Kawasaki Journal of Medical Welfare Vol. 26, No. 1, 2020 1－8

Original Paper

Self-harm Behaviors among Japanese High School Students: Chronological Changes at the Individual and Group Levels in a Provincial City Area of Japan

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(Accepted July 14, 2020)

Key words: self-harm behaviors, Japanese high school students, longitudinal survey, latent curve models

Abstract

This study aimed to obtain basic materials contributing to preventive intervention against self-harm behavior among high school students, and its purpose was to examine chronological changes of self-harm behavior in individuals and groups during three years in high school with the use of latent growth curve models. The survey consisted of 418 students enrolled in two ordinary high schools, and conducted a three-wave panel survey for three years from 2015 to 2017 using a self-answering questionnaire. The survey consisted of basic attributes and self-harm behavior (punching, stabbing, pinching, scraping, and cutting). For statistical analysis, data of 184 participants without missing values for survey items was used. And we presumed intercepts and slopes using linear latent growth curve models. Furthermore, the means of slopes were not significant, whereas the variance of slopes was significant, and the covariances were positive. The goodness of fit was indicated as CFI=1.000 and RMSEA=0.000. Based on this, it was clarified that no change was observed in the groups as for the change of the self-harm behavior and there were only individual differences. The greater the scores of self-harm behavior were in the first year, the greater the variations were. These results suggest the importance of intervening for self-harm behavior prevention earlier than the first year.

1. Introduction

Self-harm is defined as the act of causing deliberate and direct non-fatal harm to one's own body, with intent other than suicide[1]. Typical examples include cutting one's own arms/wrists with a sharp-edged tool or hitting, stabbing, pinching, and scratching one's own body. One of the main reasons for such behaviors is

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that an individual feels negative emotions, such as anger[2]. According to a 2014 study in Japan, more than 10% of high school students engaged in self-harm behaviors as a way to deal with anger, with 12.1% cutting, 29.7% scratching, and 13.9% stabbing their own bodies[3].

Although self-harm behaviors themselves are not accompanied by suicidal ideation, previous studies have shown that approximately 19% of those who engage in self-harm have attempted suicide by overdose within a year[4], and the risk of suicide is roughly 66 times greater within a year after exhibiting such behaviors[5]. As such, self-harm has become one of the risk factors for attempted suicide[6]. Moreover, while self-harm behaviors have the effect of temporarily suppressing mental pain, the body attempts to resist self-harm behaviors, such that individuals tend to increase the frequency and strength of such behaviors, which, in turn, leads to feelings of "wanting to disappear or die"[7]. Thus, the prevention of self-harm behaviors has become a serious public health issue, both in and outside of Japan.

In general, the retention rate of students, number of visits to nurses' offices, and rate of self-harm behaviors are the highest among high school students in Japan, and approximately 80% of school nurses are aware of such behaviors[8]. However, high school officials are aware of only 0.33% of the students who are at risk for such behaviors[8]. Hence, the Japanese Cabinet Office introduced its "Plan for the Acceleration of Suicide Prevention Measures," which includes a set of initiatives aimed at providing support through partnerships with healthcare, medical, and educational institutions[9]. However, research related to self-harm behaviors in Japan has been limited, especially in regard to the rate of such behaviors among the general population[10]. Moreover, the chronological changes of self-harm behaviors among Japanese high school students at the individual and group levels have yet to be clarified.

According to the Ministry of Education, Culture, Sports, Science and Technology (MEXT), over 97% of students in Japan continue on to high school. Since high school will be the highest level of education for some of these students, it is important to implement health-related awareness programs in schools. Such programs can be promoted in cooperation with mental health nurses, school nurses, and school counselors. For their implementation, it is necessary to understand the realities of self-harm behaviors, both at the individual and group levels as well as the optimal timing of such interventions within educational programs.

Against this background, the present study aimed to obtain basic materials contributing to preventive intervention against self-harm behavior among high school students. It aimed to examine chronological changes of self-harm behavior in individuals and groups during three years in high school with the use of latent growth curve models.

2. Methods

2.1 Definition of terms

Adopting the definition of self-harm behavior as intentional and direct non-lethal damage to one's own body, with non-lethal prediction from intentions other than suicide[1], we have reached the stage where we can experience the situation as being visual or some perceptual changes, with the situation actually going forward.

2.2 Research design

The study design was a longitudinal study using an anonymous self-answering questionnaire.

2.3 Survey method

Snowball sampling was used as the survey method since it was necessary to respond flexibly to the students' reactions during and after this study. Thus, research requests were conducted with high schools in the authors' networks. A total of 432 first-year students were recruited from two full-time general high schools located in the capital of Prefecture A, whose principals and classroom teachers agreed to cooperate in the three-year study. Overall, 418 students (males: 243; 58.1% of the student body; females: 175; 41.9% of the student body) gave their consent in April 2015 (baseline study), after which self-reported questionnaires were administered and follow-ups were performed in April 2016 and 2017. The criteria for inclusion in the study were that students would be able to be monitored across the three-year period and that they agreed

with the purpose of the study.

2.4 Survey contents

The survey contents consisted of basic attributes (gender) and a self-harm behavior scale[11], which included five items: "I punch my body or walls"; "I stab my skin with sharp things, such as mechanical pencils"; "I pinch my body"; "I pull my hair or skin"; and "I cut the surface of my body." The responses were scored on a five-point Likert scale, ranging from 1 ("I do not do it") to 5 ("I frequently do it"), after which the higher scores represented higher levels of self-harm behaviors, ranging from a total of 5 to 25. The validity and reliability of the scale has been confirmed[11].

2.5 Statistical analysis

After examining the repetition of self-harm behaviors through simple tabulation, a latent growth curve analysis[12] was used (through structural equation modeling) and a latent curve model was created that postulated the self-harm behaviors at the three points in time (i.e., April 2015, 2016, and 2017). This made it possible to list each individual's development trajectory (as functions) and statistically examine the overall trajectory average, the overall development trajectory average, and the individual development trajectory average[13]. More specifically, the latent curve model postulated the intercepts and slopes as latent variables, while the overall group changes were shown in the average of the slopes and the individual differences were shown through the variance values of the slopes. Furthermore, if the covariance (inter-factor correlation) was large, then it was interpreted that the greater the initial value, the greater the volume of changes. Meanwhile, the path from the intercepts to each observed variable was set as 1, and the path from the slopes to each observed variable was set as 0 for the first-year students, 1 for the second-year students, and 2 for the third-year students.

Since the latent curve model was based on structural equation modeling, it was possible to statistically show the mode's fitness index, such that it became statistically possible to determine whether the constructed model was suitable for capturing the psychological events under consideration. In this case, the compatibility of the causal relationship model with the data was determined by the compatibility of the Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). In addition, an estimation of the parameters was conducted through the Weighted Least Squares Mean and Variance Adjusted (WLSMV) method[14]. In general, if the values do not exceed 0.90 for the CFI and 0.10 for RMSEA, then the data is considered to be a good fit for the model[13]. Finally, in terms of the significance of the standardized estimated values (path coefficients) for the analysis model, the non-standardized estimated values were deemed statistically significant if their absolute values were greater than 1.96 (at a 5% significance level). For the aforementioned statistical analysis, Mplus Version 7.2 software was used.

2.6 Ethical considerations

This study was conducted based on the Helsinki Declaration of 1975 (revised in 2000) and with the approval of the ethics committee of the Kawasaki University of Medical Welfare (No. 17-102) and the high school principals. The research purpose was presented to the participants, along with a statement that their participation was entirely voluntary, the collected data would remain confidential, and the related information would not be used in any other research. Participants were also made aware that they were under no compulsion to answer questions, that it would be possible to submit a blank answer sheet, and that there would be no adverse consequences to their doing so. Moreover, the participants themselves inserted the self-reported questionnaires in adhesive envelopes and submitted them in a locked collection box that was placed out of sight of the teachers. In this case, submitting the questionnaires was deemed as consent to participating in this research. Finally, the students' identification, such as grade, class, and other related aspects, were created by the school officials, thus ensuring their anonymity.

3. Results

3.1 Distribution of the participants' attributes

Among the responses over the three-year period, the questionnaires that were incomplete or included

the same number for each item were deemed invalid and excluded from the analyzed data. Among the 418 initial participants, 184 valid questionnaires were obtained (follow-up rate: 44.0%; 138 males: 75.0%; and 46 females: 25.0%).

3.2 Distribution of the responses regarding the chronological changes in the students' self-harm behaviors

Table 1 presents the distribution of the changes in the students' self-harm behaviors over the three-year period, based on the following five items:

1) "I punch my body or walls"

Among the participants, those who responded "I do" with some frequency included 34.2% of the first-year students, 31.0% of the second-year students, and 31.5% of the third-year students.

2) "I stab my skin with sharp things such as mechanical pencils"

Among the participants, those who responded "I do" with some frequency included 15.8% of the first-year students, 15.2% of the second-year students, and 14.1% of the third-year students.

3) "I pinch my body"

Among the participants, those who responded "I do" with some frequency included 20.7% of the first-year students, 20.1% of the second-year students, and 17.4% of the third-year students.

4) "I pull my hair or skin"

Among the participants, those who responded "I do" with some frequency included 29.9% of the first-year students, 27.7% of the second-year students, and 31.5% of the third-year students.

5) "I cut the surface of my body"

Among the participants, those who responded "I do" with some frequency included 6.5% of the first-year students, 8.7% of the second-year students, and 4.9% of the third-year students.

3.3 Chronological changes in the self-harm behavior scores

In terms of the chronological changes in the students' self-harm behaviors at the individual and group levels, a latency growth curve model was used. The results indicated that the average values of the intercepts and the variances were significant (7.07, $p < 0.01$; -5.17, $p < 0.01$, respectively). Moreover, the

Table 1 Distribution of the survey responses about self-harm of high school students (n=184)

Unit:%

	Item content	School grade level	Answer categories Never	Seldom	Sometimes	Often	Very often	Average value (SD)
xa1	I punch my body or walls	first	121 (65.8)	32 (17.4)	19 (10.3)	6 (3.3)	6 (3.3)	1.61 (0.08)
		second	127 (69.0)	19 (10.3)	22 (12.0)	9 (4.9)	7 (3.8)	1.64 (0.08)
		third	126 (68.5)	31 (16.8)	17 (9.2)	7 (3.8)	3 (1.6)	1.53 (0.07)
xa2	I stab my skin with sharp things such as mechanical pencils	first	155 (84.2)	14 (7.6)	11 (6.0)	1 (0.5)	3 (1.6)	1.40 (0.07)
		second	156 (84.8)	17 (9.2)	6 (3.3)	2 (1.1)	3 (1.6)	1.41 (0.07)
		third	158 (85.9)	12 (6.5)	7 (3.8)	3 (1.6)	4 (2.2)	1.32 (0.06)
xa3	I pinch my body	first	146 (79.3)	16 (8.7)	13 (7.1)	5 (2.7)	4 (2.2)	1.28 (0.06)
		second	147 (79.9)	11 (6.0)	18 (9.8)	4 (2.2)	4 (2.2)	1.26 (0.05)
		third	152 (82.6)	15 (8.2)	11 (6.0)	3 (1.6)	3 (1.6)	1.28 (0.06)
xa4	I pull my hair or skin	first	129 (70.1)	17 (9.2)	24 (13.0)	5 (2.7)	9 (4.9)	1.63 (0.08)
		second	133 (72.3)	18 (9.8)	17 (9.2)	7 (3.8)	9 (4.9)	1.59 (0.08)
		third	126 (68.5)	27 (14.7)	17 (9.2)	7 (3.8)	7 (3.8)	1.60 (0.08)
xa5	I cut the surface of my body	first	172 (93.5)	5 (2.7)	7 (3.8)	0 (0.0)	0 (0.0)	1.10 (0.03)
		second	168 (91.3)	10 (5.4)	3 (1.6)	1 (0.5)	2 (1.1)	1.15 (0.04)
		third	175 (95.1)	6 (3.3)	2 (1.1)	1 (0.5)	0 (0.0)	1.07 (0.03)

average value of the slopes was not significant (-0.12, $p < 0.31$), whereas the variance was significant (-4.54, $p < 0.01$) and the covariance was positive ($r = 4.97$, $p < 0.01$). Additionally, this model included values of 1.000 for the CFI and 0.000 for RMSEA, thus indicating a good fit (Figure1).

4. Discussion

The purpose of this study was to clarify chronological changes in self-harm individuals and groups in high school for three years, with the aim of obtaining basic data that contributes to preventive intervention for self-harm behavior in high school students.

First, structural equation modeling was used to assess the sufficiency of the model through multiple fitness indices. Additionally, since the observed variables were an ordinal scale, WLSMV was used to estimate the parameters. More specifically, WLSMV is a robust method of weighted least squares that not only corrects standard errors according to the data distribution but also guarantees the output of stable and correct estimated values, regardless of sample size, the number of observed variables or the normality of the latent variables[14]. Furthermore, although approximately a minimum of 150 samples and preferably about 200 or more are required for analysis using structural equation modeling[15] equation modeling, the present study used 184 samples. Thus, the analytical method and the number of samples were deemed appropriate.

Second, in terms of the chronological changes in the students' self-harm behaviors at the individual and group levels over the three-year period, a latency curve model was used, after which the fitness of the model was statistically supported. Based on the average value of the slopes regarding the group changes (-0.12, $p < 0.31$), there were no changes in the students' self-harm behavior scores. Moreover, since self-harm behaviors usually begin around 12 years of age[16] and peak between 14 and 17 years of age[17], it was surmised the high school students may experience no changes over time at the group level. Conversely, the variances of the slopes showed differences at the individual level (-4.54, $p < 0.01$). There were also students whose self-harm behavior scores gradually increased, while those of others gradually decreased. As for the latter, the triggers for improvement included building stable relationships at school, forming intimate friendships, and increasing interactions with teachers[18]. Furthermore, since the covariance of the intercepts and slopes was significant ($r = 4.97$, $p < 0.01$), it was suggested that the higher the self-harm behavior scores

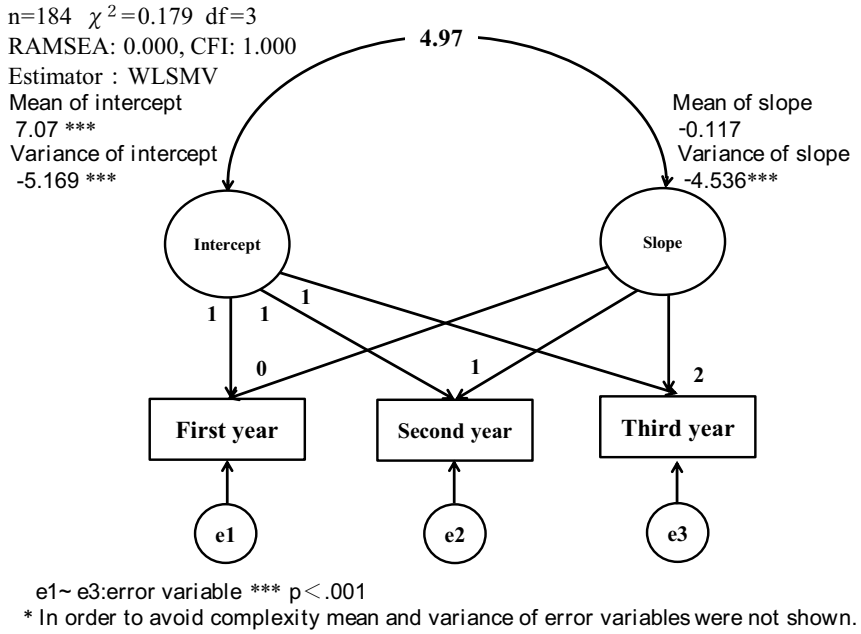

Figure 1 Latent curve model of self-harm behaviors score

of the first-year students, the greater the increase in such scores as the students progressed in school. Those who have a high score for self-harm behavior in the first year are considered to have performed self-harm behavior before entering high school. So, self-harm behavior tends to yield "resistance" just like narcotic drugs[1]. Based on this, it was thought that those who had a high score level of self-harm behavior could lead to a further increase. The previous studies have shown that approximately 70% of those that engage in self-harm behaviors regularly repeat such behaviors, thus indicating that they can become somewhat addictive[19]. Moreover, by repeating self-harm behaviors, resistance to stress decreases, along with the loss of control[2]. Studies have also shown that repeating such behaviors can ultimately lead to suicidal behaviors[20]. The repetition of self-harm behaviors suggests that some form of psychological/social problem exists either chronically or periodically[21]. Thus, it is important to understand the addiction aspect[22] as well as the individual issues behind self-harm behaviors[2].

These results suggest the need for providing early interventions to prevent self-harm behaviours from the first year. Moreover, detrimental and protective factors affecting developmental changes related to self-harm behaviors should be investigated. Furthermore, the need for developing educational programs that take students' development and the characteristics of high schools into consideration are required. Schools often function as front-line facilities for providing mental health services to students because far more students have contact with teachers in schools than with community-based mental health services[23]. Moreover, the age of starting self-harm behaviors is in the junior high school period. Therefore, cooperation between junior high schools and senior high schools could prevent self-harm behaviors.

Finally, we will describe the limitations of this study. This study is the first prospective study in Japan to longitudinally measure the experience rate of self-harm behavior during three years of high school among ordinary high school students, and has important public health significance. However, there are several limitations in this study that should be noted. First, the participants only consisted of general high school students where approval from the principals and teachers was obtained. Second, in this three-year longitudinal study, the ratio of male to female students was not balanced. As a result, the possibility of selection bias cannot be denied, and the results cannot be generalized. Therefore, future studies should focus on a wider range of high school students with self-harm behaviors, including those from different regions and specializations as well as those that have stopped attending school altogether, as a link between school absence and self-harm in young people has been reported[24].

Acknowledgements

The authors wish to thank the teachers and students of the high schools that cooperated in this research. This study was also implemented with funding from JSPS Grants-in-Aid for Scientific Research (Nos. 16H07136 and 17K12579). There are no COI-related companies that need to be disclosed by the authors.

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