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BSRS-5 (5-item Brief Symptom Rating Scale) scores affect every aspect of quality of life measured by WHOQOL-BREF in healthy workers

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Abstract
Purpose This study aims to evaluate and quantify the possible effect of psychological symptoms on healthy workers' quality of life (QOL).
Methods The workers were recruited from a factory in south Taiwan. We assessed their psychological symptoms with a 5-item brief symptom rating scale (BSRS-5) and measured the QOL using the Taiwanese version of the World Health Organization Quality of Life (WHOQOL)-BREF. Multiple linear regression analysis was conducted to explore the association between the two tools after control of confounding by other predictors.
Results A total of 1,080 workers, who attended a physical examination, completed questionnaires and informed consent forms. Scores on the BSRS-5 significantly predicted scores in each domain and items of the WHOQOL-BREF. The magnitude of psychological domain score seemed to be affected the most; every 1 point increase in BSRS-5 was associated with a 0.39 raw score (equivalent to 2.44 percentile) decrease in QOL. The sleep facet of WHOQOL appeared to have the highest association, followed by items of negative feelings, energy, and concentration.
Conclusions The BSRS-5 score is predictive for scores of all four domains and 26 items of the Taiwanese version of the WHOQOL-BREF for regular factory workers.

Keywords BSRS-5 · 5-item brief symptom rating scale · WHOQOL-BREF · Quality of life · Psychological symptoms

Abbreviations

BSRS-5	5-item brief symptom rating scale
QOL	Quality of life
WHOQOL	World Health Organization Quality of Life
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
AC-Glu	Fasting serum glucose
TG	Triglyceride
TC	Total cholesterol
HDL-c	High-density lipoprotein cholesterol
LDL-c	Low-density lipoprotein cholesterol
ANOVA	Analysis of variance

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Introduction

Psychological symptoms are not uncommon in our daily life. Such symptoms include insomnia, depression, hostility, anxiety and interpersonal sensitivity, etc. are also included in the interview of mental health [1]. They frequently occur when people are emotionally stressed or experience an important life event such as divorce or bereavement. Previous studies have shown that depression and anxiety affect quality of life (QOL) for patients with heart disease (atrial fibrillation and coronary artery disease), lung disease (chronic obstructive pulmonary disease and asthma), cancer under chemotherapy, organ transplants, and other diseases (severe obstructive sleep apnea syndrome and primary systemic vasculitis) [2–9]. In brief, psychological symptoms may influence both the clinical control and complication of physical diseases and the QOL of the subjects. However, to our knowledge, no study has investigated the effects of psychological symptoms on QOL scores in the healthy population.

QOL refers not only to physical and psychological health but also to social and environmental status, all of which can substantially affect well-being. Most measurement tools of QOL are self-reported and might be influenced by the subjective feelings at the time of filling the questionnaire. We once found that psychological symptoms were predictive to the functional performance of upper extremities, as evidenced by showing a significant influence of CHQ (Chinese Health Questionnaire) to measurements of both MHQ (Michigan Hand Outcomes Questionnaire) and DASH (Disabilities of the Arm, Shoulder, and Hand) among patients with minor hand injuries [10]. Thus, we suspected that the psychological symptoms might also affect the scores of different QOL domains/items that are not directly related to emotional or physical changes. Such a hypothesis cannot be tested among patients with any physical illness that may confound the measurement results.

So this study aims to evaluate the potential effects of psychological symptoms on the QOL of apparently healthy subjects; we assessed the former with the 5-item brief symptom rating scale (BSRS-5) and the latter with the Taiwanese version of the World Health Organization Quality of Life (WHOQOL)-BREF. Since both questionnaires contain an item related to sleep, we also postulated that the score of BSRS-5 should be associated with the score of psychological domain of WHOQOL.

Subjects and methods

Subject recruitment and study population

This study was approved by the Institutional Ethics Committee of E-Da Hospital, I-Shou University. We conducted our research after the annual, regular physical examinations for workers at a steel-making factory in southern Taiwan. All the employees who attended this examination were invited to complete our study's questionnaires, which assessed their individual scores for psychological symptoms and quality of life. The annual physical was conducted from June to December of 2007, and the questionnaires were completed from April to June of 2009. We included the data for smoking and diagnoses of metabolic syndrome as covariates, and we assumed that there were relatively few changes before the completion of this study for the individual workers. A total of 1,430 workers attended the physical examination, but only 1,173 workers completed both questionnaires and informed consent forms. We collected the following data from the annual physicals: age, gender, smoking status, waist circumference, systolic blood pressure (SBP), diastolic blood pressure (DBP), and a biochemical examination that included fasting serum glucose (AC-Glu), triglyceride (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), and low-density lipoprotein cholesterol (LDL-c). The 5 criteria for metabolic syndrome were central obesity (waist circumference above 90 cm in men and 80 cm in women), high blood pressure (SBP higher than 130 mmHg or DBP higher than 85 mmHg), elevated fasting serum glucose (AC-Glu higher than 100 mg/dl), high triglyceride level (TG higher than 150 mg/dl), and low HDL-c level (HDL-c below 50 mg/dl in women and 40 mg/dl in men). These data were published by the Bureau of Health Promotion in the Department of Health in Taiwan in 2006. The workers who met 3 or more of the above criteria were diagnosed with metabolic syndrome. Although physical illnesses may affect the quality of life, simple abnormality in any one of the above measurements might not necessarily produce a low score. Thus, we decided to include metabolic syndrome, a diagnosis with combinations of abnormality and was quite prevalent in Taiwan, as a potential predictor for the measurements of the BSRS-5 and WHOQOL-BREF.

Measuring quality of life: the Taiwanese version of the WHOQOL-BREF

In 1991, the World Health Organization initiated a project to develop a generic QOL instrument in ten countries. This project generated the World Health Organization Quality of Life (WHOQOL) instrument [11, 12]. The WHOQOL has two unique features. First, it encompasses the physical, psychological, social, and environment domains comprehensively. Second, it is a cross-cultural instrument that was developed for use across different patient groups and in different countries [13]. The WHOQOL-BREF, a short form of the WHOQOL, was developed later [14]. Yao et al.

adapted this questionnaire to Taiwan's unique culture [15]. Every subject was administered a validated, generic QOL questionnaire (the Taiwanese version of the WHOQOL-BREF) in the meeting room of the steel factory. This questionnaire contains four domains (physical, psychological, social, and environment). It includes the 26 original items of the WHOQOL-BREF and adds culture-specific questions for Taiwan. One item, which addresses "being respected by others", is categorized in the social domain, and the other, which addresses "eating what one likes to eat", is in the environment domain. We used the original methods of the WHOQOL-BREF for administration, scoring procedures, and reference time point (during the last 2 weeks). Each item is scored from 1 to 5 points, and a higher score indicates a better QOL. The number of items is different for each domain, and thus, we calculated the domain scores by multiplying the average of the scores for all the items in the domain by a factor of 4. Therefore, each domain score had the same range from 4 to 20.

Assessment of psychological symptoms: BSRS-5 (5-item brief symptom rating scale)

The BSRS-5 contains five items of psychological symptoms and is commonly used for screening psychological disorders and is available in Taiwan with excellent validity and reliability [16, 17]. For suicide prevention, the Taiwan BSRS-5 adds the sixth additional item that directly asks the subject about the urge of suicide attempts [17]. The BSRS-5 is a 5-item, self-administered questionnaire that is derived from the 50-item brief symptom rating scale, which measures anxiety (feeling tense or high-strung), depression (feeling depressed or in a low mood), hostility (feeling easily annoyed or irritated), interpersonal sensitivity (feeling inferior to others), and additional symptoms (having trouble falling asleep in the past week). The score for each item ranges from 0 to 4 (0, not at all; 1, a little bit; 2, moderately; 3, quite a bit; and 4, extremely). A total score on the BSRS-5 above 14, or a score of more than 1 on the additional suicide survey item, may indicate a severe mood disorder. Scores between 10 and 14 may indicate moderate mood disorders, and those between 6 and 9 could indicate mild mood disorders. According to the study by Chen HC et al. 2005, the optimal cutoff point of normal/psychological symptom was 5/6. So the subjects with BSRS-5 scores lower than 5 were considered to be normal [16].

Statistical analysis

We compared the demographic and clinical characteristics of the respondents and non-respondents and performed chi-squared tests for categorical variables. We also performed Student's *t*-tests for variables with interval scales to test for significant differences between the two groups. We conducted an analysis of variance (ANOVA) for differences in clinical characteristics and an independent Student's *t*-test and Cochran–Armitage Trend Test for the recruited subjects, whom we categorized into four groups according to BSRS-5 score intervals of 0–5, 6–9, 10–14, and 15–20. We then constructed multiple linear regression analyses using the scores of each domain and individual facets as the dependent variables; we included BSRS-5 score, smoking, gender, and age as the independent predictive variables. We edited and analyzed all the data with SPSS and SAS statistical software.

Results

Of the 1,173 workers who completed questionnaires, 1,080 also provided a complete physical examination. Since workers suffering from major physical or psychological illnesses are commonly away from work, all our subjects did not have such illnesses; Table 1 summarizes their demographic and clinical data. We also included 350 workers who did not complete the questionnaire (or non-respondents) but who shared their physical data for comparison, which is shown in Table 1. The average age of the non-respondents was about 2 years older than the respondents (P-value <0.001). There were no significant differences between the two groups in the demographic and clinical data for all the other items, including the proportions of smoking, gender, metabolic syndrome, elevated systolic and diastolic blood pressure, and various biochemical data.

A total of 55 (4.7%) of the 1,173 questionnaires indicated severe mood disorders; that is, the BSRS-5 scores exceeded 14, or the questionnaires expressed a suicide intention. We divided the clinical and WHOQOL data into four categories of BSRS-5 scores, shown in Table 2; the four domain scores were lower in the groups with higher BSRS-5 scores (all the P-values <0.001). We also found a significant trend that associated higher smoking scores with higher BSRS-5 scores, as Table 2 shows.

We found a positive linear association between the BSRS-5 scores and scores on the different WHOQOL domains. The highest correlation coefficient ($r = 0.605$) was between the scores for the physical domain and BSRS-5, and the lowest was between the scores for the social domain and BSRS-5 ($r = 0.459$).

Age, gender, and smoking habit were found to be significant factors that may influence QOL scores, as Table 3 summarizes. After we performed multiple linear regressions to control for the potential interference of age, gender, smoking, metabolic syndrome, and income, we found that BSRS-5 score is a universal predictor for all the

Table 1 Comparison of the demographic and clinical characteristics of the workers included and not included in this study

Workers in the factory	Included	Not included	*P*-value*
Number of subjects	1,080	350	
Smoking (yes/no)	302/600	88/159	0.544
Sex (male/female)	982/98	322/28	0.588
Age (year)	37.3 (7.1)	39.4 (8.9)	<0.001
Metabolic syndrome (yes/no)	122/958	50/300	0.156
Systolic blood pressure (mmHg)	122.6 (15.4)	123.1 (16.0)	0.606
Diastolic blood pressure (mmHg)	78.8 (10.5)	78.1 (9.7)	0.325
Fasting blood sugar (mg/dl)	88.8 (17.8)	92.1 (33.5)	0.080
Triglyceride (mg/dl)	134.8 (108.4)	139.6 (112.7)	0.473
Total cholesterol (mg/dl)	190.6 (34.2)	190.5 (32.6)	0.960
High-density lipoprotein cholesterol (mg/dl)	48.6 (10.9)	49.6 (11.9)	0.112
Low-density lipoprotein cholesterol (mg/dl)	118.8 (33.0)	116.9 (34.5)	0.343

* Chi-square tests for categorical variables and Student's *t*-tests for variables with interval scales

Table 2 Comparison of workers' clinical characteristics and scores for quality of life (measured with WHOQOL), stratified by BSRS-5 (5-item brief symptom rating scale) measures of intensity of depression

Scores of BSRS-5	0–5	6–9	10–14	≧15 or suicide scores≧2	*P*-value
Number of subjects	617	362	139	55	
Physical domain	15.6 (1.7)	14.1 (1.6)	12.9 (1.8)	12.3 (2.0)	<0.001†
Psychological domain	14.8 (2.0)	13.1 (2.0)	11.8 (2.2)	10.4 (2.6)	<0.001†
Social domain	14.7 (1.9)	13.5 (1.9)	12.7 (2.2)	12.0 (2.5)	<0.001†
Environment domain	14.4 (2.0)	13.2 (1.8)	12.2 (1.9)	11.7 (1.9)	<0.001†
Smoking (yes/no)	195/280	127/146	50/67	26/17	0.043§
Sex (male/female)	531/57	305/33	125/9	52/2	0.353‡
Age (year)	38.0 (7.3)	38.0 (7.2)	37.7 (6.9)	38.5 (7.3)	0.916†
Metabolic syndrome (yes/no)	63/509	31/293	20/113	8/43	0.278‡
Systolic blood pressure (mmHg)	122.4 (15.2)	123.0 (15.9)	123.2 (15.2)	121.7 (14.0)	0.866†
Diastolic blood pressure (mmHg)	78.5 (10.1)	78.9 (11.0)	79.6 (10.7)	78.6 (10.6)	0.734†
Fasting blood sugar (mg/dl)	89.2 (17.8)	87.7 (16.2)	89.6 (23.2)	88.4 (10.6)	0.624†
Triglyceride (mg/dl)	135.2 (121.1)	130.8 (87.4)	143.0 (103.7)	133.1 (89.1)	0.751†
Total cholesterol (mg/dl)	190.4 (33.6)	192.9 (34.5)	190.1 (34.8)	180.6 (36.0)	0.120†
High-density lipoprotein cholesterol (mg/dl)	48.2 (10.5)	49.2 (11.1)	49.0 (12.1)	46.8 (10.4)	0.331†
Low-density lipoprotein cholesterol (mg/dl)	119.4 (32.3)	120.7 (34.4)	115.0 (31.0)	110.5 (34.8)	0.098†

† Analysis of variance (ANOVA), ‡ Chi-square test, §Two-sided *P*-value of Cochran–Armitage Trend Test

domains and items of the Taiwanese version of the WHOQOL-BREF. The R-square of regression analysis in domain 1, 2, 3(TW), and 4(TW) of WHOQOL were 0.38, 0.38, 0.23, and 0.26, as summarized in Table 3. We have tested the statistical significance of following interaction terms on regression model of four domains: gender × smoking, gender × income level, smoking × metabolic syndrome, BSRS-5 × metabolic syndrome, BSRS-5 × age, age × metabolic syndrome, BSRS-5 × income level, and age x income level. Only the environment domain showed statistical significance for the term of BSRS-5 × income level, and it seems to add additional positive effect on facets of housing and transport.

Discussion

This study, to our knowledge, is the first to demonstrate that the severity of psychological symptoms, measured by the BSRS-5, can significantly predict all scores in the physical, psychological, social, and environment domains and that this effect persists after controlling for common potential confounders, including age, sex, smoking, and metabolic syndrome. Moreover, we recruited our subjects from a population that is generally healthy and works regularly, and thus our results may imply that psychological symptoms are one of the common determinants of QOL, measured by psychometry.

Table 3 Regression coefficients and standard errors (in parentheses) based on multiple linear regression analyses of each domain and facet of WHOQOL in workers

	BSRS-5	Smoking	Gender	Age	R^2
Overall QOL	−0.084**(0.006)	−0.195**(0.046)	–	–	0.21
Overall health	−0.084**(0.007)	–	0.283*(0.095)	–	0.17
Physical	−0.336**(0.015)	–	–	–	0.38
Pain	−0.060**(0.009)	−0.242**(0.066)	–	–	0.08
Medicine	−0.064**(0.007)	–	−0.014**(0.005)	−0.192*(0.080)	0.13
Energy	−0.100**(0.007)	–	–	–	0.22
Mobility	−0.068**(0.007)	–	−0.013*(0.005)	–	0.11
Sleep	−0.142**(0.008)	–	–	–	0.29
Daily activity	−0.085*(0.006)	–	–	–	0.20
Work	−0.071**(0.006)	–	0.282**(0.083)	0.011*(0.004)	0.16
Psychological	−0.391**(0.018)	−0.266*(0.135)	–	0.026*(0.012)	0.38
Positive feel	−0.086**(0.008)	–	–	–	0.14
Spirit	−0.091**(0.008)	−0.180**(0.060)	0.244*(0.109)	–	0.15
Think	−0.100**(0.007)	–	–	0.010*(0.005)	0.19
Body image	−0.087**(0.007)	–	0.214*(0.101)	–	0.15
Esteem	−0.092**(0.006)	–	0.226*(0.084)	0.014**(0.004)	0.23
Negative feel	−0.130**(0.006)	–	–	–	0.36
Social	−0.271**(0.017)	–	–	–	0.23
Relationship	−0.072**(0.006)	–	–	–	0.15
Sexual life	−0.073**(0.007)	–	–	–	0.12
Support	−0.061**(0.005)	–	–	–	0.15
Respect	−0.064**(0.006)	–	–	–	0.11
Environment	−0.264**(0.017)	−0.413**(0.131)	−0.688**(0.239)	–	0.26[†]
Safety	−0.096**(0.007)	–	–	–	0.20
Environment	−0.067**(0.010)	−0.156*(0.073)	−0.494**(0.134)	–	0.10
Finances	−0.078**(0.009)	−0.316**(0.068)	−0.344*(0.125)	–	0.14
Information	−0.073**(0.007)	–	−0.219*(0.101)	−0.021**(0.005)	0.13
Recreation	−0.077**(0.008)	−0.124*(0.061)	–	–	0.11
Housing	−0.053**(0.007)	−0.108*(0.053)	–	–	0.09[†]
Service	−0.060**(0.006)	–	–	–	0.11
Transport	−0.042**(0.006)	–	–	–	0.09[†]
Eating	−0.046**(0.007)	–	–	–	0.06

* P-value<0.05, ** P-value<0.005; all models were adjusted for the score of BSRS-5, smoking, gender, age, income level, and metabolic syndrome

[†] Interaction term (BSRS-5 × income level) was also included in the regression model of the environment domain and its related facets

Our results showed that a score change in BSRS-5 significantly predicts all of the items and each domain of the Taiwanese version of the WHOQOL-BREF. The psychological domain seems to be the most strongly associated; every 1 point increase in BSRS-5 is associated with a decrease of 0.39 points on the raw score, which is equivalent to a change of 2.44% (=0.39 × 100/(20 − 4)) along a scale of 100 percentile score. And a change of the raw score of BSRS-5 from normal (<6) to moderate (10–14) psychological symptom wound increase about 12–22 percentile scores for the psychological domain of WHOQOL. The remaining three domains, in the order of the strength of association with BSRS-5 score, are physical, social relations, and environment domains. The most strongly associated item was "sleep", followed by negative feelings, energy, and concentration, representing a similar construct between the two measurement tools of physical and psychological domains. The sleep-related item in BSRS-5 asked the subject to evaluate the severity of insomnia, while the item in WHOQOL asked the subject to rate the satisfaction of sleep. Thus, the consistent significant negative signs for the regression coefficients of BSRS-5 in all the scores of items/domains of the WHOQOL corroborate the validity of this study.

In addition, among workers who regularly perform their tasks in a factory, the psychological symptoms that BSRS-5 intends to measure are the most common predictive factor for all different facets of QOL, including those belonged to the social and environment domains. It implies that the psychological states at the time point for people to fill in the questionnaire of QOL (or patient reported outcome) might affect the scores of all items and domains of QOL and should not be ignored. When the US FDA (Food and Drug Administration) has begun to consider accepting labeling claim of symptoms for medical products, our findings may be a warning to the efficacy of such claims, especially to non-randomized trials and/or those conducted among healthy populations.[18].

The above findings may not be surprising because most previous studies of patients with chronic medical conditions have demonstrated that depression and anxiety influence QOL among physically impaired patients. One study also showed that the negative effect of mental health disorders, such as depression, anxiety, or emotional problems, on QOL is larger than the effect of chronic medical conditions such as hypertension, diabetes, or problems in the neck or back [19].

Although the BSRS-5 is not a generic questionnaire and is not commonly used in QOL studies, it contains only 5 items and can be administered to subjects to complete independently and quickly. The additional sixth question provides researchers the opportunity to detect potential suicide risks for early intervention. This questionnaire is already recommended to the general public for suicide prevention in Taiwan [20]. This study provides additional evidence that it may be suitable for the evaluation of psychological symptoms in factory workers with stable occupations.

There are some limitations to this study. First, because the subjects were from a steel factory in south Taiwan that predominantly employs men, 90% of the subjects were men. Although the chi-square test showed no significant differences in the gender proportions for the different categories and ranges of the BSRS-5 scores, we cannot make any strong inference for women due to the small sample size. However, we have tried to control for the gender factor in our construction of the model for WHOQOL scores through multiple linear regression analysis. Thus, the effect of BSRS-5 on QOL was not confounded by gender. Second, this research was cross-sectional, and it is difficult to confirm the causes and effects of psychological symptoms and QOL. This study found that BSRS-5 scores are universally predictive for all 4 domains and all 26 items of the Taiwanese WHOQOL-BREF, and many previous studies have consistently shown the negative effects of depression and anxiety on QOL scores among patients with different medical conditions. Therefore, we tentatively concluded that emotional distress could be a major factor for poor QOL scores in healthy subjects.

Conclusion

We suggest that the BSRS-5 score is predictive for scores of all four domains and 26 items of the Taiwanese version of the WHOQOL-BREF for workers who regularly perform their jobs in a factory, while mild physical illness (such as metabolic syndrome) may not be. We thus recommend that future evaluations of QOL in healthy subjects consider this instrument for the measurement of psychological symptoms, which could be controlled for in data analyses to explore the effects of other risk factors.

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