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Mental Health Symptoms among Healthcare Workers in Bamako, Mali, One Year after the Onset of the COVID-19 Pandemic: A Cross-Sectional Study

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Abstract

Introduction: The COVID-19 pandemic has been a major source of psychological distress, particularly among healthcare workers exposed to the pressures of patient care, the infection risk, and uncertainty. Early studies in Mali reported high levels of anxiety, depression, and psychological distress. This study aimed to describe the mental health symptoms among healthcare workers in Bamako approximately one year after the start of the pandemic and to examine characteristics associated with a positive screening result. **Methodology:** We conducted a cross-sectional study among healthcare workers in public and private facilities in Bamako from March to April 2021, using multistage random sampling. Data were collected through face-to-face interviews using a structured questionnaire administered via KoboToolbox. Four standardized instruments were used: GAD-7, PHQ-9, K6, and IES-R. The primary outcome was a positive screening result on at least one of the four instruments. Analyses were descriptive and bivariate, using Pearson's χ^2 or Fisher's exact test, where appropriate, and crude odds ratios (OR) with 95% confidence intervals. **Results:** Of the 300 targeted healthcare workers, 266 participated. Positive screening results were 4.5% for anxiety, 4.5% for depressive symptoms, 2.3% for psychological distress, and 7.1% for post-traumatic stress symptoms. In total, 26 participants (9.8%; 95% CI: 6.8 - 13.9) screened positive. The propor-

tions were higher among women (12.9%; OR = 1.88; 95% CI: 0.83 - 4.26), participants reporting a personal COVID-19 infection (12.3%; OR = 2.26; 95% CI: 0.88 - 5.84) or that of a colleague (13.3%; OR = 2.20; 95% CI: 0.94 - 5.12). It was also higher in district hospitals (15.2%), though no overall significant association was found. All associations were crude and unadjusted. **Conclusion:** Nearly one in ten healthcare workers had a positive mental health screening result. Post-traumatic stress symptoms were the most frequently detected. These results support maintaining mental health surveillance, psychosocial support, and referral services for healthcare workers during and after health emergencies.

Keywords

COVID-19, Mental Health Symptoms, Healthcare Workers, Mali

1. Introduction

The 2019 coronavirus disease (COVID-19) pandemic has profoundly affected health care systems and exposed health care professionals to significant pressures [1] [2]. Beyond the risk of infection, these professionals have been confronted with an increased workload, uncertainty, the fear of infecting their loved ones, and repeated exposure to illness and death [3]. These conditions have raised significant concerns about their mental health. Internationally available data have shown a high prevalence of symptoms of anxiety, depression, psychological distress, and post-traumatic stress among healthcare workers during the pandemic [3]. In Mali, early studies conducted during the initial phase of the crisis also reported a significant burden of psychological symptoms among healthcare workers [4]. These observations highlighted the need to monitor their mental health throughout the various phases of the pandemic response. However, the psychological well-being of healthcare workers can change during a prolonged crisis. Gradual adaptation to new working conditions, experience gained in caring for patients, changes in prevention measures, and perceptions of risk can alter the psychological experience of the pandemic [5] [6]. Despite the data available on the early phases of the crisis in Mali, data describing the mental health of healthcare workers at a later stage of the pandemic remain limited. The objective of this study was to describe the prevalence of symptoms of anxiety, depression, psychological distress, and post-traumatic stress among healthcare workers practicing in Bamako approximately one year after the onset of the COVID-19 pandemic, and to examine the socio-demographic, occupational, and COVID-19 exposure characteristics COVID-19 associated with a positive screening result.

2. Methodology

2.1. Study Design, Setting and Period

We conducted a cross-sectional study among healthcare professionals working in

public and private healthcare facilities in Bamako, Mali, from March to April 2021—approximately one year after the onset of the COVID-19 pandemic in the country.

The study included various levels of care, notably community health centers (CSCOMs), district hospitals, university hospitals, and private clinics involved in COVID-19 care or in health services related to the pandemic response.

2.2. Study Population and Sampling

The study population consisted of clinical and non-clinical healthcare professionals directly or indirectly involved in the management of COVID-19 or in health services related to the pandemic response. Participation was voluntary and contingent upon the signing of a written informed consent form. A multistage sampling method was used. National public hospitals and district hospitals were selected exhaustively. In each of Bamako's six health districts, three CSCOMs and three private clinics were selected at random. Within the selected facilities, healthcare professionals were systematically selected from available staff lists. Eligible healthcare professionals who were absent during the data collection period or who refused to participate were not included in the study. Because the target sample size was pragmatic and no complete sampling frame of all eligible healthcare professionals was available, a formal response rate could not be calculated. A total of 266 participants took part in the study, including 147 from CSCOMs and private clinics, 66 from district hospitals, and 53 from national public hospitals.

2.3. Data Collection

Data were collected using a structured questionnaire administered in person via KoboToolbox. Appropriate infection prevention and control measures were implemented during data collection. The questionnaire consisted of three main sections: sociodemographic and occupational characteristics; exposure to COVID-19 and perception of infection risk; and symptoms and mental health issues. Variables related to COVID-19 exposure included, among others, believing one had been infected with COVID-19, having previously undergone a PCR test, the infection of a colleague, family member, or close contact, and the perception of the risk of infection in the workplace.

2.4. Mental Health Assessment

Mental health symptoms were assessed using four standardized instruments.

Anxiety was assessed using the Generalized Anxiety Disorder-7 (GAD-7). A score of ≥10 was used to identify moderate to severe anxiety symptoms [7] [8].

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9). A score of ≥ 10 was used to identify moderate to severe depressive symptoms [9] [10]. Psychological distress was assessed using the six-item Kessler Psychological Distress Scale (K6). Scores ranged from 0 to 24, and a score of 13 or

higher was considered a positive screening result according to the conventional K6 threshold [11]-[13].

Post-traumatic stress symptoms were assessed using the 22-item Impact of Event Scale-Revised (IES-R). Each item is scored from 0 to 4, resulting in a total score ranging from 0 to 88. A total score of 33 or higher was used to define a positive screening result for post-traumatic stress symptoms [14] [15]. The validated French version of the IES-R was used [14]. Participants were asked to draw on their experience of the COVID-19 pandemic when completing the IES-R: the pandemic in general, contracting the infection oneself, a COVID-19 patient, an infected colleague, a particularly traumatic experience.

For the primary analysis, a binary composite outcome was defined as having a positive screening result on at least one of the four instruments. This composite was intended to capture the presence of at least one positive mental health screening signal across the four assessed dimensions [15]. Because these dimensions may overlap, the composite should not be interpreted as the prevalence of a single psychiatric condition or as the sum of four mutually exclusive disorders. All four screening instruments were administered in French during face-to-face interviews. The French versions of the GAD-7, PHQ-9, K6 and IES-R were used. The French version of the IES-R has been previously validated. No substantive modification of the instrument items was made for the present study. The GAD-7 and PHQ-9 assessed symptoms experienced during the previous two weeks. The K6 assessed psychological distress during the previous 30 days. For the IES-R, participants were asked to consider their experience of the COVID-19 pandemic as the reference event and to report symptoms experienced during the previous seven days.

2.5. Statistical Analysis

The data were analyzed using R software, version 4.2.1.

Categorical variables were described using counts and percentages. The proportions of participants with a positive screening result for each of the mental health issues studied were calculated along with their 95% confidence intervals.

For the composite outcome, the proportion of participants with at least one positive screening result was also estimated along with its 95% confidence interval.

Associations between positive screening result and key sociodemographic, occupational, and COVID-19 exposure characteristics were examined using bivariate analysis with Pearson's χ^2 test or Fisher's exact test, depending on the expected sample sizes. Where relevant, crude odds ratios (OR). Exact 95% confidence intervals for proportions were calculated to quantify the strength of the association between the characteristics under study and a positive screening result using the Wilson method. We acknowledge that the analysis did not explicitly account for clustering within healthcare facilities. We have added this issue to the limitations and have revised the interpretation of the bivariate associations accordingly.

No multivariate analysis was performed due to the limited number of observed

events for the composite outcome (26 participants out of 266). The analysis therefore focused on describing the prevalence of mental health problems and exploring bivariate associations.

The threshold for statistical significance was set at 5%, using two-sided tests.

2.6. Ethical Considerations

The study protocol was submitted to and approved by the Ethics Committee of the National Institute of Public Health of Mali under number 02/2021/CE-INSP on January 29, 2021.

Participation was voluntary. Written informed consent was obtained from each participant, and the confidentiality of the information collected was ensured throughout the study.

3. Results

3.1. Participant Characteristics

Of the 300 healthcare professionals initially targeted, 266 participated in the study, corresponding to 88.7% of the planned sample. Men accounted for 56.4% of the participants. The 30 - 39 age group was the most represented, comprising 42.5% of the participants. Physicians accounted for 29.7% of the sample, and nurses for 24.8%. More than half of the participants worked in primary care settings (55.3%), and 58.3% worked in the public sector (Table 1).

Table 1. Sociodemographic and professional characteristics of healthcare workers in Bamako, Mali, March-April 2021.

Characteristics n = 266	n	%
Gender		
Female	116	43.6
Male	150	56.4
Age group		
[18, 30)	44	16.5
[30, 40)	113	42.5
[40, 50)	79	29.7
[50, 80]	30	11.3
Education level		
Literate/Quranic education	4	1.5
Elementary/Secondary	8	3.0
Doctorate	85	32.0
Bachelor's degree	144	54.1
Master's degree	25	9.4
Occupation		

Continued

Clinical staff		
Physician	79	29.7
Nurse	66	24.8
Midwife	41	15.4
Medical assistant	14	5.3
Non-clinical staff		
Pharmacist	6	2.3
Biologist	18	6.8
Public health specialist	8	3.0
Administrator	16	6.0
Other staff*	18	6.8
Levels		
1st: CSCOM and private clinics	147	55.3
2nd: District hospitals	66	24.8
3rd: National public hospitals	53	19.9
Type of healthcare facility		
Public	155	58.3
Private	111	41.7

Note: Other occupations*: Driver, security guard, janitor.

3.2. Exposure to COVID-19 and Perception of Risk

Exposure to COVID-19 was common among participants. In total, 61.3% believed they had been infected with COVID-19, and 50.4% had already undergone a PCR test.

Nearly half of the participants (48.1%) reported that at least one of their colleagues had been infected with COVID-19. A family member or close friend had been infected, according to 31.6% of participants. Family difficulties or tensions related to COVID-19 or public health measures were reported by 110 participants (41.4%).

More than half of the participants (59.4%) perceived their workplace as posing a high risk of COVID-19 infection (Table 2).

3.3. Prevalence of Mental Health Problems

The results from standard mental health assessment tools are described in Table 3.

Among the 266 participants, 12 screened positive for moderate to severe anxiety, representing 4.5%. Similarly, 12 participants (4.5%) screened positive for moderate to severe depressive symptoms. Six participants (2.3%) met the predefined criterion for high psychological distress. Symptoms of post-traumatic stress were detected in 19 participants, or 7.1%. In total, 26 participants screened posi-

tive on at least one of the four instruments, representing 9.8% (95% CI: 6.8 - 13.9). Post-traumatic stress was thus the most frequently detected problem among the four dimensions assessed. These results represent screening findings and do not constitute psychiatric diagnoses.

Table 2. COVID-19 exposure and perceived risk among healthcare workers in Bamako, Mali.

Variable (N = 266)	n	%
Self-reported COVID-19 infection		
No	103	38.7
Yes	163	61.3
PCR test already performed		
No	132	49.6
Yes	134	50.4
Family member/close contact infected		
No	182	68.4
Yes	84	31.6
Colleague infected with COVID-19		
No	138	51.9
Yes	128	48.1
Family difficulties related to COVID-19/barrier measures		
No	156	58.6
Yes	110	41.4
Perceived workplace infection risk		
High	158	59.4
Moderate	66	24.8
Low	42	15.8

Table 3. Mental health screening results among healthcare workers in Bamako, Mali.

Positive screening result	Positive Screen n	% (95% CI)
Anxiety (GAD-7 ≥ 10)	12	4.5 (2.6 - 7.7)
Depression (PHQ-9 ≥ 10)	12	4.5 (2.6 - 7.7)
Psychological Distress (K6 ≥ 13)	6	2.3 (1.0 - 4.8)
Post-traumatic stress symptoms (IES-R ≥ 33)	19	7.1 (4.6 - 10.9)
At least one positive screening result	26	9.8 (6.8 - 13.9)

3.4. Characteristics Associated with a Positive Screening Result

The distribution of the composite score according to the participants' main char-

acteristics is presented in Table 4. A positive screening result was observed in 15 of 116 women (12.9%) and 11 of 150 men (7.3%). The crude odds ratio was 1.88 (95% CI: 0.83 - 4.26), with no statistically significant association. Among participants who reported having been infected with COVID-19, 20 out of 163 (12.3%) screened positive, compared with 6 out of 103 (5.8%) among those who did not report an infection. The crude OR was 2.26 (95% CI: 0.88 - 5.84). A positive screening result was observed in 17 of the 128 participants (13.3%) who reported that a coworker had been infected, compared with 9 of the 138 participants (6.5%) who did not report an infection among their coworkers. The crude OR was 2.20 (95% CI: 0.94 - 5.12).

The observed association did not reach the conventional threshold for statistical significance in the bivariate analysis. The proportion of participants with a positive screening result also varied by facility type: 6.8% in primary care facilities, 15.2% in district hospitals, and 11.3% in national public hospitals. The overall association between facility type and the composite outcome was not statistically significant (Pearson's χ^2, p = 0.15).

Table 4. Characteristics associated with a positive mental health screening result among healthcare workers in Bamako, Mali, March-April 2021.

Factor	Category	Positive screening result n/N (%)	Crude OR	95% CI	p-value
Sex	Female	15/116 (12.9)	1.88	0.83 - 4.26	0.15
	Male	11/150 (7.3)	Ref.		
Age Group	<40 years	16/157 (10.2)	1.12	0.49 - 2.58	0.78
	≥40 years	10/109 (9.2)			
Facility Level	Primary Care	10/147 (6.8)	Ref.		
	District Hospital	10/66 (15.2)	2.45	0.97 - 6.22	0.15
	National Public Hospital	6/53 (11.3)	1.75	0.60 - 5.08	
Subjective COVID-19	Yes	20/163 (12.3)	2.26	0.88 - 5.84	0.09
	No	6/103 (5.8)	Ref.		
Colleague infected	Yes	17/128 (13.3)	2.20	0.94 - 5.12	0.10
	No	9/138 (6.5)	Ref.		

Among participants under 40 years of age, 16 positive screening result were observed, compared with 10 among those aged 40 or older. No statistically significant difference was observed based on this age categorization. Overall, the bivariate analyses showed higher proportions of positive screening result in certain subgroups, particularly among participants reporting a personal infection or the infection of a colleague, and among those working in district hospitals. These findings represent unadjusted associations and should be interpreted with caution.

4. Discussion

This study assessed the mental health of healthcare professionals working in Bamako approximately one year after the onset of the COVID-19 pandemic in Mali. Among the 266 participants, 9.8% screened positive for at least one of the four mental health issues assessed. The proportions were 4.5% for moderate to severe anxiety, 4.5% for moderate to severe depressive symptoms, 2.3% for high psychological distress, and 7.1% for post-traumatic stress symptoms. Bivariate analyses revealed higher proportions of positive screening results among participants who reported that a colleague had been infected, among those who reported having been infected with COVID-19, and in district hospitals. However, the confidence intervals were wide, and the observed associations did not allow for the identification of factors independently associated with the outcome.

4.1. Comparison with Studies Conducted at the Start of the Pandemic

The levels observed in our study appear lower than those reported in some studies conducted during the early phases of the pandemic [16] [17]. A Malian study conducted at the start of the pandemic reported high levels of psychological symptoms among healthcare workers. International studies have also documented a significant burden of anxiety, depression, and stress-related symptoms among healthcare workers during the first months of the pandemic [4] [18]-[21]. However, a direct comparison between these studies and the present survey should be made with caution. The study populations, healthcare contexts, instruments used, thresholds applied, sampling methods, and data collection periods may differ. Nevertheless, since this study is cross-sectional, it does not allow us to demonstrate that the prevalence of mental health problems has decreased over time. In this study, participants were not necessarily healthcare workers directly involved in frontline patient care, even though such disorders have been frequently observed among the latter [22]. The relatively low proportion observed in our study could be consistent with a gradual adaptation of healthcare professionals to the constraints of the pandemic or with certain resilience mechanisms, but these hypotheses were not directly evaluated. The epidemiological context in Mali and the intensity of transmission at the time of the survey may also have influenced the experiences of healthcare professionals [3] [23]. However, these hypotheses were not directly assessed in our study.

4.2. Post-Traumatic Stress

Symptoms of post-traumatic stress were the most frequently detected issue, accounting for 7.1% of cases. This finding underscores that the psychological consequences of a health crisis can extend beyond mere anxiety related to the immediate risk of infection. Certain experiences during a crisis may continue to be associated with stress-related symptoms approximately one year after the onset of the pandemic. These results support the importance of incorporating the assess-

ment of stress- and trauma-related symptoms into support programs for healthcare professionals, even after the acute phase of an epidemic. These findings support the importance of incorporating the assessment of stress- and trauma-related symptoms into support programs for healthcare professionals, even after the acute phase of an epidemic has passed.

4.3. Characteristics Associated with Positive Screening Results

The proportion of positive screening results was higher among women than among men (12.9% versus 7.3%), with a crude odds ratio of 1.88 (95% CI: 0.83 - 4.26). However, this difference was not statistically significant. This trend is nonetheless consistent with several international studies conducted during the pandemic, which reported a higher prevalence of anxiety, depression, and post-traumatic stress symptoms among female healthcare workers. In particular, meta-analyses have identified female gender as one of the characteristics associated with a higher prevalence of certain mental health problems among healthcare workers exposed to COVID-19 [19] [24] [25]. Several mechanisms could contribute to this difference, including working conditions, occupational exposure, family responsibilities, and social pressures. However, these mechanisms were not specifically explored in our study and therefore cannot directly explain the observed association. A higher proportion of positive screening result was also observed among participants who reported having been infected with COVID-19 (12.3% versus 5.8%), with a crude OR of 2.26 (95% CI: 0.88 - 5.84). This trend may reflect the psychological impact of the personal experience of the disease, including anxiety about the clinical course, fear of transmitting the infection to loved ones, or the professional consequences of the infection. Studies conducted among healthcare workers during the pandemic have shown that exposure to SARS-CoV-2 and the care of patients with COVID-19 were frequently associated with symptoms of psychological distress, anxiety, or post-traumatic stress [26]. Nevertheless, in our study, the confidence interval was wide and included the null value of 1. Furthermore, infection was self-reported and therefore did not necessarily correspond, in all cases, to a biologically confirmed infection. This association should therefore be interpreted as an exploratory observation and not as evidence of a causal effect. A similar trend was observed among participants who reported that a coworker had been infected with COVID-19: 13.3% screened positive, compared with 6.5% among those who did not report this exposure (crude OR = 2.20; 95% CI: 0.94 - 5.12). Although the magnitude of the association is relatively large. A colleague's infection can be a particularly impactful experience in a professional setting, due to perceptions of personal risk, fear of transmission to loved ones, and the emotional burden associated with a team member's illness. However, these mechanisms were not directly measured in our study. Systematic reviews have documented a high prevalence of anxiety, depression, and trauma-related symptoms among healthcare professionals exposed to the pandemic, with variations depending on context and occupational characteristics [26]. Since our study did not di-

rectly measure these mechanisms, it is not possible to establish a causal link between a colleague's infection and the observed mental health symptoms. Finally, the proportion of positive screening result varied by type of healthcare facility: it was 15.2% in district hospitals, compared with 6.8% in primary care facilities and 11.3% in national public hospitals. The overall association between facility type and positive screening result was not, however, statistically significant ($p = 0.15$). This distribution could be consistent with differences in exposure conditions and work organization across levels of care. District hospitals, in particular, provide care for patients referred from primary-level facilities and may face more complex clinical situations. In the context of a pandemic, these characteristics could be accompanied by an increased clinical and organizational burden [27]. However, our study did not collect data to directly measure activity volume, workload, staffing ratios, the availability of personal protective equipment, or organizational support. These factors should therefore be considered as explanatory hypotheses to be explored in future studies and not as mechanisms demonstrated by our results. Overall, the associations observed for gender, personal infection, infection of a colleague, and type of facility should be interpreted with caution [28]. The analyses were bivariate; no multivariate models were performed, and only 26 participants screened positive on at least one screening tool. These results thus allow us to identify trends and hypotheses to be further explored rather than to establish factors independently associated with a positive screening result.

4.4. Strengths and Limitations of the Study

This study has several strengths:

- It included professionals from public and private institutions and from different levels of the healthcare system in Bamako.
- Several dimensions of mental health were explored using standardized instruments, making it possible to distinguish between anxiety, depressive symptoms, psychological distress, and post-traumatic stress symptoms.
- The study took into account different forms of exposure to COVID-19, including personal experience with the infection, infection among colleagues, and infection among close relatives.

However, several limitations must be considered:

- The cross-sectional nature of the study does not allow for the establishment of a temporal or causal relationship between the factors studied and mental health problems.
- The study was conducted in Bamako, and the results cannot necessarily be generalized to healthcare professionals in other regions of Mali, particularly in rural areas.
- Some information was self-reported and may be affected by recall bias or social desirability bias.
- The small number of positive screening results ($n = 26$) limited the precision of the association estimates and precluded a reliable multivariable analysis.

- Despite a high response rate (88.7%), nonresponse bias cannot be completely ruled out if the professionals who did not participate differed systematically from the participants in terms of mental health or exposure to COVID-19.
- The instruments used are screening tools and not tools for establishing psychiatric diagnoses. The results should therefore be interpreted as estimates of the frequency of symptoms or positive screening results.

4.5. Implications for Public Health

The results underscore the importance of maintaining systems for monitoring and supporting the mental health of healthcare professionals during health crises and beyond their acute phase. These systems could include early screening of professionals exhibiting symptoms, referral to appropriate services, psychosocial support, and follow-up. Particular attention could be given to teams that have had colleagues test positive for the infection and to work environments where the proportion positive screening result appears to be higher. Support measures should also take into account the organizational aspects of occupational health, including workload, staffing levels, infection prevention, the availability of protective equipment, and institutional communication. Longitudinal studies would be needed to determine whether mental health issues evolve during the different phases of a health crisis and to better understand the role of individual, occupational, and organizational factors.

5. Conclusions

Approximately one year after the onset of the COVID-19 pandemic in Mali, 9.8% of healthcare workers participating in this study in Bamako had a positive screening result for at least one of the four mental health symptom domains assessed. Post-traumatic stress symptoms were the most frequently detected, followed by anxiety and depressive symptoms. Higher proportions of positive screening were observed among participants reporting a personal COVID-19 infection, an infected colleague, and those working in district hospitals, although these differences were not statistically significant in the bivariate analyses.

The findings support the continued integration of mental health surveillance, psychosocial support, and referral services into occupational health and preparedness strategies for future health emergencies. Longitudinal studies are needed to assess changes in healthcare workers' mental health over time and to identify individual, occupational, and organizational factors that may influence psychological well-being during prolonged health crises.

What This Study Adds

- This study provides a cross-sectional assessment of several dimensions of mental health among healthcare workers in Bamako approximately one year after the onset of the COVID-19 pandemic.
- Positive screening for At least one positive screening result was observed in

9.8% of participants, with post-traumatic stress symptoms being the most frequently detected.

- The study identifies subgroups with higher proportions of positive screening results while avoiding causal or independent-effect interpretations because the analysis was restricted to bivariate associations.

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Data Availability

The data are, however, available from the corresponding author upon receipt of a justified request, subject to ethical and institutional approval.

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Author Contributions

Fatou Diawara, Fadjiné Diarra, Mamadou Barry and Souleymane Coulibaly designed the protocol and coordinated the study's implementation; Fadjiné Diarra, Mamadou Barry and Mamadou Fadiala Sissoko collected and entered the data; Ibrahim Terera and Mamadou Berthé conducted the data analysis; Fatou Diawara drafted the manuscript; and Abdoulaye Schoud Dabo, Sirantou Tata Déna, Akory Ag Iknane all read and revised the article.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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