Change Theory by Kotter**

The Eight-Stage Change Process of Creating Major Change by Kotter is the Change Theory that best achieves the goals of this

innovative implementation: (1) A sense of urgency has been established in dealing with the issue of SBS prevention. (2) A guiding coalition has been formed by assembling a group with sufficient power to lead to the transformation. (3) Creating a vision and strategy to guide the change endeavour, has also been the driving force in eliminating all cases of SBS through education. (4) Constantly communicating the new vision and strategies, using every vehicle available (all OB/nursery staff). (5) Encouraging risk-taking and non-traditional ideas, activities, and actions by empowering broad-based vision, removing impediments, and encouraging risk-taking and non-traditional ideas, activities, and actions **(Kotter&cohen, 2020).**

**Evidence-Based Practice (EBP)**

Individual practitioners were given an Evidence-Based Practice Model to use adapted from Haynes and colleagues' model (2002), using research findings in an evidence-based decision-making framework. When deciding on interventions or the sort of care to provide, evidence-based decision-making involves combining the best research evidence with the patient's clinical status and circumstances, the patient's choices and behaviors, healthcare resources, and professional skills, Evidence-based practice, according to **(DiCenso, etal 2004)**. The following procedures are included: Creating a clinical inquiry, searching for relevant research findings in a systematic manner, evaluating the evidence for its relevance, validity, and usefulness, Choosing an implementation strategy based on evidence, Putting the new practice into action, and assessing the practice change.

**Significance of the study:**

Shaken baby syndrome (SBS), which causes head injury, is the greatest cause of mortality, long-term impairment, and permanent damage in physically mistreated newborn infants. Each year, 21-74 per 100,000 children worldwide are victims of the shaken baby syndrome. Shaken infant syndrome is responsible for more than half of all accidental injuries, and available information suggests that it causes more than half of all morbidity and 15-38 percent of death in children under the age of one year **(Rnyan et al., 2010).**

Neurological, cognitive, developmental, and psychosocial issues affect around 75% of survivors. Shaking infants aged one year or less was seen in 9 of the 16 study locations in Brazil, Chile, Egypt, India, and the Philippines, with prevalence rates ranging from 20% to 63 %. Each year, between 1,400 and 10,000 cases of shaken baby syndrome are expected to occur in the United States alone. **(International Society for Prevention of Child Abuse and Neglect (ISPCAN), 2018).**

**Aim of the study:**

The study aimed to evaluate the effect of an evidence-based program on infants' PURPLE crying and shaken baby syndrome among nurses.

**Research hypothesis:**

**H1;** Implementation of an Evidence-Based program had a positive effect on nurses' knowledge & attitude regarding Infants' PURPLE Crying and Shaken Baby Syndrome

**H2;** Implementation of an Evidence-Based program had a positive effect on understanding the period of Infants' PURPLE crying and reducing the hazards of Shaken Baby Syndrome

**Subjects and Method**

**Research design**:

A quasi-experimental (pre-post-test) research design was used to achieve the aim of this study.

**Setting:**

This study was conducted at (PICU &NICU) and outpatient pediatric clinic in Assiut University Children Hospital.

**Sample:**

- A convenience sampling was selected of 100 pediatric nurses who are working in the Pediatric intensive care unit PICU (their total number is50 nurses), neonatal intensive care unit NICU (their total number of is30 nurses), and outpatient pediatric clinic that receive infants (their total number is 20 nurses) in Assiut University Children's Hospital. Nurses who agreed to participate in the study and met the following criteria were included:

- The facility to join the "PURPLE Crying Period" program.

- Nurses with at least two years of experience.

**Tools of the study:**

**Three instruments were used to accomplish the study's aim.**

**Tool one:** The interviews were conducted using a structured interviews questionnaire. It was adopted following a review of scholarly papers throughout the world. **(The National Center on Shaken Baby**

Syndrome, 2018), (Brubaker-vincent,2016)& (Ashour et al., 2019) beside pediatric textbooks; it was composed of three parts:

**Part one:** Personal data of studied nurses as; age, marital status, sex, educational level, department, and years of experience.

**Part two:** Shaken infant syndrome knowledge assessment questionnaire for nurses **(according to the National Center on Shaken Baby Syndrome, 2018):** There were 38 multiple choice questions with only one correct answer, while other questions had multiple valid answers such as: Do you know what shaken infant syndrome is? Children of any age are in danger of being shaken. How long does it take to shake a baby?

**Scoring system:**

Nursing knowledge scoring system: It was organized according to the elements of the questionnaire, and the researchers graded the nurses' responses using a right responses sheet. The correct response received a score of (2), and the incorrect response received a score of (1). The total knowledge score was 102. Nurses with <70% total score (<71) were deemed unsatisfactory, while those with ≥ 70% or more (≥71) were deemed satisfactory.

**Part three:** Includes a nurse's knowledge assessment questionnaire on the PURPLE Crying Period Program, which was adopted from **(The National Center on Shaken Baby Syndrome, 2018)**. It contains ten multiple-choice questions with only one correct answer, and other questions with numerous correct answers, such as Do you know what "the period of PURPLE crying" means? and The Purple Crying Period has two goals.

**Scoring system:**

Nurses' knowledge of the Period of PURPLE Crying Program is graded using the following system: It was organized according to the elements of the questionnaire, and the researchers graded the nurses' responses using a right responses sheet. The total item was 11 gained from 10 questions as there was one question that had multiple correct answers. The correct response received a score of (2), and the incorrect response received a score of (1). The total knowledge score was 22. Nurses with <70% total score (<15) were deemed

unsatisfactory, while those with ≥ 70% or more (≥15) were deemed satisfactory.

**Total scoring system for Shaken infant syndrome and PURPLE Crying Period Program:**

Nurses with <70% total score (<86) were deemed unsatisfactory, while those with ≥ 70% or more (≥86) were deemed satisfactory.

**Tool Two:** Nurses' thoughts and attitudes about shaken infant syndrome hazards on a Likert scale. It was inspired by **(The National Center on Shaken Baby Syndrome, 2018), (Brubaker-vincent, C. L., 2016) & (Ashour et al., 2019)**. It includes 15 items such as Hitting or striking is an appropriate way to discipline babies, Spanking is an appropriate way to discipline babies, and Shaking is a suitable method for relaxing newborns.

**Scoring system:** Nurses' opinions and attitudes about the risk of the shaken baby syndrome are scored. Nurses were asked to rate the appropriateness of several calming and disciplinary techniques. Likert Scale included 15 items that measure nurses' beliefs and attitudes regarding shaken baby syndrome hazards, nurses were asked to rank the appropriateness of a soothing or discipline practice. Answers were coded on a scale where 0 = risk indicated; 1 = ambiguous; 2 = appropriate. If the total score of answers >18 grades (>60%), it is considered appropriate for nurses, beliefs, and attitudes, and if the total score of answers <18 grades (≤60%) is considered inappropriate for nurses **(Dias et al, 2005) and (Ashour et al., 2019)**

**Tool Three:** Scale of Crying Knowledge It was created by**(Brubaker-vincent, C. L.,2016) and (The National Center on Shaken Baby Syndrome, 2018)**. It is a scale that asks nurses how much they agree with each statement regarding an infant's behavior and requirements during the first few months of life. It is made up of eight parts. Infants cry more frequently in the late afternoon and evening, Infant crying increases in the first few weeks of life and peaks in the first 2 or 3 months before decreasing, and Infant crying increases in the first few weeks of life and peaks in the first 2 or 3 months before decreasing.

**Scoring system:** Answers were coded on a scale of 0 to 3, with 0 indicating strong

agreement, 1 indicating agreement, 2 indicating disagreement, and 3 indicating strong disagreement.

**Method of data collection:**

- After discussing the purpose and nature, the Dean of Faculty of Nursing signed a verified agreement with the Assiut University Children's Hospital Manager to gather the date

- The **validity** index of tools was judged by a jury of five university professors in the field of Pediatric Nursing. It was 0.87 for tool one, 0.88 for tool two, and 0.89 for tool three. Also, **Tool reliability** using Cronbach's Alpha test was done for the used tools . It was found 0.66 for tool one, 0.733 for tool two 0.641, and 0.721for tool three.

- The Ethical Committee at Assiut University's Faculty of Nursing provided the ethical agreement. The purpose and scope of the study were explained to the nurses. Nurses were also informed that they could agree to or reject participation in the study. Every nurse was given an oral agreement to participate in the study, and they were promised that the information gathered would be kept confidential and used exclusively for the study.

- Pilot study: The tool's simplicity and comprehensibility, as well as the time required to complete the form, were tested on 10% of the nurses in a pilot study. Minor adjustments were made based on the results of the pilot study. The pilot research test was removed from the study sample due to alterations and changes.

- **The Period of PURPLE Crying program:** was adopted from (The National Center on Shaken Baby Syndrome, 2018) Pediatricians, pediatric nurses, child development experts, and parents collaborated on the design. The following points are integrated with the system:
  - It will be educational and appealing to pediatricians, obstetricians, and parents of newborns.
  - For all parents, with an emphasis on the dangers of shaking a baby
  - A clear, memorable, and substantial positive message.
  - Designed to be interesting and relevant to both men and women.
  - Written for students in third grade.

  - People from several cultural and social roots are symbolized.
  - No bottles or blankets; pediatric and public health nurses are fine with it.
  - Ten tongues are provided.
  - The program is covered by the sponsoring organization, and parents receive a copy to review as needed and share with others who may be responsible for their child.

**The program was implemented in four phases, as follows:**

I- **Assessment phase:** The researchers evaluated nurses' willingness to participate in the study as well as personal data such as age, gender, educational level etc.

II- **Planning phase:** This phase is comprised of making arrangements for the program's execution, such as the teaching location, sessions, audiovisual aids, booklet development., etc

- **Teaching Time:** The duration of the training is defined by the national center for shaken baby syndrome guidelines.
- **Teaching place:** This research was carried out in the Assiut University Children's Hospital's PICU, NICU, and outpatient pediatric clinic.
- **Teaching methods and materials:** The researchers taught through lectures, data displays, films, and discussions, as well as distributing a booklet to every nurse and supplemental booklets to nurses for parents during their SBS health education at the end of the program.

**Sessions:** The program's content was split into two sessions:

**Session (1):** offers illustrations and explanations of the program goals for pediatric nurses, such as:

Nurses' current understanding of Shaken Baby Syndrome (SBS) and Pediatric Abuse of Head Trauma was assessed (PAHT).

- Nurses' understanding of crying and how it relates to possible shaking injuries are assessed.
- Nurses' comprehension and knowledge of the "Period of PURPLE Crying" program content were assessed.
- SBS avoidance and appraisal of "The Period of PURPLE Crying" tutoring in nursing staff by including a pre-and post-test of the information to measure how

their understanding has changed after showing the content.

**Session (2):** A test was included to determine how well nurses understand the shaken baby syndrome, ie., nurses' awareness of when PURPLE babies cry, as well as their ideas and attitudes about the dangers of shaken infant syndrome..etc

**III. Application phase:** Each nurse was expected to attend two days of sessions to finish the three-month educational program's subjects, which included videos, data shows, and a booklet including all program information.

**IV. Appraisal stage:** After two weeks, nurses' knowledge, beliefs, and attitudes about the shaken baby syndrome and the purple crying period were assessed to fix the educational program's worth and to emphasize the need for health education for newborns' parents visiting children's hospitals to lessen the risk of SBS on their children.

**Fieldwork**:

From December 2019 to February 2020, data was collected for three months. Nurses from the pediatric inpatient(PICU&NICU) and outpatient units at Assiut University Children's Hospital were questioned. During the meeting, they presented themselves to the joining nurses and discussed the study's rationale and nature. For the pretest, two meetings were held. The researchers firstly completed the organized form. The researchers described the teaching program's contents and gave the nurses who participated in the second a handout booklet.

Approximately five nurses were interviewed twice a week. It took about 20-30 minutes to complete all portions of the form, with 10 minutes set aside for viewing films and data. The contents of the program, which included images, posters, charts, and PowerPoint presentations, as well as videos in the students' learning area, were included in the booklet. It was estimated that the post-test form would take 20-30 minutes to complete. The post-test was performed two weeks after the pretest.

**Statistical design:**

Data analysis was performed using SPSS 20 statistical software. The qualitative variables were described using frequency and percentages and quantitative variables were

described using range, mean and standard deviation. Chi-square and Mcnemar test were used. P-value <0.05 was considered significant and highly significant if P value <0.01.

**Results:**

**Table (1)** showed the distribution of the studied nurses according to their personal data. As shown in this table, 60.0 % of nurses were aged 20 > 30, and the mean age of nurses was 29.8±7.1. 92.0% of nurses were females, 46.0 % of them were graduated of the Nursing institute and 44.0% had the Bachelor's degree. 44.0% of had their years of experience 2->10 years and 59.0% were married.

**Figure (1)** showed the distribution of the studied nurses regarding their total knowledge level about the shaken baby syndrome in the pre and the post-test. As shown in this figure, in the pre-test 9% of nurses had a satisfactory level of knowledge and their knowledge were improved in the post-test to 92% while the unsatisfactory level was decreased to 8% in the post-test with highly statistically significant difference between the nurses' knowledge level in the pre and the posttest (*P*=0.001).

**Figure (2)** presented the distribution of the studied nurses regarding their total knowledge level about PURPLE Program in pre and post-test. As shown in this figure, 96% of nurses had a satisfactory level of knowledge about PURPLE Program in the post-test while the unsatisfactory level was decreased to 4% with highly statistically significant difference between the nurses' knowledge level in the pre and the posttest (*P*=0.006).

**Figure (3**) presented the distribution of the studied nurses regarding their total believes and attitudes levels about shaken baby syndrome hazard in the pre and post-test. As presented in this table, in the pretest 73% of nurses had appropriate believes and attitudes regarding shaken baby syndrome hazard. while in the post-test all of the nurses (89%) had appropriate believes and attitudes with a highly statistically significant difference between the nurses' believes and attitudes in the pre and post-test (*P*=0.004).

**Table (2):** illustrated the distribution of the studied nurses according to their crying knowledge in the pre and the post-test. In the post-test, the majority of nurses (92%) responded strongly agree that sometimes a crying infant can look like she/he is in pain

even when they are not, followed by Infants cry more often in the late afternoon and evening (90%), followed by Infant crying increases in the first few weeks of life and reaches a peak in the first 2 or 3 months before getting less (86%). Eighty three percent responded strongly agree that it is ok to walk away from a crying infant when his or her crying becomes very frustrating. About three-fourths (76%) of them responded and disagreed that when an infant cries, it is always a sign that something is wrong. Highly statistically significant differences were found between the nurses' attitudes in the pretest and the post-test ($P = 0.001$).

**Table (3):** illustrated the relation between nurses' personal data and their total knowledge

level about the shaken baby syndrome and PURPLE Program in the post-test. As shown in this table, there were significant differences in the nurses' total knowledge in the post-test regarding sex, marital status, and the years of experience ($P = 0.007**$, $0.001**$, and $0.004**$ respectively).

**Table (4):** showed the relation between nurses' personal data and their total believes and attitudes levels regarding shaken baby syndrome hazard in the post-test. As shown in this table, there were significant differences in the nurses' total knowledge in the post-test regarding their educational level, the years of experience, and marital status ($P = 0.001**$, $0.001**$, and $0.001**$ respectively).

**Table (1)**: Percentage distribution of the studied nurses according to their personal data (N=100):

| Personal data | N | % |
|---|---|---|
| **Age/ years:** | | |
| • 20->30 | 60 | 60.0 |
| • 30->40 | 30 | 30.0 |
| • 40->50 | 10 | 10.0 |
| **Age mean ±SD** | 29.8±7.1 | |
| **Sex:** | | |
| • Male | 8 | 8.0 |
| • Female | 92 | 92.0 |
| **Educational level:** | | |
| • Diploma | 10 | 10.0 |
| • Nursing institute | 46 | 46.0 |
| • Bachelor`s degree | 44 | 44.0 |
| **Years of experience:** | | |
| • Less than 2 years | 36 | 36.0 |
| • 2->10years | 44 | 44.0 |
| • 10->20 years | 14 | 14.0 |
| • 20 and more | 6 | 6.0 |
| **Marital Status:** | | |
| • Single | 36 | 36.0 |
| • Married | 59 | 59.0 |
| • Divorced | 2 | 2.0 |
| • Widowed | 3 | 3.0 |

**Figure (1)** Percentage distribution of the studied nurses regarding their total knowledge level about the shaken baby syndrome in the pre and post-test (N=100):
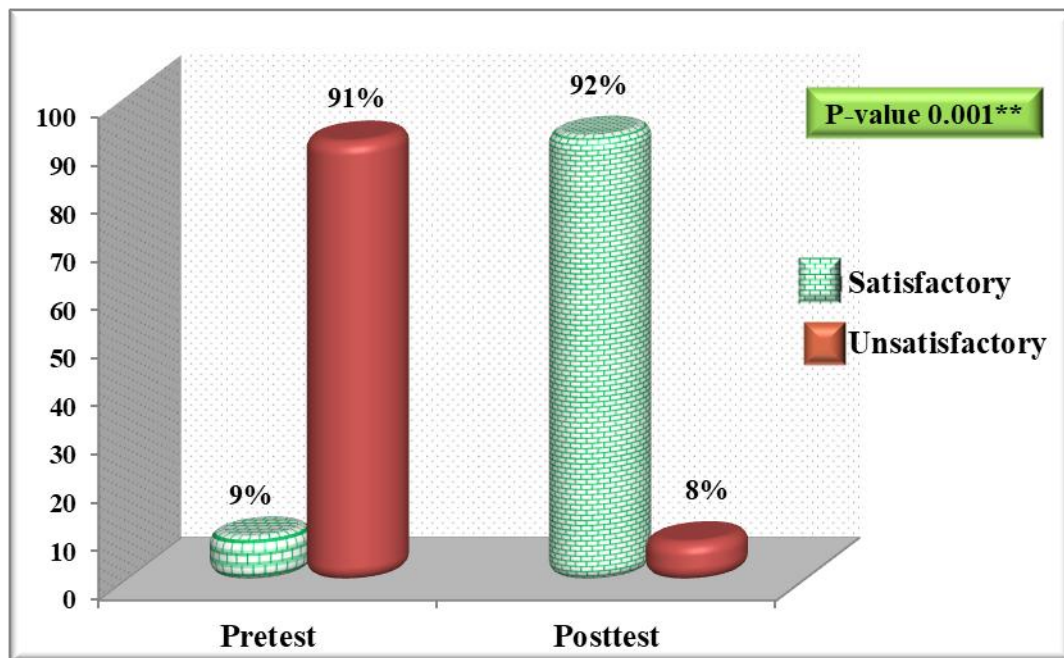


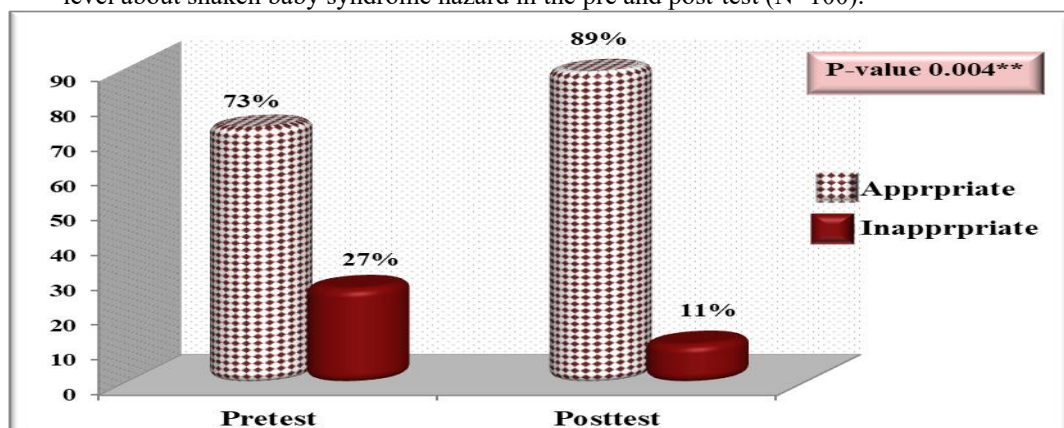(**) **Highly statistical significant difference**

**Figure (2)** Percentage distribution of the studied nurses regarding their total knowledge level about the PURPLE Program in the pre and post-test (N=100):
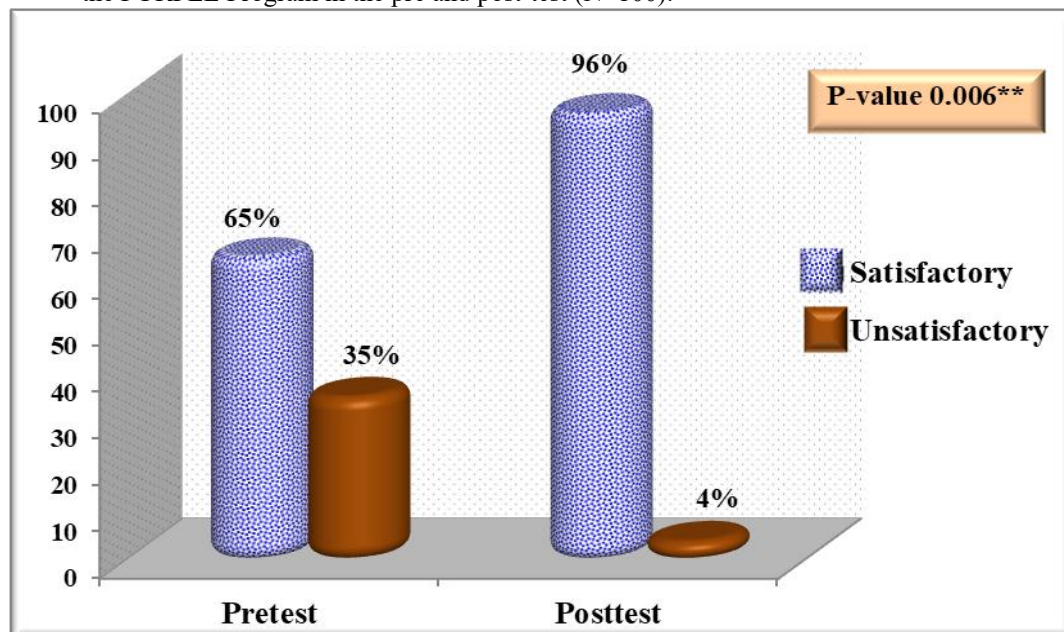


(**) **Highly statistically significant difference**

**Figure (3):** Percentage distribution of the studied nurses regarding their total believes and attitudes level about shaken baby syndrome hazard in the pre and post-test (N=100):



(**) **Highly statistically significant difference**

**Table (2):** Percentage distribution of the studied nurses according to their crying knowledge in the pre and post-test (N=100):

| Items | | Crying's knowledge | | | | p-value |
|---|---|---|---|---|---|---|
| | | pretest | | posttest | | |
| | | N | % | N | % | |
| Infants cry more often in the late afternoon and evening. | Strongly agree | 40 | 40.0 | 90 | 90.0 | 0.001** |
| | Agree | 49 | 49.0 | 10 | 10.0 | |
| | Disagree | 7 | 7.0 | 0 | 0.0 | |
| | Strongly disagree | 4 | 4.0 | 0 | 0.0 | |
| Infant crying increases in the first few weeks of life and reaches a peak in the first 2 or 3 months before getting less. | Strongly agree | 36 | 36.0 | 86 | 86.0 | 0.001** |
| | Agree | 42 | 42.0 | 14 | 14.0 | |
| | Disagree | 20 | 20.0 | 0 | 0.0 | |
| | Strongly disagree | 2 | 2.0 | 0 | 0.0 | |
| If an infant is healthy, it should not cry unexpectedly or without a clear reason. (is reverse scored) | Strongly agree | 22 | 22.0 | 2 | 2.0 | 0.001** |
| | Agree | 28 | 28.0 | 4 | 4.0 | |
| | Disagree | 42 | 42.0 | 76 | 76.0 | |
| | Strongly disagree | 8 | 8.0 | 18 | 18.0 | |
| When an infant cries it is always a sign that something is wrong. (reverse-scored) | Strongly agree | 35 | 35.0 | 8 | 8.0 | 0.001** |
| | Agree | 17 | 17.0 | 0 | 0.0 | |
| | Disagree | 32 | 32.0 | 76 | 76.0 | |
| | Strongly disagree | 16 | 16.0 | 16 | 16.0 | |
| Sometimes a crying infant can look like she/he is in pain even when they are not. | Strongly agree | 38 | 38.0 | 92 | 92.0 | 0.001** |
| | Agree | 31 | 31.0 | 6 | 6.0 | |
| | Disagree | 20 | 20.0 | 0 | 0.0 | |
| | Strongly disagree | 11 | 11.0 | 2 | 2.0 | |
| Sometimes healthy infants can cry for 5 or more hours a day. | Strongly agree | 25 | 25.0 | 80 | 80.0 | 0.001** |
| | Agree | 41 | 41.0 | 20 | 20.0 | |
| | Disagree | 26 | 26.0 | 0 | 0.0 | |
| | Strongly disagree | 8 | 8.0 | 0 | 0.0 | |
| A good parent should be able to soothe his or her crying infant. (reverse-scored) | Strongly agree | 26 | 26.0 | 0 | 0.0 | 0.001** |
| | Agree | 18 | 18.0 | 1 | 1.0 | |
| | Disagree | 27 | 27.0 | 33 | 33.0 | |
| | Strongly disagree | 29 | 29.0 | 66 | 66.0 | |
| It is ok to walk away from a crying infant when his or her crying becomes very frustrating. | Strongly agree | 34 | 34.0 | 83 | 83.0 | 0.001** |
| | Agree | 20 | 20.0 | 17 | 17.0 | |
| | Disagree | 15 | 15.0 | 0 | 0.0 | |
| | Strongly disagree | 31 | 31.0 | 0 | 0.0 | |

(**) **Highly statistically significant difference**

**Table (3):** Relation between nurses' personal data and their total knowledge level about the shaken baby syndrome and PURPLE Program in the posttest (N=100):

| personal data | Total knowledge in posttest | | | | P-value |
|---|---|---|---|---|---|
| | Satisfactory | | Unsatisfactory | | |
| | N(89) | % | N(11) | % | |
| **Age:** | | | | | |
| 20->30 | 58 | 61.1 | 2 | 40.0 | |
| 30->40 | 29 | 30.5 | 1 | 20.0 | 0.072 |
| 40->50 | 8 | 8.4 | 2 | 40.0 | |
| **Sex:** | | | | | |
| Male | 6 | 6.3 | 2 | 40.0 | **0.007**[**] |
| Female | 89 | 93.7 | 3 | 60.0 | |
| **Educational level:** | | | | | |
| Diploma | 10 | 10.5 | 0 | 0.0 | |
| Nursing institute | 42 | 44.2 | 4 | 80.0 | **0.281** |
| Bachelor degree | 43 | 45.3 | 1 | 20.0 | |
| **Years of experience:** | | | | | |
| Less than 2 years | 36 | 37.9 | 0 | 0.0 | |
| 3->10years | 41 | 43.2 | 3 | 60.0 | |
| 10->20 years | 14 | 14.7 | 0 | 0.0 | **0.004**[**] |
| 20 and more | 4 | 4.2 | 2 | 40.0 | |
| **Marital Status:** | | | | | |
| Single | 33 | 34.7 | 3 | 60.0 | |
| Married | 59 | 62.1 | 0 | 0.0 | |
| Divorced | 2 | 2.1 | 0 | 0.0 | **0.001**[**] |
| Widowed | 1 | 1.1 | 2 | 40.0 | |

(*)**Statistically significant difference**
(**) **Highly statistically significant difference**

**Table (4):** Relation between nurses' personal data and their total believes and attitudes levels regarding shaken baby syndrome hazard in the post-test (N=100):

| personal data | Total believes and attitudes in posttest | | | | P-value |
|---|---|---|---|---|---|
| | Appropriate | | inappropriate | | |
| | N(89) | % | N(11) | % | |
| **Age:** | | | | | |
| 20->30 | 55 | 61.8 | 5 | 45.5 | |
| 30->40 | 26 | 29.2 | 4 | 36.4 | 0.489 |
| 40->50 | 8 | 9.0 | 2 | 18.2 | |
| **Sex:** | | | | | |
| Male | 8 | 9.0 | 0 | 0.0 | 0.300 |
| Female | 81 | 91.0 | 11 | 100.0 | |
| **Educational level:** | | | | | |
| Diploma | 4 | 4.5 | 6 | 54.5 | **0.001**[**] |
| Nursing institute | 41 | 46.1 | 5 | 45.5 | |
| Bachelor degree | 44 | 49.4 | 0 | 0.0 | |
| **Years of experience:** | | | | | |
| Less than 2 years | 36 | 40.5 | 0 | 0.0 | **0.001**[**] |
| 3->10years | 39 | 43.8 | 5 | 45.5 | |
| 10->20 years | 8 | 9.0 | 6 | 54.5 | |
| 20 and more | 6 | 6.7 | 0 | 0.0 | |
| **Marital Status:** | | | | | |
| Single | 33 | 37.1 | 3 | 27.3 | **0.001**[**] |
| Married | 54 | 60.7 | 5 | 45.4 | |
| Divorced | 0 | 0.0 | 2 | 18.2 | |
| Widowed | 2 | 2.2 | 1 | 9.1 | |

(**) **Highly statistically significant difference**

**Discussion:**

Infants who are shaken may be brought to medical attention by a caregiver who offers no history of injury, a vague account of events, or an explanation that is not consistent with the physical findings. Unless the physician is aware of the possibility of abuse and knowledgeable about the signs of Shaken Baby Syndrome, the cause of these children's symptoms can be

missed. **(Argo et al., 2019).** Shaken baby syndrome (SBS) also known as abusive head trauma (AHT), is a constellation of symptoms and signs, such as subdural hematoma, retinal hemorrhages, and encephalopathy, often referred to as 'the triad' as caused by violent shaking. The victims of SBS display a wide range of neurological sequelae. These include cognitive and behavioral disturbances, cerebral palsy, blindness, and epilepsy **(Alshahrani et al., 2018).**

Regarding personal data of the studied nurses, more than half of nurses were aged 20 > 30. Most of the nurses were females. Nearly half of the nurses their educational level was nursing institute and nearly half were bachelor degrees. Nearly half of their years of experience were 3->10 years and more than half were married. This finding was supported by **Brubaker-Vincent, et al., (2016),** who found that majority of the nurses surveyed were female. More than two-thirds of nurses surveyed were between the age of 22-40 years of age, 12% of nurses surveyed had Diploma certifications, nearly half of nurses surveyed have an associate degree, and nearly half of nurses surveyed have BSN or higher education.

The findings of the current study showed that the majority of studied nurses had a satisfactory level of knowledge about the shaken baby syndrome in the posttest compared to the pretest while few nurses had an unsatisfactory level in the posttest with a highly statistically significant difference found between the nurses' knowledge level in the pre and the posttest. this finding agreed with **Fujiwara et al., (2021),** who found that scores on crying knowledge scales (out of 100) were significantly higher in the intervention than in control groups (56.1 vs. 53.1; difference, p < 0.005). From the researchers point of view, this result related to the effectiveness of programme in increasing nurses` knowledge about belives of the shaken baby syndrome.

The present study presented that, the majority of nurses had a satisfactory level of knowledge about the PURPLE Program in the post-test while the unsatisfactory level was decreased to slightly with a highly statistically significant difference found between the nurses' knowledge level in the pre and the posttest. This finding was consistent with the finding of the study done **by**

**Barant et al., (2015)** who showed that, the knowledge about infant crying increased significantly after program delivery (P = 0.001).

The current study also revealed that in the pretest nearly three-quarters of nurses had appropriate beliefs and attitudes regarding shaken baby syndrome hazards. while in the post-test most of the nurses had appropriate believes and attitudes with a highly statistically significant difference between the nurses' believes and attitudes in the pre and post-test. This finding was in agreement with **Adham et al., (2019).** who considered most of the participants in the study have inappropriate attitudes and beliefs regarding shaken baby syndrome hazards before the program. From the researcher point of view this result may be due to that the programme was useful for nurses and there level of knowledge .

The current study denotes that, most nurses respond strongly agree that, sometimes a crying infant can look like she/he is in pain even when they are not, followed by infants crying more often in the late afternoon and evening, followed by Infant crying increases in the first few weeks of life and reaches a peak in the first two or three months before getting less and more than three-quarters of them strongly agreed that, it is ok to walk away from a crying infant when his or her crying becomes very frustrating. About three-fourths of them, responded to disagree that when an infant cries it is always a sign that something is wrong with highly statistically significant differences found between the nurses' attitudes in pretest and post-test.

The current study also showed that there were statistically significant differences between nurses' total knowledge in post-test and personal data such as their sex, marital status, and years of experience with p values (0.007**, 0.001**, and 0.004**) respectively. This result disagrees with **Brubaker-Vincent, et al., (2016)** who found that there no statistically significant difference between knowledge of Shaken Baby syndrome and the highest level of education. **Adham et al., (2019)** stated that the knowledge of SBS was highest among those with the highest education level. Those with tertiary education also had the highest number of participants who are not aware of SBS. From the chart, among female participants12.33% were not aware of shaken baby syndrome while more than half knew SBS.

Among the male participants, only a few number were not aware of SBS. Generally, females were more knowledgeable about SBS than males.

The findings of the present study showed that there were statistically significant differences between nurses' total beliefs and attitudes and personal data in posttest such as age, educational level, years of experience, and marital status with p values (0.001**, 0.001**, and 0.001**) respectively. This finding disagreed with **Eyisi et al., (2019)** who found that the difference between wrong practices leading to shaken baby syndrome and marital status was not statistically significant (p= 0.838). Also, the difference between wrong practices leading to shaken baby syndrome and the highest level of education was not statistically significant (p= 0.633). These results may be due to that nearly half of the nurses their experiences about ten years and were bachelor`s degree which had a positive effect on their attitude and knowledge.

## Conclusions:

It was concluded from the current study that, implementation of an Evidence-Based prevention program had a positive effect on understanding the period of PURPLE crying in infants, and hense reducing the hazards of Shaken Baby Syndrome in infants as a result of knowing the nature of this period in neonates and infants. The majority of nurses had appropriate attitudes and believes after application of the program. Also, there was a highly statistically significant relationship between nurses' sex, Level of education, years of experience and marital status, and their knowledge, and beliefs regarding shaken baby syndrome hazards in the post-test.

## Recommendations:

**Based on the findings of the current study, the following recommendations are suggested:**

- Nurses should teach parents and give them a booklet about the period of PURPLE crying and practices to prevent shaken baby syndrome on the infant discharge from PICU or NICU.
- Nurses should be educated about shaken baby syndrome hazards and receive written information in their working place.
- The nurses' information leaflet should preferably be available in simple Arabic.

- Period of PURPLE crying and hazards of the shaken baby syndrome should be included in the curriculum for nursing students.

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