The Association Between Personality traits and Health-related quality of life With the Mediation Role of smoke: A Nationwide Cross-Sectional Study

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Table of Contents

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Abstract

Background: There are positive and negative correlations in different directions between smoking and personality traits and health-related quality of life (HRQOL), while smoking may have a masking path between personality and HRQOL. Understanding the masking pathway of smoking between personality and HRQOL can help deepen the understanding of the mechanisms of psychosocial effects of smoking and provide new ideas for developing tobacco control strategies.

Objective: The purpose of this study was to investigate the correlation between Big Five personality and health-related quality of life (HRQOL), and whether smoking mediates the relationship between Big Five personality and HRQOL.

Methods: This was a cross-sectional survey with data from 21,916 respondents from the 2022 Psychology and Behavior Investigation of Chinese Residents (PBICR). Linear regression models were used to analyze the correlations between smoking, Big Five personality traits, and HRQOL, controlling for potential confounders. The mediating role of smoking on the association between Big Five Personality traits and HRQOL was analyzed using the Sobel-Goodman mediation test.

Results: Extraversion (?=.001, P<.05), Agreeableness (?=.003, P <.05), and Neuroticism (?=.003, P<.05) were positively correlated with HRQOL, while Openness was negatively correlated with HRQOL (?=.001, P<.05). Smoking was associated with a decrease in HRQOL and mediated the positive effect on HRQOL between Extraversion (z=-2.482, P<.05), Agreeableness (z=-2.264, P<.05), and Neuroticism (z=-3.230, P<.05). Subgroup analyses further showed that smoking mediated the effect of Neuroticism personality on HRQOL in the chronically ill population (z=-2.724, P<.05), and in the non-chronically ill population, smoking contributed to the effect of smoking on HRQOL in Extraversion personality (z=-2.299, P<.05), Agreeableness personality (z=-2.382, P<.05), and Neuroticism personality (z=- 2.213, P<.05).

Conclusions: This study provided evidence that there is a correlation between personality and HRQOL, and also found that smoking plays a role in mediating the connection between personality and HRQOL. The development of future tobacco control strategies should consider the unique traits of each individual's personality, highlighting the significance of Extraversion, Agreeableness, and Neuroticism.

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found that smoking plays a role in mediating the connection between personality and HRQOL. The development of future tobacco control strategies should consider the unique traits of each individual's personality, highlighting the significance of Extraversion, Agreeableness, and Neuroticism.

Keywords: Big Five Personality; Health-Related Quality of Life; Smoke; Mediation

Introduction

The widely recognized theoretical framework in the field of personality psychology is the Big Five personality model, which classifies personality traits into five dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism[1]. The stability and validity of the Big Five personality theory have been consistently confirmed by previous research, which has conducted long-term follow-up studies, cross-cultural studies, and comparisons across various age groups. Studies have revealed that the Big Five traits are significantly correlation with diverse behaviors and adaptations[2], along with their interplay with genetic and environmental factors[3,4]. Various characteristics of individuals have been discovered to have a strong association with academic success[5], professional path[6], interpersonal connections[7], physical well-being, and psychological well-being[8,9]. The extensive applications of the Big Five personality theory span across multiple domains, encompassing talent management[10], mental health research[11], style of behavior[12,13], clinical practice[14], personal growth and education[15,16]. By employing the evaluation of the Big Five traits, scientists have gained insights into individuals' personality characteristics, offering direction and support. Prior research has additionally indicated that although a person's character attributes remain relatively consistent, the manifestation of these attributes is not completely rigid. Moreover, an individual's encounters, surroundings, and cultural upbringing can also influence their character traits and their overall quality of life in terms of health (HRQOL)[17,18].

The Big Five personality theory is extensively employed in the domains of health behavior and psychology to examine how personality traits influence behavioral traits and health outcomes in populations[19,20]. Research has confirmed a robust correlation between the aspects of the Big Five traits and HRQOL. People who have a strong inclination towards openness are generally more welcoming towards novel encounters, have a wider array of hobbies, and exhibit a sense of curiosity. These traits are linked to increased levels of contentment and overall quality of life[21]. Individuals who possess a strong sense of duty and a proactive attitude towards accomplishing tasks tend to have high conscientiousness. This trait is linked to improved mental well-being, reduced negative emotions, and enhanced HRQOL[22]. Individuals who have a high level of extraversion generally have enhanced social abilities, display optimistic emotional expression, and are more inclined to form and sustain positive interpersonal connections. As a result, they experience increased life satisfaction and happiness[23]. People who possess a strong agreeable nature tend to pay closer

attention to the happiness and welfare of those around them. They demonstrate kindness, empathy, and assistance in social engagements, which is linked to improved HRQOL, increased social support, and reduced feelings of isolation[24]. Individuals exhibiting elevated levels of neuroticism are prone to experience anxiety, tension, and negative emotions, which have been linked to diminished levels of life contentment and overall welfare[25]. However, some studies have proposed the concept of "healthy neuroticism", which refers to individuals with neurotic traits that do not lead to physical and mental health problems[26,27]. The healthy neuroticism theory suggests that neurotic individuals may pursue perfection, possess higher alertness and introspection, and have higher demands on themselves, which may positively influence health behaviors and thus positively impact HRQOL through high alertness to unhealthy behaviors[28].

Personality is also associated with smoking. For example, people with a high level of extraversion are usually more prone to seeking excitement and engaging in daring pursuits, which increases their susceptibility to the temptation of smoking[29]. On the other hand, people with a strong sense of conscientiousness are inclined to be more accountable and have a greater tendency to follow healthy habits, such as refraining from smoking[30]. People with a high level of agreeableness typically exhibit a compliant and cooperative demeanor. As such, those with higher agreeableness personality traits exhibit more positive social and pro-social behaviors[31], but are also more susceptible to being socially influenced to smoke. People with a high level of openness tend to be more inclined to engage in novel activities and are also more susceptible to experimenting with smoking[32]. In contrast, people with a high level of neuroticism are prone to feeling anxious, stressed, and experiencing negative emotions, which increases their likelihood of initiating smoking and makes it harder for them to quit[33].

The elderly and individuals with underlying diseases are particularly affected by smoking, as it leads to a decline in HRQOL caused by health hazards, mental strain, financial strain, and limitations on social activities[34,35]. Multiple research studies have firmly established a robust correlation between tobacco use and the emergence of diverse ailments, such as increasing the burden of cervical cancer and mortality[36], underscoring its substantial capacity to jeopardize human well-being. According to the 2021 Global Tobacco Epidemic Report by the World Health Organization, tobacco remains a significant contributor to untimely fatalities on a global scale[37]. China, being the biggest manufacturer and user of tobacco on a global scale, bears sole responsibility for around 1 million tobacco-related deaths[38]. The utilization of tobacco is a significant contributing factor linked to the greatest load of long-term illness, and a decrease in tobacco consumption can result in decreased occurrences of heart disease, stroke, and additional chronic ailments.

Past studies have confirmed that characteristics of an individual's personality affect both their HRQOL and smoking habits, where smoking is found to have an adverse effect on HRQOL. Nevertheless, the correlation among these three variables remains incompletely comprehended, particularly concerning individuals with long-term illnesses. Examining

the mechanisms of interaction between Big Five personality traits, smoking and HRQOL, and conducting tobacco control efforts at the level of individual personality traits can provide new perspectives for improving HRQOL. Based on this the present study tries to formulate the following hypotheses:

Hypothesis 1: The Big Five personality influences HRQOL.

Hypothesis 2: Smoking is associated with Big Five Personality and HRQOL, respectively, while smoking plays a mediating role between Big Five Personality and HRQOL.

Methods

Participants

The information utilized in this investigation was acquired from the questionnaire of the 2022 Psychology and Behavior Investigation of Chinese Residents (PBICR). From June to August 2022, a comprehensive survey was carried out in 148 cities, 202 districts and counties, 390 townships/towns/streets, and 780 communities/villages spanning 23 provinces, 5 autonomous regions, and 4 municipalities under the central government. To ensure the overall representativeness of the study population, the survey utilized a multi-stage sampling technique, incorporating stratified sampling at various levels including provincial, city, district/county, township/town/street, and community/village. Quota sampling was employed at the community/village level as well as at the individual level, using quotas that were determined based on gender and age attributes from the data of the Seventh National Population Census. In every city, there was recruitment of at least one enumerator or survey team, where each enumerator had the duty of gathering 30-90 questionnaires and each survey team had the duty of gathering 100-200 questionnaires. The questionnaires were distributed through the online Questionnaire Star platform, and if face-to-face surveys were possible in the area, the investigator filled out the questionnaires on-site on a one-to-one basis. In the event that face-to-face surveys were impractical due to the constraints of the new coronavirus outbreak, electronic surveys were individually provided to the participants. Participants provided their responses by clicking on the questionnaire link, and they were required to give their informed consent. The study included individuals who were at least 12 years of age, held citizenship in the People's Republic of China, and were permanent residents of China with an annual out-of-home time of no more than 1 month. Participants who did not fulfill the criteria for this research were disqualified. A total of 23,414 questionnaires were collected for the study, ensuring high quality and national representativeness of the data. Meanwhile, by eliminating duplicates and excluding missing data and logically inconsistent outlier data, 21,916 samples were finally included in this study, with a valid response rate of 93.6%. The survey program has been published[39]. The study complied with ethical review rules (JKWH-2022-02).

Variables

Dependent variable

The health status of the population was assessed using Health-related quality of life (HRQOL) in this study. The measurement of HRQOL was conducted using the EQ-5D-5L traditional scale, which has been proven to be better than its previous version, the EQ-5D-3L, in terms of practicality, upper limit impact, distinguishing ability, and agreement with other measures[40,41]. The EQ-5D-5L scale consists of five aspects: mobility, self-care, daily activity performance, pain or discomfort, and anxiety or depression, as specified in **Supplementary Table S2**. There are five levels for each dimension, ranging from 1 (no problems) to 5 (extreme problems). The levels of these questions can describe 243 different health states, forming different outcomes for combinations ranging from 11111 (perfectly good) to 55555 (perfectly poor). These health states are assigned an index value, known as the health state index (HIS), which reflects the weighting of society's preference for the health state. The HIS score varied from below 0 (where 0 represents the health state value of death; negative values indicate a health state worse than death) to 1 (representing perfect health), with higher scores indicating better health utility[41]. The health state value of death is represented by a value of 0, while values below 0 indicate a health state that is even worse than death. Based on their health preferences, the HIS value estimates for the Chinese population vary between -0.391 and 1, representing the worst and best outcomes. In this study, the final HIS was obtained according to the utility value conversion formula (X-min)/(max-min) of [0,1][42].

Independent variable

The assessment of personality involved the utilization of the BFI-10, a condensed variant of the comprehensive BFI-44.In this study, the reliability and validity of the BFI-10 were assessed to confirm its suitability for situations where there are time constraints or it is not feasible to conduct a personality assessment (e.g., telephone surveys, etc.).The scale consists of 10 items that assess 5 personality dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness. A 5-point Likert scale is used to score each item, with higher scores indicating a stronger trait. Extraversion is assessed by questions 1 and 6, agreeableness is assessed by questions 2 and 7, conscientiousness is assessed by questions 3 and 8, neuroticism is assessed by questions 4 and 9, and openness is assessed by questions 5 and 10. It should be mentioned that questions 1, 3, 5, 7, and 9 are scored in the opposite direction[43].

Mediation variables

Smoking behavior was assessed by asking respondents about their current smoking habits. Specifically, they were asked, "Do you currently smoke?". Responses were categorized into 5 levels: 0=No; 1=Yes, regular cigarettes; 2=Yes, e-cigarettes; 3=Yes, both; 4=Ever (quit). For this study, smoking was divided into two categories depending on whether participants were presently smoking or not: 0=never smoked or used to smoke but have stopped, and 1=currently

smoking.

Covariates

The variables examined in this research consist of the socioeconomic background of the participants (including gender, age range, ethnicity, political affiliation, religious beliefs, household registration, household income, place of residence, educational level, occupational status, and social status), family attributes (marital status and family structure), lifestyle elements (smoking habits and alcohol intake), and mental health status related to perception of stress, perception of social support, self-confidence, and health knowledge. Detailed information on the definitions and categorization of these variables can be found in **Supplementary Table S1**. The choice of covariates was determined by their correlation with the independent variables, as well as their impact on the association between the independent variables and the dependent variable. Age and gender were adjusted as fixed covariates. If the other covariates changed the dependent variable by more than 10% with the independent variable or were significantly associated with the dependent variable It was included as a potential confounding factor in the final model. The EPS software was used to test the selected covariates, which were chosen based on established associations or plausible biological relationships. These covariates include ethnicity, political affiliation, religious beliefs, hukou (a special Chinese identifier that impacts various aspects of life in China, such as purchasing a house, a car, public health insurance reimbursement rate, and welfare benefits), household income, place of residence, level of education, occupational status, social status, marital status, family type, alcohol consumption, stress perception ability, social support appreciation ability, self-efficacy, and health literacy. **Supplementary Tables S3-S4** contain detailed findings.

Statistical analysis

The basic study population description included the presentation of chronic diseases characteristics (yes, no, and total) as the mean ± standard deviation for continuous variables and as frequency (%) for categorical variables. To examine variations in the attributes of chronic diseases, the Student's t-test was employed for continuous factors, while the chi-square test was used for categorical factors. The correlation between smoking, Big Five personality, and HRQOL was measured using linear regression models. This was done before and after adjusting for covariates, and the findings were presented as coefficients along with 95% confidence intervals (CI). The Sobel-Goodman mediation test was utilized to examine the impact of smoke on Big Five Personality and HRQOL, while taking into account all covariates[44]. Statistical significance was determined using two-sided p-values, with $\alpha < .05$ as the threshold. The analysis of data was conducted using Stata version 17 (2021, College Station, Texas 77845 USA).

Result

General characteristics

The sample analyzed in this study consisted of 21,916 cases. There was an equal distribution of genders, with 10,958 participants identifying as male and 10,958 identifying as female, making up 50.00% of the total respondents.71.40% of the participants fell within the age range of 18-59 years, while 56.75% of them were in a marital union. The vast majority of respondents were Han Chinese (91.12%), had no religious affiliation (96.09%), and had a mass political profile (63.48%).Over half of the participants hailed from urban regions (53.89%), with a greater proportion belonging to the high-income bracket (36.65%).The majority of respondents reported never drinking alcohol (69.42%), and the largest proportion had tertiary education (44.59%).Less than 35% were employed, with over half of the households being nuclear (52.81%).The prevalence of smoking was 14.87%.The social status of respondents was close to the upper middle class (total score of 6, mean 4.35, SD 1.30).Among individuals with chronic illnesses, there was a notable decline in HRQOL (mean 0.92, SD 0.13), significantly lower than the overall (mean 0.96, SD 0.10, P< .001).Individuals with chronic illnesses exhibited a diminished level of extraversion (mean 6.14, SD 1.61, P < .001), as opposed to the general mean score of extraversion personality(mean 6.23, SD 1.62).The average rating for agreeableness personality was 7.00 with a standard deviation of 1.48.The average score for conscientiousness personality traits(mean 6.76, SD 1.65). Individuals with chronic diseases exhibited an improvement in conscientiousness (mean 6.98, SD 1.65, P< .001). The average score for neuroticism personality was 6.27 with a standard deviation of 1.56. Individuals with chronic illnesses exhibited a diminished level of openness personality (mean 6.20, SD 1.61), significantly lower than the overall (mean 6.46, SD 1.55, P< .001). The average rating for perceived stress capacity (mean 6.55, SD 2.54), indicating an increase among individuals with chronic illnesses (mean 6.63, SD 2.57, P < .05). In the meantime, the population with chronic illnesses experienced a decrease in their corresponding competencies, specifically in comprehending social support competence (mean 15.03, SD 3.78), self-efficacy (mean 7.79, SD 2.42), and health literacy (mean 27.55, SD 5.30), suggesting a decline in these abilities (P< .001). **Table 1** contains comprehensive details.

Table 1. Characteristics of respondents[a].

	Overall (n= 21916)	With chronic disease (n=5460)	Without chronic disease (n= 21796)	*P* value
Age, n(%)				<.001
12-17 years	2072 (9.45)	136 (2.49)	1936 (11.76)	
18-59 years	15647 (71.40)	2943 (53.90)	12704 (77.20)	
≥60 years	4197 (19.15)	2381 (43.61)	1816 (11.04)	
Gender, n(%)				<.001
Male	10958 (50.00)	2854 (52.27)	8104 (49.25)	
Female	10958 (50.00)	2606 (47.73)	8352 (50.75)	

Marital status, n(%)				<.001
Never married	8497 (38.77)	851 (15.59)	7646 (46.46)	
Married	12437 (56.75)	4059 (74.34)	8378 (50.91)	
Divorce	406 (1.85)	160 (2.93)	246 (1.49)	
Widowed	576 (2.63)	390 (7.14)	186 (1.13)	
Nation, n(%)				.861
Han	19970 (91.12)	4972 (91.06)	14998 (91.14)	
Minorities	1946 (8.88)	488 (8.94)	1458 (8.86)	
Religion, n(%)				<.001
None	21058 (96.09)	5091 (93.24)	15967 (97.03)	
Yes	858 (3.91)	369 (6.76)	489 (2.97)	
Political, n(%)				<.001
Party member or Probationary Party	3179 (14.51)	1059 (19.40)	2120 (12.88)	
member of the Communist Youth League	4671 (21.31)	457 (8.37)	4214 (25.61)	
Other parties	154 (0.70)	59 (1.08)	95 (0.58)	
The masses	13912 (63.48)	3885 (71.15)	10027 (60.93)	
Registered permanent residence, n(%)				.007
Urban	11811 (53.89)	2856 (52.31)	8955 (54.42)	
Rural	10105 (46.11)	2604 (47.69)	7501 (45.58)	
Family income, n(%)				<.001
Low	7229 (32.99)	2050 (37.55)	5179 (31.47)	
Moderate	6655 (30.37)	1628 (29.82)	5027 (30.55)	
High	8032 (36.65)	1782 (32.64)	6250 (37.98)	
Alcohol intake, n(%)				<.001
Never	15214 (69.42)	3277 (60.02)	11937 (72.54)	
All the time	3266 (14.90)	1019 (18.66)	2247 (13.65)	
Used to drink now not drink	2148 (9.80)	947 (17.34)	1201 (7.30)	
The past does not drink now drink	1288 (5.88)	217 (3.97)	1071 (6.51)	
Education, n(%)				<.001
Primary school and below	3412 (15.57)	1528 (27.99)	1884 (11.45)	
Middle school and junior college	8731 (39.84)	1977 (36.21)	6754 (41.04)	
College degree or above	9773 (44.59)	1955 (35.81)	7818 (47.51)	
Work status, n(%)				<.001
Employed	7601 (34.68)	1633 (29.91)	5968 (36.27)	
Student	6580 (30.02)	557 (10.20)	6023 (36.60)	
Retirement	2756 (12.58)	1539 (28.19)	1217 (7.40)	
No regular occupation	2609 (11.90)	707 (12.95)	1902 (11.56)	
Unemployed	2370 (10.81)	1024 (18.75)	1346 (8.18)	
Household type, n(%)				<.001
Couple Family	3717 (16.96)	989 (18.11)	2728 (16.58)	
Core family	11574 (52.81)	1922 (35.20)	9652 (58.65)	
Main family	3836 (17.50)	1639 (30.02)	2197 (13.35)	
Other forms of family	2789 (12.73)	910 (16.67)	1879 (11.42)	
Smoke, n(%)				<.001
No	18658 (85.13)	4306 (78.86)	14352 (87.21)	

Yes	3258 (14.87)	1154 (21.14)	2104 (12.79)	
Health-related quality of life(HRQOL), mean (SD)	0.96 (0.10)	0.92 (0.13)	0.97 (0.09)	<.001
Extraversion, mean (SD)	6.23 (1.62)	6.14 (1.61)	6.27 (1.62)	<.001
Agreeableness, mean (SD)	7.00 (1.48)	6.98 (1.52)	7.00 (1.47)	.271
Conscientiousness, mean (SD)	6.76 (1.65)	6.98 (1.65)	6.69 (1.64)	<.001
Neuroticism, mean (SD)	6.27 (1.56)	6.25 (1.60)	6.28 (1.54)	.186
Openness, mean (SD)	6.46 (1.55)	6.20 (1.61)	6.55 (1.52)	<.001
Health literacy, mean (SD)	27.55 (5.30)	26.29 (5.45)	27.96 (5.19)	<.001
Self-efficacy, mean (SD)	7.79 (2.42)	7.55 (2.47)	7.87 (2.40)	<.001
Perceived Stress, mean (SD)	6.55 (2.54)	6.63 (2.57)	6.52 (2.53)	.020
Perceived social support, mean (SD)	15.03 (3.78)	14.63 (3.74)	15.16 (3.79)	<.001
Social status, mean (SD)	4.35 (1.30)	4.30 (1.28)	4.36 (1.31)	.003

[a]Mean ± standard deviation was used to describe continuous variable, and number (constituent ratio [%]) was used to describe categorical variable

Correlation analysis

Before accounting for covariates, the linear regression model revealed a detrimental association between smoking and HRQOL (β= -.028, *P*< .05). Additionally, HRQOL exhibited significant correlations with extraversion, agreeableness, conscientiousness, neuroticism, and openness (*P* < .05). After making adjustments for various factors such as gender, age range, ethnicity, political views, religious beliefs, hukou, household income, place of residence, education level, occupation, social status, marital status, family structure, alcohol consumption, ability to perceive stress, ability to appreciate social support, self-confidence, and health knowledge, the findings indicated that smoking still had a negative association with HRQOL (β= -.016, *P* < .05). Additionally, extraversion (β= .001, *P*< .05), agreeableness (β= .003, *P* < .05), neuroticism (β=.003, *P* < .05), and openness (β= -.001, *P* < .05) were all significantly linked to HRQOL. However, in the population with chronic illnesses, the findings of the model, after accounting for covariates, indicated that only tobacco use (β= -.021, *P* < .05), agreeability (β= .003, *P* < .05), and emotional instability (β= .005, *P* < .05) exhibited a correlation with health-related quality of life (HRQOL). Refer to **Table 2** for comprehensive details.

Table 2. Linear regression analysis for HRQOL associated with smoking and Big Five Personality[β(95%CI)].

	Overall (n= 21916)		Chronic disease (n=5460)		Without Chronic disease (n= 21796)	
	unadjusted	Adjusted [a]	unadjusted	Adjusted [b]	Unadjusted	Adjusted [b]
Smoke	-0.028 (-0.032, -0.024)[e]	-0.016 (-0.020,-0.012)[e]	-0.035 (-0.043,-0.027)[e]	-0.021 (-0.029,-0.012)[e]	-0.016 (-0.020,-0.013)[e]	-0.010 (-0.014,-0.005)[e]
Extraversion	0.004 (0.003,0.005)[e]	0.001 (-0.000,0.002)[c]	0.006 (0.004,0.008)[e]	0.001 (-0.001,0.003)	0.003 (0.002,0.004)[e]	0.001 (-0.000,0.001)
Agreeableness	0.008 (0.007,0.009)[e]	0.003 (0.002,0.003)[e]	0.012 (0.010,0.014)[e]	0.003 (0.001,0.005)[d]	0.007 (0.006,0.008)[e]	0.002 (0.002,0.003)[e]
Conscientiousness	0.006 (0.005,0.006)[e]	0.001 (-0.000,0.001)	0.010 (0.008,0.012)[e]	0.001 (-0.001,0.003)	0.005 (0.005,0.006)[e]	0.001 (-0.000,0.002)
Neuroticism	0.008 (0.007,0.009)[e]	0.003 (0.003,0.004)[e]	0.011 (0.009,0.013)[e]	0.005 (0.003,0.007)[e]	0.007 (0.006,0.007)[e]	0.003 (0.002,0.004)[e]
Openness	0.001 (0.001,0.002)[d]	-0.001 (-0.002,-0.000)[d]	0.002 (0.000,0.005)[c]	0.000 (-0.002,0.002)	-0.001 (-0.001,0.000)	-0.002 (-0.003,-0.001)[e]

Note: β, beta coefficient; CI, confidence interval.
[a] Adjusting for gender, age, marital, nation, religion, political, chronic disease, registered permanent residence, family income, alcohol intake,

education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[b] Adjusting for gender, age, marital, nation, religion, political, registered permanent residence, family income, alcohol intake, education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[c] *P*<.05.
[d] *P*<.01.
[e] *P*<.001.

Before accounting for covariates, the initial linear regression analysis revealed that smoking had a negative correlation with personality of agreeableness (β= -.107, *P* < .05), while neuroticism exhibited a positive correlation with smoking (β= .185, *P* < .05), and openness displayed a negative correlation with smoking (β= -.247, *P* < .05).The findings after accounting for covariates indicated that extraversion (β= .077, *P*< .05), agreeableness (β= .059, *P*< .05), and neuroticism (β= .059,*P* < .05) exhibited a positive association with smoking. After accounting for covariates, the model demonstrated a noteworthy impact of neuroticism (β= .155, *P* < .05) within the group of individuals with chronic illnesses. **Table 3** provides a comprehensive overview of the detailed information.

Table 3. Linear regression analysis for smoking associated with Big Five Personality [β(95%CI)].

	Overall (n= 21916)		Chronic disease (n=5460)		Without Chronic disease (n= 21796)	
	Unadjusted	Adjusted [a]	Unadjusted	Adjusted [b]	Unadjusted	Adjusted [b]
Extraversion	-0.026 (-0.086,0.034)	0.077 (0.011,0.142)[c]	-0.088 (-0.193,0.016)	0.106 (-0.006,0.219)	0.028 (-0.046,0.102)	0.071 (-0.011,0.152)
Agreeableness	-0.107 (-0.162,-0.052)[e]	0.059 (-0.000,0.118)[c]	-0.201 (-0.300,-0.103)[e]	0.043 (-0.059,0.146)	-0.058 (-0.125,0.010)	0.074 (0.002,0.147)[c]
Conscientiousness	0.037 (-0.024,0.098)	-0.015 (-0.076,0.046)	-0.309 (-0.417,-0.202)[e]	-0.047 (-0.153,0.059)	0.156 (0.081,0.231)[e]	0.014 (-0.061,0.090)
Neuroticism	0.185 (0.128,0.243)[e]	0.089 (0.028,0.150)[d]	0.086 (-0.018,0.190)	0.155 (0.049,0.260)[d]	0.243 (0.173,0.314)[e]	0.063 (-0.012,0.137)
Openness	-0.247 (-0.305,-0.189)[e]	0.037 (-0.025,0.098)	-0.004 (-0.109,0.101)	0.092 (-0.018,0.202)	-0.306 (-0.376,-0.237)[e]	-0.007 (-0.082,0.068)

Note: *β*, beta coefficient; CI, confidence interval.
[a] Adjusting for gender, age, marital, nation, religion, political, chronic disease, registered permanent residence, family income, alcohol intake, education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[b] Adjusting for gender, age, marital, nation, religion, political, registered permanent residence, family income, alcohol intake, education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[c] *P*<.05.
[d] *P*<.01.
[e] *P*<.001.

Mediating analysis

Table 4 displayed the findings of the mediation analysis, indicating that smoking acted as a mediator for the impact of extraversion, agreeableness, and neuroticism on HRQOL. In terms of Extraversion, there was a positive correlation between Extraversion and smoking (β= .001, *P* < .05), while smoking showed a negative correlation with HRQOL (β= -.012, *P*< .05). Smoking mediated -13.3% of HRQOL in Extraversion (z=-2.842, *P*<.05). In terms of Agreeableness, there was a positive correlation between Agreeableness and smoking (β=.004, *P*<.05), while smoking showed a negative correlation with HRQOL (β=-.013, *P*<.05). Additionally, Agreeableness was positively correlated with HRQOL (β=.003, *P*<.05). Smoking mediated -1.5% of HRQOL in agreeableness (z=-2.264, *P*<.05). Neuroticism exhibited a positive correlation with smoking (β= .006, *P*< .05), while smoking showed a negative correlation with HRQOL (β= -.013, *P* < .05). Additionally, Neuroticism displayed a positive correlation with HRQOL (β= .003, *P*< .05). Smoking mediated -2.3% of HRQOL in Neuroticism (z=-3.230, *P*< .05). **Figure 1** displays the ultimate mediation model.

Table 4. The mediating effect of smoking on Big Five Personality and HRQOL explored by Sobel Test.

	Extraversion[a]	Agreeableness[a]	Conscientiousness[a]	Neuroticism[a]	Openness[a]
Big five personality →Smoke, β	0.005[c]	0.004[b]	0.002	0.006[d]	-0.000
Smoke →HRQOL, β	-0.012[d]	-0.013[d]	-0.012[d]	-0.013[d]	-0.012[d]
Indirect effect, β	-0.000[d]	-0.000[b]	-0.000	-0.000[d]	0.000
Direct effect, β	0.000	0.003[d]	0.002[d]	0.003[d]	-0.002[d]
Total effect, β	0.000	0.003[d]	0.002[d]	0.003[d]	-0.002[d]
Proportion of total effect that is mediated	-0.133	-0.015	-0.015	-0.023	-0.002
Sobel test	-2.842[c]	-2.264[b]	-1.531	-3.230[c]	0.176

[a] Adjust: Adjusting for gender, age, marital, nation, religion, political, chronic disease, registered permanent residence, family income, alcohol intake, education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[b] *P*<.05.
[c] *P*<.01.
[d] *P*<.001.

All

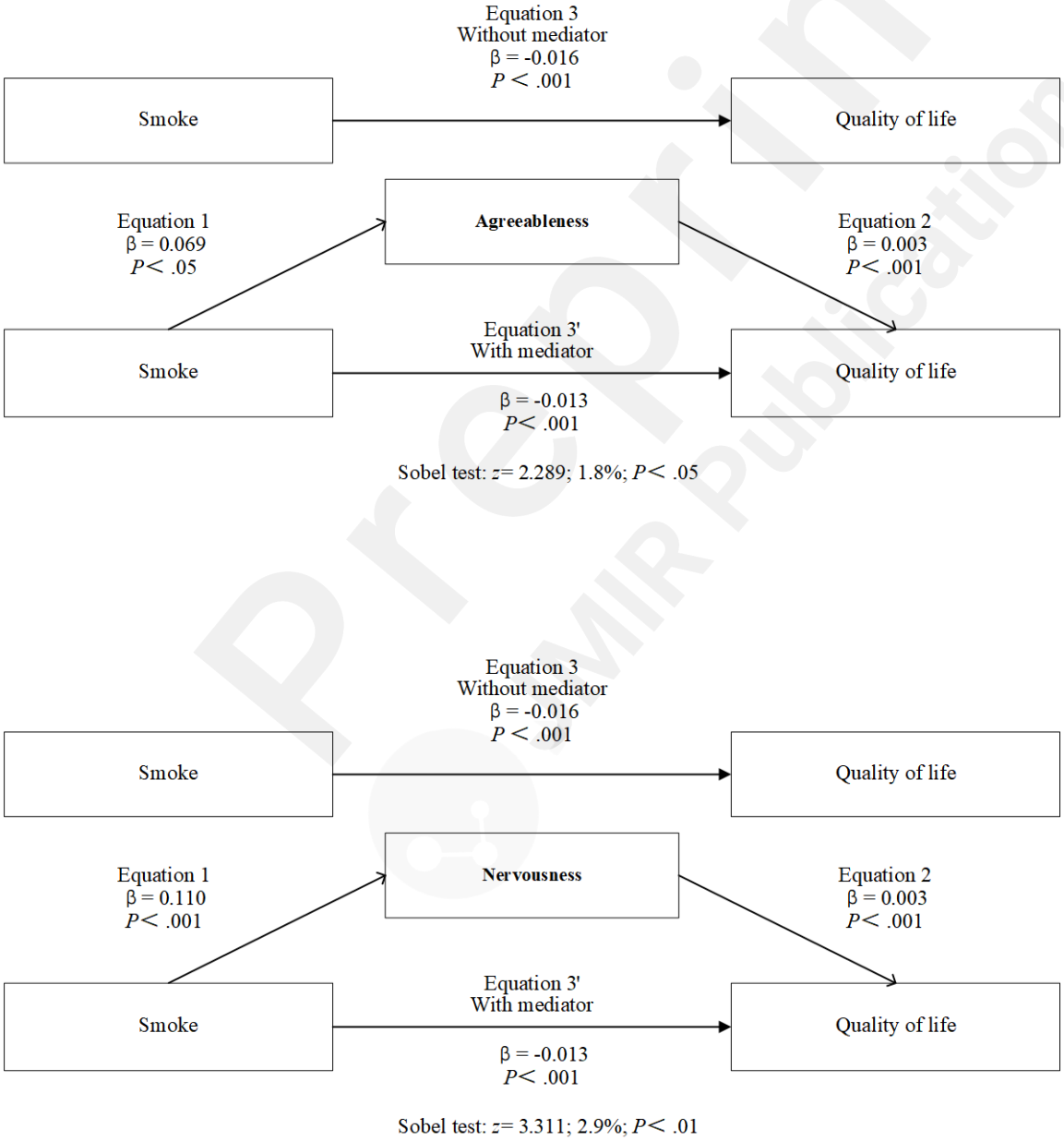


Figure 1. Mediating model of smoking in the Big Five personality and HRQOL.

Subgroup analysis

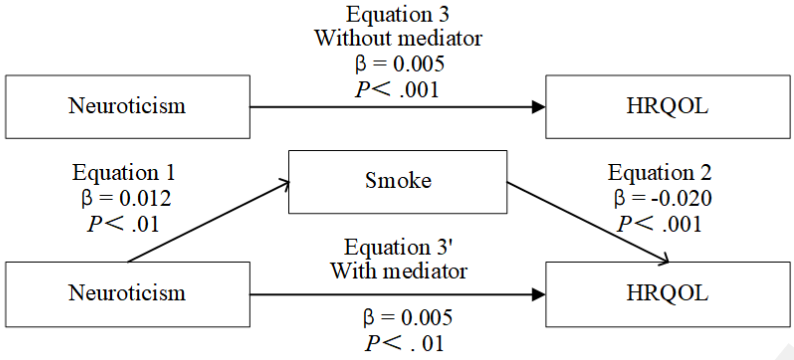
In **Table 5,** the subgroup analysis revealed that smoking acted as a mediator between Big Five personality traits and HRQOL in individuals with chronic diseases. In particular, among individuals with chronic diseases, there was a positive correlation between neuroticism and smoking (β= .012, *P* < .05), while smoking showed a negative correlation with HRQOL (β= -.020, *P*< .05). Additionally, neuroticism exhibited a positive correlation with HRQOL (β= .005, *P*< .05). Smoking mediates -1.5% of HRQOL in neurotic personalities (z=-2.724, *P*<.05). Smoking was found to have a negative impact on 1.4% of HRQOL in extraversion (z=-2.299, *P*<.05), 2.4% of HRQOL in agreeableness (z=-2.382, *P*<.05), and 1.5% of HRQOL in neuroticism (z=-2.213, *P*<.05) among the non-chronically ill population. The extent to which smoking behavior relevanced the relationship between Agreeableness personality and HRQOL was slightly greater than that of Neuroticism, while the relevance of smoking behavior on the relationship between Extraversion personality and HRQOL was the least. **Figure 2** displays the ultimate mediation model for the subgroup of chronic diseases.

Table 5. Subgroup analysis of mediation models for Big Five Personality associated with HRQOL mediated by Smoke..

		Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
Chronic disease	Big five personality →Smoke, β	0.007[b]	0.001	-0.003	0.012[c]	0.005
	Smoke →HRQOL, β	-0.019[d]	-0.019[d]	-0.019[d]	-0.020[d]	-0.019[d]
	Indirect effect	-0.000	-0.000	0.000	-0.000[c]	-0.000
	Direct effect	0.001	0.004[d]	0.003[b]	0.005[d]	-0.001
	Total effect	0.001	0.004[d]	0.003[b]	0.005[d]	-0.001
	Proportion of total effect that is mediated	-0.133	-0.006	0.018	-0.051	0.083
	Sobel test	-1.948	-0.397	0.760	-2.724[c]	-1.328
Without chronic disease	Big five personality →Smoke, β	0.004[c]	0.005[cd]	0.003[b]	0.004[b]	-0.002
	Smoke →HRQOL, β	-0.009[d]	-0.009[d]	-0.009[d]	-0.009[d]	-0.009[d]
	Indirect effect	-0.000[b]	-0.000[b]	-0.000	-0.000[b]	0.000
	Direct effect	0.000	0.003[d]	0.001[c]	0.003[d]	-0.002[d]
	Total effect	0.000	0.003[d]	0.001[c]	0.003[d]	-0.002[d]
	Proportion of total effect that is mediated	-0.136	-0.017	-0.023	-0.015	-0.008
	Sobel test	-2.299[b]	-2.382[b]	-1.841	-2.213[b]	1.121

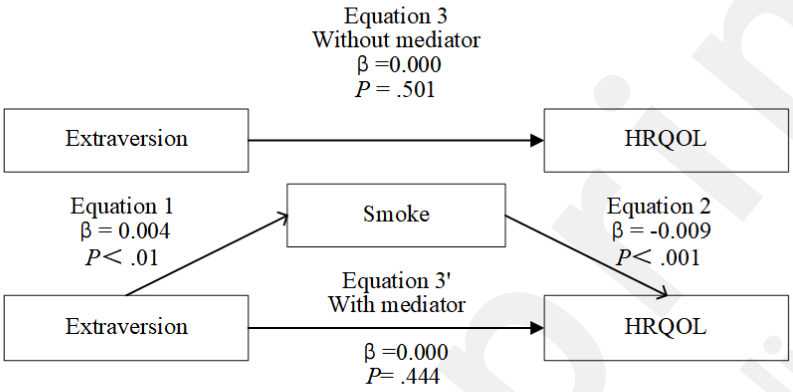
[a] Adjust: Adjusting for gender, age, marital, nation, religion, political, chronic disease, registered permanent residence, family income, alcohol intake, education, work status, social status, household type, health literacy, self-efficacy, perceived stress, perceived social support.
[b] *P*<.05.
[c] *P*<.01.
[d] *P*<.001.

Chronic

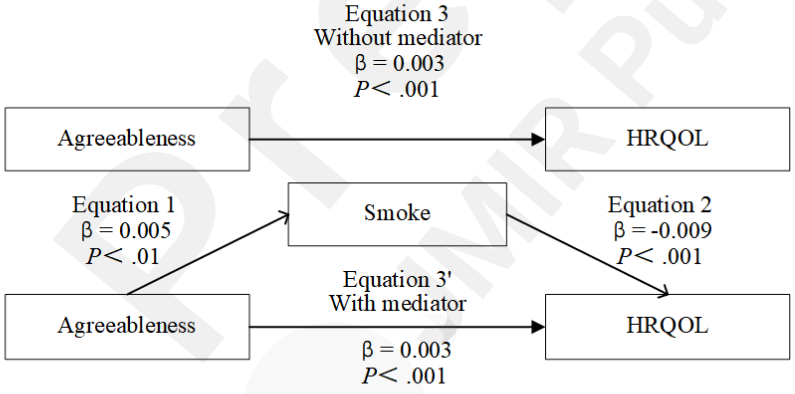


Sobel test: z= -2.724; -5.1%; *P*< .01

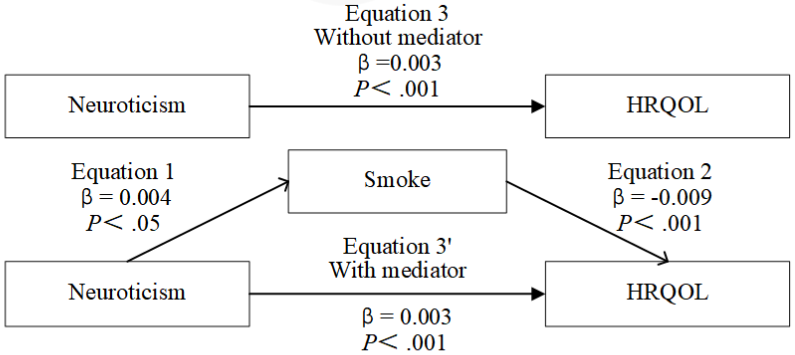
No Chronic



Sobel test: z=-2.299; -13.6%; *P*< .05



Sobel test: z=-2.382; -1.7%; *P*< .05



Sobel test: z=-2.213; -1.5%; *P*< .05

Figure 2. Subgroup analysis for Mediating models of smoking in Big Five Personality and HRQOL.

Discussion

Prior research has established robust connections between tobacco use and HRQOL[45], along with the correlation between personality traits and both smoking and HRQOL[46,47]. Nevertheless, there has been no research conducted so far that has investigated the correlation among these three variables. The impact of smoking on the relationship between the Big Five personality traits and HRQOL was investigated in our research. We utilized data from a nationwide cross-sectional survey conducted in China, which encompassed 32 provinces, including autonomous regions and centrally governed municipalities. Through the process of mediation decomposition, we were able to provide additional evidence that smoking mediates the relationship between Big Five personality and HRQOL. The results of our study indicate that there is not only a direct correlation between Big Five personality and HRQOL, but also an indirect correlation through smoking. Subgroup analyses for people with chronic conditions were also carried out.

The study findings indicated that extraversion, agreeableness, and neuroticism have a positive correlation with HRQOL, while openness has a negative correlation. Previous research has demonstrated that the Big Five personality traits impact well-being, life satisfaction, and self-identity, and thus HRQOL, through different personality traits[47]. People who possess elevated levels of extraversion and agreeableness have a greater tendency to form enduring and beneficial social connections, which can help reduce psychological strain and feelings of isolation[23,24]. Moreover, they possess a sunnier perspective on existence and exhibit enhanced resilience in the face of life's obstacles and stresses[48]. Surprisingly, our research discovered a positive correlation between high neuroticism and HRQOL, which contradicts previous study results. There is a widespread belief that elevated neuroticism is linked to feelings of anxiety, depression, and various other negative emotions[49], ultimately resulting in a diminished quality of life[25,50]. However, according to the theory of healthy neuroticism, people with healthy neurotic traits aim for flawlessness and exhibit a heightened state of vigilance and self-reflection towards detrimental actions. As a result, their chances of encountering physical and psychological health issues are reduced[26,27]. Conversely, individuals who possess elevated levels of openness are not constrained by conventional notions and routines, and they might experience remorse for impulsive or erroneous behaviors[51]. Excessive attention to and maintenance of interpersonal relationships can also diminish life satisfaction and happiness[52].

Furthermore, our study provided evidence for the favorable correlations among extraversion, agreeableness, and neuroticism with smoking. Personality traits that promote social interactions, like being friendly and reliable, are linked to high levels of Extraversion and Agreeableness[53]. As smoking is often perceived as social behavior in some settings, these individuals may be more susceptible to social influence to start or quit smoking[54,55]. Conversely, people with

elevated levels of neuroticism have a greater susceptibility to anxiety and stress[56]. Since nicotine can provide temporary relief from these emotions[57], individuals with high Neuroticism may be inclined to use smoking as a coping mechanism, increasing their likelihood of initiating smoking or becoming regular smokers.

The act of smoking has been associated with a decrease in different aspects of HRQOL and the emergence of multiple long-term illnesses[58]. The results of our study indicated a consistent negative correlation between smoking and HRQOL, which was observed in both the entire population and the subgroups with chronic diseases, aligning with previous research. Furthermore, our research suggests that smoking mediates the relationship between Extraversion, Agreeableness and Neuroticism personality and HRQOL. High levels of Extraversion and Agreeableness are positively correlated with HRQOL, but they are also strongly associated with smoking, as these personality types are more likely to smoke due to a need for social interaction[59]. Smoking has a more significant correlation on HRQOL compared to the favorable correlation of high Extraversion and Agreeableness, thus smoking's mediation weakens this positive effect. Furthermore, our research discovered that smoking can mediate the positive impact of highly healthy Neuroticism personality on HRQOL. Prior research demonstrated that high Neuroticism can be positively associated with HRQOL by promoting "Healthy Neuroticism" or introspection, while it is also strongly associated with smoking, as people with high Neuroticism personality are more likely to become dependent on tobacco for anxiety relief and experience symptoms of tobacco dependence[33]. The negative effect of smoking on HRQOL is greater than that of high Neuroticism personality. Due to the mediation of smoking, the positive effect of high Neuroticism personality on HRQOL is also weakened.

The findings from the subgroup analysis on chronic diseases additionally indicate that smoking plays a mediate role in connecting Neuroticism and HRQOL in the chronic disease population. However, the mediating effect in the non-chronic disease population remains similar to that of the overall population. The different mediating effects of personality in the chronic disease and non-chronic disease populations may be due to several factors. For example, the act of smoking is a major contributor to long-term health conditions, and people who have chronic illnesses may experience mental health issues like Neuroticism and anxiety due to their ailment. Furthermore, persistent illnesses frequently necessitate extended periods of therapy and medication, potentially leading to the formation of a neurotic character[60]. The findings of this research suggest that although the influence of mediation was minimal for certain traits, the Sobel-test produced noteworthy outcomes, indicating the existence of mediated routes. Considering the limited impact magnitudes, it is conceivable that alternative mechanisms are at play.

To summarize, our study supports the notion that smoking acts as a mediator in the relationship between the Big Five Personality characteristics and HRQOL. Therefore, employing a single tobacco control plan for the entire community may not be the best course of action; instead, tailored smoking cessation tactics based on various personality

qualities can be taken into consideration. For individuals with high levels of Extraversion and Agreeableness, interventions such as smoking cessation environments, legislation, and support from partners, friends, or support groups can greatly increase the chances of successfully quitting smoking[61]. Providing emotional support, actively listening to their emotions and uncertainties, and assisting them in discovering suitable emotion management methods like deep breathing and relaxation exercises to manage mood fluctuations during the process of quitting smoking could potentially yield greater advantages for individuals exhibiting elevated levels of Agreeableness[62]. For people with high Neuroticism personality, it is more important to promote self-reflection of people with high Neuroticism personality and shape healthy Neuroticism personality by spreading the dangers of smoking and health knowledge; Provide anxiety management techniques such as deep breathing, meditation, or relaxation training to help them cope with anxiety and stress during the process of quitting smoking; Emphasize internal factors such as self-efficacy in intervention[63,64]. It is noteworthy that the correlation coefficients between personality traits and health-related quality of life (HRQOL) in the present study were small, and that HRQOL may provide a critical research perspective not from a clinical but from a psychosocial point of view, as HRQOL covers a wealth of information and personality traits are also a potential factor influencing HRQOL. We initially explored the pathway through which Big Five personality influences individual HRQOL, and this pathway does exist. In addition, the mechanisms by which Big Five personality acts on HRQOL may be complex, and some mediating effects may be overshadowed by direct effects.

Limitation

Although the present study revealed a mediating role of smoking in the relationship between Big Five personality and HRQOL, it is important to acknowledge the existence of certain constraints that need to be considered. To begin with, this study has the inherent limitations of cross-sectional studies in inferring causality. Because a cross-sectional study is conducted at a specific point in time, it can only reveal correlations between variables and cannot directly determine causality. Thus, although our cross-sectional study found associations between Big Five personality traits, smoking, and health-related quality of life, these results were not sufficient to suggest a causal relationship between them. Future research can explore the potential reciprocal association between the Big Five personality and HRQOL, employing longitudinal and prospective studies, thereby further validating and explaining our findings. Furthermore, the correlation coefficients and mediating effects of our study were not very large, and further exploration needs to be made in the future as to exactly how Big Five personality traits affect HRQOL and how smoking mediates the relationship between Big Five personality and HRQOL. Finally, since all variables were reported by the participants themselves, there is a possibility of recall and cognitive biases being present, which could impact the precision of factors associated with health and personality. Meanwhile, the formation of an individual's character requires a significant amount of time, and

as one matures, their character tends to become more steadfast and influenced by their surroundings. As a result, personality scores may have some bias in their immediate outcomes.

Conclusion

This study demonstrated that smoking mediates the relationship between Extraversion, Agreeableness, Neuroticism and HRQOL. Also, smoking can mediate the effect of Neuroticism personality on HRQOL in a chronically ill population. In the future, when creating tobacco control strategies, it is important to consider the impact of personality, as suggested by these findings. We hope that our study will contribute to increasing the global smoking cessation rate and reducing the incidence of chronic diseases caused by smoking. This could assist in the advancement of campaigns promoting smoke-free initiatives and aid in the creation of a healthier and smoke-free atmosphere.

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Contributions made by the authors

JYC, YBW, and JHC played a role in formulating and designing the study. The data acquisition involved HML, SYL, HZZ, and XHY. Data analysis was completed by LG, YZ, and LL. The initial version of the manuscript was written by JYC, LG, and JHW. JHC and YBW assisted in overseeing the analysis of data and the creation of the manuscript. All authors participated in the revision of the paper and endorsed the submitted final version.

Conflicts of Interests

The writers assert that they have no conflicting interests.

Abbreviations

Health-related quality of life: HRQOL.

CI: Confidence interval.

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Supplementary Files

Multimedia Appendixes

Supplementary Materials.
URL: http://asset.jmir.pub/assets/caab45b8abfd146d3bb0a5a593f5dcb0.docx

CONSORT (or other) checklists

STROBE_checklist_cross-sectional.
URL: http://asset.jmir.pub/assets/74611f0123df7af958a28fdd1a81d635.pdf