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Determinants of perceived quality of health care among pregnant women in Ifo, Ogun State, Nigeria

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Abstract

Nigeria's health system is among the weakest globally, characterized by doctors' and nurses' concentration in a few tertiary facilities in the cities. Simultaneously, rural areas that constitute over 70% of the population suffer from acute health personnel and inadequate health facilities. Whether Nigeria can achieve the Sustainable Development Goal 3 (SDG 3) of access to quality essential health care by 2030 if this situation continues. Therefore, this study provides unique insights on socio-demographic and environmental determinants of quality of health care and treatment choice among women in the Ifo Local Government Area (LGA), a predominantly rural area, in Ogun State, Nigeria. It employed the 2018 cross-sectional survey data collected using a multi-stage sampling technique. A total of 1350 pregnant women aged 20-44 who attended antenatal care during the study period were interviewed. Multicollinearity diagnostics of explanatory variables showed that variance inflation factor, eigenvalues, and the condition index values were within accepted thresholds. Findings showed that the predictors of perceived quality of care were the age of respondents, level of education, type of house lived in, the number of persons in the house, type of toilet facility, primary source of water supply, waste disposal practices, and husband's level of education. Statistically significant predictors of treatment choice included husband's occupation, number of living children, type of house respondent lived in, type of toilet facility, and primary water supply source. These predictors are useful for designing policies and program activities for achieving improved quality of maternal health care at the community level and the attainment of SDG 3 for the country by 2030. *(Afr J Reprod Health 2021; 25[5s]: 27-44).*

Keywords: Perceived health care, health care quality, pregnant women, socioeconomic determinants, environmental determinants

Résumé

Le système de santé nigérian est l'un des plus faibles au monde, caractérisé par la concentration de médecins et d'infirmières dans quelques établissements tertiaires des villes. Simultanément, les zones rurales qui constituent plus de 70 % de la population souffrent d'un personnel de santé aigu et d'installations de santé inadéquates. Si le Nigéria peut atteindre l'Objectif de développement durable 3 (ODD 3) d'accès à des soins de santé essentiels de qualité d'ici 2030 si cette situation persiste. Par conséquent, cette étude fournit des informations uniques sur les déterminants sociodémographiques et environnementaux de la qualité des soins de santé et du choix de traitement chez les femmes de la zone de gouvernement local (LGA) d'Ifo, une zone à prédominance rurale, dans l'État d'Ogun, au Nigéria. Il a utilisé les données de l'enquête transversale de 2018 collectées à l'aide d'une technique d'échantillonnage à plusieurs degrés. Au total, 1350 femmes enceintes âgées de 20 à 44 ans qui ont suivi des soins prénatals au cours de la période d'étude ont été interrogées. Les diagnostics de multicolinéarité des variables explicatives ont montré que le facteur d'inflation de la variance, les valeurs propres et les valeurs de l'indice de condition se situaient dans les seuils acceptés. Les résultats ont montré que les prédicteurs de la qualité perçue des soins étaient l'âge des répondants, le niveau d'éducation, le type de maison habitée, le nombre de personnes dans la maison, le type de toilettes, la principale source d'approvisionnement en eau, les pratiques d'élimination des déchets et niveau d'instruction du mari. Les prédicteurs statistiquement significatifs du choix du traitement comprenaient la profession du mari, le nombre d'enfants vivants, le type de maison dans laquelle le répondant vivait, le type de toilettes et la principale source d'approvisionnement en eau. Ces prédicteurs sont utiles pour concevoir des politiques et des activités de programme visant à améliorer la qualité des soins de santé maternelle au niveau communautaire et à atteindre l'ODD 3 pour le pays d'ici 2030. *(Afr J Reprod Health 2021; 25[5s]: 27-44).*

Mots-clés: Soins de santé perçus, qualité des soins de santé, femmes enceintes, déterminants socioéconomiques, déterminants environnementaux

Introduction

The reduction of maternal mortality has been a significant concern in many developing countries. Every day, approximately 830 women die from preventable causes related to pregnancy and childbirth, while 99% of all maternal deaths occur in developing countries, especially among women in rural areas[1]. Similarly, Amutah-Onukagha *et al.*[2] observed that maternal mortality rates remain high in Nigeria compared to other developing countries[3]. It is essential to address structural and social factors contributing to the country's high maternal mortality rate. In sub-Saharan African countries, the maternal mortality rate (MMR) has declined by 39%, from 870 deaths in 2000 to 533 deaths per 100,000 live births in 2017[1,4]. During pregnancy and childbirth and after delivery, health care services are essential for both the mother and the child's survival and well-being. The perception of the quality of health care and treatment services has a strong bearing on a health facility's choice or its patronage. The development of poor maternal health care seeking behavior stems from multiple influences and exposures in a woman's life[5]. The choice of place of birth, just like that for general health services, is a complex behavioral phenomenon[6]. The utilization of maternal health services, either public or private, is associated with anticipated services and improved maternal and child health outcomes[3]. Muazu and Amriah Buang[7] revealed that tradition-inspired practices and norms play a significant role in maternal health.

Besides, Abdulhamid *et al.*[8] report that pregnant women's positive perceptions of traditional birth attendants (TBAs) were among the main reasons why the majority preferred the services provided by TBAs[9]. Their report further highlighted that low-risk perception regarding their susceptibility to pregnancy and labor complications was one of the main reasons older women with many children delivered at home and utilized TBAs. Joyce *et al.*[10] noted that practices of TBAs continued to be relevant in many societies despite their limitations in handling childbirth complications[9]. Similarly, Wang *et al.*[11] observed that the challenge in utilizing skilled care in many developing countries is rooted in multiple factors, despite that a few deliver their babies with skilled attendants. The World Health Organization[1] reported that the high number of maternal deaths in some areas of the world reflects inequities in access to health services and highlights the gap between the rich and poor. Florence and Dula[12] revealed that mothers, health professionals, and the community value TBAs because they provide accessible and affordable care to mothers who may otherwise have no access to health services.

Perceptions about the quality of health services dramatically influence people's decision to utilize such services[13-15]. When people perceive high quality and satisfaction with health care services, it ensures people use such services. In contrast, the patronage ceases. Perceptions of the quality of health services range from the availability of specific health services, level of care, and treatment received, and equipment amongst others affects utilization. Rizwan ul *et al.*[16] showed that less educated, the poor, and landless mothers utilized the community clinic services more than their educated and wealthier counterparts did. Also, Mavis and Seth[17] show that patients' perceptions regarding the quality of care are instrumental to utilizing health care services. Girmatsion *et al.*[18] stressed in their study that the accessibility to health facilities and perceived quality affect the use of facility delivery. While Admas *et al.*[19] study reported that reduced quality of care is a significant hindrance to its utilization, Gudmund *et al.*[20] showed that satisfaction derived is associated with the perceived quality of health service. Other studies showed different perception levels based on the health seekers' wealth quintiles, with those receiving lower income having limited perceptions than those with high incomes[16]. Factors such as poverty, inequality, education level, poor attitude towards women and their health, and cultural/traditional practices were reported to influence maternal and prenatal care in developing countries [3,21-24]. Babalola *et al.*[25] identified poverty as a significant barrier to human development as it makes standard healthcare excessively expensive. According to Verma, Kasuma, and Babu[26,3], improved utilization and access to health care facilities are often interrelated with distance, socioeconomic conditions, and women's literacy levels. A study in the Southwestern part of Nigeria by Iyun[27] identified maternal and household environment conditions as factors affecting child mortality.

Debebe and Dejene[28] also found that child survival increases with an increase in the mother's educational level, mainly secondary education.

Ebuehi and Akintujoye[29] study revealed a positive perception and use of TBAs services by the respondents as an important issue. Recent studies reveal that pregnant women see local birth attendants as persons with experience and as being part of the community with patience, tolerance, continuous availability, financial reasons, welfare services, accessibility, and without social distance[8,10,30]. Besides, despite all government effort [31] at promoting the Safe Motherhood Programme and ensuring free medical services for pregnant women, they still prefer deliveries conducted by the TBAs because of their positive perceptions about the services they receive from TBAs[32]. A study in Eastern Nigeria showed that although 93% of rural women registered for prenatal care in health facilities, up to 49% delivered at home under the supervision of TBAs[32]. The reasons for women's preference for home and TBA delivery included TBAs' availability, accessibility, inexpensive services, and rural dwellers' faith in the efficacy of their services[15,3335].

In Nigeria, despite modern health facilities' existence, only 39% of live births take place in a health facility, while 57% had at least four antenatal care (ANC) visits in a health facility[23,36]. Therefore, it is not an issue of availability of health facilities or skilled attendants but more of gross perceived quality of service and treatment choice. Nevertheless, understanding the factors affecting the choice of delivery place may control women's predicaments during pregnancy and childbirth[15]. Studies on maternal care services use have not given full attention to the quality of care and related contextual factors as determinants of treatment choice, especially in rural communities. This study was designed to fill this gap through the generation of new empirical data. It aims to ascertain how perceptions about the quality of health care and treatment influence pregnant women's utilization choice in the study area.

Methods

The paper used a cross-sectional hospital-based survey data collected in the Ifo Local Government Area (LGA) of Ogun State in Nigeria. The data collection was done through a multi-stage sampling technique in three levels; the LGA, health facility, and pregnant women registered at ante-natal clinics. In the first stage, one LGA was selected purposively from the 20 LGAs in the state. The criteria selection included whether the LGA was one of the biggest, whether it has one of the highest child mortality, and how close it was to the research team. Ifo LGA was selected because it scored high on the three parameters. The second stage was the systematic selection of 22 health facilities from the 29 existing in the LGA at the survey time. The sample of 22 facilities amounted to 75.9%, which is quite large but included the health facilities' different characteristics, i.e., when they were established, types of services offered, and geographical spread.

The third stage of sampling was on the pregnant women attending antenatal care who had given birth to at least one child in the three years preceding the survey. The patients' list served as the sampling frame from which the pregnant women were clustered according to their clinic days. Everyone who attended the ante-natal clinic on the day the research team visited the facility was taken as a cluster and interviewed.

The fieldwork was implemented between May 1 and July 31, 2018. The research team moved from one health facility to another to elicit information in a face-to-face administration of a structured questionnaire. In all, 1350 pregnant women respondents constituted 6.76% of the total population of 19,964, attending ante-natal clinics at the time of the study. The research instrument was tested and validated by a demographer and health care experts. Also, the Cronbach Alpha index test was conducted, and this yielded 0.75, suggesting that the instrument was reliable. Besides, the data survey instrument was pretested, and questions were modified to perfect its reliability. The device was an adaptation of the 2013 Nigeria Demographic and Health Survey (NDHS) questions on maternal and child health. The study elicited information from respondents on; demographic and socioeconomic characteristics, child mortality, survival characteristics, health-seeking behaviors, types of services at the health facility, and quality of these services. A team of experienced nurses and matrons fluent in English and Yoruba administered the survey questionnaires to the pregnant women at the health facility.

Data Analysis: In this study, the perceived quality of service is conceptualized to be influenced

by demographic, socioeconomic, and environmental factors. As the literature suggests, the perceived quality of health care has several components that, for better insight, should be understood independently[37]. Perceived quality of health is measured as (1) time spent at health facility, (2) availability of a range of services, (3) behavior of health service provider, (4) categories of health personnel who provided services, and (5) privacy and confidentiality at health facility among others. Perceived quality of service was measured in this study using four of these indicators of quality.

The question that captured time spent at the health facility asked: "how long does it take to obtain treatment for your child at the health facility?" To enable the conduct of bivariate analysis, responses to this question were recorded as; 1 = less than 2= 30 minutes, 3 = 31 minutes to 1 hour, and four = more than 1 hour. The variable was recoded into 1 = more than 30 minutes and 2 = 30 minutes or less to enable binary logistics regression. The second quality of health care question asked: "how would you describe the behavior of health workers at your health facility?" And responses for bivariate analysis were recoded as 1 = very cordial, 2 = cordial, 3 = indifferent, 4 = not cordial/not very cordial, and for multivariate analysis it was dichotomized as 1 = indifferent/not cordial, and 2 = cordial/very cordial. The third measure of the dependent variable, perceived quality of health services, was from the question, "how would you describe the services provided at the health facility?" And for the purposes of bivariate analysis, responses were recoded as, 1 = very good, 2 = good, 3 = neutral, and 4 = cordial/very cordial, and for multivariate binary logistics regression, it was dichotomized as 1 = else, and 2 = good/very good. The fourth measure of the independent variable was the type of personnel who attended to the respondents while at the health facility. Personnel type is an important measure of quality because the literature suggests that health personnel training, education, and experience impact the quality of services they provide[38]. This study captures the type of health personnel who provide services by asking: "who do you consult for the treatment of your children?" And responses for the purpose of bivariate analysis were categorized as; 1 = traditional healer, 2 = self-medication/others, and 3 = doctor/nurse, while for binary logistics regression is was recoded as, 1 = else, 2 = doctor/nurse.

Socio-demographic factors influencing perceived quality of health services include age of respondent grouped as 1 = 20-24 =1, 2= 25-30, 3 = 31-40, and 4 = 30 and older, age of respondent at first delivery recoded as 1 = 20 or less, 2= 21-24, 3 = 25-29, and 4 = 30 or older. Other socio-demographic factors includes religion, recoded as 1 = traditional, 2= Islam, and 3 = Christianity; marital status recoded into 1 = else, and 2 = married, and number of co-wife, conceptualized as, husband had another wife and was coded as 1 =yes, and 2 = no. Education another socio-demographic factor was recoded as 1 = none/primary, 2 = secondary, and 3 = post-secondary/professional. Occupation defines work status at the time of survey and was measured as 1 = not working, 2 = self-employed, 3 = civil servant, and 4 = private sector employee; children ever born was a continuous variable recoded as 1 = 1 or 2, 2 = 3 or 4, and 3 = 5 or more; and number of living children which gives the status of current fertility at time of survey was recoded 1 = 1 or 2, 2 = 3 or 4, and 3 = 5 or more. Respondent's spouse's information included in this study were, spouse's education recoded as 1 = none/primary, 2 = secondary, and 3 = post-secondary/professional; and spouse's occupation which defines work status of spouse at the time of study was recoded as 1 = not working, 2 = self-employed, 3 = civil servant, and 4 = private sector employee.

Environmental factors are conceptualized as living conditions influencing the perceived quality of care reported by the respondents. The environmental factors are; type of household respondent lived in, recoded as 1 = mud/grass/hut, 2 = one room, 3 = room and parlor, 4 = two/three bedroom flat, and 5 = detached house/mansion. The number of persons who lived in the respondent's household was presented as a continuous variable. This continuous variable was regrouped as 1 = 1 or 2, 2 = 3-4, 3 = 5-6, and 4 = 7 and above. Type of toilet in respondent's household was measured as, 1 = field/bush, 2 = bucket toilet, 3 = pit latrine, and 4 = flush toilet. The main source of water supply in respondent's household was measured as 1 = river/steam, 2 = covered well, 3 = tanker/truck, 4 = borehole, and 5 = tap. Another important environmental factor is household waste disposal practices, measured as 1 = government collection, 2

= private agency, 3 = disposal within the compound (including burying and burning), and 4 = unauthorized dumpsite.

Data analyses began with the transformation and recoding of variables using SPSS Version 20 software. Furthermore, categorization and recoding were done using standard categories available in the literature, especially those of NDHS relevant measures and classification standards. Bivariate analysis was conducted between the dependent variables and predictors testing for the Chi-square association at .1, .05, .01, and .001 significant levels. Collinearity diagnostics were performed between each of the dependent variables and their predictors using variance proportions (VP, 0.5), variance inflation factors (VIF, > 10), condition index (CI, > 30), eigenvalue (> 1), and tolerance (< 0.1) parameters to establish thresholds (Dormann *et al*.). The most influential socio-demographic and environmental factors were determined for the four perceived quality of health services measures using binary logistics regression.

Results

Associations between quality of care and socio-demographic factors

Statistically significant associations between time taken to obtain treatment for a child and socio-demographic and environmental factors are presented in Table 1. Results show that the socio-demographic factors on time taken to obtain treatment for child was significantly associated with were age of respondent (p-value = .000), religion (p-value = .008), marital status (p-value = .000), and respondent's husband had another wife (p-value = .035), number of living children (p-value = .000), spouse's education (p-value = .047), and occupation (p-value = .058). Environmental factors that time taken to obtain treatment for child was significantly associated with in Table 2 were; type of house that respondent lived (p-value = .030), number of people who lived in the house (p-value = .000), type of toilet facility in the household (p-value = .000), main source of water supply (p-value = .000) and household waste disposal practices (p-value = .000).

Behaviour of health workers at health facility, another quality of health services measure, was significant associated with socio-demographic factors including; religion (p-value = .001), marital status (p-value = .005), husband had another wife (p-value = .003), education of respondents (p-value = .000), respondent's occupation (p-value = .024), number of living children (p-value = .000), and spouse's occupation (p-value = .011). And behaviour of health workers at health facility was significantly associated with the following environmental factors; type of house lived in (p-value = .000), number of persons who lived in house (p-value = type of toilet facility used by household (p-value = .000), main source of water supply (p-value = .000), and household waste disposal practices (p-value = .000).

Table 2 showed that description of services provided at the health facility, another measure of the quality of health services, had a significant association with the majority of socio-demographic factors including; respondent's age (p-value = .033), age delivered first child (p-value = .026), respondent's religion (p-value = .000), marital status (p-value = .064), and respondent's education (p-value = .000). Also, description of services provided at health facility had significant association with others socio-demographic factors including number of living children (p-value = .000), spouse's level of education (p-value = .071), and spouse's occupation (p-value = .005). Environmental factors that were statistically associated with a description of services provided at the health facility were the type of toilet facility used by the household (p-value = .000), the main source of water supply (p-value = .000), and house waste disposal practices (p-value = .000).

Table 2 showed that all socio-demographic and environmental factors had statistically significant association with the forth quality of health services measure, who respondents consulted for treatment at health facility. Who respondent consulted for treatment at health facility was statistically associated with age of respondent (p-value = .004), age at delivery of first child (p-value = .074), religion of respondent (p-value = .000), marital status (p-value = .000), husband had another wife (p-value = .000), and respondent's education (p-value = .000). Other socio-demographic factors that had significant association with the dependent variable who respondent consulted for treatment of children were respondent's occupation (p-value = .003), number

Table 1: Percentage frequency distribution on pregnant women's response on time taken to obtain treatment for the child, and behavior of health workers at a health facility by socio-demographic and environmental factors

Variables	Time taken to obtain treatment for a child					Behaviour of health workers at the health facility				
	Less than 30min (%)	30 mins (%)	31mins to 1 hr. (%)	More than 1 hr (%)	p-value	Very cordial (%)	Cordial (%)	Indifferent (%)	Not cordial-not very cordial (%)	p-value
Socio-Demographic Factors										
Age of respondent										
20-24	25.9	19.2	21.3	15.8		21.2	21.2	20.6	20.3	
25-30	41.8	46.1	34.5	38.6		38.7	45.5	40.0	35.5	
31-40	25.1	27.6	33.7	29.4		29.5	26.3	26.5	33.4	
41 and above	7.2	7.1	10.5	16.2	.000	10.5	6.9	12.9	10.7	.110
Age at delivery of first child										
20 or less	13.0	10.7	12.7	11.7		11.9	11.8	14.1	11.6	
21-24	35.7	39.3	33.5	34.2		35.2	35.6	35.6	37.5	
25-29	37.7	35.1	37.3	37.4		37.8	40.0	30.9	33.3	
30 and above	13.6	14.9	16.5	16.7	.863	15.0	12.7	19.5	17.5	.428
Religion										
traditional	4.1	4.6	7.4	11.8		5.5	4.0	6.5	11.8	
Islam	34.3	34.9	35.1	32.9		35.7	32.0	37.0	34.9	
Christianity	61.6	60.6	57.5	55.3	.008	58.8	64.0	56.5	53.3	.001
Marital status										
single-divorced-separated-widowed	15.6	11.4	14.5	24.1		16.8	10.9	15.5	20.3	
married	84.4	88.6	85.5	75.9	.000	83.2	89.1	84.5	79.7	.005
Husband had another wife										
yes	26.2	20.3	21.8	29.4		23.0	19.0	28.4	30.0	
no	73.8	79.7	78.2	70.6	.035	77.0	81.0	71.6	70.0	.003
Education of respondent										
none-primary	13.5	12.9	18.4	15.4		11.4	12.5	21.9	21.0	
secondary	37.8	39.2	41.6	40.4		37.2	42.0	32.9	43.8	
post sec-professional	48.7	47.8	40.0	44.3	.163	51.4	45.5	45.2	35.2	.000
Respondent occupation										
not working	16.4	11.3	14.1	16.0		19.2	10.1	15.8	12.5	
self-employed	69.5	77.7	72.1	70.9		67.0	77.9	70.0	75.0	
civil-servant	14.1	11.0	13.8	13.1	.453	13.9	12.0	14.2	12.5	.024
Number of living children										
1 or 2	55.0	46.8	46.1	44.3		53.8	47.8	52.3	38.3	
3 or 4	36.6	39.7	33.9	33.3		34.6	38.4	38.1	34.5	
5 or more	8.4	13.4	20.0	22.4	.000	11.6	13.8	9.7	27.2	.000
Spouse education										
none-primary	11.0	9.6	10.5	15.8		11.2	8.0	13.5	15.2	
secondary	42.9	35.7	42.1	39.9		38.3	39.7	35.5	45.9	
post sec-professional	46.1	54.7	47.4	44.3	.047	50.5	52.2	51.0	39.0	.003
Spouse occupation										
not working	11.8	5.7	7.8	8.0		9.6	5.4	11.1	9.1	
self-employed	74.9	77.3	71.9	78.1		74.6	73.5	71.9	80.6	
civil-servant	13.3	17.0	20.3	13.9	.058	15.8	21.1	17.0	10.3	.011
Environmental Factors										
Type of house living in										
mud-grass-hut	4.9	6.8	8.7	10.1		3.9	5.4	5.2	17.2	
one room	25.6	26.8	29.5	31.6		31.1	25.2	24.5	29.7	

room and parlor	36.9	33.2	29.5	32.5		30.9	37.5	31.6	30.0	
two-three bedroom flat	25.6	29.9	28.7	23.2		27.1	29.9	34.8	19.7	
detached house-mansion	6.9	3.3	3.7	2.6	.030	7.0	2.0	3.9	3.4	.000
Number of persons living in the house										
2 or 1	22.2	18.5	18.4	10.1		20.1	16.5	14.2	19.0	
3-4	48.4	60.5	47.9	43.9		47.7	58.7	54.2	42.8	
5-6	23.6	17.2	29.7	39.5		27.6	21.2	25.2	32.1	
7 and above	5.8	3.8	3.9	6.6	.000	4.6	3.6	6.5	6.2	.003
Type of toilet facility used by the household										
field-bush/bucket toilet	5.2	9.6	14.5	11.4		5.9	8.5	7.1	21.0	
pit-latrine	26.5	15.9	23.2	25.4		28.0	17.9	21.3	20.7	
flush toilet	68.3	74.4	62.4	63.2	.000	66.1	73.7	71.6	58.3	.000
Main source of water supply										
river-stream	6.9	7.8	13.4	11.5		9.6	7.8	12.9	11.4	
covered well	2.3	2.0	1.8	2.2		0.9	2.2	2.6	3.5	
tanker-truck	2.9	4.1	11.3	6.6		4.2	2.0	3.9	17.3	
borehole	42.1	37.2	32.1	36.1		37.9	42.9	38.7	24.9	
tap	45.8	48.9	41.3	43.6	.000	47.5	45.1	41.9	42.9	.000
Household waste disposal practices										
govt collection	57.6	59.7	37.6	43.9		51.0	53.6	51.0	43.8	
private agency	27.1	22.8	22.9	24.1		28.2	25.2	22.6	16.9	
disposal within compound (burying or burning)	11.2	12.9	24.2	23.7		16.0	16.7	18.7	20.3	
unauthorized dumpsite	4.0	4.6	15.3	8.3	.000	4.8	4.5	7.7	19.0	.000

of living children (p-value = .000), spouse's educational level (p-value = .000) and occupation (p-value = .017). Environmental factors that were statistically associated with who respondent consulted for treatment of children were; type of house lived in (p-value = .000), number of persons who lived in house (p-value = .000), type of toilet facility used by household (p-value = .000), main source of water supply (p-value = .000), and household disposal practices (p-value = .000).

Explanation of multivariate results

An essential aspect of the multivariate level analysis is collinearity diagnostics of the association between dependent variables and predictors[47]. Appendixes I to IV present results of variance proportions, significant levels, tolerance, variance inflation factors, eigenvalues, and condition index, which are six main collinearity diagnostics tools[47]. Results of the diagnostic tools are used to corroborate each other, i.e., two or more values violating the standard thresholds suggest strong association evidence. Appendix I shows the test results of collinearity among respondent's socio-demographic and environmental predictors. The majority of the 225 variance proportion values in the table (except two) were within the threshold value of .5. None of the other five diagnostic tools corroborated the two variance proportion values. In Appendix II, collinearity diagnostics were conducted among predictors of the dependent variable, health workers' behavior at the health facility. Of the 225 variance proportion values in the table, only four were slightly above the threshold of .5. These were not corroborated by the results of the other five diagnostic tools in the table. Similarly, results of collinearity diagnostics for dependent variables, description of health services provided at health facility presented in Appendix V, and that of health personnel consulted for treatment of a child in Appendix VI were similar to those shown in Tables 3 and IV explained earlier. Table 3 shows four models, each presenting results of the

Table 2: Percentage frequency distribution on pregnant women's description of services provided at the health facility, and who they consult for treatment of children by socio-demographic and environmental factors

Variables	Description of services provided at the health facility					Who consulted for treatment of child			
	Very good (%)	Good (%)	Neutral (%)	Bad/ very bad (%)	p-value	Traditional healer (%)	Self-medication (%)	Doctor/ nurse (%)	p-value
Socio-Demographic Factors									
Age of respondent									
20-24	21.7	22.7	18.8	17.0		24.6	15.6	21.3	
25-30	36.9	45.4	40.3	40.3		34.4	36.7	41.6	
31-40	32.2	23.4	32.2	29.1		29.5	29.3	28.9	
41 and above	9.3	8.5	8.7	13.6	.033	11.5	18.4	8.2	.004
Age at delivery of first child									
20 or less	12.0	14.4	9.9	8.7		14.5	17.4	11.1	
21-24	33.6	37.6	38.0	36.9		35.0	29.2	36.9	
25-29	38.6	36.9	29.6	36.4		29.9	40.3	37.1	
30 and above	15.8	11.0	22.5	17.9	.026	20.5	13.2	15.0	.074
Religion of respondent									
traditional	4.2	5.4	7.4	14.2		16.5	15.8	4.1	
Islam	35.3	34.8	31.8	33.3		38.0	36.3	33.8	
Christianity	60.5	59.8	60.8	52.5	.000	45.5	47.9	62.1	.000
Marital status									
single-divorced-separated-widowed	17.0	11.6	17.4	18.0		21.3	31.3	12.7	
married	83.0	88.4	82.6	82.0	.064	78.7	68.7	87.3	.000
Husband had another wife									
yes	25.0	20.8	24.2	26.2		27.0	40.1	21.2	
no	75.0	79.2	75.8	73.8	.359	73.0	59.9	78.8	.000
Education of respondent									
none-primary	14.2	9.5	18.8	26.2		21.3	28.6	12.5	
secondary	40.2	37.4	47.0	37.9		40.2	45.6	38.9	
post sec-professional	45.6	53.2	34.2	35.9	.000	38.5	25.9	48.7	.000
Respondent occupation									
not working	16.9	13.1	8.7	13.5		22.0	17.9	12.8	
self-employed	70.4	72.9	80.9	73.0		70.0	76.9	72.5	
civil-servant	12.7	14.0	10.4	13.5	.303	8.0	5.1	14.7	.003
Number of living children									
1 or 2	54.2	53.2	34.2	32.0		26.2	42.2	51.6	
3 or 4	34.3	34.3	46.3	38.3		28.7	36.7	37.0	
5 or more	11.5	12.5	19.5	29.6	.000	45.1	21.1	11.4	.000
Spouse education									
none-primary	12.4	9.0	10.7	13.1		18.0	21.8	9.1	
secondary	40.0	38.5	35.6	46.6		42.6	49.0	38.6	
post sec-professional	47.6	52.5	53.7	40.3	.071	39.3	29.3	52.4	.000
Spouse occupation									
not working	9.3	7.6	3.4	10.3		15.1	7.4	7.7	
self-employed	77.0	69.5	83.2	75.8		66.7	83.0	74.9	
civil-servant	13.7	22.9	13.4	13.9	.005	18.3	9.6	17.4	.017
Environmental Factors									
Type of house living in									
mud-grass-hut	6.3	2.6	10.7	18.0		8.2	16.3	6.1	
one room	30.2	23.9	29.5	29.6		33.6	49.7	24.5	
room and palour	33.7	38.5	31.5	20.4		29.5	19.0	35.2	
two-three bedroom flat	24.8	31.2	26.8	26.7		22.1	12.9	29.9	
detached house-mansion	4.9	3.8	1.3	5.3	.000	6.6	2.0	4.3	.000
Number of persons living in the house									
2 or 1	18.7	16.8	14.1	21.4		13.9	12.2	19.2	
3-4	49.3	54.1	58.4	44.2		43.4	54.4	51.4	
5-6	27.3	23.9	22.1	30.6		29.5	30.6	25.2	

7 and above	4.7	5.2	5.4	3.9	.222	13.1	2.7	4.2	.000
Type of toilet facility used by the household									
field-bush/bucket toilet	6.5	7.6	7.4	27.7		27.9	17.7	7.1	
pit-latrine	26.9	19.4	18.8	18.0		20.5	36.1	20.6	
flush toilet	66.6	73.0	73.8	54.4	.000	51.6	46.3	72.3	.000
Main source of water supply									
river-stream	8.9	8.7	12.1	12.6		9.8	22.6	8.0	
covered well	1.8	1.7	2.7	3.4		3.3	4.1	1.7	
tanker-truck	4.2	4.0	4.0	18.0		26.2	10.3	3.4	
borehole	33.6	44.7	40.3	27.2		29.5	29.5	38.7	
tap	51.5	40.9	40.9	38.8	.000	31.1	33.6	48.2	.000
Household waste disposal practices									
govt collection	53.3	45.9	56.4	46.6		33.6	41.5	53.4	
private agency	25.5	28.6	19.5	14.6		16.4	24.5	25.0	
disposal within compound (burying or burning)	15.7	18.2	19.5	19.4		23.8	25.2	15.7	
unauthorized dumpsite	5.4	7.3	4.7	19.4	.00	26.2	8.8	5.9	.000

relationships between four dependent variables and predictors. The links' results were concerning point and interval values tested at four levels (.1, .05, .01, and .001). The confidence intervals presented in the Models show a range of acceptance of the estimated population parameters at a 95% confidence interval. Model 1 offers the results on time taken to obtain treatment for children and the socio-demographic and environmental explanatory factors. The results in the lowest panel of Table 3 suggest that Models 4 is the best fit of the four with the highest Chi-square value (199.03 compared to 98.48, 101.73, and 113.07 for Models 1, 2, and 3, respectively). Model 4 recorded the lowest -2 log-likelihood (711.67 compared to 1027.70, 1012.61, and 889.86 for Models 1,2, and 3 respectively), and it has the most significant proportion of explained variance (31.5% compared to 15.1%, 15.3%, and 17.8% respectively).

Perceived quality of health care I: time taken to obtain treatment for the child

Time spent at a health facility is an important measure of the quality of health care[48]. Furthermore, Model 1 in Table 3 presents odds on the length of time spent by pregnant women at the health facility that they visited. The socio-demographic statistically significant factors explaining the time spent at health facility's time were respondents' age and the number of living children. The odds of spending less than 30 minutes were lower for respondent aged 41 and older compared to those aged 20-24 (OR = .55, [CI = .28, 1.10]), and the odds were also lower for those aged 31-40 compared to the reference category (OR = .61, [CI = .38, .99]). The odds that the women who had five or more living children spent less than 30 minutes at the health facility were lower than the reference category with 1 or 2 children (OR = .53, [CI = .33, .85]).

In Model 1, the environmental factors significantly related to time spent at the health facility were the house type respondent lived-in, the main water supply source, and household waste disposal practices. The odds of spending less than 30 minutes at the health facility were over three times higher for respondents who lived in detached houses/mansions than their counterparts who lived in mud/grass hut (OR = 3.56, [CI = 1.18, 10.74]). The odds of spending less time at the health facility were lower for respondents who had five or six people living in the house than those who had one or two people (OR = .56, [CI = .34, .92]). The odds of spending less time at health facility was higher for respondents whose main source of water supply was tap (OR = 2.03, [CI = 1.24, 3.34]), borehole (OR = 1.62, [CI = .96, 2.72]), and covered well (OR = 2.71, [CI = 1.02, 7.19) compared to their counterparts whose source of water was river/stream. The odds of spending less than 30 minutes at health facility was lower for respondents who disposed waste at unauthorised dumpsite (OR = .38, [CI = .21, .69]), and within their compound (OR = .55, [CI = .36, .84]) compared to their counterparts who used government collection system.

Table 3: Showing the odds of negative perceived quality of health services according to socio-demographic and environmental factors

Variables	Model 1 OR (95 CI)	Sig	Model 2 OR (95 CI)	Sig	Model 3 OR (95 CI)	Sig	Model 4 OR (95 CI)	Sig
Socio-Demographic Factors								
Age of respondent								
20-24	1.00		1.00		1.00		1.00	
25-30	0.9(0.58, 1.39)	.620	1.07(0.69, 1.66)	.751	0.83(0.51, 1.35)	.456	0.72(0.41, 1.27)	.260
31-40	0.61(0.38, 0.99)	.047	0.83(0.51, 1.35)	.455	0.85(0.5, 1.45)	.552	0.71(0.39, 1.31)	.278
41 and above	0.55(0.28, 1.1)	.091	1.28(0.65, 2.54)	.478	0.94(0.45, 1.95)	.862	0.71(0.31, 1.61)	.410
Age or respondent at delivery								
20 or less	1.00		1.00		1.00		1.00	
21-24	1.35(0.81, 2.23)	.251	1.5(0.9, 2.5)	.117	0.83(0.47, 1.49)	.534	1.88(1.03, 3.45)	.041
25-29	0.98(0.58, 1.68)	.946	1.51(0.88, 2.58)	.134	1.01(0.55, 1.86)	.970	1.58(0.84, 2.96)	.156
30 and above	1.72(0.88, 3.35)	.112	1.14(0.59, 2.19)	.705	0.59(0.29, 1.21)	.151	1.52(0.69, 3.35)	.303
Religion of respondent								
traditional	1.00		1.00		1.00		1.00	
Islam	1.09(0.57, 2.08)	.806	0.91(0.48, 1.72)	.768	1.64(0.85, 3.15)	.140	2.43(1.21, 4.91)	.013
Christianity	1.09(0.57, 2.09)	.790	0.86(0.45, 1.62)	.630	1.35(0.71, 2.6)	.364	3.16(1.55, 6.41)	.001
Marital status								
single-divorced-separated-widowed	1.00		1.00		1.00		1.00	
married	1.05(0.67, 1.65)	.818	1(0.64, 1.57)	.989	0.84(0.52, 1.38)	.496	1.97(1.19, 3.26)	.008
Husband had another wife								
yes	1.00		1.00		1.00		1.00	
no	0.95(0.64, 1.4)	.789	1.17(0.79, 1.73)	.423	0.87(0.57, 1.33)	.522	0.83(0.51, 1.35)	.449
Education of respondent								
none-primary	1.00		1.00		1.00		1.00	
secondary	0.88(0.55, 1.4)	.588	1.31(0.83, 2.07)	.255	1.7(1.04, 2.8)	.035	1.06(0.61, 1.83)	.839
post sec-professional	1.09(0.63, 1.91)	.759	1.54(0.89, 2.66)	.126	2.33(1.3, 4.18)	.005	0.85(0.44, 1.65)	.628
Respondent occupation								
not working	1.00		1.00		1.00		1.00	
self-employed	0.83(0.52, 1.33)	.446	0.84(0.52, 1.36)	.477	0.89(0.52, 1.51)	.656	1.58(0.92, 2.72)	.097
civil-servant	0.67(0.35, 1.27)	.220	0.7(0.36, 1.36)	.292	0.93(0.44, 1.96)	.844	2.99(1.18, 7.55)	.021
Number of living children								
1 or 2	1.00		1.00		1.00		1.00	
3 or 4	1.17(0.81, 1.67)	.403	0.9(0.62, 1.3)	.566	0.45(0.3, 0.66)	.000	0.75(0.47, 1.2)	.233
5 or more	0.53(0.33, 0.85)	.008	0.8(0.5, 1.28)	.347	0.34(0.21, 0.55)	.000	0.23(0.13, 0.39)	.000
Spouse education								
none-primary	1.00		1.00		1.00		1.00	
secondary	1.19(0.71, 1.98)	.507	0.9(0.54, 1.49)	.673	0.61(0.34, 1.08)	.087	1.19(0.66, 2.15)	.555
post sec-professional	0.78(0.43, 1.42)	.422	0.94(0.52, 1.69)	.841	0.49(0.26, 0.92)	.028	1.69(0.84, 3.4)	.143
Spouse occupation								
not working	1.00		1.00		1.00		1.00	
self-employed	1.12(0.61, 2.05)	.719	1.36(0.75, 2.45)	.309	0.76(0.38, 1.49)	.422	0.67(0.32, 1.39)	.280
civil-servant	0.73(0.36, 1.48)	.382	1.95(0.95, 3.98)	.068	0.82(0.37, 1.83)	.625	0.9(0.36, 2.24)	.826
Environmental Factors								
Type of house living in								
mud-grass-hut	1.00		1.00		1.00		1.00	
one room	1.3(0.71, 2.38)	.394	3.42(1.9, 6.18)	.000	2.55(1.39, 4.66)	.002	0.77(0.38, 1.54)	.458
room and palour	1.64(0.88, 3.05)	.122	2.98(1.63, 5.45)	.000	2.56(1.37, 4.78)	.003	1.42(0.68, 2.96)	.351
two-three bedroom flat	1.37(0.69, 2.71)	.367	2.7(1.39, 5.24)	.003	1.99(1.01, 3.93)	.048	1.32(0.57, 3.05)	.513
detached house-mansion	3.56(1.18, 10.74)	.024	3.09(1.08, 8.85)	.036	2.27(0.76, 6.76)	.141	1.83(0.46, 7.29)	.394
Number of persons living in the house								
2 or 1	1.00		1.00		1.00		1.00	
3-4	0.92(0.61, 1.41)	.707	0.81(0.52, 1.25)	.335	1.15(0.73, 1.82)	.541	0.49(0.28, 0.88)	.017
5-6	0.56(0.34, 0.92)	.021	0.66(0.4, 1.1)	.113	1.44(0.84, 2.45)	.187	0.49(0.26, 0.95)	.035
7 and above	1.28(0.6, 2.74)	.519	0.77(0.37, 1.63)	.498	2.12(0.93, 4.88)	.075	0.82(0.33, 2.05)	.676
Type of toilet facility for household								

field-bush/bucket toilet	1.00		1.00		1.00		1.00	
pit-latrine	1.1(0.63, 1.92)	.744	1.44(0.83, 2.51)	.193	2.41(1.36, 4.27)	.003	1.45(0.78, 2.69)	.236
flush toilet	1.2(0.71, 2.04)	.500	1.05(0.62, 1.76)	.861	2.09(1.23, 3.56)	.006	2.26(1.23, 4.13)	.008
Main source of water supply								
river-stream	1.00		1.00		1.00		1.00	
covered well	2.71(1.02, 7.19)	.045	1.09(0.41, 2.86)	.865	1.62(0.57, 4.62)	.367	1.5(0.5, 4.47)	.469
tanker-truck	0.68(0.31, 1.48)	.332	0.49(0.23, 1.03)	.061	0.54(0.25, 1.16)	.113	0.33(0.15, 0.72)	.006
borehole	1.62(0.96, 2.72)	.070	1.86(1.1, 3.13)	.021	1.29(0.73, 2.29)	.382	1.18(0.65, 2.13)	.592
tap	2.03(1.24, 3.34)	.005	1.72(1.05, 2.83)	.032	1.7(0.98, 2.94)	.059	2.26(1.27, 4)	.005
Household waste disposal practices								
govt collection	1.00		1.00		1.00		1.00	
private agency	0.79(0.54, 1.14)	.206	0.92(0.63, 1.35)	.662	1.4(0.91, 2.16)	.123	1(0.61, 1.64)	.997
disposal within compound (burying or burning)	0.55(0.36, 0.84)	.005	0.84(0.55, 1.28)	.411	0.99(0.63, 1.56)	.956	0.76(0.45, 1.26)	.287
37tilizing37ed dumpsite	0.38(0.21, 0.69)	.002	0.26(0.15, 0.47)	.000	0.91(0.49, 1.69)	.762	0.35(0.18, 0.69)	.002

Note: Levels of Significance; $p \leq .1$, $p \leq .05$, $p \leq .01$, $p \leq .001$.
Model 1: dependent variable—time taken to obtain treatment for child; Chi-square = 98.478, -2 Log likelihood = 1027.703[a], Nagelkerke R Square = .151
Model 2: dependent variable—behavior of health worker at health facility; Chi-square = 101.731, -2 Log likelihood = 1012.606[a], Nagelkerke R Square = .153
Model 3: dependent variable—description of services provided at health facility; Chi-square = 113.074, -2 Log likelihood = 889.856[a], Nagelkerke R Square = .178
Model 4: dependent variable—who consulted for treatment of children; Chi-square = 199.032, -2 Log likelihood = 711.674[a], Nagelkerke R Square = .315

Perceived quality of health care II: the behavior of health worker at the health facility

Health workers' behavior toward the sampled pregnant women at a health facility is another crucial measure of health care quality examined in this paper (The Health Communication Capacity Collaborative [HCB], 2016). Model 2 in Table 3 presents the odds of health workers' behavior to pregnant women attending an ante-natal clinic at the health facilities during the survey. Only spouses' occupation of all the socio-demographic factors examined was statistically significant in explaining health workers' behavior at health facilities. The odds that health workers were cordial/very cordial was higher for respondents whose husbands were civil servants (OR = 1.95, [CI = .95, 3.98]) compared to those whose husbands were no working.

Model 2 shows that the environmental factors significantly related to health workers' behavior at the health facility were the type of house lived in, the main source of water supply, and household waste disposal practices. The odds that health workers were cordial/very cordial was higher for pregnant women who lived in; detached house/mansion (OR = 3.09, [CI = 1.08, 8.85]), two-three bedroom flat (OR = 2.7, [CI = 1.39, 5.24]), room and parlour (OR = 2.98, [CI = 1.63, 5.45]), and one room (OR = 3.42, [CI = 1.9, 6.18]) compared to their reference category counterparts who lived in mud/grass hut. The odds that health workers were cordial/very cordial was higher for respondents who reported; tap (OR = 1.72, [CI = 1.05, 2.83]) and borehole (OR = 1.86, [CI = 1.1, 3.13]) as the main source of water compared to those whose main source is rivers/streams. The odds that health workers were cordial/very cordial was lower for respondents who get water mainly from tanker/truck (OR = .49, [CI = .23, 1.03]) compared to their counterparts who obtain water from river/steam. The odds that health workers were cordial/very cordial were lower for respondents that disposed waste at unauthorized dumpsite (OR = .26, [CI = .15, .47]).

Perceived quality of health care III: description of services provided at the health facility

A standard vital measure of the quality of services is the kind of information provided at the health facility to enable informed choice[13,14]. Table 3, Model 3, presents the odds on the description of services offered by a health worker to pregnant women who attended an ante-natal clinic at the health facilities. The socio-demographic factors influencing the description of services provided to the respondents at health facilities include education, number of living children, and spouse's

education. The odds of having a good/excellent description of services at the health facility was higher for respondents who had post-secondary/professional education (OR = 2.33, [CI = 1.3, 4.18]), and also higher for those who had secondary education (OR = 1.7, [CI = 1.04, 2.8]) compared to the reference category who had primary/no education. The odds of having good/excellent services description at the health facility was lower for respondents who had five or more children (OR = .34, [CI = .21, .55]). Also, lower for those with three or four living children (OR = .45, [CI = .30, .66]) compared to the reference category with one or two children. The odds of getting a good/excellent description of services at the health facility was lower for respondents whose husbands had post-secondary/professional education (OR = .49, [CI = .26, .92]). Also, the odds of getting a good/excellent description of services is lower for those whose husbands had secondary education (OR = .61, [CI = .34, 1.08]) than the reference category.

Model 3 presents the environmental factors that had significant relationships with the dependent variable description of services offered at the health facility, including the type of house lived in, number of persons that lived in the house, kind of toilet used by household, and main source of household water supply. The odds of getting a good/very good description of services at the health facility was higher for pregnant women who; lived in a two/three bedroom flat (OR = 1.99, [CI = 1.01, 3.93]). It was higher for those who lived in room/parlour (OR = 2.56, [CI = 1.37, 4.78]), and higher for those who lived in one place (OR = 2.55, [CI = 1.39, 4.66]) compared to the reference category who lived in mud/grass hut. The odds of receiving a good/perfect description of services at the health facility was higher for pregnant women who had seven or more persons in the house (OR = 2.12, [CI = .93, 4.88]) compared to the reference category who had one or two persons. The odds of getting a good/excellent description of services at the health facility was higher for respondents who; had a flush toilet in the household (OR = 2.09, [CI = 1.23, 3.56]), and for those who had pit-latrine (OR = 2.41, [CI = 1.36, 4.27]), compared to their counterparts who had field-bush/bucket toilet. The odds of obtaining a good/perfect description of services at the health facility were higher for pregnant women whose primary water supply source was the tap, compared to the reference category whose primary source of water supply was river/steam.

Perceived quality of health care IV: who consulted with on treatment of children

The fourth measure of the quality of services at the health facility examined in this study is whom respondents consulted to treat children at a health facility. Evidence suggests that the caliber of personnel that respondents consulted with at the health facility affects the quality of services they received[39]. Model 4 in Table 3 shows that the odds on whom respondents consulted were dependent on the following socio-demographic factors; the age of respondents at the delivery of the first child, religion, marital status, occupation of the respondent, and the number of living children. The odds that respondents consulted with doctors/nurses were higher for those who had the first child at age 20-24 (OR = 1.88, [CI = 1.03, 3.45]) compared to their contemporaries who gave birth to the first child at age 20 or younger. The odds that respondents consulted with doctors/nurses were higher for Christians (OR = 2.43, [CI = 1.31, 4.91]), and Muslims (OR = 2.43, [CI = 1.21, 4.91]) respondents compared to their counterparts who were traditionalist. The odds that married respondents consulted with a doctor/nurse was higher (OR = 1.97, [CI = 1.19, 3.26]). The odds that respondents consulted with doctors/nurses were higher for those who were civil servants (OR = 2.99, [CI = 1.18, 7.55]), and those who were self-employed (OR = 1.58, [CI = .92, 2.72]) compared to the unemployed reference category. Moreover, the odds that respondents consulted with doctors/nurses were lower for those who had five or more living children (OR = .23, [CI = .13, .39]) compared to those who had one or two living children.

Model 4, Table 3 shows that the environmental factors that affected the caliber of health personnel that respondents consulted with at the health facility included; several persons that lived in the house, type of toilet facility in the household, and the primary source of water supply. The odds that respondents consulted with doctors/nurses were lower for those who had five to six persons in the household (OR = .23, [CI = .13, .39]) compared to their counterparts who had one or two persons in

the house. The odds that respondents consulted with doctors/nurses were higher for those who had a flush toilet at home (OR = 2.26, [CI = 1.23, 4.13]) compared to those who used field-bush/bucket toilet. The odds that the sampled population consulted with doctors/nurses were higher for those whose main source of water supply was tap (OR = 2.26, [CI = 1.27, 4.0]) compared to their counterpart whose main source of water supply was river/stream. The odds that the respondents consulted with doctors/nurses were lower for those whose main source of water supply was tanker/truck (OR = .33, [CI = .15, .72]) compared to their counterpart whose main source of water supply was river/stream. The odds that the respondents consulted with doctors/nurses were lower for those who used unauthorized dumpsite as waste disposal (OR = .35, [CI = .18, .69]) than the reference category who used government collection system.

Discussion

This study examined the socio-demographic and environmental factors affecting the perceived quality of health care in Ifo LGA, a predominantly rural area in Ogun state Nigeria. This type of research and findings are rarely available at the community level in most parts of the country. This information is vital to increase the demand and use of reproductive health services with untoward benefits in reducing infant and child mortality and maternal deaths in the rural area that records most such deaths. The study used hospital-based data collected among 1350 pregnant women who attended 29 antenatal clinics in the LGA at the survey time. Perceived quality of health services measures examined in the study are; (1) time taken to obtain treatment for child, (2) behavior of health worker at health facility, (3) description of health services provided at the health facility, and (4) the caliber of health personnel consulted for treatment of children.

Findings provide useful insights into crucial socio-demographic and environmental factors affecting the perceived quality of health services in the studied population. One significant result of the study is that more environmental than socio-demographic factors influenced the perceived quality of care. The time spent at the health facilities to obtain treatment for sick children was influenced more by environmental than by socio-demographic factors. Whereas only two socio-demographic factors, respondent's age and the number of living children, influenced the time spent to get treatment for respondent's children. While environmental factors that influenced this dependent variable were four, i.e., the number of persons in the household, type of house lived in, water supply source, and waste disposal practices[40,41,49]. These results suggest that programming should consider socio-demographic factors, in conjunction with more attention given to environmental factors to improve the quality of health services provided in rural areas. Thus, increasing pregnant women's health service use than traditional birth attendants use[11,12] partly due to low perceived quality of services at health facilities[7,8,10,48].

Similarly, while among socio-demographic factors, only spousal occupation was significantly related to health workers' behavior at the health facility. Environmental factors that had significant influence were the main source of water supply, waste disposal practices, and type of house lived-in, and source of water supply[42,43,49]. Likewise, more environmental factors than socio-demographic factors influenced the description of services provided by health workers. However, about the same number of socio-demographic and environmental factors changed the caliber of health personnel consulted by pregnant women to treat their children. The results showed considerable significant variation in the influence of socio-demographic and environmental factors on the four measures of perceived quality of care. These need to be factored into policy formulation and programs targeting pregnant women and other women of childbearing age[48] at the grassroots. This variation is likely to contribute to increasing the demand and use of reproductive health services in rural communities in the country. Based on these findings, each measure's impact on the perceived quality of care should be investigated in detail. These kinds of information will be useful in cost-effective program intervention to increase health care quality and overall ante-natal care in rural communities.

To further prioritize intervention for effectiveness, it is essential to note that the water supply source influenced all quality of health care measures. In comparison, waste disposal practices influenced three measures, and other environmental

factors influenced two measures. Thus, the source of water supply for households, followed by waste disposal practices, should be prime indicators of reaching respondents with low perceived quality of care and, by implication, the health facilities that they use. Although this study did not investigate contextual environmental factors influencing health facilities, the same environmental factors that affected study respondents at the individual level may contribute as impediments to quality health services at the contextual or health facility level.

Anecdotal evidence suggests that inadequate health facilities are mostly located in less developed or deprived environments and, by consequence, lead to poor quality of health services. Further research will be needed to model the individual and combine the effects of both individual and contextual factors on health service provision quality. Other contextual factors that may be examined include distance to health facility[44] financial and psychosocial cost of obtaining services[8,10,30], doctor/nurse patience ratio at the community level, and availability and materials, amongst other factors[27,36,45,46].

It is interesting to note that the health care quality measure derived from health personnel had about the same number of socio-demographic and environmental factors influencing it. These results suggest that the measure of health care quality needs to be considered differently from the other three policy formulation and program intervention measures focused on improving the health care quality in the country's rural areas. Perhaps, this leads to the need to improve the perceived quality of health through an increase in the number of doctors and nurses in health facilities in the rural areas, considering the significant socio-demographic and environmental factors of the localities' residents. Perceived quality of health care is crucial information that should guide policy formulations to improve the quality of health services in rural communities towards Nigeria's achieving SDG 3.2 by 2030.

Ethical consideration

In 2018 when this study was done, Covenant University did not have a full-fleshed ethical review committee as it does currently. However, the research protocols were approved by the Covenant University management. The team also wrote a letter and obtained tacit approval from the Chairman of Ifo Local Government Area (LGA) to conduct the study in the selected health facilities in the LGA. The study did not involve any activity that may cause harm or risk to human life. The study team applied standard research ethics, including informed consent, willingness to participate, and anonymity of the respondent who volunteered information.

Conclusion

The relationships between perceived quality of care and socio-demographic and environmental factors were examined in this study. Results showed that environmental factors than socio-demographic factors influenced the perceived quality of health care at the individual level and should be given prominence in policy formulation and program intervention. The environmental factors affecting individual and rural communities may have been neglected, reflecting the quality of available health services. Policy and programs should closely examine this study's results, including significant variations within and between factors, concerning the four dependent variables. These will enable customized design and intervention strategies to improve health care quality and increase its demand and use at the grassroots, where it is essential for children and their mothers' survival.

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Appendixes

Appendix I: Collinearity diagnostics between the time taken to obtain treatment for child and predictors

Variance proportions																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Sig	Tol.	VIF	EV	CI
1	.03	.00	.00	.00	.00	.02	.00	.09	.01	.00	.01	.03	.01	.01	.31	.022	.810	1.235	.255	7.597
2	.08	.04	.00	.00	.00	.00	.00	.17	.00	.00	.00	.01	.00	.00	.49	.485	.832	1.201	.196	8.667
3	.23	.13	.00	.00	.01	.00	.00	.38	.00	.00	.00	.01	.01	.03	.01	.929	.852	1.173	.142	10.191
4	.01	.02	.03	.00	.01	.04	.00	.00	.03	.00	.14	.30	.00	.16	.01	.488	.890	1.124	.110	11.553
5	.01	.03	.00	.01	.00	.09	.00	.26	.06	.00	.00	.33	.01	.12	.04	.463	.768	1.303	.099	12.190
6	.00	.02	.07	.02	.06	.00	.00	.01	.00	.00	.31	.07	.00	.27	.05	.974	.574	1.743	.085	13.129
7	.19	.44	.02	.00	.00	.02	.12	.00	.00	.08	.02	.10	.00	.04	.01	.297	.838	1.193	.073	14.147
8	.34	.21	.00	.01	.00	.06	.10	.00	.08	.04	.07	.01	.00	.16	.01	.026	.902	1.109	.073	14.233
9	.06	.01	.05	.00	.05	.05	.17	.00	.01	.04	.20	.05	.15	.13	.01	.299	.581	1.720	.066	14.911
10	.01	.00	.02	.02	.10	.02	.01	.01	.00	.00	.20	.00	.78	.02	.03	.260	.834	1.198	.050	17.222
11	.00	.04	.61	.09	.21	.03	.05	.00	.06	.00	.03	.00	.01	.00	.00	.083	.742	1.347	.043	18.536
12	.00	.01	.01	.21	.00	.04	.23	.01	.02	.63	.00	.01	.00	.00	.00	.225	.879	1.138	.037	20.028
13	.02	.01	.04	.01	.03	.61	.06	.00	.71	.06	.00	.00	.00	.00	.00	.339	.821	1.219	.035	20.640
14	.02	.00	.02	.44	.51	.00	.23	.00	.01	.07	.00	.02	.00	.00	.00	.007	.914	1.095	.032	21.499
15	.01	.05	.12	.20	.01	.00	.02	.06	.00	.07	.01	.05	.02	.05	.02	.000	.937	1.068	.009	40.653

Note: Adjusted R Square = .057, Std. Error of the Estimate =.48228; sig. = significance, tol. = tolerance, VIF = variance inflation factor, EV = eigenvalue, and CI = condition index; Dependent Variable: time taken to obtain treatment for child; 1 = age of respondent, 2 = age at delivery of first child, 3 = religion of respondent, 4 = marital status, 5 = husband had another wife, 6 = education of respondent, 7 = respondent occupation, 8 = number of living children 9 =spouse education , 10 = spouse occupation 11 = type of house living in , 12 = number of persons living in house, 13 = type of toilet facility used by household, 14 = main source of water supply, 15 = household waste disposal practices

Appendix II: Collinearity diagnostics between the behavior of health worker at a health facility by predictors

Variance proportions																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Sig.	Tol.	VIF	EV	CI
1	.04	.00	.00	.00	.01	.02	.00	.09	.01	.00	.01	.03	.01	.01	.28	.923	.796	1.256	.258	7.543
2	.09	.04	.00	.00	.00	.00	.00	.13	.00	.00	.00	.01	.00	.00	.52	.674	.821	1.218	.199	8.584
3	.21	.12	.00	.00	.00	.00	.00	.46	.00	.00	.00	.01	.01	.02	.01	.716	.849	1.178	.142	10.171
4	.01	.01	.03	.00	.01	.06	.00	.00	.04	.00	.16	.22	.01	.15	.01	.951	.893	1.119	.111	11.488
5	.00	.04	.00	.01	.00	.08	.00	.22	.05	.00	.00	.44	.01	.06	.05	.514	.777	1.288	.099	12.207
6	.00	.01	.07	.02	.06	.01	.00	.00	.01	.00	.32	.05	.01	.31	.03	.205	.588	1.701	.085	13.162
7	.02	.01	.01	.01	.00	.07	.25	.00	.04	.12	.04	.05	.00	.19	.02	.158	.823	1.215	.075	14.037
8	.48	.61	.02	.00	.00	.00	.01	.00	.04	.01	.01	.03	.00	.03	.00	.016	.901	1.110	.073	14.194
9	.08	.02	.04	.00	.04	.06	.13	.01	.01	.03	.25	.08	.13	.15	.00	.726	.597	1.676	.067	14.843
10	.00	.00	.04	.01	.08	.02	.00	.01	.00	.00	.19	.01	.80	.03	.03	.064	.821	1.218	.051	17.047
11	.01	.05	.61	.09	.24	.04	.07	.00	.06	.01	.01	.00	.00	.00	.00	.236	.760	1.315	.042	18.680
12	.00	.01	.00	.28	.04	.00	.22	.00	.01	.60	.00	.01	.00	.00	.00	.504	.878	1.139	.036	20.144
13	.03	.02	.05	.00	.13	.60	.00	.00	.69	.01	.00	.00	.00	.00	.00	.526	.821	1.218	.036	20.244
14	.00	.00	.00	.39	.37	.05	.31	.00	.04	.15	.00	.02	.01	.00	.01	.027	.910	1.099	.032	21.259
15	.02	.04	.12	.19	.01	.00	.02	.06	.00	.06	.01	.05	.02	.05	.03	.000	.939	1.065	.009	40.332

Note: Adjusted R Square = .039, Std. Error of the Estimate = .46424; sig. = significance, tol. = tolerance, VIF = variance inflation factor, EV = eigenvalue, and CI = condition index; dependent variable: behavior of health workers at health facility ; 1 = age of respondent, 2 = age at delivery of first child, 3 = religion of respondent, 4 = marital status, 5 = husband had another wife, 6 = education of respondent, 7 = respondent occupation, 8 = number of living children 9 =spouse education , 10 = spouse occupation 11 = type of house living in , 12 = number of persons living in house, 13 = type of toilet facility used by household, 14 = main source of water supply, 15 = household waste disposal practices

Appendix III: Collinearity diagnostics between the description of health services provided at a health facility by predictors

Variance proportions																Sig	Tol	VIF	EV	CI
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15					
1	.04	.00	.00	.00	.01	.02	.00	.09	.01	.00	.01	.03	.01	.01	.28	.647	.796	1.256	.258	7.543
2	.09	.04	.00	.00	.00	.00	.00	.13	.00	.00	.00	.01	.00	.00	.52	.094	.821	1.218	.199	8.584
3	.21	.12	.00	.00	.00	.00	.00	.46	.00	.00	.00	.01	.01	.02	.01	.803	.849	1.178	.142	10.171
4	.01	.01	.03	.00	.01	.06	.00	.00	.04	.00	.16	.22	.01	.15	.01	.472	.893	1.119	.111	11.488
5	.00	.04	.00	.01	.00	.08	.00	.22	.05	.00	.00	.44	.01	.06	.05	.321	.777	1.288	.099	12.207
6	.00	.01	.07	.02	.06	.01	.00	.00	.01	.00	.32	.05	.01	.31	.03	.008	.588	1.701	.085	13.162
7	.02	.01	.01	.01	.00	.07	.25	.00	.04	.12	.04	.05	.00	.19	.02	.335	.823	1.215	.075	14.037
8	.48	.61	.02	.00	.00	.00	.01	.00	.04	.01	.01	.03	.00	.03	.00	.000	.901	1.110	.073	14.194
9	.08	.02	.04	.00	.04	.06	.13	.01	.01	.03	.25	.08	.13	.15	.00	.013	.597	1.676	.067	14.843
10	.00	.00	.04	.01	.08	.02	.00	.01	.00	.00	.19	.01	.80	.03	.03	.663	.821	1.218	.051	17.047
11	.01	.05	.61	.09	.24	.04	.07	.00	.06	.01	.01	.00	.00	.00	.00	.498	.760	1.315	.042	18.680
12	.00	.01	.00	.28	.04	.00	.22	.00	.01	.60	.00	.01	.00	.00	.00	.035	.878	1.139	.036	20.144
13	.03	.02	.05	.00	.13	.60	.00	.00	.69	.01	.00	.00	.00	.00	.00	.004	.821	1.218	.036	20.244
14	.00	.00	.00	.39	.37	.05	.31	.00	.04	.15	.00	.02	.01	.00	.01	.048	.910	1.099	.032	21.259
15	.02	.04	.12	.19	.01	.00	.02	.06	.00	.06	.01	.05	.02	.05	.03	.939	.939	1.065	.009	40.332

Note: Adjusted R Square = .068, Std. Error of the Estimate =.42540; sig. = significance, tol. = tolerance, VIF = variance inflation factor, EV = eigenvalue, and CI = condition index; dependent variable: description of services provided at health facility; 1 = age of respondent, 2 = age at delivery of first child, 3 = religion of respondent, 4 = marital status, 5 = husband had another wife, 6 = education of respondent, 7 = respondent occupation, 8 = number of living children 9 =spouse education , 10 = spouse occupation 11 = type of house living in , 12 = number of persons living in house, 13 = type of toilet facility used by household, 14 = main source of water supply, 15 = household waste disposal practices

Appendix IV: Collinearity diagnostics between health personnel consulted for treatment of a child by predictors

Variance proportions																Sig	Tol	VIF	EV	CI
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15					
1	.04	.00	.00	.00	.01	.02	.00	.09	.01	.00	.01	.03	.01	.01	.28	.381	.796	1.256	.258	7.543
2	.09	.04	.00	.00	.00	.00	.00	.13	.00	.00	.00	.01	.00	.00	.52	.860	.821	1.218	.199	8.584
3	.21	.12	.00	.00	.00	.00	.00	.46	.00	.00	.00	.01	.01	.02	.01	.008	.849	1.178	.142	10.171
4	.01	.01	.03	.00	.01	.06	.00	.00	.04	.00	.16	.22	.01	.15	.01	.001	.893	1.119	.111	11.488
5	.00	.04	.00	.01	.00	.08	.00	.22	.05	.00	.00	.44	.01	.06	.05	.307	.777	1.288	.099	12.207
6	.00	.01	.07	.02	.06	.01	.00	.00	.01	.00	.32	.05	.01	.31	.03	.505	.588	1.701	.085	13.162
7	.02	.01	.01	.01	.00	.07	.25	.00	.04	.12	.04	.05	.00	.19	.02	.062	.823	1.215	.075	14.037
8	.48	.61	.02	.00	.00	.00	.01	.00	.04	.01	.01	.03	.00	.03	.00	.000	.901	1.110	.073	14.194
9	.08	.02	.04	.00	.04	.06	.13	.01	.01	.03	.25	.08	.13	.15	.00	.197	.597	1.676	.067	14.843
10	.00	.00	.04	.01	.08	.02	.00	.01	.00	.00	.19	.01	.80	.03	.03	.806	.821	1.218	.051	17.047
11	.01	.05	.61	.09	.24	.04	.07	.00	.06	.01	.01	.00	.00	.00	.00	.050	.760	1.315	.042	18.680
12	.00	.01	.00	.28	.04	.00	.22	.00	.01	.60	.00	.01	.00	.00	.00	.376	.878	1.139	.036	20.144
13	.03	.02	.05	.00	.13	.60	.00	.00	.69	.01	.00	.00	.00	.00	.00	.000	.821	1.218	.036	20.244
14	.00	.00	.00	.39	.37	.05	.31	.00	.04	.15	.00	.02	.01	.00	.01	.000	.910	1.099	.032	21.259
15	.02	.04	.12	.19	.01	.00	.02	.06	.00	.06	.01	.05	.02	.05	.03	.001	.939	1.065	.009	40.332

Note: Adjusted R Square = .161, Std. Error of the Estimate = .37792; sig. = significance, tol. = tolerance, VIF = variance inflation factor, and CI = condition index; dependent variable: who consulted for treatment of children; 1 = age of respondent, 2 = age at delivery of first child, 3 = religion of respondent, 4 = marital status, 5 = husband had another wife, 6 = education of respondent, 7 = respondent occupation, 8 = number of living children 9 =spouse education , 10 = spouse occupation 11 = type of house living in , 12 = number of persons living in house, 13 = type of toilet facility used by household, 14 = main source of water supply, 15 = household waste disposal practices