

Psychometric Properties of the Fear of Monkeypox Scale among Men Who Have Sex with Men

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Abstract

Objectives: An outbreak of monkeypox (Mpox) appeared suddenly and rapidly spread worldwide during 2022. Men who have sex with men (MSM) are at a high risk of contracting Mpox compared to other cohorts. In the present study, we intended to examine the psychometric properties of a newly developed scale among MSM: the Fear of Mpox Scale (FMS) assessing the fear of Mpox. **Methods:** This is an online study. The factor structures of the FMS were first examined using exploratory factor analysis. After determining the factor structure, the FMS was further examined for (a) internal consistency using Cronbach's α and (b) concurrent validity using correlations with anxiety, depression, and risk perception of contracting Mpox, and the known-group validity by comparing the scores of the FMS across MSM with sexual orientation and education level. **Results:** In total, 389 MSM participated in this study. The results indicated that the FMS had a one-factor structure. The FMS had acceptable internal consistency ($\alpha = 0.911$) and concurrent validity (associated with anxiety [$p < 0.01$], depression [$p < 0.001$], and risk perception [$p < 0.001$]). No significant difference in the FMS scores was found between the groups with regard to sexual orientation or educational level. **Conclusion:** The results of the present study indicated that the psychometric properties of the FMS were good and that they can be used for assessing the fear of Mpox among MSM.

Keywords: anxiety and depression, comorbidity, fear of COVID-19, risk perception
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Introduction

The monkeypox (Mpox) virus was first detected among research monkeys in 1958. The earliest case of Mpox infection in humans was in a baby in the Congo in 1970, and since then, cases have been reported in Central and West Africa [1]. In May 2022, an outbreak of Mpox appeared suddenly and rapidly spread worldwide. From January 1, 2022, through to November 30, 2023, a cumulative total of 92,783 laboratory-confirmed cases of Mpox from 116 countries (including 171 deaths) were reported to the World Health Organization [1]. However, the number of suspected cases of Mpox infection which have not been confirmed by laboratories is much higher. For example, from January 1, through to November 12, 2023,

a total of 12,569 suspected Mpox cases, including 581 suspected Mpox deaths, were reported in the Democratic Republic of the Congo [2]. The age of infected individuals has changed from predominantly children (mean age: four years) to young adults (mean age: 21 years) [3], with men who have sex with men (MSM) [4, 5] and individuals with human immunodeficiency virus infection predominating [6]. As of November 2023, there had been 355 confirmed cases of Mpox in Taiwan (where the present study was carried out), including one death [7]. The aforementioned statistics

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demonstrate that Mpox is an infectious disease that cannot be ignored in today's world.

Due to the recent sudden and large outbreak of Mpox infection, MSM may have a fear of Mpox, especially after the COVID-19 pandemic. Fear is a response pertaining to the existence of a threat and generally drives actions toward self-protection [8]. Fear can lead individuals to behave in dysfunctional ways, resulting in the development of general distress and irrational beliefs [9]. However, no measures have been developed to evaluate fear of Mpox. Previous studies showed that the fear of COVID-19 contributes to individuals' mental health problems [10] and decreases individuals' ability to adopt preventive behaviors against COVID-19 [11]. The Fear of COVID-19 Scale (FCV-19S) is a brief scale that was developed for assessing individuals' fear of COVID-19 [12]. Many studies have demonstrated that the FCV-19S has satisfactory psychometric properties shown in different language versions (e.g., [13-15]). adapted the FCV-19S into a new bespoke scale, namely, the Fear of Mpox Scale (FMS), and evaluated its psychometric properties in assessing MSM's fear of Mpox.

The present study examined the psychometric properties of the FMS among MSM. In addition to examining the factor structure and internal consistency of the FMS, we also examined. In the present study, we also examined the concurrent validity of the FMS by testing its correlations with anxiety, depression, and risk perception of contracting Mpox, and the known-group validity through comparing the scores of the FMS across MSM with sexual orientation and education level.

Methods

Participants and procedures

In the present study, we recruited participants by posting a link to the research survey website on Facebook, LINE, and the Professional Technology Temple bulletin board system from November 1 to December 31, 2023. The study included Taiwanese men who were ≥ 20 years of age and who had engaged in sexual intercourse with men over the past year (i.e., MSM). The MSM who were willing to participate in the present study could press the "agree to participate" button in the advertisement and following informed consent could complete the survey. Those who were unwilling to participate in the study could press the "refuse to participate" button and leave. The present study was approved by the institutional review board of Kaohsiung Medical University Hospital (IRB protocol number = KMHIRB-EXEMPT(I)-20230008, and date of approval = October 30, 2023) without the stipulation to obtain informed consents from website study participants.

Measures

Fear of Monkeypox Scale

The FMS was used to assess the fear of Mpox. To develop this scale, we replaced the word "COVID-19" with "Mpox" in the FCV-19S [12]. The seven-item FMS assesses individuals'

fear of Mpox. Each item (Table 1) is rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). A higher summed score on the FMS indicates a greater level of fear of Mpox.

Anxiety and depression

In the present study, we used the Chinese Version of the 10-item State-Trait Anxiety Inventory to assess participants' anxiety symptoms in the past month [16]. Each item is rated on a four-point scale, where a higher total score indicates a higher level of anxiety. In the present study, the Cronbach's α was 0.88. We also used Chinese Version of the 10-item Center for Epidemiologic Studies Depression Scale to assess participants' depressive symptoms in the past month [17]. Each item is rated on a four-point scale, where a higher total score indicates a higher level of depressive symptoms. In the present study, the Cronbach's α was 0.90.

Risk perception of contracting monkeypox

To assess risk perception of contracting Mpox, participants were asked a single question: "What do you think are your chances of contracting Mpox over the next month?" This item was rated on a five-point scale ranging from 1 (not at all) to 5 (extremely high).

Demographics

Participants were also asked some demographic questions including their age (in years), educational level (senior high school or below or college or above), and sexual orientation (gay or bisexual).

Data analysis

Descriptive statistics (means, standard deviations [SDs], frequencies, percentages, skewness, and kurtosis) were used to summarize the participants' characteristics and the item scores on the FMS. Regarding psychometric testing, the FMS was analyzed using (a) exploratory factor analysis (EFA), (b) internal consistency with corrected item-to-total correlation, (c) concurrent validity, and (d) known-group validity.

Table 1. Fear of Mpox Scale (adapted directly from "the Fear of COVID-19 Scale") [12]

1. I am most afraid of Mpox
2. It makes me uncomfortable to think about Mpox
3. My hands become clammy when I think about Mpox
4. I am afraid of losing my life because of Mpox
5. When watching news and stories about Mpox on social media, I become nervous or anxious
6. I cannot sleep because I'm worrying about getting Mpox
7. My heart races or palpitates when I think about getting Mpox
Rating for each item
Strongly disagree (1)
Disagree (2)
Neither disagree nor agree (3)
Agree (4)
Strongly agree (5)

Before conducting EFA using the extraction method of principal axis factoring, Kaiser–Meyer–Olkin test and Barlett sphericity test were first used to examine if the FMS data were suitable for factor analysis. When a Kaiser–Meyer–Olkin has a value > 0.8 with a significant Barlett test, the data are suitable for EFA [18, 19]. After ensuring the data appropriateness, Kaiser’s rule regarding eigenvalues was used to decide the number of extracted factors (i.e., the number of factors having eigenvalue > 1) [20] for the FMS. After deciding the number of factors for the FMS, each FMC item was evaluated using their factor loading. An item with factor loading > 0.4 indicates that the item is needed in the tested measure [21].

When the factor structure of the FMS had been determined, Cronbach’s α was used to examine the internal consistency. Moreover, corrected item-to-total correlations were assessed to reevaluate if the items in the FMS were needed. Acceptable Cronbach’s α is > 0.7 and acceptable corrected item-to-total correlation is > 0.4 [22]. Following this, each factor of the FMS was tested for concurrent validity using the following constructs: anxiety, depression, and risk perception of contracting Mpx in the next month. Pearson correlations were used for the concurrent validity, and it was hypothesized that FMS would be significantly associated with three constructs of anxiety, depression, and risk perception of contracting Mpx in the next month.

Lastly, the FMS score was compared between the following groups: participants who were gay versus those who were bisexual; and participants who had an educational level at senior high or below versus those who had an educational level at college or above. The comparisons were tested using independent *t*-tests. Cohen’s *d* was computed to examine the effect size of the comparison, where $d < 0.2$ indicates small effect size; 0.2 to 0.5 small to medium effect size; 0.5 to 0.8 medium to large effect size; and > 0.8 large effect size [23]. In the comparison tests, it was hypothesized that the comparisons of the FMS scores between groups with regard to sexual orientation or educational level would not be significantly different.

We analyzed all study variables with the Statistical Package for Social Science software version SPSS 17.0 (SPSS Inc., Chicago, Illinois, USA). The significances between the groups were considered significant if $p < 0.05$.

Results

Totally, 389 MSM participated in this online survey. As shown in Table 2, the present sample ($n = 389$) were aged 33.72 ± 6.42 (mean \pm SD) years, with the majority being gay ($n = 343$; 88.2%). Almost all participants had completed higher education (91.0% with an educational level of college or above) and more than half of the participants had been vaccinated against Mpx ($n = 233$; 59.9%). Table 2 additionally reports the participants’ scores on anxiety, depression, and perceived risk of contracting Mpx in the next month.

Table 3 reports the descriptive statistics of the FMS items. In brief, skewness values were between 0.09 and 1.17 for the FMS; kurtosis values were between -1.36 and 0.31 for the FMS.

Table 2. Participant characteristics ($n = 389$)

	Mean \pm SD
Age (years)	33.72 \pm 6.42
Sexual orientation, <i>n</i> (%)	
Gay	343 (88.2)
Bisexual	46 (11.8)
Educational level, <i>n</i> (%)	
\leq Senior high school	35 (9.0)
\leq College	354 (91.0)
Anxiety	20.56 \pm 7.17
Depression	9.00 \pm 5.35
Perceived risk of contracting Mpx	0.98 \pm 0.82
SD, standard deviation	

As shown in Table 4, both Kaiser–Meyer–Olkin (value = 0.884) and Barlett sphericity tests ($p < 0.001$) suggested that the FMS data were suitable for EFA. The EFA results showed that the FMS possessed a one-factor structure (eigenvalue = 4.222, explained variance = 60.320%) with acceptable factor loadings for all the items (ranging between 0.703 and 0.827).

Table 4 also shows that the FMS had acceptable internal consistency (Cronbach’s $\alpha = 0.911$) with adequate corrected item-to-total correlations (ranging between 0.680 and 0.771).

Table 5 shows the concurrent validity of the FMS. More specifically, the FMS score was significantly associated with anxiety ($r = 0.138$, $p < 0.01$), depression ($r = 0.257$, $p < 0.001$), and risk perception of contracting Mpx in the next month ($r = 0.276$, $p < 0.001$).

As shown in Table 6, the independent *t*-tests showed that no significant differences in the FMS scores were found between the groups with regard to sexual orientation or educational level.

Discussion

The present study adapted the FCV-19S [12] to develop the FMS (Table 1). The FMS was then examined for its psychometric properties among a sample of MSM. The results showed that the FMS had a one-factor structure. Moreover, the FMS had acceptable internal consistency, concurrent validity, and known-group validity (Tables 2-5).

The present study found that the FMS had a unidimensional structure with acceptable factor loadings for all seven items (Table 4) and satisfactory internal consistency (Table 5). The unidimensional findings of the FMS concur with most prior findings reporting the factor structure of FCV-19S [13]. However recent findings on the FCV-19S have also reported a two-factor structure or a bifactor structure [24, 25]. The FCV-19S was first found to have a unidimensional structure in the original validation study (i.e., [12]), and then was found to have other factor structures in some subsequent studies (see [25] for details). Therefore, we suggest that the FMS also has other possible other factor structures among different populations. Therefore, future studies are needed to examine if the FMS follows the factor structure findings of FCV-19S in the literature when different populations are used for examination.

Table 3. Descriptive statistics of the items in the Fear of Mpox Scale

Measure item number	Mean ± SD	Score 1, n (%)	Score 2, n (%)	Score 3, n (%)	Score 4, n (%)	Score 5, n (%)	Skewness	Kurtosis
FMS								
FMS1	2.46 ± 1.20	106 (27.2)	113 (29.0)	67 (17.2)	91 (23.4)	12 (3.1)	0.29	-1.15
FMS2	2.62 ± 1.27	100 (25.7)	96 (24.7)	59 (15.2)	118 (30.3)	16 (4.1)	0.09	-1.36
FMS3	1.88 ± 1.02	184 (47.3)	105 (27.0)	63 (16.2)	35 (9.0)	2 (0.5)	0.87	-0.31
FMS4	1.93 ± 1.10	185 (47.6)	105 (27.0)	46 (11.8)	48 (12.3)	5 (1.3)	0.95	-0.25
FMS5	2.32 ± 1.20	134 (34.4)	91 (23.4)	76 (19.5)	80 (20.6)	8 (2.1)	0.36	-1.18
FMS6	1.75 ± 1.00	214 (55.0)	96 (24.7)	43 (11.1)	34 (8.7)	2 (0.5)	1.17	0.31
FMS7	1.91 ± 1.10	193 (49.6)	96 (24.7)	49 (12.6)	45 (11.6)	6 (1.5)	0.98	-0.18

SD, standard deviation; FMS, Fear of Mpox Scale

Table 4. Internal validity results of the Fear of Mpox Scale

Measure item number	Loading	CITT	Eigen value	Explained variance (%)	α
FMS [§]					
FMS1	0.703	0.680	4.222	60.320	0.911
FMS2	0.746	0.722			
FMS3	0.783	0.736			
FMS4	0.769	0.726			
FMS5	0.803	0.766			
FMS6	0.827	0.771			
FMS7	0.800	0.746			

[§]Kaiser–Meyer–Olkin value = 0.884

χ² of Barlett sphericity test = 1778.86; *df* = 21; *p* < 0.001. Loadings were derived from exploratory factor analysis via principal axis factoring extraction method

CITT, corrected item-to-total correlation; α, Cronbach’s α; FMS, Fear of Mpox Scale

Table 5. Concurrent validity of the Fear of Mpox Scale (*n* = 389)

	<i>r</i> (<i>p</i>)			
	FMS	Anxiety	Depression	Risk perception
FMS	-			
Anxiety	0.138**	-		
Depression	0.257***	0.691***	-	
Risk perception	0.276***	0.136**	0.154**	-

p* < 0.01; *p* < 0.001, significantly different

Risk perception, risk perception of contracting Mpox in the next month
FMS, Fear of Mpox Scale

Table 6. Comparing Fear of Mpox Scale (FMS) between groups with regarding sexual orientation and educational levels

	mean ± SD		<i>t</i>	Cohen’s <i>d</i>
	Gay (<i>n</i> = 343)	Bisexual (<i>n</i> = 46)		
FMS	14.96 ± 6.44	14.28 ± 6.07	0.67	0.11
	≤ Senior high (<i>n</i> = 35)	≤ College (<i>n</i> = 354)		
FMS	16.51 ± 7.54	14.72 ± 6.26	1.36	0.26

All *t*-tests were nonsignificantly different

FMS, Fear of Mpox Scale; SD, standard deviation

Because the FMS was found to have a one-factor structure in the present data, the FMS total score was used to examine whether it had good concurrent validity (Table 5). The findings showed that the fear of Mpox was significantly associated with anxiety (*p* < 0.01), depression (*p* < 0.001), and risk perception of contracting Mpox anxiety (*p* < 0.001), Sexual orientation, and educational level did not affect the response pattern of the fear of Mpox on the FMS (Table 6).

The results (Table 5) further indicated that the FMS is a valid instrument for assessing fear of Mpox among MSM. We also suggest that because of the significant associations (Table 5) of the FMS with anxiety (*p* < 0.01), and depression (*p* < 0.001), individuals may have these comorbid psychological problems that warrant intervention in the future.

Study limitations

Caution is advised when interpreting the study findings because the present study has four limitations:

- The participants were recruited through an online advertisement using convenience sampling. Therefore, sampling bias may have occurred and the sample was not necessarily representative of MSM.
- The sample included only those who had access to the Internet which may have biased the sample toward younger individuals. Future studies with more representative samples are needed.
- All data were self-reported by the participants. Therefore, the researchers could not fully control for single-rater and recall biases. Participants might also have given socially desirable responses instead of choosing responses that are reflective of their true feelings.
- Potential information bias should be examined in further studies. Furthermore, the suitability of the FMS in populations and cohorts other than MSM warrants further study.

Summary

The present study demonstrated that the FMS is a reliable and valid psychometric instrument for assessing MSM’s fear of Mpox. As Mpox is still spreading, healthcare providers could employ the FMS to evaluate MSM’s fear of Mpox and prevent psychological problems due to severe fear of Mpox.

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Chung-Ying Lin and Chien-Wen Lin contributed equally.

Data Availability Statement

Data sharing is available upon reasonable request to the corresponding author.

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Conflicts of Interest

All authors of this article declare no conflicts of interest.

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