Research article

Associations between fear of COVID-19 and mental health in Ghana: A sequential mediation model

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ABSTRACT

Introduction: Although the coronavirus disease 2019 (COVID-19) pandemic has ceased globally, individuals may still suffer from various psychological burdens in the post-COVID-19 era. The present observational cross-sectional study investigated how fear of COVID-19 can affect mental health through mediators including stress, perceived stigma, and preventive behaviors among young adults in Ghana.

Methods: A total of 635 participants aged between 18 and 29 years (mean age = 20.2 years [SD = 2.04]) were recruited to complete measures of COVID-19 fear, stress, perceived stigma, preventive behaviors, and mental health status from June to August 2022.

Results: Results from structural equation modeling found that (i) fear of COVID-19 was associated with stress and perceived stigma (standardized coefficients [βs] = 0.518 and 0.148, *p*-values < 0.001), (ii) stress and perceived stigma were associated with frequency of preventive behaviors (β = 0.173, *p* < 0.001 for stress; −0.100, *p* < 0.05 for perceived stigma), and (iii) preventive behaviors were associated with mental health status (β = 0.118, *p* < 0.01). Stress and preventive behavior (*β* = 0.009, 95%CI: 0.000, 0.003) and perceived stigma and preventive behavior (*β* = −0.007, 95%CI: −0.283, −0.020) were significant mediators in the association between fear of COVID-19 and mental health.

Discussion: The findings suggest that fear of COVID-19 may affect mental health through multiple pathways. Health professionals should provide comprehensive mental health interventions that address various influences regarding fear of COVID-19. Further research that examines the

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relationships between COVID-19-related variables and various health conditions is needed in the post-COVID-19 era to help develop different preventive and therapy measures.

1. Introduction

The coronavirus 2019 (COVID-19) pandemic had a devastating global impact, resulting in over 775 million cases and more than 7 million deaths worldwide as of July 7, 2024 [1]. In Ghana (where the present study was carried out), the effects have been particularly severe, with over 172,000 confirmed cases and 1462 deaths as of July 7, 2024 [2]. Worldwide, the pandemic significantly disrupted economic activities [3,4], strained health systems [5–7], and altered sociocultural lifestyles [8,9]. Although the pandemic is now over, the aftereffects may still leave a psychological burden on individuals worldwide in the post-COVID-19 era [10,11].

The World Health Organization (WHO) reported an approximately 25 % increase in the global prevalence of mental health disorders due to the pandemic [12]. Meta-analyses have indicated that the prevalence of significant mental health symptoms such as depression or anxiety ranged from 20 % to 35 % globally during the COVID-19 pandemic [13–15]. Such rises may largely be attributed to the unprecedented major stressors such as social isolation, loneliness, fear of infection, stigmatization, grief, and financial concerns [16]. Among these, fear of COVID-19 emerged as a predominant factor during the COVID-19 pandemic [17]. Fear of COVID-19 has previously been reported to affect mental health by triggering various psychological responses including stress, anxiety, stigma, and behavioral alterations (e.g., preventive behaviors, workplace phobia) [18–20]. Among these responses, stress (i.e., distress emanating from COVID-19 and its post-effects [16]) has been found to be associated with fear of COVID-19, preventive behaviors, and stigma [21, 22]. In addition, stigma (especially concerns about other individuals' negative beliefs or judgments about COVID-19) [23,24] may have facilitated individuals to positively or negatively engage in preventive behaviors during the COVID-19 pandemic [24,25]. Therefore, it seems that COVID-19 stress, and perceived COVID-19 stigma may positively or negatively intervene in individuals' fear of COVID-19 and how they engage in preventive behaviors depending on factors such as cultural norms, national policies, and family structure [21–26].

Preventive COVID-19 behaviors (i.e., activities that prevent the infection and/or spread of the virus) may be negatively or positively associated with mental health (e.g., anxiety and depression) depending on the type of preventive behavior (e.g., quarantine, lockdown, mask-wearing, and physical social distancing) [27–31]. Consequently, appropriate preventive behaviors (e.g., keeping clean hands by regular washing with soap and water or sanitizer) may help boost the mental health conditions of individuals as supported by previous studies [30–33]. Due to the influences between these variables, it is worthwhile examining the mechanisms involved to better understand the processes that are significant in developing further intervention and future disease-preventive strategies. These associations and/or mediations between fear of COVID-19, stress, perceived stigma, and preventive behaviors are important because they transcend COVID-19 to other health issues, such as mental health [34,35]. Moreover, other studies have focused on the detection and prediction of pandemics using machine learning and deep learning techniques [36,37].

It should also be noted that many studies have examined the associations between at least two of the variables used in the present study [17–35]. For instance, a longitudinal study on the impact of COVID-19 on wellbeing reported that fear of COVID-19 continuously predicted increased worry and impaired sleep quality [38]. Also, meta-analyses have reported significant associations between fear of COVID-19 and mental health-related factors (i.e., anxiety, stress, depression, and sleep problems) [39,40] with anxiety serving as a mediator to the associations between fear of COVID-19, stress, and depression [40]. Moreover, one study reported the mediating role of traumatic stress or psychological distress in the association between fear of COVID-19 and preventive behavior [41], variables which are also examined in the present study. However, no previous study has ever implemented a serial mediation model study that examines the mechanisms involved in how fear of COVID-19 may eventually affect an individual's mental health.

The stress-vulnerability model provides a framework for understanding how stressors, combined with individual vulnerabilities and protective factors, affect mental health outcomes [42]. During the COVID-19 pandemic, unprecedented stressors such as fear of infection, social isolation, and stigmatization exacerbated mental health issues globally [10–15]. This model suggests that such stressors, when combined with inherent vulnerabilities – such as genetic predispositions or pre-existing mental health conditions – can worsen disorders such as anxiety and depression [42]. In this context, fear of COVID-19 emerged as a significant factor influencing mental health, triggering stress and anxiety. Perceived stigma, and concerns about being negatively judged regarding COVID-19, further compounded stress, affecting engagement in preventive behaviors. These behaviors (which are essential for physical health) also interact with stress and stigma, impacting mental health. The model emphasizes protective factors, such as supportive social networks, good hygiene, and effective coping strategies, to mitigate these effects. By examining these interactions, the present study aimed to investigate variables that may help in the development of targeted interventions addressing both stressors and vulnerabilities, enhancing mental health resilience post-pandemic. This approach is crucial for culturally diverse regions such as Ghana, where cultural norms and societal structures may shape these dynamics. Understanding these interactions helps in crafting interventions and strategies to support mental health in future pandemics.

The present study addressed a critical gap in understanding the long-term psychological impacts of the COVID-19 pandemic, with implications for mental health support, policy development, and future pandemic preparedness. The COVID-19 pandemic significantly increased mental health disorders globally, with long-lasting psychological impacts persisting post-pandemic [10–15]. Despite the official end to the pandemic, its psychological aftereffects continue to pose challenges. Understanding the complex interplay between fear, stress, stigma, and preventive behaviors is crucial for developing effective interventions and strategies to mitigate mental health challenges for future pandemics, particularly in culturally diverse regions such as Ghana. Therefore, the present study utilized a serial

mediation model to explore how these factors collectively influenced mental health in the post-pandemic era. Consequently, the study proposed a model (Fig. 1) using stress, perceived stigma, and preventive behaviors to investigate the mechanism between fear of COVID-19 and mental health status among young adults in Ghana. More specifically, it was hypothesized that stress with preventive behavior, and perceived stigma with preventive behavior may be sequential mediators in the association between fear of COVID-19 and mental health.

The long-term psychological impacts of COVID-19, particularly focusing on the interplay between fear, stress, stigma, and preventive behaviors, has both theoretical and practical significance. The findings of the present study will help in (i) the advancement of mental health models (e.g., refinement of existing mental health models such as the stress-vulnerability model), (ii) integrating psychological theories with public health theories (i.e., by examining the role of preventive behaviors, the study bridges psychological theories with public health models, contributing to a more holistic understanding of health behavior during pandemics), (iii) understanding complex interactions between mental health variables (e.g., insights into the complex pathways through which COVID-19-related fear affects mental health), (iv) the development of targeted mental health interventions that address the specific stressors and fears related to COVID-19, helping individuals manage anxiety, stress, and depression in the post-pandemic era), (v) policy development (i.e., policymakers can create effective comprehensive public health strategies that incorporate mental health support alongside traditional preventive measures), (vi) public health communication by identifying effective strategies to reduce fear and stigma, promoting adherence to preventive measures without exacerbating mental health issues in future public health crises, and (vii) enhancing pandemic preparedness by understanding the psychological impacts of COVID-19 and the effectiveness of various preventive behaviors in improving preparedness for future pandemics, enabling quicker and more effective responses to help mitigate negative mental health impacts. Following the literature review, the Methods section presents a detailed description of how the present study was conducted. The Results section presents the key findings of the study, and the Discussion section reviews the findings in relation to previous literature, the limitations the implications, and conclusions.

2. Materials and method

2.1. Participants and procedure

An offline observational cross-sectional survey was conducted using convenience sampling among 635 young adults (aged between 18 and 29 years with a mean age of 20.19 [SD = 2.04]) at the Kwame Nkrumah University of Science and Technology (KNUST) (Fig. 2). The authors contacted the university to distribute the survey from June to August 2022. The inclusion criteria were participants who were (i) aged over 18 years and (ii) able to read English. The surveys were administered in English to the participants after being recruited on campus (e.g., lecture rooms, departmental and faculty offices). The survey was in the English language because it is the only formal language used in Ghanaian universities where the data were collected. Participants were given a university-embossed pen as appreciation upon completion. Ethical guidelines were rigorously followed, adhering to the 1964 Helsinki Declaration and later amendments. Participants were informed of their rights to withdraw from the study at any time without any consequences and received a detailed explanation of the study and their role before providing written informed consent. The sample was determined based on the rule of thumb for structural equation modeling which states that n = 500 is considered very good [43]. The response rate for the present study was 79.38 % based on the initial 800 surveys sent out for data collection. The study received approval from the corresponding author's (ESA) university ethics committee (IRB ref: CHRPE/AP/203/22).

2.2. Measures

Demographic information (e.g., sex, age, and educational level) was collected. Additionally, the following five scales were employed to assess the study variables.

2.2.1. Fear of COVID-19 Scale (FCV-19S)

The FCV-19S comprises seven items that assess fear of COVID-19 [44]. Each item is scored on a five-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Total scores range from 7 to 35, with higher scores indicating greater fear. The FCV-19S has
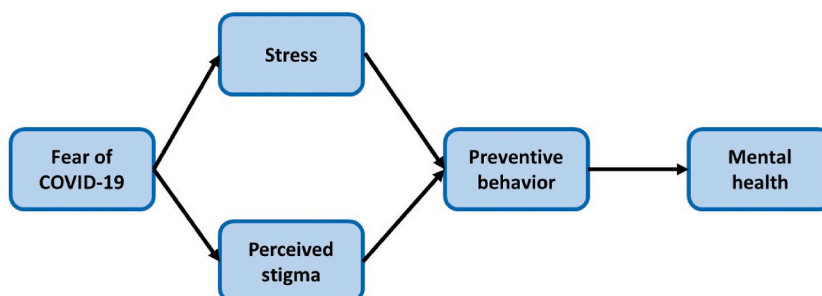

Fig. 1. Proposed model illustrating the association between fear of COVID-19 and mental health.
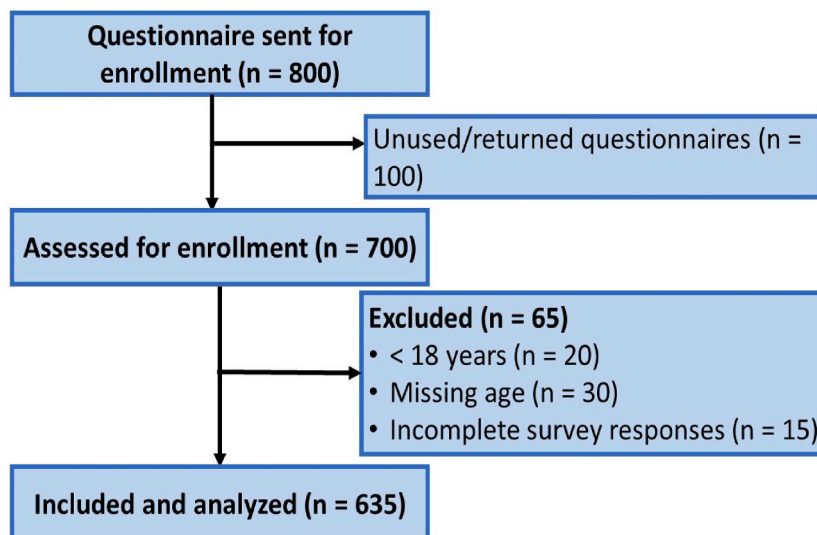
Fig. 2. STROBE (Strengthening the Reporting of Observational studies in Epidemiology) flow diagram.

robust psychometric properties [44] and has demonstrated very good internal consistency with a McDonald's omega of 0.83 in the present study. A sample item is "*I am afraid of losing my life because of COVID-19*".

2.2.2. COVID-19 Stress Scale (CSS)

The CSS comprises 36 items assessing COVID-19-related distress across multiple dimensions including fears of contamination, economic impacts, xenophobia, compulsive behaviors, and traumatic stress [45]. There are five response options (0 = *not at all,* 1 = *slightly,* 2 = *moderately*, 3 = *very*, 4 = *extremely*). Total scores range from 0 to 144 with higher scores indicating greater distress levels. The CSS has robust psychometric properties [45] and demonstrated excellent internal consistency with a McDonald's omega of 0.96 in the present study. A sample item is "*I am worried about catching the virus*" [46,47].

2.2.3. Perceived Stigma Scale from COVID-19 (PSSC)

The PSSC was adapted from the Perceived Stigma Scale developed by Williams et al. [48] to assess perceived stigma related to COVID-19. There are eight items that use a binary response scale (1 = *Yes*, 0 = *No*). Total scores range from 1 to 8 with higher scores indicating greater perceived stigma. The PSSC has robust psychometric properties [49] and demonstrated very good internal consistency with a McDonald's omega of 0.86 in the present study. A sample item is "*People act as if they are afraid of you*".

2.2.4. Preventive COVID-19 Infection Behaviors Scale (PCIBS)

The PCIBS comprises five items recommended by the World Health Organization Q&A on COVID-19 and assesses the frequency of behaviors to prevent COVID-19 infection [50]. Each item is rated on a five-point Likert scale from 1 (*almost never*) to 5 (*almost always*). Total scores range from 5 to 25, with higher scores indicating more frequent preventive behaviors. The PCIBS has robust psychometric properties [51] and demonstrated adequate internal consistency with a McDonald's omega of 0.70 in the present study. A sample item is "*I stay home more when I feel unwell*".

2.2.5. Short Form Health Survey - Mental Component Summary (SF-12-MCS)

The SF-12-MCS is one of the two components in the SF-12, a commonly used health outcome measure comprising 12 items on physical and mental health [52]. The mental component consists of six items across four domains to assess mental health: 'vitality (one item)', 'social functioning (one item)', 'role emotional (two items)', and 'mental health (two items)'. Apart from the 'role emotional' domain which has a binary response scale (1 = *Yes*, 2 = *No*), 'vitality', 'mental health' and one item from 'social functioning' domains are responded to on a six-point Likert scale from 1 (*none of the time*) to 6 (*all of the time*). The remaining item on the 'social functioning' domain is responded to on a five-point Likert scale from 1 (*extremely*) to 5 (*not at all*). The SF-12-MCS adopts a unique scoring method [53]. Total scores range from 0 to 100 with greater scores indicating better mental health. The SF-12 has robust psychometric properties [54]. Sample items include: "*Did you have a lot of energy?*" (vitality), "*During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?*" (social functioning), "*Accomplished less than you would like*" (role emotional) and "*Have you felt down hearted and blue?*" (mental health). Studies using the SF-12 have reported a Cronbach's alpha ranging between 0.60 and 0.87 [54]. In the present study, the McDonald's omega of the SF-12-MCS was 0.83.

2.3. Data analysis

Descriptive analysis was employed to summarize the characteristics of the participants. Pearson correlation coefficients were utilized to determine the relationships between variables. Structural equation modeling (SEM) using maximum likelihood (ML) estimation was applied to test the compatibility of the data for the proposed model given that both skewness and kurtosis of all the study variables were within reasonable limits (i.e., skewness ranging between −2 and +2 and kurtosis ranging between −7 and +7) [55,56]. Age and sex were controlled for in the model as covariates because they have both been previously reported as confounders in some of the study variables (e.g., fear of COVID-19) [57–59]. Moreover, the sum scores of all measures were used as observed variables in the SEM rather than using each measure item score to construct latent variables. The main reason for this was to satisfy the principle of parsimony [60], especially because the measures used in the models contained many items (e.g., the CSS has 36 items). Additionally, all measures were psychometrically robust with good internal consistency, which likely reduced the potential bias of using sum scores as observed variables. The model adequacy was assessed using four fit indices: the comparative rit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The criteria for a good model fit stipulate that CFI and TLI values should exceed 0.9, while RMSEA and SRMR values should be below 0.06 and 0.08, respectively [61,62]. Upon confirming satisfactory fit indices, the pathway model was constructed using significant coefficients. The mediation effect was additionally examined using 1000 bootstrap resampling [63]. Significance was considered when 95 % bootstrap confidence interval do not include 0 [64]. Analyses were performed using the *lavaan* package in R software and SPSS 29.0 (IBM). The significance threshold was set at $p < 0.05$.

3. Results

The characteristics of the participants (n = 635) are detailed in Table 1. The majority were male (n = 321, 50.6 %) with an average age of 20.2 years (SD = 2.04) and most had obtained a college degree (n = 469, 73.9 %). Table 1 also displays the possible ranges and mean scores of the measures used in the study.

The results of the Pearson correlation analysis are presented in Table 2. Overall, most of the study variables showed significant correlations with each other, with correlation coefficients $|r|$ ranging from 0.011 to 0.520. Notable exceptions included non-significant correlations between scores on the PSSC and PCIBS ($r = −0.063$), as well as between scores on the SF-12-MCS and the FCV-19S ($r = −0.071$), CSS ($r = −0.041$), and PSSC ($r = −0.028$) (Table 2).

The SEM results indicated an acceptable fit, as evidenced by the four indices (CFI = 0.995, TLI = 0.990, RMSEA = 0.015, and SRMR = 0.025). Further SEM analysis showed significant associations between fear of COVID-19 and both stress (standardized coefficient (β) = 0.520, $p < 0.001$) and perceived stigma ($\beta = 0.150$, $p < 0.001$). Both stress and perceived stigma were also associated significantly with preventive behaviors, with a positive association for stress ($\beta = 0.387$, $p < 0.001$) and a negative association for perceived stigma ($\beta = −0.151$, $p < 0.05$). Additionally, preventive behaviors demonstrated a significant positive association with mental health ($\beta = 0.120$, $p < 0.003$), which established significant pathways from fear of COVID-19 to mental health (Fig. 3).

The results of the mediation effects are presented in Table 3. Stress and preventive behavior ($\beta = 0.009$, 95%CI: 0.000, 0.003) and perceived stigma and preventive behavior ($\beta = −0.007$, 95%CI: −0.283, −0.020) were significant mediators in the association between fear of COVID-19 and mental health.

4. Discussion

The present cross-sectional study provided insights into the psychological conditions during post-COVID-19 era as demonstrated by the relationships between fear of COVID-19, stress, preventive behaviors, perceived stigma, and mental health among young adults in

Table 1
Baseline characteristic of participants (N = 635).

Variable	Mean (SD) or N (%)
Age (years)	20.2 (2.04)
Sex (male)	321 (50.6 %)
Education	
Junior high school	7 (1.1 %)
Senior high school	157 (24.7 %)
College undergraduate	469 (73.9 %)
Missing	2 (0.3 %)
FCV-19S (range: 7–35)	18.87 (6.33)
CSS (range: 0–4)	1.40 (0.86)
PSSC (range: 0–8)	3.66 (2.75)
PCIBS (range: 6–30)	16.28 (3.72)
SF-12-MCS (range: 0–100)	40.82 (10.32)

Abbreviations: FCV-19S = Fear of COVID-19 Scale; CSS = COVID-19 Stress Scale; PSSC = Perceived Stigma Scale from COVID-19; PCIBS = Preventive COVID-19 Infection Behaviors Scale; SF-12-MCS = Short Form Health Survey – Mental component.

Table 2
Correlations between study variables (N = 635).

	1	2	3	4	5
[1] FCV-19S	–				
[2] CSS	0.520***	–			
[3] PSSC	0.150***	0.229**	–		
[4] PCIBS	0.178***	0.144**	−0.063	–	
[5] SF-12-MCS	−0.071	−0.041	−0.028	0.111**	–

FCV-19S = Fear of COVID-19 Scale; CSS = COVID-19 Stress Scale; PSSC = Perceived Stigma Scale from COVID-19; PCIBS = Preventive COVID-19 Infection Behaviors Scale; SF-12-MCS = Short Form Health Survey – Mental component summary. **$p < 0.01$, ***$p < 0.001$.
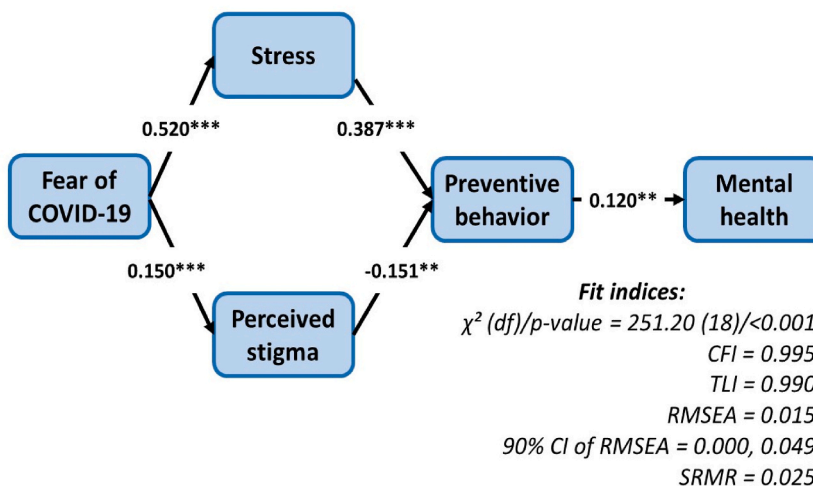

Fig. 3. Confirmed model illustrating the association between fear of COVID-19 and mental health with standardized coefficients calculated using structural equation modeling. *Note.* Age and sex were included in the model as covariates.
CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean square residual. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 3
Mediation effect in the proposed model.

	Independent variable	Mediators	Dependent variable	Standardized coefficient	95 % bootstrapping confidence interval	
					Lower limit	Upper limit
1	Fear of COVID-19	Stress → Preventive behaviors	Mental health	**0.009**	0.000	0.003
2		Perceived stigma → Preventive behaviors		**−0.007**	−0.283	−0.020

Significant coefficients are shown in **bold**.

Ghana. The results of the SEM analysis showed acceptable fit indices suggesting that the proposed model was a reliable representation of the underlying relationships related to COVID-19 impacts.

4.1. The interplay between fear of COVID-19, stress, and stigma

There was a high and positive correlation between fear of COVID-19 and stress. This suggested that individuals who experienced higher levels of fear of COVID-19 were more likely to report increased stress related to COVID-19, which concurred with previous findings [21]. This finding is important because it highlights how pervasive fear of COVID-19 can amplify responses, indicating that fear is a significant driver of stress in health-related crises [35,65].

Several factors may explain how fear of COVID-19 can trigger stress. During the pandemic, fear arose not only from direct health concerns (e.g., fear of contracting the virus, fear of complications, and fear of death) [66] but also encompassed anxiety over broader implications, with impacts on financial stability, social disruptions, and lifestyle changes. Fear can activate stress responses leading to "fight-or-flight" through the release of adrenaline [67]. However, fear can adversely affect physical health, including immune function and susceptibility to illness [68–70].

Fear of COVID-19 was also significantly correlated with perceived stigma suggesting that fear of COVID-19 not only increased stress but also contributed to the perception of stigma associated with infection. This is supported by previous studies. For example, an online survey by Zhang et al. [71] found that emotional responses, such as anger and fear, significantly correlated with public stigma of COVID-19. A randomized controlled trial by Valeri et al. [18] showed that a video-based intervention can significantly reduce COVID-19-related fear and public stigma related to COVID-19. These findings underscore a complex relationship that potentially influence public behaviors and policy responses.

4.2. Stress, stigma, and preventive behaviors

In the present study, perceived stigma was negatively associated with preventive behaviors while stress was positively associated with preventive behaviors as seen in the negative association between stigma and preventive behaviors and the positive association between stress and preventive behaviors. This dual role of psychological factors underlying the complexity of behavioral responses in pandemic conditions presents a complex interplay in the context of pandemic responses.

Stigma, characterized by negative attitudes and beliefs towards those infected or perceived to be at risk, usually leads to social isolation and discrimination [72]. This negative social feedback can deter individuals from engaging in preventive behaviors due to the fear of being associated with the disease [73,74]. During the pandemic, individuals might avoid testing or quarantine measures to escape potential stigmatization by their communities, resulting in a reduced intention to engage in preventive behaviors. A cross-sectional study conducted in Mongolia, India, and the United States highlighted this preventive behavior change due to COVID-19 stigma [26]. This implies that perceived stigma was a stressor during the pandemic.

On the other hand, stress which is likely perceived as distress from a direct threat to personal health, motivates individuals to adhere more strictly to recommended preventive behaviors. Stress usually leads to hypervigilance, which is highly sensitive to potential threats [75,76]. During a health crisis such as the pandemic, higher stress may cause greater attention to news about the virus, public health guidelines, and a proactive approach to safety measures. This may considerably increase the frequency of engaging in preventive behaviors.

4.3. Influence on mental health outcomes

The positive pathway from preventive behaviors to mental health suggested that frequent engagement in preventive behaviors may enhance mental health. This improvement may be due to an individual's sense of control over their health during a pandemic, reducing feelings of helplessness and boosting psychological well-being [77]. The present findings align with those of previous studies. For example, a study in China found a strong positive relationship between the frequency of wearing masks and mental health [78]. Similarly, a cross-sectional study in Turkey found that engaging in preventive behaviors can significantly predict good mental health, irrespective of gender, age, and chronic diseases [29]. These results demonstrate the psychological benefits of proactive health measures. However, these pathways were slightly different when considering stress and preventive behaviors, and perceived stigma and preventive behaviors as parallel mediators. The present study's findings suggested that higher fear of COVID-19 may lead to higher stress, which is connected to more frequent preventive behaviors and resulting in improved mental health. Additionally, a higher fear of COVID-19 may lead to higher perceived stigma but may negatively associate with preventive behaviors which may deteriorate mental health. Therefore, health experts and researchers should be cautious in combining or using these variables (i.e., stress, perceived stigma, and preventive behaviors) simultaneously because it may produce counter-effects.

4.4. Implications in the post-COVID-19 era

The present study's findings indicate that there are several pathways and combinations that clinicians and researchers can use to achieve good mental health. Fear can be a good variable in initiating a preventive behavior action, especially when there is an infection outbreak. Stress, although having positive results here, should only be moderately applied to this scenario because too much may be harmful. Also, health experts may have to build in stigma elimination (or pro-inclusion) messages intentionally to target the stigma associated with the situation at all levels (e.g., perceived stigma, social stigma, and self-stigma). This will boost the desired positive behavior change. It must also be stated that situations like the COVID-19 pandemic, although over, still leave post-pandemic psychological burdens so conscious efforts need to be made to mitigate factors that increase the mental health challenges of individuals. Therefore, further studies are needed to ascertain the mental health status of individuals during the post-COVID-19 pandemic era.

4.5. Limitations

Several limitations need to be mentioned. First, the participants were recruited from the same age group, in one university (KNUST), and in one country (Ghana). Therefore, the results cannot be generalized to all age groups and different cultures. Further studies with more diverse populations are necessary to draw more definitive conclusions. Second, since the study was cross-sectional, causal relationships between the study variables cannot be determined. Further research should consider using longitudinal study designs to explore potential causal relationships. Third, the data were collected using self-report surveys, which may introduce social desirability bias and recall bias. Future studies may consider employing clinician- or laboratory-based measures to obtain more reliable data. Fourth, the model tested using the SEM did not consider latent variables. Therefore, the model findings could be somewhat biased by the uncontrolled measurement errors. However, given that all the measures had good psychometric properties, any biases caused by

uncontrolled measurement errors were not likely to be severe.

5. Conclusion

The present cross-sectional study highlighted how fear of COVID-19 can significantly associate with mental health through mediators such as stress, perceived stigma, and preventive behaviors among young adults in Ghana. The study found that (i) fear of COVID-19 was positively associated with stress, (ii) perceived stigma with stress was positively associated with preventive behaviors, and (iii) perceived stigma was negatively associated with preventive behaviors. Moreover, preventive behaviors were positively associated with mental health if not used with perceived stigma as a parallel mediator. These findings suggest that fear is associated with mental health through multiple pathways. The findings of the present study may provide insights into the psychological dynamics triggered by pandemic-related fear and inform public health policies and mental health interventions. By delineating the pathways through which fear affects mental health, it is hoped that the findings of the present study can help in the development of targeted strategies to help mitigate the adverse mental health impacts of current and future public health crises. Health professionals should provide comprehensive mental health interventions that address various influences including fear, stress, and perceived stigma. Further research across diverse populations and settings is needed to draw more definitive conclusions, which may help refine public health strategies and tailor interventions to better mental health during future pandemics.

CRediT authorship contribution statement

Jiajia Ye: Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Po-Ching Huang:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis. **Emma Sethina Adjaottor:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Frimpong-Manso Addo:** Writing – review & editing, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Mark D. Griffiths:** Writing – review & editing, Validation, Methodology, Formal analysis, Conceptualization. **Daniel Kwasi Ahorsu:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Chung-Ying Lin:** Writing – review & editing, Validation, Resources, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Ethics approval and consent to participate

The data collection process for the present study adhered to the human ethics guidelines and ethical approval for this research was granted by Ethics Committee of the Kwame Nkrumah University of Science and Technology (approval number: CHRPE/AP/203/22). Informed consent was obtained from the participants during registration for the study. Participants were shown the study information details and were asked to agree to take part before any data were collected. Personal information that was collected during the course of the research was kept strictly confidential, held securely, and all data were anonymized on completion of the study. All the procedures followed the 1964 Declaration of Helsinki and later amendments.

Data availability statement

The data supporting the findings of the present study are available from the corresponding author upon reasonable request.

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.

List of abbreviations

COVID-19   Coronavirus disease 2019

KNUST: Kwame Nkrumah University of Science and Technology
FCV-19S Fear of COVID-19 Scale
CSS COVID-19 Stress Scale
PSSC Perceived Stigma Scale from COVID-19
PCIBS Preventive COVID-19 Infection Behaviors Scale
SF-12-MCS Short Form Health Survey - Mental Component Summary
SEM Structural equation modeling
ML: Maximum likelihood
CFI Comparative fit index
TLI Tucker–Lewis index
RMSEA Root mean square error of approximation
SRMR Standardized root mean squared residual
SD Standard deviation
SPSS Statistical Package for the Social Sciences

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e41407.

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