Anger and Impulsivity Among Japanese Adolescents:
A Nationwide Representative Survey

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ABSTRACT

Objective: This study aimed to clarify the prevalence of anger and impulsivity and its associated factors through a nationwide survey of junior and senior high school adolescent students in Japan.

Methods: A self-administered questionnaire covering (1) personal data, (2) lifestyle, (3) mental health status, and (4) feelings of anger and impulsivity was distributed to junior and senior high school students in Japan. Among the total of 10,955 junior high schools and 5,115 senior high schools nationwide, 130 and 110 were randomly selected, respectively. Of those, 92 junior and 80 senior high schools participated in the survey. The survey period was from December 2008 to the end of January 2009. A total of 95,680 questionnaires were collected. After excluding invalid responses, the remaining 94,777 responses (response rate: 62.3%) were analyzed.

Results: From the questions regarding anger and impulsivity, 8.7% (95% CI, 8.5%–8.9%) and 7.5% (95% CI, 7.3%–7.7%) of the participants were considered to have experienced intense anger and impulsivity, respectively. Logistic regression analysis indicated that the odds ratios for experiencing intense feelings of anger were significantly higher (all P values < .05) among students who smoked, consumed alcohol, skipped breakfast, did not wish to go to university, had short sleep duration, had decreased positive feelings, had increased depressive feelings, or used mobile phones for longer hours. The odds ratios for experiencing intense impulsivity were significantly higher among students who smoked, consumed alcohol, skipped breakfast, did not participate in club activities, had short sleep duration, had decreased positive feelings, had increased depressive feelings, or used mobile phones for longer hours.

Conclusions: The results suggest that healthy lifestyle habits, good sleep habits, and improved mental health are important for preventing intense feelings of anger and impulsivity among adolescents.

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The prevalence of violent behavior in adolescents attending junior and senior high schools in Japan has been increasing. According to a survey[1] on student behavior conducted by the Japanese Ministry of Education, the incidence rate of violent behavior (per 1,000 people) increased from 4.3 in junior and 1.3 in senior high schools in 1997 to 10.7 and 2.8, respectively, in 2012. The Ministry pointed out that this increased school violence in recent years has been mainly attributable to an increase in sudden violent outbursts among children without previous behavior problems.[2] Such outbursts are usually caused by trivial matters. Other behavioral problems among school children in Japan in recent years have included impulsive and random vandalism and verbal abuse.[2]

Studies using several approaches have been conducted to clarify the mechanisms responsible for such sudden outbursts of anger and impulsivity in adolescents. One such approach has been to focus on psychological perspectives. Increases in the rate of violence by adolescents, particularly in the United States in the 1990s and later, have heightened public concern about anger, and this in turn has prompted basic research on this issue.[3] Tangney et al[4] developed the Anger Response Inventory–Adolescence scale and used it to study sex differences in anger. Although in previous studies of anger, the definitions of anger and methods for measuring it varied,[3] Spielberger et al[5] systematized the concept of anger and defined it as being a manifestation of emotion leading to responses that motivate aggressive behavior, and considered that hostility was a series of complex behavioral manifestations directed against others. This led to the proposal of the so-called "Anger-Hostility-Aggression" theory.[5] In addition, Furlong and Smith[6] statistically classified the expression patterns of anger into 6 subtypes. On the basis of their findings, they then developed the Multidimensional School Anger Inventory scale, which is designed to measure school-related anger experiences in adolescents.[3] Impulsivity has also been investigated in psychological studies because impulsive behavior can cause various social problems. Previous studies have also indicated that impulsivity is not a unidimensional but a multidimensional concept.[7–9] Barratt created the Barratt Impulsiveness Scale (BIS) as an instrument for measurement of impulsivity[10] and developed the BIS-10 for use with a questionnaire in clinical situations.[11] The revised version, BIS-11,[12] is currently used worldwide.[13]

Other studies of violent behavior have employed a brain science approach. Such studies have gradually clarified the

Clinical Points

- To date, few studies of anger or impulsivity in adolescents have adopted an epidemiologic approach.
- If intensive anger or impulsivity is recognized in adolescents, then specific lifestyle habits, such as smoking and alcohol consumption, may further harm their future health or create problems with their mental status.
- The findings of this study may be helpful for screening of psychiatric diseases (such as ADHD) in adolescents with symptoms of impulsivity or anger.

functions of the amygdalae that control emotions such as anger and of the prefrontal area that controls impulsivity. The amygdalae are located bilaterally in the anterior inner sides of the temporal lobes. It is known that monkeys whose amygdalae have been removed lack affect, including anger (known as Klüver-Bucy Syndrome).[14] In addition, there is a case report[15] of a patient with lesions specifically in the prefrontal area of the brain who displayed an increase in impulsivity but negligible motor paralysis and speech disorder.

To date, most studies on expression of anger or impulsivity in adolescents have been performed from psychological and physiological perspectives, and few have adopted an epidemiologic approach. Kerr and Schneider[16] conducted an epidemiologic study of anger in 411 adolescents and reported associations between anger and lifestyle habits, such as alcohol consumption and aerobic activity. However, no previous epidemiologic studies have used representative, large-scale samples. In the present study, therefore, we conducted a nationwide survey of anger and impulsivity in a population of nearly 100,000 nationally representative Japanese adolescents. Our aims were (1) to clarify the prevalence of anger and impulsivity among adolescent students and (2) to identify the factors associated with these forms of behavior.

METHODS

Subjects and Sampling

For this study, of the 10,955 junior high schools and 5,115 senior high schools registered in Japan in May 2008, 130 junior high schools (selection rate: 1.2%) and 110 senior high schools (selection rate: 2.2%) were sampled. We used a stratified, single-stage cluster-sampling method. Using this method, we divided Japan into regional blocks and randomly selected schools from each block. To avoid any sampling bias toward any regional blocks, stratified sampling was performed with regional blocks as the strata. All the students enrolled in the sampled schools were the subjects of this study. The sample size was determined by referring to the response rate and confidence intervals based on the variance of the results obtained from the previous studies.[17]

In the Japanese education system, children enter primary school at the age of 6 years and leave after 6 years of study. They then enter junior high school for 3 years of study, followed by a further 3 years at senior high school. In this report, the first to third years of junior high school are called the 7th to 9th grades, and the first to third years of senior high school are called the 10th to 12th grades.

Survey Procedure

We sent a letter to the principal of each selected school asking for cooperation in our survey, along with the same number of questionnaires and envelopes as the number of students enrolled at the school. At each school that agreed to participate in our survey, each class teacher was instructed to protect the privacy of the respondents and to explain to the students that the completed questionnaires would not be seen by the teachers and that it was not necessary for the students to participate if they were not willing to do so. After the questionnaires had been completed, they were placed in the envelopes provided, which were then sealed with an adhesive flap. Delivery and collection of the questionnaires were entrusted to the teachers, who were instructed to follow the guidelines for conducting the survey. The teachers collected and sent the sealed envelopes back to Nihon University School of Medicine without opening them. The survey period was from December 2008 to the end of January 2009. This survey was approved by the Ethics Committee of Nihon University School of Medicine. Financial support for this study was provided by a health science research grant from the Ministry of Health, Labor and Welfare of the Japanese government.

Response Rates

Replies were obtained from 92 junior high schools (school response rate, 70.8%) and 80 senior high schools (school response rate, 72.7%). A total of 95,680 envelopes were collected. The student response rate as a proportion of students enrolled at the sampled schools was 92.3% for the junior high schools, 83.8% for the senior high schools, and 87.2% as a whole. Accordingly, the overall response rate was 64.1% for the junior high schools, 62.1% for the senior high schools, and 62.9% as a whole.

Of the collected questionnaires, 903 were excluded because the sex or grade was not specified or the answers were inconsistent. The data for the remaining 94,777 questionnaires were analyzed.

Measures

The major areas that were included in the questionnaire were (1) personal data, (2) lifestyle, (3) mental health status, and (4) feelings of anger and impulsivity. The personal data included sex, school grade, and type of school (junior/senior high school).

The questions related to lifestyle were whether the student ate breakfast (daily/occasionally/never) and whether he or she participated in extracurricular activities (participating/not participating). Moreover, the question, "How many days did you smoke during the previous month?" was included in the questionnaire. Similarly, the question "How many days

did you consume alcoholic beverages during the previous month?" was asked. In addition, a question regarding sleep duration was included. The question about sleep duration was "How many hours on average have you slept at night during the previous month? (less than 5 hours/5 hours or more but less than 6 hours/6 hours or more but less than 7 hours/7 hours or more but less than 8 hours/8 hours or more but less than 9 hours/9 hours or more). If the response to this question was "less than 5 hours," then the student was defined as having short sleep duration. A question about the number of hours of mobile-phone use per day was also included (less than 1 hour/1 hour or more but less than 2 hours/2 hours or more).

To evaluate the mental health status of the respondents, 2 independent factors (depression/anxiety and decrease in positive feeling) included in the 12-item General Health Questionnaire (GHQ-12)[18,19] were used. One of the items from the depression/anxiety factor (whether the respondent had felt an unusual amount of unhappiness and depression in the previous 30 days) was evaluated (not at all/no more than usual/more than usual/much more than usual). One of the items from the decrease in positive feeling factor (whether the respondent was able to enjoy normal activities more than usual in the previous month) was also evaluated (more so than usual/same as usual/less than usual/much less than usual). Previous studies have shown that evaluation of mental health status using depression symptoms with the GHQ-12 and with this cutoff point has a sensitivity of 87.0% and a specificity of 85.1%.[20]

The question on feelings of anger was "Have only you felt angry, or have you felt angry more strongly than others during the previous month, even though you may have seen, heard, or experienced the same things as others?" The question on impulsivity was "Have you behaved impulsively (for example, behaved violently, used abusive language, made an impulsive purchase despite having no money, ate or drank too much, etc.) during the previous month?" Participants were requested to select 1 answer option for each of these questions from among the following options: never, seldom, sometimes, often, and always. Those who selected often or always were defined as having experienced intense anger or impulsivity.

Statistical Analyses

First, the frequency of experiencing feelings of anger was calculated, based on sex and grade level. We examined associations between school grade and the frequency of experiencing feelings of anger based on sex, using the χ^2 test. We then examined associations between sex and the frequency of experiencing feelings of anger, again using the χ^2 test. Next, multiple logistic regression analysis was performed to examine the factors associated with intense feelings of anger. Specifically, experiencing intense feelings of anger was used as an objective variable, and the following factors were considered as independent variables: sex, grade level, alcohol-drinking, smoking, eating breakfast, extracurricular activities, wish to go to university, sleep duration, mental health status, and hours of mobile-phone use per day.

Analysis of impulsivity was also performed using the same methods as those described above for feelings of anger. We set the level of significance at $P < .05$. All analyses were performed using IBM SPSS Statistics version 19.0 for Windows (IBM Corp, Somers, New York).

RESULTS

Prevalence of Anger and Impulsivity

Table 1 shows the frequency of experiencing feelings of anger based on sex and grade. The prevalence of experiencing intense feelings of anger among the participants as a whole was 8.7% (95% CI, 8.5%–8.9%), and the corresponding prevalences for male and female students were 7.8% (95% CI, 7.6%–8.0%) and 9.6% (95% CI, 9.3%–9.9%), respectively. The prevalence among girls was higher than that among boys in all school grades and also became higher for both sexes as the grade level increased.

Table 2 shows the frequency of experiencing impulsivity based on sex and grade. The prevalence of experiencing intensive impulsivity among the participants as a whole was 7.5% (95% CI, 7.3%–7.7%), and the corresponding prevalences for male and female students were 7.0% (95% CI, 6.8%–7.2%) and 8.1% (95% CI, 7.9%–8.3%), respectively. The prevalence among girls was higher than that among boys in all school grades and also became higher for both sexes as the grade level increased.

Logistic-Regression Analyses

Table 3 shows the results of multiple logistic regression analysis in which experiencing intense feelings of anger was used as an objective variable. The adjusted odds ratios for experiencing intense feelings of anger were significantly higher among students who smoked, consumed alcohol, skipped breakfast, did not wish to go to university, had short sleep duration, had decreased positive feelings, had increased depressive feelings, or used mobile phones for longer hours.

Table 4 shows the results of multiple logistic regression analysis in which experiencing intense impulsivity was used as an objective variable. The adjusted odds ratios for experiencing intensive impulsivity were significantly higher among students who smoked, consumed alcohol, skipped breakfast, did not participate in club activities, did not wish to go to university, had short sleep duration, had decreased positive feelings, had increased depressive feelings, or used mobile phones for longer hours.

DISCUSSION

The results of this study appear to be representative of the study population for 3 reasons: (1) the subject schools were selected randomly from among those nationwide, (2) the sample size was very large with the number of analyzed responses exceeding 90,000, and (3) the rate of response to the questionnaires was acceptably high.

Table 1. Experiences of Feeling Anger Among Japanese Adolescents, Based on Sex and Grade at School

Subject	n[a]	Have Only You, Compared With Your Counterparts, Felt Angry During the Previous Month? (%)					P^b	P^c
		Never	Seldom	Sometimes	Often	Always		
Male							<.001	<.001
Junior high school								
7th grade	6,431	61.6	19.2	13.2	3.6	2.4		
8th grade	6,697	60.1	19.3	13.6	4.6	2.4		
9th grade	6,232	60.0	18.0	14.3	4.6	3.1		
Senior high school								
10th grade	10,055	54.4	19.7	17.5	5.5	2.9		
11th grade	9,485	52.7	19.8	18.9	5.6	3.0		
12th grade	8,656	56.1	17.5	17.9	5.1	3.3		
Total	47,556	56.9	19.0	16.3	4.9	2.9		
Female							<.001	
Junior high school								
7th grade	6,709	54.3	22.3	16.1	4.7	2.6		
8th grade	6,782	50.0	22.0	18.8	6.4	2.7		
9th grade	6,517	46.9	22.3	21.3	6.2	3.3		
Senior high school								
10th grade	9,883	42.6	24.1	23.0	6.9	3.4		
11th grade	8,569	40.8	23.8	24.5	7.1	3.7		
12th grade	7,818	45.5	22.1	22.9	6.6	2.9		
Total	46,278	46.1	22.9	21.4	6.4	3.2		

[a]Subjects with missing data were excluded from the analysis.
[b]*P* was calculated by χ^2 test, 5 (Anger: never, seldom, sometimes, often, always) × 2 (Sex: Male, Female).
[c]*P* was calculated by χ^2 test, 5 (Anger: never, seldom, sometimes, often, always) × 6 (Grade: 7th, 8th, 9th, 10th, 11th, 12th).

Table 2. Experiences of Impulsivity Among Japanese Adolescents, Based on Sex and Grade at School

Subject	n[a]	Have You Behaved Impulsively During the Previous Month? (%)					P^b	P^c
		Never	Seldom	Sometimes	Often	Always		
Male							<.001	<.001
Junior high school								
7th grade	6,431	66.6	15.7	12.5	3.5	1.7		
8th grade	6,697	63.5	17.3	13.1	4.2	2.0		
9th grade	6,232	64.4	15.3	13.7	4.1	2.5		
Senior high school								
10th grade	10,055	58.3	18.6	15.9	4.7	2.5		
11th grade	9,485	57.1	18.3	17.1	5.2	2.4		
12th grade	8,656	58.8	16.1	16.9	5.2	3.0		
Total	47,556	60.8	17.1	15.2	4.6	2.4		
Female							<.001	
Junior high school								
7th grade	6,709	64.8	16.9	13.0	3.5	1.9		
8th grade	6,782	60.7	17.8	14.9	4.9	1.8		
9th grade	6,517	57.6	18.4	16.5	5.0	2.5		
Senior high school								
10th grade	9,883	49.2	20.9	21.1	6.3	2.6		
11th grade	8,569	47.0	20.1	23.4	6.6	2.9		
12th grade	7,818	49.7	19.6	21.6	6.3	2.8		
Total	46,278	54.0	19.1	18.9	5.6	2.5		

[a]Subjects with missing data were excluded from the analysis.
[b]*P* was calculated by χ^2 test, 5 (Impulsivity: never, seldom, sometimes, often, always) × 2 (Sex: Male, Female).
[c]*P* was calculated by χ^2 test, 5 (Impulsivity: never, seldom, sometimes, often, always) × 6 (Grade: 7th, 8th, 9th, 10th, 11th, 12th).

In this study, significant associations were recognized between anger/impulsivity and smoking/alcohol consumption. Dose-response relationships were observed between them; the adjusted odds ratio for anger or impulsivity increased as the amount of smoking or alcohol consumption increased. With regard to associations between smoking and anger, Gehricke et al[21] performed an experiment in which 20 nonsmokers were divided into 2 groups, 1 with and 1 without attached nicotine patches, who were then required to play a match-type computer game. The time taken to react against an opponent's attack (a shorter time reflecting a higher intensity of anger) and the length of retaliation (a longer time reflecting a higher intensity of anger) were then measured as anger indices. At the same time, the active areas of the

Table 3. Factors Associated With Experiencing Intense Anger[a] Among Japanese Adolescents

Factor	n[b]	AOR	95% CI	P[c]
Sex				.284
Male	43,733	1.00		
Female	43,195	1.03	0.98–1.08	
Grade				<.001***
7th	11,768	1.00		
8th	12,296	1.06	0.96–1.17	
9th	11,712	1.01	0.91–1.12	
10th	18,736	0.90	0.82–1.00	
11th	16,995	0.89	0.81–0.98	
12th	15,421	0.80	0.72–0.89	
Number of cigarettes smoked/d				<.001***
0	82,416	1.00		
1–10	3,228	1.58	1.42–1.76	
11–20	804	1.58	1.30–1.92	
≥21	480	2.72	2.17–3.42	
Number of days of alcohol intake/mo				<.001***
0	72,329	1.00		
1–5	12,339	1.24	1.16–1.33	
6–19	1,817	1.62	1.41–1.86	
≥20	443	2.65	2.08–3.38	
Eating breakfast every day				<.001***
Yes	73,604	1.00		
No	13,324	1.16	1.09–1.24	
Participation in club activities				.736
Yes	60,348	1.00		
No	26,580	0.99	0.94–1.05	
Wishing to go to university				.005**
Yes	38,854	1.00		
No	48,074	1.08	1.02–1.15	
Sleep duration, h/d				<.001***
≥5	72,546	1.00		
<5	14,382	1.26	1.18–1.34	
Enjoying normal activities				<.001***
More so than usual	31,757	1.00		
Same as usual	46,313	1.03	0.97–1.09	
Less than usual	5,876	1.72	1.58–1.88	
Much less than usual	2,982	3.66	3.33–4.02	
Having depressive feelings				<.001***
Not at all	19,175	1.00		
No more than usual	28,933	1.56	1.40–1.73	
More than usual	26,976	4.26	3.86–4.70	
Much more than usual	11,844	5.73	5.17–6.36	
Hours of mobile-phone use, h/d				<.001***
None	12,666	1.00		
<1	29,865	1.01	0.92–1.11	
1–2	15,727	1.16	1.05–1.29	
≥2	28,670	1.62	1.47–1.78	

[a]Those who selected never, seldom, or sometimes to the question on the frequency of uniquely feeling angry during the previous month were defined as "without (experience)," and those who selected often or always were defined as "with (experience)."
[b]Subjects with missing data were excluded from the analysis.
[c]*P* was calculated by the multiple logistic regression analysis.
**$P < .01$. ***$P < .001$.
Abbreviations: AOR = adjusted odds ratio, CI = confidence interval.

Table 4. Factors Associated With Experiencing Intense Impulsivity[a] Among Japanese Adolescents

Factor	n[b]	AOR	95% CI	P[c]
Sex				.818
Male	43,733	1.00		
Female	43,195	0.99	0.94–1.05	
Grade				.144
7th	11,768	1.00		
8th	12,296	1.02	0.92–1.15	
9th	11,712	0.97	0.87–1.09	
10th	18,736	0.93	0.83–1.03	
11th	16,995	0.92	0.82–1.02	
12th	15,421	0.90	0.80–1.01	
Number of cigarettes smoked/d				<.001***
0	82,416	1.00		
1–10	3,228	1.60	1.44–1.78	
11–20	804	1.56	1.29–1.88	
≥21	480	3.06	2.47–3.80	
Number of days of alcohol intake/mo				<.001***
0	72,329	1.00		
1–5	12,339	1.46	1.37–1.56	
6–19	1,817	1.98	1.73–2.26	
≥20	443	3.36	2.67–4.24	
Eating breakfast everyday				<.001***
Yes	73,604	1.00		
No	13,324	1.24	1.16–1.33	
Participation in club activities				<.001***
Yes	60,348	1.00		
No	26,580	1.12	1.05–1.18	
Wishing to go to university				.010*
Yes	38,854	1.00		
No	48,074	1.08	1.02–1.15	
Sleep duration, h/d				<.001***
≥5	72,546	1.00		
<5	14,382	1.33	1.25–1.42	
Enjoying normal activities				<.001***
More so than usual	31,757	1.00		
Same as usual	46,313	0.95	0.89–1.01	
Less than usual	5,876	1.41	1.28–1.55	
Much less than usual	2,982	2.32	2.09–2.58	
Having depressive feelings				<.001***
Not at all	19,175	1.00		
No more than usual	28,933	1.41	1.27–1.55	
More than usual	26,976	2.49	2.27–2.74	
Much more than usual	11,844	3.37	3.04–3.72	
Hours of mobile-phone use, h/d				<.001***
None	12,666	1.00		
<1	29,865	1.05	0.94–1.16	
1–2	15,727	1.32	1.17–1.48	
≥2	28,670	2.14	1.93–2.37	

[a]Those who selected never, seldom, or sometimes to the question on the frequency of impulsive behavior during the previous month were defined as "without (experience)," and those who selected often or always were defined as "with (experience)."
[b]Subjects with missing data were excluded from the analysis.
[c]*P* was calculated by the multiple logistic regression analysis.
*$P < .05$. ***$P < .001$.
Abbreviations: AOR = adjusted odds ratio, CI = confidence interval.

brain were observed using positron emission tomography. The results of the study suggested that nicotine does have an impact on the areas of the brain involved in the inhibition of negative emotions such as anger.

Chermack and Giancola[22] conducted an interesting study on the effects of alcohol consumption on impulsivity or aggression. Two subjects competed with each other to show the most rapid response to optical stimuli on a computer screen, and the winner was allowed to inflict an electric shock on the loser. The results of the study suggested an association between alcohol intake and the level of aggression. Josephs and Steele[23] have pointed out a phenomenon known as alcohol myopia, in which an intoxicated person's attention is attracted to stimuli at the center of his/her consciousness whereas his/her interests in stimuli at the periphery of consciousness (such as future consequences of actions) are decreased.

Our present findings revealed a significant association between skipping breakfast and anger/impulsivity. Harada et al[24] conducted a questionnaire survey on the

ingredients of meals eaten by 2,279 children aged 0–15 years. The researchers subsequently calculated the amount of tryptophan taken in at breakfast and then examined associations between the amount of tryptophan ingested and anger. The results suggested an association between tryptophan intake and levels of anger in children.

The present study also demonstrated a significant association between short sleep duration and anger/impulsivity. In a study of 20 university students, Taub[25] reported that students with short sleep times exhibited significantly higher levels of anger, as scored on a mood scale. However, other epidemiologic studies[26–28] have reported no significant association between sleep duration and anger. Thus, at least in terms of epidemiology, no conclusive results have yet emerged.[29] In the context of brain science, 1 of the hypotheses proposed for the mechanism whereby sleep deprivation causes anger is a decline in function of the prefrontal cortex.[29–36] With regard to associations between sleep and impulsivity, Ireland and Culpin[37] conducted a study of 184 prisoners aged 14–20 years who were serving jail sentences because of violence or traffic offenses. The subjects were questioned about sleep quantity before and after imprisonment, as well as the intensity of impulsivity, using the Barratt Impulsivity Scale-II,[38] and the results were then evaluated and analyzed to examine associations. This revealed an association between impulsivity and sleep quantity. Several other studies conducted previously have also reported an association between sleep deprivation and impulsivity.[39–41]

The present study also revealed a significant association between long hours of mobile-phone use and anger/impulsivity. Billieux et al[42] conducted a questionnaire survey of 108 female undergraduate psychology students to investigate the actual conditions of mobile-phone use and self-awareness of their own mobile phone dependency; the level of impulsivity was evaluated using the UPPS Impulsive Behavior Scale. They reported that a relationship could be established between the use of and perceived dependence on a mobile phone and 2 facets of impulsivity: urgency and lack of perseverance.

The present study demonstrated significant associations between mental health status, such as an increase in depression and a decrease in positive affect, and anger/impulsivity. Swanson et al[43] conducted an epidemiologic catchment area survey and reported an association between depression and violent behavior. Fava et al[44] reported that some patients expressed sudden anger when presenting with symptoms similar to a panic attack and that patients having such attacks were more likely to have a higher rate of depression. Such attacks were named anger attacks.

The present study had some limitations. First, because the data were collected through a self-administered questionnaire and the collected responses were subjective, it is possible that there were differences between the prevalence found in this study and the actual prevalence. Second, because the questionnaire response rate for junior and senior high schools as a whole was 62.9%, a certain degree of nonresponse bias may have existed. However, this response rate is considered to be sufficient for this type of epidemiologic survey. Third, because this was a cross-sectional study, a causal relationship could not be determined. For example, this study found associations between lifestyle habits (such as smoking and alcohol intake) and anger/impulsivity, such that lifestyle habits may induce anger or impulsivity. However, the possibility that anger/impulsivity may induce these lifestyle habits cannot be refuted. A longitudinal study is needed to resolve this limitation and to establish a causal relationship.

Based on the present findings, it is suggested from a public health viewpoint that if intensive anger or impulsivity is recognized in adolescents, lifestyle habits (such as smoking and alcohol consumption) that may harm their future health or create problems with their mental status may be an issue. The findings of this study may be useful in suggesting important areas for further exploration and guidance for adolescents with self-reported issues of anger/impulsivity. In addition, from a clinical psychiatric perspective, the findings of our study may be helpful for the diagnosis, screening, and treatment of underlying diseases such as attention-deficit/hyperactivity disorder (ADHD). ADHD is a clinical psychiatric disease for which the diagnostic criterion is impulsivity; an associated feature that supports the diagnosis is irritability (sudden outbursts of anger).[45] Furthermore, the associations between lifestyle habits and anger/impulsivity demonstrated in our study may serve to improve our understanding of the pathological background of diseases such as ADHD.

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