

Evaluation of the Impact of Maternal Training on Knowledge of Danger Signs in Sick Newborns and Health Seeking Behaviors Among Mothers in Enugu, South-east Nigeria- a Pre-and-post Interventional Study

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Abstract

Background: During the early weeks of life, the signs/symptoms of serious illness can be subtle, thus careful watching is crucial. The World health Organization has recognized nine “danger sign” which are closely associated with morbidity and mortality when not recognized early and given adequate care. This project was undertaken to assess mothers’ knowledge of these danger signs and health seeking behavior before and after training on newborn danger signs.

Methodology: This community-based interventional study was carried amongst women in two rural communities of Enugu State. Participant’s knowledge of danger signs and care seeking behaviors were obtained using an interviewer administered questionnaire before and after training on the danger signs newborns using videos from the Integrated Management of Childhood Illnesses (IMCI). Pre- and post-training data were collated for analysis and comparison using SPSS version 20.

Results: A total of 197 women were enrolled for the study. Among the socio-demographic indices examined, only the number of newborns nursed in the past significantly determined knowledge of danger signs in the sick newborn ($P=0.032$). Prior to the training, 47% of respondents could not recount offhand any danger sign compared to 1.5% after the training ($P=0.001$). Knowledge of up to 3 danger signs significantly increased after the training ($P= 0.001$) and participants who admitted seeking medical help within 24 hours of noticing any danger signs in newborn also significantly increased, ($P= 0.043$).

Conclusion: Our study documented a strong impact of training of mothers on their knowledge of danger signs in the sick newborns and on their healthcare seeking behavior. Therefore, training and retraining of mothers and/or care givers could help improve newborn care and reduce overall infant mortality

Introduction

Neonatal mortality is of global importance as 2.4 million deaths were recorded among children within the first month of life in 2019.¹ Approximately, 6,700 neonates die daily, amounting to 47% of under-five mortality globally.¹ Although the world has made substantial progress in child survival with neonatal deaths declining from 5.0 million in 1990 to 2.4 million in 2019, sub-Saharan Africa had the highest mortality rate at 27 deaths per 1,000 live births.¹ In Nigeria, 270,000 newborns died from preventable and treatable causes in 2019, giving a mortality rate of 36/1000 live births, the highest in Africa and the second highest globally.^{1,2}

Mortality and morbidity risks are higher in newborn compared to other age groups in childhood due to inherent immature immune status. Hence, a newborn can die within minutes if prompt recognition, diagnosis and treatment are not initiated.³ Additionally, signs of sickness are often subtle hence easily missed out by untrained mothers in the household. These factors lead to increased newborn death at home or at best, late presentation to hospital with high risk of death. The World health Organization has documented the “danger sign” in the sick newborn which are closely associated with increased risk of

disability or death when not recognized early and given adequate cares.¹ The danger signs are; poor feeding since birth or stopped feeding, convulsion, respiratory rate of 60 or more (fast breathing), severe chest indrawing (difficulty in breathing), temperature of more 37.5 degree centigrade or more (fever), temperature of 35.5 degree centigrade or less (hypothermia), only moves when stimulated or not even when stimulated (weakness or lethargy), yellow soles (signs of local infection).⁴

Majority of the newborn deaths are related to late recognition of neonatal danger signs, delays in seeking appropriate care and subsequent late intervention at the time of presentation to the hospital.^{5,6,7} Babies having danger signs, born to mothers residing in rural areas are at a higher risk of death than those residing in urban areas.⁸ Data on Maternal and Newborn health disparities in Nigeria reveals that neonatal mortality rate is higher in the rural areas with an urban-to-rural ratio of 0.8.⁹ Findings from a study in some rural communities in Enugu State recorded poor knowledge level (0-30%) of danger signs of illness in the sick newborn.¹⁰ In the study, adequate health seeking behaviour by mothers was significantly determined by knowledge of at-least one danger sign in their sick newborn; as mothers who had knowledge of three or more WHO recognized danger signs compared with those who had two or less were less likely to delay at household level in seeking appropriate care for their sick newborn.¹⁰ Additionally, the study identified other perceived and experienced non WHO recognized danger signs among the study population. The authors thereafter recommended that a formal training of these women will enhance their capacity to recognize the danger signs of illness in the newborn early enough and institute healthy interventions that will enhance survival of their newborns.

On the strength of the foregoing, this project therefore aimed at equipping mothers with skills to identify danger signs in the sick newborn and educate them on the appropriate health seeking behavior for the survival of their sick newborn. Thereafter, we sought to assess mothers' knowledge and the maternal characteristic that determined adequate knowledge of these danger signs and secondarily, the impact of this training on their knowledge of danger signs and health care seeking behaviors.

Methodology

Study area

This community-based interventional study was conducted in Enugu state, the host state of Enugu State University of Science and Technology. The study was conducted over a seven (7) months period as a follow-up study in two communities of the 17 communities where poor knowledge of maternal danger signs was previously documented in our earlier study.¹⁰ The communities are Ndiuno-Uwani Akpugo in Nkanu West Local Government Area (LGA) of Enugu state and Nomeh in Nkanu East LGA. The inhabitants of these communities are predominantly cassava and yam farmers at subsistence level. There are about 400 women in Ndiuno-Uwani Akpugo and approximately 500 women in Nomeh communities. Nomeh is about 30 kilometers from Amagunze the Nkanu East LGA Headquarters, while Ndiuno-Uwani Akpugo is about 3 kilometers from Agbani, the Nkanu West LGA headquarters.

The Pre-Training Phase

All women aged 18-60 years within each study community who had nursed at least one newborn were invited to the community square on a convenient day as determined by their community leaders. On the day of training, the women were consecutively enrolled after signing or thumb-printing an informed consent form. Their knowledge of danger signs, healthcare seeking behavior and socio-demographic profiles were obtained using a structured interviewer administered questionnaire. They were asked to recount extempore the danger signs in the sick newborn, the immediate action they take when such signs are observed in their newborns and how early they would normally decide to take their sick newborns to a health care facility. Their sociodemographic indices and responses were documented in the questionnaires and categorized as follows:

1. *Age* was recategorized into ≤ 29 years; 30-40 years and > 40 years.
2. *Socioeconomic class* was assessed using Oyediji's socioeconomic indices and categorized into upper, middle, and low socioeconomic classes.¹¹
3. *Number of newborns nursed* 1-3; 4-6 and ≥ 7 .

The Training Phase

After completing the questionnaires, a plenary session was conveyed for the participants during which the Integrated Management of Childhood Illnesses (IMCI) video on the danger signs in the sick newborn was projected on a screen and important actions in the video interpreted in the Igbo, the native language of all the participants.⁷ During the training it was repeatedly emphasized that the most appropriate action to take on noticing any of the danger signs is to immediately take the newborn to a health facility.

Post-Training Phase

Three months after the training, a return visit was made to the communities to assess the impact of the training on the participant's knowledge of danger signs in the sick newborns and health seeking behavior. This was conducted by administering to each participant, a similar questionnaire completed in the pre-training phase. Quality control checks were done on site after each field activity by researchers. Pre- and post-training responses for each participant were collated for analysis and comparison using SPSS version 20.

Results

Characteristics of study participants

This study was carried out in 2 rural communities in Enugu state namely Nومه and Ndiuno Uwani Akpugo. All study participants were women, 120 participants were recruited from Nومه and the remaining 77 from Ndiuno Uwani Akpugo. Of the 197 respondents, 30% were 29 years or younger, 43% were between 30-40 years while 27% were over the age of 40 years of age. Most respondents (46%) had

nursed at least 3 newborns through infancy while 54% had nursed more than 3 newborns. Respondents from the middle socioeconomic class made up 69% of the study population with other from the low (28%) and high (6%) socioeconomic class respectively. Other demographic of study respondents is shown in Table 1.

Table 1
Summary Statistics of Mother/Caregivers Enrolled in Study

Study parameter	Variables	Frequency (n)	Percentage (%)
Community members surveyed	Ndiuno uwani Akpugo	77	39.0
<i>(N=197)</i>	Nomeh	120	61.0
Age of respondents	≤ 29 years	59	30.0
<i>(N=197)</i>	30-40 years	85	43.0
	> 40 years	53	27.0
Number of newborns nursed	1-3	90	46.0
<i>(N=197)</i>	4-6	82	42.0
	≥ 7	25	12.0
Socio-economic class	Low	55	28.0
<i>(N=197)</i>	Middle	136	69.0
	High	6	3.0
Mother's education	None	27	14.0
<i>(N=197)</i>	Completed primary	92	47.0
	Completed secondary	38	19.0
	Post-secondary	40	20.0
Father's education	None	28	16.0
<i>(N=180)</i>	Completed primary	68	38.0
	Completed secondary	28	16.0
	Post-secondary	56	30.0
Mother's occupation	Unemployed	90	46.0
<i>(N=197)</i>	Unskilled	74	38.0
	Semi-skilled	25	12.0
	Skilled	8	4.0
Father's occupation	Unemployed	59	33.0
<i>(N=179)</i>	Unskilled	50	28.0
	Semi-skilled	50	28.0

Study parameter	Variables	Frequency	Percentage
	Skilled	20	11.0

Sociodemographic determinants of knowledge of danger signs among respondents

Table 2 shows the adjusted regression analysis of sociodemographic determinants of knowledge of danger signs in caregiver. It is noted that respondents 30-40 years and those over 40 years were 0.78 and 0.96 less likely to lack knowledge of any danger sign compared to caregiver 29 years and younger OR 0.78 (95% CI 0.39 – 1.59); $P= 0.497$ and OR 0.96 (95% CI 0.39 – 2.37); $P= 0.935$ respectively. This however did not attain statistical significance. It was also noted that respondents that have nursed 4-6 newborns, OR 0.81 (95% CI 0.61 – 2.29) and those who have nursed ≥ 7 OR 0.32 (95% CI 0.11 – 0.90) less likely to lack knowledge of danger signs. In other words, mother that have nursed 4-6 and those who have nursed ≥ 7 newborns were approximately 1.2 and 3 times more likely to have knowledge of danger signs in children. Similarly, respondents with completed primary [OR 0.77 (95% CI 0.22 – 2.71); $P= 0.688$], those with completed secondary [OR 0.84 (95% CI 0.35 – 2.02); $P= 0.699$] and post-secondary education [OR 0.77 (95% CI 0.30 – 1.99); $P= 0.597$] were less likely to lack knowledge of at least 1 danger signs compared to those with no formal education. Like age, none attained statistical significance. Finally, respondents who were in unskilled employment were slightly less likely to lack knowledge of at least 1 danger sign compared to those who are unemployed OR 0.93 (95% CI OR 0.47 – 1.88) while those in semi-skilled OR 1.37 (95% CI 0.47 – 4.02) and skilled OR 1.44 (95% CI 0.30 – 6.79) employment were more likely to lack knowledge of danger signs compared to respondents that are unemployed

Table 2
Sociodemographic determinants of knowledge of danger signs among respondents

Danger signs	Variables	Knowledge of danger signs n (%) † ¹		χ^2	Logistic regression analysis	
		No	Yes		P † ¹	OR 95% CI
(N=197)	≤ 29 years	25 (27)	34 (33)	0.943	1	–
	30-40 years	43 (46)	42 (40)	0.624	0.78 (0.39 – 1.59)	0.497
	> 40 years	25 (27)	28 (27)		0.96 (0.39 – 2.37)	0.935
(N=197)	1-3	40 (43)	50 (48)	7.115	1	–
	4-6	35 (38)	47 (45)	0.029	0.81 (0.61 – 2.29)	0.622
	≥ 7	18 (19)	7 (7)		0.32 (0.11 – 0.90)	0.032
(N=197)	Low	25 (28)	28 (23)	0.020	1	–
	Middle	64 (69)	72 (69)	0.990	0.80 (0.38 – 1.71)	0.684
	High	4 (3)	4 (2)		1.24 (0.41 – 2.20)	0.789
(N=197)	None	13 (14)	74 (14)	1.070	1	–
	Completed primary	45 (49)	47 (45)	0.784	0.77 (0.22 – 2.71)	0.688
	Completed secondary	19 (20)	19 (18)		0.84 (0.35 – 2.02)	0.699
	Post-secondary	16 (17)	24 (23)		0.77 (0.30 – 1.99)	0.597
(N=197)	Unemployed	46 (46)	47 (45)	1.067	1	–
	Unskilled	37 (40)	37 (36)	0.785	0.93 (0.47 – 1.88)	0.845
	Semi-skilled	10 (11)	15 (14)		1.37 (0.47 – 4.02)	0.571

†¹Knowledge of at least 1 danger signs; †²Bold value of P is statistically significant

Danger signs	Variables	Knowledge of danger signs n (%) † ¹		χ ²	Logistic regression analysis
	Skilled	3 (3)	5 (5)		1.44 (0.30 – 6.79) 0.647
† ¹ Knowledge of at least 1 danger signs; † ² Bold value of P is statistically significant					

Respondents' knowledge of dangers sign pre and post educational intervention

Table 3 shows number of danger sign known by respondents before and after training in WHO recognized danger signs. Prior to the training, 47% of respondents could not recount any danger sign which reduced to 1.5% after the training ($P = 0.001$). Similarly, prior to the training 2.5%, 9.6% and 16.2% were able to mention 1, 2 and 3 dangers signs compared to 12.7% ($P=0.04$), 35.5% ($P = 0.001$) and 32.5% ($P=0.001$) respectively after the training. There was no significant difference of knowledge for knowledge of 4 or more danger signs before and after the training, 29 (14.7%) vs 22 (11.2%); $P=0.356$ for 4 danger sign; 9 (4.6%) vs. 7 (3.6%) $P=0.624$ for 5 danger signs, 6 (3.0%) vs. 11 (5.6%); $P=0.235$ for 6 danger signs, 3 (1.5%) vs 1 (0.5%); $P= 0.622$ for 7 danger signs, 1 (0.5%) vs 0 (0%); $P=0.998$ for 8 danger signs. In summary, respondents with at least 1 knowledge of danger sign increased from 104 (52.8%) before to 194 (98.5%) after the training intervention ($P = 0.001$). In addition, respondents that admitted they would seek medical help when danger signs are noticed in the newborn increased from 94 (47.7%) pre-intervention to 179 (90.9%) post intervention ($P=0.001$). Finally, of respondents that indicated they would seek medical intervention, significantly less would present within 24 hours of noticing the danger signs after the intervention, 88 (49.1%) compared before the intervention 58 (61.7%); $P= 0.043$. Tables 4 and 5 shows knowledge and action regarding individual danger signs.

Table 3
Pre and post intervention assessment danger signs parameters and appropriate action taken

Parameter	Intervention		
	Pre	Post	P-value†
Total number of danger sign known by respondents (N=197)			
None	93 (47%)	3 (1.5%)	0.001
1	5 (2.5%)	25 (12.7%)	0.004
2	19 (9.6%)	64 (32.5%)	0.001
3	32 (16.2%)	64 (32.5%)	0.033
4	29 (14.7%)	22 (11.2%)	0.356
5	9 (4.6%)	7 (3.6%)	0.624
6	6 (3.0%)	11 (5.6%)	0.235
7	3 (1.5%)	1 (0.5%)	0.622
8	1 (0.5%)	0 (0%)	0.998
9	0 (0%)	0 (0%)	—
At least 1	104 (52.8%)	194 (98.5%)	0.001
Action to be taken if and/or when danger sign observed in newborn (N=197)			
Would seek healthcare			
No	103 (52.3%)	18 (9.1%)	0.001
Yes	94 (47.7%)	179 (90.9%)	
Time from observing danger sign to seeking healthcare			
Time to hospital presentation	(N=94)	(N=179)	
< 24 hours	58 (61.7%)	88 (49.1%)	0.043
≥ 24 hours	36 (38.3%)	91 (50.1%)	
†Bold value of P is statistically significant			

Table 4
Knowledge of Dangers sign among Participants enrolled in the study

Danger signs	Knowledge	Pre-intervention		Post-intervention		P-value†
		n	%	n	%	
Refusal/Stop feeding (N=197)	No	146	74	115	58	0.010
	Yes	51	26	82	42	
Convulsion (N=197)	No	153	78	160	81	0.382
	Yes	44	22	37	19	
Fast breathing (N=197)	No	170	86	180	91	0.110
	Yes	27	41	17	9	
Fever (N=197)	No	107	54	20	10	0.001
	Yes	90	56	177	90	
Hypothermia (N=197)	No	157	80	140	71	0.047
	Yes	40	20	57	29	
Weakness/Lethargy (N=197)	No	152	77	88	45	0.001
	Yes	45	23	109	55	
Jaundice (N=197)	No	183	93	161	82	0.009
	Yes	14	7	36	18	
Difficulty in breathing (N=197)	No	192	75	187	95	0.001
	Yes	49	25	10	5	
Local infection† (N=197)	No	148	75	99	50	0.001
	Yes	49	25	98	50	

† Local infection such as skin, eye discharges, umbilicus infection; †Bold value of P is statistically significant

Table 5
Actions taken by Parent/caregiver when and/or if danger sign noticed in infant

Danger signs	Sought Healthcare	Pre-intervention		Post-intervention		P-value†
		n	%	n	%	
Refusal/Stop feeding (N=197)	No	166	84	130	66	0.001
	Yes	31	16	67	34	
Convulsion (N=197)	No	183	93	134	68	0.001
	Yes	14	7	63	32	
Fast breathing (N=197)	No	159	81	166	54	0.002
	Yes	38	19	91	46	
Fever (N=197)	No	183	93	145	74	0.001
	Yes	14	7	52	26	
Hypothermia (N=197)	No	176	90	147	75	0.001
	Yes	20	10	50	25	
Weakness/Lethargy (N=197)	No	162	82	135	68	0.002
	Yes	35	18	62	32	
Jaundice (N=197)	No	176	89	138	70	0.001
	Yes	21	11	59	30	
Difficulty in breathing (N=197)	No	163	83	116	59	0.001
	Yes	34	17	80	41	
Local infectionst (N=197)	No	178	90	131	67	0.001
	Yes	19	10	65	33	

† Local infection such as skin, eye discharges, umbilicus infection; †Bold value of P is statistically significant

Discussion

This interventional study assessed knowledge of danger signs in newborns among women mainly of the reproductive age group, low and middle socioeconomic class, and those who had also achieved some level of formal education.

Even though statistical significance was not attained probably due sample size, our study showed that increasing maternal educational attainment was associated with better knowledge of danger sign in

newborn. Maternal education has been shown to improve child health and earlier preventive care initiatives.¹² Maternal education is also a signal of trainability because it enables appreciation of the benefits that can be gained from complying with recommended health practices and can improve their uptake.^{13,14} Thus, the subjects were expected to be in good standing to maximally benefit from whatever knowledge or skills provided by the training. This is consistent with the findings of similar studies,^{14,15} and it has been suggested that these mothers with less education were more likely to rely on assistance from relatives with similar educational status than mothers with higher levels of education¹⁴ On the other hand, a cross-sectional study in a Neonatal Intensive Care Unit (NICU), North Central Ethiopia, documented that Secondary and above levels of education were among the factors reported as significant determinants of knowledge of neonatal danger signs among postnatal mothers.¹⁶

Our study also revealed that the number of newborns previously nursed by the respondents stood out as a significant determinant of their knowledge of danger signs in the sick newborn. Similarly, a cross-sectional survey of women's knowledge and reported practices on maternal and child health in rural Sierra Leone revealed that the number of children significantly influenced health knowledge scores.¹⁷ This finding is consistent with the age-long adage that 'experience is the best teacher". It stands to reason that they have gained such knowledge from caring for their newborns over the years. Some caregivers, possibly, got the correct information after counseling following the death of their newborn due to their failure to detect the signs early enough. It is also noteworthy that the other maternal socio-demographic variables had been shown not to be significant determinants of knowledge of danger signs in the first phase of this study in the same communities about six (6) years ago.¹⁰

Our study documented a strong influence of training in enhancing the knowledge of danger signs in sick newborns among mothers. Of the nine (9) WHO recognized danger signs in the sick newborn (refusal to feed/ stop feeding, convulsion, fast breathing, fever, hypothermia, weakness/lethargy, jaundice, difficulty in breathing, and local infections)⁴ there was a significant improvement in the knowledge of seven namely refusal to feed/ stop feeding, fever, hypothermia, weakness/lethargy, jaundice, difficulty in breathing and local infections in the post- training phase. A similar study on the impact of training on knowledge and care-seeking behavior of caregivers has documented that trained traditional birth attendants (TBAs) were more knowledgeable about danger signs during pregnancy and childbirth and were more likely to refer women with complications to a health facility, compared to untrained TBAs.¹⁸ There is a saying that "Training gives everyone a great understanding of their responsibilities and the knowledge and skills they need to do that job. This will enhance their confidence which can also improve their overall performance".¹⁹ It is the authors' view that our participants formal educational background has primed them to comprehend the content of the training.

Early recognition of these signs will enhance care and survival of the newborn because many newborn deaths are related to late recognition of neonatal illness and subsequent late intervention at the time of presentation to the hospital.²⁰ Authors strongly believe that with further trainings and re-trainings a significant improvement in the knowledge of the whole nine signs is achievable.

Another remarkable finding of this study is that the post-interventional phase recorded a significant improvement in the ability to seek care in a health facility for each of the newborn danger signs. The study documented significant improvement in seeking health care in a health facility for all the newborn danger signs. This is a welcome development and a landmark achievement. The symptoms of serious illness in newborns can be subtle.²¹ Therefore, they may elude the recognition of mothers and caregivers at home. Hence, the observed significant improvement in their ability to seek care at a health facility where healthcare workers and professionals can quickly identify these signs and institute care early enough is a welcome development that will enhance survival of the sick newborn.

The most important aspect of this care seeking is that the training has also achieved a significant improvement in the time from observing the danger signs to seeking care at a health facility. Most of the subjects now sought care at a health facility less than 24 hours after observing any danger sign in their newborn. This development will shorten level one delay (delay at household), which has been documented as a significant cause of delay in health care delivery to sick newborns and a strong contributor to neonatal mortality.^{22,23}

Conclusion

Our study demonstrated that training of mothers can significantly enhance their knowledge of danger signs in sick newborns and improve their care-seeking behaviors. One major limitation of this study is due to its cross-sectional design and financial restrictions, we were not able to follow these respondents through time to assess sustainability and practicality of the impacted knowledge on danger sign on the health and survival of their newborns.

Declarations

Ethics approval and consent to participate

Approval for this study was obtained from the Ethics and Research Committee of Enugu State University Teaching Hospital with approval number. TETF/DR&D/CE/UNI/ENUGU/IBR/2019/VOL1. The research procedure was interview-based and minimally invasive. Written informed consent was obtained from the caregivers. Participants were informed that they could freely withdraw from the study at any time, even after having consented initially, and this did not in any way affect their medical care. During data collection, participants that had significant psychological condition(s) were counselled and reported to the managing team for possible referral.

Consent for publication

Not applicable

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

EU, NIK, ODIC conceptualized the study. NIK and ODIC developed and wrote the methodology. EU, NIK, NOC, COH, AOF, EC, ANI contributed to the introduction, result, discussion, and conclusion of the study. All authors contributed to writing and reviewed the final draft of the manuscript.

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