Abstract

Objective

To estimate utilization cost of spontaneous vaginal delivery (SVD) and caesarean delivery (CD) for pregnant women with Coronavirus Disease (COVID-19) at the largest teaching hospital in Lagos, the pandemic's epicenter in Nigeria.

Methods

We collected facility-based and household costs of all nine pregnant women with COVID-19 managed at the hospital. We compared their mean facility-based costs with those paid by pregnant women pre-COVID-19, identifying cost-drivers. We also estimated what would have been paid without subsidies, testing assumptions with a sensitivity analysis.

Results

Total utilization cost ranged from US$494 for SVD with mild COVID-19 to US$4,553 for emergency CD with severe COVID-19. Though 32-66% of facility-based cost were subsidized, cost of SVD and CD during the pandemic have doubled and tripled respectively compared to those paid pre-COVID. Of the facility-based costs, cost of personal protective equipment (PPE) was the major cost-driver (50%). Oxygen was the major driver for women with severe COVID-19 (48%). Excluding treatment costs for COVID-19, mean facility-based costs were US$228 (SVD) and US$948 (CD).

Conclusion

Despite cost exemptions and donations, utilization costs remain prohibitive. Regulation of PPE and medical oxygen supply chains and expansion of advocacy for health insurance enrolments are needed to minimize catastrophic health expenditure.

INTRODUCTION

Since its emergence in December 2019, the Coronavirus disease 2019 (COVID-19) has been a major disruptor to humanity.[1] By mid-October 2020, there have been over 38 million confirmed cases, including over one million deaths globally.[1] This has come on the heels of significant gains in global maternal mortality reduction over the past two decades. In 2017, it was estimated that there were 295,000 maternal deaths worldwide.[2] However, modelled estimates published early in the COVID-19 pandemic predicted that an 8·3-38·6% increase in maternal deaths should be expected per month.[3] Such increments do not bring countries any closer to achieving the global target of reducing maternal mortality ratio to 70 per 100,000 live-births.[4] Nigeria alone accounts for 25% of the global maternal deaths

Access to skilled health personnel is critical for reducing these deaths.[5] However, one key barrier that limits access as to skilled health personnel is service cost.[2] In Africa, 97% of mothers are delivered by spontaneous vaginal delivery (SVD) or caesarean delivery (CD).[6] Guidelines have been published on how both SVD and CD should be provided to pregnant women with COVID-19 in Nigeria in line with global guidance.[7] However, do the revamped services resulting from the guideline come at an additional cost to women?

The many indirect effects of COVID-19 and the consequences of the lockdown measures implemented by many countries,[3] including Nigeria, brings a need to focus on the cost of utilizing maternity services during the pandemic. Lagos is the epicenter of the COVID-19 pandemic in Nigeria

with 20,370 cases and 204 deaths, compared to the national average of 1,644 cases and 30 deaths, as of 16th October 2020.[8] The objective of this study was to assess utilization cost of maternity services for childbirth amongst pregnant women with COVID-19 in Lagos, Nigeria.

MATERIALS AND METHODS

This was a hospital-based cost analysis from the user's (women's) perspective. Women were only approached after their discharge from the Lagos University Teaching Hospital (LUTH), Lagos, Nigeria. The inclusion and exclusion criteria used for recruitment is described in Table 1. From the included women, we collected data on direct cost components spent within the facility, outside the facility (household), opportunity (loss of productivity) costs and any other relevant costs that women claimed to have expended for their care. All of these made up total utilization cost. We noted any exemptions and donations that reduced the cost paid by women. A detailed review of patient financial account records in the hospital was used to capture all facility-based costs. In capturing facility-based costs, we separated those related to obstetric care from those for COVID-19 care. For comparison, we collected data on the standard SVD and CD facility-based cost for booked and un-booked pregnant women pre-COVID-19. A pre-tested online tool was administered to women to collect household and opportunity costs. We collected data on the monthly income of selfemployed women and their caregivers. We only included a pro-rated cost of the typical monthly cost related to the number of days that the women spent in hospital.

All cost data were collected in local currency (Naira (N)). Analysis was conducted in Microsoft Excel (Microsoft Corporation, Redmond, United States) following conversion of cost data to United States Dollars (US$) as per the mean exchange rate for the year.[9] All costs were presented in US$. To synthesize findings, we identified the obstetric (pregnancy complications)[10] and COVID-19 (mild or severe)[11] features which may influence utilization costs for each woman. Individual utilization costs were summed, and key cost drivers were identified for each case. We estimated the mean and median cost of the component and total costs per service (SVD, elective caesarean delivery (ELCD) and emergency caesarean delivery (EMCD)). We also estimated how much more women would have paid if there were no exemptions or donations. We then conducted a sensitivity analysis to test their influence on subsidy valuation. In addition, we compared mean facility-based costs for pregnant women with COVID-19 with standard facility-based costs pre-COVID-19.

Ethical approval was obtained from the Health Research and Ethics Committee, Lagos University Teaching Hospital (LUTHHREC/EREV/0520/24). Written informed consent was obtained from all participants.

RESULTS

All nine pregnant women that had laboratory-confirmed COVID-19 and managed in LUTH between 1st April 2020 and 31st August 2020 were recruited for this study. Their ages ranged from 22 to 40 years (Median: 33 years). All nine women were married and had attained tertiary education. Six of the women were employed, one selfemployed and the remaining two were unemployed. The spouses of all nine women were employed.

Of the nine women, two remained symptomatic while on admission presenting with Acute Respiratory Distress Syndrome (ARDS), the other seven were asymptomatic until discharge. Seven presented with no obstetric complications during the index pregnancy. For mode of delivery, there were eight CDs (Case 1-8). Five cases were done as an elective (Case 1-5), and the other three were

emergency (Cases 6-8). All CDs were done under spinal anesthesia. Case 9 was the only patient who gave birth via SVD. The women spent between 4 and 22 days on admission (Median: 15 days) [Table 2]. Except for one macerated stillbirth, all mothers and their babies were discharged alive.

The total utilization (facility-based and household) cost was US$494 for the sole pregnant woman who had SVD and mild COVID-19. Total utilization cost for those who gave birth via CD ranged from US$914 for a pregnant woman who had uncomplicated ELCD to US$4,553 for one who had EMCD and severe COVID-19. Mean total utilization cost across the entire population was US$1,529 (Standard deviation: US$1,112). When disaggregated, facility-based costs made up the highest proportion (67% of the mean total utilization cost) while opportunity cost due to loss of productivity of the caregiver made up 30%. Transport, childcare and purchase of other sundry items constituted the remaining 3% [Table 2].

For facility-based costs, the hospital management exempted all COVID-19 patients from paying the service fee, ward admission and feeding, in line with the Federal Government's directive. In addition, laboratory confirmation for COVID-19 by Reverse Transcription Polymerase Chain Reaction test was free. With support from government, international agencies, some charities and philanthropists, some personnel protective equipment (PPE) were made available to skilled health personnel, at no cost to the women.

For the costs still required, the woman who had SVD paid a total of US$228. Cost of additional PPE required for their care was the major cost driver (50%), followed by supplies (20%) and obstetric diagnostics (17%). For ELCD, facility-based cost ranged from US$749 to US$1,109, with a median cost of US$903. Major cost drivers for ELCD were PPE (50%), medicines (28%), and medical supplies (14%). Excluding the cost of additional supplemental oxygen required by women who had severe COVID-19 symptoms, EMCD cost from US$719 to US$1,517. The major cost drivers were medicines (35%), PPE (32%), and diagnostics (18%). Based on severity of COVID-19 symptoms, cost ranged from US$228 for a woman with mild disease and gave birth via SVD to US$2,939 paid by a woman who had severe COVID-19 symptoms requiring additional supplemental oxygen extra-operatively while on admission. For this latter case (Case 7), medical oxygen required to manage severe COVID-19 symptoms was the major cost driver (48%), followed by medicines (20%), and supplies (14%) [Table 2].

Cost of SVD for pregnant women with COVID-19 has more than doubled cost paid by a booked pregnant woman pre-COVID (US$113). For CD, excluding medical oxygen, the average facility-based cost of all eight CD patients (US$984) was about 2.5 times more than what women paid pre-COVID (US$384) [Table 2 and Table 3].

If there were no exemptions and donations, the pregnant woman with mild COVID-19 who gave birth via SVD (Case 9) would have paid US$526 as facility-based costs, meaning she received 57% of the facility-based cost as subsidies and donations. Pregnant women with mild COVID-19 requiring CD (Case 1-5 and 7) would have paid US$1,767-US$1,960, though their costs were subsidized by 43%-66%. Those with severe COVID-19 symptoms requiring CD would have paid US$2,181-US$5,088, though their costs were subsidized by 42%-65% [Table 4]. Using the most conservative estimates on potential cost subsidies being received by the women, facility-based costs were subsidized by between 21% and 51% [Table S1].

DISCUSSION

Regarding facility-based costs, we found that pregnant women with COVID-19 are paying as much as US$228 for SVD when they have mild COVID-19 and US$2,939 for EMCD when they present with

severe COVID-19. In a 2020 systematic review, median cost of utilizing SVD across LMICs was US$40 in a public hospital while CD was US$178 in public hospitals.[12] Thus suggests that COVID-19 pregnant women are paying six times more for SVD and as much as 16 times more if they have severe COVID-19 and require CD.[12]

It is established that tertiary hospitals like LUTH are significantly more expensive for care compared to secondary and primary facilities, mostly because of their specialist expertise.[12] However, the standard cost for an un-booked patient managed in LUTH pre-COVID (US$464) is still less than the maximum obtainable cost reported for another Nigerian teaching hospital (US$667) in 2013.[13] In our study, despite government-mandated cost exemptions on certain cost components and donations to support care provision,[14,15] pregnant women with COVID-19 are paying as much as two times more for SVD and three times more facility-based costs for CD when compared to the pre-COVID era. The major cost driver was PPEs. Pre-COVID, most reported that medicines and supplies, transport, and lodging were the major cost drivers that women had to tackle to access care.[12] However, there is also the emergence of medical oxygen as the major cost driver in the severe cases that require long hospital admission. This is despite oxygen being the second most important component for COVID-19 care.[16]

In our study, no woman reported giving any gifts to health workers. With so much caution being taken with care of pregnant women with COVID-19, it might be the case that the women are simply not giving gifts. However, this is unlikely, as Nigerian pregnant women typically show their appreciation of the efforts of health workers in taking care of them by gifting.[13] A more plausible explanation may be that the health workers themselves are refusing to receive gifts or tips because they want to minimize contact, conscious of the possibility of being infected through the gifting.

For the other cost components, median transport costs (US$10) reported in our study is higher than in Tanzania (US$0.09) but lower than US$51 reported in Bangladesh.[17,18] In our study, opportunity costs ranged from US$243 to US$572, while in the literature, adjusted estimates ranging from US$3 in Lao PDR for SVD to US$89 for CD in Nepal have been reported.[12] This may be because pregnant women with COVID-19 stayed longer on admission, as such, their partners had to stay longer away from work.

There are clear policy implications of our study findings. Pre-COVID-19, providers used some PPE, albeit not as many as is now being required. Indeed, demand currently outstrips supply by far, with 60% of providers reporting insufficient PPE to keep them safe while providing care.[19] With such gaps in the PPE supply chain, costs are being passed to women. This increases the risk of catastrophic health expenditure. Providers, more so those in LMICs, need to explore innovative ways to source PPEs without passing the burden unto pregnant women.[20] There is a case for governments to mobilize local PPE production and negotiate with sellers, while offering incentives for reduced costs and regulate sell-on costs. New thinking is also needed for oxygen supply. Pre-COVID-19, there was already concern about oxygen sufficiency in Africa.[16] While approaches such as installing oxygen concentrators, enabling private construction of oxygen plants, and use of solar-powered oxygen delivery are being implemented to boost oxygen supply during the pandemic,[16] these costs should not be passed on to pregnant women.

It should be noted that the women in our study were all educated and they and/or their partners were employed, yet, as our results showed, they benefited 32-62% of subsidies in facility-based costs. With 40% of the population living below the poverty line,[21] many will not be able to afford these increased service utilization of the COVID-19 era, without these donations and exemptions. Indeed, there might be a case for a comprehensive fee exemption policy, as was done by a state

government in Nigeria.[22] However, it is not known how long this can be sustained, with treatment of one patient with COVID-19 costing government US$260-US$2,604/day.[23] Likewise, how long can donations last?

With the pandemic still ongoing, costs of childbirth may yet still go up for all pregnant women, with some experts already proposing the need for universal testing of pregnant women for COVID-19 and a lower threshold for admitting pregnant women to hospital and intensive care unit.[24,25] This and any other additional costs may cause pregnant women to delay care-seeking, putting them at a greater risk of otherwise preventable obstetric complications. As these costs still need to be paid, the pandemic provides an opportunity to drive advocacy for enrolment in health insurance schemes.

There are limitations to bear in mind in interpreting findings of this study. First, we did not collect household costs data in the pre-COVID era. Second, we only reported cost from one public tertiary hospital, and this cost may not be representative of the cost being incurred by women around the country, especially within the private sector, where costs for using services are typically higher than in the public sector.[12] Followup studies should be conducted to capture utilization costs for using other public and private facilities.

In concluding, cost of utilizing maternity services for childbirth have increased and are likely to remain significantly high for women if exemptions being offered by governments become unaffordable, donations reduce or new requirements for universal testing have a chargeable fee. If COVID-19 becomes the new normal, then there will be many more pregnant women with COVID-19, including many who cannot afford the huge costs of care. Urgent measures are needed to ensure that women and their families are not being locked out of the health system.

Author contributions

AB-T conceived the study. AB-T and CAA led the study design. CCM, BBA and TAAN collected the data. AB-T and CCM conducted the data analysis. AB-T, CCM, MB, BBA and CAA were involved in drafting the manuscript. All authors read and approved the final version of the manuscript.

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Conflicts of interest

The authors have no conflict of interest.

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Tables

Table 1: Inclusion and exclusion criteria

Inclusion criteria
• Pregnant women with COVID-19 who delivered at LUTH, either by SVD or CD at term or near term
Exclusion criteria
• Pregnant women who delivered outside the hospital and were subsequently admitted for management of complications post-delivery • Pregnant women admitted into private wards and those exempted from paying user fees

Table 2: Description of care and utilization costs of spontaneous vaginal and caesarean delivery for pregnant women with COVID-19 in US Dollars

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Relevant details of care									
COVID-19 symptom state	Mild	Mild	Mild	Mild	Mild	Severe	Mild	Severe	Mild
Obstetric complication(s) in index pregnancy	None	None	None	None	None	None	Preeclampsia	None	Abruptio Placentae
Mode of delivery	ELCD	ELCD	ELCD	ELCD	ELCD	EMCD	EMCD	EMCD	SVD
Length of hospital stay (days)	11	21	20	13	5	22	21	15	4
Cost of service utilization in US$									
Facility-based costs									
Service fee*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ward admission*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feeding*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medicines	202 (24%)	331 (30%)	248 (27%)	246 (25%)	244 (33%)	594 (20%)	210 (28%)	235 (30%)	22 (10%)
Diagnostics (obstetric)	59 (7%)	96 (9%)	75 (8%)	99 (10%)	63 (8%)	248 (8%)	199(26%)	105 (14%)	38 (17%)
Diagnostics (COVID-19)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	74 (3%)	0 (0%)	0 (0%)	0 (0%)
Extra Oxygen consumption	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1,422 (48%)	0 (0%)	55 (7%)	0 (0%)
Supplies/Consumables	101 (12%)	79 (7%)	134 (15%)	173 (18%)	132 (18%)	132 (4%)	119 (16%)	99 (13%)	45 (20%)
Personal Protective Equipment	478 (56%)	597 (54%)	446 (49%)	445 (46%)	303 (40%)	463 (16%)	229 (30%)	274 (35%)	116 (51%)
Discharge fee	7 (1%)	7 (1%)	0 (0%)	12 (1%)	7 (1%)	7 (<1%)	7 (1%)	7 (1%)	7 (3%)
Total facility-based costs	847 (59%)	1,109 (99%)	903 (99%)	975 (93%)	749 (60%)	2,939 (65%)	764 (58%)	773 (47%)	228 (46%)
Household costs									
Transport (To and from)	21 (100%)	8 (100%)	10 (100%)	7 (9%)	16 (100%)	10 (11%)	5 (100%)	13 (100%)	13 (57%)
Childcare	0 (0%)	0 (0%)	0 (0%)	68 (91%)	0 (0%)	78 (89%)	0 (0%)	0 (0%)	10 (43%)
Total household costs	21 (1%)	8 (1%)	10 (1%)	75 (7%)	16 (1%)	88 (2%)	5 (<1%)	13 (1%)	23 5%)
Other costs									
Sundry items	0 (0%)	0 (0%)	0 (0%)	0 (0%)	52 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gifts/Tips to hospital staff	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total other costs	0 (0%)	0 (0%)	0 (0%)	0 (0%)	52 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Opportunity costs									
Loss of productivity cost	572 (100%)	0 (0%)	0 (0%)	0 (0%)	433 (100%)	1,525 (100%)	546 (100%)	845 (100%)	243 (100%)
Total opportunity costs	572 (40%)	0 (0%)	0 (0%)	0 (0%)	433 (35%)	1,525 (33%)	546 (42%)	845 (52%)	243 (49%)
TOTAL COST	**1,439 (100%)**	**1,117 (100%)**	**914 (100%)**	**1,049 (100%)**	**1,250 (100%)**	**4,553 (100%)**	**1,315 (100%)**	**1,631 (100%)**	**494 (100%)**

**Patients with COVID-19 are exempted from paying service fee, ward admission and feeding.*
EMCD = emergency caesarean delivery, ELCS =elective caesarean delivery, SVD = spontaneous vaginal delivery.

Table 3: Facility based cost of utilizing spontaneous vaginal and caesarean delivery pre-COVID-19 in US Dollars

	SVD - Booked	SVD - Un-booked	CS (Spinal anesthesia) - Booked	CS (General anesthesia) - Booked	CS (Spinal anesthesia) – Un-booked	CS (General anesthesia) – Un-booked
Facility-based costs in US$						
Service fee*	28 (24%)	55 (31%)	82 (21%)	82 (20%)	82 (19%)	82 (18%)
Ward admission	0 (0%)	0 (0%)	74 (19%)	74 (18%)	74 (17%)	74 (16%)
Feeding	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medicines	42 (37%)	42 (23%)	148 (38%)	175 (43%)	148 (34%)	175 (38%)
Diagnostics (obstetric)	10 (9%)	75 (42%)	74 (19%)	74 (18%)	126 (29%)	126 (27%)
Antenatal fees	28 (24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Supplies/Consumables	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Discharge fee	7 (6%)	7 (4%)	7 (2%)	7 (2%)	7 (1%)	7 (1%)
Total facility-based costs	**113 (100%)**	**179 (100%)**	**384 (100%)**	**411 (100%)**	**436 (100%)**	**464 (100%)**

**Service fees paid for vaginal delivery include ward admission and feeding.*

Table 4: Subsidies received by women due to donations and exemptions in US Dollars

Case	Days in Delivery Theatre	Delivery and immediate post-partum ($)	First day post-partum till discharge ($)	Hospital admission fees ($)	Additional days beyond week 1 ($)	Total subsidy received ($)	Actual amount paid by women ($)	PPE cost less cost paid by women for PPE ($)	Total that would have been paid ($)	% paid by women	% paid by other sources
1	8	780	770	74	36	1,264	847	478	2,111	40%	60%
2	4	780	385	74	127	851	1,109	597	1,960	57%	43%
3	4	780	385	74	118	993	903	446	1,896	48%	52%
4	4	780	385	74	55	930	975	445	1,905	51%	49%
8	4	780	385	74	0	1,018	749	303	1,767	42%	58%
5	16	780	1,539	74	137	2,149	1,517	463	3,666	41%	59%
6	7	780	673	74	127	1,508	764	229	2,272	34%	66%
7	7	780	673	74	73	1,408	719	274	2,127	34%	66%
9	2	127	71	28	0	110	228	116	338	67%	33%