WILEY | Hindawi

Research Article

Validation of the Climate Change Anxiety Scale for Korean Adults

Sun Joo Jang ⓘ **, Sophia J. Chung** ⓘ **, and Haeyoung Lee** ⓘ

Red Cross College of Nursing, ChungAng University, 84 Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea

Correspondence should be addressed to Haeyoung Lee; im0202@cau.ac.kr

Purpose. This study evaluated the validity and reliability of the Korean Climate Change Anxiety Scale (CCAS) translation. *Design and Methods.* Data were collected using an online survey from January 17 to January 26, 2022, from 459 adults aged 19–65 years. Exploratory factor analysis and confirmatory factor analysis were performed, and Cronbach's α and intraclass correlation coefficient were evaluated. *Findings.* The CCAS's Korean version can be used as an effective tool because its validity and reliability have been verified. *Practice Implications.* Studies examining climate change anxiety can help protect human security against climate change-induced disasters and achieve sustainable development goals.

1. Introduction

Climate change is no longer a problem in the distant future that affects only a specific region. There is already a consensus on the responsibility of humankind for the impacts of global warming and climate change. In a report published in August 2021 by the Intergovernmental Panel on Climate Change (IPCC), scientists worldwide have found that extreme heat events have intensified globally and that by 2040 average global temperatures are expected to rise at least 1.5°C above preindustrial levels, posing significant risks to human health [1]. In addition, the Working Group I report of its Sixth Assessment Report presented the current climate state, future climate prospects, and measures to control future climate change and advocated policymakers' interests in climate change and efforts for resolution. Meleis [2] stated that nurses have an ethical and moral obligation to help achieve the United Nation's sustainable development goals (SDGs), including climate change action. Climate change is the biggest global health threat in the twenty-first century [3]. The clear link between climate change and health problems provides a strong justification for healthcare professionals, including nurses, to participate in climate change interventions [4].

However, as various abnormal phenomena such as floods, heat waves, and forest fires occur frequently due to climate change, anxiety about the depressing future is increasing day by day and, as such, climate change is threatening not only physical health but also mental health [5]. As a result of a survey on thoughts and feelings about climate change among 10,000 young people aged 16 to 25 years in 10 countries worldwide, more than 84% of the respondents answered that they experienced insecurity [5]. Furthermore, more than 50% said that they felt emotions such as sadness, anxiety, anger, helplessness, and guilt, and more than 45% said that such feelings had a negative impact on their daily life [5]. Increased anxiety is one of the negative emotional consequences of climate change [6].

Climate change anxiety (CCA), also known as ecological anxiety, climate distress, or climate anxiety, refers to the anxiety associated with the global climate crisis and the threat of environmental disaster [7]. It has the potential to cause difficulties in daily life; additionally, extreme anxiety can lead to secondary mental health problems [6]. Further, CCA deserves more attention as the psychological effects of climate change are not limited to those experiencing its direct impacts but also extend to anyone with access to information through modern communication technology [6].

Anxiety itself does not indicate a problem with one's mental health. In fact, it can provide an adaptive function as a forward-looking attitude that signals the approach of a

threat and motivates people to prepare properly [8]. Although many people experience unpleasant feelings about climate change, eco-anxiety is often defined as an individual's healthy reaction to climate change rather than a pathological reaction such as general anxiety disorder. A person who is aware of these problems and feels unpleasant after experiencing the consequences of climate change may be more likely to take action to reduce its impacts on their daily life [9].

However, experts warn that such concerns can be a catalyst for potential mental health problems [10, 11]. It has been reported that young people feel greater discomfort about climate change than older people [6]. In a recent study conducted with Generation Z Filipinos, aged 18–26 years, CCA was found to have a significant relationship with mental health [12]. In addition, it was reported that negative emotional responses to climate change had a negative correlation with mental health and a quantitative correlation with insomnia symptoms [13]. As the risk of climate change increases, worrying about its impacts can lead to high levels of anxiety, causing cognitive, emotional, and functional impairments [6, 7]. It is, therefore, important in this context to distinguish between "appropriate" emotional responses and "extreme" psychosocial responses [7].

It is necessary to properly measure CCA to accurately evaluate its level and determine how to manage and prevent it from becoming too severe and resulting in pathological anxiety. Additionally, properly measuring CCA will lead to positive actions aimed at reducing climate change. To perform such an evaluation, a validated tool is required. Clayton and Karazsia [7] constructed the Climate Change Anxiety Scale (CCAS), which has been translated and verified in Italian [14] and German [15]. This study translated the CCAS [7] into Korean for the first time and verified its reliability and validity, thereby contributing toward the foundation for managing CCA.

2. Methods

2.1. Study Design. Based on the World Health Organization's [16] recommendations and a previous study [17], this methodological study was conducted to translate the CCAS [7] into Korean and determine the Korean version's validity and reliability.

2.2. Participants and Data Collection. Participants were selected if they were (1) of Korean nationality with Korean as the native language and (2) between the ages of 19 and 65. The exclusion criteria were as follows: (1) having been diagnosed with mental health disorders such as anxiety disorder or depressive disorder at the time of the survey; and (2) having difficulties participating in the online survey.

Based on the minimum sample size for confirmatory factor analysis (CFA) being 300 [18] and the recommended sample size for CFA being between 300 and 500 [19], and considering a 10% dropout rate, data collection was conducted with the target of including 440 participants. Data were collected through an online survey from January 17 to January 26, 2022. A flyer explaining the research and providing links to the survey was posted on a site where individuals of the target age group were active, and only those who were willing to voluntarily participate in the study were included in the study. The participants were all volunteers. To prevent duplicate participation, it was prohibited to respond to the questionnaire more than once with the same IP address. Finally, 459 completed questionnaires were collected and all data were used for analysis.

2.3. Measures

2.3.1. Climate Change Anxiety Scale. The CCAS is a tool for measuring the psychological response to climate change. Initially, it had 22 items with four factors including cognitive impairment, functional impairment, behavioral engagement, and experience of climate change. However, in its development process, the tool was ultimately established with 13 items (five-point rating scale from 1: never to 5: almost always; scoring range: 13–65 points) across the two subscales of cognitive impairment and functional impairment [7]. The higher the score on each subscale, the greater the anxiety about climate change. We used the original version of the CCAS [7].

Permission was obtained from the original tool developers to develop the Korean version. Exploratory factor analysis (EFA) and CFA were performed with a total of 396 participants at the time of development, with a Comparative Fit Index (CFI) = 0.93, Tucker–Lewis index (TLI) = 0.92, root mean square error of approximation (RMSEA) = 0.07, and all factor loadings above 0.40. Cronbach's α was 0.87 at the time of development and 0.91 in this study.

2.3.2. Future Event Questionnaire. As a tool developed to measure future event recognition [20], the Future Event Questionnaire (FEQ) includes a total of 34 items with 17 items each regarding optimism and pessimism and uses a five-point rating scale (from 1: not at all certain to 5: as certain as one can be) with a scoring range of 17–85 points. The Korean version of the FEQ devised by Hyeon, Kim, and Lee [21] was used in this study. Cronbach's α was 0.87 at the time of development, 0.94 for the Korean version, and 0.92–0.94 in this study.

2.4. Ethical Considerations. Regarding the ethical considerations pertaining to this study, we received approval from the Institutional Review Board of the researcher's university (No. 1041078-202111-HR-324-01), and the survey was conducted online in response to the COVID-19 pandemic restrictions. Information about the study, such as its purpose and method, was explained in the recruitment flyer. It was also stated that participation could be stopped at any time during the study. The explanations about the purpose and method of the study were reiterated when participants accessed the link to the survey, as was an anonymity guaranteed. The survey was conducted after obtaining electronic informed consent to participate in the study. The

names and contact information of the research director and assistant were listed to indicate that they could be contacted at any time with questions related to the study.

2.5. Data Analysis.

Data analysis was performed using IBM SPSS Statistics 26.0 and the Analysis of Moment Structure (AMOS) 26.0 statistical programs. The general characteristics of the participants were analyzed using descriptive statistics. The Content Validity Index (CVI) of the tool was calculated on a four-point rating scale by a group of experts. The Kaiser-Mayer-Olkin (KMO) test and Bartlett's test of sphericity were performed to confirm whether the collected data were suitable for factor analysis. EFA and CFA were performed to test the construct validity. After verifying suitability, factors with an eigenvalue of 1 or above, communality of over 0.40, and factor loading of over 0.50 were extracted through principal component factor analysis via the rotation method. EFA was performed by randomly selecting data from 350 of the 459 participants. Based on the EFA results, CFA was performed using the data of all 459 participants. To verify the fit of the model, the Absolute Fit Index χ^2, χ^2/df, Goodness of Fit Index (GFI), RMSEA, TLI, CFI, and Normal Fit Index (NFI) were used. Standardized factor loading (β), average variance extracted (AVE), and composite reliability (CR) were used for convergent validity of an item, and the correlation coefficient and AVE value were used for discriminant validity. To verify the criterion validity, the correlation between the CCAS and the FEQ tools was analyzed using Pearson's correlation coefficient. Cronbach's α was used to confirm the internal consistency between items for the reliability of the tool, and the intraclass correlation coefficient (ICC) was calculated by retesting 86 out of 459 participants [22] at an interval of two weeks for verification of stability.

2.6. Preliminary Tool Verification Procedure.

The primary Korean translation was performed by three researchers (one American and two Koreans) who are nursing professors. Based on the World Health Organization's [16] recommendations regarding using experts for translating instruments, an American bilingual member of the research team led the translation process. The researchers went through several agreement stages to translate the English sentences into suitable Korean ones while preserving the meaning of the original text, focusing on whether the meaning of the question was conveyed concisely and clearly. The translated Korean version of the tool was reviewed by Koreans fluent in both Korean and English for the accuracy and appropriateness of expressions.

The reverse translation was commissioned to a panel of experts who were bilingual American nursing professors, and mutual independence was maintained between the primary and reverse translators. Through a discussion between the two, the inconsistencies between the original English and the reverse-translated tools and distortions in expression and meaning due to cultural differences were confirmed and corrected. The final agreed content was confirmed as the Korean version of the CCAS.

3. Results

Based on the collected data, the verification of the preliminary tool was conducted in a stepwise manner. EFA and CFA were performed to verify construct validity. Next, convergent validity, discriminant validity, and criterion validity were assessed. Reliability analysis for the items whose validity was secured through factor analysis was performed based on the correlation between each item and the sum of all items through item-total correlation with a criterion of 0.30 or above, and the internal consistency of the items was confirmed by Cronbach's α. Through the above process, the final Korean version of the CCAS consisting of two factors and a total of 13 questions was confirmed, and the contents of each step are described below in detail.

3.1. Participants' General Characteristics.

Table 1 shows the general characteristics of the study's participants. The average age of the participants was 44.18 years (standard deviation (SD) 13.54), and there were 234 (51.0%) female participants. Of the participants, 254 (55.3%) were married; 256 (55.8%) did not participate in religious services; 314 (68.4%) had a high school diploma; and 202 (44.0%) belonged to the "middle" socioeconomic class. Four hundred and twenty participants (91.5%) had an occupation, including students, and the average length of total work experience was 14.43 years (SD 10.45). Regarding questions about environmental preservation activities, which allowed multiple responses, recycling received 440 (95.9%) responses, avoiding using disposable items received 332 (72.3%) responses, and participation in environmental activism received 13 (2.8%) responses.

3.2. Item Analysis.

The mean score for each item was 1.20–1.65. The skewness and the kurtosis values ranged from 0.04 to 2.77 and −1.04 to 7.30, respectively. This occurs when the absolute value of skewness is less than 3 and the absolute value of kurtosis is less than 10. Analyzing the item-total correlation coefficient revealed that the correlation coefficient of all the items was 0.62–0.79 (Table 2), confirming that the items had internal consistency.

3.3. Validity Analyses

3.3.1. Content Validity.

A panel of experts consisting of seven nursing professors (one in maternal nursing, two in adult nursing, one in nursing management, two in psychiatric nursing, one in community nursing, and one in pediatric nursing) evaluated the content validity of the Korean version of the CCAS. The item CVI was 0.86–1.00, and the scale CVI was 0.97.

3.3.2. Construct Validity.

To verify the construct validity of the Korean version of the CCAS, EFA was performed using the data from 350 participants who were randomly selected. The KMO value was 0.92 (standard: 0.60 or above), and the result of Bartlett's test of sphericity showed $\chi^2 = 2671.88$

TABLE 1: Participants' general characteristics ($N = 459$).

Characteristics	Categories	Number	%	M (SD)
Gender	Male/female	225/234	49.0/51.0	
Age (years)	19–29	89	19.4	
	30–39	86	18.7	
	40–49	92	20.0	44.18 (13.54)
	50–59	96	20.9	
	Above 60	96	20.9	
Marital status	Single/married	205/254	44.7/55.3	
Residence	Major city	304	66.2	
	Small city	135	29.4	
	Rural area	20	4.4	
Participation in religious services	Yes/no	203/256	44.2/55.8	
Education	Middle school	88	19.2	
	High school	314	68.4	
	Bachelor's degree	44	9.6	
	Above master's degree	13	2.8	
Health condition	Bad	55	12.0	
	Moderate	191	41.6	
	Good	213	46.4	
Socioeconomic status	Low	188	41.0	
	Middle	202	44.0	
	High	69	15.0	
Occupation	No/yes	39/420	8.5/91.5	
Working years				14.43 (10.45)
Action for environmental protection (multiple responses)	None	10	2.2	
	Recycling	440	95.9	
	Avoiding using disposable items	332	72.3	
	Environmental activism	13	2.8	
Interest in environmental protection (VAS 1–10)				6.88 (1.67)

Note. VAS, visual analogue scale; M, mean; SD, standard deviation.

TABLE 2: Item analysis of the Korean version of climate change anxiety scale ($N = 459$).

Items	M	SD	Min	Max	Skewness	Kurtosis	ITC r
1. Thinking about climate change makes it difficult for me to concentrate	1.60	0.77	1	5	1.05	0.41	0.68
2. Thinking about climate change makes it difficult for me to sleep	1.33	0.64	1	4	2.06	3.92	0.77
3. I have nightmares about climate change	1.20	0.53	1	4	2.77	7.30	0.71
4. I find myself crying because of climate change	1.40	0.70	1	4	1.73	2.28	0.76
5. I think, "why cannot I handle climate change better?"	2.44	1.04	1	5	0.04	−1.04	0.62
6. I go away by myself and think about why I feel this way about climate change	1.62	0.89	1	5	1.35	1.01	0.75
7. I write down my thoughts about climate change and analyze them	1.36	0.73	1	5	2.19	4.56	0.72
8. I think, "why do I react to climate change this way?"	1.58	0.85	1	5	1.44	1.34	0.75
9. My concerns about climate change make it hard for me to have fun with my family or friends	1.31	0.67	1	4	2.31	5.08	0.73
10. I have problems balancing my concerns about sustainability with the needs of my family	1.65	0.90	1	5	1.33	1.18	0.68
11. My concerns about climate change interfere with my ability to get work or school assignments done	1.29	0.62	1	4	2.30	5.10	0.77
12. My concerns about climate change undermine my ability to work to my potential	1.26	0.60	1	4	2.45	5.72	0.79
13. My friends say I think about climate change too much	1.33	0.65	1	4	1.97	3.25	0.79
Total	1.49	0.54					

Note. M, mean; SD, standard deviation; ITC, item-total correlation.

($p < 0.001$), confirming the data as suitable for factor analysis. Principal component analysis and varimax orthogonal rotation were used. An eigenvalue of 1 or above and the slope of the scree plot were assessed, and two factors were extracted as in the original tool. The commonality of each item was 0.44–0.78, and the factor loading was 0.54–0.86. The eigenvalue was 6.80 for Factor 1 and 1.23 for Factor 2. The explanatory factor was 52.3% for Factor 1 and 9.5% for Factor 2, with a cumulative explanatory power of 61.8% (Table 3).

TABLE 3: Factor loading of the Korean version of climate change anxiety scale ($N = 350$).

Items	Factor 1	Factor 2
	Factor loading	
Factor 1: functional impairment		
2. Thinking about climate change makes it difficult for me to sleep	0.63	
3. I have nightmares about climate change	0.68	
9. My concerns about climate change make it hard for me to have fun with my family or friends	0.78	
10. I have problems balancing my concerns about sustainability with the needs of my family	0.57	
11. My concerns about climate change interfere with my ability to get work or school assignments done	0.86	
12. My concerns about climate change undermine my ability to work to my potential	0.85	
13. My friends say I think about climate change too much	0.71	
Factor 2: cognitive impairment		
1. Thinking about climate change makes it difficult for me to concentrate		0.61
4. I find myself crying because of climate change		0.61
5. I think, "why cannot I handle climate change better?"		0.79
6. I go away by myself and think about why I feel this way about climate change		0.84
7. I write down my thoughts about climate change and analyze them		0.54
8. I think, "why do I react to climate change this way?"		0.68
Cronbach's α	0.89	0.85
Eigenvalue	6.80	1.23
Explained variance (%)	52.3	9.5
Cumulative variance (%)	52.3	61.8

Note. Kaiser–Mayer–Olkin measure for sampling adequacy, 0.92; Bartlett's sphericity test, $\chi^2 = 2671.88$, $p < 0.001$.

The two factors extracted through explanatory factor analysis were reversed compared with the original tool, so Factor 1 was labeled functional impairment and Factor 2 was labeled cognitive impairment. In addition, Item 2 ("Thinking about climate change makes it difficult for me to sleep") and Item 3 ("I have nightmares about climate change") corresponded to cognitive impairment in the original tool but were included as a factor for functional impairment in this study.

To examine the unidimensionality of the Korean version of the CCAS, an explanatory factor analysis was performed followed by a confirmatory analysis. The results of the validation of the fit of the model during the CFA process (Model 1) indicated $\chi^2 = 459.31$ ($p < 0.001$), $\chi^2/\mathrm{df} = 7.18$, GFI = 0.86, RMSEA = 0.12, TLI = 0.87, CFI = 0.89, NFI = 0.88, and standardized root mean square residual (RMR) = 0.06. In order to increase the model fit in this study, the correlation between the paths with a modification index of 10 or above was recognized, and CFA was performed on the modified model (Model 2) based on the errors between items 1 and 7, items 2 and 3, items 2 and 11, items 9 and 12, and items 11 and 12 and the correlation between the errors. The results indicated $\chi^2 = 273.38$ ($p < 0.001$), $\chi^2/\mathrm{df} = 4.67$, GFI = 0.92, RMSEA = 0.09, TLI = 0.92, CFI = 0.94, NFI = 0.93, and standardized RMR = 0.05 (Table 4).

3.3.3. Convergent and Discriminant Validities. Standardized estimate (β) values in this study range from 0.64 to 0.83, satisfying the standard value of 0.50 or above. AVE was 0.50–0.58, which satisfies the standard value of 0.50 or above. The CR was 0.86–0.91, which was above the standard value of 0.70 or above, confirming the convergent validity of the tool. The r^2 of Factor 1 items was 0.46–0.62, which was smaller than the AVE of 0.75 for Factor 1, and the r^2 of Factor 2 items was 0.38–0.56, which was smaller than the AVE of 0.58 for Factor 2, confirming discriminant validity (Table 4).

3.3.4. Criterion Validity. To confirm the criterion's validity, the correlation with future event recognition was analyzed. In general, a correlation coefficient between 0.3 and 0.5 is evaluated as fair. The criterion validity of CCA and future event recognition was confirmed as they show a positive correlation ($r = 0.31$, $p < 0.001$).

3.4. Reliability Verification. Cronbach's α for the Korean version of the CCAS was 0.91. Cronbach's α for Factor 1 was 0.89 and that of Factor 2 was 0.85. As a result of retesting at a two-week interval, the ICC was shown to be 0.84.

4. Discussion

This study demonstrated that the Korean version of the CCAS is a valid and reliable tool for assessing anxiety about climate change among Korean adults. We analyzed content validity, construct validity, convergent and discriminant validity, and criterion validity for the Korean version. Both the item CVI and scale CVI indicated adequate content validity. The KMO test and Bartlett's test of sphericity from EFA showed that the data were suitable for identifying the model. Convergent and discriminant validities were also proved. Criterion validity was confirmed based on the fair positive correlation between the Korean version of CCAS and the FEQ. This means that the more anxious an individual is about climate change, the more pessimistic are their predictions about the future. Although the validity of the Korean version was confirmed by the findings of this study, the factors and included items from CFA were slightly different from the original version of the CCAS.

From the CFA results in this study, two factors were identified, in accordance with the original version of the scale. The model from the Korean version accounted for

TABLE 4: Confirmatory factor analysis of the Korean version of climate change anxiety scale ($N = 459$).

Factors	Items	Standardized estimate (β)	SE	Critical ratio (p)	AVE	CR	r^2
1	2	0.76	0.18	—	0.75	0.95	0.59
	3	0.73	0.13	18.02 (<0.001)			0.50
	9	0.77	0.18	16.37 (<0.001)			0.53
	10	0.64	0.49	13.32 (<0.001)			0.46
	11	0.80	0.13	16.70 (<0.001)			0.59
	12	0.83	0.12	17.85 (<0.001)			0.62
	13	0.80	0.16	17.15 (<0.001)			0.62
2	1	0.67	0.33	—	0.58	0.89	0.46
	4	0.75	0.22	13.89 (<0.001)			0.58
	5	0.58	0.73	11.09 (<0.001)			0.38
	6	0.75	0.35	13.92 (<0.001)			0.56
	7	0.73	0.25	12.08 (<0.001)			0.52
	8	0.75	0.32	13.64 (<0.001)			0.56

Model 1: $\chi^2 = 459.31$ ($p < 0.001$), $\chi^2/df = 7.18$, GFI = 0.86, RMSEA = 0.12, TLI = 0.87, CFI = 0.89, NFI = 0.88, standardized RMR = 0.06
Model 2: $\chi^2 = 273.38$ ($p < 0.001$), $\chi^2/df = 4.67$, GFI = 0.92, RMSEA = 0.09, TLI = 0.92, CFI = 0.94, NFI = 0.93, standardized RMR = 0.05

Note. SE, standard error; AVE, average variance extracted; CR, composite reliability; GFI, Goodness of Fit Index; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis Index; CFI, Comparative Fit Index; NFI, Normal Fit Index; Standardized RMR, standardized root mean square residual.

approximately 62.0% of the variance among the items, which was higher than that of the German (47.0%; [15]) or Italian versions (36%; [14]), although the distribution of items or structures was slightly different. Contrary to the original version, functional impairment was found to be the first factor (52.3%), followed by cognitive impairment (9.5%), in the Korean version of the CCAS. While four factors could be more suited in the German version [15], the study from Italy found that a single-factor structure was valid [14]. In the Philippine version, a two-factor model was the most adequate [23].

The items in the factor structure found in this study were distributed differently compared with the original scale. Sleep-related items (Item 2: "Thinking about climate change makes it difficult for me to sleep" and Item 3: "I have nightmares about climate change") were found to belong to functional, not cognitive, impairment. Switching the items related to sleep to functional impairment was not found in other versions of the CCAS. This could be explained by the differences in the perception of sleep. Sleep has been associated with performance or work [24–26] as well as cognition [27, 28]. The developers of the original CCAS as well as the participants from other studies thought that sleep was more vital to concentration, one of the topics for cognitive-emotional impairment [7]. However, Koreans might consider that sleep is more related to the ability to perform or complete something, like academic performance [29].

The reliability of the Korean version of the CCAS was also proved. The ICC for the overall scale as well as each subscale showed good internal consistency. Test-retest reliability in the Korean version was confirmed as well. Because diverse versions of the CCAS, including the Korean one, showed good reliability [6, 14, 15, 23], using them could provide a chance to assess CCA among those speaking diverse languages.

In this study, South Koreans proved to be less anxious about climate change than Americans [7], Canadians [30], and Germans [15], but more anxious than Italians [14]. According to previous studies, experiences of climate change were associated with an increase in related anxiety [7, 30]. As

such, South Koreans might have relatively less experience with disasters due to climate change compared with people in Canada, Germany, and the US [31]. They also might not consider some events like floods or typhoons as serious problems related to climate change, because floods, which are frequent in South Korea, are relatively small and less intense compared with those in other countries [32]. As a result, the anxiety levels of South Koreans might be lower than those in other nations.

There are several limitations to this study. First, participants were recruited through the website where the online survey was posted. There could be a chance that people with lower e-literacy or less accessibility to the online environment were excluded. In addition, the participants might have not been representative of the whole South Korean population. Thus, it would be helpful if studies with more nationwide samples were replicated. In addition, response bias was a possibility because the CCAS is a self-administrated questionnaire. Furthermore, we only investigated people who resided in major cities, small cities, and rural areas. Additionally, people who live near the sea may perceive climate change differently than those who live in mountainous areas; thus, there may be a bias. Therefore, it is suggested that, in future studies, multilevel analyses be conducted to examine each geographical characteristic that can influence people's perception of climate change and their anxiety related to it. Finally, there could have been a floor effect in this study because all values ranged from 1.20 to 2.44. Compared with other nations except the US [7], the total scores as well as the subscale scores were below 2.0 on a five-point scale. For further research, increasing the number of response options (e.g., using a seven-point scale) or using an unbalanced scale (e.g., a negative-centered equal-interval five-point scale) could mitigate the floor effect.

In spite of these limitations, this study is significant as it validated the Korean version of the CCAS. Like the other versions of the CCAS, the Korean version was found to be

valid and reliable. More studies using different versions of the CCAS, including the Korean version, are necessary to examine cultural differences related to climate change because the best model and the level of CCA differ depending on the nation. In addition, given that climate change is a global issue [33] that has the potential to affect people worldwide, studies regarding the CCAS can be helpful in evaluating CCA and developing and implementing interventions to address it.

5. Conclusions

In this study, the CCAS was translated into Korean, and the validity and reliability of the tool were verified. Although the levels of CCA observed in this study were lower than in other nations, South Koreans are no exception from the threat of rapid climate change. This could increase related anxiety, and thus, the Korean version of the CCAS could be used to monitor anxiety levels among South Koreans, helping to prevent mental health problems among them and improve their psychological well-being.

6. Implications for Nursing Practice

Climate change is an issue requiring global effort. For the peace and prosperity of people around the world, climate action is one of the SDGs declared by the United Nations [34]. Studies about the anxiety level related to climate change could be helpful to improve an individual's psychological well-being and protect human security against disasters resulting from climate change. This could ultimately lead to achieving the SDGs.

Nurses can help achieve SDGs, especially those related to climate change, by using the Korean version of the CCAS to assess the level of CCA among Korean adults. Specifically, nurses working in hospitals can use this scale to screen for CCA among patients who are hospitalized due to climate change-related problems and help provide early, appropriate interventions. Furthermore, nurses can examine the effectiveness of the interventions aimed at relieving CCA and helping in the fight against climate change.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Ethical Approval

This study was approved for secondary data analysis by the Institutional Review Board at the Chung-Ang University (No. 1041078-202111-HRSB-324-01, approved on January 14, 2022).

Conflicts of Interest

The authors declare that there are no conflicts of interest.

References

[1] Ipcc, *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, 2021.

[2] A. I. Meleis, Edited by M. C. Smith, Ed., "Afaf Meleis' transitions theory," in *Nursing Theories and Nursing Practice*, F. A. Davis, Ed., pp. 353–370, Philadelphia, PA, USA, 5th edition, 2019.

[3] N. Watts, M. Amann, N. Arnell et al., "The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come," *The Lancet*, vol. 392, no. 10163, pp. 2479–2514, 2018.

[4] E. Dickman, C. Backler, C. D. Berg, M. Komandt, and J. Schiller, "Climate change and oncology nursing: a call to action," *Clinical Journal of Oncology Nursing*, vol. 26, no. 1, pp. 109–113, 2022.

[5] C. Hickman, E. Marks, P. Pihkala et al., "Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey," *The Lancet Planetary Health*, vol. 5, no. 12, pp. e863–e873, 2021.

[6] S. Clayton, "Climate anxiety: psychological responses to climate change," *Journal of Anxiety Disorders*, vol. 74, Article ID 102263, 2020.

[7] S. Clayton and B. T. Karazsia, "Development and validation of a measure of climate change anxiety," *Journal of Environmental Psychology*, vol. 69, Article ID 101434, 2020.

[8] D. H. Barlow, V. M. Durand, and S. G. Hofmann, *Abnormal Psychology: An Integrative Approach*, Cengage Learning, Boston, MA, USA, 8th edition, 2019.

[9] P. Cianconi, S. Betrò, and L. Janiri, "The impact of climate change on mental health: a systematic descriptive review," *Frontiers in Psychiatry*, vol. 11, p. 74, 2020.

[10] K. Hayes, G. Blashki, J. Wiseman, S. Burke, and L. Reifels, "Climate change and mental health: risks, impacts and priority actions," *International Journal of Mental Health Systems*, vol. 12, no. 1, p. 28, 2018.

[11] K. Usher, J. Durkin, and N. Bhullar, "Eco-anxiety: how thinking about climate change-related environmental decline is affecting our mental health," *International Journal of Mental Health Nursing*, vol. 28, no. 6, pp. 1233-1234, 2019.

[12] M. E. S. Reyes, B. P. B. Carmen, M. E. P. Luminarias, S. A. N. B. Mangulabnan, and C. A. Ogunbode, "An investigation into the relationship between climate change anxiety and mental health among Gen Z Filipinos," *Current Psychology*, pp. 1–9, 2021.

[13] C. A. Ogunbode, S. Pallesen, G. Böhm et al., "Negative emotions about climate change are related to insomnia symptoms and mental health: cross-sectional evidence from 25 countries," *Current Psychology*, 2021.

[14] M. Innocenti, G. Santarelli, V. Faggi et al., "Psychometric properties of the Italian version of the climate change anxiety scale," *The Journal of Climate Change and Health*, vol. 3, Article ID 100080, 2021.

[15] M. C. Wullenkord, J. Tröger, K. R. S. Hamann, L. S. Loy, and G. Reese, "Anxiety and climate change: a validation of the Climate Anxiety Scale in a German-speaking quota sample and an investigation of psychological correlates," *Climatic Change*, vol. 168, no. 3–4, pp. 20–23, 2021.

[16] World Health Organization, *Process of Translation of Instruments* WHO, Geneva, Switzerland, 2021, https://www.who.int/substabce_abuse/research_tools/translation/en/.

[17] N. Turan, H. Durgun, H. Kaya, and T. Aştı, "Turkish adaptation of the multidimensional emotional empathy scale: a validity and reliability study," *Perspectives in Psychiatric Care*, vol. 57, no. 2, pp. 455–462, 2021.

[18] R. F. DeVellis, *Scale Development: Theory and Applications*, Sage, Los Angeles, CA, USA, 4th edition, 2017.

[19] S. S. Han and S. C. Lee, *Using the SPSS/Amos Nursing and Health Statistical Analysis*, Hanarae, Seoul, Republic of Korea, 2nd edition, 2018.

[20] R. Miranda and D. S. Mennin, "Depression, generalized anxiety disorder, and certainty in pessimistic predictions about the future," *Cognitive Therapy and Research*, vol. 31, no. 1, pp. 71–82, 2007.

[21] H. Hyeon, J. S. Kim, and J.-S. Lee, "Validation study of the Korean version of the future event questionnaire(K-FEQ)," *Cognitive Behavior Therapy in Korea*, vol. 18, no. 4, pp. 467–486, 2018.

[22] B. Giraudeau and J. Y. Mary, "Planning a reproducibility study: how many subjects and how many replicates per subject for an expected width of the 95 per cent confidence interval of the intraclass correlation coefficient," *Statistics in Medicine*, vol. 20, no. 21, pp. 3205–3214, 2001.

[23] P. D. Simon, K. A. Pakingan, and J. J. B. R. Aruta, "Measurement of climate change anxiety and its mediating effect between experience of climate change and mitigation actions of Filipino youth," *Educational and Developmental Psychologist*, vol. 39, no. 1, pp. 17–27, 2022.

[24] R. M. Brossoit, T. L. Crain, J. J. Leslie, L. B. Hammer, D. M. Truxillo, and T. E. Bodner, "The effects of sleep on workplace cognitive failure and safety," *Journal of Occupational Health Psychology*, vol. 24, no. 4, pp. 411–422, 2019.

[25] D. Dawson, M. Sprajcer, and M. Thomas, "How much sleep do you need? A comprehensive review of fatigue related impairment and the capacity to work or drive safely," *Accident Analysis & Prevention*, vol. 151, Article ID 105955, 2021.

[26] A. W. Stimpfel, F. Fatehi, and C. Kovner, "Nurses' sleep, work hours, and patient care quality, and safety," *Sleep Health*, vol. 6, no. 3, pp. 314–320, 2020.

[27] A. E. Beaudin, J. K. Raneri, N. T. Ayas et al., "Cognitive function in a sleep clinic cohort of patients with obstructive sleep apnea," *Annals of the American Thoracic Society*, vol. 18, no. 5, pp. 865–875, 2021.

[28] A. Kusztor, L. Raud, B. E. Juel, A. S. Nilsen, J. F. Storm, and R. J. Huster, "Sleep deprivation differentially affects subcomponents of cognitive control," *Sleep*, vol. 42, no. 4, Article ID zsz016, 2019.

[29] J. S. Lee, K. T. Kim, and Y. W. Cho, "Sleep and academic performance in Korean high school students," *Journal of the Korean Neurological Association*, vol. 37, no. 3, pp. 262–268, 2019.

[30] A. Bratu, K. G. Card, K. Closson et al., "The 2021 Western North American heat dome increased climate change anxiety among British Columbians: results from a natural experiment," *The Journal of Climate Change and Health*, vol. 6, Article ID 100116, 2022.

[31] D. Eckstein, V. Künzel, L. Schäfer, and M. Winges, *Global Climate Risk Index 2020*, Germanwatch, Bonn, Germany, 2019.

[32] J. H. Yun and S. J. Byeon, "Current status and improvement strategy of disaster statistics and information in Korea—a case of flood disasters," *Crisis and Emergency Management: Theoria and Praxis*, vol. 15, no. 1, pp. 113–122, 2019.

[33] United Nations, "Climate action," 2022a, https://www.un.org/en/climatechange/what-is-climate-change.

[34] United Nations, "The 17 goals," 2022b, https://sdgs.un.org/goals.