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ORIGINAL RESEARCH

Effect of an educational program on adolescent premenstrual syndrome: lessons from the Great East Japan Earthquake

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Background: Catastrophic disasters such as great earthquakes cause tremendous physical and mental damage. We previously reported that the Great East Japan Earthquake worsened premenstrual symptoms among adolescent girls in the disaster-stricken area.

Objectives: We reanalyzed these data to determine the positive effects of education on premenstrual symptoms.

Materials and methods: Annual school-based surveys about premenstrual syndrome (PMS) or premenstrual dysphoric disorder (PMDD) have been conducted in Sendai since 2009. The Great East Japan Earthquake occurred on March 11, 2011. First-year students in one school had received education on PMS/PMDD before the earthquake, whereas those in another school had not. We reanalyzed data for 1431 girls (November 2010) and 1489 girls (December 2011) aged 15–18 years.

Results: The severity of PMS/PMDD in students who had received the education program showed no changes between before and after the earthquake. However, students who had not received education showed worsening of the severity of PMS/PMDD.

Conclusion: This study showed education had a possible beneficial effect for the prevention of stress-induced PMS/PMDD.

Keywords: premenstrual syndrome, premenstrual dysphoric disorder, Great East Japan Earthquake, adolescents, education

Background

Adolescence is an important and vulnerable period between childhood and adulthood. Premenstrual syndrome (PMS) is a collection of mood, behavioral, and physical symptoms that occurs 7–14 days before the onset of menstruation.[1] Epidemiologic surveys indicate that premenstrual symptoms have high frequency (80%–90%), and about 5% of women experience symptoms that are so severe that they interfere with personal/social relationships or work.[2] This severe form of PMS is defined as premenstrual dysphoric disorder (PMDD). Previously, we reported that PMS and PMDD are common menstrual problems in adolescents and should be treated as carefully as dysmenorrhea.[3] We also reported that one in nine Japanese female high school students had absences from school due to PMS.[4]

On March 11, 2011, the Great East Japan Earthquake occurred, and a massive tsunami hit the northeastern coast of Japan. Catastrophic disasters such as these cause tremendous physical and mental damage.[5] In general, women are more sensitive to traumatic events than men,[5] and there is a recognized association between stress and

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PMS/PMDD.[6,7] In a previous study, we demonstrated a relationship between PMS/PMDD and earthquake-induced post-traumatic stress disorder (PTSD)[8]; the prevalence rate of moderate to severe PMS/PMDD increased according to the comorbidity of PTSD.

Disasters such as major earthquakes cannot be predicted, so it is necessary to explore preventive measures for PMS/PMDD on a routine basis. Several previous studies have noted the beneficial effects of educational programs on PMS/PMDD,[9,10] but there are few data about whether educational programs can prevent disaster-induced PMS/PMDD. This study used data from our previous school-based study to further investigate the effect of educational programs on PMS/PMDD. By chance, the study was conducted with first-year students in one school before the earthquake; students in the second school had not received the program before the earthquake.

The aim of this study was to determine the positive effects of education on disaster-induced premenstrual symptoms.

Materials and methods

Study design and participants

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. The Tohoku University Institutional Review Board approved the study.

A school-based survey was conducted in November 2010 (n=1431) and December 2011 (n=1489) with a sample of Japanese female students who attended two comprehensive high schools in Sendai, an industrial city in northeastern Japan (Figure 1). All the students gave written informed consent for themselves. This protocol was approved by the Tohoku University Institutional Review Board. These two schools were chosen because they are close to Tohoku University in Sendai city. We have conducted this survey annually since 2009, using a self-reported questionnaire to assess the prevalence and impact of premenstrual symptoms among Japanese students attending these schools.[3,8,11] The study questionnaires are distributed by the home room teacher, completed, sealed in envelopes, and collected in the class. In this study, we reanalyzed the data by school year and compared PMS/PMDD severity before and after the Great East Japan Earthquake to evaluate any changes.

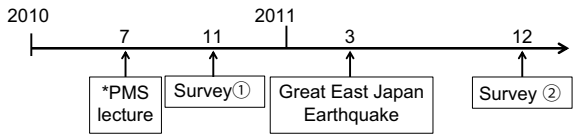

Figure 1 Time course of the surveys.
Note: *Only first-year students in school A received the educational program on premenstrual syndrome (PMS)/premenstrual dysphoric disorder (PMDD).

First-year students in one school received an educational program on PMS/PMDD in July 2010. The program comprised a 30-min health education lecture. The content covered 1) physiology of female reproductive systems; 2) prevalence of PMS/PMDD; and 3) symptoms of and self-care treatments for PMS/PMDD. This lecture was set as a required course, and both girls and boys were in the classroom.

We made a hypothesis that the educational program on PMS/PMDD could prevent the disaster-induced premenstrual symptoms. Then we compared the change of the severity of PMS/PMDD with or without the education.

Questionnaire

We used the Premenstrual Symptoms Questionnaire (PSQ) to screen for premenstrual symptoms. The PSQ was developed in our previous study[12] and translates relevant Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria into a rating scale, with degrees of severity described in Japanese. The scale is essentially identical to the Premenstrual Symptoms Screening Tool.[13] The PSQ asked, "Within the last 3 months, have you experienced the following premenstrual symptoms starting during the week before menses and remitting a few days after the onset of menses?" The premenstrual symptoms listed in the PSQ are "Depressed mood," "Anxiety or tension," "Tearfulness," "Anger or irritability," "Decreased interest in work, home, or social activities," "Difficulty concentrating," "Fatigue or lack of energy," "Overeating or food cravings," "Insomnia or hypersomnia," "Feeling overwhelmed," and "Physical symptoms, such as tender breasts, feeling bloated, headache, joint or muscle pain, weight gain." The PSQ also asked whether these premenstrual symptoms interfered with "School work efficiency or productivity, home responsibilities," "Social life activities," or "Relationships with fellow students or family." The PSQ asked the girls to rate the severity of premenstrual symptoms as "not at all," "mild," "moderate," or "severe." We divided the girls into three groups according to premenstrual symptoms: a PMDD group, a moderate to severe PMS group, and a no/mild PMS group, based on previously reported criteria.[12,13]

Statistical analyses

Statistical analyses were performed using Excel 2010 (Microsoft Corporation, Redmond, WA, USA) with add-in software Statcel 3 (OMS Inc., Tokyo, Japan). Statistical significance

was set at $p<0.05$. The Mann–Whitney *U*-test was used to test differences in the degree of severity of premenstrual symptoms and PMS/PMDD grade.

Results

First-year students in school A received the educational program on PMS/PMDD. The prevalence of each premenstrual symptom and induced interference with school work, usual activities, or relationships among these students did not change significantly between before and after the earthquake (Table 1). In addition, the severity of PMS/PMDD did not change significantly ($p=0.261$) (Figure 2A). Among second-year students in school A, the prevalence of each premenstrual symptom and induced interference with school work, usual activities, or relationships did not change significantly between before and after the earthquake (Table 2), but the severity of PMS/PMDD changed significantly ($p=0.044$) (Figure 2B). However, the first- and second-year students in school B (that did not receive the education program before the earthquake) showed an increased prevalence of each premenstrual symptom and induced interference with school work, usual activities, or relationships (Tables 3 and 4). In addition, the severity of PMS/PMDD changed significantly ($p=0.037$, $p=0.001$) (Figure 2C and D).

Discussion

Our data suggest that the PMS/PMDD educational program, which was delivered just before the earthquake, may have prevented the worsening of stress-induced PMS/PMDD. Several previous reports have noted the beneficial effects of educational programs on premenstrual symptoms.[9,10] The present study differs from these studies because we showed education had a preventative effect on PMS/PMDD progression.

Table 1 Prevalence rates of premenstrual symptoms and induced interference with school work, usual activities, or relationships with degrees of severity among school A students (2010, first year and 2011, second year)

	Not at all	Mild	Moderate	Severe	*p* (Mann-Whitney *U*-test)
Number reporting premenstrual symptoms (%)					
Depressed mood	113 (59.2)	47 (24.6)	21 (11.0)	10 (5.2)	0.300
	132 (64.7)	40 (19.6)	26 (12.7)	6 (2.9)	
Anxiety or tension	80 (41.9)	64 (33.5)	41 (21.5)	6 (3.1)	0.463
	79 (38.7)	69 (33.8)	49 (24.0)	7 (3.4)	
Tearful	118 (61.8)	46 (24.1)	18 (9.4)	9 (4.7)	0.860
	129 (63.2)	42 (20.6)	28 (13.7)	5 (2.5)	
Anger or irritability	84 (44.0)	74 (38.7)	40 (20.9)	12 (6.3)	0.389
	65 (31.9)	52 (25.5)	43 (21.1)	10 (4.9)	
Decreased interest in work, home, or social activities	131 (68.6)	47 (24.6)	11 (5.8)	2 (1.0)	0.220
	151 (74.0)	43 (21.1)	8 (3.9)	2 (1.0)	
Difficulty concentrating	74 (38.7)	85 (44.5)	26 (13.6)	6 (3.1)	0.065
	98 (48.0)	78 (38.2)	26 (12.7)	2 (1.0)	
Fatigue or lack of energy	62 (32.5)	75 (39.3)	44 (23.0)	10 (5.2)	0.213
	75 (36.8)	81 (39.7)	43 (21.1)	5 (2.5)	
Overeating or food cravings	103 (53.9)	51 (26.7)	28 (14.7)	9 (4.7)	0.715
	109 (53.4)	50 (24.5)	31 (15.2)	14 (6.9)	
Insomnia or hypersomnia	107 (56.0)	42 (22.0)	28 (14.7)	14 (7.3)	0.365
	117 (57.4)	59 (28.9)	19 (9.3)	9 (4.4)	
Feeling overwhelmed	143 (74.9)	38 (19.9)	7 (3.7)	3 (1.6)	0.620
	158 (77.5)	32 (15.7)	14 (6.9)	0 (0.0)	
Physical symptoms	94 (49.2)	51 (26.7)	37 (19.4)	9 (4.7)	0.119
	84 (41.2)	60 (29.4)	51 (25.0)	9 (4.4)	
Number reporting interference with work, usual activities, or relationships (%)					
Work efficiency or productivity	102 (53.4)	62 (32.5)	22 (11.5)	5 (2.6)	0.836
Home responsibilities	109 (53.4)	70 (34.3)	23 (11.3)	2 (1.0)	
Social life activities	150 (78.5)	32 (16.8)	7 (3.7)	2 (1.0)	0.515
	165 (80.9)	33 (16.2)	6 (2.9)	0 (0.0)	
Relationships with coworkers or family	159 (83.2)	29 (15.2)	2 (1.0)	1 (0.5)	0.422
	173 (84.8)	28 (13.7)	3 (1.5)	0 (0.0)	

Notes: Results for upper line, school A (2010, first year) (n=191); results for lower line, school A (2011, second year) (n=204).

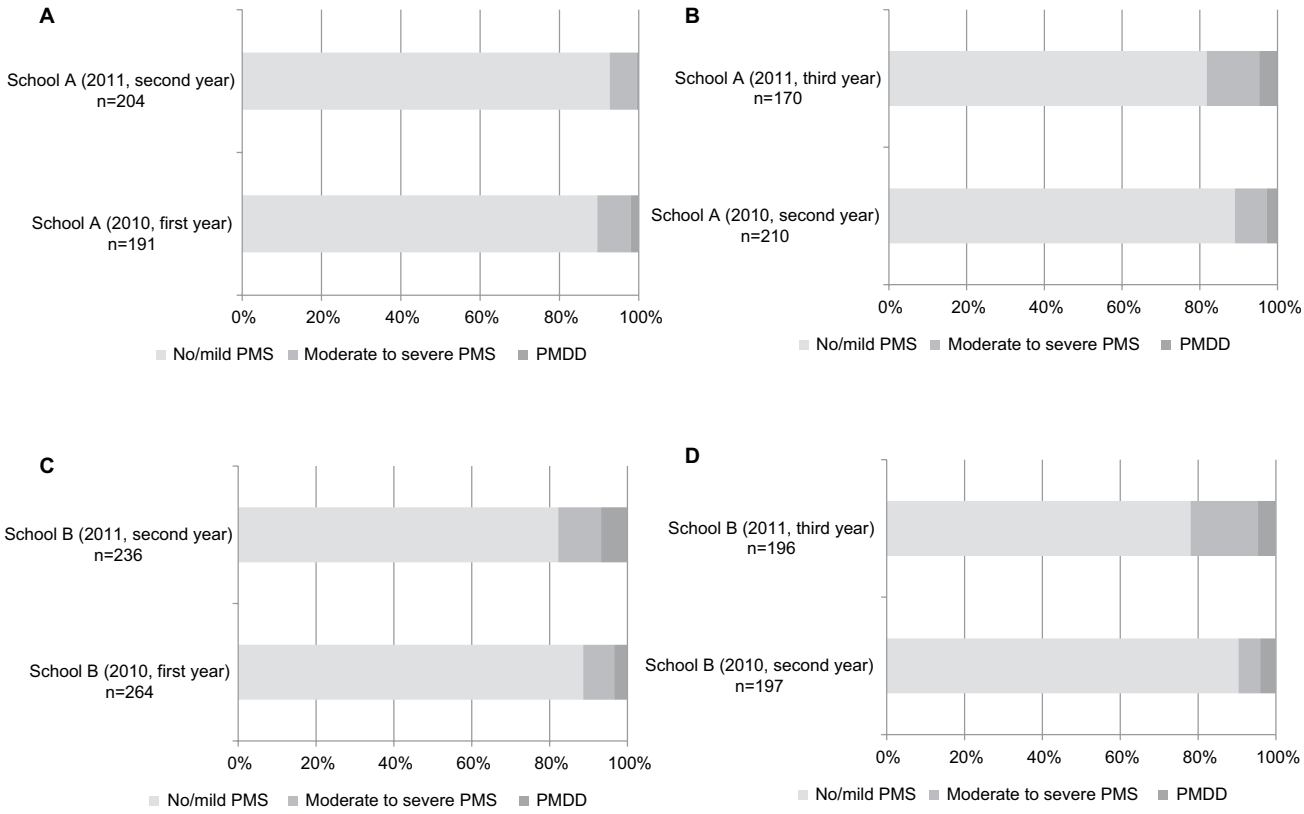

Figure 2 Changes in the severity of premenstrual syndrome (PMS)/premenstrual dysphoric disorder (PMDD).

Table 2 Prevalence rates of premenstrual symptoms and induced interference with school work, usual activities, or relationships with degrees of severity among school A students (2010, second year and 2011, third year)

	Not at all	Mild	Moderate	Severe	*p* (Mann-Whitney *U*-test)
Number reporting premenstrual symptoms (%)					
Depressed mood	111 (52.9)	58 (27.6)	30 (14.3)	11 (5.2)	0.164
	78 (45.9)	52 (30.6)	28 (16.5)	12 (7.1)	
Anxiety or tension	82 (39.0)	67 (31.9)	47 (22.4)	14 (6.7)	0.218
	58 (34.1)	51 (30.0)	51 (30.0)	10 (5.9)	
Tearful	126 (60.0)	43 (20.5)	29 (13.8)	12 (5.7)	0.097
	89 (52.4)	35 (20.6)	35 (20.6)	11 (6.5)	
Anger or irritability	84 (40.0)	74 (35.2)	40 (19.0)	12 (5.7)	0.389
	65 (38.2)	52 (30.6)	43 (25.3)	10 (5.9)	
Decreased interest in work, home, or social activities	139 (66.2)	56 (26.7)	12 (5.7)	3 (1.4)	0.507
	120 (70.6)	34 (20.0)	11 (6.5)	5 (2.9)	
Difficulty concentrating	91 (43.3)	83 (39.5)	31 (14.8)	5 (2.4)	0.622
	74 (43.5)	60 (35.3)	25 (14.7)	11 (6.5)	
Fatigue or lack of energy	78 (37.1)	77 (36.7)	44 (21.0)	11 (5.2)	0.371
	60 (35.3)	56 (32.9)	42 (24.7)	12 (7.1)	
Overeating or food cravings	107 (51.0)	60 (28.6)	33 (15.7)	10 (4.8)	0.619
	95 (55.9)	35 (20.0)	33 (19.4)	7 (4.1)	

(*Continued*)

Table 2 (*Continued*)

	Not at all	Mild	Moderate	Severe	*p* (Mann-Whitney *U*-test)
Insomnia or hypersomnia	112 (53.3)	60 (28.6)	30 (14.3)	8 (3.8)	0.235
	84 (49.4)	45 (26.5)	28 (16.5)	13 (7.6)	
Feeling overwhelmed	158 (75.2)	38 (18.1)	12 (5.7)	2 (1.0)	0.070
	115 (67.6)	34 (20.0)	17 (10.0)	4 (2.4)	
Physical symptoms	100 (47.6)	73 (34.8)	28 (13.3)	9 (4.3)	0.202
	70 (41.2)	63 (37.1)	32 (18.8)	5 (2.9)	
Number reporting interference with work, usual activities, or relationships (%)					
Work efficiency or productivity	98 (46.7)	82 (39.0)	22 (10.5)	8 (3.8)	0.124
Home responsibilities	72 (42.4)	58 (34.1)	31 (18.2)	9 (5.3)	
Social life activities	180 (76.2)	36 (17.1)	9 (4.3)	5 (2.4)	0.388
	136 (80.0)	24 (14.1)	6 (3.5)	4 (2.4)	
Relationships with coworkers or family	174 (82.9)	29 (13.8)	6 (2.9)	1 (0.5)	0.229
	133 (78.2)	27 (15.9)	8 (4.7)	2 (1.2)	

Notes: Results for upper line, school A (2010, second year) (n=210); results for lower line, school A (2011, third year) (n=170).

Table 3 Prevalence rates of premenstrual symptoms and induced interference with school work, usual activities, or relationships with degrees of severity among School B students (2010, first year and 2011, second year)

	Not at all	Mild	Moderate	Severe	*p* (Mann-Whitney *U*-test)
Number reporting premenstrual symptoms (%)					
Depressed mood	155 (58.7)	68 (25.8)	23 (8.7)	18 (6.8)	0.014
	116 (49.2)	60 (25.4)	23 (18.6)	16 (6.8)	
Anxiety or tension	89 (33.7)	85 (44.5)	64 (24.2)	26 (9.8)	0.018
	60 (25.4)	75 (31.8)	68 (28.8)	33 (14.0)	
Tearful	156 (59.1)	53 (20.1)	42 (15.9)	13 (4.9)	0.086
	123 (52.1)	50 (21.2)	47 (19.9)	16 (6.8)	
Anger or irritability	103 (39.0)	74 (28.0)	68 (25.8)	19 (7.2)	0.012
	63 (26.7)	80 (33.9)	71 (30.1)	22 (9.3)	
Decreased interest in work, home, or social activities	154 (58.3)	67 (25.4)	35 (13.3)	8 (3.0)	0.835
	134 (56.8)	66 (28.0)	28 (11.9)	8 (3.4)	
Difficulty concentrating	98 (37.1)	109 (41.3)	48 (18.2)	9 (3.4)	0.893
	90 (38.1)	97 (41.1)	34 (14.4)	15 (6.4)	
Fatigue or lack of energy	68 (25.8)	97 (36.7)	72 (27.3)	27 (10.2)	0.927
	63 (26.7)	80 (33.9)	70 (29.7)	23 (9.7)	
Overeating or food cravings	120 (45.5)	78 (29.5)	49 (18.6)	17 (6.4)	<0.001
	73 (30.9)	74 (31.4)	61 (25.8)	28 (11.9)	
Insomnia or hypersomnia	127 (48.1)	76 (28.8)	43 (16.3)	18 (6.8)	0.504
	111 (47.0)	63 (26.7)	36 (15.3)	26 (11.0)	
Feeling overwhelmed	169 (64.0)	64 (24.2)	23 (8.7)	8 (3.0)	0.971
	155 (65.7)	46 (19.5)	22 (9.3)	13 (5.5)	
Physical symptoms	114 (43.2)	91 (34.5)	38 (14.4)	21 (8.0)	0.045
	84 (35.6)	81 (34.3)	51 (21.6)	20 (8.5)	
Number reporting interference with work, usual activities, or relationships (%)					
Work efficiency or productivity	134 (50.8)	82 (31.1)	38 (14.4)	10 (3.8)	0.952
Home responsibilities	118 (50.0)	81 (34.3)	25 (10.6)	12 (5.1)	
Social life activities	189 (71.6)	51 (19.3)	19 (7.2)	5 (1.9)	0.581
	174 (73.7)	44 (18.6)	11 (4.7)	7 (3.0)	
Relationships with coworkers or family	188 (71.2)	58 (22.0)	15 (5.7)	3 (1.1)	0.598
	175 (74.2)	42 (17.8)	7 (3.0)	12 (5.1)	

Note: Results for upper line, school B (2010, first year) (n=264); results for lower line, school B (2011, second year) (n=236).

Table 4 Prevalence rates of premenstrual symptoms and induced interference with school work, usual activities, or relationships with degrees of severity among School B students (2010, second year and 2011, third year)

	Not at all	Mild	Moderate	Severe	*p* (Mann-Whitney *U*-test)
Number reporting premenstrual symptoms (%)					
Depressed mood	105 (53.3)	53 (26.9)	25 (12.7)	14 (7.1)	0.012
	79 (40.3)	62 (31.6)	42 (21.4)	13 (6.6)	
Anxiety or tension	47 (23.9)	74 (37.6)	54 (27.4)	22 (11.2)	0.075
	35 (17.9)	69 (35.2)	66 (33.7)	26 (13.3)	
Tearful	109 (55.3)	42 (21.3)	34 (17.3)	12 (6.1)	0.171
	89 (45.4)	65 (33.2)	26 (13.3)	16 (8.2)	
Anger or irritability	61 (31.0)	67 (34.0)	49 (24.9)	20 (10.2)	0.078
	46 (23.5)	69 (35.2)	54 (27.6)	27 (13.8)	
Decreased interest in work, home, or social activities	126 (64.0)	48 (24.4)	19 (9.6)	4 (2.0)	0.122
	113 (57.7)	49 (25.0)	24 (12.2)	10 (5.1)	
Difficulty concentrating	75 (38.1)	82 (41.6)	32 (16.2)	8 (4.1)	0.138
	66 (33.7)	77 (39.3)	38 (19.4)	15 (7.7)	
Fatigue or lack of energy	58 (29.4)	70 (35.5)	54 (27.4)	15 (7.6)	0.090
	42 (21.4)	75 (38.3)	59 (30.1)	20 (10.2)	
Overeating or food cravings	64 (32.5)	59 (29.9)	54 (27.4)	20 (10.2)	0.030
	46 (23.5)	59 (30.1)	61 (31.1)	30 (15.3)	
Insomnia or hypersomnia	83 (42.1)	60 (30.5)	35 (17.8)	19 (9.6)	0.339
	72 (36.7)	63 (32.1)	43 (21.9)	18 (9.2)	
Feeling overwhelmed	126 (64.0)	48 (24.4)	20 (10.2)	3 (1.5)	0.302
	117 (59.7)	50 (25.5)	20 (10.2)	9 (4.6)	
Physical symptoms	73 (37.1)	59 (29.9)	49 (24.9)	16 (8.1)	0.501
	62 (31.6)	69 (35.2)	49 (25.0)	16 (8.2)	
Number reporting interference with work, usual activities, or relationships (%)					
Work efficiency or productivity	97 (50.8)	66 (34.6)	23 (12.0)	11 (5.8)	0.015
Home responsibilities	74 (36.3)	73 (35.8)	35 (17.2)	14 (6.9)	
Social life activities	150 (78.5)	28 (14.7)	15 (7.9)	4 (2.1)	0.086
	133 (65.2)	41 (20.1)	17 (8.3)	5 (2.5)	
Relationships with coworkers or family	148 (77.5)	32 (16.8)	11 (5.8)	6 (3.1)	0.377
	138 (67.6)	43 (21.1)	11 (5.4)	4 (2.0)	

Note: Results for upper line, school B (2010, second year) (n=197); results for lower line, school B (2011, third year) (n=196).

Our data showed that the prevalence of each premenstrual symptom and PMS-induced interference among second-year students in school A (who received the education program) did not change significantly from before to after the earthquake. However, a more detailed analysis showed that some symptoms (e.g., "Tearful" and "Feeling overwhelmed") showed a worsening tendency (p=0.097 and p=0.070, respectively). Although these changes were not significant, the accumulation of worsening symptoms led to a change in PMS/PMDD severity. Compared with the worsening of symptoms/induced interference in school B, second-year students in school A were not as severely affected by the earthquake, even though they had not received PMS/PMDD education before the earthquake. The precise reason for this difference is unknown, but it may be possible that the teachers, including the school nurse, in school A had more knowledge about PMS/PMDD through the program delivered to first-year students and could therefore manage other students affected by the earthquake.

A German prospective longitudinal community survey showed that women with PMDD had more often experienced physical threat, sexual abuse, and severe accidents than non-PMDD women.[6] It may be possible that school-based educational programs on premenstrual symptoms could prevent trauma-induced PMS/PMDD in later life.

Our study had several limitations. The main limitation was that all data were self-reported, so the study was susceptible to recall bias. The second limitation was that our study design was retrospective. However, a natural disaster such as the great earthquake cannot be predicted, meaning a prospective study would be impossible to conduct. The

fact that such disasters cannot be predicted makes our data more valuable, as they provide unique insight into the effect of a major stressor on PMS/PMDD among adolescent girls. Another limitation was that our data were limited to two high schools, and we cannot state with certainty that the sample was truly representative. However, these schools are comprehensive, so we consider that the data were obtained from a relatively general adolescent population in Japan.

Natural disasters are increasing due to climate change, and the number of terrorist attacks is also rising. Stress-induced PMS/PMDD will therefore probably also increase in future. Education programs in schools could be a safe and cost-effective way of preventing or reducing it.

Conclusion

Educational programs on PMS/PMDD for adolescent girls may be useful to prevent stress-induced PMS/PMDD. Lessons from the Great East Japan Earthquake provide us with valuable data.

Author contributions

TT and MS contributed to the drafting of the manuscript. TT was the main contributor to the study design, conception, and statistical analysis. All authors contributed towards data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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