

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

The signs/symptoms of serious illness can be subtle in the first few weeks of life, so close monitoring is essential. The World Health Organization has identified nine “danger signs” that are closely associated with morbidity and mortality if not identified early and treated appropriately. This project was undertaken to assess mothers’ knowledge of these danger signs as well as their health seeking behavior before and after newborn danger sign training. From March to September 2021, this community-based interventional study was conducted among women in two rural communities in Enugu State. An interviewer administered questionnaire was used to assess participants’ knowledge of danger signs and care seeking behaviors before and after training on the danger signs of newborns using videos from the Integrated Management of Childhood Illnesses (IMCI). Three months apart, pre- and post-training data were collected for analysis and comparison using SPSS version 20.0 (Chicago IL). The study enrolled a total of 197 women. Only the number of newborns nursed in the past significantly predicted knowledge of danger signs in the sick newborn ($p=0.032$) among the socio-demographic indices examined. Prior to training, 47% of respondents could not recall any danger signs offhand, compared to 1.5% after training ($p=0.001$). Knowledge of up to three danger signs significantly increased after training ($p=0.001$), as did participants who admitted seeking medical help within 24 hours of noticing any danger signs in their newborn ($p=0.043$). Our study found that training mothers had a significant impact on their knowledge of danger signs in sick newborns as well as their healthcare seeking behavior. As a result, training and retraining of mothers and/or caregivers may aid in improving newborn care and lowering overall infant mortality.

Introduction

Neonatal mortality is a global concern, with 2.4 million children dying within the first month of life in 2020.¹ In 2020, nearly half of all under-5 deaths (47%) occurred during the newborn period, an increase from 40% in 1990.¹ Despite significant progress in child survival with neonatal deaths, Sub-Saharan Africa had the highest mortality rate, with 27 deaths per 1,000 live births.¹ In 2019, 270,000 newborns died in Nigeria from preventable and treatable causes, for a mortality rate of 36 per 1000 live births, the highest in Africa and the second highest globally.²

Because of their immature immune status, newborns have a higher risk of mortality and morbidity than other age groups in childhood. As a result, if prompt recognition, diagnosis, and treatment are not initiated, a newborn can die within minutes.³ Furthermore, signs of illness are frequently subtle, making them easily missed by untrained mothers in the household, resulting in increased newborn death at home or, at best, late presentation to hospital with a high risk of death. The World Health Organization has documented “danger signs” in sick newborns, which are closely associated with an increased risk of disability or death if not identified early and treated appropriately:¹ poor feeding since birth or cessation of feeding, convulsion, respiratory rate of 60 or more (fast breathing), severe chest in-drawing (difficulty breathing), temperature of 37.5 degrees Celsius or higher (fever), temperature of 35.5 degrees Celsius or lower (hypothermia), only moves when stimulated or does not move at all (weakness or lethargy), yellow soles (signs of local infection).⁴

The majority of newborn deaths are caused by delayed recognition of neonatal danger signs, delays in seeking appropriate care, and subsequent late intervention at the time of hospital presentation.⁵⁻⁷ Babies with danger signs born to rural mothers are at a higher risk of death than those born to urban mothers.⁸ According to data on Maternal and Newborn Health Disparities in Nigeria, neonatal mortality rates are higher in rural areas, with an urban-to-rural ratio of 0.8.⁹ Findings from a study in some rural communities in Enugu State revealed a low level of knowledge (0-30%) about danger signs of illness in sick newborns.¹⁰ In the study, adequate health seeking behavior by mothers was significantly determined by knowledge of at least one danger sign in their sick newborn, with mothers who knew three or more WHO recognized danger signs being less likely to delay seeking appropriate care for their sick newborn than those who knew two or less.¹⁰ The study also discovered other perceived and experienced non-WHO recognized danger signs among the study population. The authors then suggested that these women receive formal training to improve their ability to recognize danger signs of illness in their newborns and implement healthy interventions that will increase their newborns’ survival. On the basis of the foregoing, this project aimed to provide mothers with the skills to identify danger signs in their sick newborn and educate them on the appropriate health seeking behavior for their sick newborn’s survival. Following that, we wanted to evaluate mothers’ knowledge and the maternal characteristics that determined adequate knowledge of these danger signs, as well as the impact of this training on their knowledge of danger signs and health care seeking behaviors.

Materials and Methods

Study area

This community-based interventional study was carried out in Enugu state, which is home to Enugu State University of Science and Technology. The study was carried out over a seven-month period as a follow-up study in two of the 17 communities where poor knowledge of maternal danger signs was previously documented in our previous study.¹⁰ The two communities are Ndiuno-Uwani Akpugo in Nkanu West Local Government Area (LGA) of Enugu state and Nomeh in Nkanu East LGA, where the inhabitants are predominantly cassava and yam farmers at subsistence level. According to community registers as informed by their traditional rulers, there are approximately 400 women in Ndiuno-Uwani Akpugo communities and approximately 500 women in Nomeh

communities.

Community entry

The researchers met with the traditional rulers of the two communities they chose. The essence of the study was communicated at the meeting, and the commitment of the two traditional rulers was extracted. The training dates and locations in the two communities were agreed upon. Town criers were used to raise awareness in the communities, and all women in the communities were invited.

Recruitment of participants

On the agreed-upon day determined by their community leaders, all women in each study community were invited to the community square. On that day, the traditional ruler welcomed the researchers to the community’s gathering of women. A total of 315 women were in attendance at the venue in Nomeh while Ndiuno-Uwani Akpugo had 171 women in attendance on their day of training. The principal researcher then spoke to the women in the local dialect about the study and its purpose. Following that, all women between the ages of 18 and 60 who had nursed at least one newborn and provided consent by signing or thumbprinting an informed consent form were sequentially enrolled in the study.

A structured interviewer-administered questionnaire was used to assess the women’s knowledge of danger signs, healthcare seeking behavior, and socio-demographic profiles. The questionnaire was given out by research assistants who asked the questions in local dialect and recorded the respondents’ responses in the questionnaire. The women were also asked to recall danger signs in their sick newborns, the immediate action they take when such signs are observed, and how soon they would normally decide to take their sick newborns to a health care facility. Their socio-demographic indices and responses in the questionnaires were documented and classified as follows: i) For convenience, age was re-categorized into ≤ 29 years; 30-40 years and > 40 years; ii) Socioeconomic class was assessed using Oyedeji’s socioeconomic indices and categorized into upper, middle, and low socioeconomic classes;¹¹ iii) Number of newborns nursed was categorized into: 1-3; 4-6 and ≥ 7 .

Quality control checks were done on site after the field activity by researchers by scrutinizing each questionnaire and ensuring that the responses are complete.

The training phase

Following the completion of the questionnaires, a plenary session was held for the participants in a large hall in the village square, during which the World Health Organization (WHO) nine (9) danger signs in the sick newborn video was projected on a screen and important actions in the video were interpreted in Igbo, the native language of all participants.⁷ It was repeatedly emphasized during the training that the most appropriate action to take upon noticing any of the danger signs is to immediately take the newborn to a health facility. The participants in the study were then given signed identity cards with numbers for easy identification and reminded that the researchers would return in three months for the post-training phase. One of the researchers took the women who did not meet the inclusion criteria aside and taught them the fundamentals of childhood illnesses.

Post-training phase

A return visit to the communities was made three months after the training to assess the impact of the training on the participants’ knowledge of danger signs in sick newborns and health seeking

behavior. Only women who had been seen three months prior were invited. The study participants were confirmed using signed identity cards with numbers. Those who had lost their cards but were present during the pre-training phase were identified by the traditional ruler's representative. Those without cards who were not a part of the pre-training phase, on the other hand, were asked to leave. The post-training phase was carried out by re-administering a similar questionnaire completed in the pre-training phase to each of the participants seen 3 months earlier. A total of 31 participants who had previously been observed in the pre-training phase were lost to follow-up (13 at Nomeh community and 18 from Ndiuno Uwani Akpugo community). The study included 197 women from the two communities (both pre and post training phases).

Quality control checks were also done at the end of the post training field activity by researchers.

Data analysis

Pre- and post-training responses for each participant was entered into excel sheet and were analyzed using SPSS version 20.0 (Chicago IL). Frequency distribution statistical analysis was used to compute the results. Tests of significance was also carried out as appropriate and a p-value of less than 0.05 was regarded as significant. Results were presented in prose and tables.

Results

Characteristics of study participants

This study was carried out in 2 rural communities in Enugu state namely Nomeh and Ndiuno Uwani Akpugo. A total of 197 women completed the study, 120 participants from Nomeh and 77

from Ndiuno Uwani Akpugo. Of the 197 respondents, 59 (30%) were 29 years or younger, 85 (43%) were between 30-40 years while 53 (27%) were over the age of 40 years of age. Most respondents (90; 46%) had nursed at least 3 newborns through infancy while 107 (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 demographics of the study respondents are as shown in Table 1.

Respondents' knowledge of dangers signs pre and post training

Table 2 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% ($p=0.04$), 32.5% ($p=0.001$) and 32.5% ($p=0.001$) respectively after the training. There was no significant difference in knowledge of participants for 4 or more danger signs before and after the training. In summary, respondents with the knowledge of at least 1 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 ($p=0.001$).

Socio-demographic determinants of knowledge of danger signs among respondents

Table 3 shows the adjusted regression analysis of socio-demographic determinants of knowledge of danger signs in caregivers. It is noted that respondents 30-40 years and those over 40 years

Table 1. Summary statistics of mother/caregivers enrolled in the study.

Study parameter	Variables	Frequency (n)	Percentage (%)
Community members surveyed (N=197)	Ndiuno Uwani Akpugo	77	39.0
	Nomeh	120	61.0
Age of respondents (N=197)	≤ 29 years	59	30.0
	30-40 years	85	43.0
	> 40 years	53	27.0
Number of newborns nursed (N=197)	1-3	90	46.0
	4-6	82	42.0
	≥ 7	25	12.0
Socio-economic class (N=197)	Low	55	28.0
	Middle	136	69.0
	High	6	3.0
Mother's education (N=197)	None	27	14.0
	Completed primary	92	47.0
	Completed secondary	38	19.0
	Post-secondary	40	20.0
Father's education (N=180)	None	28	16.0
	Completed primary	68	38.0
	Completed secondary	28	16.0
	Post-secondary	56	30.0
Mother's occupation (N=197)	Unemployed	90	46.0
	Unskilled	74	38.0
	Semi-skilled	25	12.0
	Skilled	8	4.0
Father's occupation (N=179)	Unemployed	59	33.0
	Unskilled	50	28.0
	Semi-skilled	50	28.0
	Skilled	20	11.0

were 0.78 and 0.96 less likely to lack knowledge of any danger sign compared to caregiver 29 years and younger. 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) are 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 education [OR 0.77 (95% CI 0.22 – 2.71); $p=0.688$], those with completed secondary education [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. Similarly to age, none attained statistical significance. Finally, respondents who were in unskilled employment

Table 2. Pre and post intervention assessment danger signs parameters and appropriate action taken.

Parameter	Intervention		P-value†
	Pre	Post	
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 3. Socio-demographic 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
Age of respondents (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
Number of newborns nursed (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
Socio-economic class (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
Mother's education (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
Mother's occupation (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
	Skilled	3 (3)	5 (5)		1.44 (0.30 – 6.79)	0.647

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

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.

Finally, of the respondents that indicated they would seek medical intervention, significantly more 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 show participants knowledge and action regarding individual danger signs.

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.

Despite the fact that statistical significance was not achieved, most likely due to the small sample size, our study found that increasing maternal educational attainment was associated with better knowledge of danger signs in newborns. Maternal education has been shown to improve child health and to initiate preventive care initiatives earlier.¹² Maternal education is also a sign of trainability because it allows for an appreciation of the benefits of

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 infections [‡] (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 was noticed in an 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 infections [‡] (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.

adhering to recommended health practices and can improve their uptake.^{13,14} As a result, the subjects were expected to be in good enough shape to benefit fully from whatever knowledge or skills the training provided. 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 than mothers with higher levels of education to rely on assistance from relatives with similar educational status.¹⁴ A cross-sectional study in a Neonatal Intensive Care Unit (NICU) in North Central Ethiopia, on the other hand, found that secondary and higher levels of education were among the factors reported as significant determinants of postnatal mothers' knowledge of neonatal danger signs.¹⁶

Our research also found that the number of newborns previously nursed by respondents was a significant predictor of their knowledge of danger signs in the sick newborn. Similarly, in rural Sierra Leone, a cross-sectional survey of women's knowledge and reported practices on maternal and child health revealed that the number of children had a significant influence on health knowledge scores.¹⁷ This finding supports the age-old adage that "experience is the best teacher." It stands to reason that they would have learned so much from caring for their newborns over the years. Following the death of their newborn due to their failure to detect the signs early enough, some caregivers may have received the correct information after counseling. It is also worth noting that the other maternal socio-demographic variables were found to be insignificant predictors of knowledge of danger signs in the first phase of this study, which was conducted in the same communities about six (6) years ago.¹⁰

Our study found that training had a significant impact on mothers' knowledge of danger signs in sick newborns. In the post-training phase, there was a significant improvement in knowledge of seven 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 According to a similar study on the impact of training on caregiver knowledge and care-seeking behavior, 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 than untrained TBAs.¹⁸ It stands to reason that training equips one with knowledge and skills to execute a specific task. The authors believe that our participants' formal educational background has prepared them to understand the training content.

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.⁵ The 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 was a significant improvement in the willingness to seek care in a health facility for each of the newborn danger signs in the post-interventional phase. This is a positive step forward and a significant accomplishment. Serious illness symptoms in newborns can be subtle.¹⁹ As a result, they may go unnoticed by mothers and caregivers at home. As a result, 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 improve the sick newborn's survival rate.

The most important aspect of this care seeking is that the training has significantly reduced the time between observing danger

signs and seeking care at a health facility. The majority of the subjects sought care at a health facility within 24 hours of noticing any danger signs in their newborn. This advancement will reduce level one delay (delay at home), which has been identified as a significant cause of delay in the delivery of health care to sick newborns and a significant contributor to neonatal mortality.^{20,21}

Conclusions

Our research found that training mothers can significantly improve their knowledge of danger signs in sick newborns. One significant limitation of this study was that, due to its cross-sectional design and financial constraints, we were unable to follow these respondents over time to assess the long-term impact of their knowledge of danger signs on the health and survival of their newborns.

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