



Original Article

# Epidemiology and psychological factors of whiplash associated disorders in Japanese population

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**Abstract.** [Purpose] This study was designed to examine the epidemiological background of Whiplash-associated disorders in Japanese adults and to investigate the psychological factors associated with prolonged treatment for Whiplash-associated disorders. [Subjects and Methods] An online survey was completed by 127,956 participants, of whom 4,164 had been involved in a traffic collision. A random sample of the collision participants (n=1,698) were provided with a secondary questionnaire. From the 974 (57.4%) participants who returned the questionnaire, 183 cases (intractable neck pain treated over a period of 6 months) and 333 controls (minor neck pain treated within 3 months) were selected. Among the control group, the psychological factors associated with prolonged treatment for Whiplash-associated disorders were investigated. [Results] Among the 4,164 collision participants, 1,571 (37.7%) had experienced Whiplash-associated disorders. The prevalence in the general population was 1.2% (1.3% in male and 1.0% in female). Significant differences were observed between the cases and controls for all psychological factors, although both groups had similar distributions of age and gender. [Conclusion] Poor psychological factors were associated with prolonged treatment for whiplash-associated disorders in Japanese adults. These psychological factors should be considered during the treatment of whiplash-associated disorders.

**Key words:** Whiplash-associated disorders, Psychological factors, Prolonged treatment

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## INTRODUCTION

Whiplash-associated disorders (WAD) are the most common injury associated with car collisions in Japan and many Western countries<sup>1, 2)</sup>. However, there is no clear epidemiological data regarding the prevalence of WAD in Japanese adults. Although the prognosis of WAD is generally favorable, previous studies have found that up to 50% of the affected individuals are still symptomatic one year after the injury<sup>3)</sup>. In addition, there is evidence from previous studies that depression is associated with poor recovery from WAD<sup>4, 5)</sup>. However, the patient's poor psychological condition, such as depression and fear, actually refers to a hyperbolic negative perception of actual or anticipated pain<sup>6)</sup>, and this perception can prolong WAD treatment. To our knowledge, the psychological factors in the Japanese population with WAD have not been studied, and are not clearly understood.

Therefore, this study aimed to evaluate the epidemiological background of WAD in Japanese adults. Furthermore, we

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investigated the psychological factors associated with prolonged treatment for WAD, and reported the descriptive statistics for these factors.

## SUBJECTS AND METHODS

Details of the study population have been described previously<sup>7)</sup>. Briefly, we conducted an online survey to assess the prevalence of WAD in the general population. Participants were recruited through an internet research company. The initial survey was conducted online from July 1, 2012 through July 17, 2012. A total of 127,956 respondents completed items. This study was approved by the ethics review board of the Japan Labour Health and Welfare Organization.

The participants who had been in a traffic collision were considered relevant ( $n=4,164$ ). From this sample, 1,698 participants were randomly selected to participate in a secondary survey. Of the 974 (57.4%) participants who returned the secondary questionnaire, we excluded 44 participants who were not wearing a seatbelt when the collision occurred, as these were likely to have sustained serious injuries. From the 930 remaining subjects, 183 were included in our intractable group (neck pain treated over a period of 6 months) and 333 were included in the control group (minor neck pain treated within 3 months). There was no article defined the period of the early recovery of WAD. Thus we clinically decided that the upper limit of early recovery is 3 months and set as a control group for intractable group.

The questionnaire evaluated socio-demographic data, age, gender, weight, height, education (not college, college, or other), driving status, and whether the participant had been in a traffic accident. If participants had been injured in a traffic collision, the car crash severity (mild, moderate, or severe), presence or absence of WAD, and length of unemployment (none, 1–3 days, 4–7 days, 1–4 weeks,  $\geq 1$  month) were also evaluated in the initial survey. Body mass index (BMI;  $\text{kg}/\text{m}^2$ ) was calculated using the self-reported weight and height; overweight was defined as  $\text{BMI} \geq 25$ .

We evaluated kinesiophobia using the Tampa Scale of Kinesiophobia (TSK), which is one of the most frequently employed measures for assessing fear. Each 17-item questionnaire is measured on a four-point Likert scale, and scores range from 17 (no fear) to 68 (strong fear of re-injury)<sup>8)</sup>. The Japanese version of TSK has been linguistically validated<sup>9)</sup>. Pain catastrophizing was evaluated using the Pain Catastrophizing Scale (PCS)<sup>10, 11)</sup>, which is a 13-item self-reported tool that asks participants to reflect on past painful experiences and to indicate the degree to which they experience thoughts or feelings during pain. Scores are ranked on a 5-point scale, ranging from 0 (not at all) to 4 (always).

Depression was defined as a score of  $\leq 52$  on the SF-36 Mental Health summary (SF-36 MH, version 1.2), as this score is the established cutoff value for Japanese adults<sup>12, 13)</sup>. Somatizing tendency was assessed using a subset of items from the Brief Symptom Inventory (BSI)<sup>14)</sup>; the Japanese version has been linguistically validated<sup>15)</sup>. Seven somatic symptoms (faintness or dizziness, pain in the heart or chest, nausea or upset stomach, difficulty breathing, numbness or tingling in parts of the body, weakness in parts of the body, and hot or cold spells) were assessed on a 5-point scale, ranging from 0 (not at all) to 4 (extreme). A BSI score  $\geq 2$  was considered indicative of somatization<sup>14, 16)</sup>.

We also used the EuroQol-5 dimension (EQ-5D) questionnaire to evaluate general quality of life (QOL)<sup>17, 18)</sup>. The five-dimensional health care classification evaluates the patient's status regarding morbidity, self-care, usual activities, pain/discomfort, and anxiety/depression. Participants were asked to indicate their current health status by selecting the most appropriate of the three statements for each of the five QOL dimensions, where each statement represented an increasing degree of severity. These results were coded and converted into a score of utility, using a standard table of values.

Results were presented as frequencies and proportions (percentages), or as means and standard deviations (continuous variables). All statistical tests were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). The  $\chi^2$  test was used for nominal and ordinal data, and one-way analysis of variance was used for scaled data. Differences were considered statistically significant at a  $p$ -value of  $<0.05$ .

## RESULTS

Demographic data for the respondents ( $n=127,956$ ) to the initial questionnaire are listed in Table 1. Of these respondents, 4,164 (3.3%) had been injured in a traffic collision, and the characteristics of the collision and subsequent injury are listed in Table 2. Of the participants who had been in a collision, 1,571 (37.7%) were diagnosed with WAD. The prevalence of WAD in the general population was 1.2% (1.3% in male and 1.0% in female) (Table 3). Significant differences were observed between the intractable group and the control group regarding TSK, PCS (total and each component), SF36-MH, BSI, and EQ-5D (Table 4). No significant difference was detected between the groups regarding age or gender.

## DISCUSSION

Little epidemiological information is available regarding WAD in Japan. In this study, 4,164 participants reported being injured in a traffic collision, of whom 37.7% were diagnosed with WAD; a similar prevalence of WAD was reported in a previous study<sup>2)</sup>. The present study also clarified the age-gender distribution of WAD in the Japanese population. If our results are extrapolated to the Japanese population using the 2010 census data<sup>19)</sup>, approximately 980,000 persons (590,000 male and 390,000 female) aged 20 years and older are affected by WAD.

**Table 1.** Characteristics of the initial survey respondents (n=127,956)

Age years, mean ± SD	47.7 ± 10.8
Male, n (%)	81,387 (63.6%)
Overweight (BMI ≥25), n (%)	30,556 (23.9%)
Education level, n (%)	
Not college	73,747 (57.6%)
College	53,445 (41.8%)
Other	764 (0.6%)
Driving status, n (%)	
No license or occasional driver	29,193 (22.8%)
Normal driver	95,377 (74.5%)
Professional driver	3,386 (2.7%)
Traffic accident, n (%)	
Collision	4,164 (3.3%)
Other	6,155 (4.8%)
None	9,475 (18.0%)

SD: standard deviation; BMI: body mass index

**Table 3.** Prevalence of whiplash-associated disorders according to age and gender (n=127,956)

Age (years)	Male		Female	
	N	Prevalence (%)	N	Prevalence (%)
20–24	715	1.3	973	0.7
25–29	1,668	2.1	2,428	1.2
30–34	3,784	1.8	4,633	1.0
35–39	8,208	1.6	7,849	0.9
40–44	12,139	1.5	8,945	1.0
45–49	13,742	1.6	7,503	1.1
50–54	13,419	1.2	6,051	1.0
55–59	10,217	1.3	3,897	0.9
60–65	10,734	0.9	2,972	0.9
65–69	6,761	1.0	1,318	0.6
Total	81,387	1.3	46,569	1.0

**Table 2.** Collision and injury related characteristics from the initial survey (n=4,164)

Car crash severity, n (%)	
Minor	956 (23.0%)
Moderate	1,387 (33.3%)
Severe	1,821 (43.7%)
WAD, n (%)	1,571 (37.7%)
Length of unemployment, n (%)	
None	2,838 (68.2%)
1–3 days	730 (17.5%)
4–7 days	152 (3.7%)
1–4 weeks	226 (5.4%)
≥1 month	218 (5.2%)

WAD: whiplash-associated disorder

**Table 4.** The characteristics and psychological factors of whiplash-associated disorder patients

	Cases (n=183)	Controls (n=333)
Age	44.8 ± 10.3	45.3 ± 11.7
Gender, male/female	124/59	242/91
TSK	44.0 ± 9.1	34.5 ± 9.5*
PSC	32.7 ± 10.6	17.5 ± 10.5*
rumination	14.8 ± 4.1	8.9 ± 4.8*
magnification	6.9 ± 3.0	3.8 ± 2.9*
helplessness	11.0 ± 4.9	4.9 ± 4.1*
SF-36 MH, n (%)		
≤52	99 (54.1%)	116 (34.8%)†
>52	84 (45.9%)	217 (65.2%)
BSI, n (%)		
≥2	157 (85.8%)	167 (50.2%)†
1	11 (6.0%)	38 (11.4%)
0	15 (8.2%)	128 (38.4%)
EQ-5D, mean (SD)	0.674 ± 0.178	0.923 ± 0.129*

TSK: Tampa Scale for Kinesiophobia; PSC: Pain Catastrophizing Scale; SF-36 MH: SF-36 Mental Health summary (version 1.2); BSI: Brief Symptom Inventory; EQ-5D: Euro-Qol-5 dimension questionnaire

Mean ± SD, \*Statistical difference as determined by one-way analysis of variance (p<0.01); †Statistical difference as determined by  $\chi^2$  test (p<0.01)

Furthermore, we also investigated the psychological factors associated with prolonged treatment for WAD in Japanese adults. Using randomly selected participants who had been in a collision, we formed a sub-cohort of symptomatic WAD patients to evaluate their psychological factors. Intractable and control groups were evaluated for representative psychological factors and health-related QOL, and the results were compared. Significant differences were observed in catastrophizing and fear, which has also been reported in Western countries<sup>20</sup>. Interestingly, each of the psychological aspects were negative in the intractable group, which implies that poor psychological condition has a negative effect on WAD treatment. Similarly, a previous study in a Western country found that chronic whiplash syndrome is triggered by emotional discomfort and psychological distress<sup>21</sup>. In addition, individuals with somatization often complain of pain in various locations, functional disturbance of various organ systems, and are depressed or overwhelmed by these symptoms. Therefore, patients in this situation are thought to suffer from functional somatic syndrome<sup>21</sup>, and their psychological factors likely affect their treatment for WAD. In the present study, the mean EQ-5D score for the intractable group was 0.674, which was similar to the previously reported score for chronic widespread pain (CWP)<sup>22</sup>. Thus, patients with WAD and chronic widespread pain experience a marked decrease in their QOL<sup>23, 24</sup>.

This study has several limitations. Due to its cross-sectional design, we cannot comment on the causality of the relation-

ship between psychological factors and WAD treatment. In addition, our participants were internet research volunteers, who may not accurately represent the general population. For example, our participants were more likely to live in large cities compared to the general population. In addition, our respondents were more likely to have university-level or graduate-level education<sup>25</sup>). However, the effect of any potential selection bias on our results would be difficult to elucidate. Despite these limitations, this study could provide useful insights to orthopedic surgeons who are tasked with treating patients with WAD.

In conclusion, poor psychological condition was associated with prolonged treatment for WAD in Japanese adults. Therefore, psychological factors should be considered during the treatment of WAD.

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