More specifically, in the present study, we tried to extract the least possible number of items from the original PANSS as long as, first, they retained sufficient internal consistency and reliability while reflecting the three domains of the original PANSS; second, they correlated with the overall severity of schizophrenia; and third, they were sensitive to changes in overall severity. We expected that such a scale would be useful and meaningful for the follow up of patients with schizophrenia in routine clinical practice. To our knowledge this study represents the first attempt to extract the core items from the total 30 items of the PANSS.

METHODS

Ethics consideration

This study was carried out after the approval of the ethics committee of Kochi University and individual attending facilities, in line with the Helsinki Declaration by the World Medical Association and the clinical research guideline defined by the ethics committee at our facilities.

Subjects

A total of 714 patients (409 men, 305 women) were enrolled as subjects in the present study, and were diagnosed as suffering from schizophrenia based on the criteria of the DSM-IV-TR. These included 684 patients who participated in two multi-center clinical trials comparing a new atypical antipsychotic drug against a classical antipsychotic, and 30 patients who had been hospitalized and treated at Kochi Medical School Hospital. The average age of the patients was 43.8 ± 14.0 years.

Procedure

These schizophrenia patients were evaluated using the Japanese version of the PANSS,[3,4] Clinical Global Impression–Severity (CGI-S) and CGI-Change (CGI-C).[5] Six hundred and eighty-four patients participating in clinical trials completed the PANSS at study entry and at the end of the trial, while 30 patients completed the PANSS and the CGI-S upon admission and upon discharge from hospital. Moreover, the CGI-C was also implemented at the end of treatment for all patients. The CGI assesses the overall impression of the clinical status of a patient: for the CGI-S,

the overall severity of illness was evaluated in terms of seven stages: 1, normal, not at all ill; 2, borderline mentally ill; 3, mildly ill; 4, moderately ill; 5, markedly ill; 6, severely ill; and 7, most extremely ill, while for the CGI-C the degree of change in amelioration was assessed as: 1, very much improved; 2, much improved; 3, minimally improved; 4, no change; 5, minimally worse; 6, much worse; and 7, very much worse.

Extraction of the items for bPANSS

To extract the items for the bPANSS from the total 30 items of the PANSS, the following criteria were adopted: (i) to develop a scale that would be sensitive to changes resulting from antipsychotic treatment, extracting items with higher Spearman's rank correlation coefficient with the CGI-C as priorities; (ii) to develop a brief scale that can be completed within 10 min (requiring that items be excluded for which the coefficients of correlation with the CGI-S were significantly low, subsequently, no more than eight items were to be extracted from the total 30 items of the PANSS); and (iii) to select at least two items individually from the three domains (positive symptoms, negative symptoms, and comprehensive pathological scales) of the full PANSS to sufficiently reflect the profiles of schizophrenia. The extraction of the bPANSS items was conducted based on the consensus of all authors.

Validation of the bPANSS

Internal consistency of the bPANSS was examined by calculating the Cronbach's alpha. Concurrent validity of the bPANSS was examined by comparing it with the full PANSS according to the whole subjects and the individual subtypes of schizophrenia.

Statistical analysis

Statistical analysis was performed using SPSS version 16.0J (SPSS, Tokyo, Japan). For each item of the PANSS, the Spearman's rank correlation coefficients were calculated between the total PANSS score and CGI-S at two points: at study entry and at the end of treatment. Rank correlation coefficients were also calculated between the change in each item of the PANSS between study entry and the end of treatment and the CGI-C.

RESULTS

Patient characteristics

Table 1 lists the baseline demographic and clinical characteristics of the patients. The average total PANSS score was 85.1 ± 19.2 at study entry and 74.8 ± 22.8 at the end of treatment. The average CGI-S score was 4.8 ± 1.0 at study entry and 4.0 ± 1.2 at the end of treatment. The average CGI-C score was 2.8 ± 1.4 at the end of treatment.

Item extraction

Table 2 lists Spearman's rank correlation coefficients between individual PANSS items and the CGI-S at study entry and at the end of treatment, as well as those between changes in each PANSS item score and the CGI-C. Based on the aforementioned selection criteria, a number of items were extracted from the 30 items of the PANSS.

From among the items related to the positive syndrome scale, two items, P1 delusion, and P6 suspiciousness, were selected. These were the top two items with the highest Spearman's rank correlation coefficients relative to the CGI-C, and were considered to be appropriate because their coefficients of rank correlation between the total PANSS score and the CGI-S were maintained to a certain degree. From among the items related to the negative syndrome

scale, N2 emotional withdrawal, and N4 passive/apathetic social withdrawal were selected. These were also the top two items having the highest Spearman's rank correlation coefficient relative to the CGI-C, and their coefficients of rank correlation with the CGI-S were also satisfactory. From the comprehensive pathological scale, G4 tension, and G9 unusual thought content, were selected, for reasons similar to those for selection of items from among the positive syndrome scale and the negative syndrome scale. The Spearman's rank correlation coefficient with the CGI-C for G2 anxiety was as high as those for G4 and G9, but the rank correlation coefficient with the CGI-S was only 0.27 at the end of treatment and 0.13 at study entry. Therefore, G2 was not adopted. Based on these considerations, a total of six items (P1, P6, N2, N4, G4, and G9) were therefore extracted as items for the bPANSS.

Internal consistency of the brief PANSS

The Cronbach's alpha for the bPANSS was 0.67 at study entry and 0.80 at the end of treatment. If we excluded any one of the six items, the Cronbach's alpha was always lower (Table 3).

Concurrent validity of the brief PANSS

The coefficient of correlation between the bPANSS and the full PANSS was 0.86 at study entry and 0.92 at the end of treatment (both $P < 0.001$), and that between the bPANSS and the CGI-S was 0.64 at study entry and 0.84 at the end of treatment (both $P < 0.001$). Similarly, the coefficient of correlation between the degree of change in the bPANSS score between study entry and the end of treatment (delta bPANSS) and that of the full PANSS score (delta total PANSS) was 0.93 ($P < 0.001$), while delta bPANSS and CGI-C was 0.73 ($P < 0.001$).

Concurrent validity by schizophrenia subtype

A total of 626 of the 714 subjects for whom the subtypes of schizophrenia had been diagnosed were analyzed. These subjects consisted of 249 with the paranoid type, 178 with the disorganized type, 29 with the catatonic type, and 170 with the residual type. The coefficients of correlation between the bPANSS and the full PANSS, delta bPANSS and delta total PANSS, and delta bPANSS and CGI-C versus subtypes are shown in Table 4. All of these correla-

Table 1. Baseline patient characteristics (mean ± SD)

Age (years)	43.8 ± 14.0
Sex	Male 409, Female 305
Total PANSS score at study entry	85.1 ± 19.2
Total PANSS score at end of treatment	74.8 ± 22.8
CGI-S at study entry	4.8 ± 1.0
CGI-S at end of treatment	4.0 ± 1.2
CGI-C	2.8 ± 1.4
Subtypes of schizophrenia	
Paranoid type	249
Disorganized type	178
Catatonic type	29
Residual type	170
Unknown	88

CGI-C, Clinical Global Impression–Change; CGI-S, Clinical Global Impression–Severity; PANSS, Positive and Negative Syndrome Scale.

Table 2. Correlation coefficients

Item	With CGI-S (at study entry)	With CGI-S (at end of treatment)	Changes with CGI-C
Positive Syndrome Scale			
P1: Delusion	0.29	0.59**	0.53**
P2: Conceptual disorganization	0.51**	0.70**	0.50**
P3: Hallucinatory behavior	0.69**	0.68**	0.48**
P4: Excitement	0.62**	0.75**	0.45**
P5: Grandiosity	0.60**	0.36*	0.24**
P6: Suspiciousness	0.40*	0.58**	0.55**
P7: Hostility	0.70**	0.55**	0.41**
Negative Syndrome Scale			
N1: Blunted affect	0.27	0.65**	0.37**
N2: Emotional withdrawal	0.29	0.57**	0.46**
N3: Poor rapport	0.43*	0.71**	0.40**
N4: Passive/apathetic social withdrawal	0.38*	0.56**	0.46**
N5: Difficulty in abstract thinking	0.18	0.56**	0.34**
N6: Lack of spontaneity and flow of conversation	0.48**	0.41*	0.35**
N7: Stereotyped thinking	0.05	0.32	0.40**
General Pathological Syndrome Scale			
G1: Somatic concern	0.09	0.11	0.37**
G2: Anxiety	0.13	0.27	0.55*
G3: Guilt feeling	−0.03	0.31	0.32**
G4: Tension	0.31	0.23	0.56**
G5: Mannerisms and posturing	0.36	0.53**	0.43**
G6: Depression	−0.02	0.17	0.39**
G7: Motor retardation	0.25	0.41*	0.37**
G8: Uncooperativeness	0.36	0.62**	0.48**
G9: Unusual thought content	0.26	0.59**	0.55**
G10: Disorientation	0.49**	0.38*	0.20**
G11: Poor attention	0.3	0.50**	0.40**
G12: Lack of judgment and insight	0.52**	0.53**	0.48**
G13: Disturbance of volition	0.51**	0.48**	0.38**
G14: Poor impulse control	0.37*	0.41*	0.40**
G15: Preoccupation	0.27	0.49*	0.40**
G16: Active social avoidance	0.45*	0.56**	0.42**

*$P < 0.05$; **$P < 0.01$.
Bold, extracted item.
CGI-C, Clinical Global Impression–Change; CGI-S, Clinical Global Impression–Severity.

tion coefficients had satisfactorily high values and were highly significant ($P < 0.01$).

DISCUSSION

The bPANSS, consisting of six items selected from the 30 items of the full PANSS, showed a high correlation with the full PANSS score, being 0.86 at study entry and 0.92 at the end of treatment. Also, the correlation between delta bPANSS and delta total PANSS was 0.93 ($P < 0.001$), while that between delta bPANSS and CGI-C was 0.73 ($P < 0.001$). Furthermore, the correlation between bPANSS and CGI-S was 0.64 at study entry and 0.84 at the end of treatment (both $P < 0.001$). Considering that it takes a short time to complete the six items, it is believed that the requirements of the bPANSS, which is sensitive to changes in psychotic manifestations and also reflects the profile of schizophrenia to a certain extent, have been satisfied.

Attempts to select several items from among the existing clinical rating scales for certain purposes

Table 3. Internal consistency of the brief PANSS (Cronbach's alpha)

Items	Study entry	End of treatment
P1, P6, N2, N4, G4, G9	0.67	0.80
P6, N2, N4, G4, G9	0.59	0.76
P1, N2, N4, G4, G9	0.59	0.76
P1, P6, N2, G4, G9	0.65	0.78
P1, P6, N4, G4, G9	0.66	0.78
P1, P6, N2, N4, G9	0.63	0.79
P1, P6, N2, N4, G4	0.61	0.76

PANSS, Positive and Negative Syndrome Scale.

Table 5. Brief PANSS vs brief CPRS

Brief PANSS	Brief CPRS
Positive Syndrome Scale	Subjective items
P1. Delusion	1. Sadness
P6. Suspiciousness	5. Inability to feel
	6. Pessimistic thoughts
Negative syndrome scale	28. Depersonalization
N2. Emotional withdrawal	29. Feeling controlled
N4. Passive/apathetic social withdrawal	30. Disrupted thoughts
	31. Ideas of persecution
General Pathological Syndrome Scale	33. Delusional mood
G4. Tension	36. Other delusions
G9. Unusual thought content	37. Commenting voices
	Objective items
	45. Lack of appropriate emotion
	50. Perplexity

CPRS, Comprehensive Psychopathological Rating Scale; PANSS, Positive and Negative Syndrome Scale.

have been reported for a number of scales. For example, Montgomery and Asberg developed the Montgomery and Asberg Depression Rating Scale,[6] which is a representative rating scale for depression consisting of 10 items selected from the Comprehensive Psychopathologic Rating Scale (CPRS), which contains 67 items in all: 40 items for subjective psychopathological symptoms, 25 items for objective psychopathological symptoms, and two items for global rating and assumed reliability.[7] For schizophrenia they also selected 12 items that were the most sensitive to changes resulting from treatment, and they subsequently proposed an acute schizophrenia rating scale (brief CPRS) that was more sensitive to therapeutic response than the Brief Psychiatric Rating Scale.[8]

The six items in the bPANSS and the 12 items in the brief CPRS are shown in Table 5. Ten of the 12 items are related to subjective pathological symptoms in the brief CPRS. This appears to be because the items that respond readily to treatment, such as hallucination and delusion, tend to be measured mainly

as subjective pathological symptoms, and the balance of the number of items representing subjective pathological symptoms and objective pathological symptoms is not taken into consideration. In contrast, the items in the bPANSS have been selected from the three psychopathology domains of the original PANSS in a balanced manner. Considering that the correlations of the two selected items within the individual three domains are relatively high (r = 0.517–0.685), it may be possible to simply select three items instead of six.

Andreasen *et al.* extracted eight of the 30 items of the whole PANSS in order to define remission from

Table 4. Concurrent validity vs schizophrenia subtype

		Correlation coefficient			
Subtype	Subjects (n)	bPANSS and total PANSS at study entry	bPANSS and total PANSS at end of treatment	delta bPANSS and delta total PANSS	delta bPANSS and CGI-C
Paranoid	249	0.86**	0.93**	0.93**	0.78**
Disorganized	178	0.88**	0.93**	0.92**	0.70**
Catatonic	29	0.94**	0.96**	0.92**	0.72**
Residual	170	0.86**	0.90**	0.93**	0.64**

**$P < 0.01$.
delta bPANSS, degree of change in the brief PANSS score between study entry and end of treatment; PANSS, Positive and Negative Syndrome Scale.

schizophrenia.[9] A total of three items, delusion (P1), passive/apathetic social withdrawal (N4), and unusual thought (G9), overlapped with those currently selected for the bPANSS. These three items are considered to be essentially important for evaluating both remission from schizophrenia and the response to antipsychotic drugs.

Possible limitations of the present study may include the following. First, most of the study subjects were patients enrolled in two multi-center active-drug-controlled clinical trials of a new atypical antipsychotic drug, for whom CGI-S was not evaluated. In other words, we placed more emphasis on the bPANSS to reflect longitudinal changes in psychopathology, rather than reflecting the cross-sectional severity of schizophrenia. Second, all the subjects were receiving active treatment, and therefore changes due to treatment were unable to be differentiated from those due to the natural course of the disorder.

In contrast, the strengths of the bPANSS may be summarized as follows. First, it is brief and therefore exceedingly less burdensome for both patients and clinicians than the full PANSS. Second, it still covers the three broad domains of psychopathology represented by the original scale in a balanced manner. Third, it has high internal consistency reliability. Fourth, the bPANSS shows satisfactory concurrent validity with the full PANSS and the CGI-S for any of the schizophrenia subtypes. Fifth, the bPANSS is sensitive to changes resulting from treatment.

We therefore conclude that the bPANSS is a useful rating instrument that is easy to administer within a short time and is sensitive to changes in the overall clinical features of schizophrenia. One recommended practical application of the scales would be to administer the full PANSS at baseline and then at extended intervals to gain a comprehensive picture of the psychopathology, while in the meantime repeatedly monitoring the changes in the patients using the bPANSS.

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Psychotic-like experiences are associated with suicidal feelings and deliberate self-harm behaviors in adolescents aged 12–15 years

Nishida A, Sasaki T, Nishimura Y, Tanii H, Hara N, Inoue K, Yamada T, Takami T, Shimodera S, Itokawa M, Asukai N, Okazaki Y. Psychotic-like experiences are associated with suicidal feelings and deliberate self-harm behaviors in adolescents aged 12–15 years.

Objective: Psychotic disorders are a significant risk factor for suicide, especially among young people. Psychotic-like experiences (PLEs) in the general population may share an etiological background with psychotic disorders. Therefore, the present study examined the association between PLEs and risk of suicide in a community sample of adolescents.
Method: Psychotic-like experiences, suicidal feelings, and self-harm behaviors were studied using a self-report questionnaire administered to 5073 Japanese adolescents. Depression and anxiety were evaluated using the 12-item General Health Questionnaire (GHQ).
Results: The presence of PLEs was significantly associated with suicidal feelings (OR = 3.1, 95% CI = 2.2–4.5) and deliberate self-harm behaviors (OR = 3.1, 95% CI = 2.0–4.8) after controlling for the effects of age, gender, GHQ-12 score, victimization, and substance use. Suicidal feelings and behaviors were more prevalent in subjects with a greater number of PLEs.
Conclusion: Psychotic-like experiences may increase the risk of suicidal problems among adolescents.

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Significant outcomes

- Psychotic-like experiences are associated with suicidal feelings and deliberate self-harm behaviors among adolescents aged 12–15 years.
- Suicidal feelings and deliberate self-harm behaviors are more prevalent in subjects with a greater number of psychotic-like experiences.

Limitations

- This is a cross-sectional study and subjects were recruited from public schools.
- A self-report questionnaire was used to assess the psychotic-like experiences, suicidal feelings, and self-harm behaviors.
- There was a lack of data about confounding factors, such as individual personality and family circumstances.

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Introduction

Risk of suicide is significantly higher for subjects with psychotic disorders when compared to the general population (1, 2). The risk is even more pronounced during the early phase of the disorders (2, 3), with two-thirds of suicides occurring during the first 5 years after diagnosis (4, 5). As the onset of first episode of psychosis usually occurs in young people (6), the risk of suicide may be especially remarkable in young people with the disorders (7, 8).

Psychotic-like experiences (PLEs) are subclinical hallucinatory and delusional experiences. PLEs occur not only in persons with psychotic disorders but also in people in the community who may not have been clinically diagnosed with psychoses (9–11). It may be reasonable to suspect that PLEs might share an etiological background with psychotic disorders (9, 10, 12, 13). Previous epidemiologic studies have reported that PLEs were observed in more than 10% of the general population of adults (10, 11, 13). Although PLEs were originally studied in adult populations (10, 11), recent investigations suggest that PLEs may also frequently occur in children and adolescents (14–17). In longitudinal studies, PLEs in childhood and adolescence were identified as a risk factor for later psychiatric disorders and poor psychosocial outcomes (18, 19). There are few studies that have investigated the relationship of PLEs and the risk for suicide among young people in the community.

Aims of the study

The present study thus aimed to examine the associations of psychotic-like experiences (PLEs) with suicidal feelings and deliberate self-harm behaviors in a large community sample of adolescents.

Material and methods

Sample and survey procedures

In 2006, we recruited subjects (ages 12–15 years) from public junior high schools (7th–9th grade) and conducted a cross-sectional survey of psychopathologies among younger adolescents in Tsu-city, Mie Prefecture, Japan (16). Mie Prefecture is located in the central region of Japan, and Tsu-city is the prefectural capital. The total population of Tsu-city is approximately 280 000. There are 20 public junior high schools (with a total of 7127 students at the time of the survey) and attendance is compulsory, in accordance with Japanese law.

After the study was approved by the ethics committee of Mie University School of Medicine, the principal investigators (A.N. & Y.O.) approached the school principals about participation in the study. The principals then consulted with teachers and parents.

In the participating schools, the teachers were instructed on the guidelines for distribution and collection of questionnaires; then the teachers distributed the questionnaires and the envelopes to the students. The teachers also explained: i) that participation in the study was anonymous and voluntary, and ii) that strict confidentiality would be maintained. In addition, the students were asked to seal the completed questionnaire in the provided envelope. Each teacher also reported the total number of present and absent students (including those students who had been absent for more than a month) on the day of the survey. Research staff collected the sealed questionnaires at each school.

Measures

The questionnaires included items regarding the following: i) psychopathological and behavioral problems including PLEs, suicidal feelings and deliberate self-harm behaviors; ii) the Japanese version of the 12-item General Health Questionnaire (GHQ-12); and iii) other variables, including demographic characteristics. An expert in child and adolescent psychologist (N.K) and three schoolteachers (including a Japanese language teacher) from the participating schools examined the questions for age appropriate language and reading comprehension.

Psychotic-like experiences

Psychotic-like experiences were assessed using four items adopted from the schizophrenia section of the Diagnostic Interview Schedule for Children (DISC-C) (20). These items were previously used in a birth cohort study and were good predictors of schizophreniform disorder in adulthood (18). The items were as follows: i) 'Some people believe that their thoughts can be read. Have other people ever read your thoughts?' (thoughts read); ii) 'Have you ever had messages sent especially to you through the television or radio?' (special messages); iii) 'Have you ever thought that people are following you or spying on you?' (spied-upon); and iv) 'Have you ever heard voices that other people cannot hear?' (heard voices). Possible responses included: 'no', 'yes, likely' and 'yes, definitely'. We defined 'yes, definitely' as the presence of a hallucinatory and delusional experience and 'no' or 'yes, likely' as

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no experience. The number of present experiences was designated as the 'total PLEs score', with a range of 0–4.

Suicidal feelings and deliberate self-harm behaviors

Questions about lifetime experiences of suicidal feelings and deliberate self-harm behaviors in the previous year were included in the questionnaire. The item I – 'Have you ever had thoughts that your life is no longer worth living?', included four possible responses ('no', 'probably no', 'possibly yes' and 'yes') (21), and the item II – 'Have you intentionally hurt yourself within the past year?', included two possible responses ('yes' or 'no').

The GHQ-12

The GHQ-12 is one of the most widely used self-report screening tools for non-psychotic psychiatric symptoms, particularly symptoms of anxiety or depression (22). The validity and reliability of the Japanese version of the GHQ-12 have been confirmed (23, 24). The GHQ was originally applied to adult populations and subsequently used and validated for younger populations (25–28). A 4-point scale with binary scoring (0011), which is known as the GHQ method, was used for each of the questions. Responses of '1' were then added together to form the total score, with a range from 0 (best possible) to 12 (worst possible).

Other variables

Suicidal problems among young populations might be affected by other confounding factors, such as victimization and substance use, as reported in previous studies (29–32). In our questionnaire, we asked the participants about the experiences of being bullied (within the past year), violence from adults in the home (within the past month), alcohol use (within the past month), and use of recreational drugs (lifetime). The items on victimization ('being bullied' and 'violence from adults in the home') were answered as 'yes' or 'no'. The items on alcohol use and use of recreational drugs were answered as 'not at all' or 'once or more than once'.

Statistical analysis

Associations between PLEs and the lifetime experience of suicidal feelings or deliberate self-harm behaviors in the previous year were analyzed using logistic regression analysis adjusted for age, sex, GHQ-12 total score, victimization ('being bullied' and 'violence from adults in the home') and

substance use (alcohol use and use of recreational drugs). 'Suicidal feelings' or 'deliberate self-harm behaviors' were the dependent variables.

Associations between each of the four PLEs (thoughts read, special messages, spied-upon, heard voices), and suicidal feelings or self-harm behaviors were tested by comparing individuals with each PLE to those without that type of PLEs. In addition, the effect of the total PLEs score was tested. Regarding the total PLEs score, scores of 3 and 4 were merged, and the subjects were classified into three subgroups according to Lataster et al. (33): 'no PLEs', '1 PLE' and '2 or more PLEs' groups. For the item about suicidal feelings, the responses on a 4-point scale, were converted into binary scoring (0001) when employed as a dependent variable in logistic regression.

All statistical analyzes were conducted using the Statistical Package for Social Sciences (SPSS), version 15.0 for Windows (SPSS Japan Inc., Tokyo, Japan). A P-value < 0.05 was considered statistically significant.

Results

Descriptive statistics

Fourteen out of the 20 public junior high schools in Tsu-city, with a total of 5335 students, agreed to participate in the survey. On the day of the survey, 205 students (3.8%) were absent (57/205 were long-term absentees); 18 (0.3%) refused to participate; 16 (0.3%) submitted blank questionnaires; and 23 (0.4%) gave all 'yes' answers (apparently frivolous). There were 179 (out of 5073) questionnaires missing data for critical items (PLEs, suicidal feelings, deliberate self-harm behaviors, sex, and age). Finally, we analyzed 4894 questionnaires which represented 92.1% of all junior high school students in the 14 participating schools. The demographics included: students aged 12–15 years [2523 boys (51.6%) and 2371 girls (48.4%), age: 13.3 ± 0.9 years (mean ± SD)]. Table 1 summarizes the GHQ-12 scores for the students by grade. The mean GHQ-12 scores were higher in the upper grades (Table 1).

Prevalence of PLEs, suicidal feelings, and deliberate self-harm behaviors

The prevalence of the four PLEs was as follows: 'thoughts read' was observed in 76 subjects (1.6%), 'special messages' in 33 (0.7%), 'spied-upon' in 363 (7.4%), and 'heard voices' in 487 (10.0%). The experience of at least one type of PLE was reported by 746 (15.2%); 182 students (3.7%) experienced

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two or more symptoms of PLEs. The experience of lifetime suicidal feelings was observed in 908 (18.6%; 337 boys and 571 girls), while the experience of deliberate self-harm behaviors in the previous year was reported by 250 (5.1%; 75 boys and 175 girls).

Associations between PLEs and suicidal feelings/deliberate self-harm behaviors

The effect of each of the four PLEs was analyzed by logistic regression. After controlling for age, sex, non-psychotic psychiatric symptoms (the GHQ-12 score), victimization, and substance use; suicidal feelings were significantly associated with 'thoughts read', 'spied-upon', and 'heard voices' (Table 2). Deliberate self-harm behaviors were

significantly associated with 'spied-upon' and 'heard voices' (Table 3).

The total PLEs score was significantly associated with suicidal feelings and deliberate self-harm behaviors, indicating that suicidal feelings and behaviors were more prevalent in subjects with a greater number of PLEs (Tables 4 and 5).

Discussion

The current study is the first to investigate and clearly show that PLEs are significantly associated with suicide-related problems in a community sample of younger adolescents. The risk of suicidal feelings and deliberate self-harm behaviors increases when more types of PLEs are experienced. The subjects experienced two or more types

Table 1. Demographic variables, mean General Health Questionnaire (GHQ-12) scores by school grade (n = 4894: males, 2523; females, 2371)

School grade	No. subjects			Age	GHQ-12 score	
	All	Male (%)	Female (%)	Mean	Mean	SD
Grade 7	1580	831 (52.6)	749 (47.4)	12.30	2.72	2.61
Grade 8	1645	842 (51.2)	803 (48.8)	13.29	3.15	2.79
Grade 9	1669	850 (50.9)	819 (49.1)	14.31	3.70	2.93
Overall	4894	2523 (51.6)	2371 (48.4)	13.32	3.20	2.81

Table 2. Associations between suicidal feelings and psychotic-like experiences in Japanese adolescents aged 12–15 years (n = 4894)

Psychotic-like experiences (PLEs)	Lifetime prevalence of suicidal feelings*		Unadjusted odds ratio			Adjusted odds ratio‡§		
	n	%	OR†	95% CI	P-value	OR†	95% CI	P-value
Thoughts read (n = 76)	33	43.42	3.45	2.18–5.46	<0.001	2.47	1.40–4.34	0.002
Special messages (n = 33)	12	36.36	2.52	1.24–5.14	0.011	1.93	0.83–4.47	0.127
Spied-upon (n = 363)	173	47.66	4.69	3.76–5.84	<0.001	2.44	1.87–3.18	<0.001
Hearing voices (n = 487)	203	41.68	3.74	3.07–4.56	<0.001	2.26	1.79–2.87	<0.001

*The number of individuals with the lifetime experience of suicidal feelings among those with each PLE.
†Odds ratio comparing the groups with and without PLE.
‡Odds ratio adjusted forage, sex, the total score of the GHQ-12, being bullied, violence from adults in the home, alcohol use, and use of recreational drugs.
§In each section, the missing data have been excluded from the statistical analyzes.

Table 3. Associations between deliberate self-harm behaviors and psychotic-like experiences in Japanese adolescents aged 12–15 years (n = 4694)

Psychotic-like experiences (PLEs)	Prevalence of self-harm behaviors*		Unadjusted odds ratio			Adjusted odds ratio‡§		
	n	%	OR†	95% CI	P-value	OR†	95% CI	P-value
Thoughts read (n = 76)	10	13.15	2.88	1.47–5.69	0.002	1.56	0.71–3.43	0.267
Special messages (n = 33)	4	12.12	2.59	0.90–7.42	0.077	1.62	0.48–5.50	0.439
Spied-upon (n = 363)	60	16.53	4.52	3.31–6.18	<0.001	1.93	1.34–2.77	<0.001
Hearing voices (n = 487)	74	15.26	4.33	3.24 –5.78	<0.001	2.32	1.57–3.22	<0.001

*The number of individuals with the experience of deliberate self-harm behaviors in the previous year among those with each PLE.
†Odds ratio comparing the groups with and without PLE.
‡Odds ratio adjusted for age, sex, the total score of the GHQ-12, being bullied, violence from adults in the home, alcohol use, and use of recreational drugs.
§In each section, the missing data have been excluded from the statistical analyzes.

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Table 4. Association between the lifetime experience of suicidal feelings and severity of psychotic-like experiences in Japanese adolescents aged 12–15 years (N = 4894)

Psychotic-like experiences (PLEs)*	Lifetime prevalence of suicidal [feelings]†		Unadjusted odds ratio			Adjusted odds ratio‡§		
	n	%	OR	95%	P-value	OR	95% CI	P-value
No symptom group (n = 4148)	602	14.51	1.00		<0.001	1.00		<0.001
1 symptom group (n = 564)	209	37.06	3.46	2.85–4.18		2.18	1.74–2.74	
2 or more –symptoms group (n = 18)	97	53.30	6.70	4.94–9.07		3.14	2.17–4.53	

*No symptom group = individuals with no PLE; 1 symptom group = individuals with one PLE; 2 or more symptoms group = individuals with two or more PLEs.
†The number of individuals with the lifetime experience of suicidal feelings.
‡Odds ratio adjusted forage, sex, the total score of the GHQ-12, being bullied,
violence from adults in the home, alcohol use, and use of recreational drugs.
§In each section, the missing data have been excluded from the statistical analyzes.

Table 5. Association between deliberate self-harm behaviors and severity of psychotic-like experiences in Japanese adolescents aged 12–15 years (N = 4894)

Psychotic-like experiences (PLEs)*	Prevalence of self-harm behaviors†		Unadjusted odds ratio			Adjusted odds ratio‡§		
	n	%	OR	95% CI	P-value	OR	95% CI	P-value
No symptom group (n = 4150)	150	3.62	1.00		<0.001	1.00		<0.001
1 symptom group (n = 562)	59	10.50	3.12	2.23–4.29		1.88	1.18–2.40	
2 or more symptoms group (n = 182)	41	22.53	7.75	5.28–11.38		3.06	1.96–4.78	

*No symptom group = individuals with no PLE; 1 symptom group = individuals with one PLE; 2 or more symptom group = individuals with two or more PLEs.
†The number of individuals with the experience of deliberate self-harm behaviors in the previous year.
‡Odds ratio adjusted for age, sex, the total score of the GHQ-12, being bullied, violence (torn adults in the home, alcohol use, and use of recreational drugs.
§In each section, the missing data have been excluded from the statistical analyzes.

of PLEs were approximately three times more likely to experience suicidal feelings and self-harm behaviors than those who did not experience PLEs.

When each PLE was analyzed, the prevalence of 'heard voices' was the most frequent (10.0%), followed by 'spied-upon' (7.4%). Compared with these two PLEs, 'thoughts read' and 'special messages' were much less common (1.6% and 0.7%). 'Spied-upon' and 'heard voices' were significantly associated with both suicidal feelings and deliberate self-harm behaviors, after controlling for confounding factors. 'Thoughts read' was significantly associated with suicidal feelings but not with deliberate self-harm behaviors, whereas 'special messages' was not significantly associated with either the feelings or the behaviors. These results suggest that 'heard voices' and 'spied-upon' could be useful markers to identify younger adolescents who are at risk for suicide-related feelings and behaviors.

The risk of suicide behaviors is significantly higher in subjects with psychosis, including schizophrenia, during the early phase of the disease (2, 8). The risk for suicide during the early stage of psychosis may be higher for those who have greater insight about their disease (3, 34). A recent study reported that such insight might begin to

significantly elevate the risk of self-harm behaviors in subjects with the first episode of psychosis in the pretreatment phase (3). Insight about the unusual nature of the PLEs could increase the risk of the suicidal feelings/behaviors even for younger teenagers, because of the fear and distress associated with PLEs. Future studies about the relationship of insight and distress are needed to understand the effects.

The association between PLEs and suicidal feelings/behaviors was significant after controlling for anxiety/depression and use of substances. Thus far, psychotic disorders may have been considered less of a contributing factor in suicide in young people compared to mood disorders and substance use disorders (35, 36). In psychological autopsy studies, the information was mostly obtained from family members and other relevant people (7, 35, 36). Subclinical psychotic symptoms or signs which do not manifest in the behaviors of the subjects would be more likely to be overlooked than depression or substance misuse. In the present study, a substantial portion of the subjects with suicidal problems were suffering from PLEs; 306 out of 908 subjects with suicidal feelings (34%) and 100 out of 250 subjects with suicidal behaviors (40%) experienced one or more types of PLEs.

More attention should be focused on subclinical psychotic signs/symptoms in future studies of suicidal problems in young people.

This study had several limitations. First, we could not obtain answers from absent students. Poor mental health status and psychopathology may be more prevalent among frequent or long-term absentees. Second, because we used a self-report questionnaire, there may be more over-reporting and/or under-reporting on certain topics than there would be in an interview-based survey. For these reasons, the estimated prevalence of psychopathology might not be totally precise. Third, we did not ask the participants to give detailed descriptions about the PLEs which they experienced. Therefore, we could not identify possible discrepancies in what subjects perceived as real PLEs. Fourth, sufficient information about confounding factors such as personality (37, 38) and family circumstances (39, 40), which might be associated with suicidal problems, was not available in the present study. Finally, we used a cross-sectional survey, and therefore, we were not able to identify cause and effect relationships between PLEs and other factors. Hence, in the future, follow-up studies will be needed to investigate the nature of the chronological relationships between PLEs and other factors including suicide-related problems.

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Declaration of interest

None.

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Perspectives in Early Intervention

Psychotic-like experiences (PLEs) and mental health status in twin and singleton Japanese high school students

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Abstract

Aim: Studying what factors and behaviours to work on may be a key to develop the effective prevention of future mental disorder in both high-risk and general young subjects. This study aimed to investigate whether twins are more vulnerable to mental health problems including psychotic-like experiences (PLEs) than singletons and what factors on lifestyle and social environment are associated with poor mental health.

Methods: Subjects comprised 341 Japanese high-school students (173 males and 168 females) including 62 twins. We examined PLEs, general psychological distress, length and regularity of sleep, domestic violence, being bullied and other environmental factors using questionnaires including the 12-item General Health Questionnaire (GHQ-12). The variables were compared between twins and singletons. Whether variables on lifestyle and social environment affect

PLEs and GHQ-12 scores were studied by logistic regression.

Results: Significant difference was observed in PLEs and GHQ-12 between twins and singletons. Experiencing PLEs was negatively associated with being a twin (OR = 0.293, 95% CI = 0.101–0.847) and length of sleep (OR = 0.685, 95% CI = 0.519–0.903). GHQ-12 > 4 was significantly associated with irregular sleep schedule (OR = 3.042, 95% CI = 1.818–5.090), being bullied (OR = 3.677, 95% CI = 1.317–10.266) and having no people to confide in (OR = 2.615, 95% CI = 1.249–5.475).

Conclusion: Poor mental health status including experiencing PLEs might be less frequent in twins than in singletons. Problems in sleep length, its schedule and human relationships were significantly associated with mental health in high-school students as we hypothesized. Early identification programmes and mental health education focused on these factors may be helpful.

Key words: GHQ, high-school students, psychotic-like experiences (PLEs), sleep, twin.

INTRODUCTION

Early detection and intervention are thought to improve the course and prognosis of psychosis and other mental disorders.[1,2] They may also be important in light of the cost-benefits of such psychiatric treatment.[3,4] Psychotic-like experiences (PLEs) are subclinical hallucinatory and delusional experiences. PLEs occur not only in subjects with psychotic disorders but also in people in the community who may not be clinically diagnosed with psychoses.[5–7] Studies have observed that a substantial portion (10–40%) of subjects with PLEs develop psychoses and other mental disorders.[8,9] PLEs are therefore considered a good predictor of clinical psychosis.[10,11]

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Most forms of psychoses including schizophrenia develop from early teens to late twenties. A recent epidemiological study observed that 75% of adult psychiatric disorders developed by age 25.[12] These suggest that examination of PLEs in teenagers may help the prevention, including early detection/treatment, of psychiatric disorders.

For effective prevention, one of the keys may be to clarify who is at high risk, or in other words, who should be taken care of most carefully. In the present study, we focused on whether twins are more vulnerable to poor status of mental health than singletons. Previous studies have observed that twins may be more susceptible to mental disorders, due to limited blood supply and its effect on neurodevelopment during embryonic period,[13,14] while other studies did not find the difference between twins and singletons.[15,16] Thus, we postulated that twins in their teenage years may be suffering poorer mental status, including experiences PLEs, than singletons.

Another aim of the present study is to investigate what environmental and behavioural factors are associated with poor mental health including PLEs. To study what factors and behaviours to work on may be another key to develop effective prevention, in both high-risk and general young subjects. The associated factors might become a good focus in the intervention and psychological education for the prevention. Previous studies have observed that PLEs may be associated with suicidal feelings and deliberate self-harm behaviours,[17] cannabis use[18] and victimization of bullying.[19] We, in the present study focused on factors including sleep status and sleep-related behaviours, in addition to other variables regarding lifestyle and social environment such as being bullied and having people to confide in, because night sleep was significantly shortened and was irregular in Japanese teenagers in these 40 years.[20]

MATERIALS AND METHODS

Subjects

Subjects comprised Japanese high school students in grade 7, 9 and 11 of a 6-year (grades 7–12) high school in Tokyo. The high school is affiliated with a faculty of education of a university and asked to cooperate with the research and education in the university. The high school recruits and enrols 120 seventh grade students every year, who pass the entrance examinations. The most unique feature of this high school may be that among 120 students, 10–20 pairs of twins are by priority recruited and

enrolled every year. A total of 353 students (180 males and 173 females) were enrolled in the grades 7, 9 and 11 of this high school (n = 120, 120 and 113, respectively). Out of 353, 66 were twins (33 pairs, 27 males and 39 females). Among the 33 pairs, 15 pairs were monozygotic twins and 4 pairs were opposite-sex dizygotic twins. Zygosity was not determined in twins in grade 7 (n = 28, 14 pairs).

Questionnaires

The students were requested to fill out a questionnaire regarding mental health status, behaviours, lifestyle and social environment. The questions on mental health status included items on PLEs and the Japanese version of the 12-item General Health Questionnaire (GHQ-12). The questionnaire was basically the same as in our previous studies.[17,21] Questions on length and regularity of night sleep and other issues were added. The survey was conducted in June 2009.

Ethical aspects

The study was approved by the ethical committee of the Graduate School of Education, University of Tokyo, after it was discussed and approved by the research committee of the high school. Written information about the aims and methods of the study was sent to all parents of the students to ask participation in this study. It was clearly written in the information that the participation was voluntary and when the students or parents did not agree, there was absolutely no need to participate. On the day of the survey, classroom instructors distributed the questionnaire with an envelope to the students and explained that: (i) participation was voluntary and anonymous and (ii) answers to the questionnaire absolutely would not be seen by school teachers. The students who did not want to participate in the study were allowed to leave the classroom or turn in a blank paper. The students who consented to the study were asked fill in their school ID, not their names. Finally, the students were instructed to seal the questionnaire in the envelope when they completed the answers. The researchers had no information on the school ID, and therefore the answers were studied and analyzed anonymously, but longitudinal follow-up was enabled.

Analysis of PLEs and GHQ-12

PLEs and GHQ-12 were analyzed in the same manner as in our previous study.[17,21] Briefly described, four questions on PLEs, including: (i)

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'Some people believe in mind reading or being psychic. Have other people ever read your mind?'; (ii) 'Have you ever had messages sent just to you through the television or radio?'; (iii) 'Have you ever thought that people are following you or spying on you?' and (iv) 'Have you ever heard voices other people cannot hear?' were analyzed. All answers were made on a four-point scale: 'no', 'maybe', 'yes, once' and 'yes, twice or more'. We defined that each PLE was present when subjects answered 'yes, once' or 'yes, twice or more'. The number of the types of experienced PLEs was designated as 'PLEs score' (with the range of 0–4).

GHQ-12 was answered in a four-point scale with binary scoring (0011). The number of score '1' was totalled and designated as the 'GHQ-12 score', with the range of 0 (best) to 12 (worst). Also, subjects with the GHQ-12 score >4 were considered being at poor mental health status.[22]

Statistical analysis

PLEs, GHQ-12 and variables on lifestyle and social environmental factors, which might have an effect on PLEs and GHQ-12 were statistically analyzed. The variables on lifestyle and social environment included length and irregularity of sleep, use of mobile phones after lights out, drinking alcohol, domestic violence from adults, being bullied and number of people one can confide in. These scores and variables were first compared between twins and singletons, using t-test (for GHQ-12 score) or Fisher's exact test. The comparisons were conducted by sex when the sex difference was statistically significance.

We then analyzed relationships between those variables including 'twin or singleton' and PLEs or GHQ-12. Univariate and multivariate logistic regression analyses were conducted. For the multivariate analysis, sex and grade was added as co-variates. Dependent variables were whether GHQ-12 score is ≥4 or not and whether PLEs score is ≥1 or not. Statistical Package for Social Sciences (SPSS Japan Inc., Tokyo, Japan) version 16.0J for Windows was employed for the all statistically analyses. A nominal P-value of <0.05 was considered statistically significant.

RESULTS

A total of 350 students (63 twins and 287 singletons) out of 353 (99%) answered the questionnaire. No students and no parents refused consent. Three twin students and no singletons were absent on the day of the study. Among the 350, 9 students (1 twin and 8 singletons) were excluded from the analysis, because of incomplete answers to major questions including PLEs and GHQ-12. Thus, 341 students (62 twins and 279 singletons; 173 males and 168 females) were analyzed in the present study. Among the 341, 62 were twins (24 males and 38 females) and 279 were singletons (149 males and 130 females). Among the 62 twins; 27 were monozygotic and 7 were dizygotic. Zygosity was not determined in the rest of the twins; all of them were in the seventh grade. In the multivariate logistic regression, 327 (60 twins and 267 singletons) students were studied because 14 were excluded due to missing data in the independent variables.

As summarized in Table 1, PLEs were observed in 17.9% of the students. Frequency of students with GHQ-12 > 4 was 36.4% and the GHQ-12 score was 3.1 ± 3.1 (mean ± SD). Distributions of twins and non-twins were not significantly different among the grades 7, 9 and 11 in each sex ($P = 0.60$ in male and $P = 0.19$ in female, Fisher's exact test).

The GHQ-12 scores was higher in females than in males (3.8 ± 3.3 in females vs. 2.5 ± 2.8 in males (mean ± SD), t-value = 3.978, $P < 0.001$). Frequency of PLEs tended to be higher in females (21%) than males (14%), while the difference did not reach statistical significance. Comparison between twins and singletons were therefore conducted by sex. As a result, GHQ-12 scores and the frequency of subjects with GHQ-12 score >4 were lower in twins than in singletons, in males (1.4 ± 2.3 and 4% in twins vs. 2.7 ± 2.8 and 30% in singletons, t-value = 2.418, $P = 0.021$ and $P = 0.006$, respectively). The difference was not significant in females, while the similar tendency appeared to be observed (2.9 ± 3.0 and 37% in twins vs. 4.1 ± 3.4 and 50% in singletons, respectively). Frequencies of PLEs was lower in twins than singletons, in females (5% in twins vs. 26% in singletons, $P = 0.006$). In males, the difference was smaller than in females (8% in twins vs. 15% in singletons) and did not reach statistical significance. No significant difference was found in frequency of PLEs with distress between twins and singletons in either sex.

Additionally describing frequency of PLEs was 4.2% and 2.6% in male and female monozygotic twins, respectively. None of the dizygotic twins experienced PLEs. GHQ-12 scores and the frequency of subjects with GHQ-12 score >4 were 2.5 ± 2.9 and 8.3% in male and 4.0 ± 3.5 and 53% in female monozygotic twins, respectively. Those were 0 ± 0 and 0% in male and 3.2 ± 2.2 and 40% in female dizygotic twins. No statistical comparison

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TABLE 1. The number of subjects by school grade, GHQ-12 scores and PLEs in Japanese high school students (n = 341)

	Twins		Singletons		Total		
	Male	Female	Male	Female	Male	Female	All
Number of students	24	38	149	130	173	168	341
7th grade (mean age = 12.3 years)	10	18	48	42	58	60	118
9th grade (mean age = 14.2 years)	8	12	50	44	58	56	114
11th grade (mean age = 16.3 years)	6	8	51	44	57	52	109
GHQ-12 scores (mean ± SD)	1.4 ± 2.3†	2.9 ± 3.0	2.7 ± 2.8	4.1 ± 3.4	2.5 ± 2.8‡	3.8 ± 3.3	3.1 ± 3.1
GHQ-12 scores > 4 (N (%))	1 (4%)§	14 (37%)	44 (30%)	65 (50%)	45 (26%)¶	79 (47%)	124
PLEs > 1 (N (%))	2 (8%)	2 (5%)††	23 (15%)	34 (26%)	25 (14%)	36 (21%)	61
with distress (N (%))	1 (4%)	2 (5%)	16 (11%)	24 (18%)	17 (10%)	26 (15%)	43

†P = 0.021 between twins and singletons in males (t-test).
‡P < 0.001 between males and females (t-test).
§P = 0.006 between twins and singletons in males (Fisher's exact test).
¶P < 0.001 between males and females (Fisher's exact test).
††P = 0.006 between twins and singletons in females (Fisher's exact test).
GHQ-12, 12-items General Health Questionnaire; PLEs, Psychotic-like experiences; SD, standard deviation.

TABLE 2. Comparisons of variables related with lifestyle and social environment between twins and singletons

Variable		Twins		Singletons		P value†
Number of students		62		279		
Length of sleep (mean ± SD)	Hours	6.9 ± 1.2		7.0 ± 0.7		NS
Irregular sleep schedule	N (%)	24	(39%)	129	(46%)	NS
Alcohol	N (%)	5	(8%)	33	(12%)	NS
Domestic violence from adults	N (%)	4	(6%)	17	(6%)	NS
Being bullied	N (%)	3	(5%)	21	(8%)	NS
Nobody one can confide in	N (%)	3	(5%)	45	(16%)	0.042
Use of mobile phones after lights out	N (%)	13	(21%)	104	(37%)	0.017

†t-test for length of sleep and Fisher's exact test for others.
SD, standard deviation; NS, not significant.

was conducted regarding these values, considering the limited sample size.

Table 2 summarizes the variables on lifestyle and social environment, including sleep related variables (such as length, irregularity and use of mobile phones after lights out), victimizations (by domestic violence and bullying), alcohol use and human resource for help-seeking (or number of people one can confide in). Since no gender difference was observed in these variables, comparisons between twins and singletons were conducted without separating males and females. Significant difference was found in 'number of people one can confide in' and 'use of mobile phones after lights out' (P = 0.042 and P = 0.017, respectively).

Table 3 summarizes the results of univariate and multivariate logistic regression analyses of the association between PLEs and other variables. Univariate analyses showed that risk of experiencing PLEs was associated with being non-twins

(P = 0.009), shorter sleep (P = 0.004), being bullied (P = 0.042) and use of mobile phones after lights out (P = 0.003). Multivariate analysis showed significant associations between PLEs and being singletons (OR = 0.293, 95%CI = 0.101–0.847, P = 0.024) and shorter sleep (OR = 0.685, 95%CI = 0.519–0.903, P = 0.007). P-value of Hosmer-Lemeshow test was 0.516 that indicated a goodness of fit of the model. Predictive accuracy was 82.0%.

Results of the logistic regressions for the association between frequency of GHQ-12 scores >4 and the other variables are summarized in Table 4. Univariate analyses showed significant associations between GHQ-12 scores >4 and most of the variables (P < 0.05); the exceptions were 'alcohol' use and 'domestic violence from adults'. Multivariate analysis showed significant associations between GHQ-12 scores >4 and 'sex' (OR = 3.292, 95%CI = 1.941–5.582, P < 0.001), 'school grade' (P < 0.001), 'irregular sleep schedule' (OR = 3.042, 95%CI =

TABLE 3. Factors associated with PLEs in Japanese high school students (n = 327), analyzed by logistic regression†

Variable‡	Parameter	Unadjusted odds ratios			Adjusted odds ratios‡		
		OR	95% CI	P value	OR	95% CI	P value
Sex	Female/male	1.615	0.921–2.831	NS			
School grade				NS			
	9th/7th	0.851	0.414–1.750				
	11th/7th	1.632	0.844–3.157				
Twin	Yes/no	0.269	0.094–0.771	0.009	0.293	0.101–0.847	0.024
Length of sleep	(hours)	0.675	0.516–0.884	0.004	0.685	0.519–0.903	0.007
Irregular sleep schedule	Possibly, yes/no, probably not	1.571	0.901–2.741	NS			
Alcohol	Once or more/not at all	1.277	0.554–2.944	NS			
Domestic violence from adults	Yes/no	1.445	0.508–4.109	NS			
Being bullied	Yes/no	2.472	1.006–6.071	0.042			
Number of people one can confide in	None/one or more	1.052	0.480–2.305	NS			
Use of mobile phones after lights out	Once or more/none	2.331	1.328–4.091	0.003			

†Subjects with missing data were excluded from the analysis.
‡Stepwise logistic regression model.
OR, odds ratio; PLEs, Psychotic-like experiences; 95%CI, 95% confidence interval; NS, not significant.

TABLE 4. Factors associated with GHQ-12 score of >4 in Japanese high school students (n = 327), analyzed by logistic regression†

Variable‡	Parameter	Unadjusted odds ratios			Adjusted odds ratios‡		
		OR	95% CI	P value	OR	95% CI	P value
Sex	Female/male	2.525	1.602–3.980	<0.001	3.292	1.941–5.582	<0.001
School grade				<0.001			<0.001
	9th/7th	3.525	1.974–6.294		4.446	2.281–8.667	
	11th/7th	2.860	1.589–5.147		3.433	1.748–6.743	
Twin	yes/no	0.498	0.265–0.934	0.028			
Length of sleep	(Hours)	0.645	0.515–0.808	<0.001			
Irregular sleep schedule	Possibly, yes/no, probably not	3.210	2.028–5.082	<0.001	3.042	1.818–5.090	<0.001
Alcohol	Once or more/not at all	1.656	0.839–3.266	NS			
Domestic violence from adults	Yes/no	1.056	0.425–2.623	NS			
Being bullied	Yes/no	3.194	1.354–7.538	0.006	3.677	1.317–10.266	0.013
Number of people one can confide in	None/one or more	2.303	1.242–4.272	0.007	2.615	1.249–5.475	0.011
Use of mobile phones after lights out	Once or more/none	2.353	1.482–3.737	<0.001			

†Subjects with missing data were excluded from the analysis.
‡Stepwise logistic regression model.
GHQ-12, 12-items General Health Questionnaire; OR, odds ratio; 95%CI: 95% confidence interval; NS, not significant.

1.818–5.090, P < 0.001), 'being bullied' (OR = 3.677, 95%CI = 1.317–10.266, P = 0.013) and 'number of people one can confide in' (OR = 2.615, 95%CI = 1.249–5.475, P = 0.011). P-value of Hosmer-Lemeshow test was 0.450 that indicated a goodness of fit of the model. Predictive accuracy was 74.0%.

DISCUSSION

Mental health status of the present subjects, measured by GHQ-12 and PLEs, may be comparable with the previous studies in high school students. The mean GHQ-12 score was 3.1 and the frequency of the subjects with GHQ-12 score ≥ 4 was 36.4% in this study. Previous studies in Japanese high school students observed similar levels of the GHQ-12 score (mean = 3.2)[21,22] and the frequency (39.8%).[21] PLEs were experienced in 17.9% of the present subjects (mean age = 14.2). In the previous studies, prevalence of PLEs was 15.2% in Japanese students of junior-high schools (or grades 13–15, mean age = 13.3 years),[21] and 14.7% at the age 11 years[11] and 19.1% in teenagers (mean age = 14 years)[23] from

other populations. Regarding the gender difference, females tended to have PLEs more frequently and higher GHQ-12 score, although the difference in the frequency of PLEs did not reach statistical significance. This may also be consistent with previous studies.[21,24,25]

We hypothesized that twins may have poorer mental health than singletons, due to less favourable environment during embryonic neurodevelopment. Previous studies observed that adult twins were more vulnerable to mental disorders than singletons[13,14] or observed no difference in the vulnerability between twins and singletons.[15,16] In contrast to the hypothesis, twins appeared to be in better mental health status than singletons. GHQ-12 was significantly lower in twins than in singletons, in males. PLEs were less frequent in twins than in singletons in females. Weak but similar tendencies were also observed in females for GHQ-12 and in males for PLEs, while the differences were not statistically significant. A possible explanation for the discrepancy is that twinship may form a positive developmental environment for teenagers. A recent study observed that, according to peers' assessment, twins of early teenage years might be better in socioemotional behaviours including social interaction and obtain more popularity and leadership at school.[26] Twins less frequently had behavioural/emotional disturbance, also according to the teachers' assessment, although parents tended to observe slightly more problems in twin boys than in singleton boys.[27] Another recent study observed that 50% of monozygotic twins and 25% of same-sex dizygotic twins shared their friends with co-twins.[28] It was also reported that rate of receiving psychiatric treatment is lower (approximately a half) in twins in childhood than expected from the rate in general population, which might be related with availability of psychological support by co-twins.[29] In the present subjects, all pairs of the co-twins were enrolled in the same high school. As shown in Table 2, those who had nobody to confide in were significantly less in twins than in singletons. This might have a favourable effect on forming positive developmental environment and having good mental health status. In conclusion, the present result suggests that teenage twins might be less vulnerable to poor mental health status at the subclinical level, which is measured by GHQ-12 or questions on PLEs, when the co-twins are together grown up and attending the same high school.

It may however be acknowledged that the entrance examination could have an effect on the unexpected result in the comparison between twins versus singletons. Twins in the present study took the same entrance examination for admission to the high school as the singletons did. This might have prior excluded twins with developmental problems or poor mental health from the present sample. Another possibility is that twins with substantially poor mental health status were among those who were not studied. Out of the 66 twins, 3 did not participate in the study and another one was excluded from the analysis due to the missing data. The rate of those who were not studied was 6% in the twins, which may be higher than the rate in the singletons (8 out of 287, 3%).

It might also be noted that frequency of subjects who experienced two or more PLEs was 3% in twins and 5% in singletons (not shown in tables or results). The difference between twins and singletons may not be as large as in the frequencies of those with one or more PLEs or GHQ-12 score of >4. Those with severe mental health, who are really susceptible to mental disorders including psychoses, might not remarkably be infrequent in twins than in singletons. Further studies in larger samples may be recommended for detailed statistical comparison, because the present sample size is limited. In addition, it may be acknowledged that the present result might not be adequate to discuss about the risk for mental disorders of clinical level. For the discussion, what portion of the students with high PLEs or GHQ-12 develops psychoses and other mental disorders should be studied in the follow-up.

We found the association of several variables on lifestyle and social environment, with PLEs and GHQ-12, as summarized in Tables 3 and 4. Those variables include length or irregularity of sleep, being bullied, having people to confide in and school grade, in addition to being twin/singleton and sex, which we discussed above.

Sleep-related variables were associated with both PLEs and GHQs, after adjustment for other variables by multivariate logistic regression analysis; length of sleep (or shorter sleep) with PLEs and irregularity of sleep time with GHQ-12. During the past decades, length of sleep was decreasing by later in the general populations of Japan.[20] The issue may be serious in children and adolescents in the developmental stage.[20] A study in 100 000 Japanese high school students reported that 23.5% of them complained of insomnia.[30] Watching television, playing computer games and use of the Internet at night may be related with the unfavourable sleep behaviours.[31] Poor status of sleep may cause several behavioural and mental health problems. Daytime sleepiness, fatigue and poor concentration might be caused by shortage of sleep in school children.[32,33] Association of anxiety/depression with sleep disturbances was

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also observed in children.[34] Attention, injuries and emotional upset may be caused by irregular sleep schedule in adolescents.[35] Consistent with these previous findings, the present study clearly observed the association of shorter sleep and irregular sleep schedule with poor mental health including subclinical experiences of psychosis-like symptoms. Which of these variables is the cause in the association should be investigated in further studies. However, the present result suggests that improvement of sleep and its related behaviours by psychological education or other methods may have a favourable effect on the mental health status in teenagers. Use of mobile phones after lights out may be one of good focus in such education, although the association was not significant in the multivariate logistic regression and further studies are requested.[36]

Being bullied was significantly associated with GHQ-12 in multivariate logistic regression. The variable was also associated with PLEs in univariate logistic regression, while the association was not observed in the multivariate analysis. The association between PLEs and being bullied was observed in previous studies in teenagers.[21,23] Having nobody to confide in was another variable that was significantly associated with GHQ-12 in multivariate logistic regression. While the variable was associated with PLEs in our previous study,[21] the association was not observed in the present study. This might be due to the limited sample size in the present study. Having few people to confide in might be a cause of the poor mental status, but also could be a result of poor mental health. Adolescents may be more reluctant to seek help due to poorer mental status. A previous study investigated adolescents and young adults (aged 16–24) using GHQ and found that a very small portion (<10%) of the subjects with poor mental health consulted their general practitioners.[37] The association of the variable, being bullied and having nobody to confide in, with poor mental health suggests that education and other measures for the improvement of human environment in schools may be a key to good status of mental health in students. Early identification programmes for mental health problems are substantially important for the same reason, as discussed in a previous study.[38]

Limitations and future research

The following limitations may be acknowledged in the present study. First, we used a self-report questionnaire. The information could be less accurate or reliable than in studies by interview-based survey.

Second, a portion of the students did not participate in the study. Some of these students could be in bad mental states and the exclusion of these students might have affected the study, as discussed above. Third, the sample size may not be large enough for some of the variables where proportion of the minor answer was very small. Especially, the number of the twins was limited and we did not conduct statistical analyses by zygosity of the twins. This may be further studied in the future. Fourth, this is a cross-sectional study, and therefore causal relationship is not clear when a significant association was observed. Longitudinal studies by follow-up may be required.

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