

Evaluating the Validity and Reliability of the Chinese Entrapment Scale and the Relationship to Depression Among Men Who Have Sex with Men in Shanghai, China

Chen Xu

School of public health, Shanghai Jiaotong University School of Medicine

Xiaoyue Yu

school of public health, Shanghai Jiaotong university school of medicine

Lhakpa Tsamlag

School of public health, Shanghai Jiao Tong University School of Medicine

Shuxian Zhang

school of public health, Shanghai Jiao Tong University School of Medicine

Ruijie Chang

School of public health, Shanghai Jiao Tong University School of Medicine

Huwen Wang

School of public health, Shanghai Jiao Tong University School of Medicine

Shangbin Liu

School of public health, Shanghai Jiao Tong University School of Medicine

Ying Wang

School of public health, Shanghai Jiao Tong University School of Medicine

Yong Cai (✉ caiyong202028@hotmail.com)

Shanghai Jiao Tong University School of Medicine <https://orcid.org/0000-0002-5706-7906>

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Abstract

Background: Perceptions of entrapment can emerge when someone feels trapped in an aversive situation and incapable of escape. Depression and suicidal tendency are closely related to the construct of entrapment. In China, men who have sex with men (MSM) have a high incidence of depression and suicide; therefore, a tool to evaluate entrapment in this population is needed. We introduced and translated the Entrapment Scale (ES) into Chinese and evaluated its validity, reliability, applicability, and relationship to depression among MSM in Shanghai.

Methods: After the original ES was localized into a Chinese version, it was disseminated to 304 MSM from four districts in Shanghai. Participants completed a health behavior questionnaire that included baseline information and psychological measurements such as the ES and Patient Health Questionnaire (PHQ-9). The sample was randomly divided into two groups for exploratory factor analysis ($n = 143$) and confirmatory factor analysis ($n = 161$). Criterion validity was tested to explore the correlation between ES and PHQ-9 scores. The reliability of the ES was evaluated with internal consistency reliability (Cronbach's α coefficient) and split-half reliability (Spearman-Brown coefficient). We performed hierarchical regression analysis to determine the contribution of entrapment to predicting depressive symptoms after adjusting for sociodemographic factors. Finally, receiver operator characteristic curve analysis was performed to measure the optimal ES cut-off value for predicting depression.

Results: Factor analysis showed the ES had one principal component, and was a one-dimensional scale with acceptable model fit. The correlation coefficient between ES and PHQ-9 scores was 0.756 ($P < 0.01$). The Cronbach's α coefficient was 0.970 and the Spearman-Brown coefficient was 0.976. ES scores significantly predicted an additional 45.1% of depressive symptoms after controlling for sociodemographic characteristics in the MSM population ($\beta = 0.689$, $P < 0.001$). The optimum cut-off value was 23, which had a sensitivity of 70% and a specificity of 85.4%.

Conclusions: The Chinese version of the ES has good validity, reliability, and applicability in the MSM population in Shanghai, and can be used to evaluate perceptions of entrapment among MSM. The findings confirmed an association between entrapment and depression.

Background

The concept of entrapment originates from ethological studies concerning blocked or arrested defensive behaviors of animals to escape from social threats and stressors (e.g., fight, flight, or both) [1]. When encountering problems that cannot be accepted or are relatively novel, fight or flight strategies may not achieve the expected results, and psychological disorders may emerge along with defeat (a failed social struggle) [2]. Feeling defeated and trapped (called arrested flight) may lead individuals to perceive entrapment, which is considered more serious than being defeated but able to escape [2].

Gilbert and Allan defined entrapment as a personal feeling in which an individual is in an adverse state or environment and has a strong motive to take flight or get rid of the stressor, but is incapable of escape [3].

Entrapment can occur following long-term, stressful life events or situations associated with depressive disorders. The relationship between entrapment and depression has been confirmed by social rank theory, and evolutionary theory attributes the occurrence of depression to the perception of entrapment [4]. Other studies have shown clear and robust correlations between entrapment and depression [3–7]. Furthermore, feelings of entrapment and desire to escape have also been strongly linked to suicide ideation [8–11]. The Cry of Pain Model suggested that in a sample of first-time and repeat self-harm patients, entrapment had a mediating role in the defeat-suicidal ideation relationship [12]. A previous systematic review reported that self-perceived defeat and entrapment played key roles in depression, anxiety, suicidal tendency, and post-traumatic stress disorder, and emphasized that entrapment played a decisive role in depression [6].

Gilbert and Allan developed the Entrapment Scale (ES) in 1998 to measure subjective experiences of entrapment. The scale was divided into two domains based on the causes of entrapment: external entrapment (EE) and internal entrapment (IE). EE relates to perception of things in the outside world that induce escape motivation; for example, being trapped in a relationship or by a lack of resources. IE relates to escape motivation triggered by internal feelings and thoughts [3, 13]. Gilbert and Allan involved two groups of undergraduate students and patients with depression and the study showed that both EE and IE had satisfactory internal consistency and could be considered unidimensional measures [3]. That study also showed the variables of entrapment performed well, with robust correlations between depression and hopelessness in both groups [3]. The original ES has been translated into multiple languages since its publication and has been shown to have good reliability, validity, and applicability in different populations [4, 14–16]. EE and IE were originally conceptualized as two distinct constructs and evaluated using two subscales. However, Taylor et al. [17] suggested entrapment may be better considered as a single factor. This was verified by reliability and validity evaluations of the German and Chinese versions of the ES [4, 14]. Whether the ES has a single-factor structure or a two-factor structure remains to be explored.

The ES has been found to be applicable with different populations, including healthy subjects, patients with depression, caregivers, and medical students. However, no studies have evaluated perceptions of entrapment among men who have sex with men (MSM), which is a population with a high incidence of mental health problems including depression. Most studies with MSM have focused on high-risk sexual behavior, HIV infection, and substance use rather than mental health. However, in China, the MSM population has been marginalized because of their sexual orientation and corresponding prejudice related to traditional beliefs, and are generally not understood or accepted by the public. MSM are subject to social stress, prejudice, exclusion, and physical and verbal violence, which seriously affects their daily life and physical health; they also suffer more psychological pressure, anxiety, depression, and panic disorders than heterosexual men [18–20]. In addition, the presence of current psychiatric disorders has a significant independent effect on suicidal ideation among MSM [21]. In Shanghai, China, nearly one-third (30.9%) of MSM suffer from depression, which is far higher than the prevalence of depression among adults in general (2.06%) [22]. A previous study reported 10.6% of the MSM sample had suicidal thoughts

in the past year [23]. Given the relationship between entrapment, depression, and suicidal tendency, an instrument to measure perceptions of entrapment among MSM in China is worth exploring.

The present study aimed to: 1) translate the English version of the ES developed by Gilbert and Allan into a Chinese version; 2) test its reliability and validity; 3) explore the proportion of variance in explaining depressive symptoms; and 4) calculate the optimal cut-off value of the ES for predicting depression among MSM in Shanghai.

Methods

Study population and eligibility criteria

A cross-sectional study was conducted from March to November 2018 in four districts of Shanghai. After removing invalid data, a total of 304 participants were included in the analysis. The inclusion criteria were: biological males aged over 18 years who had engaged in sex with men over the past 6 months. The exclusion criterion was patients with severe mental disorders.

Recruitment and study procedure

The hidden nature of MSM and small proportion of the population prevented this study from conducting a large-scale investigation with random sampling; therefore, a snowball sampling method was used [24, 25]. First, 5–10 eligible MSM were selected as initial “seeds” in each district with the help of the local Center for Disease Control and Prevention and non-governmental organizations. Then, these participants were tasked with recruiting eligible subjects from the same sociocultural background. These second groups of participants were also asked to provide information on other potential subgroup participants, and this process continued until an adequate sample was obtained.

Unified training for the investigators was conducted that covered the survey content, methods, and relevant precautions. The investigators reached consensus on the health behavior questionnaire. Anonymous face-to-face interviews with participants were conducted as follows. First, the investigators explained the goal and procedure of the survey to participants in detail, answered any questions, and obtained their informed consent. Next, each participant was asked to independently complete a self-administered questionnaire in a private room. The questionnaire took around 30 minutes to complete. After completion of the questionnaires, the investigators checked the completeness and logicity of each questionnaire, and resolved any problems in a timely manner to ensure the accuracy of the collected data.

Entrapment Scale (ES)

With the permission of the author of the original scale, the ES was translated into Chinese by a bilingual translator. Another translator translated the Chinese version back into English to compare and correct any differences against the original scale to ensure equivalence. The final version was reviewed by the original author. Informal pretesting using a small sample of the MSM population was performed to check

the intelligibility of the items and obtain feedback on the scale. The 16 items of the Chinese version of the ES are divided into external entrapment (items 1–10) and internal entrapment (items 11–16). The response options for each item are “not at all,” “a little bit,” “moderately,” “quite a bit,” and “extremely,” which correspond to scores of 0–4. The total score ranges from 0 to 64. A higher score indicates a stronger sense of entrapment. The final Chinese version of the ES is detailed in Supplementary Material 1.

Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 was developed for criteria-based screening and diagnosis of depression [26]. The scale has been widely applied in primary care settings and demonstrated acceptable psychometric properties [27–29]. Compared with other commonly used clinical depression assessment tools, the PHQ-9 has the advantages of having fewer items, being easier to understand, and less time-consuming. The scale comprises nine items that evaluate the frequency of depressive symptoms in the previous 2 weeks. Each item is scored from 0 to 3 (representing “not at all,” “a few days,” “more than half a day,” and “nearly every day”). Total scores range from 0 to 27. The optimal cutoff point is ≥ 10 , which was described as diagnostic in a systematic review [30]. Many studies have confirmed that the generation of feelings of entrapment and defeat may trigger depression and lead to poor psychological states such as lack of self-esteem and self-confidence [3, 6, 7, 31]. Therefore, this study used the PHQ-9 to assess depressive symptoms among MSM, consistent with previous studies [32, 33]. The internal consistency reliability (Cronbach’s α coefficient) of the PHQ-9 in this study was 0.874.

Statistical analyses

Participants’ sociodemographic characteristics were calculated by numbers and proportions. The ES scores were described as mean \pm standard deviation (SD) and median (inter-quartile range, IQR). Differences between sample subgroups were tested with non-parametric tests. Participants were randomly divided into two groups using a random number generator to perform exploratory factor analysis ($n = 143$) and confirmatory factor analysis ($n = 161$) to evaluate the construct validity of the Chinese ES. The criterion validity was evaluated between ES and PHQ-9 scores using Spearman’s correlation coefficient. Cronbach’s α and Spearman-Brown coefficients were used to evaluate the internal consistency reliability and split-half reliability, respectively. We performed hierarchical regression analysis to determine the contribution of entrapment to predicting depression after adjusting for sociodemographic characteristics [3, 4]. Finally, receiver operator characteristic (ROC) curve analysis was performed to calculate optimal cut-off value of the ES for predicting depression [28]. $P < 0.05$ was considered statistically significant. All analyses were performed using SPSS 25.0 and AMOS 24.0.

Results

Sociodemographic characteristics and sample comparisons

Table 1 presents an overview of participants' sociodemographic characteristics and comparisons of ES scores between subgroups. The age of participants ranged from 18 to 69 years, with a mean age of 29.91 years. Most (85.2%) participants were unmarried and 69.7% were self-reported homosexuals. The results suggested that only the difference in ES scores between married and unmarried subgroups was statistically significant ($P=0.011$).

Construct validity

Exploratory factor analysis

A Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used to determine the feasibility of factor analysis. The results showed that the KMO measure of sampling adequacy was 0.953 and the chi-square value of the Bartlett's test was 2463.831 ($P<0.001$), indicating the data were suitable for factor analysis. Exploratory factor analysis was performed using principal component analysis with eigenvalues greater than 1 and covariance matrix. A common factor was extracted, and the percent of variance was 70.461%. The item communality and factor loading are shown in Table 2. These results suggested the ES should be regarded as a one-dimensional scale.

Confirmatory factor analysis

Confirmatory factor analysis was used to compute the model fit of the one-dimensional model including the ratio of chi-square and degrees of freedom, root of the mean square residual, root mean square error of approximation, goodness-of-fit index, normed fit index, incremental fit index, Tucker-Lewis index, and comparative fit index. The results suggested the model fit indices of the one-dimensional model were acceptable (Table 3). The regression coefficients of each item in this model were statistically significant (Table 4).

Criterion validity

The ES total score (14.19 ± 13.71) was positively correlated with the PHQ-9 (5.87 ± 4.42) score ($r=0.75$, $P<0.01$). The correlation coefficient was good and statistically significant.

Reliability

The Cronbach's α and Spearman-Brown coefficients were 0.970 and 0.976, respectively, suggesting the Chinese ES had good internal consistency reliability and split-half reliability.

Hierarchical regression analysis

Our data met the assumptions for multiple linear regression including measures for collinearity, and no multivariate outliers or influential cases were identified. The hierarchical regression analysis was used to show the predictors of depressive symptoms (Table 5). Sociodemographic characteristics were included in step 1 and ES scores were added in step 2. The feeling of entrapment significantly predicted an additional 45.1% of depressive symptoms among the MSM population ($\beta=0.689$, $P<0.001$).

Sensitivity and specificity of the ES for predicting depression

Figure 1 shows the ROC for ES as a predictor of depression. The ES had good value in predicting MSM with a PHQ-9 diagnosis of depression (area under the ROC curve was 0.854, 95% confidence interval: 0.809, 0.892). The optimum cut-off value of the ES for predicting depression was 23, which had sensitivity of 70% and specificity of 85.4% when a PHQ-9 score >9 was considered to indicate depression.

Discussion

The Chinese ES was developed and shown to be a reliable measure with acceptable internal consistency and split-half reliability. The present results also confirmed that the ES was valid and related to depression. Although the original ES comprised two subscales (EE and IE), factor analysis in this study demonstrated the ES can be considered as a single construct. This conclusion was consistent with previous studies that tested a German version of the ES and assessed the reliability and validity of the Chinese ES among medical students [4, 14]. These findings demonstrated that causes of entrapment were theoretically but not empirically divisible into internal and external sources. Some ES items cannot be easily distinguished as EE or IE, such as “I am in a situation I feel trapped in” or “I can’t see way out of my current situation” [4]. Considering that the concepts of entrapment and defeat have been brought together to form the basis of evolutionary approaches to human depression, Taylor’s research empirically supported the view that the two concepts were separate but interacting constructs should be modified [17]. Griffiths et al. proposed the two concepts were best defined as one factor [34], and developed a Short Defeat and Entrapment Scale [13]. MSM are a vulnerable population at high-risk for depression and suicide attempts. They are often not understood or accepted by the general public because of their sexual orientation and perceived sexual behavior and susceptibility to sexually transmitted diseases and mental health problems. Outside views and inner self-doubt and self-denial may have a mutual influence and association; MSM may therefore be unable to accurately divide self-perceived entrapment into internal or external sources.

Our data showed unmarried MSM had higher ES scores than the married group. In China, homosexual marriage has not been recognized. Heterosexual marriage is possible to help MSM conceal their sexual orientation and avoid social criticism and pressure. Depression is considered to be a complicated combination of high negative affectivity and low positive affectivity [35]. The correlation coefficient between ES and PHQ-9 scores was 0.75 ($P < 0.01$), and the former explained nearly half of the variance in the later. This reflected entrapment as a relevant and distinct construct in explaining depression in the MSM population. A cutoff score of 23 on the ES was suggested to be optimal (with a sensitivity of 70% and a specificity of 85.4%) when predicting a diagnosis of depression as measured by the PHQ-9. Therefore, the MSM population can rate their own perceptions and judgments about entrapment and pay attention to their current mental state using this ES cutoff score. However, this cut-off score should be used with caution in screening and other populations. The conceptualization of a state of entrapment implies the feeling of entrapment may change over time [4]. If an individual is measured with high score multiple times in the short- or long-term, their mental health problems may merit attention.

Entrapment has also been associated with anxiety, anhedonia, feelings of shame, hopeless, and suicidality [12, 36, 37]. It is important that MSM recognize the perception of entrapment early to allow timely implementation of psychological and suicide prevention interventions to avoid or relieve depressive symptoms and suicidal tendencies. Improving self-cognition and self-affirmation and enhancing self-defensive ability and external support resources are of value for MSM [38]. In addition, increased social acceptance and support may enhance self-perceived social status and improve coping ability when facing outside threats, stress, and criticism [39]. Screening for psychological status and comprehensive interventions integrating psychology, society, and behavior need to be strengthened in primary care settings.

Limitations

There were some limitations in this study. First, participants might have had some reservations when completing the questionnaire because of privacy issues, which could have resulted in information bias. However, all investigators participated in unified training and an anonymous, self-administered questionnaire was used to maximize the data quality. Second, the MSM population in the study setting is small and relatively hard to reach, meaning strict random sampling was impossible for this study. The snowball sampling method used in this study inevitably produces selection bias and sample representation problems. However, snowball sampling can identify more subjects that meet study requirements relatively easily at low cost and high efficiency. Ensuring the balance of demographic characteristics (as much as possible) during sampling also improves the sample representation to some extent. Finally, participants were limited to the MSM population in Shanghai, which is an economically developed and culturally open city; the social acceptance of MSM may be higher than in other areas. Therefore, this sample cannot represent all MSM populations in China. Use of the ES should be further explored in other areas of China.

Conclusions

The MSM population is at high risk for depression and suicidal tendency, which suggests that close attention should be paid to mental health problems among this group, especially psychological problems related to depression (e.g., feelings of entrapment). The Chinese version of the ES has good psychometric properties and can be extended to all MSM populations in China to evaluate perceptions of entrapment. This will support early identification and early intervention for mental health problems in this population.

Abbreviations

MSM: men who have sex with men; ES: entrapment scale; EE: external entrapment; IE: internal entrapment; PHQ-9: Patient Health Questionnaire-9; SD: standard deviation; IQR: inter-quartile range; CMIN/DF: the ratio of chi-square and degrees of freedom; RMR: root of the mean square residual; RMSEA: root mean square error of approximation; GFI: goodness-of-fit index; NFI: normed fit index; IFI: incremental fit index; TLI: Tucker-Lewis index; CFI: comparative fit index. ROC: receiver operator characteristic

Declarations

Ethics approval and consent to participate

The whole research process strictly complied with American Psychological Association ethical standards and with the Code of Ethics of the World Medical Association (Declaration of Helsinki). This study was approved by the Ethics Committee of the School of Public Health at Shanghai Jiao Tong University. Written informed consents were obtained from all participants before the study began.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed the design of this research. CX and XY drafted the manuscript and performed statistical analyses. LT and SZ was involved in the compilation of the questionnaire. RC, HW and SL played a major role in the field survey. YW and YC made a substantial contribution to the interpretation of the data and were involved in revision of the manuscript through all stages. All authors read and approved the final manuscript.

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Authors' information

1School of Public Health, Shanghai Jiao Tong University, School of Medicine, No.227, South Chongqing Road, Shanghai 200025, People's Republic of China.

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Tables

Table 1. Sociodemographic characteristics and sample comparisons of Entrapment Scale scores (N=304)

Sociodemographic Characteristics	Number of participants n (row%)	ES scores		P value
		Mean ± SD	Median (INQ)	
Age group				0.791
< 25	82(27%)	15.15±14.14	11.5(23)	
25-40	188(61.8%)	14.19±13.90	12(22)	
41-59	31(10.2%)	11.97±11.73	8(16)	
≥ 60	3(1.0%)	11.00±9.54	16(17)	
Education level				0.512
Less than Junior high school	25(8.2%)	16.08±13.61	16(27)	
High school	38(12.5%)	13.13±14.01	9.5(17)	
Uni. /tech./prof.	241(79.3%)	14.16±13.70	11(21)	
Income				0.232
≤ 3000	35(11.5%)	17.23±13.47	16(26)	
3001-6000	84(27.6%)	15.12±14.35	12(24)	
6001-12000	114(37.5%)	13.56±13.57	10(22)	
≥ 120001	71(23.4%)	12.59±13.22	10(17)	
Marital status				0.007
Married	35(11.5%)	9.29±14.07	3(16)	
Unmarried	259(85.2%)	14.73±13.65	12(22)	
Divorced and Widowed	10(3.3%)	14.89±8.59	16(31)	
Residence status				0.521
Local	80(26.3%)	13.99±13.47	12(21)	
Stayed ≤ 1 year	27(8.9%)	16.63±13.65	13(24)	
Stayed 1-5 year(s)	109(35.9%)	14.44±13.83	10(24)	
Stayed ≥ 5 years	88(28.9%)	13.31±13.91	10.5(18)	
HIV status				0.956
Positive	9(3.0%)	13.78±13.60	14(15)	

Negative	251(82.5%)	14.18±13.98	11(21)	
Unknown	44(14.5%)	14.34±12.40	13(24)	
Self-reported sexual orientation				0.052
Homosexuality	212(69.7%)	15.47±14.08	13.5(22)	
Heterosexuality	9(3.0%)	12.44±16.46	3(23)	
Bisexuality	69(22.7%)	10.83±11.63	6(18)	
Not sure	14(4.6%)	12.43±13.95	8.5(21)	

SD: standard deviation; IQR: inter-quartile range

Table 2. Item communality and factor loading of the Chinese Entrapment Scale (N=143)

Item-Nr	Item	Communality	Factor Loading
1	I am in a situation I feel trapped in.	0.557	0.746
2	I have a strong desire to escape from things my life.	0.716	0.846
3	I am in a relationship I can't get out of.	0.623	0.789
4	I often feel like I would just like to run away.	0.764	0.874
5	I feel powerless to change things.	0.699	0.836
6	I feel trapped by my obligations.	0.715	0.845
7	I can't see a way out of my current situation.	0.762	0.873
8	I would like to get away from other more powerful people in my life.	0.556	0.745
9	I strongly desire to leave and stay away from where I am now.	0.732	0.856
10	I feel trapped by other people.	0.652	0.807
11	I want to get away from myself.	0.673	0.820
12	I feel powerless to change myself.	0.673	0.820
13	I would like to escape from my thoughts and feelings.	0.763	0.873
14	I feel trapped inside myself.	0.790	0.889
15	I would like to get away from who I am and start again.	0.825	0.908
16	I feel I am in a deep hole that I can't escape.	0.776	0.881

Table 3. Model fit indices of the one-dimensional model (n = 161)

Model fitting index	CMIN/DF	RMR	RMSEA	GFI	NFI	IFI	TLI	CFI
one-dimensional model	2.010	0.034	0.083	0.861	0.920	0.957	0.948	0.956

CMIN/DF: the ratio of chi-square and degrees of freedom; RMR: root of the mean square residual; RMSEA: root mean square error of approximation; GFI: goodness-of-fit index; NFI: normed fit index; IFI: incremental fit index; TLI: Tucker-Lewis index; CFI: comparative fit index.

Table 4. Confirmatory factor analysis parameter estimation table (n=161)

Item-Nr	Unnormalized parameter estimates	Standard error	t value	normalized parameter estimates
1	1.000	-	-	0.767
2	1.231	0.100	12.356*	0.870
3	1.032	0.116	8.876*	0.666
4	1.266	0.104	12.116*	0.857
5	1.357	0.108	12.520*	0.879
6	1.298	0.114	11.364*	0.815
7	1.259	0.108	11.642*	0.832
8	1.079	0.101	10.658*	0.776
9	1.243	0.106	11.761*	0.839
10	1.070	0.097	11.069*	0.799
11	0.990	0.092	10.706*	0.781
12	1.329	0.108	12.323*	0.870
13	1.120	0.094	11.977*	0.852
14	1.220	0.109	11.225*	0.809
15	1.208	0.106	11.431*	0.821
16	1.222	0.103	11.838*	0.843

*P< 0.001

Table 5. Hierarchical regression analysis predicting depressive symptoms (Patient Health Questionnaire-9)

Model	R	R ²	Adjusted R ²	R ² Change	F value
Step1 ^a	0.292	0.085	0.048	-	2.261*
Step2 ^b	0.732	0.536	0.515	0.451	25.782*

^a independent variables included age, education level, marital status, income, residence status, HIV status, and self-reported sexual orientation

^b independent variables included age, education level, marital status, income, residence status, HIV status, self-reported sexual orientation, and ES score

R²: coefficient of determination

*P<0.01

Figures

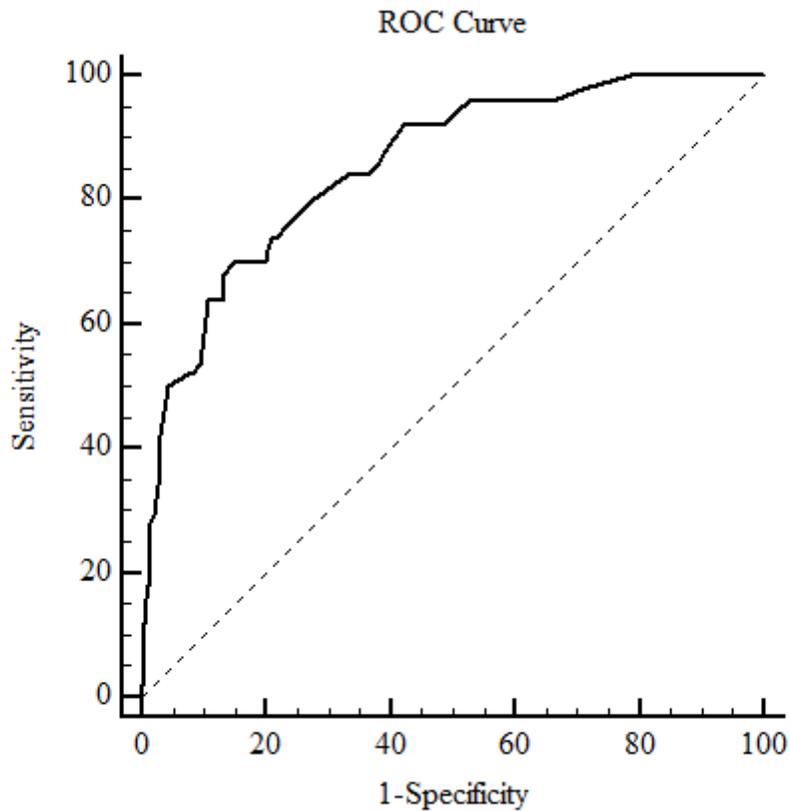


Figure 1

Receiver operator characteristic (ROC) curve for the Chinese Entrapment Scale as a predictor of depression. The area under the ROC curve was 0.854 (95% confidence interval: 0.809, 0.892). The optimum cut-off value of the ES for predicting depression was 23 with a sensitivity of 70% and specificity of 85.4% when a PHQ-9 score >9 was considered to indicate depression.

Supplementary Files

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- [SupplementaryMaterial1.docx](#)