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The attendance, quality, and related factors among women towards antenatal care before and during the COVID-19 pandemic in Monrovia, Liberia

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Abstract **Original Research Article**

Background: The COVID-19 pandemic has significantly impacted healthcare systems worldwide, including the provision of antenatal care. This study investigates the attendance, quality, and factors related to antenatal care among pregnant women in Monrovia, Liberia, both before and during the pandemic. Methods: A hospital-based cross-sectional study was conducted among 600 pregnant women who attended antenatal care (ANC) from October 2019 to February 2021 at John F. Kennedy and the E.L.W.A health facilities. The study used a purposive sampling method and collected data from two periods: 2019.10-2020.02 and 2020.11-2021.03. The study collected 600 valid records and used SPSS 25 for statistical analysis. Results: The results showed that the pre-epidemic group had higher rates of high-quality obstetrics than the post-epidemic group. The proportion of women in the pre-epidemic group who achieved high-quality prenatal examinations was 44.9%, higher than that of the post-epidemic group (15.6%). The proportion of women in the pre-epidemic group who received prenatal examinations in public hospitals was 51.0%, lower than the post-epidemic group (66.3%) and private hospitals had a higher rate of pre-epidemic group (49.0%) than the post-epidemic group (23.7%). The study also found that the number of natal examinations and the factors affecting the quality of ANC before and after the epidemic were different. Therefore, the relevant agencies' antenatal care promotion strategies need to make corresponding adjustments after the epidemic. Conclusion: In conclusion, the study highlights the need for optimizing public health education, allocating medical resources rationally, and avoiding ignoring routine health care for pregnant women due to the excessive tilt of medical resources to epidemic prevention and control.

Keywords: Determinants, Factors, Antenatal care; Perinatal Care; Postnatal care; COVID-19, African women.

1. INTRODUCTION

Antenatal care (ANC) services are an umbrella term used to describe the scientific strategies and care carried out during pregnancy (Gebresilassie et al., 2019). According to the World Health Organization (WHO), ANC services are healthcare services a pregnant mother receives earlier than birth, which involve education, screening, counselling, therapy for minor illnesses, and immunization (Akowuah et al., 2018). ANC provides a contact opportunity for a pregnant woman to join with formal health services that assist in early evaluation of pregnant women for ordinary findings to manage and effectively plan strategies to prevent future complications (Tekelab et al., 2019a). Worldwide, about 303,000 maternal deaths take place due to pregnancy and childbirth-related problems every year, with 99% of them taking place in sub-Saharan Africa and Southern Asia (Ayalew & Nigatu, 2018) (Coxon et al., 2020) (Basha, 2019).

Good antenatal care helps to limit the prevalence of maternal morbidity and mortality by means of providing facts about danger signs, health promotion, delivery preparedness, and care for pregnancy complications (Ayalew & Nigatu, 2018) . Globally, due to the significance of ANC services for both mother and child, using quality antenatal care (ANC) can prevent maternal mortality (Darmstadt et al., 2005). ANC quality is measured by three indicators: (1) timing of care initiation; (2) number of ANC visits; and (3) including all recommended components of care (Hu et al., 2021). Early initiation of ANC is beneficial as it allows for early detection of potential pregnancy and delivery complications (Ambaye et al., 2023) and promotes adherence to ANC regimens (Weldearegawi et al., 2019). The World Health Organization (WHO) recommends that all pregnant women should have at least four assessments by or under the supervision of a skilled attendant (Sarker et al., 2020) . These should, at a minimum, include all the interventions outlined in the new WHO model and ANC visits spaced at regular intervals throughout pregnancy, commencing as early as possible (Luginaah et al., 2016) (Roberton et al., 2020).

Antenatal care is very vital to pregnant women as it helps prevent mother and infant mortality and fosters a suitable relationship between husband and wife and between mom and child (Tekelab et al., 2019b). ANC is very essential in maternal health care services, usually since it focuses on gaining access to pregnant women to help discover abnormal findings for early management (Pell et al., 2013). It also focuses on health care consciousness programmed, which are necessary for the survival and well-being of both the mother and the child (Sahoo et al., 2021). The health care that a mother receives all through pregnancy is very important, due to the fact that it helps predict the results of most pregnancies and the well-being of both the mother and the child (Reichman et al., 2010). ANC services link pregnant mothers and their families with the formal health system and enable future health service attendance (Penman et al., 2023).

A growing emphasis on ending preventable maternal mortality is now an internationally accepted goal because of ANC awareness programmed Improving equitable access to ANC and other maternity health services is relevant to ensuring better maternal child safety (Gamberini et al., 2022). Globally, 536,000 maternal deaths occur annually, of which over 95% take place in sub-Saharan Africa and Asia (Atahigwa et al., 2020). Africa has the highest burden of maternal mortality in the world, with sub-Saharan Africa mostly contributing about 98% of the maternal deaths (Onambele et al., 2022).

Liberia is currently identified among the countries in the world with the highest maternal mortality ratios, with an alarming rate of about 725 deaths per 100,000 live births (Yaya et al., 2019). In Liberia the associated factors that exist between antenatal care attendance, quality and its related factors among women towards antenatal care has not been identified. However, scientific evidence from other research has shown that low utilization of Focus Antenatal Care services is influenced by some factors such as low maternal education, teenage pregnancies, multi-parity, unplanned pregnancies and cultural factor (Banke-Thomas et al., 2017). According to Thomas et al. education of the mother and her partner are the most significant factors that influence the utilization of ANC services (Banke-Thomas et al., 2017). Furthermore, findings from a systematic review conducted by Simkhada and colleagues, reported that women's' and their partners' level of education, exposure to mass media, and marital status are associated with the utilization of antenatal care (Simkhada et al., 2008). Another study reported that antenatal care is influence by a range of factors such as household level or interpersonal level (women's autonomy, husband attitude and support) and health service level (distance, accessibility and availability) (Nketiah-Amponsah et al., 2013) (Simkhada et al., 2008). Some other studies reported that financial barriers play a major role when it comes to perinatal care among women, which is related to low social-economic status (Heaman et al., 2015) . Additionally, findings from past research reported that poverty is one of the most harmful factors that influence women ANC attendance history during pregnancy (Ng et al., 2021).

The COVID-19 pandemic is posing considerable challenges for countries to maintain the provision of high-quality health services essential for mothers and newborns (Alabi et al., 2023). During the COVID-19 pandemic, pregnant women experienced difficulties accessing ANC services due to transport disruptions and being reluctant to come to health facilities due to fear of infection (Tadesse, 2020). A recent study done in the US reported that ANC coverage reductions from 51.9% to 39.3% due to the COVID-19 pandemic would result in about 56,700 maternal deaths if nothing is done to increase the use of ANC services by mothers in most countries (Tadesse, 2020). The indirect outcomes of COVID-19 at the population level as a result of social restrictions, lockdown, and reorganization of health systems have been evident in low ANC attendance by pregnant mothers in most low-resource settings and in even well-resourced countries such as Singapore (Tadesse, 2020).

In low-income countries, the influence of containment and preparedness policies on maternal and newborn health could be more pronounced (Suarez-Rico et al., 2021). Even before the emergence of COVID-19 pandemic, high quality and timely maternal health-care services have been unavailable, inaccessible, or un-affordable for tens of millions of women in resource poor countries (Goyal et al., 2021). Now, restrictions on travel and gatherings, health facilities with limited infection prevention supplies and unreliable infection control practices, and disrupted community health worker routines continue to limit access to ANC which negatively impact women's health (Filip et al., 2022).

To the best of the researcher's knowledge, there is no evidence of a study done on the attendance and related factors among Liberian women towards antenatal care services before and during the COVID-19 pandemic. In order to fill this information gap in the scientific research community and in response to the limited evidence in the country, this study aims to assess the attendance and its related factors among Liberian women towards antenatal care before and during the COVID-19 pandemic in Monrovia. Therefore, the result of this study might be beneficial in designing strategies for prioritizing maternal healthcare, even with the COVID-19 pandemic.

2. MATERIALS AND METHODS

2.1 Study Design and Period

A hospital-based cross-sectional study was conducted among pregnant or postpartum women who attended ANC and gave birth in the selected health facilities from October 2019 to March 2021. Because this study aimed at evaluating the magnitude of antenatal care attendance and its related factors among Liberia women before and during the COVID-19 pandemic in Liberia, a cross-sectional study design was appropriate, as the design enables data to be collected on individual characteristics at the time of the study alongside information about the outcome and differences between the two groups.

2.2 Study Setting

The study was conducted at two health facilities (John F. Kennedy and Eternal Love Winning Africa) found in the northern portion of the Liberian coast, which is from the Sinkor Belt and the Paynesville Special Belt. The facilities are found in districts 11 and 6, respectively, in the capital city of Liberia. John F. Kennedy Memorial Medical Hospital/Liberia Japanese Friendship Hospital, a national referral hospital, has an outpatient department (OPD), an inpatient department, and an OB-GYN (obstetrics-gynecology) unit. E.L.W.A. hospital is 3 miles away from the Atlantic Ocean, and there is a total of 12 wards, of which 3 inpatient wards and outpatient department units (3, 8, 10, and 11)—maternity ward, antenatal ward, female ward, and OPD unit—were selected by using the lottery method. The healthcare centers were selected because they are the largest and busiest healthcare facilities in Monrovia and the leading provider of primary healthcare within the country.

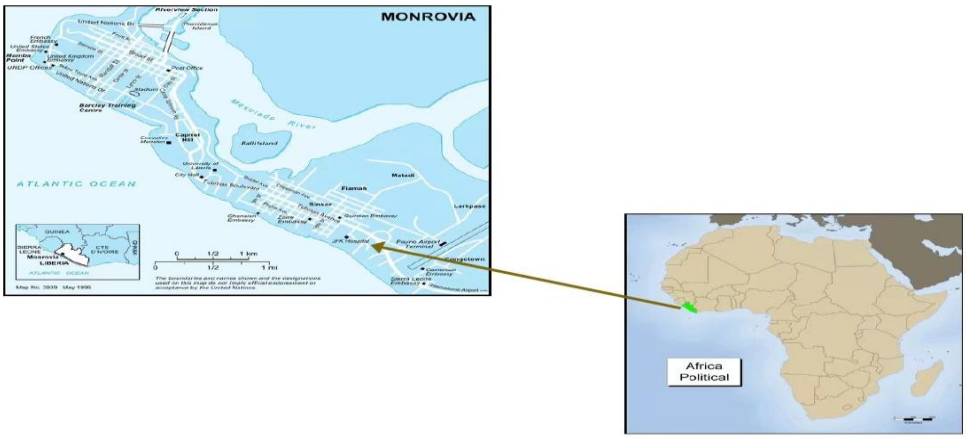

Fig. 1. Geographical setting of JFK and ELWA hospitals in Liberia

2.3 Target Population

Women attending the J.F.K. medical hospital or the E.L.W.A. hospital for either a routine or ultrasound appointment as part of their ANC were considered for participation if they met the following selection criteria:

2.3.1 Inclusion

Group A: Between October 2019 and February 2020, all women who gave birth at the two selected hospitals and had records of delivery.

Group B: All women attending antenatal checkups at these two hospitals during the COVID-19 pandemic (the delivery will take place between November 2020 and March 2021).

2.3.2 Exclusion criteria

Pregnant women with an ongoing severe maternal complication

Pregnant women with physical disabilities such as deafness and dumbness

2.4 Sampling Method

A total of two hospitals were selected by purposeful sampling techniques in Monrovia, Liberia. According to the 2019 Liberia Demographic Health Survey report (LDHS 2019), 18,546 women were admitted to the department of outpatients, 6,873 deliveries, 2,992 obstetric gynecology, and 7,756 antenatal care services were provided based on the two-participating health from October 2018 to November 2020. At ELWA hospital, there are a total of 12 wards, of which 3 in-patient wards and the OPD unit (3, 8, 10, and 11)—maternity ward, antenatal ward, female ward, and OPD unit—were selected by using the lottery method. John F. Kennedy Medical Hospital/Liberia Japanese Friendship Hospital has four outpatient departments, ten inpatient departments, 13 maternity wards, and 17 antenatal wards.

2.5 Sample Size Determination

To determine the sample size for this cross-sectional study design, assume the acceptable approximation of the

population is taken by 95% (CI of 95%); a difference of no more than 5% from the actual figure in the source population was taken. For this descriptive study the suitable formula for calculating the sample size is by the Chi-square test for Parallel Design, $\boldsymbol{n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 [p_1(1-p_1) + p_2(1-p_2]}{\delta^2}}$ where n is the sample size, **Z** is the z-score (1.96) on normal standard variable curve corresponding to 95% confidence interval level, α is the desired level of precision (in this case 5%), P_1 is the rate of the estimated average for antenatal care awareness before the course of COVID 19 pandemic, at P_1= 0.2020 (Yaya et al., 2019) and P_2 is the rate of the estimated average for antenatal care awareness during the COVID-19 pandemic; P_2=0.101; δ= superiority margin

Z = Z-score (1.96)

α = is the desired level of precision (in this case 5% is 0.05)

$\mathbf{P_1}$ = 0.202

$\mathbf{P_2}$ = 0.101

δ= superiority margin= (P_1- P_2)

$\mathbf{Z_{1-\alpha/2}}$ **= 1.96**

$\boldsymbol{Z_{1-\beta}}$**= 1.28**

n = $\frac{(1.96 + 1.28)^2 [0.202(1-0.202) + 0.101(1-0.101)}{(0.202 - 0.101)^2}$

n= $\frac{10.49 [0.161 + 0.0907]}{0.0102}$

n = 259

In a situation where the questionnaire is not filled out completely, it is recommended to add 10% to the calculated sample in order to compensate for the lost data.

10% non-response rate = 25.9

Total sample size = 259+ 25.9 = 285

N = 2n = 570; hence, a total sample of 600 women was used.

2.6 Data Collection Procedure

Research permit was obtained from the two participating health facilities prior to data collection process. Based on the positive responses from each of the participating health institutions, the researchers collected data relevant to the study using hospital medical records and questionnaire at each of the health facilities. From the two hospitals, antenatal care records of 1,316 participant's births records were obtained from October 2019 to February 2020. Contacts of the 1,316 women were listed and contacted via telephone calls for participation in the study based on the inclusion criteria. Of the 1,316 women, only 717 women were reachable through telephone calls, while 599 women phone numbers were unreachable at the time of the data collection process. 189 women who accepted the call declined to participate due to non-interest in participation in the study, while 216 women also refused to participate due to schedules with work and family activities. Finally, a total of 312 postpartum women meets the requirements and willingness to participate in the study before the COVID-19 pandemic.

Moreover, during the COVID-19 pandemic, a face-to-face interview was conducted for data collection process, which took about 15 to 20 minutes to complete the interview from each respondent. 404 women attending antenatal care services at both facilities were obtained at the facilities during their antenatal routine checkups at the maternity wards; out of the 404 women, 116 pregnant women refused to participate in the study due to reasons such as: ''I have work to do at home''; ''I am not interested''. Finally, 288 women attending antenatal checkups at these two hospitals during the COVID- 19 pandemic from September 2020 to March 2021 fulfill the eligibility criteria and were willing to participate in the study. Accordingly, a total of 600 pregnant and postpartum women who fulfilled the inclusion criteria before and during the pandemic were eligible for participation in this study.

2.7 Research Instruments

This study used hospital medical records to obtain participants before the COVID-19 pandemic, and a well-structured questionnaire comprising both closed and open-ended questions was used for the collection of data relevant to the study.

The questionnaire for participating mothers was divided into three portions designed to assess the socio-demographic data, timing and frequency of ANC attendance, and factors associated with ANC services before and during the pandemic.

Sociodemographic variables for participating mothers used included: year of birth, place of delivery, marital status, occupation, education (categorized into never-been to school, primary, secondary, and college/university), ethnicity, religion, residence, and monthly income.

Section B of the questionnaire contained details of information pertaining to media exposure. Furthermore a 5- point Likert's scale ranging from 1(one) to 5 (five) was used in measuring women worriedness during the COVID-19 pandemic. Antenatal care attendance in the present study refers to the number of visits that was made by pregnant or postpartum women before or during the COVID-19 pandemic. The number of visits was categorized as inadequate or adequate based on recommended World Health Organization antenatal care visits. Therefore, inadequate antenatal care is referred to less than 4 visits during the entire pregnancy, while adequate ANC referred to more than 4 antenatal care visits. Some of the related factors included parity, gravidity accessibility to health facility, transportation and payment of antennal care service during Visits to health facility.

2.8 Quality Control

To ensure data quality, two days of training were given to researchers on the research instrument procedure for data collection, including their responsibility for informed consent and the completeness of interviewing each respondent. A total of 11 Bachelor of Science degree nurses, 7 public health officer supervisors, 2 physicians, and 4 medical doctors were recruited in the data collection process.

2.9 Data Handling

Data were checked for completeness and validity of information by the researchers once questionnaires were obtained from participants. This was done to check for missing data and correct mistakes to avoid deviations and errors in the collected data. The researcher serially numbered the corrected data sheets. The checked questionnaires were kept by the researcher ready for data processing and analysis.

2.10 Ethical Consideration

An official letter was obtained from the National Public Health Institute of Liberia, which in turn wrote a letter to each health facility seeking permission for data collection. A letter of introduction was also obtained from the Ministry of Health and Social Welfare, Republic of Liberia, and was presented to the Assistant Medical Director of the John F. Kennedy Hospital and the Medical Director of the Eternal Love Winning Africa Hospital, seeking permission for research to be conducted. Research permits were finally obtained from participating health facilities prior to data collection. The purposes of the study were explained to the study participants; verbal consent was also obtained from each of them, as were various ethical principles such as voluntary consent, privacy, and withdrawal. Confidentiality of the responses was ensured throughout the research process.

2.11 Statistical Analysis

This study uses SPSS 25 for statistics. The main statistical methods are multivariate logistic regression and backward stepwise regression. This study performed regression analysis on three sets of data: pre-epidemic maternal data, post-epidemic maternal data, and two combined data sets. The dependent variable is the number of birth check-ups or the quality of the check-up, and the independent variable is the demographic characteristic variable and the check-up-related variables.

3. RESULTS

3.1 Socio-demographic characteristics of study participants before and during the COVID-19 pandemic

A total of 312 women participated in the study before (Group A) the COVID-19 pandemic, while 288 participated during (Group B) the period, accounting for a total of 600 reproductive-age women in the study. The age range was 16 to 43, with a mean age of 27.06±6.48 for participants before the pandemic and 28.07±5.29 for participants during the pandemic. Additionally, the mean number of children was 1.59±0.640 and 1.97±0.918, respectively. The majority (59.9%) of the women delivered in hospitals, compared to 23.7% of those who delivered in clinics during the pandemic. However, more women delivered at clinics (49.0%) during the pandemic compared to before the COVID-19 emergence. Most of the participants, 273 (87.5%), were literate (had formal education), which applies to the other badge of women, 248 (86.1%). Furthermore, 230 (73.7%) of the women were single, and only 24.7% (77) were married in the cohort before the pandemic. Equally, the majority of the participants in the second group were single (67.7%). Regarding family income, 44.4% (151) of the women are from families with income ranging from 500 L$ to 1,005 Liberian Dollars (L$), followed by an income range of 1005-2,605 L$ (24.7%). Similarly, many of the participants in the second group felt within the 500–1,004 L$ range, 124 (43.1%). The majority, 177 (56.7%), are from the rural part of the country in the first group, compared to 131 (45.5%) in the second group. Most of the participants covered their own medical expenses in groups one and two (72.4% and 53.8%, respectively). Regarding complications during childbirth, more pregnancy complications were reported 85 (27.2%) before the pandemic compared to 41 (14.2%) during the pandemic.

Table 1: Sociodemographic Comparison of Participants Before and During the COVID-19 Pandemic with a Test of P Value

Variables	**Group A n (%)**	**Group B n (%)**	χ^2	***P* Value**
Age			11.190	.040
16-25	132 (42.3)	92 (31.9)		
26-35	145 (46.5)	173 (60.1)		
36-45	35 (11.2)	23 (8.0)		
Educational status			55.457	.000
No formal education	39(12.5)	40(13.9)		
Primary Education	104(33.3)	79(27.4)		
Secondary education	38(12.2)	104(36.1)		
College/University	131(42.0)	65(22.6)		
Occupation status			21.347	.000
Unemployed	141(45.2)	179(62.2)		
Employed	89(28.5)	43(14.9)		
Government worker	82(26.3)	66(22.9)		
Family income (Liberian $)			15.4781	.000
500 L$-1,004 L$	46(14.7)	124(43.1)		
1,005 L$-2,604 L$	38(12.2)	74(25.6)		

2,605 L$-5,004 L$	151(48.4)	18(6.25)		
5,005 L$ & above	77(24.7)	72(25.0)		
Medical Expenses			22.426	.000
Own Expenses	226(72.4)	155(53.8)		
Medical insurance	19(6.1)	28(9.7)		
Public expenses	67(21.5)	105(36.5)		
Place of Delivery			2.286	.131
Hospital	125(40.1)	155(53.8)		
Clinic	187(59.9)	133(46.2)		
Marital Status			123.634	.000
Single	230(73.7)	82(28.5)		
Married	77(24.7)	195(67.7)		
Divorced	3(1.0)	9(3.1)		
Widowed	2(0.6)	2(0.7)		
Residence			.298	.585
Rural	135(43.3)	131(45.5)		
Urban	177(56.7)	157(54.5)		
Religion			139.821	.000
Christianity	233(74.7)	212(73.6)		
Muslim	79(25.3)	76(26.4)		
Partner's occupation			424.709	.000
No partner	3(0.97)	205(71.2)		
Unemployed	25(8.0)	28(9.7)		
Self-employed	11(3.5)	34(11.8)		
Employed	235(75.3)	21(7.3)		
Government worker	38(12.2)	0(0.0)		
Partner's education			452.082	.000
No partner	3(0.96)	207(71.9)		
No formal education	26(8.3)	3(1.0)		
Primary	26(8.3)	36(12.5)		
Secondary	22(7.1)	40(13.9)		
College/University	235(75.3)	2(0.7)		
Pregnancy Comp.			207.510	.000
No	227(72.8)	247(85.8)		
Yes	85(27.2)	41(14.2)		

Note: Figures in brackets are in percentages. Pearson Chi-Square test $(\chi)^2$ Group A = Before COVID 19, Group B = During COVID 19

3.2 Media exposure among participants before and during the COVID-19 pandemic

With regards to media exposure among participants, many watched televisions (1.68±1.07), followed by radio listening and cinema/theatre (1.54±1.05), respectively. The least utilized media outlet was newspapers and magazines, 1.36±1.08 [**Table 2**].

Table 2: Media exposure among participants in Group A, n (%)

Questions	Not at all	Less than once a week	At least once a week	Almost everyday	Mean (SD)
Read newspaper	84(26.9)	92(29.5)	76(24.4)	60(19.2)	1.36(1.08)
Listen to radio	61(19.6)	96(30.8)	82(26.3)	73(23.4)	1.54(1.05)
Watch television	49(15.7)	97(31.1)	72(23.1)	94(30.1)	1.68(1.07)
Go cinema/ theatre	51(16.3)	117(37.5)	69(22.1)	75(24.0)	1.54(1.03)

Note: The figures in the bracket are percentages; SD = standard deviation; Group A = before COVID 19.

However, during the COVID-19 pandemic, most of the participants read newspapers (1.64±1.16) compared to television in the first group (before the COVID-19 pandemic). The least utilized media was cinema/theatre (1.11±1.23), which is due to the contrast among participants before COVID 19 [**Table 3**].

Table 3: Media exposure among participants in Group B (%)

Questions	Not at all	Almost everyday	At least once a week	< Once in a week	Mean (SD)
Read Newspaper	67(23.3)	63(21.9)	64(22.2)	94(32.6)	1.64(1.16)
Listen to Radio	73(25.3)	97(33.7)	40(13.9)	78(27.1)	1.43(1.14)
Watch television	74(25.7)	38(13.2)	105(36.5)	71(24.7)	1.60(1.12)
Go cinema/ theatre	136(47.2)	51(17.7)	34(11.8)	67(23.3)	1.11(1.23)

Note: figures in brackets are percentages and SD =standard deviation; Group B = during COVID 19.

3.3 Timing and Frequency of Antenatal Care Clinic Attendance

All the participants in the study registered their pregnancy, attended ANC services, and received ANC health check-ups at least once before and during COVID-19 (100%). Also, many (44.2%) of the participants before COVID-19 had at least more than 6 visits, followed by 4-6 visits by ANC (26.6%) during the period of October 2019 to February 2020. However, fewer women made six ANC visits (11.8%) during the COVID-19 pandemic. Many of the respondents, 184 (59%), were in their first trimester at the time of booking among women before COVID-19; moreover, women during the COVID-19 pandemic booked in their second trimester, 157 (54.5%). The delay in seeking antenatal care was mainly due to monetary issues. 122 (39.1%) among women before COVID-19, while among participants during COVID-19, personal business or issues were the main reason for the delay, 107 (37.2%). Most of the participants before COVID-19 had their last ANC visit during the third trimester, 178 (57.1%), while participants during COVID-19, 197 (68.4%), also had their last ANC visit during their third trimester. Also, many of the women indicated that the reason for their first ANC visit was because of family advice: 135 (43.3%) and 119 (41.3%), respectively. Furthermore, reasons for attending ANC were for check-ups, with both groups accounting for 181 (58%) and 211 (73.3%), respectively. More than half of the women received ANC services from governmental hospitals, 159 (51%), while among participants during COVID-19, 191 (66.3%) received services from private hospitals or clinics, and most of the women were examined by nurses or midwives, 172 (55.1%) and 167 (58%), respectively [**Table 4].**

Table 1 : Timing and frequency of ANC attendance before and during the COVID-19 pandemic

Variables	Group A n (%)	Group B, n (%)
Number of ANC visits		
1-2 visits	47(15.1)	132(45.8)
3-4 visits	44(14.1)	84(29.2)
5-6 visits	83(26.6)	38(13.2)
Above 6 visits	138(44.2)	34(11.8)
When did you begin ANC care		
First trimester	184(59.0)	114(39.6)
Second trimester	128(41.0)	157(54.5)
Third trimester	0(0.0)	17(5.9)
Reason for ANC delay		
Money issues	122(39.1)	98(34.0)
Personal issues	95(30.4)	83(28.8)
Busy schedule	95(30.4)	107(37.2)
Last ANC visit		
First trimester	20(6.4)	8(2.8)
Second trimester	114(36.5)	83(28.8)
Third trimester	178(57.1)	197(68.4)
Reason for first ANC visit		
Wellbeing of mother & child	110(35.3)	84(29.2)
Personal decision	67(21.5)	85(29.5)
Family Advice	135(43.3)	119(41.3)
Reason for attending		
Because of problem	100(32.1)	25(8.7)
Just for checkup	181(58.0)	211(73.3)
Cannot remember	31(9.9)	52(18.1)
Where did you receive ANC?		
Government hospital	159(51.0)	97(33.7)

Private hospital	153(49.0)	191(66.3)
ANC examination done by whom?		
Doctor	140(44.9)	105(36.5)
Nurse/Midwife	172(55.1)	167(58.0)
Non-skilled	0(0.0)	16(5.6)

Note: The figures in the brackets are in percentages (%). Group A = Before COVID-19, Group B = During COVID-19

3.4 Accessibility to health facilities among participants before and during the COVID-19 pandemic

Antenatal care utilization can be hampered by numerous factors, including accessibility, especially in Africa, where the road network is poor. In this current study, 128 (41%) of the women who participated in the first cohort indicated that they live very far from health facilities. This is similar to the second cohort, with 64.2% of respondents indicating very far the means of transportation to the health facilities were mainly by vehicle for the first and second groups, 202 (64.7%) and 251 (87.2%), respectively. Many of those who used vehicles indicated waiting for less than half an hour for transport to arrive. However, of those who used foot (35.3%) as a means of transportation, 45 (40.9%) in the first group and 20 (54.1%) in the second group spent less than 30 minutes to reach their destination. Also, the majority of the respondents in both groups said they were not encouraged, 164 (52.6%) and 222 (77.1%), respectively, to attend ANC services, and out of those who were encouraged, 91 (61.5%) were done by family members. Interestingly, participants during the COVID-19 pandemic received encouragement for ANC attendance mainly from friends, 41 (62.1%). Decision-making was mainly done by the women in the first group, 155 (49.7%), and 274 (95.1%) for respondents in the second group [**Table 5**].

Table 5: Frequency analysis of factors associated with access to health facilities for antenatal care attendance before and during the COVID-19 pandemic.

Variables	**Group A n (%)**	**Group B n(%)**
How far is the health facility from your residence		
Near	123(39.4)	23(8.0)
Far	61(19.6)	80(27.8)
Very Far	128(41.0)	185(64.2)
Means of transportation		
Vehicle	202(64.7)	251(87.2)
Foot	110(35.3)	37(12.8)
If by vehicle, how easy		
Must wait between 1-2 hours	57(28.2)	83(33.1)
Must wait less than half an hour	78(38.6)	97(38.6)
Readily Available	0(0.0)	32(12.7)
Must wait for more than 2 hours	67(33.2)	39(15.5)
If by foot, how long		
Less than 30 minutes	45(40.9)	20(54.1)
Between 30 to 1 hour	26(23.6)	10(27.0)
More than 2 hours	20(18.2)	4(10.8)
One to 2 hours	19(17.3)	3(8.1)
Anyone encourages you		
No	164(52.6)	222(77.1)
Yes	148(47.4)	66(22.9)
Who encourage you		
Family member	91(61.5)	19(28.8)
Husband	29(19.6)	6(9.1)
Friend	28(18.9)	41(62.1)
Who accompany you for ANC		
Family member	109(34.9)	20(6.9)
Husband	6(1.9)	0(0.0)
Friend	128(41.0)	3(1.0)
No body	69(22.1)	265(92.0)

Who make decision for your health		
Family member	145(46.5)	0(0.0)
Husband	12(3.8)	6(2.1)
Health Workers	0(0.0)	8(2.8)
Myself	155(49.7)	274(95.1)

Note: The figures in the brackets are in percentages: Group A = Before COVID 19, Group B = During COVID-19.

3.5 Possible factors associated with antenatal care attendance (times) before and during the COVID-19 pandemic.

According to the World Health Organization, the number of visits made denotes the quality of ANC (Odusina et al., 2021). Less than four visits are regarded as inadequate care, and four or more are regarded as adequate clinic attendance or care. The analysis showed that before the COVID-19 pandemic, a majority of 75.4% of the respondents had four or more visits or times to the clinic or hospital for checkups. Logistic regression analysis was conducted to determine predictors related to ANC attendance before and during the COVID-19 pandemic. The backward method was used in the data entry process. The analysis showed that married women compared to single mothers were less likely to attend ANC before the COVID-19 outbreak (OR = 0.408, 95% *CI*: 0.234~0.711).

Table 6: Description of the variables used in the binary regression analysis for factors associated with antenatal care attendance (times) before and during the COVID-19 pandemic

Variables	Assigned Parameter Coding
Place of Birth (X_1)	Hospital=0, Clinic=1
Marital Status (X_2)	Single=0, Married=1
Group (Y)	Group A=0 Group B=1

Table 2: Possible factors associated with antenatal care attendance (times) before and during the COVID-19 pandemic

Variables	β	Wald X^2	*P* value	OR	95% CI	
					Lower	Upper
Group before COVID-19 (Ref)						
Group during COVID-19	-1795	81.865	.000	0.166	0.113	0.245
Place of Birth						
Hospital (Ref)						
Clinic	-0.352	3.535	0.060	0.703	0.487	1.015
Marital Status						
Single						
Married	-0.47	5.55	0.018	0.625	0.423	0.924
Constant	1.158	52.016	0	3.183		

β= Beta Sig.= Significance, OR= Odd Ratio

3.6 Factors associated with high quality of antenatal care attendance before and during the COVID 19 pandemic.

Binary regression show that participants during the COVID 19 pandemic were greatly influenced by high quality antenatal care attendance compared to participants before the COVID 19 pandemic, (*OR*=0.228, 95% *CI*: 0.154~0.336) [**Table 9**].

Table 3: Description of the variables used in the Binary regression analysis for high quality of antenatal care attendance for all participants before and during the COVID 19 pandemic.

Variable	Assigned Parameter Coding
Group (Y)	Group A=0 Group B=1

Table 4: High Quality of antenatal care attendance for all participants before and during the COVID 19 pandemic.

Variables	B	Wald	*P* value	OR	95% CI	
					Lower	Upper
Group B during COVID- 19	-1.481	55.785	<0.001	0.228	0.154	0.336
Constant	-0.206	3.27	0.071	0.814		

β= Beta, Sig.= Significance, OR= Odd Ratio

3.7 Relationship between socio-demographic variables and ANC attendance before COVID-19

Before the COVID-19 pandemic, logistic regression was able to predict four significant relationships between demographic variables and antenatal care attendance. Married women compared to single mothers were less likely to attend ANC before the COVID-19 pandemic (OR = 0.408, 95% *CI*: 0.234~0.711). Also, women who received ANC services from private clinics or health facilities were almost two times more likely to attend ANC services before COVID-19 compared to those who received care from government facilities (OR = 1.986, 95% *CI*: 1.177~3.351). Binary regression also shows that information on media exposure was significantly a protective factor among women attending antenatal care services before the COVID-19 pandemic; the women who get less media exposure are more likely to get fewer antenatal care services (OR = 0.503, 95% *CI*: 0.265~0.955). Media exposure may be defined as "the extent to which audience members have encountered specific messages or classes of messages or media content (Slater, 2004). This is a simple and straightforward definition, but even then, the definition of "experienced" poses conceptual and measurement challenges.

Table 10: Description of the variables used in the binary regression analysis relationship between demographic variables and ANC attendance before the COVID-19 pandemic.

Variables	Assigned Parameter Coding
Marital Status (X_1)	Single=0, Married=1
Media Exposure (X_2)	1-4=0, 5-8=1, 9-12=2
Place of Birth (X_3)	Government Hospital=0, Private Hospital=1
Intended Pregnancy (X_4)	Yes=0, No=1
Group (Y)	Group 1=0 Group 2=1

Table 11: Relationship between socio-demographic variables and ANC attendance before COVID-19

Variables	β	Wald	*P* value	OR	95% CI	
					Lower	Upper
Marital Status						
Single (Ref)						
Married	-0.897	9.994	0.002	0.408	0.234	0.711
Media Exposure						
1-4		4.514	0.105			
5-8	-0.688	4.418	0.036	0.503	0.265	0.955
9-12	-0.623	2.049	0.152	0.536	0.229	1.259
Where did you receive ANC						
Government Hospital						
Private Hospital	0.686	6.616	0.01	1.986	1.177	3.351
Intended Pregnancy						
Yes						
No	-0.641	3.45	0.063	0.527	0.268	1.036
Constant	1.849	20.904	0.000	6.355		

β= Beta, Sig.= Significance, OR= Odd Ratio

3.8 Relationship between demographic variables and high quality of antenatal care before the COVID-19 pandemic

The logistic regression model was able to predict a significant relationship between two predictor variables and the high quality of antenatal care before the COVID-19 pandemic. The binary logistic regression showed that women who did not intend to get pregnant compared to those who did were less likely to receive quality ANC before the COVID-19 pandemic (OR = 0.549, 95% *CI*: 0.315~0.956). All the other variables showed no significant relationship with the quality of antenatal care before COVID-19 [**Table 13**].

Table 12: Description of the variables used in the binary regression analysis for high quality of antenatal care attendance before the COVID-19 pandemic

Variables	**Assigned Parameter Coding**
Family Income (X_1)	500 L$-1,004 L$=0, 1,005L$-2,604L$=1, 2,605L$-5,004L$ =2, 5,005L$ & above=3
Intended Pregnancy (X_2)	Yes=0, No=1

Table 13: Relationship between demographic variables and high quality of antenatal care before the COVID-19 pandemic

Variable	**β**	**Wald X^2**	**Sig.**	**OR**	**95% CI**	
					Lower	**Upper**
Family Income						
500L$ -1,004L$		6.730	0.81			
1,005L$-2,604L$	0.201	2.762	0.097	1.223	0.965	1.550
2,605L$-5,004L$	0.05	4.158	0.978	1.005	0.577	1.749
5,005L$ & above	0.144	0.278	0.267	0.605	1.155	1.993
Intended Pregnancy						
Yes						
No	-0.6	4.482	0.034	0.549	0.315	0.956
Constant	-0.102	0.09	0.764	0.903		

β= Beta, Sig.= Significance, OR= Odd Ratio

3.9 Level of information about COVID-19 during COVID-19 pandemic

During the COVID-19 majority (227 majority (227, or 78.8%) of the women agreed that they would need more information about COVID-19. Furthermore, 78.1% (225) agreed that they were aware of all the advice given by the government about COVID-19. Similarly, many agree that they experienced many changes during the COVID-19 lockdown [**Table 14**].

Table 14: Responses to items on information about COVID-19 (%)

Variables	**Strongly Agree/Agree**	**Neutral**	**Strongly Disagree/ Disagree**	**Mean (SD)**
I am aware of all the advice given by government about COVID 19	225(78.1)	40(13.9)	23(8.0)	1.81(0.96)
I have been given clear information about COVID-19	254(88.2)	6(2.1)	28(9.7)	1.66(0.92)
I have experienced many changes during COVID-19 lockdown	248(86.1)	11(3.8)	29(10.1)	1.72(0.94)
I would like more info about COVID-19 transmission	227(78.8)	25(8.7)	36(12.5)	1.99(0.97)

Note: The figures in brackets are in percentages (%).

3.10 Level of worry and attitude among women during the COVID-19 pandemic

The analysis showed that women who sought antenatal care services during the COVID-19 pandemic were more worried about "not having someone with them during an ANC appointment", (2.97±1.1). Also, participants were worried about "the risk of them or their babies getting the virus at a health facility", (2.93±0.98). Equally, many participants were worried about getting the virus (2.89±1.13. The least worrisome item was not having friends or family around at home after having a baby" [**Table 15**].

Table 15: Status of worrisome among women during the COVID-19 pandemic (%)

Variables	Not at all worried	Worried	Neutral	Very Worried	Mean (SD)
Getting the virus passing to my baby	33(11.5)	105(36.5)	20(6.9)	130(45.1)	2.86(1.12)
The risk of getting the virus	29(10.1)	113(39.2)	6(2.1)	140(48.6)	2.89(1.13)
Not having someone with me during appointment	23(8.0)	111(38.5)	6(2.1)	148(51.4)	2.97(1.11)
Getting to the clinic when in labor	27(9.4)	115(39.9)	14(4.9)	132(45.8)	2.87(1.11)
The risk of me or my baby getting the virus at clinic	18(6.3)	95(33.0)	63(21.9)	112(38.9)	2.93(0.98)
Not having friends/family around at home after having baby	132(45.8)	87(30.2)	0(0.0)	69(24.0)	2.02(1.19)

Note that figures in brackets are in percentages (%) and SD is the standard deviation.

3.11 Relationship between ANC attendance and demographic variables during the COVID-19 pandemic

During the COVID-19 pandemic, logistic regression analysis depicted that no meaningful variables were included in the analysis, either the ANC attendance or quality of the ANC. [**Table 16**].

Table 16: Description of the variables used in the binary regression analysis for the relationship between demographic variables and antenatal care attendance during the COVID-19 pandemic

Variables	Assigned Parameter Coding
Formal Education (X_1)	Primary=0, Secondary=1, College/ University=2
Attitude (X_2)	4-6=0, 7-9=1, 10-12=2

Table 17: Relationship between ANC Attendance and demographic variables during COVID-19 pandemic

Variables	B		Wald	Sig.	OR	95% CI	
						Lower	Upper
Formal education							
Primary (Ref)			5.168	0.075			
Secondary	-0.774		3.645	0.056	0.461	0.208	1.021
College/ University	0.151		0.246	0.62	1.162	0.641	2.107
Attitude							
4-6			4.742	0.093			
7-9	-0.535		3.374	0.066	0.585	0.331	1.037
10-12	-0.892		2.74	0.098	0.41	0.142	1.178
Constant	-0.66		6.515	0.011	0.517		

β= *Beta, Sig.= Significance, OR= Odd Ratio*

4. DISCUSSION

In our study, there was no significant difference in the proportion of the socio-demographic variables across the two groups (before and during COVID-19). There was almost equal representation in terms of age category, educational level, occupational status, residence, religious affiliation, and presence of a pregnancy complication. However, on marital status, there were more single women (73.7%) in the before-COVID-19 group compared to the second group. On the other hand, there were more (67.7%) married participants in the during-COVID-19 group than in the before-COVID-19 group. This striking difference is vital, especially in the African setting, where unmarried women tend to shy away from public scrutiny and hence may conceal pregnancy, which may result in late bookings and inadequate attendance. This assertion is supported by a study conducted in Uganda (Kawungezi et al., 2015). Hence, in our study, it was revealed that women who are married were more likely to have more ANC visits compared to

single mothers. This finding was supported by a study conducted in Nigeria (Dairo & Owoyokun, 2011). Furthermore, women with family income between 1,005 L$ and 2,604 L$ were more likely to receive quality ANC services compared to those from families with income between 500 L$ and 1,004 L$. This finding is consistent with some other studies, which reported that financial barriers play a major role when it comes to perinatal care among women, which is related to low social-economic status (Roozbeh et al., 2016) (McPake, 2013). Additionally, findings from past research reported that poverty is one of the most harmful factors that influence women's ANC attendance history during pregnancy (McPake, 2013).

4.1 High quality Antenatal care attendance before and during the COVID-19 pandemic

The study findings illustrated that all the respondents registered for ANC care before and during the COVID-19 pandemic. Our results also showed that more than half of the participants (59%) registered in the first trimester, while less than half of the respondents registered in the second trimester. This finding is similar to results from a study conducted in Ghana (Sharma et al., 2015) in which 61% of the participants registered for ANC during the first trimester and 32% registered in the second trimester. Similarly, our finding was also supported by a study conducted in Kenya, in which more than half of the participants registered for ANC in their first trimester (Afulani et al., 2019). This was also impressive compared to a study in rural India where only 38% of women initiated ANC during their first trimester (Pallikadavath et al., 2004) (McCaw-Binns, 1995) . It is evidenced that early initiation of ANC is the only means by which adequate services can be obtained, as recommended by the WHO. Numerous interventions programmed to optimize the health of the mother are implemented throughout the pregnancy period and beyond. Such interventions include malaria prophylaxis, vitamin and iron supplements, tetanus prophylaxis, and Helminthes prophylaxis. Therefore, late ANC enrollment means missed opportunities for services, with an increased likelihood of detrimental outcomes such as mortality or morbidity. The high proportion of registration and attendance in our study might be a result of the high level of health education programmed and the outreach clinics or services conducted monthly across the country. Also, our study showed that fewer participants (29.2%) attended fewer than 4 ANC visits, the WHO recommended minimum standard for uncomplicated pregnancy, while 70.8% of the women attended more than 4 ANC visits. More visits mean more contacts with the health care providers, and it is better to detect anomalies earlier and act promptly.

However, during the COVID-19 pandemic, our study showed that ANC registration in the first trimester was lower (39%) compared to those who sought ANC before COVID-19. Also, our study revealed that the majority (75%) of the participants attended fewer than four visits during the COVID-19 pandemic compared to before the pandemic. The findings are supported by a systematic review conducted by (Chmielewska et al., 2021) which revealed that global maternal and fetal outcomes worsened during the COVID-19 pandemic, in which there was an increase in maternal deaths and stillbirth (Chmielewska et al., 2021). The low proportion of ANC attendance could be attributed to adequate human and material resources, especially in sub-Saharan Africa with poor infrastructure to cope with the high demand for services. In addition, these plausible misconceptions surrounding the COVID-19 pandemic (Menendez et al., 2020) might be another deterrent to seeking ANC care as recommended by the WHO. Antenatal mothers are faced with additional challenges during social distancing due to their valuable contribution to the workforce as caregiver coupled with the need to attend antenatal care (Qiao, 2020). Modern techniques of offering services, such as virtual meetings with care providers, are not available; hence, women would prefer to stay home and not risk contracting the disease.

In terms of quality of ANC care, our study showed that the quality of ANC was suboptimal in terms of timing of registration during the COVID-19 pandemic in relation to before the pandemic. This is evidenced in our study, in which more women were recruited for the study before the COVID-19 pandemic compared to during the COVID-19 pandemic. Hence, it is paramount that innovative strategies are put in place to make sure that there is no interruption of maternal and childcare during public health emergencies such as the COVID-19 pandemic. The implications attached to poor-quality ANC can have adverse outcomes for both the mother and fetus and the family at large.

4.2 Factors associated with ANC attendance before COVID-19 pandemic

Many studies revealed that ANC attendance could be affected by numerous factors. In our study, married women, place of ANC attendance, media exposure, and the intention to become pregnant were significantly associated with ANC attendance. The findings showed that single women, compared to married mothers, were more likely to attend ANC before the COVID-19 pandemic. This finding is consistent with the results of many similar studies (Pell et al., 2013) (Dahiru & Oche, 2015) (Nketiah-Amponsah et al., 2013) (Simkhada et al., 2008). The family burden of single mothers is relatively small, and health decisions are relatively independent, so they may be relatively active in the ANC services. This finding is consistent with results from a study conducted in Sierra Leone (Norman & Lamin-Boima, 2019).

Furthermore, women who received ANC services from private clinics or health facilities were almost two times more likely to attend ANC services before COVID-19 compared to those who received care from government facilities. This finding is also supported by a previous study in which many women preferred private health facilities to government health institutions (Tiruaynet & Muchie, 2019). This could be a result of the quality of health care services associated with private health institutions in comparison to government health facilities. This is very typical in many African countries, and Liberia is no exception. Therefore, ANC attendance could be attributed to the quality of care rendered, which could be human or material (Atchessi et al., 2018). In addition, this finding is also consistent with a study conducted in Gandhinagar (Rural) District, Gujarat, which revealed that more women (60%) attended

antenatal care services in private hospitals compared to governmental facilities (Chandhiok, 2006).

In addition, our study showed that women with unintended pregnancies were less likely to initiate ANC attendance compared to those with planned pregnancies. However, this finding was inconsistent with a study conducted in Kenya, which showed that women who reported unintended pregnancy were less likely to delay antenatal care initiation (Ochako & Gichuhi, 2016). Similarly, in another study conducted in South Africa, women with unintended pregnancy were attributed mainly to failure of family planning, which was a significant predictor of antenatal care attendance and quality (Kaswa et al., 2018) (Ebonwu et al., 2018). However, the finding of the current study is consistent with a national-level study from Rwanda, which stated that women with unintended pregnancies are less likely to attend ANC services and more likely to be late in the initiation of ANC (Manzi et al., 2014). The reason might be related to cultural and geographical location. In many African cultures, pregnancy is usually accompanied by pride, but if not planned, it can create some undesirable effects for the mother and family at large, and the community seems to stigmatize the culprit. In Liberia, communities live in close harmony and discuss family issues, and this can greatly affect the uptake of ANC.

4.3 Factors associated with ANC attendance during the COVID-19 pandemic.

Antenatal care attendance during the COVID-19 pandemic could be very challenging compared to ANC care before COVID-19. The difference in factors associated with ANC attendance was very evident in our study. The study findings showed that women who opted for ANC services were more likely not to attend ANC services during the COVID-19 pandemic compared to before the pandemic. This finding is consistent with a previous study conducted in Iran (Saadati et al., 2020). The result demonstrated that low use of healthcare service among pregnant women was very prevalent during the COVID-19 pandemic as a result of infectious symptoms, isolation, or treatment for suspected or confirmed COVID-19 cases, their concerns over the unsafe environment of healthcare settings, and concerns over affliction by the disease.

Additionally, our findings demonstrated that ANC during the COVID-19 pandemic appeared to be unaffected by the variables. However, a previous study of the fight against Ebola in Sudan in 2015 found that education was the only meaningful predictor of the impact of the epidemic on people, with less educated mothers less aware of the epidemic and more likely to blindly choose not to go to the hospital or even to go outside. Previous studies have shown that maternal and partner education affects the timing of the first ANC, with lower levels of education associated with more negative prenatal examinations and a delay in the timing of the first ANC, thereby preventing access to high-quality prenatal care. The results of this study indicate that the factors influencing the number and quality of obstetric examinations before and after the epidemic have changed, which means that the strategies of relevant institutions to promote obstetric examinations before and after the epidemic need to be adjusted accordingly.

This comparison study revealed that ANC attendance could be severely disrupted during public health emergencies such as COVID-19 compared to a normal situation. Also, the study revealed that factors associated with ANC attendance differ in these two scenarios. Therefore, it is paramount that proper infrastructural and material/human resource arrangements are available during health emergencies to avoid maternal and child morbidity or mortality.

4.4 Implications of the study

One of the most relevant issues covered by this research is the determination of antenatal care attendance among reproductive-age women in Liberia before and during the COVID-19 pandemic. This research examines factors that are associated with antenatal care services before and during the COVID-19 pandemic. This research contributes theoretically to the scientific community on antenatal care by extending the literature on differences in attendance rates before and during the COVID-19 pandemic in Monrovia, Liberia. The findings of this study highlight the loopholes and the ill-preparedness of our health institutions to cope with health emergencies and continue with routine health services without any shortcomings. The disruption in service delivery, especially maternal health services, could have dire consequences for the mother and newborn. Furthermore, the economic burden associated with public health emergencies can have a catastrophic effect on the health care-seeking behaviour of patients or clients. This study also revealed the lack of spending on our health system by stakeholders and the government at large. Lack of commitment to health care surfaces when emergencies such as COVID-19 strike; hence, this is an eye-opener for our politicians to invest more in health to save lives and prevent deaths that are avoidable, such as maternal and neonatal deaths.

5. CONCLUSION

This cross-sectional study carried out in Monrovia, Liberia, reflects the maternity check-ups of local mothers during the period before and during the COVID 29 pandemic. We found that the factors affecting the check-up before the pandemic included the location of the check-up and family income. Hospital check-ups and high incomes can be used. Promote the frequency of maternity check-ups and improve the quality of the check-ups. During the pandemic, a factor that affects the maternity check-up is the education level of the mother. The higher the education level, the more frequent the maternity check-up will be. Under the normalization of the pandemic situation, we should strengthen public health education, rationally allocate medical resources, and avoid ignoring the routine health care of pregnant women due to the excessive tilt of medical resources towards pandemic prevention and control.

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