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Knowledge and Attitude of Nurses Regarding Newborn Hearing Impairment and Screening at Health Centers and clinics in Assiut City

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Abstract
Background: Hearing impairment is a partial or total inability to hear, may occur in one or both ears. In children hearing problems can affect the ability to learn spoken language and result in loneliness. **Aim of the study:** assess knowledge and attitude of nurses regarding Newborn Hearing Impairment and screening at Health Centers and clinics in Assiut City. **Subjects and Methods:** Descriptive cross-sectional design was used. A Total coverage sample of 235 nurses has participated**. Tool 1:** A structured self-administered questionnaire, it included three parts**, Part one:** personal data, **Part two:** questions related to attending training course regarding newborn hearing screening, **Part three:** knowledge about Newborn Hearing Impairment (NHI) and screening. **Tool 2:** It included two scales, **Part one:** Attitude assessment scale about NHI, and **Part two**: Attitude assessment scale about Newborn Hearing Screening. **Results:** 34.5% of nurses had poor knowledge, and 69.4% of them had a positive attitude regarding NHI, while 68.9% had a negative attitude against newborn hearing screening. There is a statistically significant difference between the score of nurses' knowledge and their age. **Conclusion:** Deficit in nurses' knowledge regarding newborn hearing impairment and screening; and fluctuation in their attitude between negative and positive. Also, there were statistically significant differences between the level of nurses' attitude about newborn hearing screening, their age, and years of experience. **Recommendations**: in-service training programs should be developed and implemented for nurses.

Keywords: Attitude, Knowledge, Nurses, Newborn Hearing Impairment, & Screening

Introduction
The ear is a very complex organ of the human body, composed of three parts; external, middle, and inner ear. It is mainly concerned with detecting, transmitting, and transducing sound. Maintaining a sense of balance is another important function performed by the human ear **(Rigato, 2017)**.
Hearing is one of the most important primary senses which help to the proper development of speech, language, and communication smoothly with the hearing world. Unfortunately, hearing is often neglected and people usually fail to realize its importance unless it is diminished or reduced gradually**.** Childhood hearing impairment can have profound effects on overall development, interpersonal communication, quality of life, and daily function **(Sanju et al., 2018 & Kunnath et al., 2021)**.
Hearing impairment is defined as when hearing loss greater than 40 decibels (dB) in the better hearing ear in adults and a hearing loss is greater than 30 decibels in the better hearing ear in children. The overall development of a child is determined by how healthy a child is. It determines a child ability to acquire knowledge and skill, though there are various reasons, a child is to be labeled as challenged, one of the most important reasons is disruptive functioning of the five basic senses (to see, to hear, to smell, touch and to taste) **(Ferrite et al., 2017).**
Hearing impairment can occur during or shortly after birth as early-onset hearing loss, or it can appear later in life as late-onset, progressive, or acquired hearing loss with varying degrees of severity. Various prenatal factors such as Genetic factors including hereditary and non-hereditary hearing loss, intrauterine infections - such as rubella and cytomegalovirus infection; perinatal morbidities and their management and postnatal Birth asphyxia, Hyperbilirubinemia, and Low-birth weight are some causes that can lead to a permanent hearing loss **(WHO, 2019).**
Hearing loss is divided into four categories, according to the National Dissemination Center for Children with Disabilities (NICHCY): conductive, sensor neural, mixed, and central. These identify the location in the body where the hearing impairment occurs **(Johnson, 2017).** Hearing impairment can be classified as mild (26-40 dB), moderate (41-60 dB), severe (61-80 dB), or profound (over 81 dB), based on how well a person can hear the frequencies that are commonly associated with speech **(Carew et al., 2018).**

Undetected hearing impairment can adversely affect a child's speech, language, social development, and educational achievement. However, these negative effects can be prevented through a newborn hearing screening program (NHSP) **(Mazlan & Min, 2018).**

In Egypt, The Ministry of Health and Population announced the launch of the initiative of President Abdel Fattah Al-Sisi implemented (NHSP) on July 1, 2019, which aimed to identify infants with hearing loss by three months of age and provide appropriate early intervention no later than six months of age to discover and treat hearing loss and impairment in newborns, this examination is preferably performed 3-7 days after birth, it does not take Only a few minutes, shows whether the child is normal or suspected of hearing impairment **(MOHP, 2019).**

The knowledge, attitudes questionnaire identifies what a specific group of individuals knows about certain topics and how they interact with them. The knowledge section is a set of questions that are placed to assess the participant's information on a focused medical notion locally or global. The attitude section covers queries used to check the current attitude, thoughts, misconceptions and confusions **(Alqudah et al., 2021).**

Community health nurses play a key role in direct contact with the parents and encouraging them for follow-up services. They can educate and counsel expectant mothers as well as during the postpartum period on the need and importance of Newborn Hearing Screening, steps followed, early identification, intervention, and timely follow-up. Also, they can provide valuable information on motor, sensory and language developmental-milestones, and form a crucial emotional support system for parents of diverse socio-economic and cultural backgrounds during the Newborn Hearing Screening **(Ravi et al., 2017).**

Significance of the study:

Hearing loss has become the fourth leading cause of disability globally**,** Neonatal hearing impairment has a prevalence that is more than twice that of other newborn disorders such as congenital hypothyroidism and phenylketonuria **(Cunningham & Tucci, 2017 and WHO, 2018)**. The WHO estimated the prevalence of worldwide hearing loss to be ~466 million people, and 34 million are children. By 2050, it is predictable that more than 900 million people will have disabling hearing loss **(WHO, 2017).**

The prevalence of neonatal permanent hearing loss is reported globally to be about 0.5 to 5.0 per 1000 infants, in some low- and middle-income countries even higher. Nearly two-thirds of neonatal hearing loss affects both ears, while one-third occurs unilaterally **(Neumann et al., 2019).** In Egypt, the prevalence of hearing loss among children is estimated to be 20.9% according to a previous study that was established in the Shebin El-Kom District of Egypt **(Elbeltagya et al., 2019).**

Aim of the study: -

Assess knowledge and attitude of nurses regarding Newborn Hearing Impairment and Screening at Health Centers and clinics in Assiut City.

Research questions: -

What are the nurses' score of knowledge and attitude regarding Newborn Hearing Impairment and Screening?

Subjects and Methods:

Research design:

A descriptive cross-sectional research design was used in this study.

Setting:

The present study was carried out at all health centers and clinics in Assiut City. The total number of Health centers and clinics is 22 which divided into 12 in East Assiut and 10 in West Assiut.

Sample:

Total coverage sample used for nurses in all health centers and clinics in Assiut City. The total numbers in this study were (240) nurses; (5) nurses were excluded because they retired during data collection to become the sample size (235) nurses.

The following table clears the number of nurses in each health center and clinic: -

Health center and clinic	Actual Number of Nurses
East Assiut City	
Alwalidia health center	15
Found Walidia health center	14
Nazlet Abdellah health center	13
Genetic Extension center	3
Feryal child care	26
Red child care	17
Alwalidia child care	14
Kdwani child care	11
East assiut health administration	4
Raja district clinic	6
Walidia district clinic	9
Red district clinic	8
West Assiut City	
Mubarak health center	19
Kolta child care	19
West child care	17
Fifth health office	6
Sadat district	7
Office of health administration	2
Kolta district clinic	4
Sheikh mentash clinic	4
Great mosque district clinic	8
West district clinic	9
Total	235

Tools of study:

A structured self-administered questionnaire was developed by researchers to collect necessary data, after reviewing related literature; two proper tools were used for data collection.

Tool (1): It included three parts:

Part (1): Personal data of the nurses included age, sex, level of education, year of experience, that aimed to clarify the relation between nurses' knowledge, attitude and their personal characteristics,

Part (2): Questions related to attending training course regarding newborn hearing screening, time of training, importance of screening, the center has hearing screening device and the nurse able to explain the hearing screening process to parents.

Part (3): Assessment of knowledge about Newborn Hearing Impairment (NHI) and screening to assess nurses' knowledge, it included (13) questions such babies born with hearing impairment, causes of NHI, risk factors, symptoms, degrees, methods of diagnoses, the best age of hearing screening, another testing and final diagnoses, methods of treatment, time of wearing hearing aids, age of early intervention, to whom infant should be referred **(Ravi et al., 2017 & Sanju et al., 2018).**

The scorning system for knowledge:

The total grades of knowledge were (39); one grade for each correct answer and zero for incorrect answer and don't know. The total sco

Tool (2): It included two scales:

Part (1): Attitude assessment scale about Newborn Hearing Impairment developed by **(López-Vázquez et al., 2009**), was adapted with modifications by researchers that were culturally and socially relevant. This scale aimed to assess the attitude of nurses**;** it was five-point likert scale; the statements that was positively worded had response as strongly disagree (0), disagree (1), do not know (2), agree (3) and strongly agree (4).

Part (2): Attitude assessment scale about Newborn Hearing Screening, this scale adapted from **(Danhauer et al., 2006 & Moeller et al., 2006)** to assess the attitude of nurses. It was five-points Likert scale; Each positive statement had a response as Strongly agree (5`), Agree (4), don't know (3), disagree (2), and, strongly disagree (1), While negative statements had response as strongly disagree (5), disagree (4), don't know (3), agree (2), and strongly agree (1).

Scoring system for attitude about newborn hearing impairment and screening:

The total score was calculated by summing up and then converting into a percentage score.

- Nurses' attitude was considered positive if the score was ≥ 60%.
- Nurses' attitude was considered negative if the score was < 60% **(Al jawf, 2017).**

Validity of the study tools: -

The tools were transferred to the Arabic language and reviewed to ascertain their content validity by 3 experts in audiology and nursing science, Assiut University. Every member was contacted and asked to review the tool content and its structural design to ascertain completeness, clarity and relevance of the items of questions. All comments and suggestions were done.

Reliability of tools:

Reliability was applied by the researchers for testing the internal consistency of the tools and the value of Cronbach's Alpha reliability was 0.853 for knowledge, 0.729 for attitude about newborn hearing impairment and 0.807 for attitude about newborn hearing screening.

Methodology:

Administrative phase

An official letter approval was obtained from Dean of the faculty of nursing, Assiut University to general director of maternity and child care at the directorate of health affairs in Assiut and then sent to directors of east and west health centers offices and clinics in Assiut City. The letter included a brief explanation of the objectives of the study and permission to carry out the study.

Pilot study: -

It aimed to test clarity of the tools and estimated the time needed to fill the questionnaire**.** This carried out before starting of data collection on 10% from the total sample size (24 nurses) and included in the study, there was no modification in the questionnaire.

Data collection:

Ethical consideration: -

Research proposal approved from Ethical Committee in the Faculty of Nursing. The study followed common ethical principles in clinical research. Formal consent obtained from nurses who were willing to participate in the study, after explaining the nature and purpose the study. Confidentiality and anonymity assured. Study subject had the right to refuse to participate or withdraw from the study without any rational at any time.

field work:

An explanation of the purpose of the research was done to directors of health centers and clinics and the researchers gave the directors of each setting a copy of official letter. Also the purpose of the study was explained to nurses to gain their cooperation before starting data collection. The researchers started to collect data from the last week of September, 2020 to the end of December, 2020 (13 weeks) two days a week for nurses in the morning shift and approximately from 8- 10 questionnaires were collected daily.

Self-administered questionnaire filled by the nurses themselves after clarify of the instruction. Filling each sheet was taken (15-20) minutes.

Statistical Analysis:

Data entry and data analysis were done using SPSS version 22 (Statistical Package for Social Science). Data were presented as numbers, percentages, mean, and standard deviation. Chi-square test was used to compare between qualitative variables. Pearson correlation was done to measure the correlation between quantitative variables. P-value considered statistically significant when $P < 0.05$.

Results:

Table (1): Distribution of Personal data among nurses at health centers and clinics in Assiut city, 2020

Personal data	No. (235)	%
Age: (years)		
< 30	50	21.3
30 - < 40	70	29.8
40 - < 50	86	**36.6**
≥ 50	29	**12.3**
Mean ± SD (Range)	**38.66 ± 9.31 (21-59.8)**	
Sex:		
Female	235	**100**
Education:		
Nursing secondary school	161	**68.5**
Nursing technical institute	52	22.1
Faculty of nursing	22	9.4
Years of experience:		
1 – 10	63	26.8
>10 – 20	63	26.8
>20 – 30	88	**37.4**
> 30	21	8.9

Table (2): Nurses attending training courses about newborn hearing screening at health centers and clinics in Assiut city, 2020

Items	No. (235)	%
1. Attending training courses regarding newborn hearing screening:		
Yes	23	**9.8**
No	212	90.2
2. Time of training courses: (No. 23)		
< 6 months	4	17.4
≥ 6 months -1 year	16	**69.6**
> 1 - 3 years	3	13.0
3. Is it important to screen all newborns for permanent hearing loss?		
Yes	230	**97.9**
No	5	2.1
4. The center has a newborn hearing screening device:		
Yes	130	**55.3**
No	105	44.7
5. The nurse able to explain the newborn hearing screening process to parents		
Yes	95	40.4
No	140	**59.6**

Table (3): Knowledge of nurses regarding newborn hearing impairment at health centers and clinics in Assiut city, 2020

Knowledge of nurses about newborn hearing impairment	No. (235)	%
1. The babies born with hearing impairment:		
Correct	217	**92.3**
Incorrect	18	7.7
2.Causes of newborn hearing impairment: #		
1- High fever	191	**81.3**
2- Measles	67	28.5
3- Ear discharge	135	57.4
4- Convulsion	57	24.3
5- Some type of drug/ medication	71	30.2
6- Jaundice	119	**50.6**
7- Prolonged noise	146	62.1
8- Delayed crying at birth	42	17.9
3.Risk factors for newborn hearing impairment: #		
1- Meningitis	155	66.0
2- Frequent colds	139	59.1
3- Hypotonia	24	**10.2**
4- >48 hrs in Neonatal intensive care unit	63	26.8
5- Cleft palate	98	41.7
6- Mother over age 40	36	15.3
7- Congenital heart disease	121	51.5
8- Congenital syphilis	29	**12.3**
9- Family history of childhood hearing loss	182	**77.4**
4.Symptoms of hearing impairment in infants: #		
1. The infant does not react to loud noises and sounds	191	**81.3**
2.The infant does not respond to your calls	171	72.8
3. The child makes simple sounds	48	20.4
4. Constantly rubbing the ear	66	28.1
5. Pain in the ear	37	15.7
5.Degrees of newborn hearing impairment: #		
1.Slight/mild hearing impairment	191	**81.3**
2.Moderate hearing impairment	151	64.3
3.Severe hearing impairment	157	66.8
4.Profound hearing impairment	129	54.9

(#) more than one answer

Table (4): Nurses' knowledge about diagnoses and treatment of hearing impairment for newborns at health centers and clinics in Assiut city, 2020

Diagnosis and treatment of hearing impairment	No. (235)	%
1. Diagnoses hearing impairment for newborns:		
1. By newborn hearing screening only (correct)	208	**88.5**
2. Don't know	27	11.5
The best age for a newborn to receive the hearing screening testing:		
1. Before 3 months (correct)	222	**94.5**
2. Don't know	13	5.5
The best age for newborn doesn't conduct hearing screening to receive another testing:		
3. Before 3 months (correct)	192	**81.7**
4. 3-6 months	10	4.3
5. After 1 year	4	1.7
6. Don't know	29	12.3
The best age for final diagnosis as the child having a permanent hearing loss:		
1. By 3 months (Correct)	60	**25.5**
2. 3-6 months	63	26.8
3. 6-12 months	15	6.4
4. After 1 year	28	11.9
5. Don't know	69	29.4

Diagnosis and treatment of hearing impairment	No. (235)	%
2. Methods of hearing impairment treatment for newborns: #		
1. Drugs/ medication	71	30.2
2. Ear tubes	90	38.3
3. Wearing hearing aids	202	**86.0**
4. Cochlear implant	158	67.2
5. Sign language	52	**22.1**
The suitable time for children wearing hearing aids:		
1. Before 3 months	25	10.6
2. 3-6 months (Correct)	35	**14.9**
3. 6-12 months	42	17.9
4. After 1 year	78	33.2
5. Don't know	55	23.4
The best age for early intervention:		
1. Before 3 months	83	35.3
2. 3-6 months (Correct)	70	**29.8**
3. 6-12 months	40	17.0
4. After 1 year	9	3.8
5. Don't know	33	14.0
The infant with hearing impairment should be referred to...		
1. An Ear, Nose & Throat physician	17	7.2
2. A pediatric audiologist	218	**92.8**

(#) more than one answer

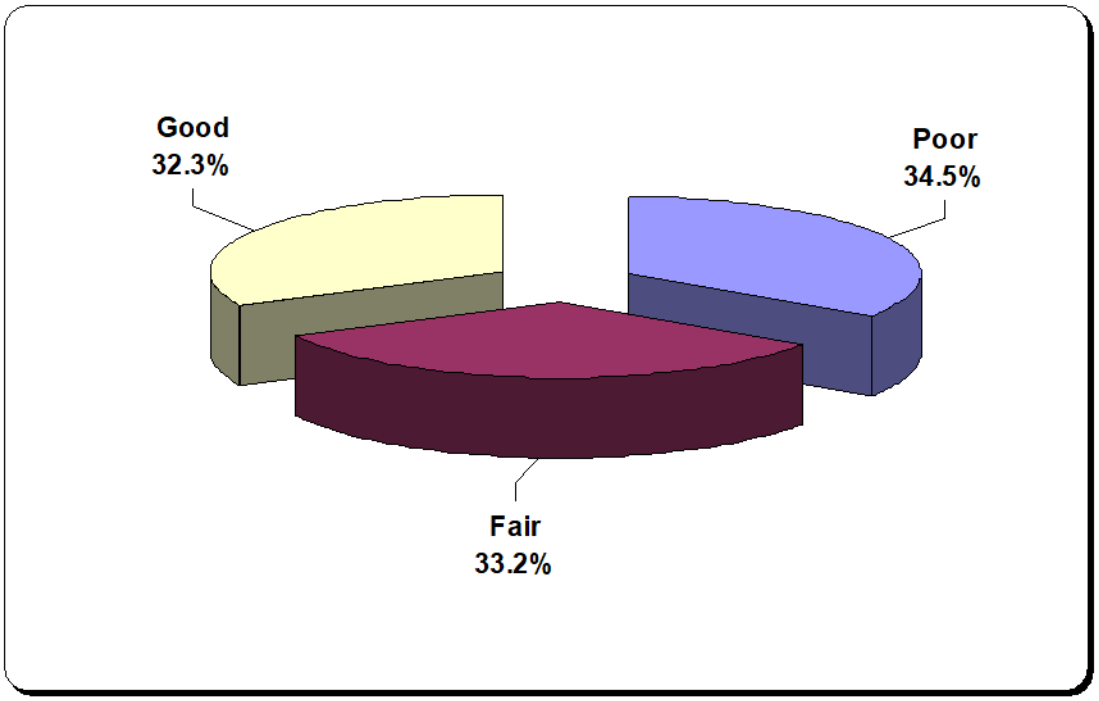

Figure (1): Total score of nurses' knowledge regarding newborn hearing impairment and screening at health centers and clinics in Assiut city, 2020

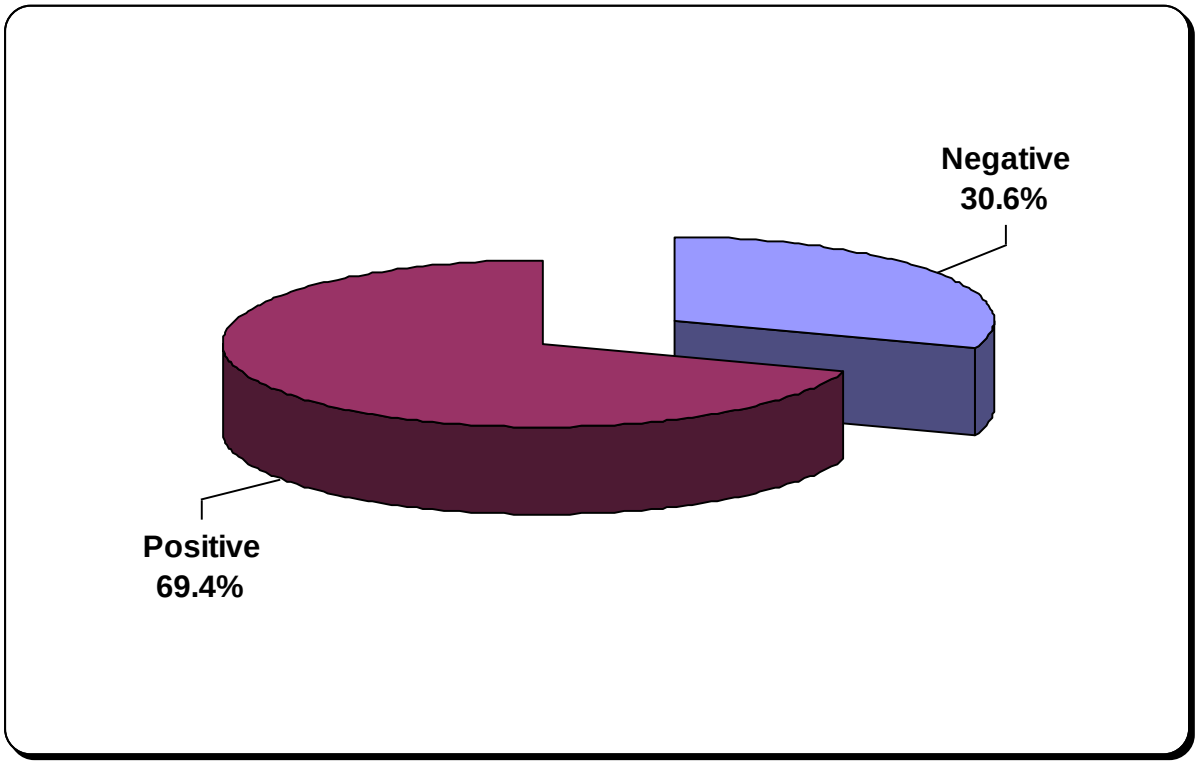

Figure (2): Total score of Nurses' attitude regarding newborn hearing impairment at health centers and clinics in Assiut city, 2020

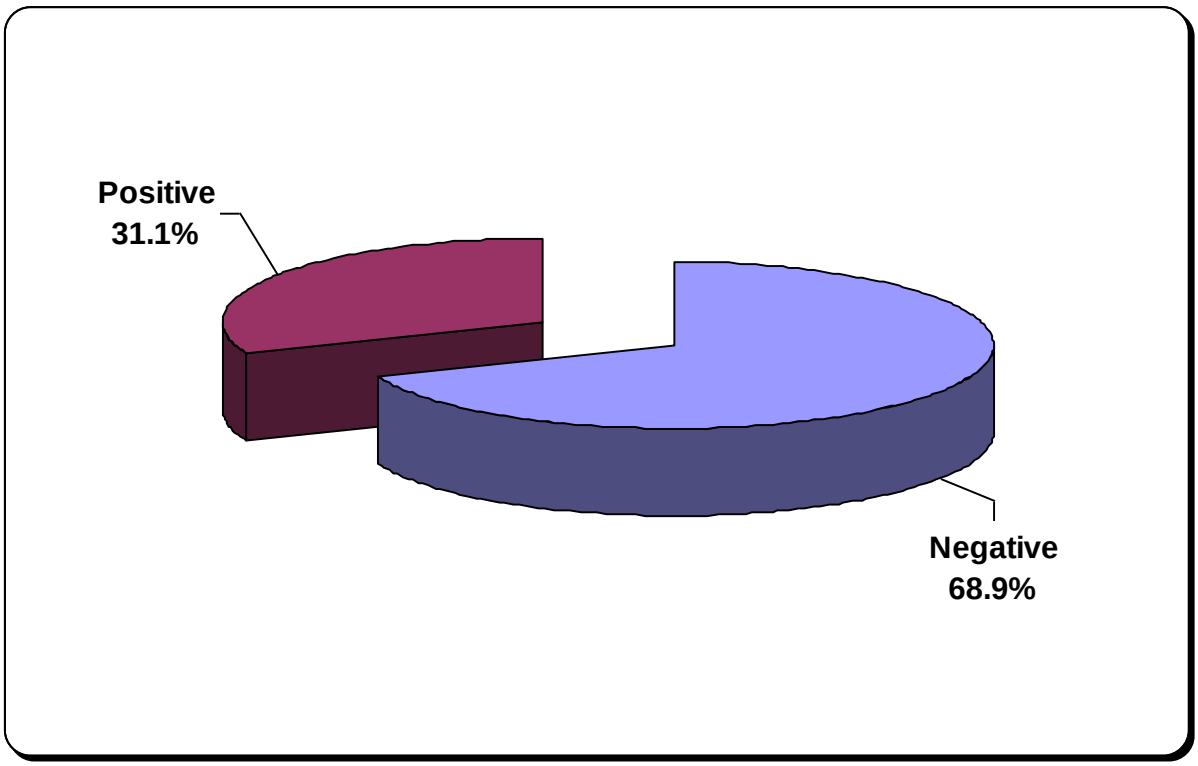

Figure (3): Total score of nurses' attitude regarding newborn hearing screening at health centers and clinics in Assiut city, 2020

Table (5): Relationship between Level of nurses' knowledge and their personal data at health centers and clinics in Assiut city, 2020

Personal data	Knowledge level						P-value
	Poor		Fair		Good		
	No.	%	No.	%	No.	%	
Age: (years)							
< 30	22	44.0	13	26.0	15	30.0	
30 - < 40	18	25.7	19	27.1	33	47.1	**0.016***
40 - < 50	33	38.4	31	36.0	22	25.6	
≥ 50	8	27.6	15	51.7	6	20.7	
Education:							
Nursing Secondary school	55	34.2	54	33.5	52	32.3	**0.803**
Nursing Technical institute	18	34.6	19	36.5	15	28.8	
Nursing Faculty of nursing	8	36.4	5	22.7	9	40.9	
Years of experience:							
1 – 10	25	39.7	19	30.2	19	30.2	
>10 – 20	17	27.0	18	28.6	28	44.4	**0.152**
>20 – 30	33	37.5	30	34.1	25	28.4	
> 30	6	28.6	11	52.4	4	19.0	
Training courses regarding newborn hearing screening:							
Yes	11	47.8	5	21.7	7	30.4	**0.305**
No	70	33.0	73	34.4	69	32.5	

Test of significant used: chi-square **Statistical significance at p ≤ 0.05*

Table (6): Relationship between Level of nurses' attitude about newborn hearing impairment and their personal data at health centers and clinics in Assiut city, 2020

Personal data	Attitude about newborn hearing impairment				P-value
	Negative		Positive		
	No.	%	No.	%	
Age: (years)					
< 30	20	40.0%	30	60.0%	
30 - < 40	17	24.3%	53	75.7%	**0.249**
40 - < 50	28	32.6%	58	67.4%	
≥ 50	7	24.1%	22	75.9%	
Education:					
Nursing Secondary school	48	29.8%	113	70.2%	**0.068**
Nursing Technical institute	21	40.4%	31	59.6%	
Nursing Faculty of nursing	3	13.6%	19	86.4%	
Years of experience:					
1 – 10	25	39.7%	38	60.3%	
>10 – 20	11	17.5%	52	82.5%	**0.031***
>20 – 30	31	35.2%	57	64.8%	
> 30	5	23.8%	16	76.2%	
Training courses regarding newborn hearing screening:					
Yes	8	34.8%	15	65.2%	**0.650**
No	64	30.2%	148	69.8%	

Test of significant used: chi-square **Statistical significance at p ≤ 0.05*

Table (7): Relationship between Level of nurses' attitude about newborn hearing screening and their personal data at health centers and clinics in Assiut city, 2020

Personal data	Attitude about newborn hearing screening				P-value
	Negative		Positive		
	No.	%	No.	%	
Age: (years)					
< 30	40	80.0	10	20.0	**0.013***
30 - < 40	49	70.0	21	30.0	
40 - < 50	60	69.8	26	30.2	
≥ 50	13	44.8	16	55.2	
Education:					
Nursing Secondary school	107	66.5	54	33.5	**0.088**
Nursing Technical institute	42	80.8	10	19.2	
Nursing Faculty of nursing	13	59.1	9	40.9	
Years of experience:					
1 – 10	51	81.0	12	19.0	**0.010***
>10 – 20	41	65.1	22	34.9	
>20 – 30	61	69.3	27	30.7	
> 30	9	42.9	12	57.1	
Training courses regarding newborn hearing screening:					**0.176**
Yes	13	56.5	10	43.5	
No	149	70.3	63	29.7	

Test of significant used: chi-square **Statistical significance at p ≤ 0.05*

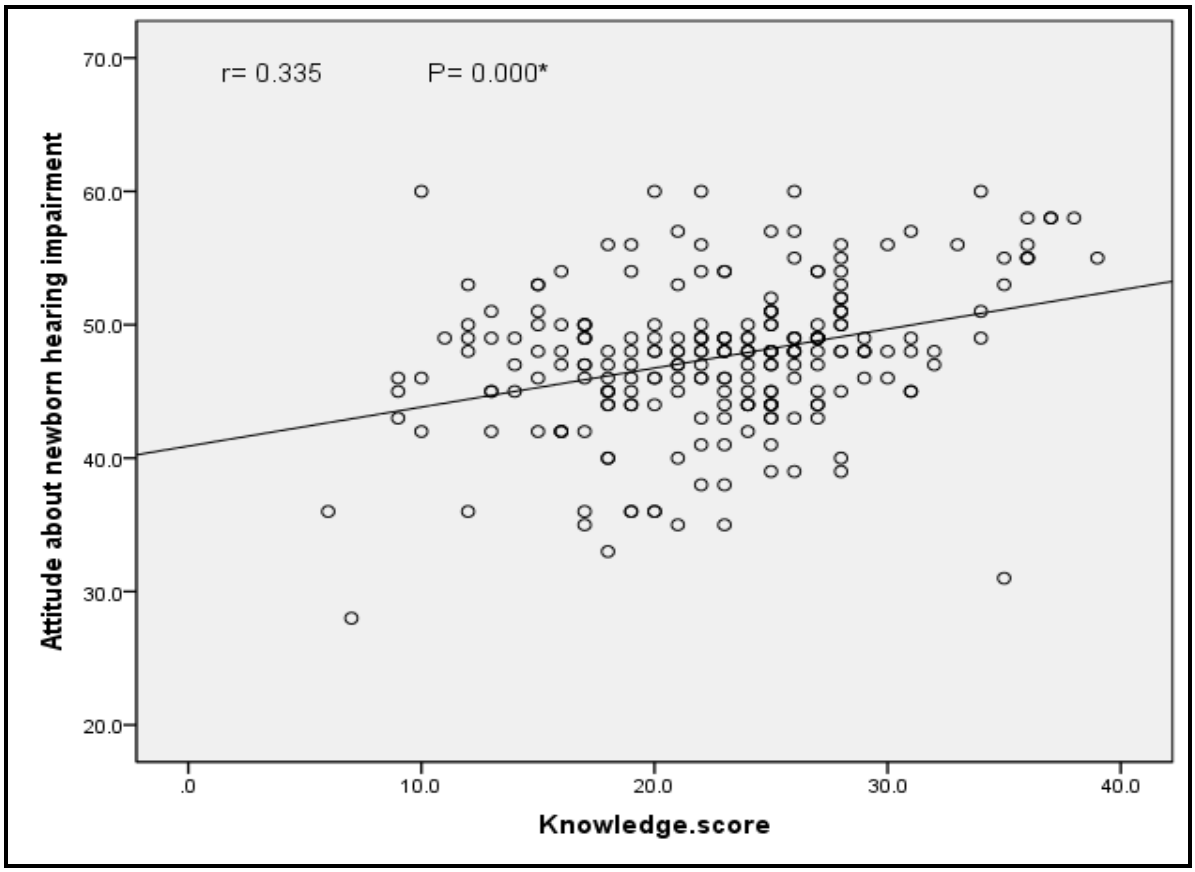

Figure (4): Correlation between total score of nurses' knowledge and their attitude about newborn hearing impairment at health centers and clinics in Assiut city, 2020

Table (1): It was revealed that, 36.6% of nurses aged 40- < 50 years and 12.3 % of them aged ≥ 50 years with mean ± SD 38.66 ± 9.31years. Regarding sex 100.0 % of nurses were females and 68.5 % of them graduated from nursing secondary school. According to years of experience, it was observed that 37.4 % of nurses had > 20-30 years of experience.

Table (2): Represented that only 9.8 % of nurses attending training courses regarding newborn hearing screening and 69.6% of them attended training courses from ≥ 6 months to 1year. Also, 97.9% of nurses mentioned it is important to screen all newborns for permanent hearing loss and 55.3% of them reported the center has a newborn hearing screening device. Finally, 59.6 % of nurses aren't able to explain the newborn hearing screening process to parents.

Table (3): Showed that, 92.3% of nurses mentioned that the babies born with hearing impairment, 81.3 % and 50.6 % of them knew high fever and jaundice as causes of newborn hearing impairment respectively. According to risk factors, 77.4 % of nurses said family history, only 12.3% and 10.2% of them referred to congenital syphilis and > 48hrs in neonatal intensive care unit respectively. In addition, 81.3% of nurses knew the infant does not react to loud noise and sounds is one of the symptoms of hearing impairment and slight/mild hearing impairment is considered a degree of it.

Table (4): Clarified that; 88.5% of nurses knew methods of diagnoses hearing impairment in newborns. Whereas, (94.5%, 81.7%, and 25.5%) of nurses answered correctly the age for a newborn to receive the hearing screening testing, age for newborn doesn't conduct hearing screening to receive another testing and age for final diagnosis as the child having a permanent hearing loss respectively. Also, it was found that (86.0 % and 22.1 %) of nurses reported wearing hearing aids and sign language as methods of hearing impairment treatment in children respectively. while, (14.9 % and 29.8 %) of them mentioned correct answer about The suitable time for child wearing hearing aids and best age for early intervention respectively. Furthermore, 92.8 % of them stated that infant with hearing loss should be referred to a pediatric audiologist.

Figure (1): Presents that 34.5 % of nurses had poor score of knowledge followed by 33.2% of them had fair score of knowledge while 32.3% had good score of knowledge.

Figure (2): Reveals that 69.4% of nurses had a positive attitude regarding newborn hearing impairment, while 30.6% had a negative attitude.

Figure (3): Indicates that 68.9% of nurses had a negative attitude against newborn hearing screening, while 31.1% had a positive attitude.

Table (5): Clears that, there was only a statistically significant difference between the level of nurses' knowledge and their age (p-value = 0.016); while there wasn't a statistically significant difference with education, years of experience, and training courses (p-value = 0.803, 0.152 and 0.305) respectively.

Table (6): Demonstrates that, there was a statistically significant difference between the level of nurses' attitude about newborn hearing impairment and their years of experience (p-value = 0.031); on the other hand, there wasn't a statistically significant difference in their age, education and attending training courses (p-value = 0.249, 0.068 and 0.650) respectively.

Table (7): It revealed that there was a statistically significant difference between the level of nurses' attitude about newborn hearing screening, their age, and years of experience (p-value = 0.013 and 0.010) respectively. Moreover, there wasn't a statistically significant difference with their education and attending training courses (p-value = 0.088 and 0.176) respectively.

Figure (4): Illustrates that, there was a positive correlation between total score of knowledge and attitude among nurses regarding newborn hearing impairment (r= 0.335, p= 0.000).

Discussion:

Hearing impairment can be a substantial barrier to children' education and social integration. Early identification and intervention for hearing impairment can provide important benefits because hearing is critical for learning oral communication, as well as academic and social participation **(Alsudays et al., 2020).** The present study aimed to assess the knowledge and attitude of nurses regarding Newborn Hearing Impairment and Screening at Health Centers and clinics in Assiut City.

The present study found that more than one-third of nurses' aged from 40 - < 50 years with a mean age of them was 38.66 ± 9.31, this is similar to **Barbosa et al., 2013** who conducted a study on Newborn and infant hearing health education for nursing professionals at a university hospital in Brazil and found that the participants were with a mean age 41.6 years; on the other hand, these results inconsistent with **Khan et al., 2018** who carried a study about The hearing screening experiences and practices of primary health care nurses at South Africa, reported that near to half of the participants aged between 36 and 50 years. In my opinion, the difference in these results may be due to the difference of sample size and level of education in all studies.

According to the nurses' sex, the current study revealed that all of them were female, From the researcher's point of view, this may be attributed to female nurses play the role of a healer and having

informal knowledge on health practices, passed on from woman to woman.

These results are consistent with **Sharma et al., 2021** who applied a study under the title of "Knowledge and attitude of nurses about newborn hearing screening in Nepal" and presented all participants were female. Also, that similar to **Khan et al., 2018** who reported that the majority of participants were female.

Regarding educational level, the present study revealed that all nurses were professional as more than two thirds of them had graduated from nursing secondary school and more than one fifth of participants had graduated from nursing technical institute. This finding can be explained as, it is common for nursing professionals to start their professional lives in middle level programs as primary care providers, even with the possibility of moving on to higher education. This finding agrees with **Khan et al., 2018** who found that more than three-quarters of respondents were professional nurses.

Concerning years of experience, more than one-quarter of nurses had 1-10 years. Furthermore, the same percentage of participants had 10 – 20 years. This result is incompatible with **Khan et al., 2018** who found half of the nurses had less than 10 years of experience, and disagrees with **Hussein et al., 2018** who applied a study entitled "Knowledge and attitudes of early childhood development practitioners towards hearing health in poor communities and presented the vast majority of participants had 1-25 years of experience. In my opinion, this difference in these results may be due to the difference of sample size, and educational level in these studies.

The present study cleared that majority of nurses didn't attend training course regarding newborn hearing screening, this may be due to the newborn hearing screening program in Egypt implemented since July 2019 and some of the centers didn't have screening device. So, it's important to add newborn hearing impairment themes in the training of nurses, as we consider the knowledge and attitude of nursing professionals affected by training.

This result is the same line to **Barbosa et al., 2013** who mentioned that the majority of nurses stated they did not receive information concerning auditory health during their professional training.

The study's finding showed that more than half of the nurses mentioned they were able to explain the newborn hearing screening process to parents. this finding disagrees with **Khan et al., 2018** who reported two-fifths of the nurses provided feedback to the caregivers about the child's hearing loss.

Regarding nurses' knowledge about hearing impairment, the current study cleared that the most majority of them knew the concept of hearing impairment and high fever as a cause of newborn hearing impairment. The reason may be due to the nurses' years of experience that influence their knowledge about the effect of fever on all body systems and can cause newborn hearing impairment.

These findings are incompatible with **Sanju et al., 2018** who conduct a study in north India about **"**the knowledge and attitude of nurses towards infant hearing impairment" and they found that more than two-thirds of the nurses were not aware of the fact that high fever can cause hearing loss.

In addition, more than one-quarter of nurses mentioned measles as a cause of newborn hearing impairment and more than half of them said ear discharge. From the researcher's point of view, this finding may be related to these causes are most familiar to most people.

The current study agrees with **Sanju et al., 2018** who indicated more than one-quarter and more than half of nurses were aware regarding measles and ear discharge can cause hearing loss in infants respectively.

Also, the finding showed that about one-third of nurses and half of them knew some type of drug and jaundice as causes of newborn hearing impairment; These results disagreed with **Sanju et al.,2018.** In my opinion**,** this dissimilarity may be due to the changing level of knowledge about causes of hearing impairment among nurses with different qualifications.

The present study found more than one-quarter of nurses mentioned that newborns staying in the Neonatal Intensive Care Unit (NICU) for more than two days is considered one of the risk factors for newborn hearing impairment and more than two-fifths of them mentioned cleft palate. From the researcher point of view, this result may be due to their experience about the fact of high incidence of hearing loss in neonates who spend time at the NICU.

These findings disagree with **Mazlan & Min, 2018** who conducted a study about the knowledge and attitude of Malaysian healthcare professionals towards newborn hearing screening program and cleared that the majority of participants did not know that newborns staying in NICU for more than two days and cleft palate were associated with increased risk of late-onset hearing loss.

According to nurses' knowledge about the best age for a newborn to receive the hearing screening testing, the most majority of nurses reported that it should be performed before three months of age. that similar to **Barbosa et al., 2013** who illustrated that the most majority of nursing professionals said that the first

month of life is ideal to do the newborn hearing screening.

Regarding nurses' knowledge about the best time for final diagnosis, represented that more than one-quarter of them reported by three months of age. This may be due to different educational levels of nurses who had participated in the study; small number of them were professional and studied a chapter about pediatrics in the faculty's curriculum.

This finding is discordant with **Barbosa et al.,2013 and Mazlan & Min, 2018** who presented more than three-quarters and more than two-thirds of healthcare professionals knew that hearing loss should be diagnosed by three months of age.

In referral to nurses' knowledge about methods of treatment, the majority of nurses knew wearing hearing aids as a method of treatment and more than two-thirds of them knew cochlear implant. which is similar to **Mazlan & Min, 2018** who cleared that about two-thirds of the participants were aware that cochlea implants are the intervention options for children with hearing loss. Moreover, that disagreed hearing aids as methods of treatment.

Concerning nurses' knowledge about the best age for the child with a permanent hearing loss to be referred to early intervention services, more than one-quarter of them reported from three to six months of life, the reason may be due to decrease health educational actions which may expand the knowledge of healthcare professionals on the topic. Such actions aim at contributing to the identification of auditory changes as soon as possible, as well as for the intervention at the ideal time.

This finding is in contrast with **Mazlan & Min, 2018** who presented that about half of the participants correctly answered that intervention for children with hearing impairment should begin by six months of age. Also, that disagrees with **Barbosa et al., 2013** who cleared that majority of nursing professionals reported that by the sixth month of life is the ideal age to start intervention for a child with hearing loss.

Furthermore, the current study illustrated that the most majority of nurses stated that infants with hearing impairment should be referred to a pediatric audiologist, this finding disagrees with **Barbosa et al.,2013 & Sharma et al., 2021**who cleared that one-fifth of participants reported the need to refer neonates and infants to a specialist.

Concerning the total score of knowledge for nurses about newborn hearing impairment and screening, this study revealed that slightly more than one-third of nurses had a poor score of knowledge, this may be attributed to lack of nurses' training about newborn hearing screening program.

This finding is inconsistent with **Sanju et al., 2018** who cleared that poor knowledge among nurses regarding hearing impairment in infants can be observed in the present study. Also, that is incongruent with **Adib-Hajbaghry & Rezaei-Shahsavarloo, 2015** who conducted a study entitled "Nursing students' knowledge of and performance in communicating patients with hearing impairment" and stated that three-fifth of the participants had very low levels of knowledge about hearing impairment.

As regards total score of nurses' attitude newborn hearing screening, the present study revealed that two-thirds of nurses had a negative attitude, this might be due to lack of awareness of nurses toward newborn hearing screening, this result is inconsistent with **Mazlan & Min, 2018** who found that an overall positive attitude was indicated by all participants. Also, that disagrees with **Goedert et al., 2011** who conducted a study titled "Midwives' Knowledge, Attitudes, and Practices Related to Newborn Hearing Screening" and they cleared that more than two-thirds of participants had a positive attitude.

In addition to the result of the present study observed that there were statistically significant differences between the level of nurses' knowledge and their age; (p-value = 0.016), the older age, more years of experience, and higher qualifications of the practitioners have an effect on the knowledge level in favor of higher level. Also, between nurses' attitude about NHI and their years of experience; (p-value = 0.031). as well, there were statistically significant differences between the level of nurses' attitude about newborn hearing screening, their age, and years of experience; (p-value = 0.013 and 0.010) respectively.

These findings disagree with **Ruesch, 2018** who carried a study about **"**Exploring an educational assessment tool to measure registered nurses' knowledge of hearing impairment and effective communication strategies in the USA", and showed there were no statistically significant differences in the participants' total score of knowledge about hearing impairment and their age.

In addition, the current study is inconsistent with **Hussein et al., 2018** who present that no significant effect on participants' overall knowledge and attitudes regarding childhood hearing impairment and their age. while, that agree to the current study in relation to participants' duration of experience.

Also, these results are incompatible with **Velonaki et al., 2015** who conducted a study in Attica, Greece about "Nurses' knowledge, attitudes, and behavior toward Deaf Patients" and reported no statistically significant differences were found between nurses' age and years of experience with knowledge and attitudes toward deaf people.

Finally, the result of present study cleared that there was a positive Correlation between total score of knowledge and attitude among nurses regarding

newborn hearing impairment with significant relation (r =0.335 p =0.000*). This finding can be explained as nurses with high levels of knowledge might have correct attitudes toward newborn hearing impairment. Having a satisfactory level of knowledge and attitude about newborn hearing impairment and screening is necessary to help early detection and intervention for neonates.

On the other hand, this result differs from that recorded by **Velonaki et al., 2015** who said that no correlation was found between nurses' knowledge and attitudes.

Conclusion:

Based on the results of the present study, it can be concluded that:

Deficit in nurses' knowledge regarding newborn hearing impairment and screening; and fluctuation in their attitude between negative and positive. Furthermore, there were statistically significant differences between the level of nurses' knowledge and their age, Also, between nurses' attitude about NHI and their years of experience. As well, there were statistically significant differences between the level of nurses' attitude about newborn hearing screening, their age, and years of experience.

Recommendations:

The study recommended that:

- In-service training programs should be developed and implemented for nurses to increase their awareness about newborn hearing impairment and screening.
- Continuous supervision of maternal and neonatal care by the Ministry of Health and Population to ensure Periodic Hearing Screening for Early Identification should be done for children before 6 months of age.
- Nursing education should pay more attention to newborn hearing impairment, and screening as it is their responsibility to prepare competent nurses for the common issues they will face in practice.
- Specific recommendation for future research to replicate this study in other health centers and clinics with different nurses to increase the ability to generalize the findings.

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