

The Mediating Role of Health-Promoting Behaviors on the Association between Symptom Severity and Quality of Life among Chinese Individuals with Mental Illness: A Cross-Sectional Study

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Keywords

Gender difference · Health-promoting behaviors · People with mental illness · Quality of life · Symptom severity

Abstract

Introduction: Research has shown that people with mental illnesses (PMI) are found to show poorer lifestyle than the general population. Yet, the effect of their psychiatric symptoms in the association between gender difference, health-promoting behaviors, and quality of life have received little attention. The present study examined the association between symptom severity, health-promoting behaviors, and quality of life among PMI in Hong Kong. Gender difference on the association between these variables was also examined. **Method:** A cross-sectional survey was conducted among 591 individuals with DSM-IV-TR Axis 1 diagnosis recruited from the community. **Results:** Results from MANOVA showed that PMI with more severe psychiatric symptoms engaged in a significantly lower level of health-promoting behaviors and reported a lower level of quality of life. Results

from structural equation modeling showed that health-promoting behaviors mediated the association between psychiatric symptoms and quality of life. Multigroup analyses showed that the association between psychiatric symptoms and health-promoting behaviors was stronger among female participants, while the association between health-promoting behaviors and quality of life was stronger among male participants. **Discussion/Conclusion:** Despite clear evidence suggesting symptom severity to be negatively correlated with quality of life, the underlying mechanism has been less clear. There is a need to promote health-promoting behaviors in order to improve the quality of life of PMI. Gender-specific interventions are warranted.

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Introduction

Mental Illness as an Important Public Health Concern
Mental illness is a major health concern across the globe. It is estimated that close to 1 billion people are living

with a mental disorder worldwide [1]. Mental illness remains among the top ten leading causes of burden worldwide [2]. The Global Burden of Disease (GBD) 2019 study has shown that the global number of DALYs due to mental disorders increased from 80.8 million to 125.3 million, and the proportion of global DALYs attributed to mental disorders increased from 3.1% to 4.9% between 1990 and 2019 [2]. In Hong Kong, the Hong Kong Mental Morbidity Survey conducted in 2010–2013 reported that the prevalence of common mental disorders among Chinese adults aged 16 and 75 years was 13.3%. The most common disorders were mixed anxiety and depressive disorder (6.9%), followed by generalized anxiety disorder (4.2%), depressive episode (2.9%), and other anxiety disorders (1.5%) [3]. However, the data were collected in a voluntarily self-reported basis and the number of PMI in Hong Kong might have been underestimated. Along with psychiatric impairment, people with mental illness (PMI) tend to have increased risk of physical morbidity and premature mortality [4–8]. To maximize their full potential recovery and to improve their overall quality of life, service providers and their agencies should provide services that cater to their physical, psychological, and social needs [9]. Therefore, it is important to examine their pattern of health behaviors and to identify factors that may promote their uptake of health-promoting behaviors and hence quality of life.

The Importance of Healthy Lifestyle on Health and Quality of Life

The World Health Organization estimates that 60% of deaths are attributable to major chronic diseases (cancer, cardiovascular disease, chronic respiratory disease, and diabetes mellitus) that are closely related to an unhealthy lifestyle [10]. There is ample evidence that healthy lifestyle is associated with better health and quality of life. For example, research has shown that physical activity is associated with lower levels of depression [11–13], reduced risks of stroke [14], better quality of life [15, 16], and reduced mortality [17, 18]. Furthermore, a diet high in fruit and vegetables reduces development of chronic disease such as diabetes, stroke, as well as cardiovascular disease [19–21]. On the other hand, research has shown that tobacco use is associated with increased mortality due to cancer, heart disease, and pulmonary diseases [22]. Among PMI, studies have also reported that engaging in healthy behaviors, such as physical activity or quitting smoking, are associated with positive health outcomes [23, 24]. Therefore, promoting healthy lifestyle is imperative to the maintenance of health and quality of life in both the general population and PMI.

Poorer Health and Lifestyle among PMI

An increasing number of studies have reported that PMI have increased risk of physical illness and early mortality [7, 25]. They are at increased risk of coronary heart diseases, diabetes, hypertension, stroke, and emphysema [4, 5, 26]. Physical comorbidity is high, with 65% of them reported having at least one lifetime medical condition and 36% having more than one [27]. They are also shown to have poorer quality of life than the general population [28, 29]. Despite the well-known benefits of lifestyle on health and quality of life, research has shown that PMI have poorer lifestyle [30], for example, lower level of physical activity, than the general population [31–35]. PMI are also at higher risk of overweight and obesity compared to those without a mental illness, presumably due to lower level of physical activity and poorer dietary habits [36, 37]. One study among individuals with schizophrenia found that 92% of men and 91.7% of women had central adiposity, they only consumed less than 3 portions ($M = 2.8$) of fruit and vegetable per day, and over a third did not eat any fruit in a typical week [38]. Other review studies also showed that PMI had a high intake of saturated fat and a low consumption of fiber and fruit [39]. PMI are also more likely to smoke compared to the general population [36, 40]. Specifically, 74% of people with diagnosed schizophrenia, 66% of people with diagnosed bipolar disorder, and 57% of people with diagnosed major depression reported to smoke tobacco [41]. Given the heightened physical morbidities of PMI and their poorer lifestyle, understanding the factors of health-promoting behaviors in PMI can provide important information for the design of health interventions to motivate them to initiate and adhere to healthier lifestyle.

Psychiatric Symptoms on Health-Promoting Behaviors and Quality of Life

Numerous factors of health-promoting behaviors among PMI have been identified in the literature. For example, diagnosis of mental illness is often associated with lower priority given to physical health management while expending considerable resources to deal with psychiatric symptoms [42, 43]. The lack of energy, lack of motivation, and fatigue as a result of side effects from medications prevent PMI from engaging in physical activity [43, 44]. Research has also shown that mental illness is associated with considerable financial burden on an individual, implying difficulty in carrying out required changes in lifestyle and health-seeking behavior [45]. On the other hand, social support and encouragement from significant

others might facilitate changes in diet and uptake of physical activity [34, 35, 46]. A high level of perceived self-efficacy is critical for the uptake of health-promoting behaviors [34, 35], even when positive beliefs about the benefits of physical activity and healthy diet are commonly held among PMI [47].

Psychiatric symptoms may prevent PMI from engaging in health-promoting behavior, due to lack of motivation [47], cognitive deficits associated with the illness [5, 48], and health problems such as body pains associated with chronic illnesses [46]. Other illness-related barriers to health-promoting behaviors include low self-confidence and treatment effects [49]. We hypothesized that more severe psychiatric symptoms may be associated with lower level of health-promoting behaviors, which in turn is associated with poorer quality of life.

Gender Difference in the Association between Symptom Severity and Health-Promoting Behaviors

Gender difference in health and lifestyle has been extensively reported in the literature. In particular, women consistently report more number of physical symptoms, rate their symptoms as more severe, and perceive their health as poorer compared to men [50–52]. On the other hand, the literature also reveals that women tend to report better lifestyle than men. The gender difference in the association between symptom severity, health-promoting behaviors, and quality of life has, however, received much less attention. The socialization processes, in which males are taught to be stoic, result in a lower selective attention to body symptoms and a lower tendency to attribute somatic sensations to illness among men than women [51]. It is also shown that women are more susceptible to illness as their responsibility for the family's well-being allows them greater acceptability to attend to and report symptoms [52]. As men are socialized to endure symptoms, while women are shown to have heightened susceptibility to the influence of symptom severity, we conjectured that the association between symptom severity and health-promoting behaviors, and between symptom severity and quality of life might be stronger among female PMI. A more robust association between health-promoting behaviors and quality of life should also be seen among female PMI as women are more sensitive to their body changes, and thus are more aware of the benefits resulted from the health-promoting behaviors. They are also more likely to believe that once they engage in healthy lifestyles, they will be less vulnerable to physical illness and thus enjoy better quality of life. Very few research has directly addressed this issue.

The Present Study

The present study examined the association between psychiatric symptoms, health-promoting behaviors, and quality of life among PMI in Hong Kong. It is hypothesized that psychiatric symptoms may be associated with poorer quality of life, which is mediated by a lower level of health-promoting behaviors. It is also hypothesized that the strength of the association between these variables will be stronger among female PMI compared to male PMI.

Methods

Study Design

A cross-sectional survey was conducted among a stratified sample of PMI in Hong Kong. Inclusion criteria were: (1) adults 18 or above, (2) permanent residents of Hong Kong, (3) being able to understand Cantonese, the native language in Hong Kong, (4) having at least one DSM-IV-TR Axis I diagnosis, and (5) currently living in the community. Exclusion criteria include: (1) pregnancy or lactation, (2) intellectual disability, (3) dementia, and (4) low levels of comprehension and cooperation. Stratified sampling based on gender, age, and diagnostic composition was used, and participants were recruited from various community mental health centers in Hong Kong. The Integrated Community Centres for Mental Wellness assisted by our collaborating NGO offers routine follow-up at the psychiatric services and scope of community services, including outreaching services, casework counseling, therapeutic and supportive group work, and outreaching occupational therapy services. Clinical psychologists, social workers, occupational therapists, nurses, mental health education officers, peer support workers, and program workers were involved in the provision of corresponding services. These services represented the vast majority of the community support services, day training, and vocational rehabilitation services that are being provided to PMI in Hong Kong.

Procedure

Upon informed consent, each PMI was interviewed by a trained interviewer on a structured questionnaire at one of the community mental health service centers. Separate consent was also obtained from the participants for their diagnoses, health check records, and medications from their medical records. Participants were given a HKD 70 (=USD 9.03) supermarket coupon as compensation for their time spent in the study.

Measures

Demographics

Participants were asked to provide demographics and medical information such as gender, age, marital status, education level, employment status, financial situation, and type and duration of psychiatric illness.

Psychiatric Symptom Severity

Psychiatric symptom severity of the participants was measured by a 24-item Behavior and Symptom Identification Scale (BASIS-R) over six domains: depression and functioning, interpersonal

relationships, psychosis, substance abuse, emotional lability, and self-harm [53]. Participants indicated their experience of relevant symptoms with respect to different domains during the past week. Responses were rated on a 5-point scale from 0 = *no difficulty/none of the time* to 4 = *extreme difficulty/all of the time*. A mean score between 0 and 4 is derived, with higher scores indicating greater severity of psychiatric symptom. The Cronbach's alpha for the scale was 0.85.

Health-Promoting Behaviors

Health-promoting behaviors were measured by a 16-item health-promoting behaviors questionnaire [54, 55]. Participants rated how well the lifestyle choices and health-promoting behaviors describe their typical practice along a 4-point scale from 1 = *very unlike me* to 4 = *very like me*. A mean score between 1 and 4 is derived for each health-promoting behavior, with higher scores indicating a higher level of health-promoting behaviors. This questionnaire has been used among Chinese in Hong Kong [54, 55]. In the present study, the Cronbach's alpha for the scale was 0.68.

Quality of Life

The quality of life was measured by the SF-12 Health Survey (SF-12) [56]. It is an abbreviated version of SF-36 that measures eight dimensions of health status (i.e., physical functioning, role limitations due to physical problems, role limitations due to emotional problems, energy, social functioning, pain, emotional well-being, and general health). The score for each dimension can be transformed from 0 (the worst possible health status) to 100 (the best possible health status), with higher scores indicating a better quality of life. Its Chinese version has been validated among Chinese adults in Hong Kong [57]. In the present study, the Cronbach's alpha for the scale was 0.82.

Data Analysis

Descriptive statistics were performed. Missing data were handled using pairwise deletion. Participants were divided into one of two groups by the median score of BASIS-24. "Low severity" group comprised of those individuals whose psychiatric symptoms were less severe and their score of BASIS-24 was lower than the median score. "High severity" group indicated those who reported more severe psychiatric symptom and scored above the median score of BASIS-24. Descriptive analyses of background characteristics of "low severity" group and "high severity" group were performed, and the differences between groups were compared by using the χ^2 test or the independent *t* test. Multivariate analysis of variance (MANOVA) tests were performed to explore whether health-promoting behaviors and quality of life between participants differed between groups.

To test the association between symptom severity, health-promoting behaviors, and quality of life, a two-stage procedure recommended by Anderson and Gerbing [58] was used. Confirmatory factor analysis was conducted to examine the adequacy of the measurement for each of the constructs under investigation [59]. Structural equation modeling was then performed to compare the fit of hypothesized structural model. Next, equivalence of the hypothesized model was tested based on participants' gender. Multigroup analysis was performed to compare two models within the analysis: a restricted model, in which all estimated parameters were required to be equal across groups, and an unrestricted model, in which these parameters estimated were allowed to differ

across the groups. To examine the significance of each path across groups, a series of models with different paths being constrained were also compared. χ^2 test was employed to evaluate the fit. However, as χ^2 statistics are sample size dependent, several goodness-of-fit indices, specifically, incremental fit index (IFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were also chosen to evaluate the model fit. CFI and IFI range between 0 and 1, with values greater than 0.90 indicating good fit [60]. RMSEA is a measure of the discrepancy between the model and the data per degree of freedom [61]. An RMSEA value below 0.05 reflects an excellent fit; that between 0.05 and 0.08 reflects a reasonable fit; and that between 0.08 and 0.10 reflects an acceptable fit.

Results

Background Characteristics

A total of 591 of PMI completed the study. The background characteristics of participants are shown in Table 1. Of the participants, 55.1% were female; 37.1% were older than 50 years old; 32.3% were married or in a relationship with someone; 25.0% attained primary education; and 33.1% were currently unemployed. The majority of the participants were diagnosed with schizophrenia (70.3%), followed by major depression (13.5%) and bipolar disorders (7.1%). The mean duration of mental illness was 15.4 years.

Classification of Participants into Low and High Symptom Severity Groups

The median score of BASIS-R is 1.04. Using this as the cutoff score, 295 participants were classified as in the low symptom severity group ($M = 0.71$, $SD = 0.25$), while 296 participants were classified as in the high severity group ($M = 1.45$, $SD = 0.30$), $t(-32.84)$, $p < 0.001$. No significant difference in background characteristics was found between low and high symptom severity groups (Table 1).

Difference in Health-Promoting Behaviors between Low and High Symptom Severity Groups

The MANOVA test showed a significant difference in health-promoting behaviors between low and high symptom severity groups, Pillai's Trace = 0.215, $F(16, 569) = 9.726$, $p < 0.001$. Post hoc analyses showed that participants in the low severity group showed better health-promoting behaviors in social activities, $F = 11.04$, $p < 0.01$, exercise regularly, $F = 5.36$, $p < 0.05$, excessive drinking, $F = 8.99$, $p < 0.01$, eating too much fat, $F = 3.59$, $p < 0.05$, controlling stress, $F = 43.61$, $p < 0.001$, eating plenty of fiber, $F = 20.52$, $p < 0.001$, eating high cholesterol food, $F = 6.71$, $p < 0.05$, eating too much salts, $F = 5.48$, $p < 0.05$,

Table 1. Demographic characteristics of participants ($N = 591$)

| Variables | Total ($N = 591$) | Low severity ($N = 295$) | High severity ($N = 296$) | Difference between groups |
|--|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------|
| Gender, n (%) | | | | $\chi^2(1) = 0.007$ |
| Male | 265 (44.9) | 132 (44.7) | 133 (45.1) | |
| Female | 325 (55.1) | 163 (55.3) | 162 (54.9) | |
| Age | $M = 46.00$ $SD = 10.66$ | $M = 46.37$ $SD = 10.65$ | $M = 45.65$ $SD = 10.68$ | $t(588) = 0.820$ |
| Marital status, n (%) | | | | $\chi^2(2) = 2.428$ |
| Single | 263 (44.7) | 126 (42.7) | 137 (46.6) | |
| In a relationship/cohabitating/married | 190 (32.3) | 104 (35.3) | 86 (29.3) | |
| Separated/divorced/widowed | 136 (23.1) | 65 (22.0) | 71 (24.1) | |
| Education, n (%) | | | | $\chi^2(3) = 6.631$ |
| Primary school or less | 140 (25.0) | 74 (26.7) | 66 (23.3) | |
| Secondary | 364 (65.0) | 170 (61.4) | 194 (68.6) | |
| Foundation | 11 (2.0) | 9 (3.2) | 2 (0.7) | |
| College or higher | 45 (8.0) | 24 (8.7) | 21 (7.4) | |
| Employment, n (%) | | | | $\chi^2(4) = 2.877$ |
| Unemployed | 195 (33.1) | 90 (30.5) | 105 (35.7) | |
| Part-time | 108 (18.3) | 53 (18.0) | 55 (18.7) | |
| Full-time | 192 (32.6) | 105 (35.6) | 87 (29.6) | |
| Self-employed | 6 (1.0) | 3 (1.0) | 3 (1.0) | |
| Others | 88 (14.9) | 44 (14.9) | 44 (15.0) | |
| Monthly income, HKD | $M = 3,152.05$ $SD = 1,985.62$ | $M = 3,187.91$ $SD = 1,939.76$ | $M = 3,118.41$ $SD = 2,030.67$ | $t(527) = 0.402$ |
| Primary diagnosis of mental illness, n (%) | | | | $\chi^2(6) = 10.27$ |
| Schizophrenia | 395 (70.3) | 197 (71.4) | 198 (69.2) | |
| Major depression | 76 (13.5) | 28 (10.1) | 48 (16.8) | |
| Bipolar disorder | 40 (7.1) | 25 (9.1) | 15 (5.2) | |
| Substance-related disorder | 6 (1.1) | 4 (1.4) | 2 (0.7) | |
| Anxiety disorder | 6 (1.1) | 4 (1.4) | 2 (0.7) | |
| Adjustment disorders | 7 (1.2) | 4 (0.3) | 3 (1.0) | |
| Others | 30 (5.3) | 12 (4.3) | 18 (6.3) | |
| Duration of mental illness, years | $M = 15.35$ $SD = 10.64$ | $M = 16.08$ $SD = 11.34$ | $M = 14.62$ $SD = 9.88$ | $t(561) = 1.635$ |

eating too much sugar, $F = 4.09$, $p < 0.04$, plenty of sleep, $F = 28.67$, $p < 0.001$, stay happy, $F = 105.74$, $p < 0.001$, and relax regularly, $F = 12.70$, $p < 0.01$ (Table 2).

Difference in Quality of Life between Low and High Symptom Severity Groups

The MANOVA test showed a significant difference in quality of life between low and high symptom severity groups, Pillai's Trace = 0.271, $F(8, 574) = 26.70$, $p < 0.001$. Post hoc analyses indicated that participants in the low severity group scored significantly higher in all eight dimensions of quality of life than the high symptom severity group: physical functioning, $F = 23.24$, $p < 0.001$, role limitations due to physical problems, $F = 51.48$, $p < 0.001$, role limitations due to emotional problems, $F = 95.52$, $p < 0.001$, energy, $F = 60.45$, $p < 0.001$, social functioning,

$F = 96.98$, $p < 0.001$, pain, $F = 89.49$, $p < 0.001$, emotional well-being, $F = 138.85$, $p < 0.001$, and general health, $F = 31.45$, $p < 0.001$ (Table 3). Overall, the SF-12 score of the participants was lower than the norm of the Hong Kong general population [57] (Table 3).

Measurement Model of the Hypothesized Model

Table 4 presents the factor loadings of the measurement model. The test of the measurement model resulted in the following statistical values: $\chi^2(132) = 511.94$, CFI = 0.88, IFI = 0.88, RMSEA = 0.07, which were indicative of the need for some modifications. Based on the Modification Indices provided in the CFA results, two correlation paths between some error terms (error terms between self-harm and substance abuse of BASIS-R and error terms between physical functioning and role physical of

Table 2. Difference in health-promoting behaviors between participants with low and high level of symptom severity (split by median score)

| Variable | Total (N = 591), mean (SD) | Low severity (N = 295), mean (SD) | High severity (N = 296), mean (SD) | F value |
|-----------------------------------|----------------------------|-----------------------------------|------------------------------------|-----------|
| Smoking (R) | 3.40 (0.93) | 3.45 (0.93) | 3.35 (0.93) | 1.53 |
| Social activities | 2.64 (0.79) | 2.75 (0.83) | 2.53 (0.73) | 11.04** |
| Exercise regularly | 2.51 (0.85) | 2.59 (0.84) | 2.43 (0.85) | 5.36* |
| Excessive drinking (R) | 3.66 (0.53) | 3.73 (0.46) | 3.60 (0.58) | 8.99** |
| Eating too much fat (R) | 2.84 (0.74) | 2.90 (0.73) | 2.79 (0.75) | 3.59* |
| Controlling weight | 2.71 (0.68) | 2.75 (0.67) | 2.66 (0.70) | 2.78 |
| Checking blood pressure regularly | 2.33 (0.86) | 2.34 (0.83) | 2.33 (0.89) | 0.037 |
| Controlling stress | 2.65 (0.71) | 2.83(0.62) | 2.47(0.74) | 43.61*** |
| Eating plenty of fiber | 2.81 (0.66) | 2.94 (0.63) | 2.69 (0.67) | 20.52*** |
| Eating high cholesterol food (R) | 2.83 (0.69) | 2.91 (0.65) | 2.76 (0.72) | 6.71* |
| Taking vitamin pills | 1.87 (0.82) | 1.83 (0.85) | 1.90 (0.79) | 1.07 |
| Eating too much salts (R) | 2.94 (0.66) | 3.01 (0.63) | 2.88 (0.69) | 5.48* |
| Eating too much sugar (R) | 2.83 (0.71) | 3.00 (0.72) | 2.67 (0.79) | 4.09* |
| Plenty of sleep | 2.83 (0.78) | 3.00 (0.72) | 2.67 (0.80) | 28.67*** |
| Stay happy | 2.83 (0.75) | 3.12 (0.62) | 2.54 (0.76) | 105.74*** |
| Relax regularly | 2.71 (0.73) | 2.82 (0.71) | 2.61 (0.74) | 12.70** |

R, items with reverse scoring (higher score indicates a lower level of the respective risky behavior). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3. Difference in quality of life score (SF-12) between participants with low and high level of symptom severity[#]

| Variable | Population norm [57], mean (SD) | Total (N = 591), mean (SD) | Low severity (N = 295), mean (SD) | High severity (N = 296), mean (SD) | F value |
|----------------------|---------------------------------|----------------------------|-----------------------------------|------------------------------------|------------|
| Physical functioning | 87.30 (22.40) | 67.95 (29.04) | 73.73 (26.33) | 62.16 (30.48) | 23.244*** |
| Role-physical | 79.80 (22.80) | 62.78 (24.88) | 70.00 (24.03) | 55.53 (23.60) | 51.484*** |
| Bodily pain | 77.60 (25.00) | 60.87 (29.86) | 71.86 (26.82) | 49.83 (28.69) | 89.488*** |
| General health | 47.80 (27.80) | 44.11 (27.34) | 50.31 (27.54) | 37.93 (25.74) | 31.454*** |
| Vitality | 62.40 (25.40) | 50.64 (27.25) | 58.90 (26.15) | 42.35 (25.82) | 60.445*** |
| Social functioning | 81.80 (23.80) | 65.45 (28.33) | 76.27 (24.50) | 54.59 (27.79) | 96.978*** |
| Role-emotional | 77.20 (21.50) | 65.58 (26.00) | 75.38 (22.48) | 55.74 (25.60) | 95.515*** |
| Mental health | 68.80 (18.70) | 61.55 (21.82) | 71.14 (18.46) | 51.91 (20.68) | 138.854*** |

[#] MANOVA test was conducted to compare the difference in SF-12 score between participants with low and high level of symptom severity. The population norm listed in the table was included as a reference and no statistical analyses were done to compare the norm with the score obtained by the participants in the study. *** $p < 0.001$.

SF-12) were added. Results of the CFA showed that the overall modified measurement model yielded an acceptable fit, $\chi^2(130) = 420.03$, CFI = 0.91, IFI = 0.91, RMSEA = 0.06. Standardized factor loading of the modified measurement model ranged from 0.41 to 0.81 and was all statistically significant at the $p < 0.001$ level.

Structural Model of the Hypothesized Model

Results of structural equation modeling showed that the proposed model yielded an acceptable fit, $\chi^2(130) = 420.66$, CFI = 0.91, IFI = 0.91, RMSEA = 0.06. In sum, psychiatric symptoms were negatively related to health-promoting behaviors, which in turn was positively related to quality of life. Psychiatric symptoms were also negatively related to quality of life. The overall model ex-

Table 4. Unstandardized and standardized loadings for the measurement model

| Parameter estimates | Unstandardized loading (SE) | Standardized loading |
|---|-----------------------------|----------------------|
| Health-promoting behaviors → parcel score 1 | 1.00 | 0.80 |
| Health-promoting behaviors → parcel score 2 | 0.58 (0.05)*** | 0.55 |
| Health-promoting behaviors → parcel score 3 | 0.66 (0.06)*** | 0.57 |
| Health-promoting behaviors → parcel score 4 | 0.44 (0.06)*** | 0.45 |
| Psychiatric symptoms → psychosis | 1.00 | 0.48 |
| Psychiatric symptoms → emotional lability | 2.10 (0.19)*** | 0.81 |
| Psychiatric symptoms → self-harm | 0.90 (0.11)*** | 0.48 |
| Psychiatric symptoms → relationships | 0.88 (0.13)*** | 0.46 |
| Psychiatric symptoms → depression/functioning | 1.80 (0.16)*** | 0.80 |
| Psychiatric symptoms → substance abuse | 0.41 (0.04)*** | 0.41 |
| Quality of life → mental health | 1.00 | 0.72 |
| Quality of life → physical functioning | 0.79 (0.08)*** | 0.43 |
| Quality of life → role-physical | 1.18 (0.08)*** | 0.65 |
| Quality of life → bodily pain | 1.17 (0.09)*** | 0.62 |
| Quality of life → general health | 0.77 (0.08)*** | 0.44 |
| Quality of life → vitality | 0.99 (0.08)*** | 0.57 |
| Quality of life → social functioning | 1.20 (0.08)*** | 0.67 |
| Quality of life → role-emotional | 1.18 (0.08)*** | 0.71 |

SE, standard error. *** $p < 0.001$.

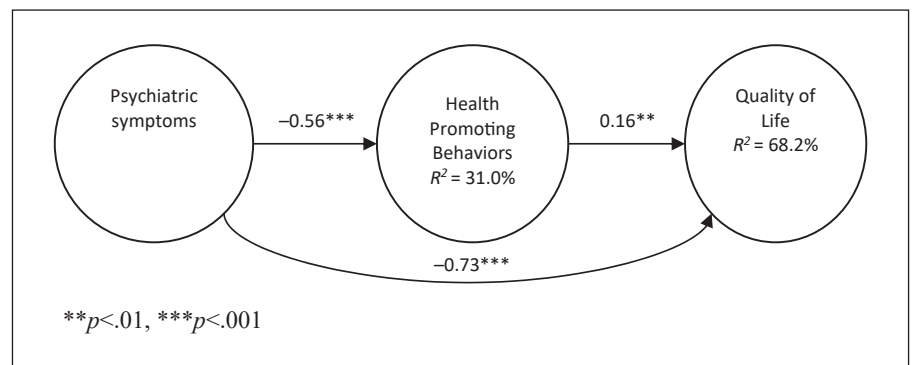


Fig. 1. Structural model of psychiatric symptoms, health-promoting behaviors, and quality of life. ** $p < 0.01$; *** $p < 0.001$.

plained 31% of the variance in health-promoting behaviors, and 68.2% of the variance in quality of life. The standardized path coefficients of the structural model are presented in Figure 1.

Multigroup Analysis by Gender

Before testing the difference in the proposed model across gender, a multigroup analysis was conducted to examine the equivalence of the measurement model between the groups. Results did not reveal a significant difference between the unrestricted and restricted models (Models 1.1–1.2, Table 5). Therefore, in testing for the equality of the structural model across gender, all factor loadings were estimated freely.

To examine whether the significance of each path differed across gender, a series of nested models were tested by cumulatively constraining different paths as equal (Models 2.1–2.8, Table 5). Results of the model comparisons showed that constraining either path (except the one from health-promoting behaviors to quality of life) in the model resulted in a significant change in model fit. Overall, comparison of the various models showed that Model 2.1, in which all parameters were estimated freely, showed the best fit to the model, $\chi^2(260) = 568.36$, CFI = 0.90, IFI = 0.90, RMSEA = 0.05, indicating that the effect of psychiatric symptoms on health-promoting behaviors and quality of life varied across gender. Further analyses revealed that the relationship

Table 5. Summary statistics for tested models in multigroup analyses

| | χ^2 (df) | CFI | IFI | RMSEA | $\Delta\chi^2$ (Δ df) |
|-------------------|----------------|------|------|-------|-------------------------------|
| Measurement model | | | | | |
| Model 1.1 | 568.36 (260) | 0.90 | 0.90 | 0.05 | – |
| Model 1.2 | 582.48 (275) | 0.90 | 0.90 | 0.04 | 14.12 (15) |
| Structural model | | | | | |
| Model 2.1 | 568.36 (260) | 0.90 | 0.90 | 0.05 | – |
| Model 2.2 | 1,045.55 (262) | 0.73 | 0.74 | 0.07 | 477.19 (2)*** |
| Model 2.3 | 575.45 (262) | 0.90 | 0.87 | 0.05 | 7.09 (2) |
| Model 2.4 | 729.41 (262) | 0.84 | 0.82 | 0.06 | 161.05 (2)*** |
| Model 2.5 | 1,196.53 (264) | 0.68 | 0.63 | 0.08 | 628.17 (4)*** |
| Model 2.6 | 1,011.05 (264) | 0.75 | 0.71 | 0.07 | 442.69 (4)*** |
| Model 2.7 | 1,087.24 (264) | 0.72 | 0.73 | 0.07 | 518.88 (4)*** |
| Model 2.8 | 1,246.81 (266) | 0.67 | 0.67 | 0.08 | 678.44 (4)*** |

1.1 All factor loadings in the measurement model were estimated freely. 1.2 All factor loadings in the measurement model were constrained to be equal. 2.1 All path coefficients in the structural model were estimated freely. 2.2 Path coefficient from psychiatric symptoms to health-promoting behaviors was constrained to be equal. 2.3 Path coefficient from health-promoting behaviors to quality of life was constrained to be equal. 2.4 Path coefficient from psychiatric symptoms to quality of life was constrained to be equal. 2.5 Path coefficient from psychiatric symptoms to health-promoting behaviors and from psychiatric symptoms to quality of life was constrained to be equal. 2.6 Path coefficient from health-promoting behaviors to quality of life and from psychiatric symptoms to quality of life was constrained to be equal. 2.7 Path coefficient from psychiatric symptoms to health-promoting behaviors and from health-promoting behaviors to quality of life was constrained to be equal. 2.8 All path coefficients in the structural model were constrained to be equal. *** $p < 0.001$.

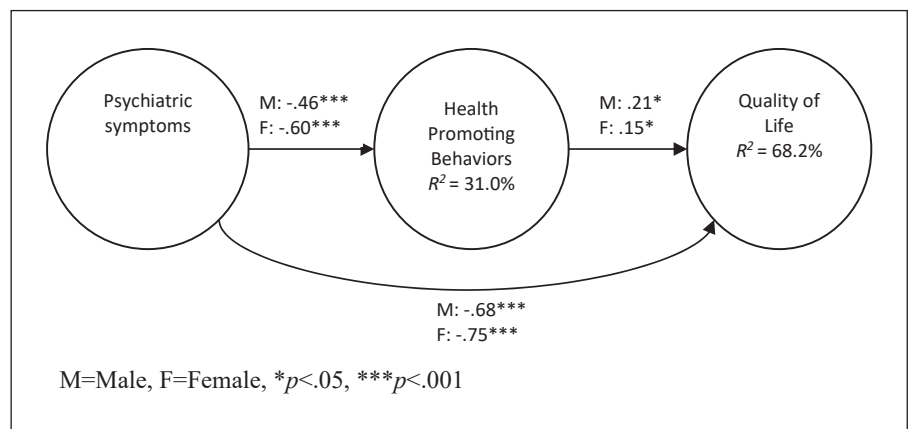


Fig. 2. Structural model of psychiatric symptoms, health-promoting behaviors, and quality of life by gender. M, male; F, female. * $p < 0.05$; *** $p < 0.001$.

between psychiatric symptoms on health-promoting behaviors and the relationship between psychiatric symptoms and quality of life were stronger among women, while those between health-promoting behaviors and quality of life were stronger among men. Figure 2 presents the standardized path coefficients of the structural model across gender.

Discussion

The present study evaluates the association between symptom severity, health-promoting behaviors, and quality of life in a sample of individuals with mental illness. Overall, PMI with higher level of symptom severity engage in significantly fewer health-promoting behaviors and have a lower quality of life than those with lower

symptom severity. The association between psychiatric symptoms, health-promoting behaviors, and quality of life also differs by gender.

Consistent with our speculation, results show that health-promoting practice of PMI is negatively correlated with symptom severity. Specifically, participants with higher symptom severity engage in significantly fewer social activities, physical activities, and dieting behavior, are more prone to stress and negative mood, and display more sleep disturbances. The finding that individuals with more severe symptoms participate less frequently in social activities is consistent with previous research [62]. Although social interaction facilitates social support, for those with severe functional impairment, frequent social contact can equally likely exacerbate conflict, stress, and even the potential for physical violence [63]. Research has shown that individuals with serious mental illness are less receptive to physical exercise as a therapeutic tool than do moderately severe patients [64], and are less likely to change to a healthy diet [65]. This might be due to the fact that PMI with severe impairment are more preoccupied with management of psychiatric symptoms and other functional corollaries such as poverty and unemployment, as opposed to physical health management [43]. Naturally, PMI with severe symptoms are affected by considerable life stress due not only to the mere severity of their mental illness but also to other aspects such as unemployment, financial strains, social stigma, and interpersonal conflicts [66]. Apart from that, sleep disturbances often co-occur with psychiatric illness and are especially prevalent among individuals with high symptom severity. A majority of psychiatric inpatients, including patients diagnosed with schizophrenia and depression, display clinical symptoms of insomnia in moderate to severe range [67].

In accordance with previous evidence, quality of life of PMI is found to be negatively correlated with symptom severity. The significant difference in quality of life between high and low symptom severity groups can be addressed depending on the type of symptoms concerned. Some previous studies reported a strong negative correlation between severity of negative or depressive symptoms and quality of life [68–70] along with a relatively weaker negative correlation between severity of positive symptoms and quality of life [69, 71]. On the other hand, depressive symptoms can manifest as negatively biased attributions, which is why patients with depression tend to report having low quality of life [72].

Despite clear evidence suggesting symptom severity to be negatively correlated with quality of life, the underlying mechanism has been less clear. The present study

shows that the association between symptom severity and quality of life is mediated by health-promoting behaviors, suggesting that for PMI with more severe psychiatric symptoms, their reduced quality of life is a function of both the bothering symptomatology and a lower level of health-promoting behaviors. It is likely that severe psychiatric symptoms, especially affective symptoms, as well as lack of energy and motivation, lead patients to withdraw from health-promoting behaviors, thereby affecting their quality of life. Findings highlight the importance of promoting health-promoting behaviors so as to improve the quality of life among Chinese PMI.

Gender differences in illness experiences and health behavior are widely cited among general population although very little direct evidence exists among PMI [50–52]. Our results revealed that the association between psychiatric symptoms and health-promoting behaviors and between psychiatric symptoms and quality of life is stronger among women. The finding that both paths involving psychiatric symptoms were stronger among female supports the fact that women are more susceptible to the influence of symptom severity. Out of our expectations, the association between health-promoting behaviors and quality of life was stronger among men, suggesting that men might emphasize more on the benefits which health-promoting behaviors may bring to the individual than women.

Limitations

There are limitations in this study that should be noted. First of all, the study was cross-sectional so no causality can be implied. The factors associated with quality of life of PMI may be different depending on the type of mental illness of the participants. For example, negative symptoms may be an important predictor of quality of life for individuals with schizophrenia but not for those with depression. In this case, the current study did not control for other factors that can influence quality of life alongside health-promoting behaviors. Furthermore, subjective quality of life was measured based on self-reports in the present study. Subjective and objective measures of quality of life are considered distinct variables with different associated factors [73]. To establish a more accurate association between symptom severity, health-promoting behaviors, and quality of life, future research should also include objective quality of life as one of the outcome measures. Finally, the quality of care may vary greatly among PMI. The quality of health care received could be a potentially important factor on one's quality of life. While evidence has shown that classical social factors only partly

explains the quality of life in people with chronic mental condition [74], health-promoting behaviors may be identified as another new important factor, which should be supported by more evidence in future studies.

Conclusion

To conclude, the present study showed that psychiatric symptoms were associated with a lower level of health-promoting behaviors, which, in turn, were associated with poorer quality of life among PMI. Gender difference in the association between psychiatric symptoms, health-promoting behaviors, and quality of life was also observed. There is an urgent need to promote health-promoting behaviors so to improve the quality of life of PMI. To maximize the effect of such interventions, gender difference should also be taken into account.

Relevance for Clinical Practice

While most studies have chosen quality of life as an outcome measure, few have examined the role of psychiatric symptoms alongside with health-promoting behaviors. The fact that PMI with higher severity symptoms engage in considerably fewer health practices and hence lower quality of life calls for extensive identification of such individuals for health intervention programs. In particular, health care professionals should also focus on promoting health-promoting behaviors among this population in addition to paying attention to improving their psychiatric symptoms. Also, given the gender differences in the way which psychiatric symptoms and health-promoting behaviors influence quality of life, different factors should be considered when attempting to improve quality of life of men and women, respectively. Health care providers should pay more attention to improving the psychiatric symptoms among female PMI, while male patients should be given more resources and opportunities to engage in health-promoting behaviors such as exercise and smoking cessation. Overall, the gender differ-

ences in the strength of association between symptom severity, health-promoting behaviors, and quality of life among PMI warrant further attention and research in this area.

Statement of Ethics

Ethical approval was obtained from the Survey and Behavioural Research Ethics of the Chinese University of Hong Kong (Ref: Nil). Informed consent was obtained from all individual participants included in the study. Separate consent was also obtained from the participants for their diagnoses, health check records, and medications from their medical records.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Phoenix K.H. Mo: design of the study, write-up, and final approval of the version to be published. Georgina Y.K. So: write-up and final approval of the version to be published. Zhihui Lu: data analysis. Winnie W.S. Mak: design of the study and final approval of the version to be published.

Data Availability Statement

Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data are not available.

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