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Adherence to face mask use during the COVID-19 pandemic among women seeking antenatal care in Kinshasa, Democratic Republic of Congo: a facility-based cross-sectional study

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ABSTRACT

Objectives To describe face mask use among pregnant women seeking antenatal care (ANC) in Kinshasa, Democratic Republic of Congo and to identify factors associated with masking adherence in this population.

Design Facility-based cross-sectional study nested within a prospective cohort study.

Setting Random sample of 10 health facilities, including 5 primary health centers and 5 secondary facilities or hospitals.

Participants A total of 934 pregnant women aged 18 years or above with a gestational age of at least 32 weeks were consecutively surveyed from 17 August 2020 to 31 January 2021.

Primary and secondary outcome measures We estimated the proportions of pregnant women wearing a face mask and masking correctly (ie, over the mouth and nose), and assessed their knowledge regarding the COVID-19 pandemic. Multivariable logistic regression was employed to identify factors associated with overall and correct face mask use.

Results Overall, 309 (33.1%) women wore a mask during the interview after their antenatal appointments, but only 33 (10.7%) wore a mask correctly. The odds of masking and correct mask use were significantly higher among women who had their ANC visit in a facility that provided COVID-19 care. Additionally, women who experienced COVID-19-like symptoms in the past 6 months had higher odds of wearing a mask correctly compared with those reporting no recent symptoms. Although 908 (97.2%) women were aware of the COVID-19 pandemic, only 611 (67.3%) thought that COVID-19 was circulating locally in Kinshasa.

Conclusion Overall and correct face mask adherence levels were low among pregnant women attending ANC in Kinshasa. Our study highlights the need for improving adherence to correct face mask use in order to help control the spread of COVID-19 within Kinshasa alongside other control measures, like vaccination.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ First study in the Democratic Republic of Congo that explores adherence to correct face mask utilisation among pregnant women.
⇒ Correct face mask wearing was assessed by direct observation.
⇒ The study did not assess the reasons for, or motivations behind, mask adherence.
⇒ Some important covariate information, such as socioeconomic status, was not collected as a part of the main study in which this cross-sectional survey was nested.

outbreak.[1] COVID-19 quickly crossed borders and spread to most countries worldwide within 4 months, and was then declared a pandemic by the WHO on 11 March 2020.[2] As of 9 May 2022, over 518 million reported cases have occurred globally, resulting in over 6.3 million deaths[3]; Africa has remained the least affected continent with only 11.7 million (2.3%) cumulative cases and 253 104 (2.2%) deaths, of which 87 023 cases and 1337 deaths have occurred in the Democratic Republic of the Congo (DRC).[3]

The first case of COVID-19 in DRC was reported in Kinshasa on March 10, 2020. By March 19, the government's response to the pandemic included restrictions on both national and international travel, containment and lockdown orders, closing down crowded events, and mandating face mask use and physical distancing in public areas. However, enforcement of these policies by police remained weak and inconsistent in most locations. By July 2020, the government had started relaxing restrictions, but still required (with inconsistent enforcement)

INTRODUCTION
In December 2019, SARS-CoV-2 emerged in Wuhan, China, causing the COVID-19

mandatory masking among the general population in all public spaces and highlighted these measures for high-risk populations, including pregnant women.[4] The government launched a vaccination campaign against COVID-19 on 19 April 2021. As of 6 April 2022 though, only 0.87% of the general population have received at least one dose of the vaccine (ie, either AstraZeneca-Covishield, Moderna, Pfizer-BioNTech, Johnson & Johnson or Sinovac) and only 0.56% are considered fully vaccinated.[5] Pregnant women have not been designated as a high-priority population for vaccination currently in DRC. Additionally, the country has redistributed 1.3 million doses of the vaccine to other African countries, such as Angola and Togo, and has had over 300 000 doses expire, highlighting high levels of vaccine hesitancy.

Correct face mask wearing, along with hand washing, social distancing, and vaccination, has emerged as one of the more effective approaches for curbing the spread of COVID-19.[6–9] However, high compliance is required for this control measure to be effective.[6] Adherence to face mask wearing in the general population has been described in different African countries, with sparse data presented on pregnant women.[10–12] In a recently published study conducted among the general population in seven of the twenty-six provinces of DRC (including Kinshasa), 41.4% of respondents overall and 92.0% in Kinshasa self-reported through an online survey wearing face masks while in public.[13] Masking adherence rates reported among the general population in Kinshasa may be overestimated based on social desirability bias in self-reporting without visual confirmation or assessment by trained interviewers; as a result, the measurement of true adherence requires an investigation with direct observation.

The transmission of SARS-CoV-2 can occur early in the course of infection with COVID-19 patients frequently shedding virus before they develop symptoms, contributing to the poorly mitigated spread of this virus around the world.[14 15] As such, professional organisations, including the American College of Obstetricians and Gynecologists, have recommended face coverings for pregnant women, especially in places where physical distancing is lacking.[16] This approach is of utmost priority in densely populated cities of low-income and middle-income countries, such as Kinshasa, where physical distancing is hard to implement and near-impossible to enforce. Factors that contribute to difficulties in physical distancing include overcrowding at the household level and multi-generational housing; high use of public transport with almost no physical barriers between passengers; and high use and overcrowding related to other aspects of daily life, such as attendance at health facilities for regular care seeking, including antenatal care (ANC). Therefore, understanding pregnant women's adherence to face mask use while attending ANC is of critical importance. Masking adherence in pregnant women is especially important since COVID-19's impact on pregnancy progression and embryonic development are still evolving.[17–20] In addition, initial studies indicate that pregnant women with COVID-19 are at higher risk of hospitalisation, severe disease and pregnancy adverse events than pregnant women of the same age who do not have COVID-19.[21–24] This paper aims to describe the level of adherence of pregnant women to face mask use during ANC in Kinshasa and to identify factors associated with this adherence.

METHODS
Sampling and study procedures

The overall sampling process for this study has been described elsewhere.[25] Briefly, this investigation was a facility-based cross-sectional study nested within the prospective arm of a cohort study consisting of both retrospective and prospective arms. The cohort study aimed to assess the feasibility of the Global Alignment of Immunisation Safety Assessment in pregnancy project case definitions for the surveillance of adverse birth outcomes and maternal immunisation in Kinshasa, DRC.

The study was implemented in ten health facilities including five primary health centers and five secondary facilities or hospitals that were randomly selected among all of Kinshasa's health facilities that met the following criteria (n=823): (1) designation as a hospital with a maternity ward, or other health facility such as a clinic or a health center where deliveries are performed; (2) record of at least 1000 annual deliveries during the year prior to study initiation (ie, 2018) and (3) on-site archival of birth records.

The prospective arm of the study took place from 17 August 2020 to 31 March 2021 and enrolled pregnant women 18 years of age or older who attended one of the 10 health facilities for regular ANC visits during their last 8 weeks of pregnancy (ie, 32 weeks gestational age or more) or shortly after birth. During the enrolment period, all eligible women were invited to participate in the study voluntarily. If they accepted, participants provided oral consent after the study explanation procedure, which took place in either French or Lingala (a Bantu language spoken in Kinshasa and throughout northwestern DRC). Overall, 934 pregnant women and 2196 recently-delivered mothers were surveyed. Enrolled women were followed up until 31 March 2021.

Our analysis here is limited to the pregnant women enrolled prospectively during their ANC visit. Therefore, this analysis includes the 934 pregnant women who visited the study facilities throughout Kinshasa for ANC services, of which the following three facilities additionally provided COVID-19 care in separate units: Saint Joseph Hospital, Kinshasa Provincial General Referral Hospital (KPGRH) and Ngaliema Clinic.

Data collection

Data from the study were collected through an encrypted questionnaire using Open Data Kit Collect software and uploaded to a secure online server. Pregnant women were surveyed in a dedicated study room after their

Table 1 Sociodemographic characteristics of interviewed pregnant women attending antenatal care in 10 health facilities sampled in Kinshasa

	Frequency (n=934)	Percentage
Health facility attended		
Bomoi Health Center	296	31.7
Bondeko Health Center	138	14.8
Esengo Hospital	91	9.7
Lisanga Health Center	88	9.4
Siloe Health Center	87	9.3
Mokali Hospital	79	8.5
Saint Joseph Hospital	64	6.9
Ngaliema Clinic	62	6.6
Kinshasa Provincial General Referral Hospital	22	2.4
Bosembo Health Center	7	0.8
Travelled abroad in past 6 months		
No	930	99.6
Yes	4	0.4
Travelled outside the province in past 6 months		
No	914	97.9
Yes	20	2.1
Maternal information available in birth records		
No	157	16.8
Yes	777	83.2
Maternal age (years)*		
18–25	227	29.2
26–36	427	55.0
36–44	123	15.8
Mean (SD)	30.5 (10.6)	
Range	18–44	
No of previous pregnancies*		
1	204	26.3
2	198	25.5
3	126	16.2
4	104	13.4
5	77	9.9
6 or above	68	8.8

*Only women with information available in birth records (n=777) had this information recorded.
SD, standard deviation.

ANC consultation. The questionnaire included limited maternal and child demographic information, vaccine hesitancy assessment for routine immunisations, and a COVID-19 module that included questions on women's behaviour and perception towards COVID-19. For this paper, our primary outcomes of interest were face mask wearing assessed via the following questions: (1) Is the

woman wearing a mask? and (2) How is the woman wearing the mask? The information on whether the woman was wearing a mask and how the woman wore the mask were both collected by direct observation during the interview of the woman by the data collector. A binary (ie, yes or no) categorisation was used to assess whether each woman wore a mask, while how they wore the mask was classified according to the following categories: covering mouth and nose, covering only the mouth or covering neither the mouth nor nose.

Data processing and management
Women were classified as wearing their mask correctly if the mask covered both their mouth and nose. Participants were classified as wearing their masks incorrectly if the mask covered only their mouth, or neither their mouth nor their nose.

A woman was considered as having experienced COVID-19-like symptoms if she reported experiencing at least one of the following symptoms in the 6 months preceding the survey: fever >38°C, subjective fever (felt feverish, unconfirmed), chills, muscle aches (myalgia), non-allergic runny nose (rhinorrhea), sore throat, cough (new onset or worsening of chronic cough), shortness of breath (dyspnoea), nausea or vomiting, headache, abdominal pain, diarrhoea (at least three loose/looser than normal stools per 24-hour period), loss of sense of taste, loss of sense of smell or abnormal or unexplained fatigue.

A woman was considered as having a pre-existing medical condition if she reported having at least one of the following conditions: asthma, emphysema, chronic obstructive pulmonary disease, other chronic lung disease, diabetes mellitus, cardiovascular disease, chronic renal disease, chronic liver disease, neurological/neurodevelopmental/intellectual disability, hypertension, active cancer, autoimmune disease or other immunocompromised condition. Each condition was explicitly defined and explained to the women by the interviewer for consistency purposes.

Evidence of BCG vaccination was assessed either by direct observation of the women's forearm to check for a scar or through self-report of previous vaccination.

Data analysis
Basic demographic information on pregnant women was tabulated; means with standard deviations (SDs) were estimated for continuous variables while proportions were provided for categorical variables. We estimated the proportion of pregnant women wearing a face mask and the proportion of those wearing a face mask correctly among those wearing a mask. Next, we performed two multivariable logistic regression models to produce adjusted odds ratios (ORs) with associated 95% confidence intervals (CIs). In both models, within-facility clustering was adjusted for using a robust estimate of variance. The first multivariable model aimed to identify factors associated with correct face mask wearing among those

Table 2 Awareness of the COVID-19 outbreak and COVID-19 presence/transmission in Kinshasa, by health facility

Health facility	Total Frequency	Aware of the COVID-19 outbreak		Believe COVID-19 exists in Kinshasa*	
		Frequency	Percentage	Frequency	Percentage
Bomoi Health Center	296	275	92.9	185	67.3
Bondeko Health Center	138	138	100.0	127	92.0
Esengo Hospital	91	86	94.5	15	17.4
Lisanga Health Center	88	88	100.0	47	53.4
Siloe Health Center	87	87	100.0	64	73.6
Mokali Hospital	79	79	100.0	65	82.3
Saint Joseph Hospital	64	64	100.0	43	67.2
Ngaliema Clinic	62	62	100.0	44	70.9
Kinshasa Provincial General Referral Hospital	22	22	100.0	16	72.7
Bosembo Health Center	7	7	100.0	5	71.4
Total	934	908	97.2	611	67.3

*Only asked of those aware of COVID-19.

wearing a mask. Independent predictors were selected through a backward stepwise approach, and a final model included the variables with the lowest penalised-likelihood as assessed by Akaike information criterion. Using the same variables included in the first model, we performed a second logistic regression to identify factors associated with face mask wearing within the full sample. In both models, we checked multicollinearity among independent variables by estimating the variance inflation factor (VIF). All VIF values were less than 10, thereby indicating that there was no multicollinearity present. A p value less than 0.05 was considered statistically significant. Data were analysed using Stata software V.14.1.

Patient and public involvement

Study participants were not involved in the design, recruitment, or implementation of this study. There are no direct plans to disseminate the results to study participants. However, the results of this study were disseminated within each participating health facility. We have also shared the results during a large dissemination workshop that included stakeholders in charge of

Table 3 Source of participants' first exposure to information regarding COVID-19

Source of information	Frequency*	Percentage
Television	629	69.3
Friend	122	13.4
Internet	43	4.7
Community/health worker	42	4.6
Radio	41	4.5
Other	31	3.4

*Subset among the 908 women who were aware of the COVID-19 outbreak.

maternal healthcare within the DRC Ministry of Health, the Expanded Programme for Immunisation, and participating health facilities.

RESULTS

Of the 934 women included for analysis, the average age at the time of the study was 30.5 years of age (SD=10.6). Approximately one-third of participants were enrolled in Bomoi Health Center. Almost all women had not travelled in the 6 months preceding the study (table 1).

Almost all women were aware of the COVID-19 outbreak (97.2%), although only 67.3% of them thought that COVID-19 was circulating in Kinshasa, ranging from 17.4% in Esengo Health Center to 92.0% in Bondeko Health Center (table 2).

Among women who were aware of the outbreak, 629 (69.3%) first heard about the COVID-19 pandemic from television (table 3). The majority of pregnant women in this study had received a BCG vaccine as evidenced through a scar on their forearm (75.1%) or through self-report (17.0%). About 9.0% of women indicated having a pre-existing medical condition, and less than one-third (26.7%) had experienced COVID-19-like symptoms in the past 6 months. Among those who had experienced symptoms, seven (2.8%) felt that their symptoms were severe. Nineteen women (2.1%) had been tested for COVID-19, all of whom returned a negative result (table 4).

Overall, 309 women (33.1%) wore a face mask, ranging from no women masking in Esengo Hospital and Bosembo Health Center, to 86.1% of women masking in Mokali Hospital. Among women wearing a mask at all, 10.7% wore their face mask correctly across all study sites, ranging from no women masking correctly in Lisanga Health Center and the KPGRH, to 40.0% masking correctly at Bondeko Health Center. The proportion of

Table 4 Clinical characteristics of interviewed pregnant women attending antenatal care in ten health facilities sampled in Kinshasa

	Frequency	Percentage
Ever received BCG vaccine (n=934)		
Yes, viewed scar on forearm	701	75.1
Yes, from recall only	159	17.0
No	45	4.8
Missing	29	3.1
Pre-existing medical conditions (n=934)		
No	853	91.3
Yes	81	8.7
Experienced COVID-19-like symptoms (n=934)		
No	685	73.3
Yes	249	26.7
Severity of symptoms (n=249)*		
Mild	161	64.7
Moderate	81	32.5
Severe	7	2.8
Ever been tested for COVID-19 (n=908)†		
No	889	97.9
Yes	19	2.1
Tested positive (n=19)‡		
No	19	100.0
Yes	0	0.0
Suspect prior COVID-19 infection (n=19)‡		
No	19	100.0
Yes	0	0.0
Household member diagnosed with COVID-19 (n=908)†		
No	904	99.6
Yes	4	0.4
Household member experienced COVID-19-like symptoms (n=908)†		
No	906	99.8
Yes	2	0.2

*Only calculated among women who experienced COVID-19-like symptoms.
†Subset among the 908 women who were aware of the COVID-19 outbreak.
‡Only calculated among women who had ever been tested for COVID-19.
BCG, Bacille Calmette-Guerin.

women wearing a face mask (65.5% vs 27.0%; p<0.001), and the proportion of women wearing their mask correctly (23.7% vs 4.7%; p<0.001) were significantly higher among women who had their ANC visit in a facility that provided COVID-19 care than among their counterparts, respectively (table 5).

After controlling for confounding factors through multivariable regression analysis, the odds of both face mask use and correct face mask wearing remained significantly higher among women who had their ANC visit in a facility that provided COVID-19 care than among those visiting non-COVID-19 care facilities. In addition, women who experienced COVID-19-like symptoms in the past 6 months had higher odds of wearing a mask correctly than women who did not experience such symptoms (table 6).

DISCUSSION

This study examined adherence to face mask wearing for the prevention of COVID-19 among pregnant women attending ANC facilities in Kinshasa, DRC. We observed poor adherence to both overall masking as well as correct face mask use among pregnant women seeking ANC in Kinshasa. Adherence to mask wearing during the interview after delivery was much lower among recently delivered women, as only 19 (0.86%) used a mask during the survey (data not shown).

The prevalence of face mask wearing in our study is lower than that reported in Ethiopia (88.1%) and in Uganda (60.3%),[26 27] but higher than the prevalence reported in Ghana (18.0%).[28] Variability between masking may stem from the fact that face mask use in the Ghanaian, Ugandan and Ethiopian studies was assessed by women's self-report rather than direct observation, resulting in potential underestimation or overestimation of the true prevalence. In addition, the estimates from Ghana excluded women who stated that they wear a mask less frequently, which may have contributed to selection bias and limited the generalisability of those findings.[28]

Although the reasons for poor adherence to correct masking were not investigated in our study, we speculate that women's inexperience with masking procedures likely played a role. Moreover, the failure to adequately educate pregnant women on the part of ANC providers may also contribute to poor knowledge of mask wearing as a non-pharmaceutical measure and thus incorrect face mask placement.[28 29] Pregnant women might have also felt uncomfortable with a mask that covers both the nose and mouth at the same time[30 31]; future studies in this area should thus investigate factors related to the potential effect of this discomfort on the ability to mask properly.

In Kinshasa, the government had formerly made it compulsory to wear a face mask, with fines imposed on noncompliant people; however, enforcement has been variable with little evidence of how mandates have been officially or consistently implemented. Currently, mask wearing compliance in public is still officially mandatory in Kinshasa, but the enforcement by the police has been lifted, which could thereby make the population inadvertently assume that the importance of preventive strategies for COVID-19 has diminished. We found disparities in face mask wearing between health facilities ranging from no women in Esengo Hospital and Bosembo Health

Table 5 Percentage of women wearing a mask and masking correctly

	Total	Wearing a mask			Masking correctly*		
	n	n	%	P value	n	%	P value
Health facility				<0.001			<0.001
Bomoi Health Center	296	110	37.2		1	0.9	
Bondeko Health Center	138	5	3.6		2	40.0	
Esengo Hospital	91	0	0.0		NA	NA	
Lisanga Health Center	88	3	3.4		0	0.0	
Siloe Health Center	87	26	29.9		3	11.5	
Mokali Hospital	79	68	86.1		4	5.9	
Saint Joseph Hospital	64	48	75.0		9	18.8	
Ngaliema Clinic	62	45	72.6		14	31.1	
Kinshasa Provincial General Referral Hospital	22	4	18.2		0	0.0	
Bosembo Health Center	7	0	0.0		NA	NA	
Total	934	309	33.1		33	10.7	
ANC in COVID-19 care facility				<0.001			<0.001
No	786	212	27.0		10	4.7	
Yes	148	97	65.5		23	23.7	
Thinks COVID-19 exists in Kinshasa				0.03			0.01
No	297	86	29.0		3	3.5	
Yes	611	221	36.2		30	13.6	
Experienced COVID-19-like symptoms				<0.001			0.094
No	685	249	36.4		23	9.2	
Yes	249	60	24.1		10	16.7	
Pre-existing medical conditions				0.77			0.60
No	853	281	32.9		30	10.7	
Yes	81	28	34.6		3	10.7	

P values determined using Wald X^2 tests of proportions.
*Only assessed among those women who wore a mask.
ANC, antenatal care; NA, not available.

Center to 86.1% in Mokali Hospital, suggesting that education of patient populations and implementation of masking policies vary widely across antenatal clinics and maternity wards around the province. Our findings highlight the need for health facilities to reinforce mask mandates and the need for standardised masking policy implementation and enforcement across the province.

Studies of adherence to preventive measures of COVID-19 among pregnant women scarcely focus on the correct use of face masks. To be protective against COVID-19 infection, masks should be worn so that they fully cover both the nose and the mouth.[4] Worryingly, only about 11.0% of pregnant women wearing a mask in our study did so correctly while attending ANC services. Incorrect face mask use may actually increase exposures to SARS-CoV-2 since women may inadvertently feel they are protected from transmission and engage in high-risk behaviours due to this perceived protection, despite limited protection from improper face coverage.[32 33]

Although almost all women interviewed believe that the COVID-19 outbreak exists in DRC, a substantial number of them still did not believe the outbreak impacted the Kinshasa region. For instance, only 17.4% of women in Esengo Hospital thought that a COVID-19 outbreak existed in Kinshasa, even though 94.5% believed that the outbreak existed in DRC. This discrepancy highlights the low level of sensitisation to the risk of SARS-CoV-2 infection among pregnant women, mainly in periurban settings such as Esengo Hospital. Furthermore, the low reported prevalence of COVID-19 in Kinshasa, coupled with the low proportion of women reporting a household member diagnosed with COVID-19, may have reinforced doubts regarding the existence and sustained transmission of the disease in Kinshasa. Relaxation of control strategies enforcing compliance to COVID-19 preventive strategies by the police may have also led people to think that COVID-19 no longer posed a public health threat in Kinshasa after the deconfinement by July 2020.

Table 6 Factors associated with general face mask use and correct mask use among pregnant women in Kinshasa

	Wearing a mask (n=908)		Correct masking (n=309)	
	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
ANC received in COVID-19 care facility		0.011		<0.01
No	1		1	
Yes	5.0 (1.46 to 17.18)		6.7 (2.51 to 18.12)	
Thinks COVID-19 exists in Kinshasa		0.40		0.65
No	1		1	
Yes	1.4 (0.63 to 3.13)		5.1 (0.90 to 28.90)	
Experienced COVID-19-like symptoms		0.11		0.045
No	1		1	
Yes	0.5 (0.24 to 1.16)		2.0 (1.02 to 3.85)	
Pre-existing medical conditions		0.44		0.95
No	1		1	
Yes	1.3 (0.68 to 2.42)		1.1 (0.18 to 6.47)	

ANC, antenatal care; CI, confidence interval; OR, odds ratio.

When accessing ANC services in Kinshasa, pregnant women are expected to attend group sessions of health education before being consulted individually by a healthcare provider.[34] These group sessions often take place without physical distancing measures. In such settings, high compliance to correct face mask wearing is of utmost importance to protect healthy pregnant women and healthcare providers from prenatal patients that may be infected but are asymptomatic.[35–37] However, this study was unable to assess if adherence during these meetings was increased in comparison to during the interviews.

Although all groups examined here displayed poor adherence to correct use of face masks, women attending a facility with a COVID-19 treatment Center had higher odds of not only wearing a mask, but also of wearing it correctly compared with their counterparts. Healthcare providers in facilities with a COVID-19 treatment Center may have been exposed to more training on the prevention of the disease and may have provided more education to women regarding the prevention of COVID-19, including on correct mask usage. In addition, infographics on correct face mask use and/or guards at the entrance of these facilities may have reminded or asked women to wear a mask before entering the facility. These factors may have resulted in improved mask wearing among pregnant women in these facilities.

Women who had experienced COVID-19-like symptoms within the past 6 months had higher odds of wearing a mask correctly than those who had not. One possible explanation is that women who experienced COVID-19-like symptoms may have received more information about the disease and its prevention strategies (including correct face mask wearing). Furthermore, these women may have also felt more vulnerable to the disease and thus been more likely to avoid risky behaviours than women who had not experienced COVID-19-like symptoms.

Our study shows the need for improving the adherence to correct masking procedures among pregnant women attending ANC services in Kinshasa and within the general population. Health education during ANC visits, sensitisation through mass media (such as television or radio), and the deployment of community health workers should be used to educate pregnant women on the importance of the correct use of face masks and other preventive practices such as hand washing, social distancing and vaccination to prevent SARS-CoV-2 infection.

To the best of our knowledge, this is the first study in DRC that explores the adherence to correct face mask wearing among pregnant women. Nonetheless, the study has a number of limitations. First, as face mask wearing was assessed by direct observation during the interview only, pregnant women might have made an extra effort to appear compliant to face mask guidance due to social desirability or alternatively might have only worn a mask when with a healthcare provider but not while waiting for care. We attempted to mitigate this social desirability bias by not informing the women that they were being observed. Second, we were not able to assess the reasons behind mask wearing adherence. Third, these results only apply to pregnant women in health facilities and cannot necessarily be extrapolated to their behaviour outside of the health facilities or the general populations behaviours. Fourth, important covariate information, such as socioeconomic status and education level, were not collected as a part of the main study, thereby potentially resulting in some uncontrolled confounding. Fifth, most predictor variables were captured via self-report, therefore increasing the likelihood of measurement errors.

CONCLUSION

Despite the fact that virtually all women in the study were aware of the COVID-19 outbreak and that more than half of them believed that COVID-19 was circulating in Kinshasa, we found that overall and correct face mask adherence levels were low among pregnant women attending ANC in Kinshasa. Future studies in this area should employ qualitative methods to better understand the reasons behind this low adherence so that health education campaigns regarding the importance of face masks can be properly developed. Despite a slow increase in the vaccination rate in DRC, vaccines do not provide absolute protection against COVID-19; our study thus highlights the need for improving adherence to correct face mask use in order to help control the spread of COVID-19 within Kinshasa and complement other public health control measures.

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