

Caregivers' Awareness of Neonatal Hypoxic Ischemic Encephalopathy and Subsequent Infant Development

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Abstract

Background: Hypoxic ischemic encephalopathy is one of the most serious and life-threatening types of infant brain damage that can occur during childbirth that affects all aspects of infant's life. This complex disorder requires caregivers that have sufficient knowledge of the basics of hypoxic ischemic encephalopathy and be more aware of the relevant care strategies provided the disease. **Aim:** This study aims to assess caregivers' awareness about neonate hypoxic ischemic encephalopathy and subsequent infant development. **Research design:** A descriptive design. **Subject:** A convenient sample of 45 caregivers and a purposive sample of their hospitalized neonates. **Setting:** The neonatal intensive care units at Maternity and Gynecological Hospital and Children's Hospitals affiliated to Ain Shams University, Egypt. **Methods:** three tools were used to conduct the study. **Tool 1)** Pre-designed questionnaire sheet. **Tool 2)** Caregivers self-reported practices format. **Tool 3)** Caregiver's spiritual and psychological well-being Scales toward children with hypoxic ischemic encephalopathy. **Results:** nearly three quarters of studied caregivers had unsatisfactory knowledge, most of the studied caregivers had incompetent practice, two fifths of them had low spiritual well-being, and two thirds of the studied caregivers have poor psychological well-being. **Conclusion:** There was also highly statistically significant relation between total knowledge of caregivers and their education level and residence. In addition, there was a highly statistically significant relation between total self-reported and their age and education level. There was highly statistically significant positive correlation between all domains listed. **Recommendations:** Continuous health education programs are necessary to improve caregivers' adjustments toward the care of their hypoxic ischemic encephalopathy infant through discussing infant needs and reassuring the importance of follow-up care.

Keywords: caregivers, awareness, hypoxic ischemic encephalopathy.

Introduction:

Neonatal encephalopathy is a heterogeneous condition that results from a number of disorders that impair central nervous system (CNS) function within the first several days after birth (*Russ et al., 2021*).

Neonatal hypoxic ischemic encephalopathy (NHIE) is a common occurrence in the NICU and refers to central nervous system dysfunction in the neonatal period (birth through 28 days-of-life), in a neonate born at or beyond 35 weeks gestation (*Rasmussen, 2017*). Loss of oxygen (hypoxia) and blood supply (ischemia) to the brain can occur before, during or shortly after birth. Moderate to severe hypoxic-ischemic encephalopathy (HIE) occurs in ~1 to 3/1000 live births in developed nations and can lead to death, or in survivors, brain damage with lifelong

disability, including cerebral palsy and epilepsy. Induced mild "therapeutic" hypothermia (cooling) is now established to significantly improve survival without disability, but many infants still survive with disability despite treatment (*Zhou et al., 2021*).

Hypoxic ischemic encephalopathy (HIE) is a major cause of acute neonatal brain injury and can lead to disabling long term neurological complications. Treatment for HIE is limited to supportive care and hypothermia within 6 hours injury which is reserved for full term infants (*Park et al., 2021*).

The complication of hypoxic ischemic such as brain damage, within 12 to 36 hours, which leads to a neonatal encephalopathy, also HIE called perinatal cerebral hypoxia ischemia.

Neonatal encephalopathy or NHIE is a clinical syndrome characterized by disturbed neurological function in the earliest days of life in the term infant, manifested by difficulty with initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness, and often seizures (*Naidoo, 2016*).

In general, approximately 25% of all newborns with neonatal HIE will have permanent neurological deficits, in the form of cerebral palsy with or without associated mental retardation, learning disability, and epilepsy (*Rasmussen, 2017*).

Neonates with a diagnosis of HIE had detailed neuro developmental follow-up at 3–5 years of age. The neurological examination at discharge from the Neonatal Intensive Care Unit was more useful to identify infant with subsequent developmental delay such as decreased motor movement, language skills, and lower Intelligence Quotient stand (IQs) (*Dan, 2021*).

Hypotonia or low muscle tone (floppy baby syndrome), Moro, grasp, suck and swallow reflexes may be absent or depressed (*Williams & Brown, 2021*).

The admission of a new-born to a neonatal intensive care unit (NICU) causes emotional stress for the family and hence complicates the baby's bonding process. Nursing support for care giver of hospitalized children can be conceptualized as providing supportive communication and ongoing information, helping care giver maintain their parental role by encouragement, positive feedback and appraisal, giving emotional support, and providing expert nursing care to the baby (*Ndango, 2018*).

In a recent study, caregiver of a newborn with HIE need current information about the disease, its treatment, care their infant is receiving and prognosis. Provide information and emotional support to care giver of newborns with HIE during the hospitalization of their infant. Its goal is to empower care giver and provide resources for resilience to the challenges posed by care giving in a context of chronic illness, improve their control of the situation and to become empowered

in decision making, decrease stress and improve coping skills (*Rubia et al., 2020*).

Significance of Study:

Moderate to severe (HIE) is a significant cause of neonatal mortality and permanent disability in surviving newborns. Therapeutic hypothermia (TH) is the only effective intervention to reduce these outcomes. Being a parent of these babies is a traumatic and strenuous event. To address these difficulties, care giver need information and support. It provides information to care giver about HIE, treatment and care, future outcomes, and coping strategies (*Rubia et al., 2020*).

Hypoxic ischemic encephalopathy (HIE) is a complication resulting from intrapartum and neonatal asphyxia. Adverse intrapartum events remain a major cause of neonatal mortality. If not treated, 62% of infants with perinatal hypoxic brain injury will die or have moderate to severe disabilities by the age of 18 to 22 months; treatment reduces this rate to 41%. Survivors also develop long-term neurologic disabilities as follows: 45% have cognitive and developmental delay or learning difficulties, 29%, some degree of cerebral palsy, 26% blindness or vision defects, 17% gross motor, coordination problems and epilepsy, 9% hearing loss and 1% behavioral issues (*Abate et al., 2021*).

The neonatal mortality rate in Egypt was found to be 25 per 1000 live birth. In this survey, hypoxic ischemic encephalopathy accounts for 18% of neonatal mortality and is the second most common cause of neonatal death (*Ali, 2018*).

The caregiver's members play a great role and have big responsibility there is the most fundamental social institution, the cornerstone of care, and directly dealing with the health members, social and community services. So it's important to assess their background of knowledge, attitude, practice toward the care of those newborns with HIE (*Santos et al., 2019*).

Aim of the Study:

This study aimed to assess the caregivers' awareness about neonate hypoxic ischemic encephalopathy and subsequent infant development.

Research question:

- What are the care givers' awareness about HIE?
- What are the care givers' awareness and reported practice about subsequent infant development?
- Is there a relation between caregivers' awareness and their reported practice regarding care for neonates having HIE?
- Is there a relation between caregivers' awareness and their well being regarding care for neonates having HIE?

Subject and Methods

I. Technical design:

The technical design included research design, setting, subject and tools for data collection.

Research Design

A descriptive study was utilized in this study.

Study Settings

This study was conducted at Neonatal intensive care unit (NICU) at Maternity & Gynecological Hospital and Children's Hospital affiliated to Ain Shams University.

Subject

A Convenience sample composed of all the available study period of the study caregivers (45) regardless their characteristics and purposive sample of their neonates suffering from HIE (15) one infant for more one caregiver.

Inclusion criteria The selection criteria were included:

All the available neonates in the study setting suffering from HIE and their accompanying caregivers.

Data collection tools

First tool: Pre-designed Interviewing Questionnaire Format:

It was designed by the researcher after reviewing the related literature and was reviewed by supervisors. It consisted of closed end questions and was written in an Arabic language for gathering data in relation to the following parts:

Part I:

A: It included Socio-demographic data of sample such as: age, gender, educational level, income, work condition, and place of residence, type of family, number of family member and house condition.

B: Demographic characteristics of HIE neonate as: Gestational age, Post natal age, sex, ranking, weigh, length and type of delivery.

Part II:

A: It was assess data related to the care giver awareness regards HIE such as a meaning, symptoms, causes, types of complications, treatment and follow up.

B: It was assess data related to the care giver awareness about subsequent infant development such as meaning, types, factors.

❖ Scoring system:

The studied caregiver answer was compared with a model key answer, where (2) scores were given for completely correct answer, (1) scores for incompletely correct answer and (0) for do not know the answer or wrong answer. Total score, 100% were

categorized as the following according to caregivers' knowledge were categorized into:

- **Satisfactory, if score was $\geq 60\%$**
- **Unsatisfactory, if score was $< 60\%$**

Tool II: Caregiver self reported practice:

A: Gross Motor Function Measure (GMFM-88). It was adopted by (*Russel & Rosenbaum, 2013*) to assess the awareness of care giver about reported practice regarding care of infant with HIE.

B: Gavage feeding It was adopted by (*Jahnke, 2008*) to assess the awareness of care giver about reported practice regarding gavage feeding of infant with HIE.

❖ **Scoring system:**

A scoring system followed to assess care giver awareness; Response to each item consists of two options: No = zero, Yes =1. Total score, 100% will classified into 2 categories:

- Competent if score $\geq 85\%$.
- Incompetent if score $< 85\%$.

Tool III:

A- Spiritual Well-Being Scales (SWB): It was originally adapted from (*Anu Behay et al., 2002*). To measure caregivers spiritual well-being.

Scoring system:

Responses were as (5) strongly agree, (4) agree, (3) neutral (2) disagree, and (1) strongly disagree. Total score, 100% will classified into 2 categories:

- High spiritual well-being $\geq 60\%$.
- Low spiritual well-being $< 60\%$.

B-Ryff's Psychological Well-Being Scale (PWB) It was originally adapted from (*Ryff's, 1989*). To measure caregivers psychological well-being.

❖ **Scoring system:**

Responses were as (5) strongly agree, (4) agree, (3) neutral, (2) disagree, and (1) strongly disagree. Total score, 100% will classified into 2 categories:

- Good psychological well-being $\geq 60\%$.
- Poor psychological well-being $< 60\%$.

II. Operational Design:

Preparatory Phase:

The researcher reviewed the relevant and related literature using articles, journals, periodicals and textbooks for developing the data collection tools. During this phase, the researcher also visited the selected places to be acquainted with the personnel and the study settings. Development of the tools was under supervisors' guidance and experts' opinions were considered.

Content validity of the study tools:

Content validity was ascertained by three experts in pediatric Nursing Department, Faculty of Nursing, Ain Shams University to test its comprehensiveness, accuracy, clarity and relevance.

Reliability of the study tools

It was conducted for the developed tool to achieve the criteria of trust-worthiness of the tool reliability.

Reliability test was assessed to test the internal consistency of the study tools.

- Knowledge (0.804) good reliability.
- Reported practice (0.819) good reliability. By using Cronbach alpha test.

Pilot Study

A pilot study was carried out after modifying the tools and before starting in data collection.

It was conducted on 10 % (4) of a total sample size of caregivers to investigate and ensure the feasibility, and applicability of the study tools. Also, to assess the clarity and time needed for the tools to be filled in. The modification was done according to the results of a pilot study. The sample of the pilot study was excluded from the study sample.

Fieldwork

Caregivers were asked for oral consent for participating in the study they were informed that their participation is completely voluntary. Each caregiver was interviewed individually to collect data. Questions were clearly explained in a standard way to minimize errors in interviewing. Each interview took from 30-45 minutes. This study was done two days/weeks from 9 am-1 pm every Monday and Thursday. Data was collected over a period of 6 months started (December 2021 and ending in May 2022). The anonymity of caregivers and responses were guaranteed and confidentiality of data was maintained. The researcher distributed questionnaire to caregivers who can read and write and read questions to illiterate mothers in order to collect the required data to assess knowledge of caregivers regarding hypoxic ischemic encephalopathy and subsequent infant development.

Ethical Consideration:

- The research approval was obtained from the faculty Ethical Committee before starting the study.
- Verbal approval was obtained from caregivers before inclusion in the study; a clear and simple explanation was given according to their level of understanding, physical and mental readiness.
- The studied caregivers were secured that all the gathered data was confidential and used for research purpose only.
- The caregiver informed that they are allowed to choose to participate or not in the

study and they have the right to withdraw from the study at any time.

III. Administrative Design

An official approval was obtained from the Dean of Faculty of Nursing, Ain Shams University to the directors of the hospitals to carry out this study, after explaining the purpose of the study and it's expected outcomes.

IV. Statistical Analysis

Data collected from the studied sample was revised, coded checking and verification process were carried out in order to avoid any errors.

The statistical analysis of data was done by using the computer software of Microsoft Excel Program and Statistical Package for Social Science (SPSS) version 23. Data were presented using descriptive statistics in the form of frequencies and percentage for categorical data, the mean (X) and standard deviation (SD) for quantitative data. Qualitative variables were compared using chi square test (X)², P-value to test association between two variables and Pearson correlation test (R- test) to the correlation between the study variables. The confidence interval was set to 95% and the margin of error accepted was set to 5 %. So, the P-value were considered significant at the following:

- P <0.05 was considered significant.
- P <0.01 was considered as high significant.
- P >0.05 was considered insignificant.

Results:

Table (1): shows that, nearly half of studied caregivers (48.9%) range in age between 20 to less than 30 years old, with mean age \bar{x} SD.22±3.69 years, more than half of them (55.6) were female. Most of them (84.5%) had inadequate occupation income. More than half of them (51.1%) were working. As regard residence, most of them (84.5%) were from urban area. Also, more than fifth of them (62.2%) were extended family.

Figure (1): represents that (28.9%) of the studied caregiver were highly educated /diploma while 26.7% of them were read and write.

Table (2): shows that, four fifths of studied neonates (80.0%) are 37-40 weeks of gestation, with mean age $\bar{x} \pm S.D.$ 35.90 \pm 1.85 weeks. All of them (100%) were delivered by Cesarean section.

Figure (2): indicates that, less than three quarters of them (71.1%) had unsatisfactory knowledge. In addition, more than one quarter of them (28.9%) had satisfactory knowledge.

Figure (3): shows that, (20%) of the studied caregivers had competent practice. While most of them (80%) had incompetent practice.

Figure (4): represents that, two fifths of studied caregiver (40.0%) had High spiritual well-being, but three fifths of them (60.0%) had Low spiritual well-being.

Figure (5): shows that, one third of the studied caregivers (35.6%) had good psychological well-being. In addition, nearly two thirds of them (64.4%) had poor psychological.

Table (3): illustrates that there was a highly statistically significant relation between total knowledge of studied caregivers and their education level and residence with ($X^2=9.621$, $p=0.003^{**}$). As well, a statistically significant relation between total knowledge and their age and Work position with ($X^2=4.658$, $p=0.021^*$) and ($X^2=4.368$, $p=0.012^*$) respectively. No statistically significant relation exists between total knowledge and gender, occupation income

status, and caregiver's relationship with the infant with ($X^2=1.692$, $p=0.053$), ($X^2=1.196$, $p=0.089$) and ($X^2=2.076$, $p=0.072$) respectively.

Table (4): reveals that there was a highly statistically significant relation between total self-reported of studied caregivers and their age and education level with ($X^2=10.120$, $p=0.001^{**}$), ($X^2=8.541$, $p=0.005^{**}$) respectively. As well, a statistically significant relation is found between total self-reported and their gender and residence with ($X^2=4.204$, $p=0.027^*$) and ($X^2=3.982$, $p=0.036^*$) respectively.

Table (5): indicates that there was a highly statistically significant relation between total spiritual aspects of studied caregivers and their Age, work position and residence with ($X^2=9.504$, $p=0.005^{**}$), ($X^2=8.972$, $p=0.000^{**}$) and ($X^2=6.810$, $p=0.009^{**}$) respectively. As well, a statistically significant relation was found between total spiritual aspects and their income with ($X^2=3.960$, $p=0.035^*$).

Table (6): represents that there was highly statistically significant relation between total psychological well being of studied caregivers and their gender, education level and residence with ($X^2=9.457$, $p=0.003^{**}$), ($X^2=9.801$, $p=0.002^{**}$) and ($X^2=9.324$, $p=0.000^{**}$) respectively. As well, a statistically significant relation was found between total psychological well being and their occupation income status and work position with ($X^2=4.804$, $p=0.015^*$) and ($X^2=3.946$, $p=0.037^*$) respectively.

Table (7): illustrates a highly statistically significant positive correlation ($p<0.01$) between all domains listed.

Table (1): Distribution of the studied caregivers according to their Socio-demographic characteristics (n= 45).

Personal information	N	%
Age		
20- <30	22	48.9
30-40	18	40.0
> 40	5	11.1
$\bar{x} \pm S.D$ 22 \pm 3.69		
Gender		
Male	20	44.4
Female	25	55.6
Income		
Adequate	7	15.5
Inadequate	38	84.5
Work condition		
Working	23	51.1
Not working	22	48.9
Residence		
Rural	7	15.5
Urban	38	84.5
Type of family		
Nuclear	17	37.8
Extended	28	62.2
Number of family member		
3 member	2	4.5
4 member	20	44.4
>4	23	51.1
Relationship to infant		
Father	15	33.3
Mather	15	33.3
Grand mather	7	15.6
Aunt	8	17.8

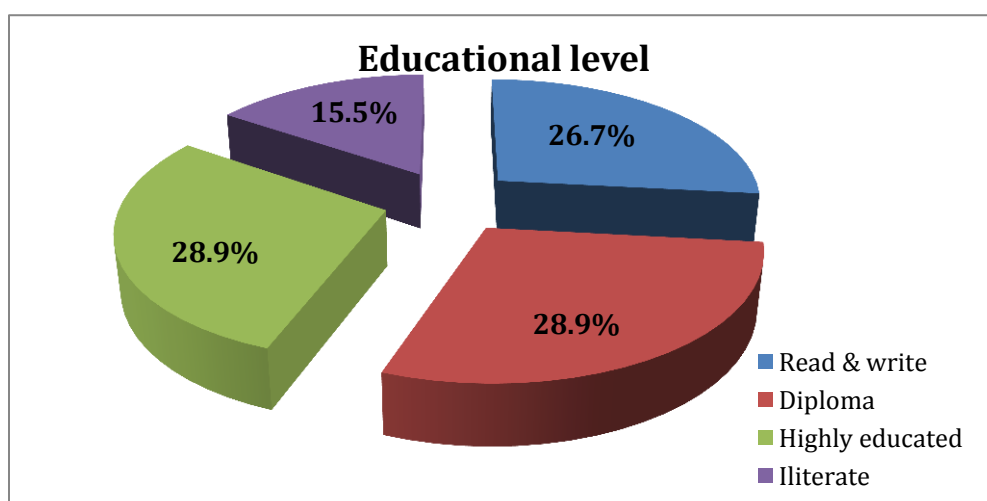
**Figure (1):** Percentage distribution of the studied caregiver according to their educational level (n=45).

Table (2): Distribution of the studied neonates according to their general characteristics (n= 15).

Items	N	%
Gestational age (Week)		
37-40	12	80
>40	3	20
$\bar{x} \pm S.D$ 36.90 \pm 1.85		
Post natal age (Days)		
< 7	2	13.3
7 < 15	9	60.0
15 \leq 30	4	26.7
Sex		
Male	8	53.3
Female	7	46.6
Ranking		
First	2	13.3
Second	3	20.0
Third and more	10	66.7
Weight (Kg)		
2.500 < 3.500	12	80.0
\geq 3.500	3	20.0
Length (Cm)		
50 -55	4	26.7
>55	11	73.3
Types of delivery		
Normal	0	0
Cesarean section	15	100

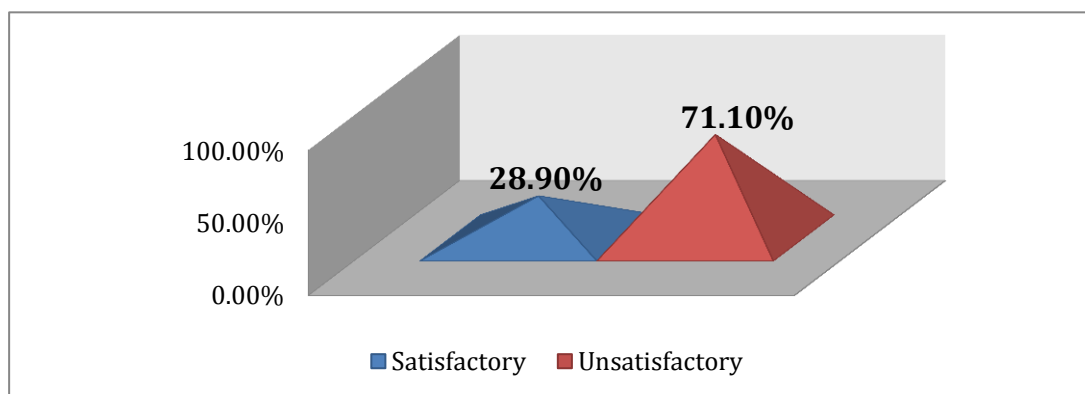


Figure (2): Percentage distribution of the studied caregiver according to their total knowledge about the HIE and infant development (n=45).

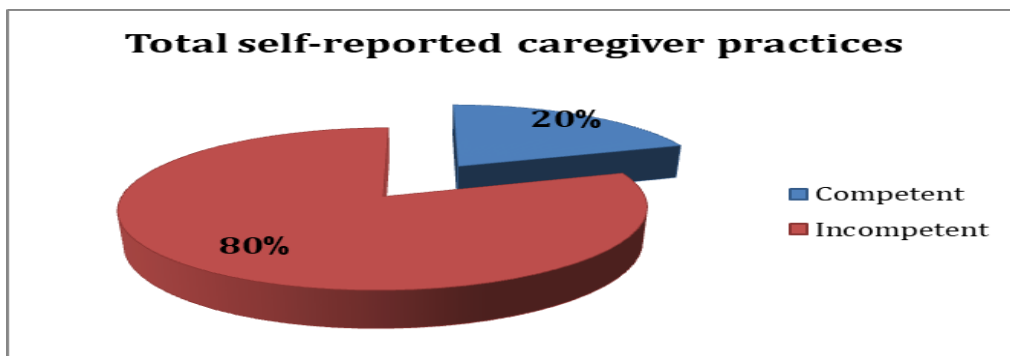


Figure (3): Percentage distribution of the studied caregiver according to their total self-reported practices for infant with HIE (n=45).

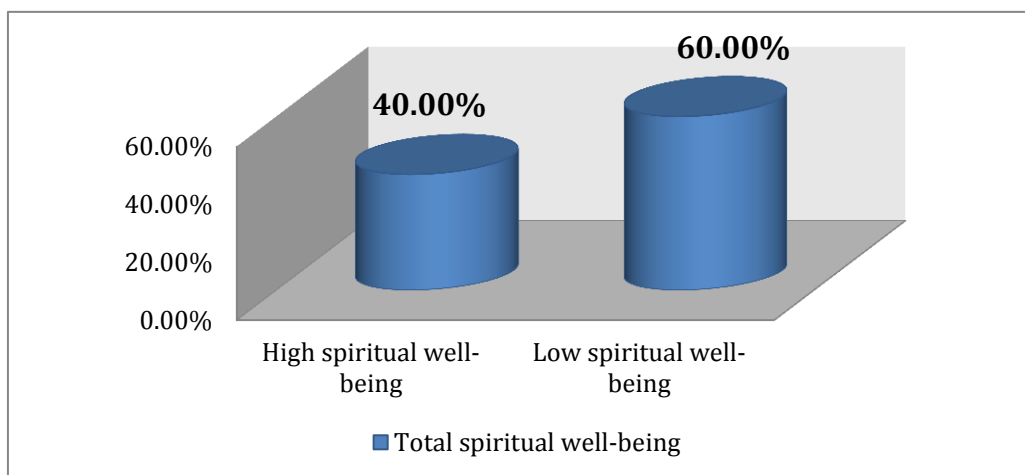


Figure (4): Percentage distribution of the studied caregiver according to their total spiritual aspects of life (n=45).

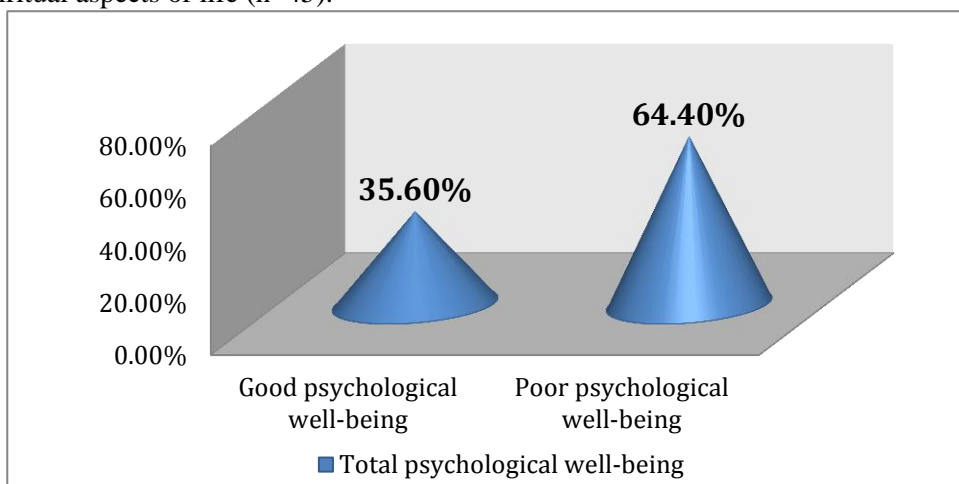


Figure (5): Percentage distribution of the studied caregiver according to their total psychological wellbeing (n=45).

Table (3): Relationship between socio demographic characteristics of studied caregivers and their total knowledge about the HIE and infant development (n=45).

Items	Total knowledge				X ²	P-Value	
	Satisfactory		Unsatisfactory				
	N	%	N	%			
Age	20<30	1	7.7	21	65.6	4.658	.021*
	30-40	8	61.5	10	31.3		
	> 40	4	30.8	1	3.1		
Gender	Male	6	46.2	14	43.8	1.692	.053
	Female	7	53.8	18	56.2		
Education level	Don't read and write	6	46.2	1	3.1	9.621	.003**
	Read & write	0	0	12	37.5		
	Diploma	1	7.7	12	37.5		
	Highly educated	6	46.2	7	21.9		
Income	Adequate	3	23.1	4	12.5	1.196	.089
	Inadequate	10	76.9	28	87.5		
Work condition	Working	9	69.2	14	43.8	4.368	.012*
	Not working	4	30.8	18	56.2		
Residence	Rural	2	15.4	5	15.6	10.431	.001**
	Urban	11	84.6	27	84.4		
Caregiver's relationship with the infant	Father	4	30.8	11	34.4	2.076	0.072
	Mother	4	30.8	11	34.4		
	Grand Ma	3	23.1	4	12.5		
	Aunt	2	15.3	6	18.7		

Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.0.

Table (4): Relationship between socio demographic characteristics of studied caregivers and their total self-reported caregiver practices for infant with HIE (n=45).

Items	Total self-reported practice				X ²	P-Value	
	Competent		Incompetent				
	N	%	N	%			
Age	20<30	1	11.1	21	58.3	10.120	.001**
	30-40	5	55.6	13	36.1		
	> 40	3	33.3	2	5.6		
Gender	Male	2	22.2	18	50.0	4.204	.027*
	Female	7	77.8	18	50.0		
Education level	Don't read and write	5	55.6	2	5.6	8.541	.005**
	Read & write	0	0	12	33.3		
	Diploma	1	11.1	12	33.3		
	Highly educated	3	33.3	10	27.8		
Income	Adequate	3	33.3	4	11.1	1.185	.067
	Inadequate	6	66.7	32	88.9		
Work condition	Working	6	66.7	17	47.2	1.401	.058
	Not working	3	33.3	19	52.8		
Residence	Rural	2	22.2	5	13.9	3.982	.036*
	Urban	7	77.8	31	86.1		
Caregiver's relationship with the infant	Father	3	33.4	12	33.3	1.003	0.072
	Mother	2	22.2	13	36.1		
	Grand Ma	2	22.2	5	13.9		
	Aunt	2	22.2	6	16.7		

Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Table (5): Relationship between socio demographic characteristics of studied caregivers and their total spiritual well being about caregivers (n=45).

Items	Total spiritual aspects				X ²	P-Value	
	High N=18		Low N=27				
	N	%	N	%			
Age	20<30	2	11.1	20	74.1	9.504	.005**
	30-40	11	61.1	7	25.9		
	> 40	5	27.8	0	0		
Gender	Male	7	38.9	13	48.1	1.578	.073
	Female	11	61.1	14	51.9		
Education level	Don,t read and write	3	16.7	4	14.9	1.763	.074
	Read & write	4	22.2	8	29.6		
	Diploma	6	33.3	7	25.9		
Income	Highly educated	5	27.8	8	29.6	3.960	.035*
	Adequate	5	27.8	2	7.4		
	Inadequate	13	72.2	25	92.6		
Work condition	Working	2	11.1	21	77.8	8.972	.000**
	Not working	16	88.9	6	22.2		
Residence	Rural	6	33.3	1	3.7	6.810	.009**
	Urban	12	66.7	26	96.3		
Caregiver's relationship with the infant	Father	5	27.8	10	37	4.075	0.022*
	Mother	10	55.6	5	18.5		
	Grand Ma	2	11.1	5	18.5		
	Aunt	1	5.6	7	26		

Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Table (6): Relationship between socio demographic characteristics of studied caregivers and their total psychological well being (n=45).

Items	Total psychological aspects				X ²	P-Value	
	Better N=16		Bad N=29				
	N	%	N	%			
Age	20<30	8	50.0	14	48.3	1.368	.061
	30-40	6	37.5	12	41.4		
	> 40	2	12.5	3	10.3		
Gender	Male	13	81.2	7	24.1	9.457	.003**
	Female	3	18.8	22	75.9		
Education level	Don,t read and write	4	25.0	3	10.3	9.801	.002**
	Read & write	1	6.25	11	37.9		
	Diploma	1	6.25	12	41.4		
Income	Highly educated	10	62.5	3	10.3	4.804	.015*
	Adequate	5	31.2	2	6.9		
	Inadequate	11	68.8	27	93.1		
Work condition	Working	12	75.0	11	37.9	3.946	.037*
	Not working	4	25.0	18	62.1		
Residence	Rural	2	12.5	5	17.2	9.324	.000**
	Urban	14	87.5	24	82.8		
Caregiver's relationship with the infant	Father	8	50	7	24.1	3.776	0.041*
	Mother	3	18.7	12	41.4		
	Grand Ma	5	31.3	2	6.9		
	Aunt	0	0	8	27.6		

*Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Table (7): Correlation between the studied variable (n=45).

		1	2	3	
1. Total knowledge	r				
	p				
2. Total reported practice	r	.775			4
	p	.000**			
3. Total spiritual well being	r	.635	.682		
	p	.001**	.001**		
4. Total psychological well being	r	0.815	0.769	0.828	
	p	.000**	.000**	.000**	

(**) Statistically significant at $p < 0.01$. r Pearson correlation.

Discussion:

Regarding to the caregivers education, it was noticed that more than one quarter of them read and write while there were more than half of them working. This finding this result supported with *Alruwaished et al., (2020)* who conduct study "Knowledge and attitude of caregivers of cerebral palsy children in Riyadh city", reported that, a minority of them had higher education. This lower level of education among the studied caregivers was reflected in their knowledge and practice levels were more prevalent in those caregivers with lower education level which was supported by several studies *Mostafa et al., (2015)* who reported that, family caregiver's knowledge scores increase with the family caregiver's education levels which improve the care of the HIE neonates. This result may explain that, the educated caregiver had more information and positive attitude than illiterate or lower education.

Regarding to neonatal characteristic the findings of the present study showed that four fifths studied neonates had gestational age was ranged from 37 to 40 weeks. This result is congruent with *El sadany (2018)* who conducted study about "Evaluation Of Serum S100 B Protein In Term Newborn Infants With Hypoxic Ischemic Encephalopathy" who found that Gestational age ≥ 36 weeks. *El Gamal (2018)* who conducted study about "The role of advanced magnetic resonance imaging techniques in diagnosis of hypoxic ischemic encephalopathy and prediction of development of cerebral palsy in term neonates exposed to perinatal hypoxia" and who found that their gestational ages ranged between 37 and 40 weeks.

Concerning the mode of delivery, this study showed that all of the study neonates delivered by cesarean section. This correlates with research by *Devries et al., (2019)*. "Patterns of neonatal hypoxic-ischaemic brain injury" who report that emergency caesareans as well as assisted vaginal deliveries have an increased risk of HIE.

Regarding to total knowledge of the studied caregiver about the HIE and infant development, the study showed that, nearly three quarters of them had unsatisfactory knowledge. As well, this opinion is congruent with *Zhao et al., (2021)* who conducted a study about " application of neonatal intensive care unit main caregiver ability evaluation index system in premature infants with hypoxic ischemic encephalopathy" and found that most caregivers of HIE infants lack information about the illness and its therapy.

Regarding to total self reported practices of studied caregivers, the current study finding most of studied caregivers have incompetent practice. These finding come in line with *Sharon et al., (2013)* who mentioned in a study about "Discrepancies between mothers and clinicians in assessing functional capabilities and performance of children with cerebral palsy" and found that, highest practice of caregiver in the study group had incompetent practice.

Regarding to total spiritual well being among studied caregivers, finding of current study proved that, two fifths of them had high spiritual well-being, but three fifths of them had Low spiritual well-being. These finding were paralleled with study finding of *Kelly et al. (2016)*, who mentioned in a study entiteld "Assessment of the spiritual needs primary caregivers of children with

life-limiting illness is valuable yet inconsistently performed in the hospital.”, that majority of caregivers desired inquiry of the provision of spiritual care in the hospital and need to spiritual support by the hospital and from the subject religious.

Concerning the total psychological well-being among studied caregivers, finding of current study show that, one third of them good psychological well-being. In addition, nearly two thirds of them had poor psychological well-being. This finding were contradicted with study finding of *Craig et al. (2020)*, who conducted in a study about " Parental Perceptions of Neonatal Therapeutic Hypothermia; Emotional and Healing Experiences" substantial impact on the quality of life and psychological health burden on the family.

The current study showed that, there was highly statistically significant between caregivers' knowledge and their education level. which was supported by several studies *Raj et al., (2022)*, *Alloush et al., (2019)* who reported that, family caregiver's knowledge scores increased with the family caregiver's education levels which may improve the care of the HIE infant. This could be explained as educated caregiver usually have more information and better practices compared with illiterate or lower educated one. These findings which could suggest the possibility of specific intervention directed towards less educated families.

The current study showed that, there is a highly statistically significant relation between total self-reported practice and their age and education level, this opinion is congruent with *El-Gamal, (2021)* "Quality of life for mothers who have children with cerebral palsy in el-qaliobyeya government", who reported that, improve the caregivers' knowledge and practices for proper dealing with their children with CP as it plays an important role on their quality of life which and lead to achieving of their children's health needs.

The current study showed that, there was highly statistically significant between total psychological well-being and their gender, education level and residence which was supported with *El-Gamal, (2021)* the result proved that, there were highly significant

statistical differences between quality of life for mothers and their socio-demographic characteristics.

Finally present study indicated that, there is significant positive correlation between all domains listed. This outcome matched with study by *Williams & Brown (2021)* entitled "Understanding Early Childhood Resilience Following Neonatal Brain Injury From Parents' Perspectives Using a Mixed-Method Design" and showed that Statistically significant relations were shown between knowledge and practices among studied sample.

Conclusion:

Based on the results of the present study, it can be concluded that, Based on the results of the present study, it can be concluded that, nearly three-quarters of the studied caregivers had unsatisfactory knowledge, most of the studied caregivers have incompetent reported practice. Nearly two fifth of them had low spiritual well-being have poor psychological well-being.

Recommendations:

- **Based on the findings of the present study, the following recommendations made:** Continuous health education programs are necessary to improve caregivers' adjustments toward the care of their HIE infant.
- Applying guidance brochures including information about community resources, and comprehensive care needs for caregivers with infants HIE to meet their needs and prevent further complications.
- Conducting the study on large number of caregivers for generalization the result.

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