# Psychometric Properties of the Moral Injury Symptoms Scale among Chinese Health Professionals during the COVID-19 Pandemic

**Zhizhong Wang** ( wzhzh_lion@126.com )
Ningxia Medical University https://orcid.org/0000-0002-0612-3218
**Harold G Koenig**
Duke University School of Medicine
**Yan Tong**
Center of Disease Control and Prevention at Shizuishan
**Jing Wen**
Ningxia Medical University
**Mu Sui**
Ningxia Medical University
**Hongyu Liu**
Ningxia Medical University
**Guangtian Liu**
Fourth People's Hospital at Ningxia

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# Abstract

**Aims** To assess the psychometric properties of the 10-item Moral Injury Symptoms Scale-Health Professional (MISS-HP) among healthcare professionals in China.

**Methods**: A total of 583 nurses and 2,423 physicians were recruited from across mainland China. An online survey was conducted using the Chinese version of the MISS-HP from March 27 to April 26, 2020 (during the middle of the COVID-19 pandemic). Reliability was assessed by internal consistency reliability and test-retest reliability. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) was performed to determine scale structure.

**Results:** Cronbach's α of the scale for both samples was acceptable (0.71 for nurses and 0.70 for physicians), as was test-retest reliability ( ICCs for the individual items ranged from 0.41 to 0.74, with 0.77 for the overall scale in physicians). EFA suggested three factors, and the CFA indicated good fit to the data. Convergent validity was demonstrated with the 4-item Expressions of Moral Injury Scale (r=0.45 for physicians, r=0.43 for nurses). Discriminant validity was demonstrated by correlations with burnout and well-being (r=0.34–0.47), and concurrent validity was suggested by correlations with depression and anxiety symptoms (r=0.37–0.45). Known groups validity was indicated by a higher score in those exposed to workplace violence (B=4.16, 95%CI: 3.21-5.10, p<0.001).

**Conclusion**: The MISS-HP demonstrated acceptable reliability and validity in a large sample of physicians and nurses in mainland China, supporting its use as a screening measure for moral injury symptoms among increasingly stressed health professionals in this country during the COVID-19 pandemic.


# Background

The term moral injury (MI) has increasingly appeared in the research literature since it was first coined by psychiatrist Johnathan Shay in the early 1990s [1]. To date, there are many definitions of MI in the literature [2]. More recently, Shay suggested a definition made up of three components: "(1) betrayal of 'what's right'; (2) by someone who holds legitimate authority; (3) in a high stakes situation" [3]. MI has been found to be present in a wide range of populations experiencing severe trauma, including military personnel, war veterans, first responders, rape victims, and others [4, 5]. At least one qualitative study has reported that the term moral injury is useful for exploring the experience of medical students in emergency medicine settings[6]. A study of refuges in Switzerland found that MI accounted for 16% of the variance in posttramatic stress disorder (PTSD) symptoms [7]. Papazoglou described that MI experienced by police officers after suffering from repeated trauma[8].

Until 2013, there were no measures for assessing MI as currently understood. Since then, several have emerged to assess the presence of MI among military populations, including two types of assessment tools: (1) those that measure both morally injurious events and MI symptoms, and (2) those that measure MI symptoms only. With regard to measures in the first category is the 9-item Moral Injury Events Scale (MIES) developed Nash and colleagues that was developed and refined in diverse military samples[9, 10].

Several years later, 20-item Moral Injury Questionnaire was developed by Currier and colleagues, again assessing morally-injurious events and symptoms [11]. The first measure in the MI symptoms only category was the 45-item Moral Injury Symptoms Scale-Military Long Form (MISS-M-LF) [12], followed soon by the publication of the 17-item Expressions of Moral Injury Scale-Military version (EMIS-M) by Currier and colleagues[13]. The MISS-M-LF was then shorted by Koenig and colleagues to a 10-item version (MISS-M-SF) [14], and this was later followed by a 4-item short version of the EMIS-M [15]. Those measures were all developed in and for active duty military or war veterans.

These scales largely followed the definitions of Shay [3] and Bret Litz et al [16] that focused on MI symptoms acquired during combat, such as feelings of shame, grief, meaninglessness, and remorse from having violated core moral beliefs [17]. Symptoms relate to what one has done (killed combatants or innocents, dismembered bodies, maltreated others, or deserted comrades during battle), what one has failed to do (protected innocents or prevented the death of fellow soldiers), and what one has observed others do or fail to do [18]. MI symptoms may also involve intense feelings of betrayal by those in authority, either in or outside of the military, and include religious or spiritual struggles or a complete loss of religious faith resulting from experiences during wartime [17].

Recently, MI among physicians and other health professionals has attracted attention in the mainstream literature discussing issues related to burnout [19]. Clinicians may experience MI when they feel their ability to deliver care is compromised by the systems (e.g., insurance, reimbursement, electronic health record) being implemented in hospitals, clinics, and medical practices[20]. During the COVID-19 pandemic, physicians in China have faced difficult ethical/moral decisions given the enormous influx of patients with life-threatening infections and limitations in available ventilators, personal protective equipment, and lifesaving medications. These physicians (and nurses) have had to play God in making decisions on who gets treatment and who does not, as well as having to deal with exposure themselves to the coronavirus and the risk this poses to their families and patients [21, 22]. As a result, health professionals have been stigmatized as vectors of contagion, resulting in their assault, abuse, and isolation during the COVID-19 pandemic, just as they had been during the SARS pandemic [23]. This situation has caused many health professionals to feel a sense of helplessness, shame, and guilt, as hundreds of patients die every day [24]. Unfortunately, until now there have been no psychometrically reliable and valid scales to measure MI symptoms such as these in healthcare professionals.

The purpose of this study was to examine the psychometric properties of the 10-item Moral Injury Symptoms Scale-Health Professional (MISS-HP) developed by Koenig and colleagues[25], which is a modified version of the MISS-M-SF developed in military personnel [13] made specifically applicable to healthcare professionals. This measure assesses ten dimensions of the moral injury: betrayal, guilt, shame, moral concerns, loss of trust, loss of meaning, difficulty forgiving, self-condemnation, religious struggle, and loss of religious/spiritual faith.

# Methods

# Participants and procedure

A convenience sample of physicians and nurses from across mainline China was recruited using a snowball sampling method [26] between May 27 and April 26, 2020. Inclusion criteria were 1) physicians or nurses; and 2) length of practice at least two years. The exclusion criteria were: (1) a history of six months or more of an extended break from practice for any reason during the past two years; (2) unable to use the internet or other mobile devices due to the vision or other disability preventing the completion of an online questionnaire; and (3) those not formally licensed to practice medicine or nursing.

Potential participants were provided a link to an online questionnaire through a popular social media platform (Wechat). Those who responded to the invitation were encouraged to forward the invitation letter to colleagues and post it on social media sites.

The invitation letter was initially sent to 19,583 potential participants by the Wechat network, of which 4,003 responded to the invitation; 28 participants refused after reading the informed consent form, resulting in 3,975 completed questionnaires (Fig. 1). Of those, 968 records were excluded during the data cleaning process, leaving a final sample of 3,006 that consisted of 583 nurses and 2,423 physicians for inclusion in the analysis.

Two-week test-retest reliability was determined by asking 100 physicians from three hospitals to complete a questionnaire version of the full survey on two occasions, of whom 73 completed the survey at both times.

# Measures

Sociodemographic characteristics. Information was collected on age, gender, marital status, educational attainment, ethnicity (Chinese Han vs. minority ethnicity), area of specialty, work area (general medical ward, ICU, emergency room), and length in practice.

Moral injury. Moral Injury Symptoms Scale-Health Professional (MISS-HP) is a measure of moral injury symptoms that assesses betrayal, guilt, shame, moral concerns, loss of trust, loss of meaning, difficulty forgiving, self-condemnation, religious struggle, and loss of religious/spiritual faith [25]. Response options for each of the ten items range from 1 to 10 signifying agreement or disagreement with each statement, with a total score ranging from 10 to 100. The higher scores indicate a greater number and severity of MI symptoms [14].

In order to assess convergent validity, the 4-item Expressions of Moral Injury Scale-Short Form (EMIS-SF) was administered. Developed by Currier and colleagues, this measure has been used widely to assess MI in military personnel [10]. Items were rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Higher total scores indicate the number and severity of MI symptoms, reflecting maladaptive behaviors and internal experiences associated with the moral challenges of delivering clinical care.

Mental health. The 9-item Patient Health Questionnaire (PHQ-9) [27] and 7-item Generalized Anxiety Disorder (GAD-7) [28]were used to measure depressive symptoms and anxiety symptoms, respectively. These two instruments are short screening measures frequently used in medical and community settings. Each item on these measures is rated on 4-point Likert scale (from 0 to 3) indicating how often each symptom has occurred within the past two weeks. Total scores range from 0–54 for PHQ-9 and 0–42 for GAD-7, with higher scores indicating more severe symptoms. The Chinese version of PHQ-9 and GAD-7scale both have strong internal and test-retest reliability as well as strong construct and factor structure validity in both medical patients and those in the general population [29, 30].

Well-being. The 12-item Secure Flourish Index (SFI) was used to measure six domains of well-being: happiness and life satisfaction, physical and mental health, meaning and purpose, character and virtue, close social relationships, and financial and material stability [31]. Each item was measured on an 11-point visual analogue scale (from 0 to 10), where higher scores indicate higher levels of well-being in each of these areas. Two items assess each of the six domains, and these are averaged to domain-specific scores; the total SFI score is calculated as the average of all six domains with equal weighting. The Chinese version of the SFI has been shown to have acceptable validity and reliability in a Chinese sample [32].

Burnout. A modified Maslach Burnout Inventory-Human Services Survey for Medical Personnel (MBI-HSMP) was used to measure the three dimensions of burnout that include emotional exhaustion, depersonalization, and reduced personal accomplishment[33]. Each item on the 22-item scale is scored on a 7-point Likert scale from 0 (never) to 6 (daily). Higher scores on each subscale and the overall scale indicate higher levels of burnout. The Chinese version of MBI-HS has been translated following a standard procedure and shown to have acceptable reliability and validity in a sample composed of participants from a range of occupations[34].

Workplace violence. Workplace violence was measured by asking, “Have you ever been attacked by your patients or their close relatives, either physically or verbally?” Response categories were yes or no.

# Translation Of Instruments

The 4-step procedure recommended by WHO was used to guide the translation of instruments in this into Chinese [35, 36]. First, the original English MISS-HP was translated into Chinese by two health professionals from out research team who were bilingual and fluent in both Chinese and English. Next, the two translations were compared and discrepancies reconciled to arrive at a draft Chinese version. Second, a bilingual expert panel consisting of three health professionals (including the original translators) and two social science researchers reviewed the draft Chinese translation separately, making cultural adaptations as necessary. Third, the draft Chinese version was back translated into English by two bilingual health professionals (different translators than those in the first step). The back-translated English version was then compared to the original English version and reviewed by the original author to ensure that the questions were translated correctly and discrepancies resolved at this stage. Fourth, the

draft version of the scale was administrated to 11 physicians from two hospitals for pre-testing. These physicians were asked to send back comments about ease of administration, clarity of wording, and time burden. Necessary changes in language were then made based on consensus to arrive at the final Chinese version of the MISS-HP (**Supplementary Table 1**).

# Data Analysis

Missing values. When computing scale scores, the mean substitution method was used to replace missing values[37]. If two items or fewer on a scale were missing, we substituted the average of items answered on the scale for the missing item score. If more than two items were missing, the scale score was considered missing and no substitutions made.

Statistical analyses. Descriptive analyses were performed on all subjects depending on whether responses were categorical or continuous. Differences in socio-demographic characteristics between nurses and physicians tested using the Student's t-test for continuous variables and the chi-square test for categorical variables. The difference in MISS-HP total scores between different demographic groups were examined using one-way analysis of variance (ANOVA). General linear regression was used to control for covariates.

Convergent/divergent validity was determined by examining correlations between the MISS-HP score and other measures. A correlation matrix was constructed using Pearson correlation coefficients. Cronbach's alpha was used to assess the internal consistency the of MISS-HP, where alphas equal to or greater than 0.70 are considered acceptable[38]. The intra-class correlation coefficient (ICC) was used to determine 2-week test-retest reliability, where ICCs between 0.41 and 0.60 indicate moderate reliability, those between 0.61 and 0.80 represent good reliability, and those higher than 0.80 indicate excellent reliability[39]. Internal reliability tests were performed separately for the total sample, nurses, and physicians.

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to extract scale factors. The total sample of physicians was split randomly into two groups. EFA was performed using principal components analysis with Promax rotation (an oblique rotation method allowing factors to correlate with each other) using group 1 (n = 1,198). The Kaiser-Meyer-Olkin (KMO) index was used to measure sample adequacy, where KMO values of 0.6 or higher indicate adequacy. The Bartlett's test of sphericity was used to assess the appropriateness of the correlations between variables in the factor model. For nurses, the full sample was used for both EFA and CFA.

CFA using the maximum likelihood method was performed to assess the stability of the factor structure (using group 2, n = 1,225 for physicians). Model adequacy was determined using the chi-square test with degrees of freedom (*df*). If the p-value is less 0.05, the model is considered acceptable and should improve with smaller $\chi 2$ values and larger df. Indices for the model fit included the comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), and root mean square error of approximation (RMSEA). The Akaike information criterion (AIC) was also calculated. Values of CFI > 0.90, NFI > 0.90, IFI >

0.90, and RMSEA < 0.08 indicate that the model fit is acceptable. All the statistical analyses completed under IBM SPSS 23.0 version software (SPSS Inc., Chicago, IL, USA).

# Results

## 3.1 Demographic characteristics

The final sample includes 583 nurses and 2,423 physicians (Table 1). The average age of the overall sample was 35.4 (SD 8.1) years, ranging from 20 to 70 years, and the average length in practice was 11.6 (SD 8.5) years (range 2 to 50 years). Approximately one-third of participants were male, and more than half (62.5%) provided inpatient care. Nearly two-thirds (64.2%) of participants reported experiencing workplace violence at some time during their professional practice. Compared with the physicians, nurses were more likely to be female, younger, work in the ICU or emergency room, had lower educational attainment, and were less likely to experience burnout. Specialty area among physicians was 34% internal medicine, 14% surgery, 12% obstetrics-gynecology or pediatrics, 8% psychiatry, and 31% other specialties.

Table 1
Socio-demographic characteristics of participants

| | Overall n = 3,006 | Nurses n = 583 | Physicians n = 2,423 | $x^2/t$ | P |
|---|---|---|---|---|---|
| Gender, Male, n (%) | 1049 (34.9) | 40 (6.9) | 1009 (41.6) | 250.23 | < 0.001 |
| Marital status, n (%) | | | | | |
| Unmarried | 656 (21.8) | 148 (25.4) | 508 (21.0) | 6.32 | 0.042 |
| Married | 2266 (75.4) | 416 (71.4) | 1850 (76.4) | | |
| Divorced/widow | 84 (2.8) | 19 (3.3) | 65 (2.7) | | |
| Ethnic (minorities) n (%) | 371 (12.3) | 58 (9.9) | 313(12.9) | 3.83 | 0.050 |
| Work area, n (%) | | | | | |
| Inpatient | 1878 (62.5) | 367 (63.0) | 1511 (62.4) | 45.06 | < 0.001 |
| Outpatient | 714 (23.8) | 94 (16.1) | 620 (25.6) | | |
| ICU/emergency | 280 (9.3) | 85 (14.6) | 195 (8.0) | | |
| Other | 134 (4.5) | 37 (6.3) | 97 (4.0) | | |
| Education, n (%) | | | | | |
| Bachelors degree | 2029 (67.5) | 568 (97.4) | 1461(60.3) | 295.42 | < 0.001 |
| Masters | 813 (27.0) | 14(2.4) | 799 (33.0) | | |
| Ph.D. | 164 (5.5) | 1(0.2) | 163 (6.7) | | |
| WPV, yes, n (%) | 1931(64.2) | 337 (57.8) | 1594 (65.8) | 13.03 | < 0.001 |
| Age, years, M ± SD | 35.4 ± 8.1 | 33.0 ± 7.5 | 35.9 ± 8.1 | 62.94 | < 0.001 |
| LP, years, M ± SD | 11.6 ± 8.5 | 11.1 ± 8.0 | 11.7 ± 8.6 | 2.10 | 0.147 |
| PHQ-9, M ± SD | 10.6 ± 6.0 | 10.6 ± 6.1 | 10.6 ± 5.9 | 0.05 | 0.815 |
| GAD-7, M ± SD | 8.3 ± 5.3 | 8.1 ± 5.4 | 8.3 ± 5.2 | 0.39 | 0.528 |
| EE, M ± SD | 26.0 ± 11.7 | 23.9 ± 11.8 | 26.5 ± 11.6 | 22.45 | < 0.001 |
| RPA, M ± SD | 30.3 ± 14.1 | 32.3 ± 10.0 | 34.2 ± 8.9 | 18.67 | < 0.001 |
| Dep, M ± SD | 10.4 ± 6.9 | 9.3 ± 7.0 | 10.6 ± 6.8 | 15.96 | < 0.001 |
| SFI, M ± SD | 6.3 ± 1.6 | 6.3 ± 1.6 | 6.2 ± 1.6 | 2.53 | 0.112 |
| MISS-HP, M ± SD | 46.9 ± 12.7 | 46.3 ± 12.2 | 47.1 ± 12.8 | 2.11 | 0.146 |
| EMIS-SF, M ± SD | 10.2 ± 3.2 | 9.9 ± 3.2 | 10.3 ± 3.2 | 7.05 | 0.008 |

| | Overall n = 3,006 | Nurses n = 583 | Physicians n = 2,423 | $x^2/t$ | P |
|---|---|---|---|---|---|

*p < 0.05, **p < 0.01

M: mean; SD = standard deviation; WPV: workplace violence; LP: length of practice; MISS-HP: moral injury symptom scale; EMIS-SF: Expressions of Moral Injury Scale-short form; PHQ-9: Patient Health Questionnaire; GAD-7: Generalized Anxiety Disorder; EE: Emotional Exhaustion; RPA: Reduced Personal Accomplishment; Dep: Depersonalization; SFI: secure flourishing index

# 3.2 Reliability

As shown in Table 2, The Cronbach's alpha for the MISS-HP scale when each item was deleted ranged from 0.64 to 0.76 in the total sample, 0.65 to 0.71 in nurses, and 0.63 to 0.69 in physicians. The Cronbach's α for the overall scale in the entire sample was 0.70, 0.71 in nurses, and 0.70 in physicians. Test-retest reliability after two weeks indicated ICCs for individual MISS-HP scale items ranging from 0.41 to 0.74, and for the total score, the ICC was 0.77 in physicians. Pearson correlations between the two times of administration were similar to ICCs (results not showed).

Table 2
Cronbach's alpha for the MISS-HP with items removed and total score

| Items | Overall (n = 3006) | | Nurses (n = 583) | | Physicians (n = 2,423) | | ICC (n = 73) |
|---|---|---|---|---|---|---|---|
| | M ± SD | α* | M ± SD | α* | M ± SD | α* | |
| MI1 | 4.1 ± 2.6 | 0.70 | 4.2 ± 2.7 | 0.69 | 4.1 ± 2.7 | 0.69 | 0.65 |
| MI 2 | 6.4 ± 3.0 | 0.64 | 6.2 ± 3.0 | 0.66 | 6.4 ± 3.0 | 0.64 | 0.51 |
| MI 3 | 5.8 ± 3.0 | 0.64 | 5.8 ± 3.0 | 0.65 | 5.8 ± 3.0 | 0.63 | 0.48 |
| MI 4 | 5.7 ± 3.0 | 0.64 | 5.3 ± 2.8 | 0.66 | 5.8 ± 3.0 | 0.64 | 0.58 |
| MI 5 | 3.6 ± 2.4 | 0.70 | 3.5 ± 2.5 | 0.71 | 3.6 ± 2.4 | 0.69 | 0.41 |
| MI 6 | 3.6 ± 2.6 | 0.70 | 3.4 ± 2.5 | 0.71 | 3.6 ± 2.6 | 0.69 | 0.57 |
| MI 7 | 6.1 ± 2.7 | 0.70 | 6.2 ± 2.9 | 0.70 | 6.1 ± 2.7 | 0.69 | 0.43 |
| MI 8 | 3.4 ± 2.5 | 0.69 | 3.4 ± 2.5 | 0.70 | 3.4 ± 2.5 | 0.68 | 0.74 |
| MI 9 | 3.5 ± 2.5 | 0.66 | 3.4 ± 2.5 | 0.68 | 3.5 ± 2.5 | 0.66 | 0.50 |
| MI 10 | 4.8 ± 2.9 | 0.69 | 4.8 ± 3.0 | 0.69 | 4.8 ± 2.9 | 0.69 | 0.51 |
| **Total** | 46.9 ± 12.7 | 0.70 | 46.3 ± 12.2 | 0.71 | 47.1 ± 12.8 | 0.70 | 0.77 |

**α**: Cronbach's alpha; * Alpha for the individual items refers to alpha for scale if item deleted; ICC: intraclass correlation coefficients.

# 3.3 Validity

As evidence for convergent validity, a significant positive correlation was found between the MISS-HP and EMIS-SF in both groups (r is 0.45 for physician, 0.43 for nurse) (Table 3). Divergent or discriminant validity was demonstrated by moderate correlations between MISS-HP score and mental health, well-being, and burnout scales. These included PHQ-9 depressive symptoms (r = 0.45 for physicians, r = 0.37 for nurses), GAD-7 anxiety symptoms (r = 0.41 for physicians, r = 0.37 for nurses), and similar correlations for the three burnout subscales, and well-being measure.

Table 3
Correlation matrix for moral injury, mental health, burnout, and well-being

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1.MISS | 1 | **0.45**** | **0.45**** | **0.41**** | **0.42**** | **-0.28**** | **0.42**** | **-0.50**** |
| 2.EMIS | 0.43** | 1 | **0.47**** | **0.46**** | **0.36**** | **-0.10**** | **0.37**** | **-0.33**** |
| 3.PHQ | 0.37** | 0.47** | 1 | **0.81**** | **0.62**** | **-0.20**** | **0.53**** | **-0.61**** |
| 4.GAD | 0.37** | 0.53** | 0.77** | 1 | **0.60**** | **-0.18**** | **0.49**** | **-0.55**** |
| 5. EE | 0.34** | 0.33** | 0.62** | 0.62** | 1 | **-0.06**** | **0.74**** | **-0.53**** |
| 6. RPA | -029** | -0.12** | -0.09* | -0.09* | 0.02 | 1 | **-0.22**** | **0.39**** |
| 7. Dep | 0.40** | 0.38** | 0.59** | 0.57** | 0.78** | -0.14** | 1 | **-0.52**** |
| 8. SFI | -0.47** | -0.37** | -0.54** | -0.53** | -0.49** | 0.39** | -0.54** | 1 |

In bold is the correlation matrix for physicians (n = 2,423); left part is the correlation matrix for nurses (n = 583)

*p < 0.05, **p < 0.01

M:mean; SD = standard deviation; MII: moral injury index; EMIS: Expressions of Moral Injury Scale; PHQ: Patient Health Questionnaire; GAD: Generalized Anxiety Disorder; EE: Emotional Exhaustion; RPA: Reduced Personal Accomplishment; Dep: Depersonalization; SFI: secure flourishing index.

Known groups validity was supported by comparing MISS-HP scores between those who reported workplace violence compared to those who did not. As indicated in Table 4, health professionals who experienced workplace violence scored higher on the MISS-HP and EMIS-SF score than those who did not (p < 0.01). After controlling demographic variables, workplace violence was significantly correlated with MI symptoms ($B$ = 4.16, 95%CI: 3.21–5.10, p < 0.001).

Table 4
Moral injury score and workplace violence exposure

| | Nurses (n = 583) | | Physicians (n = 2,423) | |
|---|---|---|---|---|
| | **no** | **yes** | **no** | **yes** |
| Moral Injury Symptoms Scale | | | | |
| M ± SD | 44.2 ± 12.2 | 47.8 ± 11.9 | 44.8 ± 12.6 | 48.4 ± 12.7 |
| *t / P* | 12.21 / 0.001 | | 44.29 / <0.001 | |
| Expressions of Moral Injury Scale | | | | |
| M ± SD | 9.4 ± 3.3 | 10.3 ± 3.0 | 9.8 ± 3.2 | 10.5 ± 3.1 |
| *t / P* | 10.72 / 0.001 | | 28.10 / <0.001 | |
| M: mean; SD = standard deviation | | | | |

Construct validity was examined by exploratory factor analysis (EFA) followed by CFA. For the EFA in the nurses' sample, the overall KMO index was 0.75, and Bartlett's test of sphericity indicated that the sample was factorable at $p < 0.001$ ($X^2_{45} = 1.24E^3$). As illustrated in **Supplementary Fig. 1**, the three factors extracted explained 58.4% of the total variance. In physicians, the KMO index was 0.73, and Bartlett's test of sphericity also showed factorability at $p < 0.001$ ($X^2_{45} = 5.27E^3$). Similar to nurses, three factors were extracted that explained 58.9% of the total variance. As indicated in Table 5, factor 1 ("shame and guilty") included items MI2, MI3, and MI4, whereas factor 2 ("mistrust") included items MI5, MI6, and MI10 and factor 3 ("forgiveness") made up of four items MI1, MI7, MI8, and MI9.

Table 5
The factor structure model of the MISS-HF

| Items | Nurses (583) | | | Physicians (n = 1,198) | | |
|---|---|---|---|---|---|---|
| | Factor Component | | | Factor Component | | |
| | 1 | 2 | 3 | 1 | 2 | 3 |
| MI1 | 0.45 | 0.24 | **0.40** | 0.15 | 0.09 | **0.61** |
| MI 2 | **0.84** | -0.12 | 0.03 | **0.83** | -0.11 | 0.08 |
| MI 3 | **0.79** | -0.19 | 0.13 | **0.84** | -0.11 | 0.14 |
| MI 4 | **0.74** | -0.07 | 0.19 | **0.69** | -0.05 | 0.30 |
| MI 5 | -0.09 | **0.76** | 0.16 | -0.17 | **0.71** | 0.15 |
| MI 6 | -0.10 | **0.78** | 0.19 | -0.09 | **0.80** | 0.15 |
| MI 7 | -0.01 | 0.37 | **0.54** | 0.19 | 0.44 | **0.62** |
| MI 8 | 0.15 | 0.18 | **0.74** | 0.26 | 0.30 | **0.61** |
| MI 9 | 0.20 | 0.08 | **0.75** | 0.30 | 0.09 | **0.66** |
| MI 10 | -0.08 | **0.70** | -0.17 | -0.03 | **0.74** | -0.05 |
| Items in the factor are marked in bold | | | | | | |

CFA confirmed the three factor model for the MISS-HP scale in nurses (n = 583) ($\chi2 = 119.65$; df = 32; $p < 0.001$, CFI = 0.93, NFI = 0.90, IFI = 0.93, RMSEA = 0.069, AIC = 165.65, and ECVI = 0.29). Likewise, CFA confirmed the three factor model for physicians (n = 1,225) ( $\chi2 = 232.03$; df = 32; $p < 0.001$, CFI = 0.93, NFI = 0.92, IFI = 0.93, RMSEA = 0.071, AIC = 278.03, and ECVI = 0.23) (see Fig. 2).

# Discussion

To our knowledge, this is the first study to examine the psychometric properties of the MISS-HP, a short but comprehensive measure of moral injury symptoms, in a large sample of health professionals. Unlike other measures of MI, the MISS-HP is unique in that it assesses both psychological and religious/spiritual dimensions of MI. The results from this study found it to be a reliable and valid measure of MI in both nurses and physicians. The findings provide primary evidence supporting the use of this tool for assessing symptoms of MI as part of health promotion programs for health professionals in China. The MISS-HP also fills an important gap in research that examines the prevalence, correlates, and health consequences of MI in nurses and physicians.

The internal consistency of the MISS-HP (alpha = 0.70 for physicians and 0.71 for nurses) is acceptable, as is the test-retest reliability (ICC = 0.77 in physicians). With regard to validity, the MISS-HP has

acceptable convergent validity with another measure of MI, the EMIS-SF (r = 0.45 for physicians and r = 0.43 for nurses). Correlations with common mental conditions (depression and anxiety), well-being, and burnout measures are as robust with the MISS-HP as with the EMIS-SF.

Known groups validity supports using the MISS-HP to identify MI among those suffering from potentially morally injurious events, such as being assaulted by patients or relatives. This finding partly supported by the study of veteran family members, which found that such violence inflicts damage to moral belief systems and causes a loss of trust[40]. Many physicians have been killed and injured during the past decade in China [41]. Moral injury can be the consequence of unexpected violence from patients or their relatives, giving rise to feelings of betrayal in nurses and physicians by the very population that they are risking their lives to help (especially during this COVID-19 pandemic) [16].

Construct validity of the MISS-HP was established using exploratory factor analysis (EFA), which was then verified by CFA. The factor analysis indicated a three-dimensional structure for the MISS-HP, explaining 59% of the total variance. This finding is consistent with the work of Griffin and colleagues [2]who suggested at least two interrelated MI symptom dimensions, self-directed outcomes (e.g., thoughts/feelings of responsibility for occurrence of moral violations such as shame or viewing oneself as unlovable or unforgivable) and other-directed outcomes (e.g., thoughts/feelings associated with being a victim of others' morally transgressive acts). Add to this the R/S dimension of MI involving struggle and loss of faith.

**Limitations** Several aspects of the present study limit generalizability of the findings, therefore, may influence both research and clinical implications. First, we assessed the MISS-HP in a single cross-sectional study involving a nonrandomized sample of Chinese health professionals, requiring cautious generalization to service members in other areas of the China, and the health professionals out of China. Second, although, standard translation procedure applied in the study, cultural differences between China and the Western society (where the scale initially developed and designed for use in) may have affected the translation of the MISS-HP scale here (both the translation and the meaning of items). Third, despite the consistent findings showed in nurses and physicians, the test-retest conducted only in a group of physicians may lead to uncertainty of using this scale in nurses. Finally, like any other self-report measures, the accuracy of responses cannot be guaranteed where access to benefits may be influenced by symptom reports (even though anonymous online survey design employed).

# Conclusions

The 10-item MISS-HP is a brief, comprehensive, reliable, and valid measure for assessing symptoms of moral injury in physicians and nurses who are providing healthcare to patients in mainland China during the COVID-19 pandemic. Scores on the scale of 50 or higher have been found to signify significant difficulty with social and occupational functioning in this population. [41]. Thus, from both a clinical and research perspective, the MISS-HP can be used to screening for MI symptoms and follow response to treatment.

# Abbreviations

MI
moral injury; PTSD:posttramatic stress disorder; MIES:moral injury events scale; MISS-M-LF:Moral Injury Symptoms Scale-Military Long Form; EMIS-M:Expressions of Moral Injury Scale-Military version; MISS-HP:Moral Injury Symptoms Scale-Health Professional; MISS-M-SF:Moral Injury Symptoms Scale-Military Short Form; PHQ-9:Patient Health Questionnaire; GAD-7:Generalized Anxiety Disorder; SFI:Secure Flourish Index; MBI-HSMP:Maslach Burnout Inventory-Human Services Survey for Medical Personnel; ANOVA:one-way analysis of variance; ICC:intra-class correlation coefficient; EFA:Exploratory factor analysis; CFA:confirmatory factor analysis; KMO:Kaiser-Meyer-Olkin; CFI:comparative fit index; NFI:normed fit index; IFI:incremental fit index; RMSEA:root mean square error of approximation; AIC:Akaike information criterion; SD:standard deviation;

# Declarations

### Ethics approval and consent to participate

The survey was anonymous. The potential risks and benefits of the survey were described on the first page of the survey. Online informed consent was obtained by asking participants to check a box on the device's screen with the response (I agree to participate in the study; I do not agree to participate in the survey). If the answer was “I do not agree”, the survey was immediately terminated automatically. The study approved by the institutional review board of Ningxia Medical University (approval #2020-112).

### Consent to publish

Not apply

### Availability of Data and Materials

Data in request to Wang ZZ at wzhzh_lion@126.com. This paper does not include any information about patients with COVID-19, and the data reported in this paper has not included in any other reports.

### Competing interests

The authors declare that they have no competing interests.


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### Authors' contributions

Study concept and design: Wang ZZ, Koenig HG; acquisition of subjects and data collection: Tong Y, Wang ZZ, Sui M, Wen J, Liu HY, Liu GT; analysis and interpretation of data: all authors; preparation of manuscript: Wang ZZ, Koenig HG; revision of manuscript for critical intellectual content: Wang ZZ, Koenig HG. All authors have read and approved the manuscript.

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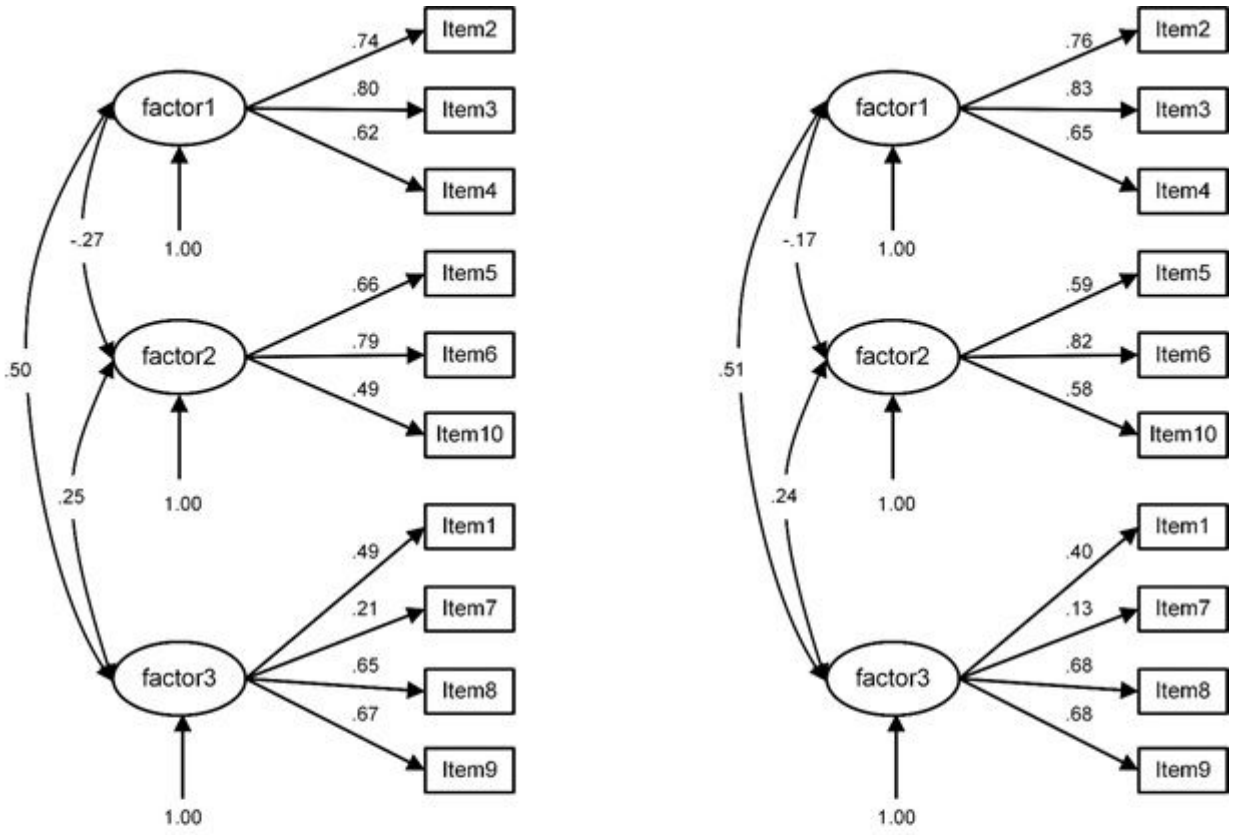
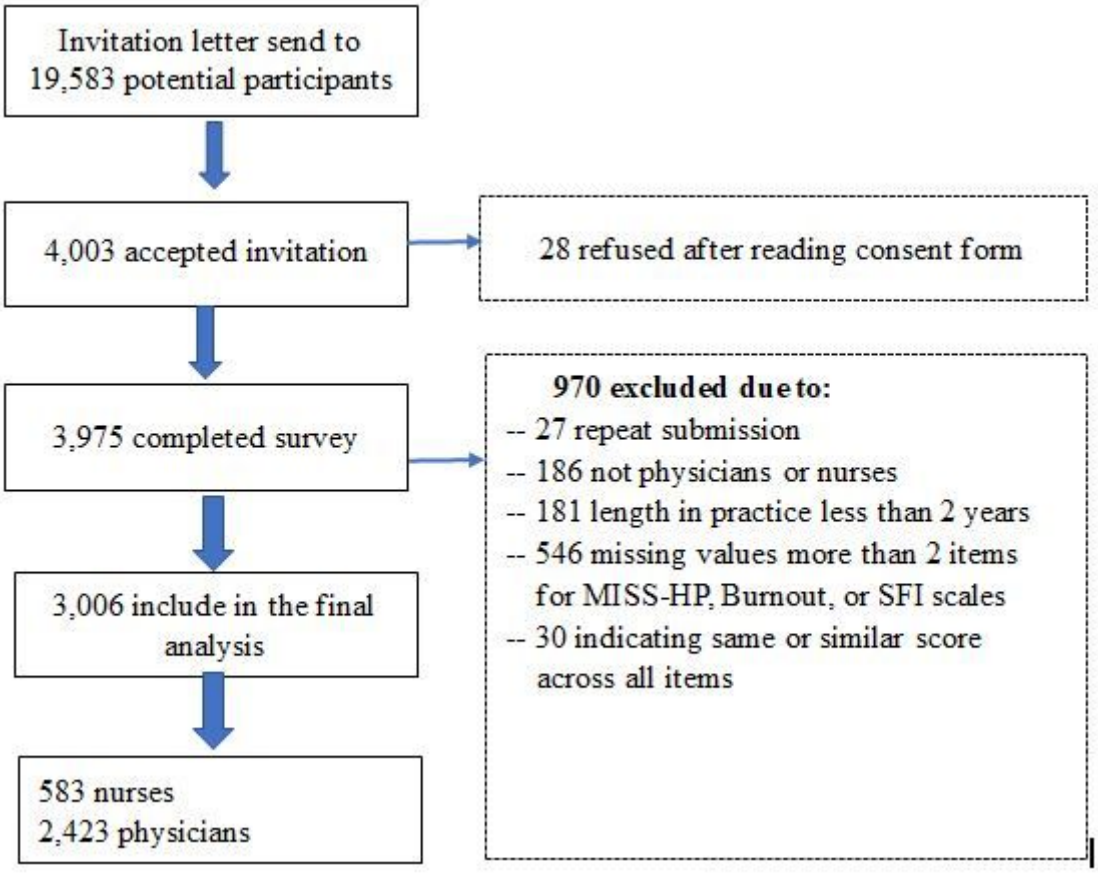
# Figures




## Figure 1

The flowchart of participant enrollment (MISS-HP: moral injury symptoms scale; SFI: secure flourishing index)




## Figure 2

The confirmative factor analysis models