

## Original Article

**Cite this article:** Takeuchi E, Fujisawa D, Miyawaki R, Yako-Suketomo H, Oka K, Mimura M, Takahashi M (2021). Cross-cultural validation of the Cancer Stigma Scale in the general Japanese population. *Palliative and Supportive Care* **19**, 75–81. <https://doi.org/10.1017/S1478951520000486>

Received: 17 February 2020



Revised: 13 May 2020

Accepted: 9 June 2020

**Key words:**

Cancer; Discrimination; Japan; Stereotype; Stigma

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**Abstract**

**Background.** The stigma associated with cancer has negative impacts on cancer patients as well as the general public, who have a potential risk of cancer. To the best of our knowledge, a validated measure to assess cancer stigma among the general Japanese population does not exist.

**Method.** We translated the Cancer Stigma Scale (CASS) — a 25-item self-administered scale to evaluate stigma related to cancer — into Japanese and examined its psychometric properties. The Japanese version of CASS (J-CASS) was validated among a sample of the general Japanese population through an online survey to validate its test–retest reliability, internal consistency, and concurrent validity.

**Results.** A total of 319 responses were included in the analysis. An exploratory factor analysis eliminated two original items but showed a six-factor model (*Awkwardness, Severity, Avoidance, Policy Opposition, Personal Responsibility, and Financial Discrimination*), which was similar to the original scale. Cronbach's alpha for each factor was satisfactory, ranging from 0.81 to 0.91. The internal correlation coefficients were above 0.70, except for Policy Opposition. The total and subtotal scores of each factor of the J-CASS were significantly associated with respondents' age, gender, familiarity with cancer patients, and social desirability, demonstrating the scales' good concurrent validity. A substantial proportion of the participants selected “unsure” for some items of the scale, suggesting a further need for refining the scale.

**Significance of results.** This study demonstrated that J-CASS is a reliable and valid measure for evaluating misconceptions and stigma toward cancer in the general Japanese population.

**Introduction**

Cancer is the second largest global cause of death, leading to one death out of six patients worldwide (Ferlay et al., 2015). However, this can lead to a misconception that cancer is always an unpreventable and fatal disease that leads to death, pain, suffering, loss of control and independence, helplessness, and isolation (Daher, 2012). This misconception and the resulting stigma impact not only cancer patients themselves (Fujisawa and Hagiwara, 2007) but also the general public, who have a potential risk of cancer. Past studies have demonstrated that the general population hesitates to have cancer screenings or treatment due to cancer stigma, which leads to a delay in cancer detection and care (Carter-Harris et al., 2014; Meacham et al., 2016). Reducing the stigma associated with cancer is a national and international goal.

Goffman conceptualized stigma as an individual being disqualified from full social acceptance (Goffman, 1963). He stated that stigma is subject to the social context, which means that a specific trait may be negatively evaluated in one situation but may be evaluated differently in different situations (Goffman, 1963). Cancer stigma has been reported worldwide (Liu et al., 2015; Shim et al., 2016; Suwankhong and Liamputtong, 2016; Tang et al., 2016), and the prevalence of cancer stigma among cancer patients has been reported to be between 52% and 58% (Peters-Golden, 1982; Cho et al., 2013). Although cancer stigma has not been widely examined in Japan, a few studies suggest that it does exist in Japanese society (Tsuchiya et al., 2012; Fujisawa et al., 2014).

To challenge cancer stigma, the Japan Cancer Control Act promotes cancer education among school students and has been running a series of campaigns to educate the general public (Mlhw.go.jp, 2018). However, an unexpected adverse effect of cancer education has been reported. Yako-Suketomo et al. (2019) demonstrated that children who received cancer education tend to develop a stereotyped view of cancer patients, seeing them as pitiable, sickly, thin, and pale. Some children have also come to view cancer patients as heavy drinkers and heavy smokers. These results indicate that the knowledge that the potential causes of cancer can be

related to daily habits — such as smoking and diet — and that cancer is avoidable by vaccine and routine checkups has increased the stigma against cancer patients.

To evaluate the public's attitude toward cancer and to address the stigma issue, a reliable measurement tool is necessary. A few instruments are available to measure cancer-related stigma (Cataldo et al., 2011; Kissane et al., 2013; Stump et al., 2016); however, these scales are designed to assess perceived stigma among cancer patients themselves. To the best of our knowledge, the Cancer Stigma Scale (CASS) is the only measure of which the psychometric properties have been validated that assesses the general public's attitude toward cancer (Marlow and Wardle, 2014). Cancer stigma is considered to be multidimensional, consisting of the following components: peril, course, concealability, disruptiveness, and esthetics. Additionally, behavioral characteristics and attitudes toward discrimination are also considered to be included in cancer stigma. The CASS was originally developed and validated in the UK (Marlow and Wardle, 2014). The Chinese version of CASS — with a similar structure to the original — was developed and an analysis of its psychometric properties demonstrated adequate internal consistency, reliability, and indices of model fit (Ye et al., 2019). CASS has been applied in two studies, identifying that lung cancer patients were more stigmatized than patients with other types of cancer (Marlow et al., 2015) and examining the correlation between cancer stigma and cancer screening behaviors (Vrinten et al., 2019). For these reasons, we considered that CASS may be a suitable tool to measure cancer-related stigma in the general Japanese population.

This study, therefore, aims to translate the CASS into Japanese (J-CASS) and validate its psychometric properties in the general Japanese population. We hypothesize that the J-CASS has appropriate psychometric properties and can be applicable in Japan.

## Methods

### Translation process

After obtaining approval for the translation of CASS from the original author, the scale was translated from English to Japanese by a first translator following the process of translation and adaptation of instruments published by the World Health Organization (2020). A bilingual expert panel was convened to identify and modify inadequate expressions and concepts of the translation. The discrepancies between the forward translation and the original version were also discussed. Back translation was conducted independently by a second translator without any knowledge of the original scale. The discrepancies between the forward and back translations were discussed by the expert panel, and the back translation of the scale was approved by the original author. All translators were health care providers fluent in both English and Japanese, knowledgeable concerning English-speaking cultures, and familiar with the terminology of psychology. The expert panel included specialists in health and education with experience in instrument development and translation.

### Participants and setting

We targeted the general population in Japan aged 20–69 able to read Japanese. To assure anonymity and thereby avoid social desirability bias, participants were recruited via an online market research agency (MyVoice Communications, Inc.) that has more

than one million registered Japanese users. We estimated that 250 (the total number of J-CASS items multiplied by 10) is an acceptable sample size to evaluate the reliability and validity of the measure (Hair et al., 2014). After removing answers with missing data, we received 450 responses. A total of 3,317 potential respondents who were randomly selected were informed about the study. We set quotas based on the original CASS development to ensure equal distribution concerning gender and age (20–34 and 35–69 years old) (Marlow and Wardle, 2014). The potential respondents were asked to provide electronic informed consent prior to the survey. It was explained that participation is free from any coercion. To examine the test–retest reliability, we asked the respondents to participate in a second survey two weeks after the first. Each participant was reimbursed with 20 points (to the value of 20 Japanese Yen) that can be exchanged for gifts. The study was approved by the ethical committee of the Japan Women's College of Physical Education (Application number: 2017-32).

### Measurements

The CASS is a multidimensional measure used to evaluate a person's negative attitude toward cancer that has been shown to have good reliability and validity (Marlow and Wardle, 2014). The scale consists of 25 items and six factors: *Awkwardness* (i.e., I would feel comfortable around someone with cancer), *Severity* (i.e., Once you've had cancer, you can never be "normal" again), *Avoidance* (i.e., I would try to avoid a person with cancer), *Policy Opposition* (i.e., More government funding should be spent on the care and treatment of cancer patients), *Personal Responsibility* (i.e., A person with cancer is to blame for their condition), and *Financial Discrimination* (i.e., It is acceptable for banks to refuse to approve loans for people with cancer). Each item is evaluated on a 6-point Likert scale (1: Strongly disagree to 6: Strongly agree) with an additional option of "not sure," which is converted to missing data.

The following items were used for evaluating the validity of J-CASS.

### Demographics and socioeconomic status

The participants' age, gender, marital status, education history, employment status, and income were recorded.

### Cancer experience

We asked whether the participants themselves, their close family, or their friends had ever been diagnosed with cancer (yes/no answer).

### Social desirability

We used the short-form Marlow–Crowne Social Desirability Scale to measure participants' perception of socially desirable behavior (Crowne and Marlowe, 1960; Kitamura and Suzuki, 1986). This 13-item scale with yes/no responses is the shorter version of the original 33-item Marlow–Crowne Social Desirability Scale (Reynolds, 1982). A higher score indicated that the respondent tends to behave in a socially desirable way.

### Data analysis

Similar to the procedure in the original CASS development process, returned surveys of which more than 20% of the 25 CASS items were answered with "not sure" (converted to missing

data) were eliminated from the analysis. The median scores of the items were imputed for the missing data (“not sure” responses). The homogeneity of the sample was assessed by comparing the characteristics of the participants who were included and excluded by using a *t*-test and Fisher’s exact test.

As stigma is subject to cultural context, we conducted factor analyses to examine the structure of the scale, instead of merely applying the factor structure of the original scale. We used a *promax* rotation to examine the factor structure and to estimate the factor loading. An eigenvalue of greater than one was set as the criteria to identify the most suitable number of factors. Items with factor loadings of <0.4 were eliminated. Next, a confirmatory factor analysis was conducted to assess the model fitness using the following criteria: Root Mean Square Error of Approximation (RMSEA) < 0.08, Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Normed Fit Index (NFI) ≥ 0.80, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI) > 0.90, and  $\chi^2/df < 5.0$  (Ishiyaku et al., 2017). The subscale scores of the J-CASS was compared with that of Marlow’s CASS by using the *t*-test. The correlations between the factors were assessed, and the internal reliability of each factor was assessed by Cronbach’s alpha. The Cronbach’s alpha is considered satisfactory if the value exceeds 0.70. To examine the test–retest reliability, internal correlation coefficients (ICCs) between the initial and second surveys were calculated. An ICC value between 0.5 and 0.75 and between 0.75 and 0.9 are, respectively, indicative of moderate and good reliability (Koo and Li, 2016).

The concurrent validity of the scale was assessed by *t*-test and ANOVA, with the hypotheses that males, younger respondents (20–34 vs. 35–54 vs. 55+), and those with lower social desirability scores (0–5 vs. 6–13) would have higher J-CASS scores, whereas respondents who are more familiar with cancer (i.e., those who have been diagnosed with cancer, or those who have a close friend or family member who has been diagnosed with cancer) would have lower J-CASS scores. These hypotheses match those in the original CASS development (Marlow and Wardle, 2014). All data analyses were conducted using SPSS version 24 for Windows. The significance levels were set at  $p < 0.05$  (two-sided).

## Results

### Participants’ characteristics

A total of 450 participants completed the initial survey (response rate: 13.6%). Of these, 300 participants completed the second survey (response rate: 67%). In the initial survey, no participants left any J-CASS items blank, but approximately 30% of the participants selected “not sure” for more than 20% of the items. These responses were excluded from the data analysis. Therefore, 319 participants were included in the final analysis, of which 171 participants — who completed both surveys with less than 20% “not sure” items — were included in the test–retest analysis.

The characteristics of the participants are shown in Table 1. The mean age of the initial 319 respondents was 39.8 ( $\pm 15.0$ ). Approximately half of the participants were male, married, and earned relatively high annual salaries (more than four million Japanese Yen). Fifteen participants (5%) had been diagnosed with cancer, 43% of the participants had close family who had been diagnosed with cancer, and 19% had a close friend who had been diagnosed with cancer. The Fisher’s exact tests showed that the participants who were included in the analyses were more likely to have been diagnosed with cancer themselves (*Odds Ratio*

**Table 1.** Demographics ( $N = 450$ )

	Included in the analysis ( $n = 319$ )		Excluded from analysis ( $n = 131$ )		<i>p</i>
	<i>N</i>	(%)	<i>N</i>	(%)	
Age (mean, SD)	39.8	15.0	38.7	14.0	0.594 <sup>a</sup>
Sex					
Male	164	(51.4)	61	(46.6)	
Female	155	(48.6)	70	(53.4)	0.406 <sup>b</sup>
Marital status					
Unmarried	175	(54.9)	78	(59.5)	
Married	144	(45.1)	53	(40.5)	0.403 <sup>b</sup>
Education					
Below college level	138	(43.3)	57	(43.5)	
Above college level	175	(54.9)	71	(54.2)	
Unknown	6	(1.9)	3	(2.3)	0.931 <sup>b</sup>
Employment status					
Full-time	159	(49.8)	59	(45.0)	
Part-time	48	(15.0)	16	(12.2)	
Unemployed	71	(22.3)	35	(26.7)	
Students	33	(10.3)	12	(9.2)	
Others	8	(2.5)	9	(6.9)	0.180 <sup>b</sup>
Annual salary					
Under 4 million Japanese yen	247	(77.4)	97	(74.0)	
Over 4 million Japanese yen	72	(22.6)	34	(26.0)	0.464 <sup>b</sup>
Cancer experience					
Participant themselves	15	(4.7)	1	(0.8)	0.048 <sup>b</sup>
Close family	137	(42.9)	44	(33.6)	0.072 <sup>b</sup>
Close friend	59	(18.5)	10	(7.6)	0.004 <sup>b</sup>

<sup>a</sup>Mann–Whitney *U* test.

<sup>b</sup>Fisher’s exact test.

[*OR*] = 6.4,  $p < 0.05$ ) and were more likely to have a close friend who had been diagnosed with cancer (*OR* = 2.7,  $p < 0.01$ ) than the participants who were excluded from the analyses.

### Explanatory factor analysis

All 25 items of the J-CASS were entered into an explanatory factor analysis with a *promax* rotation (Table 2). After eliminating items 17 (“I would feel embarrassed discussing cancer with someone who had it”) and 25 (“It is acceptable for insurance companies to reconsider a policy if someone has cancer”) due to their low factor loadings (<0.4), the eigenvalue suggested a six-factor solution, which explained 70% of the variance. The Kaiser–Meyer–Olkin value was 0.81 and Bartlett’s test of sphericity value was significant ( $p < 0.001$ ). The number of items in each factor was the same as that of the original CASS in the factors

**Table 2.** Exploratory factor analysis of J-CASS

Items		Factor loading
Avoidance		
18	I would distance myself physically from someone with cancer	0.88
19	If a colleague had cancer, I would try to avoid them	0.79
12	I would try to avoid a person with cancer	0.77
13	I would feel angered by someone with cancer	0.77
16	I would feel irritated by someone with cancer	0.75
14	I would find it difficult being around someone with cancer (AW)	0.64
15	I would find it hard to talk to someone with cancer (AW)	0.61
Personal Responsibility		
5	A person with cancer is accountable for their condition	0.89
3	A person with cancer is to blame for their condition	0.80
9	If a person has cancer, it is probably their fault	0.78
8	A person with cancer is liable for their condition	0.68
Severity		
2	Getting cancer means having to mentally prepare oneself for death	0.76
1	Once you've had cancer, you can never be "normal" again	0.75
4	Having cancer usually ruins a person's career	0.67
7	Cancer devastates the lives of those it touches	0.65
6	Cancer usually ruins close personal relationships	0.55
Policy Opposition		
22	More government funding should be spent on the care and treatment of cancer patients (R)	0.81
23	We have a responsibility to provide the best possible care for cancer patients (R)	0.77
21	The needs of cancer patients should be given top priority (R)	0.71
Awkwardness		
11	I would feel comfortable around someone with cancer (R)	1.04
10	I would feel at ease around someone with cancer (R)	0.81
Financial Discrimination		
20	It is acceptable for banks to refuse to approve loans for people with cancer	0.91
24	Banks should be allowed to refuse mortgage applications for cancer-related reasons	0.77
Others (Excluded from the exploratory factor analysis)		
17	I would feel embarrassed discussing cancer with someone who had it	–
25	It is acceptable for insurance companies to reconsider a policy if someone has cancer	–

(R) Items were reversed; (AW) Items are included in the Awkwardness factor in the original CASS.

*Personal Responsibility*, *Severity*, and *Policy Opposition*, while those in *Avoidance* (seven items), *Awkwardness* (two items), and *Financial Discrimination* (two items) were different from the original CASS.

### Confirmatory factor analysis

A six-factor confirmatory factor analysis model suggested a poor model fit: RMSEA = 0.10, GFI = 0.81, AGFI = 0.76, CFI = 0.82, TLI = 0.79, NFI = 0.79, and  $\chi^2/df = 5.41$ . Therefore, the model was adjusted based on the modification indices. When the correlations between items 13 and 16 and between items 14 and 15 were added, the model of fit improved remarkably, exceeding

the proposed criteria: RMSEA = 0.07, GFI = 0.86, AGFI = 0.82, CFI = 0.91, TLI = 0.90, NFI = 0.87, and  $\chi^2/df = 2.67$ .

### Mean and inter-factor correlation

The mean score of the J-CASS total score and subtotal scores were significantly higher than those of Marlow's original study ( $t = 2.60-19.27$ ,  $p < 0.01$ ) [20]. There were significant correlations between each factor, ranging from  $r = 0.11$  to  $r = 0.39$  (Table 3). An exception is *Policy Opposition*, which was only correlated with *Severity* and not with other factors. Moreover, *Financial Discrimination* and *Personal Responsibility* were not significantly correlated with each other.



**Table 3.** Correlation, internal consistency, and test-retest reliability of each factor

Factors	F1	F2	F3	F4	F5	F6	Total
Correlation							
F1: Avoidance	1.00						
F2: Personal responsibility	0.36**	1.00					
F3: Severity	0.28**	0.19**	1.00				
F4: Policy opposition	−0.02	0.08	−0.18**	1.00			
F5: Awkwardness	0.39**	0.11*	0.24**	0.10	1.00		
F6: Financial discrimination	0.26**	0.10	0.22**	0.07	0.14*	1.00	
Internal consistency <sup>a</sup>	0.90	0.87	0.81	0.81	0.91	0.84	0.85
Test-retest reliability <sup>b</sup>	0.83	0.77	0.84	0.65	0.71	0.70	0.84

<sup>a</sup>Cronbach's alpha.<sup>b</sup>Internal correlation coefficient.\* $p < 0.05$ .\*\* $p < 0.01$ .

### Internal consistency and test-retest reliability

The internal consistency was satisfactory for the total scale and for each factor (Cronbach's alpha = 0.81–0.91; Table 3). The ICC value was 0.84 for the total score and between 0.65 and 0.84 for each factor, which indicated moderate to good test-retest reliability.

### Concurrent validity

To test our hypotheses, the differences in the mean scores of each factor were examined according to gender, age, cancer experience, and social desirability (Table 4). Male respondents scored significantly higher for *Personal Responsibility* than female participants. Younger respondents scored higher for *Financial Discrimination*. Participants whose close friends have been diagnosed with cancer had lower scores for *Avoidance*, *Severity*, *Awkwardness*, and *Financial Discrimination*. Higher social desirability was associated with lower scores for *Severity*, *Awkwardness*, and *Financial Discrimination*. Participants' personal experience of cancer had no significant correlation with any of the factors.

### Discussion

In this study, the CASS was translated into Japanese and tested on a sample of the general Japanese population. The J-CASS consisted of six factors and proved to have adequate internal consistency and moderate to good test-retest reliability. As we hypothesized, the J-CASS score was significantly associated with age, gender, cancer experience, and social desirability, supporting the scale's construct validity. To the best of authors' knowledge, the J-CASS is the only validated scale that evaluates cancer stigma in the general Japanese population.

For cross-cultural adaption, translation and back translation were done while remaining true to the meaning of the original items. No specific adjustments were necessary for cultural adaptation and the back translation was approved by the original author. The analysis demonstrated that J-CASS has a similar construct to the original CASS in the number of factors and items in each factor. However, the two scales have certain minor differences. J-CASS did not fit the original model and two items were removed from the scale. In particular, in J-CASS, *Awkwardness*

showed a different factor structure compared with that of the original CASS. Two items of *Awkwardness* were included in *Avoidance* and one item was removed due to insufficient factor loading. Considering that there is a moderate inter-factor correlation between *Awkwardness* and *Avoidance* — in both J-CASS and the original CASS (Marlow and Wardle, 2014) — *Awkwardness* and *Avoidance* are similar in their concept and some of the included items can be interchangeable. For example, the item "I would find it hard to talk to someone with cancer" is included in *Awkwardness* in the original scale but in *Avoidance* in the J-CASS. We assumed that these items are interchangeable in meaning depending on whether participants focus on the emotional aspect or behavioral aspect.

Each subscale of the J-CASS was associated with social-demographic variables and social desirability, the same as the original CASS development. However, cancer experiences held by the participants themselves were not associated with stigma. This result indicates that cancer experience does not result in patients having either a positive or negative attitude toward cancer. Another finding is that, although those who have a close friend with cancer felt a higher level of stigma, those who have a close family with cancer did not. This fact indicates that emotional attachment has more impact on stigma than does a biological relationship.

Despite slight differences in the factor structures, the J-CASS scores in this study were significantly higher than that of the original CASS study across all factors. There are a few possible interpretations of this finding. First, it may reflect the difference in cancer stigma between the UK and Japan as a whole. Second, it may be due to a difference in the participants' characteristics. Despite the two studies adopting a similar methodology and the basic characteristics of the participants (mean age and gender proportion) being alike, differences in their characteristics are possible. This aspect needs to be addressed in future studies.

In the current study, approximately 30% of the respondents were excluded from the analysis, as they selected "not sure" for more than 20% of the questions. This differs from Marlow's original study, where only 6% of the participants were excluded due to missing data (Marlow and Wardle, 2014). When comparing participants included in the data analysis and those excluded, those who did not have experience of a cancer diagnosis or close friends or family diagnosed with cancer were more likely to select "not

**Table 4.** Concurrent validity of J-CASS ( $N = 319$ )

	<i>N</i>	Avoidance		Personal Responsibility		Severity		Policy Opposition		Awkwardness		Financial Discrimination	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Gender													
Male	164	2.49	0.91	2.71	1.08	3.57	0.96	3.33	0.88	3.22	0.94	3.09	1.14
Female	155	2.30	0.86	2.47	0.92	3.48	0.85	3.32	0.80	3.15	0.96	2.94	1.03
<i>t</i>				2.11	*								
Age (years)													
20–34	163	2.50	0.95	2.62	1.03	3.53	0.93	3.31	0.83	3.18	1.01	3.16	1.06
35–54	83	2.38	0.80	2.64	1.04	3.66	0.90	3.31	0.90	3.25	0.88	2.95	1.01
55+	73	2.21	0.83	2.49	0.92	3.36	0.88	3.36	0.79	3.10	0.86	2.77	1.19
<i>F</i>												3.60	*
Cancer experience (participants themselves)													
No	304	2.41	0.89	2.60	1.01	3.55	0.92	3.33	0.84	3.20	0.95	3.02	1.07
Yes	15	2.12	0.80	2.53	0.98	3.08	0.70	3.22	0.83	2.77	0.75	3.00	1.49
<i>t</i>													
Cancer experience (close family)													
No	182	2.41	0.88	2.54	1.03	3.53	0.88	3.39	0.92	3.15	0.93	2.98	1.06
Yes	137	2.39	0.91	2.67	0.98	3.53	0.96	3.24	0.71	3.22	0.97	3.07	1.12
<i>t</i>													
Cancer experience (close friend)													
No	260	2.48	0.89	2.65	1.01	3.62	0.90	3.31	0.84	3.24	0.97	3.10	1.06
Yes	59	2.06	0.81	2.36	0.99	3.13	0.86	3.40	0.86	2.93	0.77	2.65	1.12
<i>t</i>		3.35	**			3.78	**			2.61	*	2.89	**
Social Desirability													
Low score (0–5)	218	2.46	0.81	2.63	0.98	3.81	0.90	3.23	0.80	3.26	0.90	3.12	1.01
High score (6–13)	232	2.35	0.77	2.57	0.89	3.50	0.84	3.36	0.73	3.09	0.79	2.92	0.98
<i>t</i>						3.80	**			2.05	*	2.11	*

*N*, Number of respondents.

\* $p < 0.05$ .

\*\* $p < 0.01$ .

sure.” We assume that the respondents’ unfamiliarity with cancer may be a reason for the large proportion of “not sure” responses. To minimize “not sure” responses, the scale may need to clarify the meaning of the “not sure” response. A past study that scrutinized potential intention of “not sure” responses among Japanese respondents demonstrated that a “not sure” response represents a variety of respondents’ intentions, ranging from an incapability to make a decision due to lack of information, indifference to the topic, self-repression, or an unpleasant feeling when answering the questions (Ishida, 2016). Further studies need to be conducted to clarify the meaning of the “not sure” response and to refine J-CASS question items.

### Clinical implications

There are many potential clinical implications concerning J-CASS. First, correlations between cancer stigma and some key clinical variables — such as cancer screening uptakes, psychological status, social support, and quality of life — could be explored

based on J-CASS. Second, comparing cancer stigma in the general public with stigma in cancer patients may provide information on how we can support cancer patients with a high level of perceived stigma. Third, J-CASS can be used as an indicator of the effectiveness of cancer education programs. Further studies to demonstrate the usefulness of J-CASS is warranted.

### Study limitations

This study has several limitations. First, as mentioned above, approximately 30% of the respondents were excluded from the analysis due to their high number of “not sure” responses. The significant differences in demographics between the participants who were included and excluded in the analysis imply the presence of substantial selection bias. Second, the study participants were limited to internet users who were registered as internet monitors in a single agency. These participants may not necessarily represent the entire general Japanese population (Hunter, 2012). Moreover, the low response rate infers potential sampling

bias. Third, even though the survey was conducted online to maintain anonymity, social desirability bias among the respondents may be unavoidable. Last, the scale was forward and back translated by a single translator, which may cause a potential bias, but the final translation was carefully reviewed by the expert panel.

## Conclusions

This study successfully translated CASS into Japanese and demonstrated its appropriate psychometric properties. This is the first attempt to examine the psychometric properties of CASS among the general Japanese population. Minor differences between the original CASS and J-CASS were demonstrated, which warrants further investigation of the differences in cancer-related stigma in different cultural backgrounds.

**Funding.** This study was supported by the National Cancer Center Research and Development Fund (28-A-23).

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