Investigating Household Factors and Child Physiognomies as Predisposing Dynamics to Optimal Breastfeeding among
Fertile Mothers in West Africa: A Multilevel Study

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Abstract
Background

In many West African countries, the vulnerability of infants and under-five children to life threatening infections, poor physiological development, cognitive impairments and mortality, due to their weak immune system has been extensively related to the non-adherence of mothers to optimal breastfeeding. Earlier studies had inspected and explored the conceivable predictors of the non-conformity of mothers in the region to the recommended breastfeeding practices by UNICEF/WHO. However, these empirical studies had neither investigated the joint effect of household factors and child physiognomies nor adopted the multilevel method across countries in West Africa. The study addresses this limitation by investigating the identified explanatory variables as predisposing dynamics to optimal breastfeeding among fertile mothers in three selected West African countries

Method

This study was a cross-sectional multilevel survey. It analysed secondary quantitative data extracted from the Demographic Health Surveys conducted in Guinea (2012 GDHS), Nigeria (2013 NDHS) and Sierra Leone (2013 SLDHS). Information was sourced from a weighted sample size of 12,180 (NDHS), 5,008 (SLDHS), and 3,082 (GDHS) for fertile mothers aged 20-49 years old, who have had at least a birth prior the surveys. The response variable was optimal breastfeeding practice. It was captured by adherence and non-adherence to it thus, it was dichotomised into ''1'' if adhered to by fertile mothers and ''0'' if otherwise. The explanatory variables were household factors and child physiognomies and were measured at individual and community levels.

The fixed and random effect logistic regression was carried out using Stata 14.

Results

Results showed that < 10% of fertile mothers practiced optimal breastfeeding in Guinea (5.3%), and Nigeria (8.6%), while only 14% of fertile mothers in Sierra Leone adhered to the practice. The fixed effect results showed that household factors, child physiognomies, and maternal factors at community level were significantly associated with optimal breastfeeding (p<0.05). the random effect results showed that household factors at community level accounted for 29.0%, 23.6% and 23.3% variation in adherence to optimal breastfeeding in Guinea, Nigeria, and Sierra Leone respectively. Results showed that child characteristics, at community level contributed 36.3%, 20.6% and 18.7% variation in adherence to optimal breastfeeding by fertile mothers in Guinea, Nigeria, and Sierra Leone respectively. Results, further showed that household factors and child physiognomies, at the community level jointly accounted for 20.4%, 21.5%, and 19.85 variation in adherence to optimal breastfeeding by fertile mothers in Guinea, Nigeria, and Sierra Leone respectively.

Conclusion

The study concluded that adherence of fertile mothers to optimal breastfeeding is fundamental to reducing the vulnerability of infants and young children to life threatening infections, poor physiological and cognitive impairments, and early childhood death to the lowest in Guinea, Nigeria, Sierra Leone, and the sub-region of West Africa as a whole.

Keywords: Optimal breastfeeding, predisposing dynamics, physiognomies, fertile mother.

Introduction

The definition of breastfeeding is relative. It is defined based on its categorization and the person defining it. Breastfeeding is the process or act of feeding the child with breast milk directly from the mother's breast or wet nurse or expressed with breastmilk, solid or semi-solid foods and also requires the feeding of an infant with non-human milk (UNICEF, 2016). Adequate and appropriate breastfeeding protects infants and young growing children against allergies and it as well boosts intimacy between mother and her infant. Breastfeeding contains healthier nutrients compared to formulas and promotes infant's immunity, growth and development. Breastfeeding promotes mothers' health and contributes cost-effective benefits to the household, healthcare services and work-plan (Doherty, Horwood, Heskins, Magasan, et al., 2019; Derso, Biks, Tariku, et al., 2017).

Recent facts linking growing children health to breastfeeding revealed that about 43% of early childhood deaths arising majorly from respiratory infections and sudden infant-death were largely attributed to non-compliance of mothers to optimal breastfeeding practices (UNICEF, 2017). Feeding new-borns with colostrum, and breastfeeding infants, at least exclusively for six months safeguard them against deadly early childhood infections that are peculiar to infants and growing children. Across communities in many West African countries and the sub-Saharan region in totality, the predominance of household poverty, poor socioeconomic conditions of many mothers were identified as some of the leading threats that had restrained these women from adhering to optimal breastfeeding (Doherty, *et al.,* 2019; Horii, *et al*., 2017; Mogre, Dery and Gaa, 2016; Tamara, *et al.,* 2015; Ekanem, *et al.,* 2012).

In fact, Rutstein and Rebecca (2014) observed most women in West Africa had a good knowledge of the health implications of optimal breastfeeding, yet a larger proportion of these women were not fully adhering to this recommended breastfeeding practice, majorly due to their poor nutritional status. Evidences from contemporary studies have clearly revealed that young children that were neither exclusively breastfed for a period of six months nor put to breast milk within an hour after birth were more susceptible to chronic and deadly infections than those that were optimally breastfed (Bankole, Solanke and Bisiriyu, 2020; Ahmed and Salih, 2019; Sholaye, Badejo and Jeminusi, 2014; Doherty, Sanders, Jackson, Lombard et al., 2012).

Hence, life-long physical and cognitive impairments that are relatively higher among infants and young children born in the region have been extensively linked to improper and suboptimal breastfeeding practices among women (Grummer-Strawn, Holiday, Jungo, *et al.,* 2019; Victora, Bahl, Barros and França, 2016; Ghwass and Ahmed, 2011). Nearly, 25 million infants and young children in the world were not exclusively breastfed (UNICEF, 2014). Malnourished infants and young children, particularly those that were not exclusively breastfed in their first three months and three weeks of life accounted more for the approximated 2.6 million deaths of infants every year (UNICEF, 2017).

In spite of the severe implications that ensue from non-adherence of mothers to optimal breastfeeding as recommended by UNICEF and World Health Organisation, there is a dearth of studies that have addressed the subject matter beyond the conventional methodological approach. Also, contemporary works on breastfeeding practices in the sub-region of West Africa had limited their study area to a specific nation at a time (Cresswell et al., 2019; Kambale, *et al.,* 2018; Ndirangu *et al.,* 2018; Genetu *et al.,* 2017; Asfaw *et al.,* 2015; Ugboaja *et al.,* 2013). Hence, the study addresses this

gap in literature by employing a multilevel methodological approach to investigating household factors and child physiognomies as predictors of breastfeeding practices among fertile mothers in West Africa. Nigeria, Guinea and Sierra Leone were specifically selected as studied countries because mothers in these countries least adhered optimal breastfeeding as indicated in the recently conducted Demographic Heath Surveys and Multiple Indicator Cluster Surveys

Literature Review

Documented empirical findings from earlier studies revealed that about one million sub-optimally breastfed infants died globally of chronic but preventable early childhood infections as a result of the poor infant and young child feeding in the year ending 2011 (Grummer-Strawn, Holiday, Jungo, et al., 2019; Ahmed and Salih, 2019; Ajibade et al., 2015; UNICEF 2013). Taking a critical look at the patterns of breastfeeding across the various regions in the world in last few decades, it was observed that the attitude and perception of women towards breastfeeding practices in most scenario were significantly influenced by how much understanding these women had on the negative implications of non-adherence to optimal breastfeeding (Doherty et al., 2019; Cresswell et al., 2019; Hashim et al., 2017; Rutstein and Rebecca, 2014).

Contemporary studies have evidently and consistently revealed that adequate, thorough and proper breastfeeding has numerous benefits for both lactating mothers and their new-borns, the non-adherence of most mothers to optimal breastfeeding were clearly explained by way of life, quality of life and socioeconomic factors that most of these mothers were exposed in their various communities (Grummer-Strawn, Holiday, Jungo, et al., 2019; Hashim et al., 2017; WHO, 2017; Fjeld, et al., 2008; Doherty et al., 2012). The implications were more severely expressed in the developing regions. This is obvious, largely due to the high prevalence of poverty in the sub-Saharan African region, as well as sociocultural practices in relation to the act of breastfeeding. Consequently, babies born in the developed regions of the world were relatively exposed to lower life-threatening infections compared to those that were born in the underdeveloped or developing regions of sub-Saharan Africa, Latin America and Southeast Asia (WHO, 2017; Mogre, Dery and Gaa, 2016; Rutstein and Rebecca, 2014).

According to Victora *et al*, (2016), a significant proportion of women in the developed countries were finding it extremely difficult as a result of their tight work schedule to have their babies exclusively breastfed for six months before the introduction of formula-feeding. In line with this assertion, Arora, *et al*. (2017) observed that most mothers in the developed regions of the world were rest assured that their babies would grow healthier

and survive with the availability of adequate healthcare services delivery within their reach. Extracts from empirical studies further showed that while only 3 in every 20 infants were exclusively breastfed for the first six months in the United States, Sweden, Norway, Italy, Finland, Canada and Australia; while just 1 in every 100 young children were exclusively breastfed in the United Kingdom and Belgium. On the average, more than half of babies born in the developed countries were not exclusively breastfed in their first six months of life (Victora *et al,* 2016; PRB, 2018).

Consistently, the patterns of breastfeeding practices across regions of the world were found to differ significantly through race, culture, literacy and wealth status while non-adherence to exclusive breastfeeding was observed to higher be among women of lower socioeconomic status (Bankole, Solanke and Bisiriyu, 2020; UNICEF, 2017; WHO, 2017; Ajibade, Olakunlade, Makinde *et al.,* 2015). In a recent study carried out by Rollins, Bhandari, Hajeebhoy & Horton (2016) on breastfeeding practices across regions of the world, they discovered that about two-thirds of gainfully employed mothers with at least a bachelor's degree in South Asia did not exclusively breastfeed their infants (Rollins *et al,* 2016). Equally, black mothers of 30 years and above in the United Kingdom were found to be twice more likely to exclusively breastfeed their babies compared to younger mothers (Rollins *et al,* 2016).

A varying number of dynamic factors have been identified as the key threats that have been preventing mothers from adhering to exclusive breastfeeding, among which were mothers' socioeconomic characteristics and the extent of knowledge on the importance of exclusive breastfeeding to the survival and healthy growth of their infants (Doherty et al., 2019; Victora et al, 2016; Haroon, Salam, Imdad and Bhutta, 2013). Cresswell et al. (2019) and Salmon (2015), argued that mothers who were determined to exclusively breastfeed their babies would do just that regardless of the shortcomings on their way. Furthermore, studies have revealed that maintained that women were most often faced with challenges arising from cultural precision, traditional fallacies and economic weaknesses in their attempts to have their babies optimally breastfed (Berde and Yelcin, 2016; Ugboaja, Bertrand, Igwegbe, et al, 2013). Therefore, the length at which any mother may go in her willingness to adhere to optimal breastfeeding was perhaps measurable by how much such mother understanding of the health benefits that come with the practice irrespective of her community of residence (WHO, 2017; Meedya, Fahy and Kable, 2010; Haroon et al. 2013).

Studies by Rollins et al (2019) and Doherty, et al. (2019) "on why mothers stop breastfeeding in their first year" buttressed the argument that mothers putting to bed for the first time were often faced with challenges that came with breastfeeding; hence, these mothers in most cases saw the act of

exclusive breastfeeding as one of such practices that were rather harmful to their own health wellbeing. Rollins et al, (2019), Hashim et al. (2017) and Senbanjo et al. (2013) observed this laidback view by mothers as one of the key factors that hindering them from having their babies adequately and optimally breastfed as contained in the Innocenti Declaration (1990) In WHO. (2012). Thus, the absence of appropriate encouragement, neglects by some of the healthcare providers as well as distribution of free formula kits was some of the noticeable factors that have been influencing breastfeeding choices among women across regions of the world negatively (Rollins et al, 2019; Victora et al. 2016; Qureshi et al. 2011).

Retrospectively, in many sub-Saharan African countries, mothers, infants and young children were more vulnerable to protracted and deadly infections than any countries in other region of the world (Horwood, *et al.,* 2018; Fagbamigbe and Idemudia, 2015; Lawoyin and Olawuyi, 2001; Mututho, 2012). The vulnerability of mothers and their babies to protracted infections, cognitive and physiological impairments in many of the countries in sub-Saharan Africa has been largely attributed to mothers' poor nutritional status arising from their inadequate and improper feeding habits (Horwood, *et al.,* 2018; Fatoumata, *et al.,* 2009).

According to Horii et al., (2017), Ekanem, et al. (2012) and Agbo, Dibley, Odiase, et al. (2011) mothers' adherence rate to optimal breastfeeding in the West African sub-region had been poor despite the positive health benefits that have been associated with the recommended breastfeeding practice. The choice of breastfeeding among mothers seemed almost the same across countries in West Africa, with most of these mothers yet to fully adhere to the recommended practice by WHO/UNICEF (Bankole et al., 2020). According to the UNICEF (2016) reports on infant and young children extracted data for the region showed that the compliance rates to exclusive breastfeeding was lowest in Chad and highest in Cape Verde at 0.3% and 59.6% respectively.

The reports further revealed that exclusive breastfeeding was merely practiced by 12.1%, 17.4%, 20.5%, 23.3%, 26.9%, 32% and 33.3% women of reproductive age in Cote D'Ivoire, Nigeria, Guinea, Niger, Mauritania, Sierra Leone and Senegal respectively (UNICEF, 2016). On the contrary, the outcomes of the survey showed that one in every two women approximately breastfed her infant child exclusively in Burkina Faso (50.1%), Ghana (52.3%), Liberia (55.2%), Guinea Bissau (52.5%) over the same period of time (UNICEF, 2016).

Ajibade, Olakunlade, Makinde, et al., (2015), Bankole (2014) and Agbo, Dibley, Odiase, et al., (2011) maintained the major underlying factors that deterred mothers from adhering to exclusive breastfeeding in Nigeria was lack of financial commitment by the government to meet-up with the

healthcare needs of the people, and influence of cultural and traditional norms and values on breastfeeding practices. Bankole et al. (2020), Ekanem, et al. (2012) and Ogunlesi (2010) posited that mothers' non-adherence to exclusive breastfeeding in the country was largely due to the gap in knowledge regards what they and their babies stand to fully benefits from having their babies optimally breastfed.

Bankole, *et al.* (2020) further maintained that the socioeconomic and demographic characteristics of mothers, particularly of the urban working-class mothers had significance influence on the exclusive breastfeeding of their babies in their first-six months of life. Also, the socio-demographic characteristics of mothers were similarly identified by Berde and Yelcin (2016) and Ogunlesi (2010) as the major predictors of timing of breastfeeding initiation and exclusive breastfeeding in a semi-urban settlement of Nigeria. According to Berde and Yelcin (2016), the extent to which breastfeeding mothers willingly submitted to exclusive breastfeeding practices were discouraging.

According to a contemporary study conducted by Kambale, Buliga, Isia, *et al.,* (2018) in eastern Democratic Republic Congo, it was discovered that sociocultural influence played a significantly role in the timing of first breastfeeding initiation among women of reproductive age in Bukavu, South Kivu communities. In a similar study carried out by Ndirangu, Gatimu, Mwinyi*, et al.,* (2018), results showed that the timing of breastfeeding initiation among women in Namibia was also due to their conformity to some sociocultural practices that negated early breastfeeding initiation. In a related study conducted earlier among Hindus in India, Laroia and Sharma (2006), cultural influence, especially religiosity was established as the major predictors of the extent that mothers in the community were willing and ready to adhere to optimal breastfeeding as recommended by Bankole et al. (2020). Also, socio-demographic characteristics of mothers were similarly identified by Berde and Yelcin (2016) and Ogunlesi (2010) as the major predictors of timing of breastfeeding initiation and exclusive breastfeeding in a semi-urban settlement of Nigeria. According to Berde and Yelcin (2016), the extent to which breastfeeding mothers willingly submitted to exclusive breastfeeding practices were discouraging.

The outcomes of a qualitative study with a focus on the promotion of exclusive breastfeeding by Abba, De Koninck and Hamelin, (2010), the refusal of one in every three in mothers in Niamey, Niger, to adhere to exclusive breastfeeding for six months could be attributed to the failure of the country's government to fully implement the UNICEF and WHO recommended breastfeeding practices. The study was in consensus with Ogunlesi (2010) and Abba, De Koninck and Hamelin (2010) who maintained that poor socioeconomic status of mothers and cruel cultural beliefs did not

only hinder mothers from practicing exclusive breastfeeding but also deterred them from feeding their babies with colostrum as recommended.

Rees, Hawkesworth, Moore, Dondeh, and Unger (2016) posited that inaccessibility of women to primary healthcare facilities in Gambia has done worse than could be imagined when related to women's awareness on the reason for the proper and adequate breastfeeding of their infants and young children. It also perceived that delayed in the time of initiation of breastfeeding by most mothers in Gambia were avoidable if these women had had their babies in public health facilities (Rees et al, 2016).

Accordingly, the reviewed literature on the patterns of breastfeeding practices vividly showed that sub-optimal rather than optimal breastfeeding was predominantly practised among mothers in West Africa. Notable identified correlates of non-adherence of mothers to optimal breastfeeding practice among mothers in West Africa were poor nutritional status of mothers, lack of family supports, weak financial commitment to maternal and child healthcare by the government, poor utilisation of healthcare facilities, mother age at birth, household poverty, poor knowledge of mothers on the reasons for optimal breastfeeding of their babies, and ignorance, ranging from their wrong belief that the size of babies at birth should determine how much and long an infant be fed.

Theoretical Focus: *Socio-Ecological Theory*

Mothers' disposition, and the extent to optimal breastfeeding is practiced in a given community is largely predisposed by the influence of socio-ecological factors, prevailing socio-cultural factors, and individual characteristics (UNICEF, 2014). In recent time, attitude or perception of mothers in many West African countries to child and young child nutrition take a nearly similar pattern. Nevertheless, a possible divergent in approach to breastfeeding is imminent. This could be attributed to not just shared attitude to health-related factors but also due to government approach and dire willingness to implementing the recommendations of the WHO and UNICEF on the infant and young child feeding (UNICEF, 2014).

The socioecological theory by McLeroy et al. (1988) is a comprehensive approach to the behavioural deed, which is customarily predisposed by multiple levels of predictors. According to McLeroy et al. (1988) human behaviour is controlled by some multidimensional factors such as environmental and social problems, which have the tendency to change over time. Hence, the socioecological theory underpins the study since it links, and sufficiently clarifies household factors and child physiognomies as a predisposing factor to optimal breastfeeding among fertile mothers in Nigeria, Sierra Leone and Guinea. Congruently, outcomes

of the study are in line with the socio-ecological theory as posited by McLeroy et al (1988).

Methods
Research Design, Data Sources and Sample Size

The study adopted cross-sectional descriptive research design. Secondary data were mined from the Nigeria Demographic and Health Survey (NDHS), the 2013 and the 2012 Guinea Demographic and Health Survey (GDHS) and 2013 Sierra Leone Demographic and Health Survey (SLDHS). The study analysed information from 5,008 (Sierra Leone), 12,180 (Nigeria), and 3,082 (Guinea) fertile mothers of aged 20-49 years who had at least a live birth in the preceding five years before the surveys. Fertile mothers who were currently pregnant, and those who gave birth at least two months preceding the surveys were not included in the study. The study was aimed to investigate the random and fixed effect of household factors and child physiognomies on adherence of fertile mothers to optimal breastfeeding in Nigeria, Sierra Leone and Guinea.

Research Variables

The response variable of the study is adherence to optimal breastfeeding. Optimal breastfeeding was captured by adherence and non-adherence to it. Optimal breastfeeding was measured by the all-inclusive adherence of fertile mothers to six months of exclusive breastfeeding, time of breastfeeding initiation, and duration of breastfeeding before a child was weaned. The indicator of breastfeeding duration of was categorised into "1" if less than 6 months, "2" if greater than 6 months but less than 24 months (the recommended minimum duration of breastfeeding by UNICEF/WHO) and "3" if is equal to or greater than 24 months (the recommended acceptable duration of breastfeeding by UNICEF/WHO). We generated exclusive breastfeeding by collapsing of timing of introduction of pre-lacteal diets immediately a baby was born, and the number of months that a mother fed her child exclusively with breast milk. A fertile mother who exclusively breastfed her infant for 6 months, put her baby to breastmilk (colostrum) within an hour after birth, and breastfed such children within the minimum breastfeeding duration was considered to practice optimal breastfeeding, and it was categorised as "1" or "0"otherwise.

The key explanatory variables for the study are household factors, child physiognomies and community level variables. References were made to evident important features at each level of classifications. The household factors are household headship, marriage type, spouse's level of education and household wealth index. The child physiognomies were birth interval,

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birth type, mode of child delivery, birth size and place of delivery. All community level of the study was generated from selected individual (maternal) level factors, household factors and child physiognomies. The selected community level variables of the study are community poverty level, community level of hospital delivery, community level of antenatal care visit, community type, media saturation in the community and community level of education. Community levels Child physiognomies, and household variables were aggregated at the level of primary sampling unit to create the community-level variables of importance. Our decision to generate the community level variables of importance in the study was based on the practical arguments from literature that breastfeeding is a cultural practice that is community specific and has been established to have homogeneity influence on child bearing matters (Horii et al., 2017; Sika-Bright, 2010). Our choice of all incorporated explanatory variables in the study was steered by reviewed literature and the socio-ecological theory.

Data Analysis

All statistical analyses were carried out using Stata version 14. Multilevel mixed-logistic regression was engaged to investigate the factors (household factors, child physiognomies and community factors) at twofold level to the outcome variable. Thus, two effects were calculated for. The fixed effect, where the "ordinal ratio of binary logistic regression was generated, and "random effect" where the intra-class correlation coefficients (ICC) , and the log-likelihood tests were generated. All indicators of importance in the study were appropriately captured by the Demographic Health Survey datasets used in the study. The justification for the adoption of multilevel analysis was the basic to account for clustering in the sample design. A twofold model is specified as follows:

$$y_{ij} = \beta_0 X_{0ij} + \beta_1 X_{1ij} + U_j X_{0ij} + \xi_{ij}$$

Where

y_{ij} was breastfeeding practice of ith woman in the jth community

β_0, β_1 were the fixed effects; U_j, ξ_{ij} were the random effects

Five models were fitted employing the Stata xtmelogit command (StataCorp 2015). Three models were fitted to generate the fixed-effects, and these comprised Models 1, 2 and 3. On the other hand, two models were also fitted in view to establishing the random effects of the study. These included Models 4 and 5. Model 1 was fitted based on household factors, while child physiognomies and community characteristics were controlled for. Model 2 was fitted based on child physiognomies, while household factors and community level characteristics were controlled for. Model 3 was fitted for community level characteristics, while household factors and child physiognomies were controlled for.

In order to derive for mixed effects logistic regression, a void model was fitted to explain the extent of variation in the outcome variable (optimal breastfeeding), thereby dropping the covariates. Subsequent with the addition of the explanatory variables were then fitted Hence, Models 4 and 5 were fitted. Model 4 was fitted based on household factors and child characteristics, while community level characteristic was controlled for. Model 5 (full model) was fitted on the household factors, child characteristics and community level characteristics. The Variance Inflation Factor (VIF) was also carried out to check the magnitude of multi-collinearity of each of explanatory variables. Variables with VIF > 10 were not included in multivariate models. Our exclusive decision was based on the postulation that variables with VIF > 10 were considered as such with a severe or high level of multi-collinearity (O'brien, 2007; Akinwande, Dikko, & Samson, 2015). Correspondingly, the ICC was derived as follows:

$$\frac{\sigma_{ui}^2}{\sigma_{ui}^2 + [n^2/3]}$$

Where σ_{ui}^2 was the variance at the community level (Merlo *et al.* 2016).

Results

Table 1 presents the results of the respondents according to household factors and child physiognomies. The results showed that that seven in each 10 of the respondents' spouses from Guinea (70.1%) and Sierra Leone (70%) had no formal education while nearly 30% of the respondents' spouses from Nigeria had high school education. The results showed that about two-thirds of the respondents from Nigeria (66.7%) and Sierra Leone (64.2%) were in a monogamous marriage while nearly half (48.7%) of the respondents from Guinea were in a polygamous marriage. Results by household head showed that majority of the respondents from Guinea (86.2%), Nigeria (88.5%) and Sierra Leone (74.9%) were from households headed by men.

Results by child birth interval showed that except for respondents from Guinea (50.6%), less than half of the respondents from Nigeria (38.1%) and Sierra Leone (46%) stayed less than 36 months before giving birth their current child. The results by child sex showed that 1.4% of and 50.3% of mothers from Guinea and Nigeria had the male child in their last birth while less than half of mothers from Sierra Leone (48.2%) gave birth to male birth. Also, results by birth type showed that almost all respondents from Guinea (97.3%), Nigeria (97.8%) and Sierra Leone (97.4%) had no multiple births in during their last child delivery.

Results by place of delivery showed that about three-third of mothers from Nigeria (60.3%) and Guinea (58.6%) had their last birth at home while 56.3% of mothers from Sierra Leone had their babies in health facilities.

Results further showed that at least two in each five of mothers from Guinea (48.3%), Nigeria (43.8%) and Sierra Leone (43.7%) gave birth to babies that were larger than average; while nearly all the mothers from Guinea (97.2%), Nigeria (97.3%) and Sierra Leone (95.9%) had their last birth through vaginal delivery.

Table 2 presents the results of odds ratio for fixed effects in relation to optimal breastfeeding. In Model 1, we fitted in household factors and controlled for child physiognomies and community level factors respectively. In Model 2, we fitted in child physiognomies and controlled for household and community level factors respectively. Our results showed in Guinea showed that fertile mothers whose partners had post-secondary education were 19.8% less likely to practice optimal breastfeeding than those whose spouses had no formal education (OR = 0.80). Results by household wealth showed that fertile mothers from the richer household were 14.1% less likely to practise optimal breastfeeding than those from the poorest household. Results by child sex showed that the likelihood of mothers' adherence to optimal breastfeeding was 14.9% less likely among fertile mothers who had female babies to breastfeed than those with male babies (OR = 0.85). Similarly, fertile mothers who had multiple births were 82.1% less likely to adhere to optimal breastfeeding than those with single births (OR = 0.18).

The odds ratio results in Nigeria showed that fertile mothers from richer households were 36.7% more likely to adhere to optimal breastfeeding than those from the poorest households (OR = 1.37). Results by birth type showed that fertile mothers with multiple births were 54.1% less likely to adhere to optimal breastfeeding than those with single birth in the country (OR = 0.46). Results showed that fertile mothers who delivered their babies in health facilities were 19.3% more likely to practice optimal breastfeeding than those who had theirs at home (OR = 1.19). Our results also showed that birth type and child mode of delivery were significantly associated with optimal breastfeeding among fertile mothers in Nigeria (p<0.05).

In Sierra Leone, fertile mothers in polygamous marriage were 4.7% less likely to practice optimal breastfeeding than those in monogamous marriage (OR = 0.95). Results by household wealth for the country showed that fertile mothers from the richest households were 19.3% more likely to practice optimal breastfeeding than those from the poorest households (OR = 1.19). Similarly, our results showed that fertile mothers from the female headed households were 4.7% more likely to practice optimal breastfeeding than mothers from the male headed households (OR = 1.05). Fertile mothers with multiple births in Sierra Leone were 31% less likely to practise optimal breastfeeding than those who had single birth (OR = 0.69); while fertile mothers who had their babies in health facilities were found to be 3.7% less

likely to adhere to optimal breastfeeding than those who had their babies at home (OR = 0.96). More so, fertile mothers who had their babies through caesarean were found to be 19.3% more likely to adhere to optimal breastfeeding than those who had their babies through vagina delivery (OR = 1.19). Our results further showed that birth interval and household headship significantly influenced fertile mothers' adherence to optimal breastfeeding in Sierra Leone (p<0.05).

Table 3 presents the results of odds ratio for fixed effects in relation to optimal breastfeeding. In Model 3, we fitted in community level factors and controlled for household factors and child physiognomies respectively. Our results showed that in Guinea, rural mothers were 98.7% less likely to adhere to optimal breastfeeding than urban residents fertile mothers (OR = 0.01). Results by community poverty level showed that fertile mothers within the high-class level of poverty were 23.7% less likely to adhere to optimal breastfeeding than those in low poverty class (OR = 0.77). Fertile mothers with high level of education were 15.4% more likely to practice optimal breastfeeding than those with low level of education (OR = 1.15). We also noted that fertile mothers who had visited health facilities for at least four times during pregnancy were 18.4% more likely to adhere to optimal breastfeeding than those who had rarely visited health facilities during the same period (OR = 1.18).

Our odd ratio results showed that in Nigeria, rural fertile mothers were 8.7% less likely to adhere to optimal breastfeeding than those living in urban communities (OR = 0.92). Results by community poverty concentration showed that fertile mothers in high poverty class were 142% more likely to adhere to optimal breastfeeding than those in the low poverty class in the country (OR = 2.14). Similarly, fertile mothers who had fully utilised health facilities during child delivery were found to be 27.3% less likely to adhere to optimal breastfeeding than those who rarely had their babies in health facilities (OR = 0.73). Also, our results showed that fertile mothers who visited health facilities for at least four times during pregnancy in Nigeria were 75.7% more likely to adhere to optimal breastfeeding than those who had visited for more than four times during the same period (OR = 1.76). Our results further showed that adherence to optimal breastfeeding and antenatal care visit were significantly associated among fertile mothers in Nigeria (p<0.05).

In Sierra Leone, we observed that rural fertile mothers were 43.7% more likely to adhere to optimal breastfeeding than fertile mothers living in urban residence. Our results showed that mothers with high level of education were 5.3% less likely to adhere to optimal breastfeeding than those with low level of education (OR = 0.95). Evidence from our study showed fertile mothers who constantly utilised health facilities during child birth

were 43.1% less likely to adhere to optimal breastfeeding than mothers with low-level utilisation of health facilities (OR = 0.57). Our results further showed that there was a significant association between community level of child place of delivery and adherence to optimal breastfeeding among fertile mothers in Sierra Leone (p<0.05). Relatively, we discovered that the adherence of mothers to optimal breastfeeding in Sierra Leone was significantly associated with community level of antenatal care visits and level of mass media exposure (p<0.05).

In Table 4, the values of the log-likelihood tests and ICC outcomes explained the existence of significance association between the explanatory variables, and the response variables, as well as the contribution of the community level characteristics for mothers' adherence to optimal breastfeeding in the studied West African countries. Results of the ICC confirmed two indications. Firstly, it confirmed the existence of rational variation in fertile mothers' adherence to optimal breastfeeding in the absence of the covariates in the three studied countries. Hence, as presented in Table 4, the outcomes in the "empty model" for Guinea, the community level characteristics accounted for 40.4% of the variation in adherence to optimal breastfeeding practice for mothers. Similarly, in the "empty model" for Nigeria and Sierra Leone, the community level characteristics accounted for 20.3% and 21.4% of the variation in the adherence of fertile mothers to optimal breastfeeding respectively. Furthermore, the log-likelihood test with unpredictable values of the chi-square statistic confirmed the goodness of fit for all the fitted models (p<0.05).

The results in Model 4 showed that household factors, and child characteristics at the community level accounted for 40.3%, 22.7% and 20.7% variation in adherence to optimal breastfeeding for fertile mothers in Guinea, Nigeria and Sierra Leone respectively. Also, the log-likelihood test with varying figures of the chi-square statistic established the goodness of fit (p<0.05) of Model 4 in all these three countries. Based on these outcomes, we can conclude that community level household factors, and child characteristics were predictors of fertile mothers' adherence to optimal breastfeeding in Guinea, Nigeria and Sierra Leone respectively.

Similarly, maternal characteristics, at the community level accounted for 36.3%, 20.6% and 18.7% variation in adherence to optimal breastfeeding practice for fertile mothers Guinea, Nigeria and Sierra Leone respectively. Our results further showed that the log-likelihood test with varying figures for the chi-square statistic confirmed the goodness of fit (p<0.05) of Model 5 in all the three studied countries. Based on our findings, we can conclude that maternal characteristics at the community level, and fertile mothers' adherence to optimal breastfeeding in Guinea, Nigeria and Sierra Leone were significantly associated.

Figure 1 presents the results of the adherence of fertile mothers to optimal breastfeeding in the studied countries. Our results showed that only 5.6%, 7.7% and 15.9% of fertile mothers who were living in rural settlements of Guinea, Nigeria and Sierra Leone adhered to optimal breastfeeding as recommended by WHO/UNICEF. Also, we observed that optimal breastfeeding was practiced as little as 4.8%, 10.1% and 9.5% among who were residing in urban settlements of Guinea, Nigeria and Sierra Leone respectively. The totality of fertile mothers who practiced optimal breastfeeding was 5.3%, 8.6% and 14% in Guinea, Nigeria and Sierra Leone respectively. Our results across the three countries showed that optimal breastfeeding was least practiced among fertile mothers in Guinea.

Table 1: Percentage distribution of fertile mothers according to household and child in physiognomies

Variables	Guinea n = 3082	Nigeria n= 12180	Sierra Leone n = 5008
Household Factors	%	%	%
Spouse's education level			
No formal education	70.1	38.9	70.0
Elementary	10.6	18.6	7.9
High School	13.4	29.1	17.3
Tertiary	5.9	13.3	4.9
Marriage type			
Monogamy	51.3	66.7	64.2
Polygamy	48.7	33.3	35.6
Household wealth index			
Poorest	21.0	21.3	21.9
Poorer	20.9	21.4	20.0
Middle	20.6	19.5	20.7
Richer	19.7	18.7	19.8
Richest	17.8	19.2	17.6
Household head			
Male	86.2	88.5	74.9
Female	13.8	11.5	25.1
Child Physiognomies			
Birth interval			
< 24 months	20.4	27.3	24.3
24 – 36 months	28.9	34.7	29.7
> 36 months	50.6	38.1	46.0
Child's sex			
Male	51.4	50.3	48.2

Female	48.6	49.7	51.8
Birth type			
Single birth	97.3	97.8	97.4
Multiple birth	2.7	2.2	2.6
Child's Place of delivery			
Home	58.6	60.4	43.7
Health facilities	41.4	39.6	56.5
Baby's size at birth			
Larger than average/very large	48.3	43.8	43.7
Average	40.1	41.5	38.2
Smaller than average/very small	11.5	14.3	16.0
Not reported	0.1	0.5	2.1
Mode of child delivery			
Vaginal	97.2	97.3	95.9
Caesarean	2.8	2.7	4.1

Source: Author's work 2020 (Data generated from 2012 GDHS, 2013 NDHS and 2013 SLDHS)

Table 2: Binary logistic odds ratio for fixed effects related to optimal breastfeeding practices among fertile mothers

Characteristics	Guinea			Nigeria			Sierra Leone		
	OR	p-value	95% CI	OR	p-value	95% CI	OR	p-value	95% CI
Model 1: Household Factors, controlling for Child Physiognomies and Community Level Factors									
Spouse's education level									
No formal education [ref]	**1.000**			**1.000**			**1.000**		
Primary	0.538	0.148	0.233-1.245	1.080	0.597	0.812-1.436	0.922	0.658	0.642-1.324
Secondary	0.781	0.504	0.377-1.614	1.032	0.830	0.772-1.380	0.909	0.517	0.682-1.212
Post-secondary	0.802	0.687	0.274-2.348	1.035	0.855	0.717-1.494	0.652	0.136	0.371-1.144
Marriage type									
Monogamy [ref]	**1.000**			**1.000**			**1.000**		
Polygamy	0.938	0.771	0.608-1.446	1.060	0.580	0.862-1.303	0.953	0.650	0.774-1.173
Household wealth									
Poorest [ref]	**1.000**			**1.000**			**1.000**		
Poorer	0.862	0.653	0.450-1.649	1.138	0.414	0.834-1.552	0.917	0.558	0.685-1.226
Middle	0.719	0.351	0.360-1.437	1.277	0.173	0.899-1.816	0.888	0.439	0.658-1.199
Richer	0.859	0.677	0.420-	1.367	0.108	0.933-	0.703	0.035*	0.506-

	OR	p	95% CI	OR	p	95% CI	OR	p	95% CI
			1.757			2.001			0.975
Richest	0.632	0.354	0.240-1.666	1.014	0.948	0.658-1.565	0.657	0.053	0.430-1.006
Household head									
Male ref	**1.000**			**1.000**			**1.000**		
Female	0.897	0.772	0.428-1.876	1.124	0.496	0.803-1.571	1.047	0.706	0.824-1.331

Model 2: Child Physiognomies, controlling for Household Factors and Community Level Factors

		OR	p	95% CI	OR	p	95% CI	OR	p	95% CI
Birth interval									
< 24 months ref	**1.000**			**1.000**			**1.000**		
24 – 36 months	1.061	0.885	0.475-2.368	1.295	0.065	0.984-1.705	1.437	0.044*	1.011-2.043
> 36 months	1.167	0.693	0.541-2.516	0.946	0.692	0.717-1.248	1.386	0.061	0.984-1.950
Child's sex									
Male ref	**1.000**			**1.000**			**1.000**		
Female	0.851	0.450	0.560-1.293	0.993	0.942	0.826-1.194	1.019	0.847	0.839-1.238
Birth type									
Single birth ref	**1.000**			**1.000**			**1.000**		
Multiple birth	0.179	0.112	0.021-1.502	0.459	0.029*	0.228-0.922	0.690	0.286	0.349-1.364
Child's place of delivery									
Home ref	**1.000**			**1.000**			**1.000**		
Health facilities	1.384	0.213	0.830-2.306	1.193	0.153	0.937-1.520	0.963	0.747	0.770-1.206
Baby's size at birth									
Very large/larger than average ref	**1.000**			**1.000**			**1.000**		
Average	1.040	0.867	0.659-1.644	1.061	0.565	0.867-1.299	0.925	0.502	0.737-1.161
Very small/smaller than average	0.779	0.508	0.372-1.631	0.794	0.137	0.586-1.076	0.898	0.478	0.666-1.210
Child Mode of delivery									
Vaginal ref				**1.000**			**1.000**		
Caesarean	Omitted due to severe collinearity			0.339	0.016*	0.141-0.816	0.548	0.070	0.286-1.051

Notes: OR = Odd Ratio; ref (reference category); *p<0.05, **p<0.01, ***p<0.001, p>0.05 (not significant).

Table 3: Binary logistic odds ratio for fixed effects related to optimal breastfeeding practices among fertile mothers (Model 3)

Characteristics	Guinea			Nigeria			Sierra Leone		
	OR	p-value	95% CI	OR	p-value	95% CI	OR	p-value	95% CI
Community type									
Urban [ref]	**1.000**			**1.000**			**1.000**		
Rural	0.013	0.764	0.604-2.019	0.913	0.481	0.708-1.176	1.437	0.059	0.987-2.092
Community level of poverty concentration									
Low [ref]	**1.000**			**1.000**			**1.000**		
Medium	0.542	0.153	0.234-1.257	1.469	0.013*	1.083-1.992	1.387	0.086	0.955-2.013
High	0.767	0.669	0.228-2.582	2.142	0.001**	1.389-3.301	1.127	0.683	0.635-2.001
Community level of women education									
Low [ref]	**1.000**			**1.000**			**1.000**		
Medium	1.129	0.785	0.474-2.688	0.950	0.727	0.709-1.270	1.062	0.767	0.714-1.579
High	1.154	0.823	0.328-4.063	0.724	0.120	0.482-1.088	0.947	0.845	0.548-1.638
Community level of child delivered in health facilities									
Low [ref]	**1.000**			**1.000**			**1.000**		
Medium	1.242	0.619	0.529-2.920	0.945	0.729	0.686-1.301	0.516	0.000***	0.374-0.712
High	1.387	0.531	0.499-3.859	0.727	0.102	0.497-1.065	0.569	0.001**	0.407-0.798
Community level of antenatal									

care visit

Low [ref]	**1.000**			**1.000**			**1.000**		
Medium	1.746	0.198	0.745-4.078	1.389	0.053	0.996-1.939	1.776	0.001**	1.254-2.514
High	1.184	0.745	0.426-3.279	1.757	0.006**	1.173-2.633	1.926	0.000***	1.304-2.844
Community level of media saturation									
Low [ref]	**1.000**			**1.000**			**1.000**		
Medium	1.156	0.698	0.556-2.401	0.947	0.705	0.711-1.259	0.688	0.038*	0.483-0.979
High	1.143	0.735	0.527-2.478	1.177	0.282	0.875-1.584	0.690	0.092	0.447-1.063

Notes: OR = Odd Ratio; ref (reference category); *p<0.05, **p<0.01, ***p<0.001, p>0.05 (not significant)

Table 4: Multilevel logistic regression for random effects related to optimal breastfeeding practice for mothers in selected

	Guinea			Nigeria			Sierra Leone		
Parameter	**Empty Model**	**Model 4**	**Model 5**	**Empty Model**	**Model 4**	**Model 5**	**Empty Model**	**Model 4**	**Model 5**
Random Effect									
Community–level variance (SE)	2.234 (.77)	2.217 (.88)	1.876 (.78)	0.836 (.14)	0.967 (.20)	0.853 (.19)	0.897 (.14)	0.861 (.16)	0.756 (.15)
ICC (%)	40.4	40.3	36.3	20.3	22.7	20.6	21.4	20.7	18.7
Log-likelihood	-575.4	-491.3	-484.8	-3398.4	-2825.5	-2813.2	-1958.3	-1546.5	-1534.7
Model Fitness									
Log-likelihood test	55.9***	44.6***	35.7***	150.87***	127.7**	105.5**	157.7**	95.5***	77.9***
AIC	1156.7	1020.6	1023.7	6802.8	5673.0	5690.4	3922.6	3135.1	3133.4

*Note: *p<0.05, **p<0.01, ***p<0.001, p>0.05 (not significant)*

Figure 1: Practice of Optimal Breastfeeding among Fertile Mothers
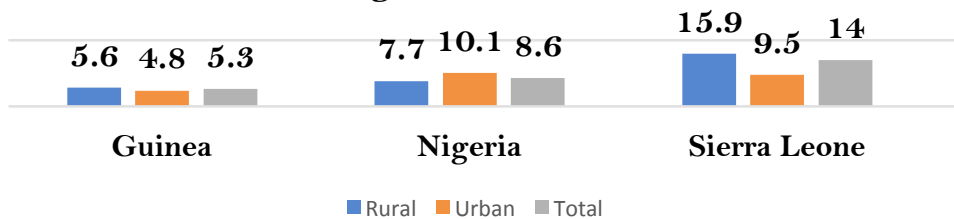
Source: Author's work 2020 (Data generated from 2012 GDHS, 2013 NDHS and 2013 SLDHS)

Discussion

This study extensively investigated the association between household factors, child physiognomies and the adherence of fertile mothers to optimal breastfeeding practice in Guinea, Nigeria and Senegal. Evidence from our unadjusted binary logistic regression showed that household wealth index and birth interval were household predictors of optimal breastfeeding among fertile mothers. These factors were found to have positive and significant influence on optimal breastfeeding among fertile mothers in Sierra Leone ($p<0.05$). Similarly, child physiognomies, such as child mode of delivery, the place of birth delivery were identified as predictors of optimal breastfeeding among mothers in Nigeria ($p<0.05$). On the other hand, our results showed that the probability that fertile mothers will adhere to optimal breastfeeding in Guinea, Nigeria and Sierra Leone were found to significantly associated with household wealth index, birth interval, household head, birth type, baby's size at birth and child mode of delivery.

Also, evidence from our binary logistic odds for fixed effects related to optimal breastfeeding showed that household factors and child physiognomies played a very significant role on the extent to which optimal breastfeeding was adhered to by fertile mothers in all the three countries. Our findings were consistent with Bankole et al., (2020), Mogre, Dery and Gina (2016) who attributed the choice of breastfeeding patterns to the socioeconomic characteristics of mothers in Nigeria and Ghana respectively. Similarly, our findings corroborated Salmon (2015), Qureshi et al. (2011) and Ogunlesi (2010) who maintained that maternal level of education, house factors such as level of education, house wealth index, age at first birth, place of residence and spouse level of education had significance influence on choice of breastfeeding among mothers in many of sub-Saharan Africa countries.

Our results further showed that community level of poverty, community level education of women, access to education, the uptake of healthcare facilities, and child's delivery all had an influence on the adherence of fertile mothers to optimal breastfeeding practice in Guineas, Nigeria and Sierra Leone respectively (p<0.05). Comparatively, the decision to practice optimal breastfeeding or not at the community level was significantly influenced by how many times mothers attended antenatal care in the country (p<0.05). It is evident from the results of the binary logistic ratio fixed effects that the utilisation of healthcare facilities during the antenatal period had a significant influence on the adherence of fertile mothers to optimal breastfeeding in Nigeria and Sierra Leone respectively (p<0.05). Also, the results showed that the likelihood of adherence of mothers to optimal breastfeeding practice in Sierra Leone was found to be strongly associated with the extent of community level of media saturation (p<0.05).

Our findings corroborated Grummer-Strawn et al., (2020), Horwood (2018), WHO (2017), Victora et al., (2016), and Andy (2015) who maintained that the likelihood or tendency that a community of fertile mothers would adhere to proper and breastfeeding practices was dependent on such factors, extending from socioeconomic factors to access to primary and maternal healthcare system. Similarly, our findings were not totally different from Bankole et al., (2020), Kambale et al., (2018), Sika-Bright (2010) and Laroia and Sharma (2006) who posited that societal norms, and values placed on self, could influence the extent to which mothers of reproductive age would adhere to optimal breastfeeding in West Africa.

Equally, our findings corroborated Doherty et al., (2019), Rees et al (2016) and Haroon et al. (2013) who observed that shortage, and inaccessibility to primary healthcare facilities indirectly influenced the choice of breastfeeding practices among mothers of reproductive age. More so, our findings were in agreement with Tampah-Naah and Kumi-Kyereme (2013) who argued that more than a third of mothers in Ghana had not exclusively breastfed their infants for the recommended six months. They however, claimed that there were discrepancies in mothers' non-adherence to exclusive breastfeeding; and these discrepancies were observed through mother's sociocultural, demographic, economic and accessibility to primary healthcare facilities (Tampah-Naah and Kumi-Kyereme, 2013).

Conclusion

It was evident from our findings that optimal breastfeeding was practiced by an insignificant proportion of fertile mothers in Guinea, Nigeria and Sierra Leone. It was also explicit that household factors and child physiognomies at community level had significance influence on breastfeeding practices among fertile mothers in these three countries covered by the study. For instance, the spread of household poverty, low level of maternal education at the community level, shortage and inaccessibility of primary healthcare facilities by nursing mothers, and during birth were responsible for the poor adherence of fertile mothers to optimal breastfeeding.

Although there were variations in the adherence level of fertile mothers to optimal breastfeeding in the three studied countries, the level of non-adherence was lowest among mothers in Guinea. Unless the aforementioned hindrances to optimal breastfeeding are fully addressed, the burdens and implications of sub-optimal breastfeeding are bound to manifest with time. The study concluded that fertile mothers' adherence to optimal breastfeeding is fundamental to reducing vulnerability to life threatening infections, poor physiological development, cognitive impairments and early childhood death to the lowest possible rates among infants and young children in Guinea, Nigeria, Sierra Leone respectively.

Policy Recommendations

Based on our findings, we are suggesting the following recommendations:

i.   Since, the spread of household poverty is predominantly high in many communities, the governments of these countries need to come to the supports of pregnant and nursing mothers. To start with, there should be a form of social welfare packages for these women during these periods. This will enhance their nutritional status, and also that of their infants. Following behind is the need to invest in the empowerment of the young girls and married women of reproductive age. Therefore, the proposed empowerment schemes must be well spelt-out, codified and fully implement across these three countries.

ii.   Also, there is an urgent need for the government of Guinea, Nigeria and Sierra Leone to invest heavily, and prudently in the establishment of more primary healthcare facilities in both rural and urban settlements across countries. The government should also invest in the training of medical health personnel in order to ease the workload on the few available healthcare personnel in these countries.

iii.   In order to address the influence of child physiognomies in relation to optimal breastfeeding, two measures are imperative. One, there is a need to

provide pregnant women and nursing mothers with firsthand information on the future implications of their non-adherence to optimal breastfeeding on their young children. Child's right awareness programme should be relayed in local languages - major stakeholders in the communities should be carried along and engaged in the programmes. Two, mothers who violate child's rights, especially, if such rights relate to infant and young child nutrition should have their babies taken from them and raise in government established foster homes.

iv.   Finally, in order to ease the burdens that come with infant care, especially in the early weeks after child delivery, the governments of Guinea, Nigeria and Sierra Leone should consider extending paternity leave to husbands, at least in the first three weeks after their wives put to bed. Also, maternal leave should be extended to a period of 6 months after child delivery. This extension may encourage exclusive breastfeeding among nursing mothers.

Limitations of the Study

A detailed predictor of optimal breastfeeding practices calls for the availability of intricate and heterogenous variables which are partially available in GDHS, NDHS and SLDHS datasets that were used in our study. Likewise, DHS datasets used did not provide us with adequate sociocultural influences on optimal breastfeeding, through which inferences could be generated for the study population. Moreover, the cross-sectional datasets employed in the study did not well explain the cause-effect association between the outcome and explanatory variables captured in the study. Consequently, significant variation may have occurred in the study outside the existing data. Hence, it is imperative that a further study should employ the mixed-method approach in order to explore cultural norms and values that may influence optimal breastfeeding.

Ethics approval and consent to participate

The custodian of the DHS datasets (MEASURE DHS), authorised access to the data analysed in the study. Analyses of this study are of no threat or imprudence to any individual or organisations since they are in anonymised form. The data analysed are accessible in the public domain.

Availability of data and materials

The dataset supporting the conclusions of this article is available online at https://dhsprogram.com/data/available-datasets.cfm

Acknowledgement

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