



## The relationship between schizophrenia patients' attitudes towards physical health and the prevalence of metabolic syndrome

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### ABSTRACT

**Purpose:** Previous studies have established that metabolic syndrome (MetS) is associated with an increased risk of mortality. Several studies have demonstrated that the assessment of patients' attitudes or behaviors regarding their physical health problems is an important parameter in initiating positive health behaviors and providing patients with metabolic control. To determine whether schizophrenia patients' attitudes towards physical health affect the prevalence of MetS, we conducted a questionnaire survey of schizophrenia patients.

**Methods:** We obtained 7,655 and 15,461 questionnaire responses from 520 and 247 facilities for outpatients and inpatients, respectively. The final analysis included data from a total of 6,576 subjects (2,213 outpatients and 4,363 inpatients). We assessed the effects of patients' attitudes as risk factors for having MetS using multivariate logistic regression analysis.

**Results:** The prevalence of MetS was higher in outpatients compared with inpatients (34.7% and 13.2%, respectively). Multivariate logistic regression analysis indicated that positive attitudes towards disease prevention and health care were related to a lower prevalence of MetS for outpatients and inpatients. In addition, greater knowledge of, and interest in, physical risk were associated with a lower prevalence of MetS only in outpatients.

**Conclusions:** We detected substantial gaps in knowledge and negative health attitudes among respondents, suggesting that educational programs should be incorporated into current management protocols for patients with a high risk of MetS.

**Keywords:** *metabolic syndrome, Japanese mental health care system, prevalence, patients' attitudes towards physical health, educational program*

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## Introduction

Metabolic syndrome (MetS) causes a range of serious medical conditions, including cardiovascular disease, and increases the risk of mortality [1, 2]. The prevalence of MetS is higher in patients with schizophrenia compared with the general population [3, 4]. A previous study in our laboratory revealed that the prevalence of MetS in Japanese outpatients is significantly higher compared with inpatients and the general population [5]. Moreover, life expectancy is at least 30% shorter in patients with schizophrenia compared with the general population in the United States [6]. However, adequate metabolic screening and medical intervention are less likely to be provided for patients with schizophrenia compared with the general population [7-9].

Adherence to treatment of patients with diabetes is critical for preventing complications [10]. Attitudes towards diabetes are reported to be significantly correlated with metabolic control [11]. Negative attitudes regarding health and disease have been reported in patients with high HbA1c levels [11] and diabetic patients with high blood pressure [12]. These findings demonstrate that the assessment of patients' attitudes or behaviors regarding their physical health problems is a significant parameter for initiating positive health behaviors and providing patients with metabolic control [13]. However, to date, few studies have examined the relationship between schizophrenia patients' attitudes towards physical health and the development of various physical diseases.

To protect patients with schizophrenia from physical risks, the Japan Psychiatric Hospital Association and the Japanese Society of Clinical Neuropsychopharmacology initiated a collaborative project in 2012. In Japan, private psychiatric hospitals, most of which are affiliated with the Japan Psychiatric Hospital Association, provide most psychiatric care. In previous studies in our laboratory, we reported differences between the distinctive features of physical risks faced by Japanese outpatients and inpatients [5, 14]. However, it is currently unclear whether patients with schizophrenia who also have MetS contracted the latter condition as a result of their attitudes towards physical health. In the present study, we used a comprehensive questionnaire survey developed in our previous collaborative project to determine the current situation regarding physical risks faced by Japanese patients with

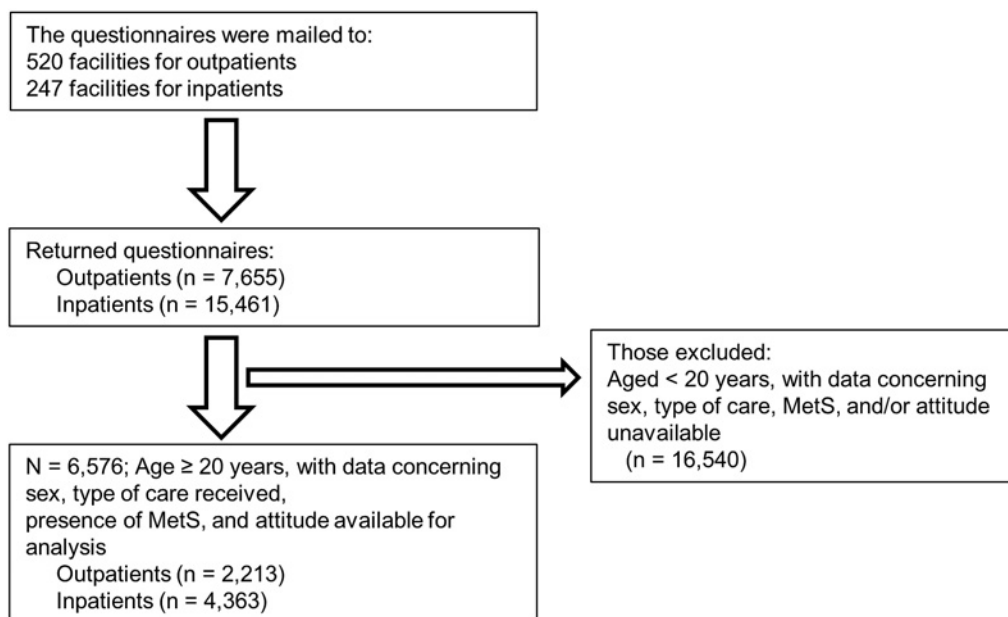
schizophrenia, as well as their attitudes towards physical health problems. The primary aim of the present study was to determine whether patients' attitudes towards their physical health affects the prevalence of MetS. A secondary aim of the current study was to investigate differences in attitudes towards physical health between outpatients and inpatients with schizophrenia. To the best of our knowledge, this is the largest study to investigate the relationship between Japanese patients' attitudes towards physical health and the prevalence of MetS.

## Subjects and Methods

We conducted the questionnaire survey between January 2012 and June 2013, as previously described [5]. The current study used a cross-sectional design. After reviewing the relevant literature and extant guidelines, we developed a new brief questionnaire to determine patients' recognition of the following: dietary habits, lifestyle, self-monitoring, knowledge, and medical practice. This questionnaire included 22 items for outpatients and 20 items for inpatients (Supplementary material). When assigning scores to each item, responses that reflected a healthier lifestyle were assigned a higher score. Additionally, we conducted another brief questionnaire to obtain patients' demographic information (age and sex), height, weight, waist circumference (WC), blood pressure (BP), high-density lipoprotein (HDL), triglyceride (TG), and fasting plasma glucose (FPG). Furthermore, patients' body mass index (BMI) was determined by measuring the ratio of weight to height ( $\text{kg}/\text{m}^2$ ). Additional standardized health questionnaires were used to determine behavior, including current smoking status.

Participants with  $\geq 3$  of the following the National Cholesterol Education Program Adult Treatment Panel III (ATP III-A) criteria were defined as having MetS:

- (1) Abdominal obesity: WC  $\geq 90$  cm for men and  $\geq 80$  cm for women
- (2) High BP:  $\geq 130/85$  mmHg
- (3) Low HDL cholesterol: HDL  $< 40$  mg/dl for men and  $< 50$  mg/dl for women
- (4) Hypertriglyceridemia: TG  $\geq 150$  mg/dl
- (5) High fasting glucose: FPG  $\geq 100$  mg/dl.



**Fig. 1.** Flow diagram illustrating participant inclusion and exclusion

### Subjects

A total of 7,655 outpatients and 15,461 inpatients from 520 and 247 facilities, respectively, responded to the questionnaires. All of the participants were diagnosed with schizophrenia, according to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (DSM-IV-TR) or the International Statistical Classification of Diseases and Related Health Problems version 10 (ICD-10) criteria. We excluded individuals aged < 20 years and those whose data for sex, attitude and MetS were not disclosed in the survey. Consequently, we included a total of 6,576 subjects (2,213 outpatients and 4,363 inpatients; Fig. 1) in the final analysis.

### Ethical statement

This survey was approved by the Ethics Committee at the Japan Psychiatric Hospitals Association and was in accord with the principles of the Declaration of Helsinki. All participants provided informed consent.

### Statistical analysis

We compared demographic and clinical characteristics between inpatients and outpatients using unpaired Student's *t*-tests and  $\chi^2$  tests for continuous and categorical variables, respectively. We assessed the effect of patients' attitudes, age, and sex as risk factors for having MetS, using a multivariate logistic regression analysis. We analyzed inpatients and outpatients separately because the number of items included in the questionnaire differed depending on

whether the respondents were inpatients or outpatients. A probability level of  $p < 0.05$  was considered to indicate statistical significance. We used SPSS for Windows version 19.0 (IBM Japan, Tokyo, Japan) for statistical calculations.

## Results

### Characteristics of the Study Population

Outpatients were significantly younger than inpatients (Table 1). However, WC, BP, TG, and FPG were higher among outpatients than in inpatients. The prevalence of MetS was significantly higher in outpatients (34.7%) compared with inpatients (13.2%). Antipsychotic polypharmacy and total chlorpromazine equivalent doses were lower in outpatients than in inpatients.

### The effect of patients' attitudes towards their physical health on the prevalence of MetS

To assess the independent effect of schizophrenia patients' attitudes towards their physical health on the odds ratios regarding the prevalence of MetS, we performed a multivariate logistic regression analysis (Table 2). In the analysis process, we excluded the questionnaire items linking dietary habits and lifestyle (Q1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 20) from the analysis because we determined that responses for those items could be influenced by the current physical condition of the patient (e.g., obesity). Similarly, the questionnaire items linking medical practice (Q12, 13, 14 and 18) were also excluded from the analysis because we specu-

**Table 1.** Demographics and clinical characteristics of outpatients and inpatients

	Outpatients <i>n</i> = 2,213	Inpatients <i>n</i> = 4,363	p value
Age (years)	51.7 ± 13.3	59.0 ± 13.1	<0.001 <sup>a</sup>
Body mass index (kg/m <sup>2</sup> )	25.3 ± 4.6	21.9 ± 3.9	<0.001 <sup>a</sup>
Waist circumference (cm)	87.5 ± 13.2	81.6 ± 11.3	<0.001 <sup>a</sup>
Systolic blood pressure (mmHg)	126.1 ± 18.8	117.1 ± 16.2	<0.001 <sup>a</sup>
Dyastolic blood pressure (mmHg)	77.8 ± 12.7	72.8 ± 11.6	<0.001 <sup>a</sup>
HDL-cholesterol (mg/dl)	56.1 ± 18.4	56.7 ± 19.4	NS <sup>a</sup>
LDL-cholesterol (mg/dl)	117.3 ± 34.8	104.4 ± 32.9	<0.001 <sup>a</sup>
LDL/HDL ratio	2.3 ± 1.0	2.0 ± 1.0	<0.001 <sup>a</sup>
Total-cholesterol (mg/dl)	196.8 ± 38.1	176.9 ± 36.1	<0.001 <sup>a</sup>
Triglycerides (mg/dl)	142.7 ± 111.9	95.5 ± 58.3	<0.001 <sup>a</sup>
Fasting plasma glucose (mg/dl)	106.9 ± 41.3	90.1 ± 23.1	<0.001 <sup>a</sup>
Prevalence of MetS (%)	34.7	13.2	<0.001 <sup>b</sup>
Status of antipsychotic therapy			
Not treated (%)	4.8	6.4	<0.001 <sup>b</sup>
Antipsychotic monopharmacy (%)	49.5	40.0	
Antipsychotic polypharmacy (%)	45.7	53.6	
Ratio of SGA therapy (%)	76.4	78.0	NS <sup>b</sup>
Total CP equivalence (mg)	561.6 ± 472.6	724.1 ± 635.9	<0.001 <sup>a</sup>
Smoking (%)	37.4	24.3	<0.001 <sup>b</sup>

<sup>a</sup> Data were analyzed using unpaired Student's *t*-tests to contrast outpatients and inpatients

<sup>b</sup> Data were analyzed using  $\chi^2$  tests to contrast outpatients and inpatients

Data were expressed as mean ± SD

MetS: metabolic syndrome, CP: chlorpromazine, HbA1c: hemoglobin A1c, SGA: second-generation antipsychotic

NS: not significant, HDL: high-density lipoprotein cholesterol,

LDL: low-density lipoprotein cholesterol, TC: total cholesterol, TG: triglyceride

**Table 2.** Logistic regression analysis for assessing variables' impact on MetS

	Independent variable	B	P value	OR (95%CI)
Outpatients	Q15	0.129	0.006	0.879 (0.801 to 0.964)
	Q17	0.365	0.006	0.694 (0.535 to 0.901)
	Q21	0.241	0.040	0.786 (0.624 to 0.990)
	BMI	0.299	< 0.001	1.348 (1.308 to 1.390)
Inpatients	Q22	0.226	0.048	0.798 (0.638 to 0.998)
	BMI	0.35	< 0.001	1.418 (1.377 to 1.461)

lated that the responses of those items could be affected by the attitudes of the medical staff. For outpatients, three items (Q15, 17, and 21) and BMI scores were significantly associated with the prevalence of MetS, whereas for inpatients, one item (Q 22) and BMI scores were found to have this effect.

## Discussion

To the best of our knowledge, the present study is

the first study to demonstrate a relationship between the attitudes of schizophrenia patients towards their physical health and the prevalence of MetS. The current results indicated that two types of patients' attitudes towards physical health might be related to the prevalence of MetS.

The multivariate logistic regression analysis revealed that outpatients with higher scores on Q21 exhibited a lower prevalence of MetS; furthermore,

inpatients with higher scores on Q22 also exhibited a lower prevalence of MetS. We interpreted the responses to Q21 and Q22 as reflecting disease prevention. Therefore, these results indicate that positive attitudes towards disease prevention and health care may relate to a lower prevalence of MetS. In addition, multivariate logistic regression analysis also revealed that outpatients with high scores in response to Q15 and Q17 had a low prevalence of MetS. We interpreted the responses to Q15 and Q17 as representing interest in and knowledge about the disease. However, no items exhibiting the same trend could be detected for inpatients. These results suggest that a higher level of interest in, and knowledge about, physical risk may contribute to a lower prevalence of MetS only in outpatients. This difference may be caused by the relatively free management of outpatients' overall lives, compared with inpatients. Therefore, two positive forms of patient attitudes towards physical health, "positive attitude towards disease prevention and health care" and "interest in and knowledge of physical risk", were identified as being independent factors related to MetS prevalence. A previous study reported that negative attitudes towards health status had a significant influence on adherence to lifestyle changes and medication [15]. Another study revealed that negative attitudes can negatively affect the level of management of different metabolic risks [16, 17]. The current findings are consistent with the results of these previous studies. Improvements in attitude have been shown to be associated with adopting better health-related behavior, leading to better control rates for several diseases [18, 19]. The most difficult patients to treat are those who are non-adherent to their treatment and have negative attitudes toward their health, and there are substantial opportunities for psychiatrists to make a difference with non-health-conscious patients who have positive attitudes towards their treatment [19]. Another potential issue is that many patients in the present study possessed inadequate knowledge regarding the concepts of MetS and BMI. It has also been shown that inadequate knowledge regarding MetS negatively affects adherence to lifestyle changes, but not adherence to medication. Inadequate knowledge can affect the level of threat patients perceive in regard to complications, negatively influencing patients' motivation to undertake behavioral changes [19, 20].

Obesity is becoming more common in patients with schizophrenia compared with the general population

[21, 22], and is a major risk factor for MetS, which can lead to cardiovascular disease [23]. Furthermore, previous studies have reported that obesity reduces quality of life, and is related to low self-esteem [24, 25]. Thus, it is clear that although the health-related consciousness of obese schizophrenia patients may increase with the recognition that they are obese, regardless of the type of care involved, a lack of health-related consciousness may increase the prevalence of MetS. Although these previous findings demonstrate the importance of health-related consciousness, in the present study we excluded several items linking dietary habits and lifestyle (Q1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 20) from the analysis because those items fluctuated depending on each patient's physical condition, such as the presence of obesity or MetS. Furthermore, we believed that these items did not directly reflect attitudes that affect the prevalence of MetS among patients.

Most outpatients in our study felt that they were not regularly examined with body weight measurements and blood tests. In our previous study in Japan, the results revealed that most psychiatrists reported monitoring the lipid profiles and blood glucose levels of their patients more than twice a year [26]; however, only a small number of psychiatrists felt that this monitoring frequency was sufficient. Considering this issue together with the results of our questionnaire suggests that regular monitoring could provide motivation for patients. Although inpatients with schizophrenia are monitored regularly by medical staff, there may be few such opportunities for outpatients. Nevertheless, we also chose to exclude some questionnaire items regarding medical practice (Q12, 13, 14 and 18) because we felt that responses to those items might fluctuate depending on the patients' awareness of the various medical staff in question.

Regarding items linking dietary habits and lifestyle (Q1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 20), if patients who do not have a physical condition (e.g., obesity) make conscious efforts to prevent becoming obese, it could be useful for contributing to a reduction in the prevalence of MetS. Furthermore, regarding items linking medical practice (Q12, 13, 14 and 18), a previous study reported that physicians' attitudes had a salutary influence on the physical risks of patients, reflecting this phenomenon. It has also been reported that periodic weight measurement and blood monitoring helps patients avoid de-

veloping physical risks. In actual clinical practice, careful attention must also be paid to the awareness of the medical staff involved, and it is necessary to develop an environment in which adequate monitoring can be provided. Unfortunately, in the current study we were unable to examine the relationships between the items linking dietary habits, lifestyle, medical practice and physical risk. As such, further studies are required to elucidate this topic in future.

The number of psychiatric beds per person in Japan is the highest in the world [27]. Most patients with schizophrenia who have been hospitalized for long periods may not seek treatment for physical illnesses, because they are refractory and have severe psychotic symptoms, negative symptoms, cognitive impairment, and social isolation [28]. Thus, physical illness can easily be overlooked in long-term hospitalized patients with schizophrenia. Recently, Japanese inpatients have been encouraged to shift to community-based care. However, most inpatients do not have sufficient knowledge of adverse metabolic events. Consequently, educational programs designed to prepare long-term hospitalized schizophrenia patients for discharge from hospitals are necessary.

The current results demonstrated that the prevalence rates of MetS using ATP III-A were 34.7% and 13.2% in Japanese outpatients and inpatients with schizophrenia, respectively. The MetS prevalence of outpatients was significantly higher compared with inpatients. This difference may be caused by environmental factors; a lack of physical activity and an imbalanced diet may lead to the development of MetS. In addition, according to the Japanese criterion proposed by the Japan Society for the Study of Obesity (JASSO), the prevalence rates of MetS in outpatients and inpatients are 22.9% and 8.3%, respectively, with outpatients exhibiting a significantly higher prevalence. The prevalence of MetS for both groups reported by JASSO is lower compared with that in ATP III, mainly due to the stricter standards for waist circumference. Therefore, Japanese inpatients may have been at a lower risk of MetS because an appropriate lifestyle was promoted at the health care facility. At the same time, it should be noted that this result is consistent with other previous studies conducted in Japan [29].

Several methodological limitations involved in the present study should be considered. One important

limitation is the reliance on self-reported questionnaires in the current study, which are prone to both systematic and random errors. Second, our study was cross-sectional in design and lacked data concerning the actual practices of psychiatrists. Therefore, our study was not able to confirm a causal relationship between psychiatrists' practice and attitudes concerning patients with schizophrenia. Third, we did not assess several potential confounding factors, including antipsychotic medications, duration of illness, treatment, and the severity of schizophrenia. Although the severity of schizophrenia may also affect the onset of MetS, we did not evaluate the severity of each patient, so could not examine the association in the current study. Fourth, it was not possible to determine the exact response rate, because it was not known how many patients were asked to perform the survey at each of the responding facilities. Fifth, because the current study was cross-sectional, conclusions cannot be drawn regarding the causality of the relationship between the patient's awareness of the disease and the prevalence of MetS. In future, it may be valuable to establish an educational program promoting health-related consciousness among patients, and evaluate it longitudinally. Finally, in the present study, because of the large amount of missing data that were necessary for the diagnosis of MetS, approximately two-thirds of the obtained responses could not be used in this study.

## Conclusions

The current results indicate that a lack of health-related consciousness is associated with an increased prevalence of MetS. Therefore, "positive attitude towards prevention and management" and "knowledge of or interest in physical risk" were identified as independent factors affecting the prevalence of MetS. In addition, we detected a substantial deficiency of knowledge and a high level of negative health attitudes among respondents, suggesting that educational programs should be incorporated into current management protocols for patients who have a high risk of MetS. Such programs may improve health-related consciousness and consequently ameliorate cardiovascular risk.

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### Abbreviations

MetS: metabolic syndrome; WC: waist circumference; BP: blood pressure; HDL: high-density lipoprotein; TG: triglyceride; FPG: fasting plasma glucose; BMI: body mass index; ATP III-A: the National Cholesterol Education Program Adult Treatment Panel III for Asian populations; DSM-IV-TR: the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision; ICD-10: the International Statistical Classification of Diseases and Related Health Problems version 10.

### Author's Contributions

All authors read and approved the final manuscript.

Conceptualization: TS1, YS, TS2

Methodology: TS1, MY, TM, HM, KO, TS

Software: TS1

Validation: TS1, YS, KS, YO, NS, NYF

Formal analysis: TS1, YS

Investigation: TS1, YS, YW, TS2

Resources: TS1, YS, KS, NS, NYF, TS2

Data curation: TS1, YS

Writing - original draft: TS1, YS, YW, TS2

Writing - review & editing: TS1, YS, YW, MT, KS, YO, HM, NS, NYF, KO, TS3, TS2

Visualization: TS1

Supervision: YS, TS

Project administration: TS1, YS, TS2

Funding acquisition: KS, MY, TM

### **Ethics approval and consent to participate**

This survey was approved by the Ethics Committee at the Japan Psychiatric Hospitals Association in accord with the principles of the Declaration of Helsinki. All participants provided written informed consent.

### **Availability of data and materials**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### **Consent for publication**

The participants were informed during the consent process of the prospect of the personal information and pertinent findings of this study being published in an international peer reviewed journal at an appropriate time. Participants were reassured of optimal levels of confidentiality being adhered to with regards to handling and dissemination of any potentially identifying information.

### **REFERENCES**

- [1] Church TS, Thompson AM, Katzmarzyk PT, et al. Metabolic syndrome and diabetes, alone and in combination as predictors of cardiovascular disease mortality among men. *Diabetes Care*. 2009; 32: 1289-1294.
- [2] Isomaa B, Almgren P, Tuomi T, et al. Cardiovascular mortality and morbidity associated with metabolic syndrome. *Diabetes Care*. 2001; 24: 683-689.
- [3] Casey DE. Metabolic issues and cardiovascular disease in patients with psychiatric disorders. *Am J Med*. 2005; 118(S2): 15S-22S.
- [4] Gurpegui M, Martínez-Ortega JM, Gutiérrez-Rojas L, et al. Overweight and obesity in patients with bipolar disorder or schizophrenia compared with a non-psychiatric sample. *Prog Neuropsychopharmacol Biol Psychiatry*. 2012; 37(1): 169-175.
- [5] Sugai T, Suzuki Y, Yamazaki M, et al. Difference in prevalence of metabolic syndrome between Japanese outpatients and inpatients with schizophrenia: A nationwide survey. *Schizophr Res*. 2016; 171(1-3): 68-73.
- [6] Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Prev Chronic Dis*. 2006; 3: A42.
- [7] Kisely S, Smith M, Lawrence D, et al. Inequitable access for mentally ill patients to some medically necessary procedures. *CMAJ*. 2007; 176: 779-784.
- [8] Morrato EH, Newcomer JW, Allen RR, et al. Prevalence of baseline serum glucose and lipid testing in users of second-generation antipsychotic drugs: a retrospective, population-based study of Medicaid claims data. *J Clin Psychiatry*. 2008; 69: 316-322.
- [9] Nasrallah HA, Meyer JM, Goff DC, et al. Low rates of treatment for hypertension, dyslipidemia, and diabetes in schizophrenia: data from the CATIE schizophrenia trial sample at baseline. *Schizophr Res*. 2006; 86: 15-22.
- [10] De Coste KC, Scott LK. Diabetes update: promoting effective disease management. *Journal of the American Association of Occupational Health Nurses*. 2004; 52: 344-353.
- [11] Daniel M, Messer LC. Perception of disease severity and barriers to self-care predict glycemic control in aboriginal persons with type 2 diabetes mellitus. *Chronic Dis Can*. 2002; 23: 130-138.
- [12] Ratanasuwan T, Indharapakdi S, Promrerk R, et al. Health belief model about diabetes mellitus in Thailand: the culture consensus analysis. *J Med Assoc Thai*. 2005; 88: 623-631.
- [13] Tan MY. The relationship of health beliefs and complication prevention behaviors of Chinese individuals with type 2 diabetes mellitus. *Diabetes Res Clin Pract*. 2004; 66: 71-77.
- [14] Sugai T, Suzuki Y, Yamazaki M, et al. High prevalence of underweight and undernutrition in Japanese inpatients with schizophrenia: a nationwide survey. *BMJ Open*. 2015; 5(12): e008720.
- [15] Alefishat EA, Abu Farha RK, Al-Debei MM. Self-reported adherence among individuals at high risk of metabolic syndrome: effect of



- knowledge and attitude. *Med Princ Pract.* 2016; 26(2): 157-163.
- [16] Hartayu TS, Mi MI, Suryawati S. Improving of type 2 diabetic patients' knowledge, attitude and practice towards diabetes self-care by implementing Community-Based Interactive Approach-diabetes mellitus strategy. *BMC Res Notes.* 2012; 5: 315.
- [17] Karaeren H, Yokusoglu M, Uzun S, et al. The effect of the content of the knowledge on adherence to medication in hypertensive patients. *Anadolu Kardiyol Derg.* 2009; 9: 183-188.
- [18] Burkhart PV, Sabaté E. Adherence to long-term therapies: evidence for action. *Eur J Cardiovasc Nurs.* 2003; 2: 323.
- [19] Lewis SJ, Rodbard HW, Fox KM, et al. SHIELD Study Group. Self-reported prevalence and awareness of metabolic syndrome: findings from SHIELD. *Int J Clin Pract.* 2008; 62: 1168-1176.
- [20] Awwad O, Akour A, Al-Muhaisen S, et al. The influence of patients' knowledge on adherence to their chronic medications: a cross-sectional study in Jordan. *Int J Clin Pharm.* 2015; 37: 504-510.
- [21] Allison DB, Casey DE. Antipsychotic-induced weight gain: a review of the literature. *J Clin Psychiatry.* 2001; 62(7): 22-31.
- [22] Susce MT, Villanueva N, Diaz FJ, et al. Obesity and associated complications in patients with severe mental illnesses: a cross-sectional survey. *J Clin Psychiatry.* 2005; 66(2): 167-173.
- [23] Leucht S, Burkard T, Henderson J, et al. Physical illness and schizophrenia: a review of the literature. *Acta Psychiatr Scand.* 2007;116 (5): 317-333.
- [24] Allison DB, Mackell JA, McDonnell DD. The impact of weight gain on quality of life among persons with schizophrenia. *Psychiatr Serv.* 2003; 54(4): 565-567.
- [25] De Hert M, Peuskens B, van Winkel R, et al. Body weight and self-esteem in patients with schizophrenia evaluated with B-WISE. *Schizophr Res.* 2006; 88(1-3): 222-226.
- [26] Sugawara N, Yasui-Furukori N, Yamazaki M, et al. Psychiatrists' attitudes toward metabolic adverse events in patients with schizophrenia. *PLoS One.* 2014; 9(1): e86826.
- [27] Ministry of Health and Welfare. Patient Survey 1996. Tokyo: Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare; 1999 (in Japanese).
- [28] De Hert M, Cohen D, Bobes J, et al. Physical illness in patients with severe mental disorders. II. Barriers to care, monitoring and treatment guidelines, plus recommendations at the system and individual level. *World Psychiatry.* 2011; 10(2): 138-151.
- [29] Sugawara N, Yasui-Furukori N, Sato Y, et al. Comparison of prevalence of metabolic syndrome in hospital and community-based Japanese patients with schizophrenia. *Ann Gen Psychiatry.* 2011; 10: 21.

**Supplementary Table 1.** The questionnaire for schizophrenia patients' attitudes towards physical health

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Q1. How often do you drink soft drinks (e.g., cola) ?	<input type="checkbox"/> Not at all (3) <input type="checkbox"/> More than once a month (2) <input type="checkbox"/> More than once a week (1) <input type="checkbox"/> Every day (0)
Q2. [For outpatients] Do you regularly eat breakfast, lunch, and dinner?	Yes (1) / No (0)
[For inpatients] How much do you eat (three meals a day = 100%) ?	<input type="checkbox"/> 100% (5) <input type="checkbox"/> 90% (4) <input type="checkbox"/> 80% (3) <input type="checkbox"/> 70% (2) <input type="checkbox"/> 60% (1) <input type="checkbox"/> 50% or less (0)
Q3. Do you eat cake or other sweet foods more than once a day?	Yes (0) / No (1)
Q4. [For outpatients] Have you been warned by your family or friends that you eat too much?	Yes (0) / No (1)
[For inpatients] Have you been warned by the people around you that you eat too many snacks?	Yes (0) / No (1)
Q5. [For outpatients] When you go out, do you generally eat candy?	Yes (0) / No (1)
[For inpatients] When you go out or stay out overnight, do you generally eat candy?	Yes (0) / No (1)
Q6. Do you constantly feel hungry?	Yes (0) / No (1)
Q7. Do you feel that you have gained weight over the past year?	Yes (0) / No (1)
Q8. How often do you go out?	<input type="checkbox"/> Every day (3) <input type="checkbox"/> More than once a week (2) <input type="checkbox"/> More than once a month (1) <input type="checkbox"/> Once a month or less (0)
Q9. [For outpatients only] Do you cook or do you exercise?	Yes (0) / No (1)
Q10. How often do you exercise?	<input type="checkbox"/> Every day (3) <input type="checkbox"/> More than once a week (2) <input type="checkbox"/> Once a week (1) <input type="checkbox"/> Not at all (0)
Q11. How often do you watch television?	<input type="checkbox"/> Every day (2) <input type="checkbox"/> Sometimes (1) <input type="checkbox"/> Not at all (0)
Q12. Has your doctor told you that your current medication can cause side effects such as weight gain?	Yes (1) / No (0)

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**Supplementary Table 1.** continued

Q13. [For outpatients]

How often is your body weight measured at the hospital?

- Every visit (4)  
 At least once every three months (3)  
 At least once every six months (2)  
 At least once a year (1)  
 Not at all (0)

[For inpatients]

How often is your body weight measured at the hospital?

- Every day (5)  
 Once a week (4)  
 Once a month (3)  
 At least once every six months (2)  
 At least once a year (1)  
 Not at all (0)

Q14. [For outpatients]

How often do you have blood tests at the hospital?

- Every visit (4)  
 At least once every three months (3)  
 At least once every six months (2)  
 At least once a year (1)  
 Not at all (0)

[For inpatients]

How often do you have blood tests at the hospital?

- Every month (4)  
 At least once every three months (3)  
 At least once every six months (2)  
 At least once a year (1)  
 Not at all (0)

Q15. [For outpatients only]

How often do you weigh yourself?

- Every day (3)  
 More than once a week (2)  
 More than once a month (1)  
 Not at all (0)

Q16. Are you familiar with the term "metabolic syndrome"?

Yes (1) / No (0)

Q17. Are you familiar with the terms "BMI" or "body mass index"?

Yes (1) / No (0)

Q18. Has your doctor encouraged you to be mindful of any of the following?  
(multiple answers allowed)

- Eating balanced meals and appropriate amounts of food Yes (1) / No (0)  
 Refraining from alcohol Yes (1) / No (0)  
 Refraining from candy or soft drinks Yes (1) / No (0)  
 Refraining from smoking Yes (1) / No (0)  
 Engaging in moderate physical exercise Yes (1) / No (0)

Q19. Of which of the following are you mindful?  
(multiple answers allowed)

- Eating balanced meals Yes (1) / No (0)  
 Refraining from fast food Yes (1) / No (0)  
 Refraining from soft drinks (e.g., cola) Yes (1) / No (0)

**Supplementary Table 1.** continued

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<input type="radio"/> Refraining from alcohol	Yes (1) / No (0)
<input type="radio"/> Refraining from smoking	Yes (1) / No (0)
<input type="radio"/> Sleeping enough	Yes (1) / No (0)
<input type="radio"/> Moderate physical exercise	Yes (1) / No (0)
Q20. Do you feel that you are obese?	Yes (1) / No (0)
Q21. Would you be willing to receive blood tests regularly to prevent weight gain and diseases such as diabetes?	Yes (1) / No (0)
Q22. Would you be willing to weigh yourself regularly to prevent weight gain and diseases such as diabetes?	Yes (1) / No (0)

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