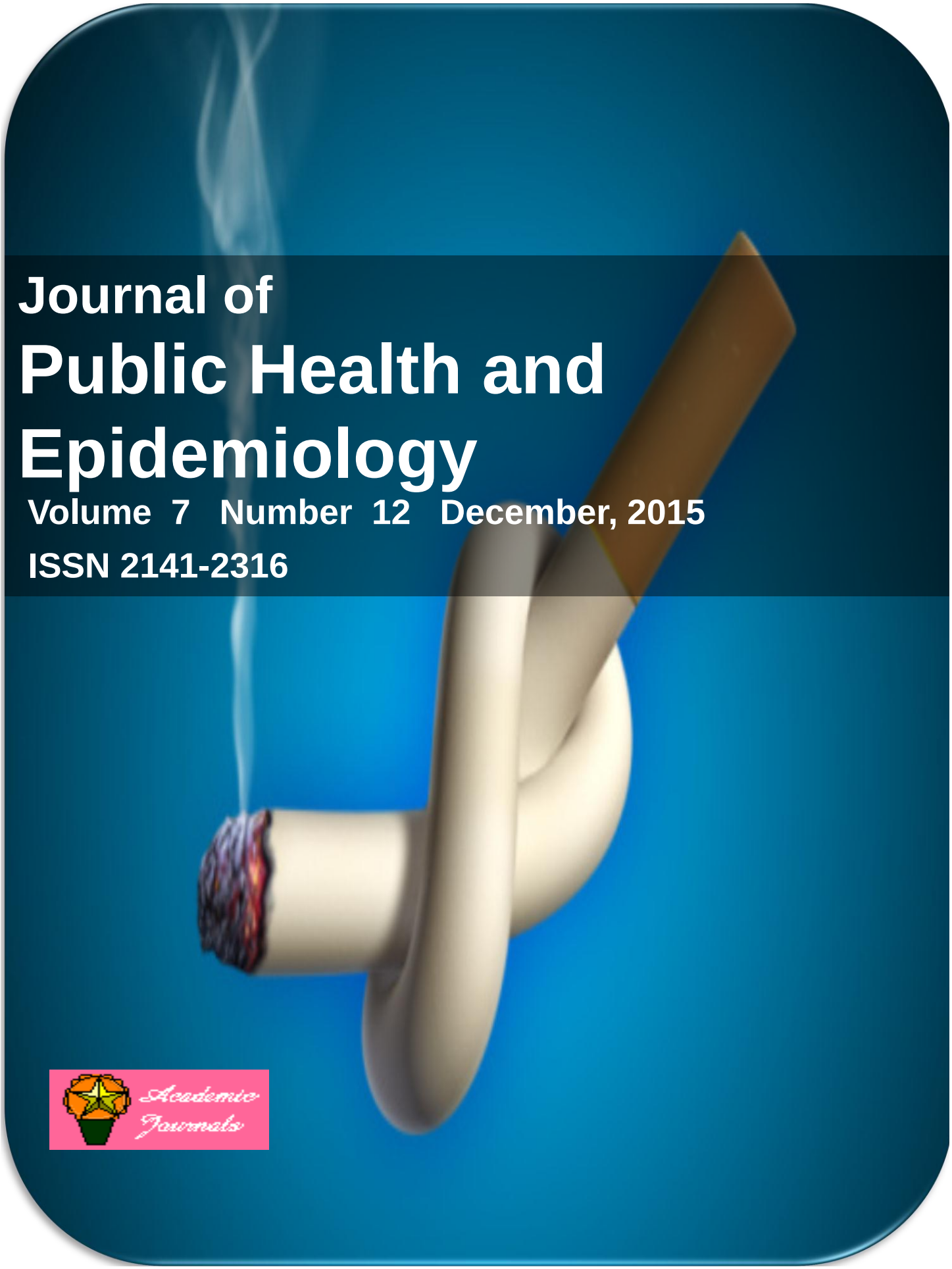

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Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing Escherichia coli in the Calgary Health Region: emergence of CTX-M-15-producing isolates. Antimicrob. Agents Chemother. 51: 1281-1286.

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Full Length Research Paper

Breast feeding initiation time and its impact on diarrheal disease and pneumonia in West Africa

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Although breast feeding (BF) is protective against infectious disease amongst children, its timing initiation effect after birth is unknown, whether immediate (<1 h), hours (>1 to <24 h) or days (>24 h). The authors examined relationships between early initiation time of BF and the prevalence of pneumonia and diarrhea in infants and under 5 children adjusting for gender, previous sibling death, maternal educational level, place of delivery and birth weight. This study utilized secondary database analysis of the de-identified and publicly available Multiple Indicator Cluster Survey (MICS) 4 data for the period between 2009-2011. A cross-sectional study was conducted for children under 5 years, using the data from Nigeria (n=26018), Ghana (n=7586), Togo (n=4908) and Sierra Leone (n=8798). A total of 47310 children were recorded for the four countries in West Africa with a mean age and birth weight distribution of 1.72±2 (0.45) years and 2.17±2 (0.62) kg, respectively. 'Hours' breast fed infants were significantly more likely to be protected from diarrhea than 'days' breast fed with a crude OR of 0.74 (95% CI= 0.68-0.80 P=0.0292). The estimated adjusted OR for 'hours' breast feeding in relation to protection against diarrhea as compared to 'days' is 0.81 (95% CI= 0.72-0.92 P=0.0478). In this population representing infants and children less than 5 years of age from four countries within the West African sub-region, breast feeding within 24 h after birth showed a protective effect against diarrhea as compared to breast feeding which commenced days after birth even after all adjustments for confounding variables had been considered.

Key words: Breast feeding initiation, breast feeding protection, infectious disease and breast feeding trends.

INTRODUCTION

According to UNICEF 2012 data, pneumonia is the single largest killer of children under age 5 worldwide and the leading infectious cause of childhood mortality. It also accounts for 17% of all under-five deaths and it killed 3,000 children a day in 2012 (1.1 million that year). Most of its victims were less than 2 years old. On the other hand, diarrhea is also ascribed a leading killer of children, which accounts for 9% of all deaths among children under age 5 worldwide. This translated into 1,600 young children dying each day, or more than 580,000 children a

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year. The bulk of this mind blowing statistics occur among children less than 2 years of age living in South Asia and sub-Saharan Africa. Many studies have investigated the preventive effect of breast feeding on different disease parameters in the under 5 children and based on some of these studies, the WHO recommends early breastfeeding within the first 24 h of birth as being protective (Arifeen et al., 2001; Debes et al., 2013; César et al., 1999; Lamberti et al., 2013).

A study that evaluated the role of breastfeeding in reducing hospitalizations for pneumonia in children under 1 year conducted in Sao Paolo Brazil estimated that breastfeeding may be responsible for the reduction of 9.1% of the infant mortality rate, and can prevent more than 600,000 deaths worldwide from acute lower respiratory infections; this represents about 30% of post-neonatal mortality and 50% of preventable neonatal mortality from acute respiratory infections in Latin America (Boccolini et al., 2011). In the first years of life, breastfeeding can reduce hospital admissions for acute lower respiratory infections. Exclusive breastfeeding also has a protective effect on hospitalization from pneumonia, especially in the first 3 months of life; also improves the outcome of acute diarrhea by reducing the number and volume of diarrheal stools (Chisti et al., 2011; Jaillon et al., 1873; César et al., 1999; Khin et al., 1985; Lamberti et al., 2013; López-Alarcón et al., 1997**;** Mullany et al., 2008; Sanjoy et al., 2013). However, there is little literature on the relationship between time/period of breast feeding initiation time and development of diseases (Clemens et al., 1999).

Based on this gap in literature, our study aimed to examine association between breast feeding initiation time after birth and its effect on pneumonia and diarrhea in children under 5 years; and it was hypothesized that initiation of breast feeding during the first hour than later initiation time is associated with a higher protection from pneumonia and diarrhea. Information on breast feeding initiation time utilized includes 'immediate' (time <1 h after birth), 'hours' (time >1 h but < 2 h after birth) and 'days' (time >24 h after birth) (Mullany et al., 2008).

METHODOLOGY

Study sampling

The sample for the Multiple Indicator Cluster Survey (MICS4) was designed to provide estimates for a large number of indicators on the situation of children and women at the national level, for urban and rural areas, and for the states/districts/regions of several countries. The urban and rural areas within each region were identified as the main sampling strata and the sample was selected in two stages. Within each stratum, a specified number of census enumeration areas (EA) were selected systematically with probability proportional to size. After a household listing was obtained within the selected EA, a systematic sample of households was drawn in each selected EA. All the selected EAs were visited during the fieldwork period. The sample was thus stratified by district/state/region and then by urban/rural areas. The study design is a cross-sectional survey.

Household interview

Exposure

Random household visit questionnaire based information was collected from the mothers of the participant children in relation to their household link. Questions on breast feeding initiation time were asked in this format: 'how long after birth did you first put to breast?' they provided response to the question as 'immediately', 'hours', 'days' or 'special'.

Outcome

Information on diarrhea was coined as: 'in the last 2 weeks, has child had diarrhea?' for which the response was "yes" or "no". Information on pneumonia was collected by asking questions on cough: 'child ill with cough in last two weeks? Fever: 'child ill with fever in last two weeks?' and difficulty in breathing: 'When child had an illness with a cough, did he/she breathe faster than usual with short, rapid breaths or have difficulty in breathing? If the response to these three questions was "yes", then it was assumed to be 'pneumonia'

Data and samples

This study utilized the de-identified, publicly available MICS 4 data from the World Health Organization/United Nations International Children's Emergency Fund (WHO/UNICEF) database. It is a dataset that provides information (high quality data) to monitor the situation of children and women around the World 2009-2011. UNICEF assists countries to carry out the surveys every three years which are essential for monitoring countries' progress towards national goals and global commitments, including the Millennium Development Goals (MDGs) for the target year 2015. The dataset contains information on 'household', 'women with birth history', 'women without birth history', 'men' and 'children'.

The designated study area of interest are four west African countries and data for Nigeria, Togo, Ghana and Sierra Leone wee harnessed with emphasis on the information on the under 5. The data files adopted includes the individual women (with birth history) and children under five files. A total of 26018 from Nigeria, 4908 from Togo, 7586 from Ghana and 8798 from Sierra Leone, children of ages less than 5 years were included in the study. These children comprises of both male and female from different ethnic backgrounds and religious affiliations.

Measurement of variables

To assess the potential confounders, information on child's gender and birth weight was collected. Other information that was collected included: (a) place of delivery 'where did you give birth to child' (b) maternal educational level 'What is the highest level of school you attended?' (c) History of previous sibling death 'Have you ever given birth to a boy or girl who was born alive but later died?' The maternal level of education was used as a marker for socio-economic status.

Statistical analysis

Statistical analysis was performed using the SAS 9.4 software suite developed by SAS institute used for advanced statistical analysis which handles complex design models. The frequency distribution of variables of children was calculated according to the different countries of interest. The appropriate χ^2 tests were used to compare several items in immediate, hours and days breast fed children and

Table 1. Descriptive and summary statistics for infants (N=19574).

Variable	Nigeria	Togo	Ghana	Sierra Leone	Total
	N=10,993 (100%)	N=2112 (100%)	N=3012 (100%)	N=3457 (100%)	N=19574 (100%)
Gender					
Male	5626 (51.18)	1092 (51.71)	1544 (51.26)	1750 (50.62)	10012 (51.15)
Female	5367 (48.82)	1020 (48.29)	1468 (48.74)	1707 (49.38)	9562 (48.85)
Birth weight					
<2.5	307 (11.95)	147 (13.78)	194 (14.71)	192 (11.55)	840 (12.70)
2.5-3.8	1397 (54.40)	670 (62.79)	845 (64.06)	938 (56.44)	3850 (58.19)
>3.8	864 (33.65)	1295 (23.43)	280 (21.23)	532 (32.01)	1926 (29.11)
Sibling death					
Yes	3467 (34.24)	615 (31.83)	835 (28.82)	1226 (38.72)	6143 (33.90)
No	6659 (65.76)	1317 (68.17)	2062 (71.18)	1940 (61.28)	11978 (66.10)
Breast feeding					
Immediately	2146 (22.68)	914 (48.69)	1118 (39.66)	1333 (45.20)	5511 (32.21)
Hours	4554 (48.12)	574 (30.58)	1325 (47.00)	1337 (45.34)	7790 (45.53)
Days	2687 (28.40)	381 (20.30)	356 (12.63)	268 (9.09)	3692 (21.58)
Special	77 (0.81)	8 (0.43)	20 (0.71)	11 (0.37)	116 (0.68)
Education					
Primary	2036 (33.50)	646 (68.36)	570 (41.19)	430 (43.48)	3682 (39.19)
Secondary	2759 (45.39)	240 (25.40)	635 (45.88)	523 (52.88)	4157 (44.24)
Higher	713 (11.73)	40 (4.23)	148 (10.69)	36 (3.64)	937 (9.97)
No Formal Education	570 (9.38)	19 (2.01)	31 (2.24)		620 (6.60)
Place of delivery					
Home	5482 (56.10)	746 (39.18)	1234 (43.68)	1524 (50.40)	8986 (51.28)
Public/Govt. Facility	2334 (23.89)	962 (50.53)	1407 (49.81)	1376 (45.50)	6079 (34.69)
Private	1557 (15.93)	182 (9.56)	159 (5.63)	101 (3.34)	1999 (11.40)
Others	399 (4.08)	14 (0.73)	25 (0.88)	23 (0.76)	461 (2.63)
Pneumonia					
Yes	499 (4.54)	261 (12.36)	175 (5.81)	410 (11.86)	1345 (6.87)
No	10494 (95.46)	1851 (87.64)	2837 (94.19)	3047 (88.14)	18229 (93.13)
Diarrhea					
Yes	2056 (20.25)	562 (28.82)	509 (17.34)	561 (17.25)	3688 (20.16)
No	8096 (79.75)	1388 (71.18)	2426 (82.66)	2692 (82.75)	14602 (79.84)

their association with pneumonia and diarrhea. Survey logistic regression models were used to assess the impact of variables that were significantly associated (P<0.05) with both exposure and outcomes. Logistic regression was conducted for both infants and under 5s in different countries, and combined as a whole. Confounding was assumed to have occurred if the odds ratio changed by ≥10% and they were included in the final logistic regression model. The MICS 4 survey design did not take into account weighted variables and the possibility of missing values in some variables from respondents. Hence, maintaining the statistical rigor was paramount and unwanted observations in person-level files are not deleted in the analysis.

Ethical consideration

This study received ethical approval from the Rutgers University Biomedical and Health Sciences (RBHS) Institutional Review Board and the United Nations International Children's Emergency Fund (UNICEF).

RESULTS

Table 1 shows the demographic background of subjects

who are less than one year old that are involved in this study. The gender distribution revealed that males have a higher distribution than females with frequencies of 51.18, 51.71, 51.26 and 50.62% for Nigeria, Togo, Ghana and Sierra Leone, respectively. On the average, the estimated distribution of males to female ratio in the combined countries was 1.01: 1. In terms of breast feeding trend, Togo recorded 48.69% of women who commenced breast feeding immediately after birth as compared to other countries which had 22.68, 39.66 and 45.20% for Nigeria, Ghana and Sierra Leone, respectively. Overall percentage of infants commenced on 'immediate' feeding after birth is 32.21 and 45.53% for 'hours' later, 21.58% for 'days' later and those on some special breastfeeding recommendation accounts for 0.68%. Nigeria recorded the highest percentage for infants with birth weight greater than 3.8 kg (over weight) with a value of 33.81%. The number of response to history of previous sibling death is almost the same across the different countries as the total frequency is 33.90%. More than half of the study population responded that their place of delivery was in their personal homes or other homes apart from medical centers across the different countries. Utilization of public hospitals for delivery in Nigeria was relatively low as 23.89% responded to its use as compared to Togo, Ghana and Sierra Leone that had 50.53, 49.81 and 45.50%, respectively for use. For the combined study, 51.28% of the infants were delivered in homes. With regards to the outcome, Togo has a total 12.36% of pneumonia cases and 28.82% of diarrhea which is the highest for all the countries included in the study (Table 1).

For the general under 5 years population as depicted in Table 2, a total of 47310 respondents were recorded for the four countries in west Africa which has a mean age and birth weight distribution of 1.72±2 (0.45) years and 2.17±2 (0.62) kg, respectively. The frequency distribution for most variables is similar to that of the under 1 year population. However with regards to no formal education, over 76% were non-respondents in Sierra Leone when compared with 9.91, 1.88 and 2.49% for Nigeria, Togo and Ghana, respectively. Women whose highest level of education is secondary were most likely to utilize the public/government hospital which is the benchmark standard for developing countries. Breast feeding hours after delivery was the most common trend for the general study population (45.75% of children) likewise the common pattern for the infant population as well (45.53% of breast feeding pattern). This breast feeding pattern is similar to most countries apart from Togo that has about 49.09% of immediate breast feeding. Breast feeding showed a protective effect over diarrhea amongst infant with an estimated OR = 0.87 (95% CI= 0.81- 0.93 P=<0.0001).

Hours and immediate breast fed children in Nigeria were significantly more likely to be diarrhea free than children breast fed days after with a crude OR of 0.72 (95% CI= 0.65-0.80 P=0.0108) and 0.74 (95% CI= 0.66-0.83 P=0.0439). The crude estimate for immediate breast feeding in Sierra Leone on diarrhea is significant (0.66 {95% CI= 0.49-0.88 P=0.05}). Hours breast fed under 5s were substantially more likely to be diarrhea free than those breast fed days after with a crude OR of 0.74 (95% CI= 0.68-0.80 P=0.0292) as depicted in Table 3. There was no significant statistic association between immediate breast feeding and days later feeding. This relationship was adjusted for multiple covariates including place of delivery, birth weight, gender and previous history of sibling's death. After adjusting for these covariates, the effect of 'hours' compared to 'days' commencement of breastfeeding on diarrhea remained significant with a P-value of 0.0478 as the estimated adjusted OR was 0.81 (95% CI= 0.72-0.92); effect of immediate breast feeding compared to days was not significant after adjustment. The adjusted estimate for pneumonia remained not significant in all countries for both the 'hours' and 'immediate' breast feeding. Impact of the different trends of breast feeding on pneumonia and diarrhea amongst infants did not yield any statistical significant relationship either as depicted in Table 4. After adjustment with covariates for effect on pneumonia, the estimate was not significant.

DISCUSSION

In this study of population representing infants and children under 5 years of age from four countries within the West African sub-region, 'hours' breast feeding initiation time after birth showed a protective effect over incidence of diarrhea as compared to breast feeding commencement days after birth even after all adjustments for confounding variables have been considered. This result is consistent with a previous study done on breast feeding patterns, time to initiation and mortality risk among newborns in Southern Nepal as there was associated reduced risk of mortality during the neonatal period (Mullany et al., 2008). There was no effect with regards to immediate breast feeding commencement as their estimates of effect showed somewhat non-significant protection trend. Similar association cannot be ascribed to its impact on pneumonia; this could be due to the amount of cases of pneumonia in the study; as there were some tendencies during the different estimation per country. Hence, this study does not improve the literature already documented on pneumonia. However, some studies have shown that breast feeding has protective effect on pneumonia (Barsam et al., 2013; Chisti et al., 2011; César et al., 1999; Lamberti et al., 2013). This study also shows that 'immediate' initiation and 'hours' initiation of breast feeding has similar impact on diarrhea amongst infant and children generally; so breast feeding within 24 h is

Table 2. Descriptive and summary statistics for under 5s (N=47310).

Variable	Nigeria	Togo	Ghana	Sierra Leone	Total
	N=26,018 (100%)	N=4908 (100%)	N=7586 (100%)	N=8798 (100%)	N=47310 (100%)
Gender					
Male	13284 (51.06)	2512 (51.18)	3872 (51.04)	4395 (49.95)	24063 (50.86)
Female	12734 (48.94)	2396 (48.82)	3714 (48.96)	4403 (50.05)	23247 (49.14)
Birth weight					
<2.5	459 (11.39)	193 (12.32)	264 (13.87)	268 (11.53)	1184 (12.05)
2.5-3.8	2209 (54.80)	1003 (64.01)	1223 (64.27)	1322 (56.86)	5757 (58.59)
>3.8	1363 (33.81)	371 (23.68)	416 (21.86)	735 (31.61)	2885 (29.36)
Sibling death					
Yes	8856 (36.88)	1505 (33.28)	2200 (31.45)	3084 (40.22)	15645 (36.22)
No	15158 (63.12)	3017 (66.72)	4795 (68.55)	4583 (59.78)	27553 (63.78)
Breast feeding					
Immediately	3539 (23.13)	1426 (49.09)	1690 (39.84)	1887 (45.63)	8542 (32.14)
Hours	7382 (48.26)	903 (31.08)	1997 (47.08)	1878 (45.42)	12160 (45.75)
Days	4258 (27.84)	561 (19.31)	525 (12.38)	355 (8.59)	5699 (21.44)
Special	118 (0.77)	15 (0.52)	30 (0.71)	15 (0.36)	178 (0.67)
Education					
Primary	4981 (35.51)	1499 (68.76)	1310 (41.35)	952 (45.44)	8742 (40.72)
Secondary	6105 (43.52)	550 (25.23)	1476 (46.59)	1054 (50.31)	9185 (42.78)
Higher	1551 (11.06)	90 (4.13)	303 (9.56)	89 (4.25)	2033 (9.47)
No Formal Education	1390 (9.91)	41 (1.88)	79 (2.49)		1510 (7.03)
Place of delivery					
Home	9103 (57.44)	1233 (41.31)	1968 (46.13)	2182 (51.05)	14486 (52.92)
Public/Govt. Facility	3665 (23.13)	1425 (47.74)	2022 (47.40)	1899 (44.43)	9011 (32.92)
Private	2444 (11.06)	267 (8.94)	229 (5.37)	140 (3.28)	3080 (11.25)
Others	636 (4.01)	60 (2.01)	47 (1.10)	53 (1.24)	796 (2.91)
Pneumonia					
Yes	1123 (4.32)	612 (12.47)	408 (5.81)	992 (11.86)	3135 (6.63)
No	24895 (95.68)	4296 (87.53)	7178 (94.62)	7806 (88.72)	44175 (93.37)
Diarrhea					
Yes	3949 (15.70)	1039 (21.90)	1123 (14.96)	1392 (16.21)	7503 (16.32)
No	21198 (84.30)	3706 (78.10)	6385 (85.04)	7193 (83.79)	38482 (83.68)

protective as compared to breast feeding >24 h later. Though there are some evidences of transmission of immunoglobulins from mother to child through intake of colostrum, the mechanism involved still needs more research (Mullany et al., 2008).

The relationship with place of delivery in this study revealed that a huge population of mothers responded that they delivered at home and this practice may be a contributing factor to the occurrence of diarrhea and pneumonia. Judging from literature, the effect of socio-economic status, maternal education and cultural practices has a huge impact on the general health outcome of children in developing countries. A huge percentage of death from diarrheal and pneumonia morbidity are often attributed to families with poor income as they are more likely to live in poor sanitary conditions; also inability to afford medical care (Shwetal et al., 2012 It is also note-worthy that the protective effect of breast

Table 3. Crude and Adjusted estimate of immediate breast feeding on pneumonia and diarrhea for the under 5.

Countries		Crude OR (95% CI)		Adjusted OR (95% CI)	
	Ref= days	Pneumonia	Diarrhea	Pneumonia	Diarrhea
Nigeria	Immediate	0.685 (0.554-0.846)	0.741* (0.659-0.834)	----	----
	Hours	0.699 (0.588-0.831)	0.722* (0.654-0.796)	----	----
Togo	Immediate	0.848 (0.628-1.144)	0.776 (0.622-0.969)	0.914 (0.676-1.235)	0.836 (0.668-1.046)
	Hours	1.171 (0.858-1.598)	0.834 (0.657-1.059)	1.223 (0.896-1.668)	0.876 (0.689-1.114)
Ghana	Immediate	0.799 (0.528-1.209)	0.837 (0.643-1.090)	----	1.036 (0.787-1.366)
	Hours	0.861 (0.576-1.287)	0.894 (0.691-1.156)	----	1.161 (0.745-1.810)
Sierra Leone	Immediate	0.831 (0.594-1.163)	0.658* (0.494-0.876)	----	----
	Hours	0.844 (0.604-1.181)	0.721 (0.542-0.959)	----	----
West Africa	Immediate	1.011 (0.886-1.153)	0.762 (0.699-0.830)	1.135 (0.955-1.349)	0.948 (0.831-1.082)
	Hours	0.892 (0.786-1.011)	0.741* (0.684-0.803)	0.627 (0.484-0.810)	0.812* (0.718-0.918)

Key- adjusted diarrhea; adjusted pneumonia; Togo: Adjusted for place of delivery, gender; place of delivery. Ghana: Adjusted for maternal education, previous sibling death; Nil. West Africa: Adjusted for place of delivery, maternal education, gender; place of delivery, maternal education. *Significant different (P<0.05); ----. Nil adjustment.

Table 4. Crude and adjusted estimate of immediate breast feeding on pneumonia and diarrhea for Infants.

Countries		Crude OR (95% CI)		Adjusted OR (95% CI)	
	Ref= days	Pneumonia	Diarrhea	Pneumonia	Diarrhea
Nigeria	Immediate	0.714 (0.552-0.924)	0.758 (0.659-0.873)	----	----
	Hours	0.671 (0.543-0.831)	0.739 (0.658-0.830)	----	----
Togo	Immediate	0.953 (0.667-1.361)	0.886 (0.682-1.151)	1.040 (0.725-1.492)	0.946 (0.725-1.234)
	Hours	1.183 (0.813-1.721)	0.919 (0.692-1.220)	1.235 (0.847-1.801)	0.961 (0.722-1.280)
Ghana	Immediate	0.738 (0.455-1.197)	0.804 (0.593-1.089)	0.738 (0.445-1.197)	1.763 (0.791-3.930)
	Hours	0.885 (0.557-1.407)	0.860 (0.639-1.156)	0.885 (0.557-1.407)	1.984 (0.900-4.376)
Sierra Leone	Immediate	0.939 (0.632-1.395)	0.639 (0.462-0.883)	----	----
	Hours	0.982 (0.662-1.485)	0.700 (0.507-0.965)	----	----
West Africa	Immediate	1.050 (0.897-1.229)	0.982 (0.681-0.834)	1.090 (0.886-1.342)	0.963 (0.881-1.052)
	Hours	0.905 (0.778-1.058)	0.740 (0.673-0.814)	0.667 (0.494-0.901)	1.255 (1.132-1.390)

Key- Adjusted diarrhea; adjusted pneumonia. Togo: Adjusted for place of delivery, gender; place of delivery; Ghana: Adjusted for maternal education, previous sibling death, birth weight; Nil. West Africa: Adjusted for place of delivery, maternal education, gender; place of delivery, maternal education. N/B: *. Significant different (P<0.05). ----. Nil adjustment.

feeding within 24 h after birth could be ascribed to high colostrum level which is fortified with a lot of immunologic components (Clemens et al., 1999). Pentraxin 3 (PTX3) which is a soluble pattern recognition receptor involved in the initiation of protective responses against selected pathogens, is a constituent of colostrum and very vital for the initial innate immune response in children; thus protective against morbidities (Jaillon et al., 1873).

Several studies on effect of breast feeding on diarrhea showed positive association and that of Pneumonia were inconclusive as some noted positive associations and others negative. However, there are few studies on time of initiation of breast feeding and its effect on diarrhea and pneumonia; with the extent of mixed evidence already documented in literatures, there are proposals to conduct prospective studies that will bridge the

knowledge gap on the trends of breast feeding. Presently, some medical management history taken from patients on post natal care has breast feeding trend questions incorporated in it; and if universally accepted, it will help in computing data for different associations of health outcomes with breast feeding by researchers.

This study utilized a cross-sectional data from UNICEF MICS 4 which could pose a huge limitation as some of the questions that were used to ascertain this model relationship might not be goal specific for the aims and hypothesis highlighted in the literature review. Hence, despite ascertaining some effect from the study, the temporal sequence of events from exposure to desire outcome cannot be achieved. Secondly, the study had few respondents who have ever been diagnosed of pneumonia; this may have affected some of the output statistics conducted as the effect of breast feeding initiation pattern on pneumonia was not significant after adjustment. On the other hand, a possible reason for the reduced level of significance could be that the 'pneumonia' outcome was deduced by computation of response from questions on cough, fever and difficulty in breathing symptoms occurring at the same point in time. Thirdly, the questionnaires used in this study from 2011 MICS 4 datasets were self-reported and has a high likelihood to jeopardize the validity of the response of subjects (respondent's bias); this could be from subjects reporting the wrong information to questions being asked in the questionnaire either by over reporting or under reporting of events, and this will definitely affect the reliability of the effects measured in the study.

The fourth limitation of this study is the likelihood of recall bias to some of the variable of interest in the questionnaire like time of breast feeding initiation for which respondents might have distorted information on them by giving random response to immediately, hours and days. These random response can also be attributed to the fact that a lot of these women in the study, do not possess any form of formal education and will not comprehend the importance of their response; thus leading to distortion in the effect estimate of the study. Another possible limitation from this study is the possible misclassification of outcome into the datasets by analysts; and this could cause a probable misclassification bias in the study. Prevalence-incidence bias cannot be neglected in this study as response to both outcome of interest are acute in nature and could be described as short duration diseases (Neymar bias). Thus, incidence of diarrhea and pneumonia cannot be ascertained from this model of study. As any other survey modeled study, this study is also prone to a lot of missing response to question of interest (Non-response bias) and will tend to bias some estimate of effect in the study.

Despite the numerous limitations of this study, there is need to emphasize the large sample size of the overall population as a major strength; even though the bulk of the population is from Nigeriawhile Togo had the smallest population. As this large sample size ensures that there is minimal random error in the study and also takes into account the different country-region predisposition. So it is generalizable as it represents the study population (external validity). The association between breast feeding initiation time and occurrence of diarrhea serves as a plat form for comprehensive prospective studies to be conducted. It is also very vital for establishment of hypothesis, health planning and understanding the disease pathology. This model also saved a lot of time in estimating the effect on diarrhea and cost effective to achieve as there was no loss to follow up as well.

In conclusion, breast feeding initiation within 24 h after birth reduced the risk of diarrhea among children less than five years of age in Nigeria, Togo, Ghana and Sierra Leone as compared to those breast fed days after birth. This effect is more likely to be related to the level of immunologic nutritional composition of breast milk within 24 h after birth. Reducing childhood diarrhea and its consequences may be an important motivation in the drive to encourage immediate breast feeding in all countries. The effect of breast feeding trends on pneumonia is still questionable and can be ascribed as inconclusive; thus more research and study in a large population with large incidence/prevalence of pneumonia is still needed.

Conflict of Interests

The authors have not declared any conflict of interests.

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