Journal of Multidisciplinary Healthcare

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Knowledge, Attitude, and Practice of Medical Staff Towards Metabolic Syndrome in Schizophrenia in Chinese Hospitals: A Cross-Sectional Study

Yuejia Wang[1,2], Xuefen Yu[3,4], Haiqin Chen[2], Chunxia Tang[2], Na Zhang[5]

[1]Zhejiang University School of Medicine, Hangzhou, Zhejiang, 310000, People's Republic of China; [2]Nursing Department of Huzhou Third Municipal Hospital, Huzhou, Zhejiang, 313000, People's Republic of China; [3]Stomatology Hospital, School of Stomatology, Zhejiang University School of Medicine, Zhejiang Provincial Clinical Research Center for Oral Diseases, Hangzhou, 310000, People's Republic of China; [4]Key Laboratory of Oral Biomedical Research of Zhejiang Province, Cancer Center of Zhejiang University, Engineering Research Center of Oral Biomaterials and Devices of Zhejiang Province, Hangzhou, 310000, People's Republic of China; [5]Psychiatry Department of Huzhou Third Municipal Hospital, Huzhou, Zhejiang, 313000, People's Republic of China

Correspondence: Xuefen Yu, Email yuxf@zju.edu.cn

Background: This study aimed to investigate the knowledge, attitude, and practice (KAP) of medical staff regarding metabolic syndrome in schizophrenia in Chinese hospitals, emphasizing implications for improving clinical management.

Methods: This multicenter, cross-sectional study enrolled medical staff in 5 hospitals between March 2024 and April 2024. A self-administered questionnaire was developed to collect the demographic information and KAP scores of the participants.

Results: A total of 359 valid questionnaires were analyzed, with 280 respondents (77.99%) being female and 298 (83.01%) employed in public tertiary hospitals. Mean scores for knowledge, attitude, and practice were 30.93±7.45, 28.81±3.60, and 22.50±5.11, respectively. The proportion of participants achieving good levels of knowledge, attitude, and practice (defined as scores ≥60% of the maximum score) was 75.77%, 99.72%, and 88.58%, respectively. Multivariate logistic regression identified several factors independently associated with practice: higher knowledge scores (OR = 1.16), positive attitude scores (OR = 1.09), being female (OR = 2.64), having ≥16 years of experience (OR = 3.24), and previous experience in managing patients with metabolic syndrome in schizophrenia (OR = 0.50). Approximately 64.9% of participants had experience treating patients with schizophrenia and metabolic syndrome, and this experience was significantly associated with higher practice scores. Structural equation model analysis revealed that knowledge influenced attitude (β = 0.10), attitude influenced practice (β = 0.82), and knowledge directly influenced practice (β = 0.50).

Conclusion: Medical staff possess adequate knowledge, positive attitude, and proactive practice concerning metabolic syndrome in schizophrenia. Although the overall level of KAP was good, there is still room for further improvement. The findings suggest targeted interventions, such as continuous education programs and training tailored for Chinese medical staff, could enhance their proactive practices in managing metabolic syndrome in schizophrenia patients.

Keywords: knowledge, attitude, practice, medical staff, schizophrenia, metabolic syndrome

Background

Schizophrenia is a chronic psychiatric disorder affecting approximately 1% of the global population.[1] Patients with schizophrenia experience a significantly reduced life expectancy and higher mortality rates compared to the general population, largely attributed to cardiometabolic disorders, including metabolic syndrome.[2,3] In China, the National Health Commission has issued guidelines emphasizing the importance of metabolic monitoring in schizophrenia patients, particularly focusing on regular assessments of blood glucose, lipids, and body weight.[4] Despite this, compliance with these guidelines remains suboptimal in many clinical settings. According to recent reviews, the prevalence of metabolic syndrome in individuals with schizophrenia is notably higher than in the general population, which underscores its significant contribution to overall morbidity and mortality.[5,6]

Received: 29 October 2024
Accepted: 23 April 2025
Published: 7 June 2025

Metabolic disturbances are prevalent among individuals with schizophrenia; these include abdominal obesity, lowered levels of high-density lipoprotein (HDL) cholesterol, elevated triglyceride levels, and diabetes.[7] However, research suggests that primary care providers and psychiatrists often face barriers in implementing routine metabolic monitoring for these patients.[8] A study found that primary care providers encounter challenges in monitoring the metabolic side effects of antipsychotics due to lack of clear guidelines and interdisciplinary coordination.[9] Existing training programs for medical staff in China often focus on psychiatric management, with limited emphasis on integrated care approaches addressing both mental health and metabolic complications.[10] This gap highlights the need for more targeted education initiatives that prioritize metabolic syndrome management in this population. It is noteworthy that over half of the patients with schizophrenia meet the criteria for metabolic syndrome.[11] In China, approximately 30% of inpatients with schizophrenia are diagnosed with metabolic syndrome.[12] Furthermore, the coexistence of metabolic syndrome or its individual components significantly impairs cognitive function in these patients. Psychiatrists and psychologists in other regions, such as India, have also reported a lack of confidence and knowledge regarding metabolic health interventions for patients with mental disorders, further emphasizing the global need for interdisciplinary training programs.[13] Notably, obesity—a central component of metabolic syndrome—heightens the risk of neuropsychiatric disorders. Concurrently, the lifestyle habits of patients with mental illnesses, including poor dietary choices and pharmacologically induced increases in appetite, contribute to the prevalence of obesity.[14]

The Knowledge, Attitude, and Practice (KAP) model is pivotal in public health, positing that individual behaviors are influenced by knowledge and attitude, which in turn shape practice. This model is often explored through KAP surveys that assess knowledge, attitude, and risk perceptions to elucidate health-related behaviors.[15–17] A recent meta-synthesis analyzed perspectives of both patients and healthcare professionals regarding metabolic monitoring in individuals receiving second-generation antipsychotics. Their findings indicate that while awareness of metabolic risks exists, adherence to monitoring practices remains inconsistent, largely due to systemic barriers and lack of institutional support.[18] In the context of metabolic syndrome in schizophrenia—a condition with a significant prevalence that complicates patient management and impacts outcomes—it is essential to understand and enhance medical staff's awareness and approaches. The presence of metabolic syndrome in schizophrenia patients critically affects their health and cognitive functions, making comprehensive care that addresses both psychiatric symptoms and metabolic complications vital for improving their overall health and quality of life. Studies have also suggested that primary care physicians and psychiatrists hold differing views regarding responsibility for metabolic monitoring, further complicating care coordination, reported that while psychiatrists acknowledged the metabolic risks of antipsychotic treatment, they often deferred responsibility for metabolic monitoring to primary care providers, highlighting the need for clear role definitions and interdisciplinary collaboration.[19,20]

International research on KAP regarding metabolic syndrome in schizophrenia has shown varied results across healthcare systems. A study from Australia reported that mental health professionals' knowledge about metabolic monitoring was generally high, but actual screening practices remained inconsistent.[21] Similarly, research from the United States found that while psychiatrists demonstrated adequate knowledge of metabolic risks, only 40% regularly performed metabolic monitoring.[22] Medical staff are integral to the management of patients with schizophrenia and metabolic syndrome, as their knowledge, attitude, and practice critically influence patient health outcomes and the efficacy of treatment. Despite the crucial role of medical staff, there is a notable lack of KAP studies focused on this area.[14] Considering the importance of the KAP model sequence in altering physicians' practice patterns,[23] this study aims to investigate the knowledge, attitude, and practice of medical staff regarding metabolic syndrome in schizophrenia. In the Chinese healthcare context, metabolic syndrome significantly impacts patient outcomes through several mechanisms. The hierarchical healthcare delivery structure concentrates specialized psychiatric care in urban tertiary hospitals, creating geographical barriers for rural patients requiring regular monitoring. Despite recent insurance reforms, considerable out-of-pocket expenses for chronic condition management may lead to treatment discontinuation. Additionally, the traditionally compartmentalized nature of medical specialties may hinder integrated care necessary for complex conditions like schizophrenia with metabolic syndrome. Recent studies indicate that only about one-third of psychiatric departments have established formal consultation pathways with endocrinology departments.[24] The introduction of

collaborative care models in several pilot hospitals has shown promise in reducing metabolic-related hospital readmissions,[25] highlighting the potential benefit of interdisciplinary approaches within the Chinese system.

Methods

Study Design and Participants

This multicenter cross-sectional study enrolled medical staff in 5 hospitals (Supplementary Box S1) between March 2024 and April 2024. Inclusion criteria were 1) certified medical staff and 2) volunteered for the study. Participants who refused informed consent were excluded. Those participants who could not be defined as doctors or nurses were considered others. The study was approved by the HuZhou Third Municipal Hospital Medical Ethics Committee (2024-065). All participants were informed about the study protocol and provided written informed consent to participate in the study.

Questionnaire

The questionnaire was designed according to the available expert consensus[26] and revised following feedback from three senior experts in the field of psychiatry. The experts provided the following suggestions: (1) include an age segment selection; (2) delete question 10 in the first part, which asks whether a family member suffers from schizophrenia with metabolic syndrome; (3) add an item in the fourth part, stating, "As a doctor, I will actively carry out exercise intervention measures to prevent/treat metabolic syndrome in patients with schizophrenia." A pilot test was conducted using stratified sampling to select 28 medical staff, yielding 28 valid responses. The overall Cronbach's alpha of 0.8620 signifies robust internal consistency of the questionnaire. The questionnaire's construct validity was assessed through confirmatory factor analysis (CFA) (Supplementary Figure S1), which demonstrated good model fit with RMSEA=0.084, SRMR=0.075, TLI=0.915, and CFI=0.925 (Supplementary Table S1). Factor loadings were significant for all items ($P<0.05$): knowledge items ranged from 1.00 to 1.15, attitude items from 1.00 to 1.56, and practice items from 0.97 to 1.14 (Supplementary Table S2). The Kaiser-Meyer-Olkin (KMO) test demonstrated excellent sampling adequacy (KMO=0.940, $P<0.001$).

The final questionnaire, presented in Chinese, encompasses four sections including demographic information, knowledge, attitude and practice dimension (Supplementary material). Among them, demographic information contains 9 items, including gender, age, education, occupation, professional title, years of work, institution, department, and experience in managing patients with schizophrenia and metabolic syndrome. The knowledge section contains 9 items. The knowledge section consists of 9 items, the attitude section contains 7 items, and the practice section includes 8 items.

Questionnaire Distribution and Quality Control

The questionnaire was uploaded to the Wenjuanxing platform, and a QR code was generated for distribution. Using stratified sampling, five regionally representative psychiatric hospitals in Zhejiang Province were selected. The researchers coordinated with the medical and nursing departments of these hospitals to distribute the QR codes to eligible participants. Prior to the survey, the researchers thoroughly explained the study's purpose, content, and significance to the participants. Only those who voluntarily agreed participated in the survey. To ensure data completeness, the electronic questionnaire was designed to require responses to all items before submission, thus eliminating missing data. Additionally, to prevent duplicate responses, the system restricted submissions to one per IP address. Questionnaires with incomplete answers or logically inconsistent responses were classified as invalid. To control response quality, responses completed in less than 60 seconds (n = 2) and 90 seconds (n = 49) were excluded, as these durations were deemed insufficient to thoughtfully complete the questionnaire. The cutoffs were determined based on an internal pilot test, which found that the minimum reasonable completion time was approximately 100 seconds. A comparative analysis between included and excluded responses was conducted to assess potential selection bias The questionnaire also included a trap question (Q10 in the second part), which required respondents to correctly calculate $15\times5 = 85$. Those who selected incorrect answers (option B) were regarded as providing invalid responses and were excluded from the analysis (n = 33).

Sample Size Calculation

The sample size was calculated to be 10 times the number of items on the questionnaire,[27] and given that our questionnaire comprised 33 items, the minimum required sample size was determined to be 330. The sample size also met the requirements for structural equation modeling (SEM) analysis, which typically requires 5–10 cases per parameter. With our model containing 24 observed variables and their associated parameters, the sample size of 359 was adequate for robust analysis.

Statistical Analysis

Data analysis was conducted using STATA 17.0 (Stata Corporation, College Station, TX, USA). Continuous variables were presented as means and standard deviations (SD). The continuous variables with a normal distribution were tested using the *t*-test. The continuous variables with a skewed distribution was tested the Mann–Whitney *U*-test. In cases where continuous variables involved three or more groups and exhibited normal distribution and uniform variance, one-way analysis of variance (ANOVA) was utilized for comparison. For non-normally distributed data among multiple groups, the Kruskal–Wallis test was applied. Categorical data were presented as n (%). Scores for each dimension were calculated as follows: knowledge scores were derived from 9 items rated on a five-point Likert scale from "very unfamiliar" (1 point) to "very familiar" (5 points), yielding a possible range of 9–45 points. Attitude scores came from 7 items rated from "strongly disagree" (1 point) to "strongly agree" (5 points), with the first two items reverse scored, resulting in a possible range of 7–35 points. Practice scores were calculated from 6 items rated from "never" (1 point) to "always" (5 points), with a possible range of 6–30 points. The total score for each dimension was obtained by summing the individual item scores. Questions 5 and 8 of the practice dimension were limited to doctors, so only descriptive statistics were performed. Higher scores indicated better knowledge, more positive attitudes, and more proactive practices. A score of 60% or higher across these dimensions is considered indicative of good knowledge, attitude, and practice.[28] Spearman correlation analysis was used for correlation analysis. Univariate logistic regression was used to screen variables and multivariate logistic regression was employed to analyze independent factors associated with practice, with the median as cutoff. SEM was utilized to explore the relationships between knowledge, attitude, and practice. Model fit was evaluated using Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Tucker–Lewis Index (TLI), and Comparative Fit Index (CFI). A two-sided $P < 0.05$ was considered statistically significant.

Results

Initially, this study collected a total of 428 questionnaires. After excluding 2 responses due to a completion time of less than 60 seconds, 49 responses with a time less than 90 seconds, and 33 responses with incorrect answers to trap questions, 359 valid questionnaires remained. This results in a validity rate of 71.66%. In the final analysis, 280 respondents (77.99%) were female, 154 (42.9%) were aged between 19 and 30 years, 281 (78.27%) held a bachelor's degree, 259 (72.14%) were nurses, 142 (39.55%) held a junior professional title, 105 (29.25%) had up to 5 years of work experience, 298 (83.01%) were employed in public tertiary hospitals, 228 (63.51%) were from psychiatric departments, and 233 (64.9%) had experience treating or caring for patients with schizophrenia and metabolic syndrome (Table 1).

The mean scores for knowledge, attitude, and practice were 30.93±7.45 (possible range: 9–45), 28.81±3.60 (possible range: 7–35), and 22.50±5.11 (possible range: 6–30), respectively. The proportion of participants achieving good levels

Table 1 Demographic Information of Medical Staff

	N (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total	359	30.93±7.45		28.81±3.60		22.50±5.11	
Gender			**0.580**		**0.271**		**0.009**
Male	79 (22.01)	30.43±8.11		28.44±3.69		21.32±4.68	
Female	280 (77.99)	31.07±7.25		28.90±3.57		22.83±5.18	

(*Continued*)

Table 1 (Continued).

	N (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Age			**0.058**		**0.018**		**0.322**
19–30 years	154 (42.9)	31.37±7.85		28.31±3.66		22.43±5.18	
31–40 years	135 (37.6)	29.90±7.17		29±3.50		22.27±4.86	
40 years and above	70 (19.50)	31.94±6.88		29.5±3.52		23.08±5.41	
Education			**0.004**		**0.027**		**0.343**
Technical secondary school/College	52 (14.48)	31.88±7.81		27.90±4.12		22.32±4.92	
Bachelor degree	281 (78.27)	30.32±7.27		28.85±3.49		22.41±5.17	
Master and above	26 (7.24)	35.53±6.98		30.11±3.20		23.76±4.78	
Occupation			**<0.001**		**0.015**		**0.001**
Doctor	77 (21.45)	32.55±7.72		29.41±3.77		22.53±4.78	
Nurse	259 (72.14)	31.17±7.07		28.79±3.53		22.79±5.12	
Other	23 (6.41)	22.73±5.30		26.91±3.10		19.08±4.97	
Professional title			**0.046**		**0.002**		**0.156**
None	47 (13.09)	28.91±7.24		26.91±3.31		21.44±4.42	
Junior	142 (39.55)	31.18±8.14		28.90±3.52		22.78±5.56	
Intermediate	115 (32.03)	30.88±6.59		28.93±3.58		22.56±4.67	
Associate and above	55 (15.32)	32.09±7.27		29.89±3.55		22.52±5.29	
Years of work			**0.050**		**0.019**		**0.043**
≤5 years	105 (29.25)	30.49±7.48		28.11±3.60		21.60±5.05	
5–10 years	99 (27.58)	31.80±7.93		28.76±3.66		23.07±5.08	
11–15 years	83 (23.12)	29.50±7.19		29±3.40		22.26±4.94	
≥16 years	72 (20.06)	32±6.77		29.63±3.59		23.29±5.29	
Institution			**0.225**		**1.000**		**0.594**
Public tertiary hospital	298 (83.01)	31.06±7.48		28.82±3.64		22.53±5.22	
Other	61 (16.99)	30.29±7.28		28.72±3.42		22.34±4.57	
Department			**<0.001**		**0.182**		**0.171**
Psychiatry	228 (63.51)	32.62±6.92		29.02±3.55		22.85±4.77	
Other departments	131 (36.49)	27.98±7.43		28.42±3.66		21.88±5.60	
Experience of managing patients with metabolic syndrome in schizophrenia			**<0.001**		**0.020**		**0.003**
No	126 (35.1)	26.89±8.11		28.24±3.70		21.32±5.71	
Yes	233 (64.9)	33.11±6.04		29.10±3.51		23.13±4.63	

Notes: All P-values are highlighted in bold. This table presents the demographic and professional characteristics of the participants, as well as their corresponding scores in knowledge, attitude, and practice (KAP). The values for continuous variables are expressed as mean ± SD, and categorical variables are presented as counts and percentages. Statistical comparisons of KAP scores were performed across demographic categories using appropriate statistical tests, as indicated in the Methods section.

of knowledge, attitude, and practice (defined as scores ≥60% of the maximum score) was 75.77%, 99.72%, and 88.58%, respectively. Analysis of demographic characteristics revealed significant variations in knowledge, attitude, and practice scores across occupation (all $P < 0.05$), and years of work (all $P < 0.05$). Notably, the experience of treating or caring for patients with schizophrenia and metabolic syndrome significantly influenced these scores (all $P < 0.05$). Additionally, knowledge scores differed significantly among various departments ($P < 0.001$), professional titles ($P = 0.046$) and department ($P < 0.001$), while attitude scores varied notably across different age groups ($P = 0.018$), education ($P=0.027$) and professional titles ($P < 0.001$) (Table 1).

The distribution of knowledge dimension revealed that the three questions with the lowest number of participants choosing the "Very aware" option were "Clinical management strategies for metabolic syndrome in schizophrenia". (K9) with 7.52%, "Risk stratification of metabolic syndrome in patients with schizophrenia". (K4) with 9.19%, and

"Comprehensive assessment of metabolic indicators, including evaluating metabolic indicators and screening risk factors, should be conducted initially for patients with schizophrenia". (K6) with 9.19% (Supplementary Table S3).

Responses to the attitude dimension showed that 54.6% disagreed that there is no relationship between metabolic syndrome and schizophrenia (A1), 58.77% disagreed that metabolic syndrome is not the primary cause of death in patients with schizophrenia and it does not require additional attention (A2), and 49.3% strongly agreed that it is important for patients with metabolic syndrome in schizophrenia to regularly monitor metabolic indicators (A4) (Supplementary Table S4).

When it comes to relevant practice, 30.36% always and 42.62% often remind schizophrenia patients and their families about the trends of relevant metabolic indicators (P7), 25.91% always and 25.91% often monitor metabolic indicators of schizophrenia patients on a continuous and regular basis (P2). However, proactive behaviors such as attending relevant training sessions or collaborating with specialists were less frequent, indicating potential gaps in practice. 37.6% sometimes and 10.86% seldom would take the initiative to attend relevant training (P4) (Supplementary Table S5). These findings indicate that while the overall practice level is good (with 88.58% of participants achieving practice scores ≥60% of the maximum possible score), there are specific areas such as professional development and inter-disciplinary collaboration that could be enhanced.

Correlation analysis indicated significant positive correlations between knowledge and attitude ($r = 0.3031$, $P < 0.001$), as well as practice ($r = 0.5468$, $P < 0.001$). Meanwhile, there was also positive correlation between attitude and practice ($r = 0.3340$, $P < 0.001$) (Table 2).

Multivariate logistic regression showed that knowledge scores (OR = 1.16, 95% CI: [1.11, 1.21], P < 0.001), attitude scores (OR = 1.09, 95% CI: [1.01, 1.17], P = 0.017), female (OR = 2.64, 95% CI: [1.55, 4.50], P = 0.001), ≥ 16 years of working (OR = 3.24, 95% CI: [1.04, 10.0], P = 0.042), and experience of patient management (OR = 0.50, 95% CI: [0.27, 0.91], P = 0.024) were independently associated with practice (Table 3). To further explore the seemingly

Table 2 Correlation Analysis

	Knowledge Dimension	Attitude	Practice
Knowledge dimension	1		
Attitude	0.3031 (P<0.001)	1	
Practice	0.5468 (P<0.001)	0.3340 (P<0.001)	1

Table 3 Univariate and Multivariate Regression Analysis of Practice

Practice	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge score	1.14 (1.10, 1.18)	<0.001	1.16 (1.11, 1.21)	<0.001
Attitude score	1.15 (1.08, 1.23)	<0.001	1.09 (1.01, 1.17)	0.017
Gender				
Male	Reference		Reference	
Female	2.64 (1.55, 4.50)	0.015	2.64 (1.55, 4.50)	0.001
Age				
19–30 years	Reference			
31–40 years	1.05 (0.66, 1.67)	0.813		
40 years and above	1.27 (0.72, 2.24)	0.397		
Education				
Technical secondary school/College	Reference			
Bachelor degree	1.29 (0.71, 2.35)	0.393		

(*Continued*)

Table 3 (Continued).

Practice	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Master and above	1.85 (0.71, 4.82)	0.202		
Position				
Doctor	Reference		Reference	
Nurse	1.39 (0.83, 2.33)	0.199	1.13 (0.54, 2.34)	0.737
Other	0.26 (0.08, 0.85)	0.026	1.00 (0.25, 4.04)	0.992
Professional title				
None	Reference		Reference	
Junior	2.38 (1.19, 4.79)	0.014	1.56 (0.61, 4.00)	0.347
Intermediate	1.95 (0.95, 3.99)	0.066	0.86 (0.26, 2.81)	0.806
Associate and above	2.37 (1.05, 5.34)	0.036	0.76 (0.18, 3.15)	0.712
Years of working experience				
≤5 years	Reference		Reference	
5–10 years	1.59 (0.91, 2.77)	0.098	1.68 (0.77, 3.69)	0.189
11–15 years	1.15 (0.64, 2.07)	0.618	1.76 (0.68, 4.52)	0.236
≥16 years	2.01 (1.09, 3.71)	0.024	3.24 (1.04, 10.0)	0.042
Nature of your institution				
Public tertiary hospital	Reference			
Other	0.95 (0.55, 1.65)	0.874		
Department				
Psychiatry	Reference			
Other departments	0.88 (0.57, 1.36)	0.585		
Experience of treating or caring for patients with metabolic syndrome in schizophrenia				
No	Reference		Reference	
Yes	1.56 (1.00, 2.42)	0.045	0.50 (0.27, 0.91)	0.024

contradictory relationship between patient management experience (OR = 0.50) and ≥16 years of work experience (OR = 3.24), we tested for interaction effects between patient management experience and other variables. We found a significant interaction between patient management experience and years of work experience in the 11–15 years group (11–15 years*Yes: OR=0.08, P=0.017), indicating that professionals with 11–15 years of experience who also had direct patient management experience had significantly lower odds of achieving good practice scores. Other interactions including knowledge scores (OR=1.02, P=0.646), attitude scores (OR=0.89, P=0.198), gender (Female*Yes: OR=0.94, P=0.936), and professional titles were not statistically significant (Supplementary Table S6).

The SEM analysis showed that knowledge directly influenced attitude (β = 0.10, P < 0.001), attitude directly influenced practice (β = 0.82, P = 0.001), and knowledge directly influenced practice (β = 0.50, P < 0.001) (Figure 1). The fitting indices of the SEM model reached the expected range, indicating a good model fit (Supplementary Table S7). To address potential limitations of our initial SEM model, we tested alternative models incorporating indirect effects and potential confounding variables. Our expanded model maintained good fit indices (RMSEA=0.079, SRMR=0.068, TLI=0.921, CFI=0.932) while testing whether attitude mediates the relationship between knowledge and practice. The indirect effect of knowledge on practice through attitude was significant (β = 0.082, P = 0.003), indicating that knowledge influences practice both directly and indirectly through shaping attitudes. When controlling for years of professional experience as a potential confounder, the model still demonstrated robust relationships between the KAP variables, suggesting that these relationships exist independently of professional tenure.

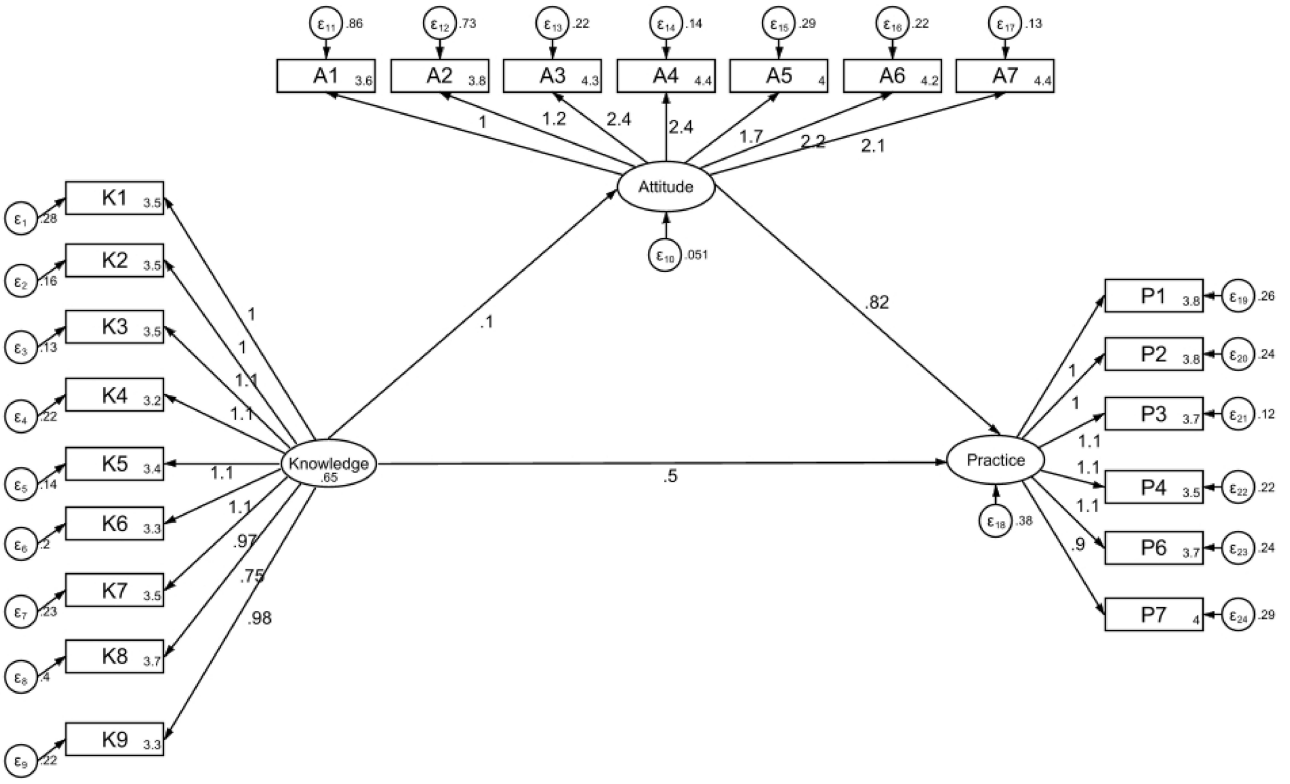

Figure 1 Structural equation model (SEM). This model illustrates the direct and indirect relationships between knowledge, attitude, and practice dimensions. The path coefficients (β) show that knowledge has a direct effect on attitude (β = 0.10) and practice (β = 0.50), while attitude demonstrates a strong direct effect on practice (β = 0.82). The model includes all measured variables (K1-K9 for knowledge, A1-A7 for attitude, and P1-P7 for practice) with their respective factor loadings and error terms (e). All paths shown are statistically significant (P < 0.001). Model fit indices confirm good model fit (RMSEA=0.084, SRMR=0.075, TLI=0.915, CFI=0.925).

Discussion

While medical staff demonstrate a satisfactory level of knowledge and maintain a generally positive attitude, their practices in managing schizophrenia patients with metabolic syndrome reveal areas that need improvement. Despite some proactive behaviors, the relatively low rates of consistent monitoring and education suggest opportunities for enhancing their practical engagement. It is recommended that continuous education and training programs be implemented to further enhance the knowledge and skills of medical staff, ensuring effective management and improved outcomes for schizophrenia patients with metabolic syndrome.

Our findings emphasize the interdependence of knowledge, attitude, and practice in the healthcare settings, as evidenced by the significant positive correlations observed in our study. Specifically, knowledge scores were positively correlated with attitude ($r = 0.3031$, $P < 0.001$) and practice ($r = 0.5468$, $P < 0.001$), while attitude was also significantly correlated with practice ($r = 0.3340$, $P < 0.001$). Correlation analyses revealed significant positive correlations between knowledge and both attitudes and practices, suggesting that enhanced knowledge positively influences attitudes and directly leads to better practices. The SEM results further substantiated these relationships, indicating that knowledge not only impacts attitudes but that both knowledge and attitudes are significant predictors of proactive practice behaviors, which is consistent with previous research indicating that enhanced knowledge and favorable attitude are pivotal for the adoption of best practice in healthcare settings.[29]

In examining demographic and professional variables, this study found that longer tenure, specifically among those with 16 or more years of work experience, was significantly associated with superior KAP scores. This finding aligns with the literature, which indicates that healthcare professionals with more years of experience tend to have higher levels of clinical competence and confidence in managing complex cases.[14] The negative association between patient management experience and practice scores appears contradictory to the positive effect of ≥16 years of work experience. Our

interaction analysis revealed that this negative effect is particularly pronounced among professionals with 11–15 years of experience who also had prior patient management experience his finding suggests that mid-career professionals may have developed established practice patterns that are resistant to change despite evolving clinical guidelines. Medical staff with longer overall professional tenure may benefit from broader clinical exposure and ongoing professional development opportunities, while those with specific and possibly limited patient management experience may adhere to previously learned approaches that do not necessarily align with current best practices. Similarly, doctors demonstrated higher KAP scores than other medical staff roles, likely due to their extensive training and pivotal role in patient care management. The significant discrepancies in KAP scores between doctors and staff in other roles, such as administrative positions, could be attributed to the differences in direct clinical engagement and training. Multivariate logistic regression analysis reinforced these findings, indicating that knowledge and attitude independently predict practice behaviors. This complements previous study, which also found strong relationships between knowledge and practice among healthcare professionals.[30]

Furthermore, the experience of treating or caring for patients with schizophrenia and metabolic syndrome was associated with higher KAP scores, suggesting that hands-on experience is crucial in enhancing both theoretical knowledge and its practical application. This is supported by previous study, which found that direct patient interaction fosters better clinical skills and empathy, thereby enhancing all aspects of KAP.[31,32] Significant differences were also noted across different professional titles concerning attitude scores. Staff with higher professional titles tended to report more favorable attitudes towards patient care, potentially reflecting greater experience and responsibility, which could foster a more positive outlook and proactive approach to managing complex cases. Experience in managing patients with metabolic syndrome in schizophrenia was particularly influential. This experience likely provides specific insights and skills relevant to this patient group, leading to better patient outcomes.

Considering these insights, it is crucial to implement targeted educational interventions tailored to managing metabolic syndrome in schizophrenia patients. Research on schizophrenia consultations has demonstrated that condition-specific education enhances the ability of healthcare professionals to address both psychiatric and metabolic health concerns effectively.[33] Focusing on these tailored approaches, rather than general continuing medical education (CME) programs, may provide more direct benefits for schizophrenia patients with metabolic syndrome.

The distribution of knowledge scores suggests that while a significant portion of medical staff is aware or very aware of issues related to schizophrenia and metabolic syndrome, there are notable gaps.[34,35] For example, less familiarity was observed concerning risk stratification (K4), comprehensive metabolic assessment (K6), and clinical management strategies (K9). To address these knowledge gaps, targeted interventions should focus on areas where familiarity is lowest. Previous KAP studies on metabolic syndrome management have demonstrated that specialized training improves healthcare outcomes. For instance, a study found that psychiatrists with specific training in metabolic monitoring showed significantly better adherence to screening guidelines and improved identification of metabolic abnormalities in schizophrenia patients.[36] Similarly, another study demonstrated that implementing structured metabolic monitoring protocols led to a 30% increase in appropriate screening practices among mental health professionals.[37] In the Chinese healthcare context, interdisciplinary collaboration between psychiatry and endocrinology departments resulted in better management of metabolic conditions in schizophrenia patients.[38] A study demonstrated that nurse-led metabolic health promotion interventions improved both monitoring rates and patient outcomes when staff received specialized training in this area.[39]

Attitude towards the significance of metabolic syndrome in schizophrenia show a strong recognition of its importance, yet a sizeable minority underestimates its impact on patient mortality and overall management. To improve this, awareness campaigns could be more aggressively pursued within healthcare facilities, emphasizing the severe implications of untreated metabolic syndrome in schizophrenia. Additionally, hosting interactive forums and Q&A sessions online with experts could help dismantle misconceptions and reinforce the importance of vigilant management of metabolic syndrome in schizophrenia.[40]

Practical application scores indicate that while there is a fair commitment to monitoring and educating about metabolic syndrome, proactive measures like collaboration with specialists and consistent patient education are less

frequent. To enhance practices, healthcare institutions could consider implementing training programs and feedback sessions that reinforce the importance of consistent care. These trainings could be conducted as in-person workshops or interactive webinars, specifically designed to highlight effective collaboration techniques and case management strategies for schizophrenia patients with metabolic syndrome.[41,42] In addition to these training opportunities, the development of a mobile application for healthcare professionals could significantly streamline and improve practice. This app would serve as a comprehensive tool providing reminders, educational resources, and a platform for direct consultation with specialists. Features could include forums for case discussions, alerts for new research updates, and tools for tracking patient metrics.[43]

This study had several limitations. First, its cross-sectional design limits the ability to infer causality between variables. Second, the use of self-reported questionnaires may introduce response bias, potentially overestimating participants' KAP. Third, the sample was primarily from tertiary public hospitals, limiting generalizability to other healthcare settings. Lastly, the study design prevented calculation of the response rate, hindering the assessment of non-response bias and representativeness.

Conclusions

In conclusion, medical staff demonstrate satisfactory knowledge, a favorable attitude, and moderate levels of proactive practice in managing metabolic syndrome in schizophrenia. However, prior patient management experience did not consistently translate into better practice scores. This suggests that while experience enhances familiarity with patient care, it may not always align with updated clinical guidelines. Ensuring that experienced medical staff engage in continuous education may help bridge this gap. The observed correlations between knowledge, attitude, and practice align with the KAP framework and are consistent with findings from similar studies. These results highlight the importance of addressing gaps in practice to improve care quality and outcomes for schizophrenia patients with metabolic syndrome. To address knowledge gaps, targeted training programs should focus on improving clinical decision-making, risk assessment, and comprehensive metabolic evaluations. Interactive case-based learning and inter-disciplinary collaboration could enhance the practical application of these concepts in daily clinical practice.

Abbreviations

KAP, Knowledge, attitude, and practice; HDL, High-density lipoprotein; SD, Standard deviations; ANOVA, Analysis of variance; SEM, Structural equation model; RMSEA, Approximation; SRMR, Standardized Root Mean Square Residual; TLI, Tucker–Lewis Index; CFI, Comparative Fit Index; CME, Continuing medical education.

Data Sharing Statement

All data generated or analysed during this study are included in this published article.

Ethics Approval and Consent to Participate

The study was approved by the HuZhou Third Municipal Hospital Medical Ethics Committee (2024-065). All participants were informed about the study protocol and provided written informed consent to participate in the study. I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no competing interests in this work.

References

1. Jacomb I, Stanton C, Vasudevan R, et al. C-reactive protein: higher during acute psychotic episodes and related to cortical thickness in schizophrenia and healthy controls. *Front Immunol*. 2018;9:2230. doi:10.3389/fimmu.2018.02230
2. Goh KK, Chen CY, Wu TH, Chen CH, Lu ML. Crosstalk between schizophrenia and metabolic syndrome: the role of oxytocinergic dysfunction. *Int J Mol Sci*. 2022;23(13). doi:10.3390/ijms23137092
3. Rukavishnikov GV, Kasyanov ED, Zhilyaeva TV, Mazo GE. [Schizophrenia and cardiometabolic disorders]. *Zh Nevrol Psikhiatr Im S S Korsakova*. 2021;121(6):132–138. Hungarian. doi:10.17116/jnevro2021121061132
4. Li W, Zhang HH, Wang Y, et al. Poor insight in schizophrenia patients in China: a meta-analysis of observational studies. *Psychiatr Q*. 2020;91 (4):1017–1031. doi:10.1007/s11126-020-09786-7
5. Jauhar S, Johnstone M, McKenna PJ. Schizophrenia. *Lancet*. 2022;399(10323):473–486. doi:10.1016/S0140-6736(21)01730-X
6. McCutcheon RA, Reis Marques T, Howes OD. Schizophrenia-an overview. *JAMA Psychiatry*. 2020;77(2):201–210. doi:10.1001/jamapsychiatry.2019.3360
7. Sormunen E, Saarinen MM, Salokangas RKR, et al. Metabolic trajectories in childhood and adolescence: effects on risk for schizophrenia. *Schizophrenia*. 2022;8(1):82. doi:10.1038/s41537-022-00282-4
8. Abdulhaq B, Dardas LA, Sami O. Monitoring for the metabolic side effects of second-generation antipsychotic medications: psychiatrists' views and practices. *Perspect Psychiatr Care*. 2021;57(3):1237–1243. doi:10.1111/ppc.12679
9. Mangurian C, Giwa F, Shumway M, et al. Primary care providers' views on metabolic monitoring of outpatients taking antipsychotic medication. *Psychiatr Serv*. 2013;64(6):597–599. doi:10.1176/appi.ps.002542012
10. Li W, Ng RMK, Li L. Psychiatric education in Greater China. *Int Rev Psychiatry*. 2020;32(2):167–171. doi:10.1080/09540261.2019.1687427
11. Eskelinen S, Sailas E, Joutsenniemi K, Holi M, Suvisaari J. Clozapine use and sedentary lifestyle as determinants of metabolic syndrome in outpatients with schizophrenia. *Nord J Psychiatry*. 2015;69(5):339–345. doi:10.3109/08039488.2014.983544
12. Sun F, Ren Z, Jiang Y, Fang X, Wang N, Jin W. A placebo-controlled study on the treatment of metabolic syndrome of Qi stagnation and dampness obstruction related to atypical antipsychotics with Traditional Chinese Medicine (TCM). *Evid Based Complement Alternat Med*. 2020;2020:5103046. doi:10.1155/2020/5103046
13. Suhavana B, Raghavan V, Rosenbaum S, Padmavati R. Barriers, attitudes, confidence, and knowledge among psychiatrists and psychologists in India to provide physical health interventions for metabolic health to persons with mental disorders: a cross-sectional survey. *Asian J Psychiatr*. 2025;103:104337. doi:10.1016/j.ajp.2024.104337
14. Adamowicz K, Mazur A, Mak M, Samochowiec J, Kucharska-Mazur J. Metabolic syndrome and cognitive functions in schizophrenia-implementation of dietary intervention. *Front Psychiatry*. 2020;11:359. doi:10.3389/fpsyt.2020.00359
15. Liu J, Fu L. Metabolic syndrome in patients with schizophrenia: why should we care. *Medicine*. 2022;101(32):e29775. doi:10.1097/MD.0000000000029775
16. Saxena A, Patel D, Ayesha IE, et al. Metabolic syndrome causing cognitive impairment in patients with schizophrenia: a systematic review. *Cureus*. 2023;15(10):e47587. doi:10.7759/cureus.47587
17. Sethi S, Wakeham D, Ketter T, et al. Ketogenic diet intervention on metabolic and psychiatric health in bipolar and schizophrenia: a pilot trial. *Psychiatry Res*. 2024;335:115866. doi:10.1016/j.psychres.2024.115866
18. Poojari PG, Khan S, Shenoy S, et al. Perspectives of patients and healthcare professionals on metabolic monitoring of adult prescribed second-generation antipsychotics for severe mental illness: a meta-synthesis. *PLoS One*. 2023;18(4):e0283317. doi:10.1371/journal.pone.0283317
19. Mangurian C, Giwa A, Brosey E, et al. Opinions of primary care clinicians and psychiatrists on monitoring the metabolic effects of antipsychotics. *J Am Board Fam Med*. 2019;32(3):418–423. doi:10.3122/jabfm.2019.03.180176
20. Lin CH, Lai TY, Chen YJ, Lin SK. Social distance towards schizophrenia in health professionals. *Asia Pac Psychiatry*. 2022;14(3):e12506. doi:10.1111/appy.12506
21. Crawford MJ, Jayakumar S, Lemmey SJ, et al. Assessment and treatment of physical health problems among people with schizophrenia: national cross-sectional study. *Br J Psychiatry*. 2014;205(6):473–477. doi:10.1192/bjp.bp.113.142521
22. Mangurian C, Newcomer JW, Modlin C, Schillinger D. Diabetes and cardiovascular care among people with severe mental illness: a literature review. *J Gen Intern Med*. 2016;31(9):1083–1091. doi:10.1007/s11606-016-3712-4
23. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*. 1999;282 (15):1458–1465. doi:10.1001/jama.282.15.1458
24. Han X, Jiang F, Shen L, et al. Workplace violence, workforce stability, and well-being in China's psychiatric hospitals. *Am J Prev Med*. 2022;62(4): e265–e273. doi:10.1016/j.amepre.2021.09.013
25. Xiang YT, Zhao N, Zhao YJ, et al. An overview of the expert consensus on the mental health treatment and services for major psychiatric disorders during COVID-19 outbreak: china's experiences. *Int J Biol Sci*. 2020;16(13):2265–2270. doi:10.7150/ijbs.47419
26. Merlijn T, Swart KMA, van der Horst HE, Netelenbos JC, Elders PJM. Fracture prevention by screening for high fracture risk: a systematic review and meta-analysis. *Osteoporos Int*. 2020;31(2):251–257. doi:10.1007/s00198-019-05226-w
27. Kline RB. *Principles and Practice of Structural Equation Modeling*. New York, NY: Guilford Press; 2015.
28. ALruwaili BF, Thirunavukkarasu A, Alsaidan AA, et al. Knowledge, attitude, and practice towards evidence-based medicine among Northern Saudi Primary Care Physicians: a cross-sectional study. *Healthcare*. 2022;10(11):2285. doi:10.3390/healthcare10112285
29. Adamowicz K, Kucharska-Mazur J. Dietary behaviors and metabolic syndrome in schizophrenia patients. *J Clin Med*. 2020;9(2):537. doi:10.3390/jcm9020537
30. Boiko AS, Mednova IA, Kornetova EG, et al. Metabolic hormones in schizophrenia patients with antipsychotic-induced metabolic syndrome. *J Pers Med*. 2022;12(10):1655. doi:10.3390/jpm12101655
31. Nebhinani N, Tripathi S, Suthar N, Pareek V, Purohit P, Sharma P. Correlates of metabolic syndrome in patients with schizophrenia: an exploratory study. *Indian J Clin Biochem*. 2022;37(2):232–237. doi:10.1007/s12291-020-00912-7
32. Sun MJ, Jang MH. Risk factors of metabolic syndrome in community-dwelling people with schizophrenia. *Int J Environ Res Public Health*. 2020;17(18):6700. doi:10.3390/ijerph17186700

33. Rus M, Crisan S, Andronie-Cioara FL, et al. Prevalence and risk factors of metabolic syndrome: a prospective study on cardiovascular health. *Medicina*. 2023;59(10):1711. doi:10.3390/medicina59101711
34. Grezenko H, Rodoshi ZN, Mimms CS, et al. From Alzheimer's disease to anxiety, epilepsy to schizophrenia: a comprehensive dive into neuropsychiatric disorders. *Cureus*. 2024;16(4):e58776. doi:10.7759/cureus.58776
35. Yu H. Understanding health-promoting behaviors and influential factors in schizophrenia patients. *Nutrients*. 2024;16(10):1490. doi:10.3390/nu16101490
36. Laugharne J, Waterreus AJ, Castle DJ, Dragovic M. Screening for the metabolic syndrome in Australia: a national survey of psychiatrists' attitudes and reported practice in patients prescribed antipsychotic drugs. *Australas Psychiatry*. 2016;24(1):62–66. doi:10.1177/1039856215618521
37. De Hert M, Vancampfort D, Correll CU, et al. Guidelines for screening and monitoring of cardiometabolic risk in schizophrenia: systematic evaluation. *Br J Psychiatry*. 2011;199(2):99–105. doi:10.1192/bjp.bp.110.084665
38. Liu NH, Daumit GL, Dua T, et al. Excess mortality in persons with severe mental disorders: a multilevel intervention framework and priorities for clinical practice, policy and research agendas. *World Psychiatry*. 2017;16(1):30–40. doi:10.1002/wps.20384
39. Bressington D, Mui J, Hulbert S, Cheung E, Bradford S, Gray R. Enhanced physical health screening for people with severe mental illness in Hong Kong: results from a one-year prospective case series study. *BMC Psychiatry*. 2014;14:57. doi:10.1186/1471-244X-14-57
40. Chugunov DA, Shmilovich AA. [Primary and secondary negative disorders in schizophrenia as an actual problem of modern clinical psychiatry]. *Zh Nevrol Psikhiatr Im S S Korsakova*. 2022;122(8):41–47. Hungarian. doi:10.17116/jnevro202212208141
41. Fiszdon JM, Wang K, Lê K, Parente L, Choi J. Efficacy of cognitive training on cognition, symptoms and functioning: impact of motivation and attendance. *Schizophr Res Cogn*. 2024;37:100313. doi:10.1016/j.scog.2024.100313
42. Thibaudeau E, Peyroux E, Franck N, Carling H, Lepage M. Navigating social cognitive impairments in schizophrenia spectrum disorders: protocol for a pilot pre-post quasi-experimental study for remote avatar-assisted cognitive remediation therapy. *JMIR Res Protoc*. 2024;13:e54251. doi:10.2196/54251
43. Zhang X, Lewis S, Chen X, Zhou J, Wang X, Bucci S. Acceptability and experience of a smartphone symptom monitoring app for people with psychosis in China (YouXin): a qualitative study. *BMC Psychiatry*. 2024;24(1):268. doi:10.1186/s12888-024-05687-2