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Influence of the level of education on women's knowledge, attitude, and practices to control the transmission of COVID-19 in the Democratic Republic of the Congo

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ABSTRACT

Adequate knowledge, attitude, and practices (KAP) towards the novel coronavirus (COVID-19) can reduce its spread and may also be useful in preventing and controlling the transmission of severe acute respiratory syndrome coronavirus 2 (ARS-CoV-2) in the community. This study examines the influence of women's education level on COVID-19 KAP behaviour in the Democratic Republic of the Congo (DRC). This study uses COVID-19 data obtained from the Performance Monitoring for Action (PMA) in Kinshasa, the DRC's capital city. Data were collected through telephone interviews held in June 2020 with a representative sample of 1773 women aged 15–49 years. Data were then analysed using multiple probit regression and marginal effects techniques. To address possible sample selection bias due to the use of a telephone to recruit participants, the data were adjusted to account for the selectivity due to telephone number ownership through inverse probability weighting. In general, the results of this study indicate no statistically significant difference in the influence of the level of education on women's KAP to control the transmission of COVID-19 in the DRC, women with higher levels of education are not found to always exhibit improved knowledge, attitude, or practices of appropriate strategies for the prevention and control of COVID-19 in the DRC. The results also indicate that education can have both positive and negative influences in alleviating the burden of COVID-19.

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Introduction

On 31 December 2019, the World Health Organization (WHO) reported several cases of pneumonia in Wuhan, Hubei Province, China. The virus was identified in January 2020 as a new coronavirus, SARS-CoV-2, and the subsequent disease is commonly referred to as coronavirus disease COVID-19. On 30 January 2020, WHO declared the outbreak a public health emergency of international concern, and the outbreak reached the status of a pandemic in March 2020. In the same month, the Democratic Republic of the Congo (DRC) confirmed its first known COVID-19 case, a Congolese national who had spent time in France. The DRC government established a response coordination structure to: (1) strengthen the traceability of the

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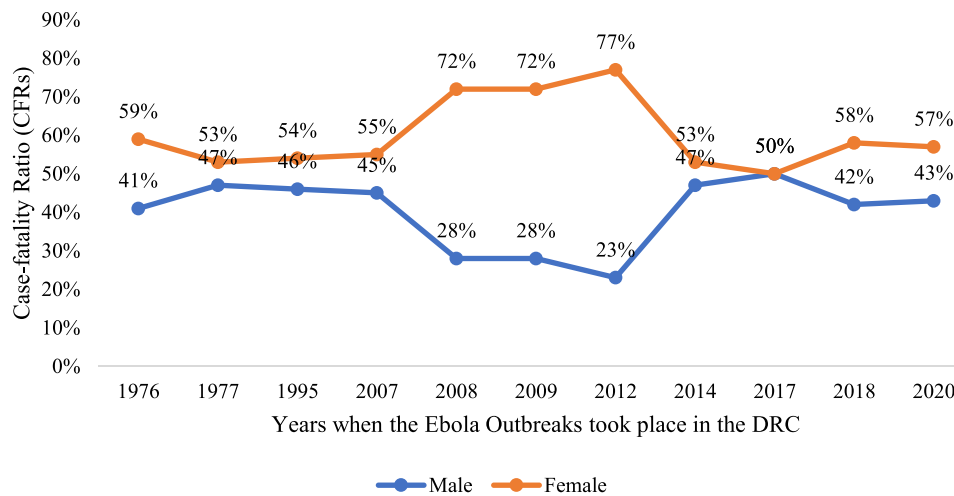


Fig. 1. Case-fatality ratios (CFRs) of Ebola outbreaks in the DRC by gender.
Source: Created by the authors based on Rosello et al. [23] and WHO (2021).

chains of contamination; (2) support screening; (3) manage medical cases; (4) prevent future cases; (5) control the infection in health facilities; (6) organise quarantine systems; and (7) spread information to inculcate lower-risk behaviours. Other measures taken by the DRC government to avoid the spread of COVID-19 included mandating the wearing of facemasks in public, the prohibition of meetings of more than ten people, and implementing social distancing measures. Despite these measures to prevent the spread of COVID-19, when this article was drafted, more than 54,009 people had already been infected, of whom 1053 had lost their lives. Given the low rate of COVID-19 testing, a widely held view among medical specialists is that all 26 provinces in the country are currently affected. Against this background, this study examines how the level of women's education influences their knowledge, attitudes, and practices (KAP) to control the transmission of COVID-19 in the Democratic Republic of the Congo. The remainder of this paper is organised as follows. In section 2, we contextualise the information about COVID-19 and discuss how the previous major health crises disproportionately impacted women in the country. We also present a literature review of KAP and COVID-19 to identify knowledge gaps and explain how this study contributes to that knowledge. In Section 3, we introduce the methodology and data used throughout the paper to illustrate the different statistical approaches to measure KAP towards COVID-19. Section 4 presents the main findings of this study, and Section 5 provides a detailed discussion of our findings. Finally, Section 6 concludes the paper.

Context of the study

Level of women's education in the context of COVID-19 and previous infectious disease outbreaks in the DRC

Previous infectious disease outbreaks in the DRC have revealed a low level of education and poor KAP for infectious diseases, including cholera, Ebola, polio, and measles [3]. For instance, in 2018, the country recorded its 10th epidemic of Ebola in its eastern region, where as in June 2020, the 11th epidemic of Ebola was confirmed in its northwest region. In fact, the DRC is the home of the Ebola virus, which was discovered in 1976 and named after the river Ebola, close to the source of the outbreak in the country, then known as Zaire. According to Nkangu et al. [18], in the last three decades since the first reported case of the Ebola virus [29], women have consistently recorded relatively high fatality rates (see Fig. 1).

This poor KAP may indicate that the prevention and control of the spread of COVID-19 may pose significant challenges in the DRC. Specifically, women in the DRC are at a higher risk of exposure to the disease due to their education level. Despite the findings of some of the studies, such as that of Pradhan and Olsson [21], the severity and mortality of COVID-19 are higher in men than in women [13,15]. In the DRC, the combined effect of a lack of institutional capability and inadequate investment in the education sector has kept the education level of women low. For instance, the educational participation of girls is still low in the country despite the significant progress in the expansion of the education sector in recent years, such as a substantial increase in the completion rate of primary-level education from 29% in 2002 to 70% in 2014. UNESCO [31] estimated that 31% of the girls living in the DRC do not attend primary school. In addition, while one of every three adults in the country (32%) could not read or write, 41% of the women could not. Accordingly, although the high health returns from investing in women's education are indisputable, the DRC has much to do to ensure these benefits. This is particularly alarming considering that extensive research has shown that educated mothers are more likely than uneducated mothers to take advantage of modern medicine and comply with recommended treatments [1,28]. Moreover, education may help increase knowledge and create a positive attitude among mothers regarding the cause, prevention, and management of diseases [8,17].

Literature review

Evidence suggests that increasing people's educational attainment may improve their KAP towards diseases and their control over them [8]. Furthermore, it enhances several interventions to reduce the disease burden and promote the health of the general population [8]. Women lack of education can, for example, reduce their ability to find, understand, and use health information [11,24]. Thus, education is an important determinant of women's health status in both developed and developing societies. In this regard, recent trends in the global spread of COVID-19 have heightened the need to investigate the influence of women's education level on KAP to control the transmission of the disease. Researchers have established that education is strongly linked to health [7] and helps promote and sustain healthy lifestyles and positive choices [30]. Raghupathi and Raghupathi [22] argued that adults with higher educational attainment have better health and longer lifespans than their less-educated peers. However, the relationship between an individual's education level and their KAP to control the transmission of COVID-19 remains unclear.

Studies conducted over the past few months have provided insightful information. For instance, in a study of the gender differences in COVID-19 knowledge among young adults in India, Pinchoff et al. [19] reported that women are less likely to correctly identify all the major COVID-19 symptoms, are less likely to engage in the most effective COVID-19 prevention behaviours and are more likely to report depressive symptoms. The study suggests that disparities in the knowledge of key COVID-19 symptoms between men and women are likely due to young women's lower educational attainment, lower media exposure, and lower access to mobile phones. The findings also indicate a significant difference between the characteristics of women with and without COVID-19 knowledge and the practice of best behaviour, including greater educational attainment, urban residence [5], and higher economic status. These factors most likely reflect increased literacy and access to information among young women.

Similarly, Anwar et al. [3] found younger, more-educated women to have a higher KAP towards COVID-19 than older, less-educated women in Bangladesh. They state that marginalised groups, such as females, in the lower-middle-income countries have poor awareness of health-related issues. Women face health-related marginalisation owing to the scarcity of resources pertaining to health care and literacy. Consequently, they exhibit a negative attitude towards and perception of health issues. Two other studies, Anikwe et al. [2] in Nigeria and Lee et al. [16] in Singapore, have shown that women's education levels are insufficient to facilitate adherence to the recommended KAP to reduce the transmission rates of COVID-19. Similarly, studies in Bangladesh [4,10] and Mexico [14] have found that the population associated with more positive KAP, such as social distancing, staying at home, and wearing a facemask, to have higher levels of education.

Despite extensive research on women's educational attainment and their KAP toward COVID-19, evidence regarding this relationship continues to be conflicting, inconclusive, or uncertain [2]. For instance, most studies examining women's KAP regarding the control of COVID-19 do not include education as a variable of interest. This is evident in the work of Ferdous et al. [10], Banik et al. [4], and Ding et al. [9], who ignored the social context in which the level of education can directly or indirectly influence KAP toward the control of COVID-19. Additionally, since a number of studies of the KAP related to COVID-19 used data collected via online forms, e-mails, or telephones, there have been no controlled studies using inverse probability weighting to account for the possible sample selection bias associated with the use of online services or telephones to recruit participants. Thus, this study will advance our understanding of the relationship between women's educational attainment and their KAP towards the control of COVID-19 by utilising data adjusted for selectivity due to telephone ownership via an inverse probability weighting approach. Moreover, this research will add to the body of knowledge on the impact of women's educational attainment and caregiver roles in households and communities affected by COVID-19. Furthermore, the findings will shed new light on whether women's educational attainment truly matters in reducing the risk of exposure to COVID-19.

Methodology

Conceptual framework

The conceptual framework of this study is based on the arguments developed by Feinstein et al. [12], Nkangu et al. [18], and Connor et al. [6] on gender roles and their impact on the exposure of women to COVID-19 and the disease risks in Africa. In fact, COVID-19 is thought to spread mainly from one person to another via close contact; thus, the best way to avoid infection is to avoid close contact with other people. In the African context, however, women are required to fulfil their gendered social roles and responsibilities, most of which require close and prolonged contact with their family members, communities, and support networks, increasing their chances of exposure to the virus. Following Nkangu et al. [18], this study employed the population health risk management framework to characterise risk. This framework illustrates how a population's health improves through various interventions carried out via the modification of health determinants and interactions between them, while the risk management component shows how to avoid risk by mitigating exposure to individual risk factors that can cause harmful health outcomes. Similar to Nkangu et al. [18], this study also used the risk assessment component of the framework to explore the reported risk factors for COVID-19 and inform risk management and planning. Thus, we specifically emphasise the influence of the level of education of women on their knowledge, attitudes, and practices to control the risk associated with the transmission of COVID-19 in the DRC.

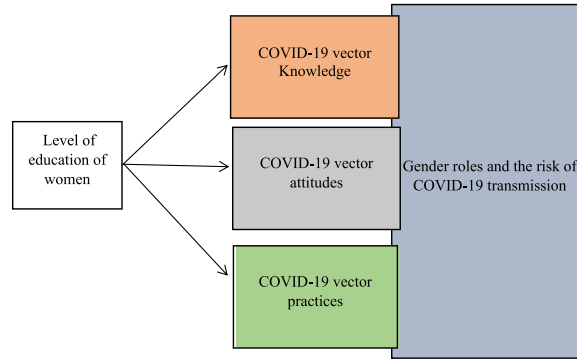


Fig. 2. Model of the influence of the level of education of women on their KAP.

Source: Created by the authors based on Feinstein et al. [12], Nkangu et al. [18], and Connor et al. [6].

As illustrated in Fig. 2, this study aimed to determine the effect of women's educational attainment on their KAP toward COVID-19. To accomplish this, we identify two key variables: the level of education of women, which serves as a predictor variable, and the vector variables of KAP, which serve as our response variables. In other words, the DRC women's KAP toward COVID-19 is contingent on their education level. Our hypothesis was that as a woman's education level increases, her KAP toward COVID-19 will become more favourable. To confirm the above relationship (Fig. 2), we considered additional variables that may affect women's KAP toward COVID-19, such as age, residence location, and marital status. These control variables were held constant to avoid confounding the results.

Hypothesis

The study hypothesises that the level of education of women will influence their knowledge, attitudes, and practices regarding COVID-19 transmission risk prevention in the DRC.

Empirical models

In this study, the response variables of interest, mainly KAP, were distinct binary response vector variables (see Table 1). This study subsequently uses binary response models, specifically multiple probit models and marginal effects techniques, to determine whether differences in the level of education of women are associated with changes in the response vector variables. The empirical model is as follows:

$$p(x) \equiv P(y = 1|x) = P(y = 1|x_1, x_2, \dots, x_k) \quad (1)$$

$$\Pr(y = 1) = \int_{-\infty}^x \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} d(\text{probit})x \quad (2)$$

$$\frac{\partial \Pr(y = 1)}{\partial x_k} = \phi(x\beta) \beta_k (\text{average marginal effects}) \quad (3)$$

$$\text{Let } K = (K_1, K_2, \dots, K_n)^T, A = (A_1, A_2, \dots, A_n)^T, \text{ and } P = (P_1, P_2, \dots, P_n)^T \quad (4)$$

Let Z variables in $Z \times n$ matrix X be independent variables:

$$K_i = \beta_0 + \beta_1 \text{educ}_i + \beta_2 X_i + \varepsilon_i \quad (5)$$

$$A_i = \beta_0 + \beta_1 \text{educ}_i + \beta_2 X_i + \varepsilon_i \quad (6)$$

$$P_i = \beta_0 + \beta_1 \text{educ}_i + \beta_2 X_i + \varepsilon_i, \quad (7)$$

where K_i is the vector of knowledge, A_i is the vector of attitudes, P_i is the vector of practices, and educ_i is the level of education of women. X_i represents the vector of covariates for woman i .

Table 1

Summary of the statistics of the main variables used in the study.

Variables	Definition of variables	Obs.	Mean	SD	Min	Max
Response variables						
Knowledge related to COVID-19 (symptoms and mechanisms of transmission)						
some_immune	1 if believes some people are immune	1770	0.541	0.498	0	1
most_mild_symptoms	1 if believes most people have mild symptoms	1770	0.500	0.500	0	1
serious_illness	1 if believes most people develop serious illness requiring hospitalisation	1770	0.829	0.376	0	1
no_symptoms	1 if believes people can be infected and not have symptoms	1770	0.480	0.499	0	1
if_symptoms	1 if believes only people with symptoms are contagious	1770	0.702	0.458	0	1
by_handshake	1 if believes in the possibility of becoming infected by shaking hands with someone who is infected	1770	0.919	0.272	0	1
when_close	1 if believes in the possibility of becoming infected by close contact with infected people, even without touching	1770	0.874	0.331	0	1
all_ages	1 if believes people of all ages can become infected	1770	0.659	0.474	0	1
rich_people	1 if believes COVID-19 is mostly a risk to rich people	1770	0.141	0.347	0	1
Attitude towards COVID-19						
secret	1 if willing to keep it a secret if a family member has contracted COVID-19	1770	0.142	0.349	0	1
community_spread_concern	1 if concerned about the spread of COVID-19 in community	1770	0.549	0.498	0	1
self_covid_concern	1 if concerned about contracting COVID-19	1770	0.521	0.499	0	1
distance	1 if unable to practice social distance	1770	0.778	0.416	0	1
Practices to reduce the risk of being infected by COVID-19						
wash_hands	1 if washes hands	1770	0.916	0.276	0	1
sanitiser	1 if uses sanitiser	1770	0.916	0.278	0	1
distancing	1 if practices social distancing	1770	0.929	0.257	0	1
stay_home	1 if stays at home	1770	0.883	0.321	0	1
vaccination	1 if being vaccinated	1770	0.327	0.469	0	1
traditions	1 if using traditional practices	1770	0.473	0.499	0	1
wear_mask	1 if wearing a mask	1770	0.914	0.280	0	1
prayer	1 if practising prayer to prevent infection	1770	0.873	0.332	0	1
Control variables						
school						
Highest level of school attended						
never	1 if never attended school	1770	0.255	0.436	0	1
primary	1 if completed primary education	1770	0.023	0.149	0	1
secondary	1 if completed secondary education	1770	0.499	0.500	0	1
tertiary	1 if completed tertiary education	1770	0.223	0.416	0	1
Individual characteristics						
age	Individual's age	1770	31.21	7.299	15	49
marital_status						
liveman	1 if living with a man	1770	0.125	0.331	0	1
single	1 if single	1770	0.459	0.499	0	1
married	1 if married	1770	0.341	0.474	0	1
divorced	1 if divorced	1770	0.058	0.233	0	1
widow	1 if widowed	1770	0.0164	0.127	0	1

Source: Authors' estimation based on the PMA data (2020).

Data

The data used in this study were obtained from performance monitoring for action (PMA) data collected in Kinshasa, the capital city of the DRC. Data were collected in June 2020 in partnership with other actors, including the Congolese University School of Public Health, the Bill and Melinda Gates Institute for Population and Reproductive Health, the Johns Hopkins Bloomberg School of Public Health, and Jhpiego [27]. The survey questionnaire was administered via telephone interviews with a representative sample of 1773 women aged 15–49 years. The participants were recruited from another study that began in 2019 to evaluate women's knowledge, practices, and access to family planning services using a multi-stage stratified cluster design in Kinshasa as the baseline round. To address the possible sample selection bias due to the use of a telephone to recruit participants, the data were adjusted to account for selectivity using the inverse probability weighting approach [20,25,26]. The COVID-19 survey weights were generated using the log odds of owning a phone or having access to a phone, which was modelled as a linear combination of age, education, marital status, wealth, and residence at baseline. The inverse predicted probability of owning/having access to a phone was then used as a weight to adjust the initial phase 1 weight. Table 1 provides a detailed summary of the statistics for the main variables used in this study.

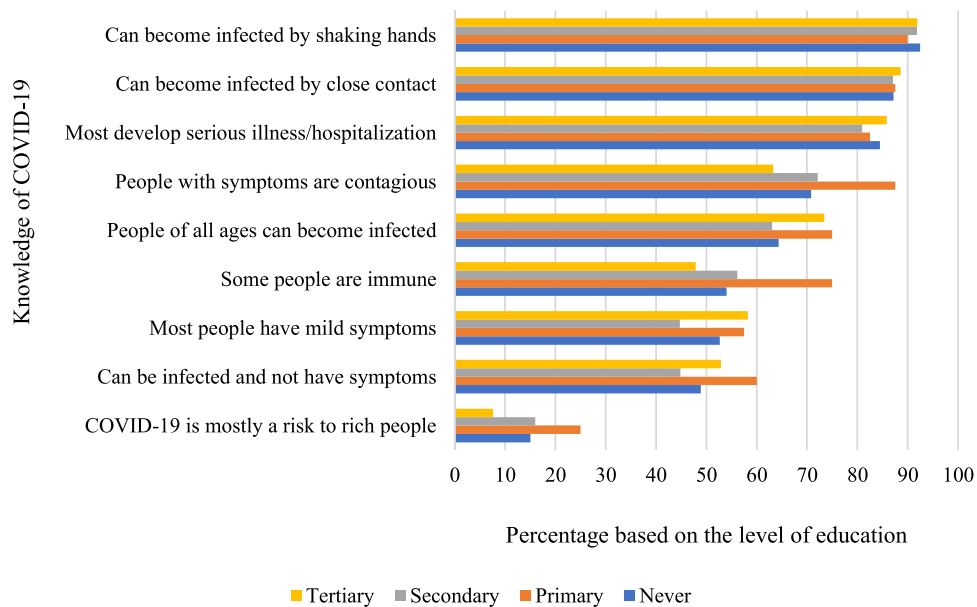


Fig. 3. Women's knowledge of COVID-19 by level of education.
Source: Created by the authors based on the PMA data (2020).

Women's knowledge of COVID-19 by level of education

To determine how the difference in the education level of women may influence their knowledge of COVID-19, we cross-tabulated education, which is a categorical variable, using the knowledge vector. Overall, a significant proportion of women with or without education were considered to have adequate knowledge of COVID-19, while several also had inadequate knowledge (Fig. 3).

For instance, 92.5% of women with no education believed that it is possible to contract COVID-19 by shaking hands with someone who is infected. There was no proportional difference as approximately 92% of those with tertiary education held the same opinion. Additionally, 87.2% of women with no education believed that being in close contact with infected people can cause infection even without touching them, and nearly 88.6% of those with tertiary education held the same opinion. Moreover, 84.5% of women with no education believed that most COVID-19 patients developed serious illness requiring hospitalisation, compared to 85.2% of those with tertiary education. 70.8% of women with no education believed that only people with symptoms were contagious and 63.3% of those with tertiary education held the same opinion. The same lack of proportional differences in education level can be found among women who believe that people of all ages can become infected with COVID-19, those who believe that some people cannot become infected with COVID-19, those who believe that most people experienced mild or no symptoms, those who believe that people can be infected and do not have symptoms, and those who believe that COVID-19 is primarily a risk for the wealthy. Contrary to expectations, the above descriptive statistics did not indicate any significant differences in the knowledge possessed by the proportion of women with no education and those with tertiary education.

Women's attitudes towards COVID-19 by level of education

With regard to women's attitudes toward COVID-19, Fig. 4 shows that 79.9% of the women with no education declared themselves unable to observe social distancing, versus 82% of those with tertiary education. Additionally, only 52% of the women sampled seemed concerned about the spread of COVID-19 in their community, and more worryingly, only 50% of those with tertiary education were so concerned. While 55% of the women with no education worried about contracting COVID-19, the rate was 57% for those with tertiary education. There would be significant risk if a large percentage of those who were unconcerned were to adopt a business-as-usual approach. What is especially troubling is that while 12% of the women with no education reported a desire to conceal if someone in their family contracted COVID-19, the same was the case for 19% of those with tertiary education. Women's attitudes present a risk of further spreading of the disease, which may have particularly serious consequences given women's social roles, the interconnectedness of their communities and support networks, and the family context in the DRC.

Women's practices towards COVID-19 by level of education

Regarding women's practices towards COVID-19, Fig. 5 presents the better and worse practices adopted to prevent and reduce the transmission of COVID-19. For example, 93% of the women with no education in the sample believed that washing hands frequently with hand sanitiser would prevent them from getting COVID-19, as did 95% of those with tertiary

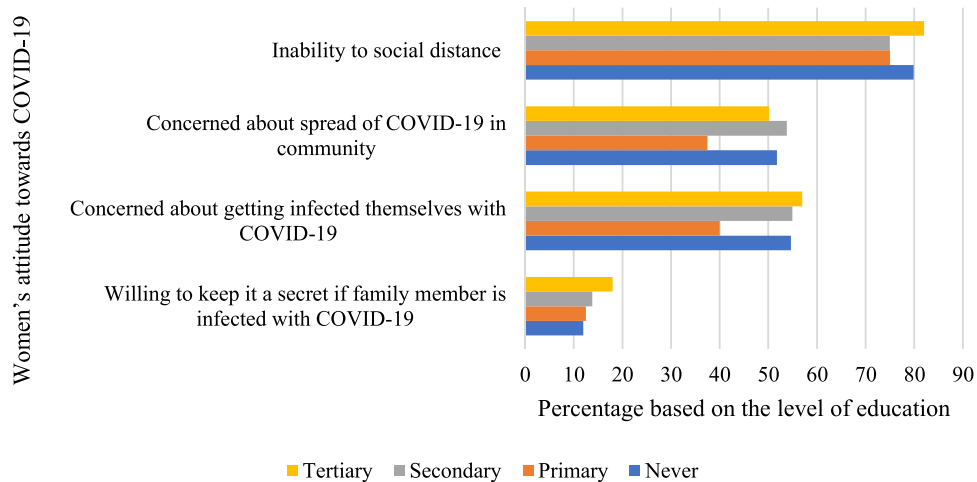


Fig. 4. Women's attitudes towards COVID-19 by level of education.
Source: Created by the authors based on the PMA data (2020).

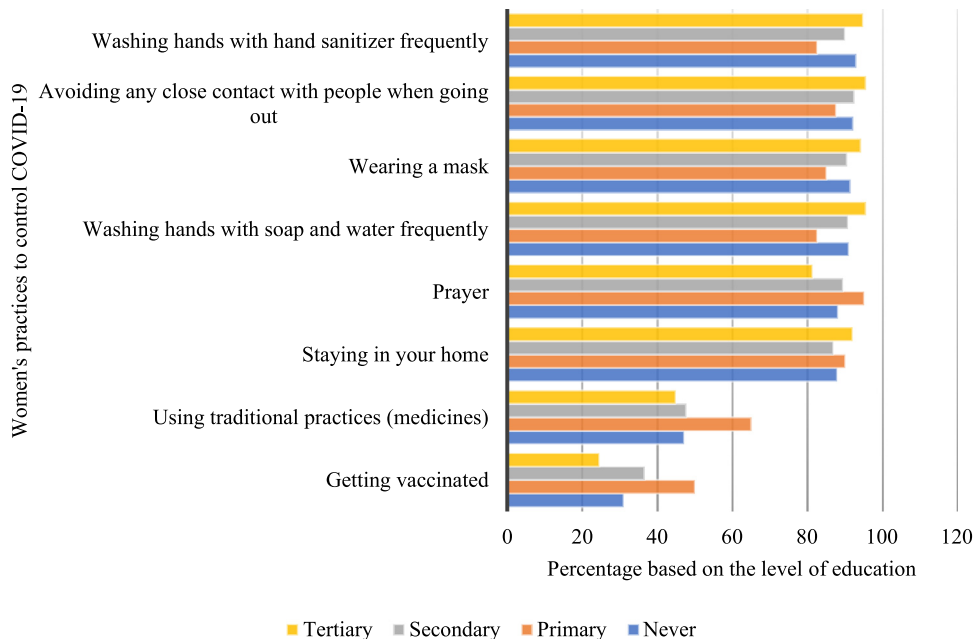


Fig. 5. Women's practices to control COVID-19 by level of education.
Source: Created by the authors based on the PMA data (2020).

education. While 92% of the women with no education sampled believed that avoiding close contact (staying more than 2 m away from people) when leaving the home would prevent them from getting COVID-19, the percentage of women with tertiary education holding the respective belief was 95.4%. Furthermore, there were no proportional differences in education level when it came to better and worse practices used to prevent and reduce COVID-19 transmission among women who believe that wearing something that covers their mouth and nose or a mask when going out will reduce their risk of contracting COVID-19; those who believe that frequent handwashing with soap and water will reduce their risk of infection to COVID-19; and those who believe that simple prayers, using traditional medicines or getting vaccines can reduce their risk of infection to COVID-19. What is particularly striking about these results is that even a higher level of education did not have affect participants' mistaken beliefs.

Results

Multiple probit regression analyses and marginal effects techniques were used to assess the influence of women's level of education on their KAP to control the transmission of COVID-19 in the DRC. In general, the results of this study showed

Table 2

Estimates for the influence of the level of education of women on their knowledge of COVID-19 in the DRC (all marginal effects).

	Knowledge of COVID-19								
	immune	mild symptoms	serious_illness	no_symptoms	if_symptoms	by_handshake	when_close	all_ages	rich_people
Primary	0.182* (0.0766)	0.0455 (0.0836)	−0.0217 (0.0669)	0.115 (0.0817)	0.175** (0.0555)	−0.0101 (0.0467)	0.00989 (0.0523)	0.133* (0.0660)	0.0723 (0.0649)
Secondary	0.0223 (0.0290)	−0.0741* (0.0290)	−0.0330 (0.0218)	−0.0396 (0.0291)	0.0161 (0.0267)	−0.00295 (0.0157)	−0.00180 (0.0190)	−0.00953 (0.0273)	0.00526 (0.0193)
Tertiary	−0.0548 (0.0347)	0.0521 (0.0347)	0.0109 (0.0262)	0.0313 (0.0348)	−0.0803* (0.0330)	−0.0127 (0.0200)	0.00939 (0.0225)	0.0813** (0.0314)	−0.0662** (0.0205)
Age	0.00185 (0.00208)	0.000483 (0.00209)	−0.00172 (0.00153)	0.000742 (0.00209)	−0.00126 (0.00190)	0.000611 (0.00111)	0.0000341 (0.00137)	−0.0000227 (0.00195)	−0.0000601 (0.00138)
Single	−0.00493 (0.0404)	0.0885* (0.0406)	0.0313 (0.0288)	0.0985* (0.0407)	0.0591 (0.0363)	0.0647*** (0.0186)	0.0329 (0.0255)	0.105** (0.0369)	−0.107*** (0.0239)
Married	−0.0132 (0.0403)	0.0914* (0.0404)	0.0384 (0.0275)	0.0850* (0.0405)	0.0517 (0.0353)	0.0676*** (0.0157)	0.0183 (0.0246)	0.0577 (0.0365)	−0.0881*** (0.0213)
Divorced	0.113 (0.0579)	0.131* (0.0580)	0.0599 (0.0352)	0.206*** (0.0557)	0.0987* (0.0470)	0.0440* (0.0178)	0.0641* (0.0275)	0.0438 (0.0536)	−0.0861*** (0.0220)
Widowed	0.178 (0.0925)	0.187* (0.0919)	0.0991* (0.0466)	0.0305 (0.102)	0.0803 (0.0817)	0.0457 (0.0278)	−0.0491 (0.0738)	−0.0413 (0.0970)	−0.0440 (0.0467)
N	1770	1770	1770	1770	1770	1770	1770	1770	1770

Source: Authors' estimation based on the PMA data (2020).

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

no significant difference in women's KAP toward COVID-19 with regard to their level of education in the DRC at a 1% significance level.

Regarding knowledge, Table 2 illustrates the main results for the influence of women's level of education on their knowledge of COVID-19 in the DRC, taking individuals with no education as the reference group. It is apparent from this table that the scale of knowledge of COVID-19 does not vary greatly with the level of education of women in the DRC.

For instance, having a primary education increases the probability of women believing that some people cannot be infected with COVID-19 by 18.2 percentage points. It also increases the probability of believing that only those with symptoms of COVID-19 can be contagious by 17.5 percentage points. Moreover, it increases the probability of believing that people of all ages can become infected with COVID-19 by 13.3 percentage points. Having a secondary education decreases the probability of women believing that most people experience mild or no symptoms by 7.41 percentage points. Finally, having a tertiary education decreases the probability of women believing that only those with symptoms are contagious by 8.03 percentage points. However, it increases their probability of believing that people of all ages can become infected with COVID-19 by 8.13 percentage points and decreases their probability of believing that COVID-19 is mostly a risk to the rich by 6.62 percentage points.

On the question of women's attitudes, the marginal effects analysis was used to estimate the influence of the level of education of women on their attitudes towards COVID-19 in the DRC, as shown in Table 3. In general, no significant difference was evident in the women's attitudes related to their level of education at a significance level of 1%. However, having tertiary education increases women's probability of desiring to conceal if a family member gets infected with COVID-19 by 5.84 percentage points.

Regarding COVID-19 prevention practices, Table 4 shows that the level of education of women did not appear to affect their practices at a 1% level of significance. It further showed that having a primary and secondary education increased the probability of women receiving vaccines by 25.4 percentage points and 5.73 percentage points, respectively, and having a tertiary education decreased the probability of women receiving vaccines by 8.23 percentage points. Additionally, it showed tertiary education increases the probability of women frequently washing their hands with soap and water to reduce the risk of infection by 4.43 percentage points. However, the probability of practising prayer to reduce the risk of COVID-19 infection decreased by 6.43 percentage points.

Discussion

Prior studies that have noted the importance of women's level of education on health have shown that education may help increase knowledge and create a positive attitude among mothers regarding the cause, prevention, and management of diseases [8,17]. Additionally, a strong relationship between mothers' level of education and health has been reported in the literature. For instance, Andriano and Monden [1] and Vikram and Vanneman [28] have argued that educated mothers are more likely than uneducated mothers to take advantage of modern medicine and comply with the recommended treatments.

With respect to the aim of this study, if it is well established that COVID-19 can easily spread through close contact from person to person and that education can help mitigate the effects of the diseases through health behaviours, risky contexts, and preventive service use, the evidence of the relationship between the level of education of women and their

Table 3

Estimates of influence of women's level of education on their attitudes towards COVID-19 (all marginal effects).

	Women's attitude towards COVID-19			
	secret	com_concerned	self_concerned	able_to_distance
Primary	0.000687 (0.0602)	−0.130 (0.0826)	−0.124 (0.0822)	−0.0413 (0.0738)
Secondary	0.0178 (0.0208)	0.00415 (0.0290)	0.0248 (0.0291)	−0.0431 (0.0241)
Tertiary	0.0584* (0.0272)	0.0111 (0.0345)	−0.0283 (0.0347)	0.0171 (0.0290)
Age	−0.00342* (0.00149)	−0.00308 (0.00207)	−0.00214 (0.00208)	−0.00435* (0.00172)
Single	−0.0116 (0.0288)	0.0711 (0.0400)	0.109** (0.0401)	0.0428 (0.0320)
Married	0.0262 (0.0299)	0.0894* (0.0394)	0.106** (0.0398)	0.0761* (0.0299)
Divorced	0.126* (0.0563)	0.145** (0.0547)	0.134* (0.0568)	0.00812 (0.0465)
Widow	0.0115 (0.0793)	0.0206 (0.0995)	0.0928 (0.0963)	0.165*** (0.0396)
N	1770	1770	1770	1770

Source: Authors' estimation based on the PMA data (2020).

Table 4

Estimates of the influence of women's level of education on their practices to control the transmission of COVID-19 (all marginal effects).

	Practices to control the transmission of COVID-19							
	wash_hands	sanitiser	distance	stay_home	vaccine	tradition	wear_mask	pray
Primary	−0.0691 (0.0576)	−0.0819 (0.0610)	−0.0119 (0.0399)	0.0382 (0.0414)	0.254** (0.0847)	0.152 (0.0821)	−0.0437 (0.0529)	0.0706 (0.0393)
Secondary	−0.00245 (0.0151)	−0.0300 (0.0159)	0.00323 (0.0139)	−0.00400 (0.0178)	0.0573* (0.0272)	0.00707 (0.0291)	−0.00860 (0.0156)	0.0132 (0.0195)
Tertiary	0.0443** (0.0154)	0.0110 (0.0194)	0.0233 (0.0154)	0.0333 (0.0199)	−0.0823** (0.0311)	−0.0150 (0.0347)	0.0229 (0.0176)	−0.0643* (0.0258)
Age	0.000251 (0.00116)	−0.000506 (0.00109)	−0.00203* (0.000980)	−0.00396** (0.00127)	−0.000711 (0.00196)	0.00540** (0.00208)	0.00127 (0.00117)	0.000159 (0.00137)
Single	−0.00104 (0.0205)	0.0508** (0.0188)	0.0336 (0.0176)	0.0395 (0.0227)	0.132*** (0.0390)	0.0300 (0.0405)	0.0226 (0.0198)	−0.000122 (0.0272)
Married	0.0365 (0.0189)	0.0664*** (0.0158)	0.0609*** (0.0145)	0.0950*** (0.0191)	0.0815* (0.0397)	−0.0286 (0.0403)	0.0564** (0.0178)	−0.00543 (0.0273)
Divorced	0.00809 (0.0292)	0.0466** (0.0175)	−0.00810 (0.0263)	0.0108 (0.0309)	0.0885 (0.0615)	0.0755 (0.0605)	0.00357 (0.0291)	0.0336 (0.0353)
Widow	−0.0474 (0.0629)	−0.0505 (0.0583)	−0.00966 (0.0425)	0.103*** (0.0144)	−0.197** (0.0711)	0.126 (0.101)	−0.105 (0.0754)	−0.00264 (0.0701)
N	1770	1770	1770	1770	1770	1770	1770	1770

Source: Authors' estimation based on the PMA data (2020).

KAP toward COVID-19 is inconclusive. Anwar et al. [3] found younger and more-educated women to have better KAP toward COVID-19 than older and less-educated women. Anikwe et al. [2] and Lee et al. [16] suggested that the level of women's education is not the only factor that conveys the importance of observing the recommended KAP to reduce the contraction and transmission of COVID-19. Ferdous et al. [10], Irigoyen-Camacho et al. [14], and Banik et al. [4] found that higher levels of education to be associated with more positive KAP, such as social distancing, staying at home, and wearing a facemask.

In general, the results of this study broadly corroborate the findings of Anikwe et al. [2] and Lee et al. [16], linking the level of education of women with their KAP regarding COVID-19. This is attributable to the fact that our findings did not show any consistent significant differences in the DRC in women's KAP toward COVID-19 based on their level of education at a 1% significance level. In the African context, this result may be explained by the fact that education does not affect the KAP toward COVID-19 in isolation from other factors. Place of residence, for example, can also exert an important influence on lifestyle, which is itself an important influencing factor (whether positive or negative) in an individual's level of education and KAP toward a disease. The current study was based on a sample collected only in the capital city of the DRC. Notwithstanding the relatively limited sample, this study offers valuable insights on the level of education of women and their KAP regarding COVID-19.

Another significant finding of this study is that regardless of the level of education, marital status indicated statistically significant differences in women's positive KAP toward COVID-19, such as frequent washing of hands with hand sanitiser and

avoiding close contact (2 m) with people when going out or staying at home to reduce the risk of COVID-19 infection. This strongly observed association between marital status and women's KAP indicates that although women in the DRC must fulfil their social roles and responsibilities, most of them require close and prolonged contact with their family members, communities, and support network, thus increasing their chances of being exposed to the virus. The fact that the country has experienced several epidemic outbreaks has helped them build extensive experience, giving them a greater capacity to assess or control the risks connected to COVID-19.

Conclusions

The main objective of the current study was to determine how the level of women's education influences their KAP in controlling the transmission of COVID-19 in the DRD. To this end, multiple probit regression analyses and marginal effects techniques were used, showing that women with higher levels of education do not always exhibit improved knowledge, attitudes, or practices regarding appropriate strategies for the prevention and control of COVID-19 in the DRC.

The results indicate that education can have both a positive and negative influence on alleviating the burden of COVID-19 thus, women's level of education does not play a large role in the DRC on a variety of measures related to knowledge, attitudes, and practices, including assessing effectiveness and the risk of contracting COVID-19. For example, if women with at least a secondary school education believe the vaccine is much safer and more effective, those with a high level of education are much less likely to receive a COVID-19 vaccination and are willing to keep it a secret if a family member is infected by COVID-19. The findings of this study suggest that there is no clear association between the education level of women and their general KAP related to COVID-19 prevention and control in the DRC, complementing the findings of earlier studies. This work contributes to the existing knowledge of women's level of education and health outcomes by providing new evidence that education does not act on the KAP toward COVID-19 in isolation from other factors. Additionally, an analysis of the influence of the level of education of women on their KAP toward COVID-19 has shown that despite the pandemic, women must still fulfil their social roles and responsibilities in the DRC, most of which require close and prolonged communication with their family members, communities, and support network, thus increasing their chances of being exposed to COVID-19. The fact that the country has experienced several epidemic outbreaks has afforded them extensive experience, giving them greater capacity to assess or control the risks associated with COVID-19.

One of the limitations of this study, which might have affected the measurement of the influence of the level of education of women on their KAP toward COVID-19, was that the small sample was limited to the capital city of the DRC. This did not allow us to draw any general conclusions on whether the influence of women's education level on their KAP on COVID-19 varies across provinces. Despite its limitations, the study certainly adds to our understanding of how the level of education of women may influence their KAP toward an infectious disease in the African context.

Given that previous infectious disease outbreaks in the DRC have shown that low levels of education, poor KAP may present a challenge to efforts to prevent the spread of the disease, this study has raised many questions that meriting further investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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