Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Mental distress before and during the COVID-19 pandemic: A longitudinal study among communities affected by Ebola virus disease in the DR Congo

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ABSTRACT

Background: Associated with high mortality rate, fear, and anxiety, Ebola Virus Disease (EVD) is a significant risk factor for mental distress. This longitudinal study aims to investigate the prevalence and predictors associated with mental distress among populations affected by EVD outbreaks in the Province of Equateur in DR Congo.
Methods: Surveys were administered in zones affected by the 2018 EVD outbreak in Equateur Province with a 16-month interval. Measures assessed sociodemographic characteristics, mental distress (GHQ-12), COVID-19 and EVD exposure and related stigmatization, and Resilience. Models of logistic regression and path analysis were used to estimate factors related to mental distress outcomes.
Results: Prevalence of mental distress decreased from Wave 1 to Wave 2 (*Mental distress* $_{T1}$= 57.04%, *Mental distress* $_{T2}$= 40.29%, x^2= 23.981, p<.001). Clinical mental distress score at follow-up was predicted by greater levels of exposure to Ebola at baseline (B= .412, p<.001) and at Wave 2 (B= .453, p<.001) as well as Ebola stigmatization at baseline (B= .752, p<.001), and Protestant religion (B= .474, p=.038). Clinical mental distress score at follow-up was significantly associated with higher levels of exposure to COVID-19 (B= .389, p=.002) and COVID-19 related stigmatization (B= .480, p<.001). COVID-19 related stigmatization partially mediated the association between exposure to EVD (Time 1) and mental distress (*B*= .409, *p*<.001).
Conclusions: Although a decrease in mental distress symptoms was observed, its prevalence remains high. The results show that mental health programs need to develop better health and education communication strategies to reduce stigmatization.

1. Introduction

From 2017 to 2021, the Democratic Republic of the Congo (DRC) has faced five outbreaks of Ebola Virus Disease (EVD), two in Equateur Province, two in the Eastern regions and one in the Bas-Uelé Province (DR Congo Ministry of Health WHO-Africa, 2019; World Health Organization, 2019a, 2019b). The mortality rate varied between 42.31% to 65.83%, creating fear and anxiety among affected populations (DR Congo Ministry of Health WHO-Africa, 2019; World Health Organization, 2019a, 2019b). Cross-sectional studies conducted in communities affected by EVD and survivors have shown that many people in the general population show significant symptoms of various mental health problems (e.g., anxiety, depression, PTSD, psychological distress) (Cénat et al., 2021d, 2020a, 2020b; Etard et al., 2017; Keita et al., 2017; Lieberman Lawry et al., 2021; Mohammed et al., 2015). However, no studies have assessed the mental health status of these communities with a longitudinal design to measure the consistency of the symptoms and resilient strategies developed by the communities.

Furthermore, in March 2020, the DRC experienced its first cases of COVID-19, starting in Kinshasa (Adepoju, 2021; Juma et al., 2020).

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Subsequently, the various provinces affected by the EVD were in turn affected by COVID-19. The resurgence of EDV in Equateur Province in May 2020 put local populations in a state of fear of being infected by the EVD and COVID-19 (Adepoju, 2021). For nearly six months, populations faced the fear and anxiety associated with both diseases (Nachega et al., 2020a; Nachega et al., 2020b). A systematic review showed that survivors, health professionals, and populations affected by EVD experienced higher prevalence of mental health problems compared to unaffected populations. Although COVID-19 has a significantly lower mortality rate and is not comparable to EVD, studies conducted in the DRC during the pandemic have shown a tendency for increased mental health problems in affected communities (Cénat et al., 2021a; Wu et al., 2021). Cross-sectional studies conducted to date in the DRC investigating the mental health consequences of COVID-19 and EVD separately have made the same observations (Cénat et al., 2021b,c).

Most studies conducted in the DRC also showed that the most important predictor of mental health problems related to COVID-19 and EVD was the stigmatization associated with them in the local population (Cénat et al., 2021e, 2021b, 2021d, 2020b). Studies conducted in various countries during the COVID-19 pandemic showed similar results (Adom et al., 2021; Miconi et al., 2021; Taylor et al., 2020).

We are analyzing data from a 2-wave accelerated longitudinal study to analyze the progression of mental distress among populations affected by EVD in the Equateur Province, in the DRC. The study was conducted seven months after the 2018 EVD outbreak in Equateur Province (Wave 1 conducted between March 11 to April 23, 2019) and 16 months after as the province faced the resurgence of EVD and COVID-19 cases (Wave 2 conducted between August 12 to September 26, 2020). We first hypothesize that because the affected populations in Equateur province were affected by both the resurgence of EVD and COVID-19, their mental health would deteriorate resulting in a higher prevalence of mental distress. Second, based on the results of previous studies, we hypothesize that stigmatization related to EVD and COVID-19 would be the most important risk factor of mental distress among participants, whereas resilience would be a protective factor. Finally, we hypothesize that stigmatization related to COVID-19 (at time 2) would be a mediating factor in the association between EVD exposure and mental distress.

2. Method

2.1. Study design and participants

The baseline sample of the current study was recruited 7 months after the declaration of the end of the 2018 outbreak of EVD in the Province of Equateur in the DRC, from March 11 to April 23, 2019. Data were collected through a two-stage stratified and random sample according to estimates from the National Statistics Institute: 1) the demographic weight of the affected rural and urban areas was considered, and 2) the proportion of women and men in rural and urban areas affected by the EVD outbreak. In absence of studies on mental health problems in the Equateur province, the two-stage stratified sampling was used to ensure adequate representation of gender and urban and rural areas in the province of Équateur where most rural areas remain difficult to access. We recruited data in Bikoro, Iboko and Wangata, the three "health zones" affected by the 9th EVD outbreak in the DRC. Households were randomly selected in the 18 affected rural and urban areas. When a house was found vacant by interviewers or individuals refused to participate, the next house was selected. The inclusion criteria were: 1) being at least 18 years old, 2) living in one of the 18 affected rural and urban areas, 3) being a French or Lingala speaker, and 4) not having a mental health disorder that interferes with their judgment. The door-to-door survey was conducted by 26 regional Lingala-speaking regional interviewers (14 men, 12 women), including junior psychologists, educators, and psychiatric nurses. The 26 interviewers received a day and a half-day training on ethical issues and on ways to administer the questionnaire and one-day training for Wave 2. Because of a high illiteracy rate in Equateur, the items of the questionnaires were read and completed by the interviewers. The questionnaires were available in three different Lingala dialects and in French. Addresses of the participants were collected to conduct a follow-up survey. In case of difficulties in noting some addresses, especially for participants in rural areas, location points were noted (e.g., school, church, small stores closest to the house, community leader). The follow-up (Wave 2) was conducted from August 12 to September 26, 2020 (16 months of intervals between the two waves), while the Province of Equateur was encountering cases of both EVD and COVID-19. All precautions were taken to protect the interviewers, including wearing personal protective equipment, washing hands after each interview, and maintaining physical distance.

A total of 1637 people were solicited and 98.6% agreed to participate in the study at the baseline (N = 1614). The response rate to the outcome measure at baseline was 99.57%. In total, 1607 participants (M = 34.10 years-old, SD = 12.60; 50% female) were included in the analyses (Fig. 1). More details on Wave 1 are provided in Cénat, Kokou-Kpolou, et al.(2021). Participants from the baseline were invited for the follow-up during COVID-19 pandemic (Wave 2). Of 1614, we identified 862 at Wave 2 and 38 refused to participate. A total of 824 participants (46.6% female) completed the follow-up questionnaires (Fig. 1). All participants signed an informed consent form. The study protocol was approved by the ethics committees of the University of Ottawa, University of Kinshasa, and the National Institute of Biomedical Research.

2.2. Measures

2.2.1. Sociodemographic

The sociodemographic form encompassed information about age (18-24, 25-34, 35-44, 45-54, 55-64, 65 and more), sex (male/female), residency area (rural/urban), employment status (employed/unemployed), education (none, primary school, secondary school, professional, university), religion (Catholic, Protestant, Animist, Kimbanguist, Muslim, Other), and marital status (single, married, divorced, separated, widowed, in a relationship).

2.2.2. General health questionnaire (GHQ-12)

The GHQ-12 is a 12-item questionnaire that measures the incapacity to complete routine activities and the apparition of new mental health problems that cause psychological distress (e.g., anxiety, depression, social difficulties, and somatization difficulties (Werneke et al., 2000). Four scoring methods can be used for GHQ-12, including binary method (0-0-1-1), 4-point Likert scale (0-1-2-3), modified Likert scoring (0-0-1-2), and C-GHQ scoring 0-0-1-1 for positive items (agreement indicates health), and 0-1-1-1 for negative items (agreement indicates illness). We used the binary method (0-0-1-1) as the standard method (Pierce et al., 2021, 2020) to identify mental distress mean. A cut-off score of 4 was used for the presence of mental distress. The Cronbach's alpha for the GHQ scale was .89 and .85 in the baseline and follow-up, respectively. Participants completed GHQ-12 in both waves.

2.2.3. Exposure to Ebola virus disease (EVD) and COVID-19

Exposure to EVD and COVID-19 scale includes 17 yes/no items which was developed in accordance with the Trauma Exposure Scale (Cénat and Derivois, 2014). This scale, largely used among populations affected by both COVID-19 and EVD with excellent psychometric properties (Cénat et al., 2021d, 2021e, 2021b, 2020b), measures participants' experiences about EVD and COVID-19 (two columns of answers: one for EVD and one for COVID-19) and their effect on their social network, life, and families (e.g., "Have you been hospitalized in a … (column 1: Ebola virus treatment center; column 2: COVID-19 treatment center)?", "Has a member of your family fallen ill because of the …?"). This scale also includes items about injuries and deaths within participants' social networks such as family and friends (e.g., "Have you participated at a funeral of a person deceased because of the…?"). A

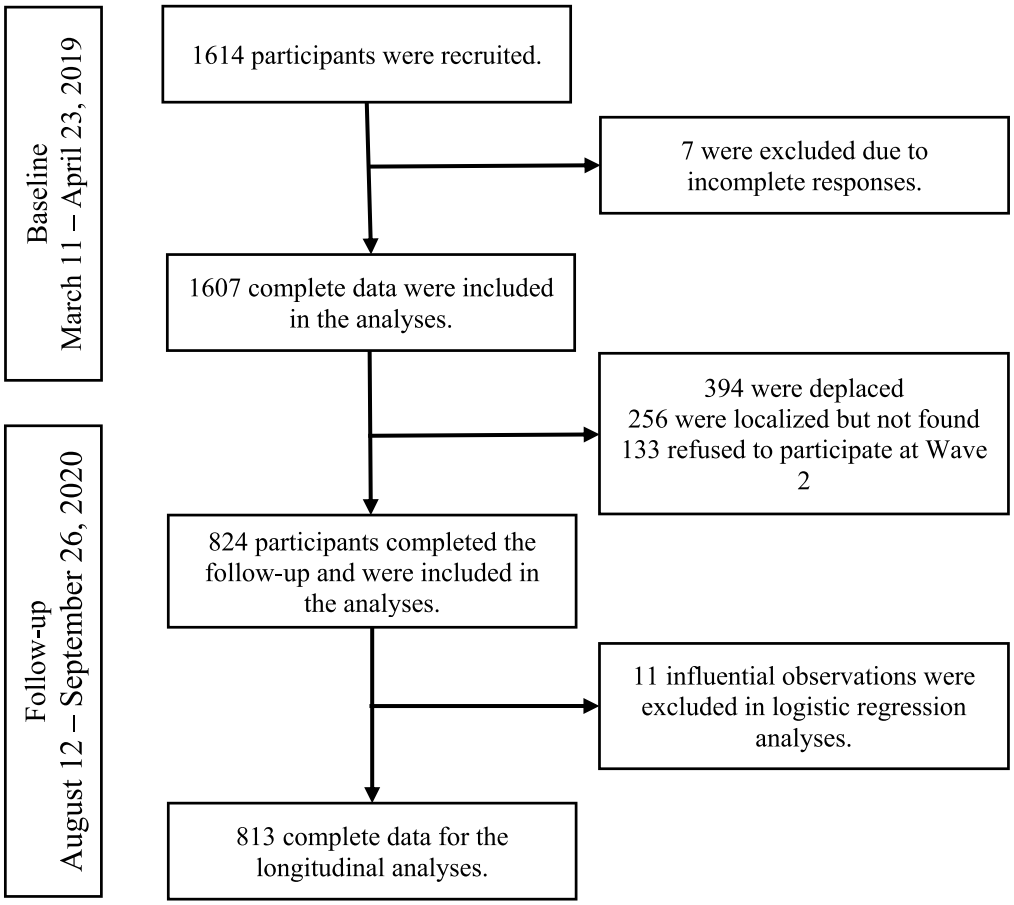

Fig. 1. Flowchart of participants in baseline and follow-up study samples.

Cronbach's alpha of .93 was observed in both baseline and follow-up for EVD and was .87 for COVID-19. Participants completed exposure to EVD in both waves and for COVID-19 in the second wave.

2.2.4. *Stigmatization related to Ebola virus disease (EVD)*

Stigmatization related to EVD and COVID-19 scale was developed on the basis of the WHO reports and the social science and behavioral data compilation to measure EVD-related stigmatization (e.g., "Someone refused to talk to you…"; "A company refused to hire you…"). It is widely used among communities affected by EVD and COVID-19 with excellent internal consistency coefficients (Cénat et al., 2021d, 2021e, 2021b, 2020b). This scale includes 20 items with a 5-Likert point response type, ranging from *Never* (0) to *Always* (4). Cronbach's alpha in our sample (both baseline and follow-up) was .97. Cronbach's alpha in our sample (follow-up) was .97. Participants completed stigmatization related to EVD in both waves and only in the second wave for COVID-19.

2.2.5. *The resilience scale 14 (RS-14)*

The RS-14 is a 14-item scale that measures how individuals deal with traumatic events (e.g., "I have self-discipline", "I can usually find something to laugh about", "My life has meaning") (Wagnild, 2009). It consists of a 7-point scale (Totally disagree to Totally agree). The total score can be computed by summing the answers to all the items (range of 14-98). Higher scores represent higher levels of resilience. Cronbach's alpha in our sample (follow-up) was .95. Participants completed RS-14 in the follow-up.

2.3. *Statistical analysis*

First, the prevalence of mental distress (GHQ) was compared among categorical variables using Pearson's chi-square tests as well as continuous variables using independent *t*-tests at baseline and follow-up, separately. The homogeneity of variances was checked for continuous variables, if Levene's test was significant, alternative *t*-tests results were reported. As well, if a cell of the cross-tabulations had an expected count less than 5, alternative non-parametric tests (e.g., Fisher's exact test) were reported. To compare the prevalence rates of mental distress and related factors between the baseline and follow-up, we used chi-square tests with Yates's correction (for categorical variables) and paired sample *t*-tests (for continuous variables) for individuals who completed both follow-up and baseline surveys.

Second, two logistic regression analyses were performed. In model 1, we tested the effects of the baseline features controlling for the mental distress at baseline on the mental distress at the follow-up. In model 2, the associations between the follow-up features and mental distress were examined after controlling for the baseline variables. Before conducting the multiple logistic regression models, multicollinearity was checked using the variance inflation factor (VIF). Moreover, multivariate influential observations were detected using Cook's distance values. We used a significance level of .05 with 95% confidence intervals (CIs). The first and second steps were conducted by SPSS 27.

Third, we applied path analysis using structural equation modeling (SEM) with an application of Stata 13. We used model fit indices, including the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the Tucker-Lewis fit index (TLI), chi-square tests. Values of CFI and TLI above .95, insignificant chi-square, and a value of RMSEA below .08 indicate good model fit (Kline, 2015). In order to deal with the Type I error rate, we conducted the mediation analysis using a 95% CIs bootstrapping approach with 2000 replications. Bootstrapping method is the most powerful approach characterized by

high statistical power and low Type I error rates (Little et al., 2016; Shrout and Bolger, 2002). A mediator is applicable when a significant indirect effect is observed (Shrout and Bolger, 2002). Regarding complete mediation, if the previous condition is met and an insignificant total effect is observed, there is complete mediation. Otherwise, partial mediation is applicable (Mehmetoglu, 2018).

3. Results

Among 1607 participants at baseline, 52.27 % (3.7 % missing data) reported significant mental distress. A higher prevalence of mental distress was observed among individuals living in rural areas (χ^2 = 35.545, $p < .001$) and employed ($\chi^2 = 16.970$, $p < .001$). Results also showed significant differences with respect to age ($\chi^2 = 14.689$, p = .012), education ($\chi^2 = 28.855$, $p < .001$), religion ($\chi^2 = 46.731$, $p <$ .001), and marital status ($\chi^2 = 26.965$, $p < .001$). Participants with significant mental distress reported higher levels of exposure to Ebola ($M = 7.48$, $SD = 4.80$), $t(1541.68) = -10.852$, $p < .001$, $d = -.54$, and Ebola stigmatization ($M = 31.34$, $SD = 22.74$), $t(1506.55) = -17.895$, $p < .001$, $d = -.88$, compared with individuals without significant mental distress (Table 1).

In total, 824 individuals participated at the follow-up and 40.29 % of them reported significant mental distress. Higher prevalence of mental distress was observed in employed individuals ($\chi^2 = 9.762$, $p = .002$) and people living in rural areas ($\chi^2 = 21.208$, $p < .001$). No significant differences were found regarding sex, age, education, religion, and marital status at the follow-up. Participants with significant mental distress reported higher levels of exposure to Ebola ($M = 6.20$, $SD =$ 5.15), t (593.36) = -7.717, $p < .001$, $d = -.57$, exposure to COVID-19 (M = 1.55, $SD = 3.02$), t (451.34) = -4.140, $p < .001$, $d = -.33$, COVID-19 stigmatization (M = 12.41, SD = 19.13), t (442.96) = -7.068, $p <$ .001, $d = -.56$, Ebola stigmatization ($M = 21.52$, $SD = 17.78$), t (469.16)

Table 1
Prevalence of Mental Distress over Sample Sociodemographic Characteristics.

Variables	Before COVID-19, N (%[1])				During COVID-19, N (%)			
	Total sample (n = 1607)	With mental distress	Participants in T_2 with mental distress in T_1	*p*-value[2]	Total sample (n = 824)	With mental distress (n = 332)	*p*-value	*p*-value (T_1 vs T_2)[3]
Sex	1607	840 (52.27)	470 (57.04)		824	332 (40.29)		< .001
Male	804 (50.03)	410 (51.00)	245 (55.68)		440 (53.40)	166 (37.73)		< .001
Female	803 (49.97)	430 (53.55)	225 (58.59)	.305	384 (46.60)	166 (43.23)	.108	< .001
Age								
18-24 years	378 (23.52)	178 (47.09)	107 (53.50)		209 (25.36)	78 (37.32)		.001
25-34 years	468 (29.12)	235 (50.21)	144 (54.75)	.012	279 (33.86)	104 (37.28)	.231	< .001
35-44 years	292 (18.17)	169 (57.88)	97 (58.08)		189 (22.94)	87 (46.03)		.030
45-54 years	165 (10.27)	97 (58.79)	48 (64.00)		78 (9.47)	30 (38.46)		.003
55-64 years	95 (5.91)	57 (60.00)	16 (57.14)		32 (3.88)	17 (53.13)		.958
65 and more	24 (1.49)	10 (41.67)	6 (85.71)		4 (.49)	2 (50.00)		1.000
Residence area								
Urban	707 (44.00)	233 (32.96)	91 (35.27)	< .001	282 (34.22)	83 (29.43)	< .001	.174
Rural	900 (56.00)	607 (67.44)	379 (66.96)		541 (65.66)	249 (46.03)		< .001
Education								
None	61 (3.80)	33 (54.10)	21 (61.76)		33 (4.00)	12 (36.36)		.066
Primary	172 (10.70)	99 (57.56)	58 (61.70)	< .001	95 (11.53)	38 (40.00)	.051	.004
Secondary	894 (55.63)	499 (55.82)	227 (61.97)		451 (54.73)	200 (44.35)		< .001
Professional	54 (3.36)	32 (59.26)	19 (65.52)		34 (4.13)	15 (44.15)		.148
University	391 (24.33)	161 (41.18)	86 (43.43)		201 (24.39)	64 (31.84)		.022
Employment								
Yes	895 (55.69)	506 (56.54)	297 (60.74)	< .001	538 (65.29)	237 (44.05)	.002	< .001
No	655 (40.76)	301 (45.95)	151 (50.00)		278 (33.74)	91 (32.73)		< .001
Religion								
Catholic	710 (44.18)	423 (59.58)	253 (62.62)	< .001	404 (49.03)	154 (38.12)	.237	< .001
Protestant	400 (24.89)	212 (53.00)	125 (56.56)		226 (27.43)	91 (40.27)		< .001
Animist	30 (1.87)	20 (66.67)	9 (69.23)		13 (1.58)	5 (38.46)		.238
Kimbanguist	73 (4.54)	34 (46.58)	17 (51.52)		33 (4.00)	15 (45.45)		.805
Muslim	52 (3.24)	20 (38.46)	9 (39.13)		23 (2.79)	6 (26.09)		.529
Other	330 (20.54)	128 (38.79)	57 (44.88)		123 (14.93)	60 (48.78)		.623
Marital Status								
Single	569 (35.41)	281 (49.38)	167 (53.70)	.002	314 (38.11)	116 (36.94)	.450	< .001
Married	743 (46.24)	380 (51.14)	199 (56.70)		338 (41.02)	147 (43.49)		< .001
Divorced	62 (3.86)	38 (61.29)	23 (62.16)		39 (4.73)	19 (48.72)		.343
Separated	32 (1.99)	13 (40.63)	9 (52.94)		22 (2.67)	8 (36.36)		.478
Widowed	42 (2.61)	28 (66.67)	17 (70.83)		25 (3.03)	12 (48.00)		.182
In a Relationship	119 (7.41)	85 (71.43)	46 (67.65)		76 (9.22)	30 (39.47)		.001
Continuous Variables								
Exposure to Ebola	6.15 (5.26)	7.48 (4.80)	7.82 (4.52)	< .001	4.66 (4.69)	6.20 (5.15)	< .001	< .001
Ebola Stigmatization	23.01 (21.62)	31.34 (21.74)	31.42 (22.15)	< .001	11.94 (15.72)	21.52 (17.78)	< .001	< .001
Exposure to COVID-19					1.11 (2.29)	1.55 (3.02)	< .001	
COVID-19 Stigmatization					7.63 (14.73)	12.41 (19.13)	< .001	
Resilience					60.67 (18.78)	57.00 (15.42)	< .001	

[1] Some percentages are not summed to 100 because of missing data. For continuous variables: Mean (Standard Deviation)
[2] *p*-values were calculated with *t*-tests and $\chi 2$ tests for continuous and binary measures, respectively.
[3] *p*-values were calculated with paired sample *t*-tests and $\chi 2$ with Yates's correction for proportion/mean differences between waves.

= -14.966, $p < .001$, d = -1.18, and lower levels of resilience (M = 57.00, SD = 15.42), t (809.54) = 4.932, $p < .001$, d = .33 compared to individuals without significant mental distress (Table 1). We also tested the prevalence rates of mental distress differences between participants who completed both time points (*Mental distress* $_{T1}$= 57.04%, *Mental distress* $_{T2}$= 40.29%). The results showed that the proportion of significant mental distress significantly decreased at the follow-up (χ^2 = 23.981, $p < .001$). All proportion/mean differences between waves are presented in Table 1.

Correlations analyses were conducted between main variables. A correlation matrix of main variables was provided as a supplementary file. To carry out multiple logistic regression analyses, we first standardized all continuous predictors and checked multicollinearity using VIF. A high collinearity for Ebola stigmatization (time 2) was observed (VIF > 2.5), resulted in dropping this variable from the analyses. Second, we checked potential influential observations using Cook's distance. As a result, 11 influential observations were removed. As shown in Table 2, the clinical mental distress at the follow-up was predicted by Protestant religion (B = .474, p = .038), greater levels of exposure to Ebola at the baseline (B = .412, $p < .001$) and follow-up (B = .453, $p < .001$) as well as Ebola stigmatization at the baseline (B = .752, $p < .001$). Moreover, the clinical mental distress at the follow-up was significantly associated with higher levels of exposure to COVID-19 (B = .389, p = .002) and COVID-19 stigmatization (B = .480, $p < .001$).

Regarding the mediation analysis, a bootstrapping method (95% CIs) with 2000 replications and maximum likelihood estimations for the complete data was conducted. We included significant predictors at baseline and follow-up controlling for the mental distress at baseline to predict mental distress at follow-up. The mediator variable was COVID-19 stigmatization for these associations. The mediation model was presented in Fig. 2. The model showed a perfect model fit: X^2 (1) = 1.977, p = .160, RMSEA = .038, CFI = .996, TLI = .959. Consistent with the logistic regression, one unit increment in exposure to Ebola and Ebola stigmatization at baseline was associated with .463 (p = .002) and .890 ($p < .001$) point increase in the mental distress at follow-up, respectively. Likewise, one unit increase in exposure to Ebola and exposure to COVID-19 at follow-up was associated with .576 (p < .001) and .323 (p = .011) point increase in mental distress at follow-up, respectively. The results also showed that mental distress at follow-up was directly associated with COVID-19 stigmatization (B = .409, $p <$ .001). With respect to the relationship between the mediator variable and predictors, COVID-19 stigmatization was significantly associated with Ebola stigmatization at baseline (B = .129, p = .011), exposure to Ebola at the follow-up (B = .161, p = .001), and exposure to COVID-19 (B = .232, p = .002). After including the mediator variable (COVID-19 stigmatization), a significant indirect effect was found for Ebola stigmatization at baseline (B = .053, p = .026), exposure to Ebola at the follow-up (B = .066, p = .022), and exposure to COVID-19 (B = .095, p = .011). The total effects for all predictors, except for mental distress at baseline, were significant. Therefore, the results indicated that COVID-19 stigmatization played the role of a partial mediator in the relationships between Ebola stigmatization at baseline, exposure to Ebola at follow-up, and exposure to COVID-19. All coefficients with 95% CIs were presented in Table 3.

Table 2
Predicting Mental Distress at the follow-up.

	Model 1			Model 2		
Variable	*B* (SE)	Wald	OR [95% CI]	*B* (SE)	Wald	OR [95% CI]
Sex						
Female	.21 (.19)	1.22	1.23 [.85, 1.77]	.30 (.20)	2.19	1.35 [.91, 2.00]
Age						
Age	.06 (.40)	.38	1.07 [.87, 1.31]	.36 (.53)	.46	1.43 [.51, 4.04]
Age $_{T2}$				-.31 (.52)	.35	.73 [.26, 2.04]
Residence area						
Rural	-.01 (.25)	.00	.99 [.61, 1.61]	-.28 (.29)	.92	.75 [.43, 1.34]
Education						
Primary	.41 (.52)	.62	1.51 [.54, 4.23]	.43 (.54)	.62	1.53 [.53, 4.44]
Secondary	.59 (.48)	1.49	1.80 [.70, 4.62]	.52 (.50)	1.10	1.68 [.64, 4.45]
Professional	.59 (.65)	.82	1.80 [.50, 6.43]	.57 (.67)	.72	1.77 [.47, 6.60]
University	.07 (.52)	.02	1.08 [.39, 2.97]	.02 (.53)	.00	1.02 [.36, 2.92]
Employment						
Employed	-.19 (.22)	.70	.83 [.54, 1.29]	-.28 (.24)	1.35	.76 [.47, 1.21]
Religion						
Protestant	.44 (.21)	4.12*	1.55 [1.01, 2.36]	.47 (.23)	4.29*	1.61 [1.03, 2.52]
Animist	.06 (.78)	.01	1.06 [.23, 4.92]	-.42 (.82)	.26	.65 [.13, 3.28]
Kimbanguist	.47 (.50)	.91	1.60 [.61, 4.25]	.58 (.53)	1.20	1.78 [.63, 5.01]
Muslim	-.24 (.62)	.15	.79 [.23, 2.66]	.04 (.64)	.00	1.04 [.30, 3.65]
Other Religion	.53 (.28)	3.65	1.69 [.99, 2.91]	.54 (.29)	3.36	1.72 [.96, 3.06]
Marital Status						
Married	.28 (.23)	1.41	1.32 [.83, 2.09]	.24 (.25)	.92	1.27 [.78, 2.06]
Divorced	.32 (.48)	.46	1.38 [.54, 3.55]	.36 (.50)	.51	1.43 [.53, 3.86]
Separated	.16 (.65)	.06	1.17 [.33, 4.16]	.51 (.68)	.56	1.67 [.44, 6.38]
Widowed	-.13 (.54)	.06	.87 [.30, 2.51]	-.09 (.59)	.02	.91 [.29, 2.89]
In a Relationship	.58 (.34)	2.83	1.79 [.91, 3.51]	.43 (.36)	1.43	1.54 [.76, 3.15]
Mental Distress $_{T1}$	.19 (.20)	.94	1.21 [.82, 1.80]	.16 (.21)	.57	1.17 [.78, 1.77]
Exposure to Ebola $_{T1}$	.40 (.11)	12.96***	1.49 [1.20, 1.86]	.41 (.12)	11.98***	1.51 [1.20, 1.91]
Ebola Stigmatization $_{T1}$	.70 (.12)	34.16***	2.01 [1.59, 2.55]	.75 (.13)	33.55***	2.12 [1.64, 2.73]
Exposure to Ebola $_{T2}$				.45 (.11)	17.83***	1.57 [1.27, 1.94]
COVID-19 Stigmatization $_{T2}$				.48 (.11)	18.52***	1.62 [1.30, 2.01]
Exposure to COVID-19 $_{T2}$				.39 (.12)	9.83**	1.48 [1.16, 1.88]
Resilience $_{T2}$				-.16 (.10)	2.65	.85 [.70, 1.03]

*$p < .05$.
**$p < .01$.
***$p < .001$ Reference criteria for sex was Male; reference criteria for Employment was Unemployed; reference criteria for Education was None; reference criteria for Religion was Catholic; reference criteria for Marital status was Single. Model 1: All baseline variables. Nagelkerke R^2 = .27 Model 2: The follow-up variables controlling for the baseline predictors. Nagelkerke R^2 = .38.

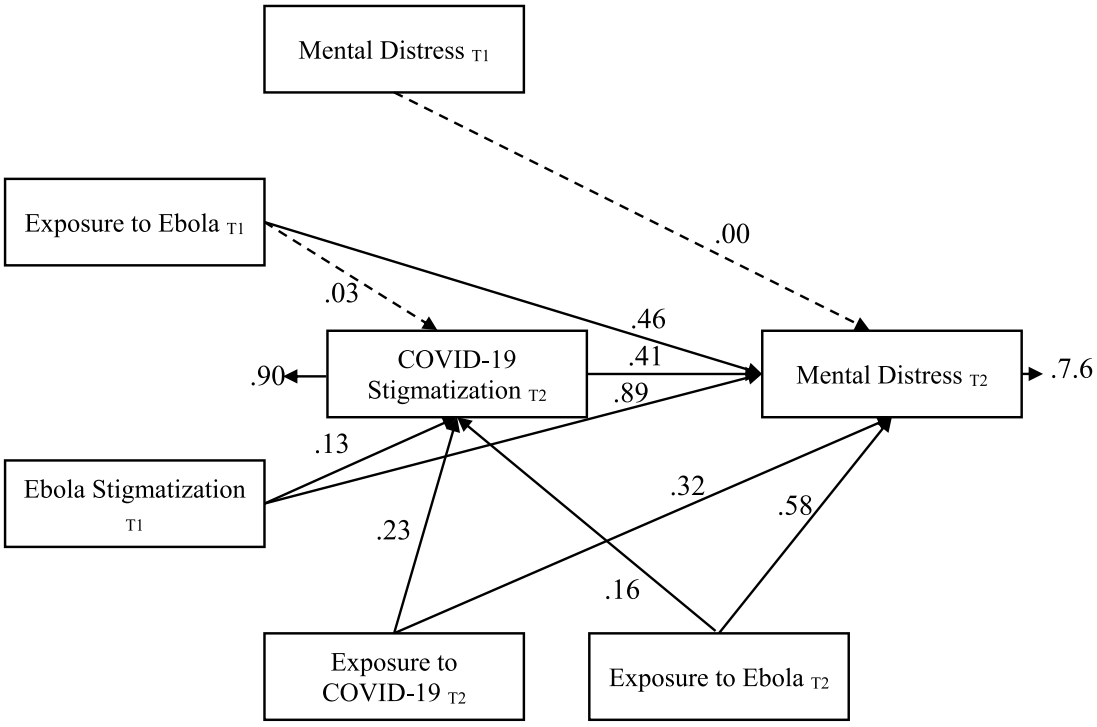

Fig. 2. The mediation model with unstandardized coefficients.

Table 3
Direct, indirect, and total effects of the mediation model.

	COVID-19 stigmatization			Mental distress T2		
	B (SE)	z	95% CIs	B (SE)	Z	95% CIs
Direct effect						
Exposure to Ebola T1	.03 (.11)	.57	[-.06, .11]	.46 (.15)	3.13**	[.17, .75]
Ebola stigmatization T1	.13 (.05)	2.54*	[.03, .23]	.89 (.16)	5.58***	[.58, 1.20]
Mental distress T1				.00 (.13)	.02	[-.25, .26]
Exposure to Ebola T2	.16 (.05)	3.25**	[.06, .26]	.58 (.11)	5.03***	[.35, .80]
Exposure to COVID-19 T2	.23 (.07)	3.15**	[.09, .38]	.32 (.13)	2.55*	[.07, .57]
COVID-19 stigmatization T2				.41 (.11)	3.68***	[.19, .63]
Indirect effect						
Exposure to Ebola T1				.01 (.02)	.57	[-.03, .05]
Ebola stigmatization T1				.05 (.02)	2.22*	[.01, .10]
Exposure to Ebola T2				.07 (.03)	2.29*	[.01, .12]
Exposure to COVID-19 T2				.09 (.04)	2.55*	[.02, .17]
Total effect						
Exposure to Ebola T1				.47 (.15)	3.68***	[.19, .63]
Ebola stigmatization T1				.94 (.16)	5.97***	[.63, 1.25]
Exposure to Ebola T2				.64 (.12)	5.37***	[.41, .88]
Exposure to COVID-19 T2				.42 (.13)	3.13**	[.16, .68]

All coefficients, standard errors (SE), and 95% CIs are based on bootstrapping results (replications = 2000).
*$p < .05$.
**$p < .01$.
***$p < .001$.

4. Discussion

The first objective of this study was to analyze the progression of mental distress in communities in Equateur Province, in the DRC affected by both EVD and COVID-19. We hypothesized that because affected populations in Equateur Province were affected by both the resurgence of EVD and the COVID-19 pandemic, their mental health would deteriorate with a higher prevalence of mental distress. The results do not support this hypothesis. The prevalence of mental distress significantly decreased among participants regardless of gender and other sociodemographic characteristics of the sample. In fact, regarding the sociodemographic characteristics of the participants, the prevalence of mental distress did not increase at any point. However, there was no significant difference for people living in urban areas and in small groups such as certain religions (Muslim, Animist, Kimbanguist) and people aged 55 and over. While no longitudinal studies have been conducted among EVD-affected populations to observe mental health issues, studies conducted during the COVID-19 pandemic have shown similar results (O'Connor et al., 2021; Stroud and Gutman, 2021). Indeed, longitudinal studies conducted during the COVID-19 pandemic showed that although during the first months of the pandemic the mental health of populations deteriorated, it subsequently improved (Daly and Robinson, 2021; O'Connor et al., 2021; Stroud and Gutman, 2021). When the province of Equateur faced its first ever EVD outbreak in 2018, anxiety, along with fear-based awareness campaigns and high EVD-related lethality played a significant role in the stigmatization of EVD among local populations. This stigmatization, which is even more prevalent in rural areas, has played an important role in the observed high prevalence of mental health problems (Cénat et al., 2021b, 2021e). Although previous studies do not provide a clear explanation for observed improvement in EVD-affected populations' mental health, the past experiences of EVD in Equateur Province in 2018, which required mobilization of defense mechanisms, better knowledge of EVD, and a decrease in stigmatization are all factors that may explain this improvement in their mental health.

At both Wave 1 and Wave 2, the results show that people living in rural areas are more prone to be classified as having a clinical score of

mental distress. Reduced access to information, limited health infrastructures and services, lack of knowledge on EVD and COVID-19, and greater stigmatization are factors that may explain this higher prevalence of mental distress in rural areas (Alenichev, 2021; Cénat et al., 2021f; Lieberman Lawry et al., 2021). The results also reveal a non-significant difference between men and women. This is a consistent observation from studies of populations in the DRC and other countries in Africa affected by EVD and COVID-19 (Alenichev, 2021; Cénat et al., 2021f). Qualitative studies should focus on gender roles, especially in rural areas, where women are less likely to experience mental health problems, whereas the reverse is true in urban areas.

The second objective of this study was to examine the risk factors related to mental distress at Wave 2. We hypothesized that stigmatization related to EVD and COVID-19 would be the most important risk factor for mental distress, while resilience would be a protective factor. The results partially confirmed this hypothesis. First, the results revealed that EVD stigmatization at Wave 1, COVID-19-related stigmatization (Wave 2), exposure to EVD and COVID-19 at Wave 2, and mental distress at time 1 and being of Protestant faith were the risk factors for mental distress at Wave 2. In cross-sectional studies of communities affected by EVD, related stigmatization has consistently been a significant risk factor for mental health problems (Cénat et al., 2021d, 2021b, 2021e, 2020b). Although we did not identify any longitudinal studies examining the association between stigmatization and mental health problems during the COVID-19 pandemic, cross-sectional studies have shown strong association between them (Cénat et al., 2021e, 2021b; Miconi et al., 2021). However, for resilience, results showed that the negative association found was not significant. This only partially confirms our second hypothesis.

The final objective of this study was to examine the mediating role of COVID-19-related stigmatization (Time 2). We hypothesized that COVID-19-related stigmatization would be a mediating factor for mental distress. The results confirmed this hypothesis. Results from cross-sectional studies have shown that COVID-19-related stigmatization has a strong association with mental health problems (Cénat et al., 2021d; Miconi et al., 2021). This study clarifies the nature of this association, which remains very important despite the weight of other variables including exposure to EVD and COVID-19 and EVD-related stigmatization.

4.1. Limitations

This study is based on self-reported questionnaires, not psychiatric diagnoses. It better reveals the trajectories of symptoms than of mental disorders faced by local populations affected by both EVD and COVID-19. Although those who completed both measurement waves had a similar prevalence of mental distress at Wave 1, as well as the total sample at Wave 2, high attrition is a limitation of this study. We expected high attrition rate in rural communities, given the nomadic lifestyle often observed, and we had taken significant steps to address it. However, the COVID-19 pandemic caused many people to move to the city of Mbandaka, the provincial capital. As soon as the first cases occurred, many people preferred to return to their rural areas of origin.

4.2. Implications and conclusions

Although a decrease in mental distress symptoms wa sobserved, its prevalence remains high. The results point to several clear avenues for consideration. First, given the predictive role of stigmatization related to EVD and COVID-19, prevention programs should be based on education rather than fear, which increases stigmatization. Better knowledge of the modes of transmission, prevention, and treatment methods for these diseases, as well as credible information about treatment centers can remove taboos and reduce the stigmatization associated with them in affected populations. The results also indicate the need to address mental distress early. Since mental distress at Wave 1 is one of the most important risk factors of mental distress at Wave 2, early treatment could have reduced the risk of long-term mental health problems. Given that the DRC has an already failing health care system and virtually no mental health care services in rural areas, early intervention can be designed with local public health authorities by involving general practitioners, nurses, and educators, among others (Cénat et al., 2020c). Intensive psychological first aid programs with at least 30 hours of training and ongoing supervision for providers can also be considered on a larger scale to help people better understand themselves and know when to consult a mental health professional (Cénat et al., 2020c). These programs need to be scaled up in rural areas where there are no mental health services and where more people are experiencing significant symptoms of mental distress. These programs also need to be culturally appropriate, considering factors related to gender, area of residence (rural vs. urban), education level, religion, among others.

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Declaration of Competing Interest

No conflict of interest for any author.

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Supplementary materials

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