

RESEARCH ARTICLE

Psychometric properties of the Korean adaptation of the communities advancing resilience toolkit (CART) assessment survey

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Abstract

Aims: This study aimed to establish a cross-cultural adaptation of the Communities Advancing Resilience Toolkit (CART) assessment survey for Korean communities (K-CART) and evaluated its psychometric properties of K-CART.

Design: A cross-sectional study design was used.

Methods: A forward and backward translation of the CART was conducted. The psychometric properties of K-CART were evaluated with test-retest reliability, internal consistency, content validity and construct validity. A field study was conducted involving 315 older adults in Pohang city, South Korea from January to March, 2019. Two versions of K-CART were analysed, based on the four-factor and the expanded five-factor K-CART.

Results: The test-retest reliability and internal consistency were acceptable (intraclass consistency coefficient = .90). The consistency reliability was satisfactory (Cronbach's $\alpha = 0.91$). The content validity index (CVI) was found to be acceptable; wherein the item-CVI and scale-CVI were both 0.95. Confirmatory factor analysis confirmed that the construct validity of the expanded K-CART with five factors reached a more acceptable model fit ($\chi^2/df = 2.27$, CFI = 0.89, TLI = 0.86, RMSEA = 0.05).

KEYWORDS

assessment, community, disaster planning, resilience, risk management

1 | INTRODUCTION

Globally, 315 natural disasters had occurred in 2018, affecting over 68 million people, killing 11,804 and resulting in economic losses of US\$ 131.7 billion (Centre for Research on the Epidemiology of Disaster, 2019). South Korea, which experiences various types of natural disasters including storms, severe rains, floods, heavy snow and, recently, earthquakes, endured 27 natural disasters in 2018 that killed 53 people and resulted in economic losses worth 141.3 billion Korean won (US\$ approximately 124.2 million) (Korean

Ministry of the Interior and Safety, 2019). The number of people affected, and the monetary losses tell only partly the story of destruction faced by individuals, families, organizations and communities (Sinclair et al., 2016, 2020; Wu et al., 2020). At the individual level, disaster exposure can cause physical harm, including injury, disability and illness, and psychological problems such as anxiety, depression, post-traumatic stress disorder and other mental health conditions (Bonanno et al., 2010; Khachadourian et al., 2015; Sinclair et al., 2016, 2020; Wu et al., 2020). Moreover, disasters disrupt roles and routines and the social networks and processes that could

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potentially contribute to community recovery, thus jeopardizing the structure and functioning of the community across multiple dimensions (Pfefferbaum et al., 2007).

Disasters disrupt the functioning of communities and can cause enormous human, material, economic and environmental damages that exceed the response and restorative capacity of local resources (Mayner & Arbon, 2015; United Nations Office for Disaster Risk Reduction, 2020). Communities are increasingly focusing on community resilience as a strategy to enhance disaster preparedness, response and recovery. Unfortunately, relatively few instruments are available to measure and operationalize community resilience (Cui et al., 2018; Ostadtaghizadeh et al., 2015; Pfefferbaum, Pfefferbaum, & Van Horn, 2015). One such instrument is the theory-based, evidence-informed Communities Advancing Resilience Toolkit (CART) Assessment Survey (Pfefferbaum et al., 2011, Rev 2013; Pfefferbaum, Neas, et al., 2013; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015), which was developed to assess community disaster resilience and guide community efforts to build resilience. Providing a valid and reliable instrument to measure community resilience among people who have experienced disasters can be important to identify community strengths and challenges and to implement interventions that improve community resilience. Therefore, this study aims to adapt the CART survey to the Korean cultural context (henceforth called K-CART) and evaluate its psychometric properties. A K-CART field study was conducted to identify community strengths and challenges as perceived by community members exposed to an earthquake in South Korea.

2 | BACKGROUND

Resilient individuals and communities are capable of adapting to and recovering from the onslaught of adversities associated with disasters. Resilience can be conceptualized as a process, an attribute and/or an outcome at the individual, family and community levels (Aburn et al., 2016; Laksmi et al., 2020; Pfefferbaum, Van Horn, & Pfefferbaum, 2015; Southwick et al., 2014). Community resilience is distinguished from personal resilience in that community members, buttressed by available physical and social conditions and structures, work together to respond to and recover from the hardships and adversities facing the community. Community resilience is grounded in the ability of community members to take meaningful, deliberate and collective action (Pfefferbaum, Van Horn, & Pfefferbaum, 2015). Community resilience thus enhances disaster preparedness and recovery (Cui et al., 2018; Pfefferbaum, Van Horn, & Pfefferbaum, 2015; West et al., 2020). A recent systematic literature review of community resilience and its various definitions described nine core elements constituting community resilience as applied to disaster management: local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness and mental outlook (Patel et al., 2017).

Despite growing attention to community resilience in disaster management in South Korea (Korean Ministry of the Interior and Safety, 2019), few studies have described how to assess or build community resilience in South Korea. One of the relatively few guidebooks and toolkits available online (Ostadtaghizadeh et al., 2015)—the Communities Advancing Resilience Toolkit (CART) (Pfefferbaum et al., 2011, Rev 2013)—includes a community assessment survey (Pfefferbaum et al., 2011, Rev 2013; Pfefferbaum, Neas, et al., 2013; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015) along with other assessments and analytic instruments for addressing community resilience. The theory-based, evidence-informed CART Assessment Survey questionnaire (Pfefferbaum et al., 2016; Pfefferbaum, Neas, et al., 2013; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015) can be used to assess community resilience to identify the strengths and challenges in communities in disaster situations and to compare community resilience before and after a disaster or an intervention. Community leaders, local organizations, responder groups and healthcare providers can use the CART Assessment Survey to document the status and inform the development of disaster preparedness, response and recovery plans, programmes and policies (Pfefferbaum, Pfefferbaum, et al., 2013).

The primary purpose of this study was to evaluate the psychometric properties of K-CART as an instrument to assess community resilience. The specific objectives were (1) to conduct a cross-cultural adaptation of the CART Assessment Survey in the Korean cultural context, and (2) to evaluate its stability, internal consistency reliability, content validity and construct validity. The study, which involved an application of K-CART in a sample of Korean elders directly affected by an earthquake that occurred in 2017 in South Korea, also identified community resilience strengths and challenges in the context of the affected community.

3 | METHODS

3.1 | Design

A cross-sectional design with population-based survey was conducted among older adults.

3.2 | Instrument

The CART Assessment Survey was developed in the United States (US) by the Terrorism and Disaster Center (TDC) of the National Child Traumatic Stress Network (Pfefferbaum, Pfefferbaum, et al., 2013). The literature on community capacity and competence (Cottrell, 1976; Gibbon et al., 2002; Goepfinger & Baglioni, 1985; Goodman et al., 1998; Labonte & Laverack, 2001a, 2001b) provided the theoretical foundation for the early development of the instrument. Key informant input and a series of field tests yielded a questionnaire with 21 items that were categorized into four

domains based on exploratory and confirmatory factor analyses (Pfefferbaum, Neas, et al., 2013). The four interrelated domains both reflect and contribute to community resilience: (1) Connection and Caring (characterized by participation, relatedness, shared values, support, equity, justice, hope and diversity in a community); (2) Resources (including a community's natural, physical, human, social and economic resources); (3) Transformative Potential (derived from the ability of a community to frame collective experiences, collect and analyse relevant data, assess community performance and build skills); and (4) Disaster Management (associated with the prevention and preparedness, mitigation, response and recovery activities of a community) (Pfefferbaum, Neas, et al., 2013; Pfefferbaum, Pfefferbaum, et al., 2013).

An expanded version of the CART survey with five domains was created by adding four items related to Information and Communication (e.g. providing information about relevant issues). Evidence from early field-test samples suggested that information and communication were important elements of each of the original four domains rather than being a separate domain, but the importance of information and communication as a potential separate domain became increasingly apparent based on new research and current events over recent years. Field testing confirmed the five-factor model and an expanded survey demonstrated good reliability (Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015). Further, minor revisions of the five-domain CART survey, based on empirical research in a variety of communities, have been affirmed by confirmatory factor analysis (CFA). The present study is based on a version of the CART survey containing a total of 26 items in five domains (confirmation of the instrument was received from the tool developer via personal communication, September 2018 and September 2020).

CART survey item responses are measured using a five-point Likert scale, with options ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The responses "agree" and "strongly agree" are used to determine the percentage of agreement with individual items. The high and low percentage of agreement scores among the survey items identify the primary community resilience strength and challenge factors, respectively (Pfefferbaum et al., 2016; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015).

3.3 | Cultural adaptation and translation of the CART survey into Korea for evidence-based practice

Permission was obtained from the developers of the CART survey to use the tool and to translate it into Korean (personal communication, September 2018). Forward and backward translation was conducted in compliance with the World Health Organization guidelines (WHO, 2021). A bilingual researcher, who is a nursing professor, performed forward translation from English to Korean. Two bilingual nursing professors, with expertise in disasters and community health nursing, reviewed the translated Korean version of the survey to evaluate its appropriateness in the cultural context of Korea. A researcher, who is a doctoral-level student in the Korean language,

reviewed the translated version of the survey for semantic differences in grammar and vocabulary. Some detailed expressions were modified to increase the equivalence with the English version of the survey. Back translation was performed by an independent bilingual translator with a master's degree in nursing who worked as a nurse in the US. The developers of the CART survey reviewed the back-translated tool, confirmed that most questions were equivalent in meaning to the English tool and recommended specific changes in wording. Finally, all researchers endorsed the Korean version of the survey.

To apply the instrument across cultures, using culturally appropriate and psychometrically validated instruments is essential for making comparisons between studies conducted in other countries. Original version of CART was evaluated psychometric property with reliability, face validity, convergent validity and discriminant validity. This study evaluated stability, internal consistency reliability, content validity and construct validity of K-CART for cultural adaptation.

A content validity test was conducted to ensure that each item reflected the appropriate content and that the items were clearly understandable in the Korean cultural context. A panel of eight experts with disaster research and practice experience examined the content validity of K-CART. Panel members were asked to determine the comprehensiveness, relevance, suitability and interpretability of the items, and subsequently, the unclear Korean expressions were modified. The content validity index (CVI) was calculated on a four-point ordinal scale using semi-structured questionnaires (Polit & Beck, 2006). Test-retest reliability was conducted at intervals of 2 weeks with 26 older adults who had experienced earthquakes and were not included in the field study. K-CART was administered in the form of a structured questionnaire, and participants were asked to provide feedback for readability.

3.4 | Participants

The study included 332 older adults who were directly affected by a 5.4 magnitude earthquake on November 15, 2017, in Heunghae district of Pohang city, South Korea. All participants were selected from earthquake-hit areas in eight villages of the Heunghae district which suffered more extensive damage than other villages in Pohang city: Namsung-ri, Masan-ri, Mangchen-ri, Sungnae-ri, Yaksung-ri, Oksung-ri, Jungsung-ri and Haksung-ri. The participants were recruited using quota sampling with the number of older adults calculated proportionately to the number of older adults who living in each of the eight villages (Kim et al., 2022). The inclusion criteria required that participants (1) were over 65 years of age, (2) scored more than 24 points on the Korean Mini-Mental State Examination (Kang et al., 1997) and (3) understood and responded to the questionnaire. Survey responses from 315 participants were analysed after excluding participants who did not meet the inclusion criteria and those with insufficient responses. K-CART consists of 26 items; thus, the sample size met the requirement of a minimum of 10 observations per variable (that is, 260 observations) for CFA (Everitt, 1975; Tabachnick et al., 2007).

3.5 | Data collection

This cross-sectional study was conducted from January 15, 2019, to March 19, 2019, using face-to-face interviews based on the structured K-CART questionnaire (Kim et al., 2022). A total of 10 surveyors, who were nursing students, conducted the interviews. Surveyors visited 22 senior citizen centres, senior citizen schools and temporary housing facilities during the data collection period. Each interview lasted 25–40 min.

3.6 | Ethical considerations

This study was approved by the institutional review board of the Yonsei University Health System in South Korea (IRB No. Y-2018-0111). Informed consent was obtained from survey participants, all of whom agreed to participate voluntarily. Participants were provided with research information about the purpose, methods, benefits and risks of the study. They received a small compensation for their participation.

3.7 | Data analysis

STATA version 13.0 (StataCorp.) and IBM SPSS version 25.0 (SPSS Inc.) were used for data analyses with a significance level of 0.05. Descriptive statistics, including frequency, percentage, means and standard deviations, were calculated for general characteristics and the K-CART scores. The internal consistency reliability of the K-CART survey was calculated using Cronbach's α coefficient and the corrected item-total correlation score. A Cronbach's $\alpha > 0.70$ (interobserver) was considered acceptable (Cronbach, 1951; Schene et al., 2000), and a corrected item-total correlation of $> .30$ was considered to contribute to the measurement (Field, 2009).

3.8 | Validity and reliability

Test-retest reliability was assessed using the value of intraclass correlation coefficients (ICCs) $\geq .70$ for substantial agreement, with 0.50 to 0.70 as moderate agreement, to demonstrate the stability of the instrument (Schene et al., 2000).

Content validity was assessed to obtain item relevance and clarity using a four-point (1 = "not relevant" to 4 = "highly relevant") content validity index (CVI) at both the item (I-CVI) and scale (S-CVI) level. I-CVI was calculated as the proportion of experts who judged an item as content valid (rating 3 or 4). S-CVI was the proportion of total items judged content valid. S-CVI for the tool was obtained using the average method (S-CVI/ave) (Polit & Beck, 2006). I-CVI of > 0.78 for three or more experts for individual items (Lynn, 1986) and an S-CVI/ave of > 0.80 (Davis, 1992; Lynn, 1986; Polit & Beck, 2006) were considered acceptable.

CFA was conducted to identify the construct validity. Given that the CART survey was developed based on theory and reported to have acceptable psychometric properties (Pfefferbaum et al., 2016; Pfefferbaum, Neas, et al., 2013; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015), this study used CFA to identify whether the original CART structure would be suitable for use in a Korean cultural context. This study first evaluated a four-factor model of the CART survey. The modified four-factor model was assessed following the correction of error terms to improve the model fit. The five-factor model with 26 items was also assessed to evaluate the expanded survey, augmented with the Information and Communication domain. Subsequently, the modified five-factor model was developed following the correction of error terms to improve model fit.

Factor loadings of the variables were calculated, and maximum-likelihood estimation was employed to estimate the model fit in CFA. The model's goodness of fit was evaluated using multiple indices: chi-square (χ^2); number of degrees of freedom (*df*); chi-square statistics divided by degrees of freedom ($\chi^2/df < 3$); a comparative fit index (CFI) > 0.90 ; a Tucker-Lewis index (TLI) > 0.90 ; and a root mean square error of approximation (RMSEA) < 0.05 (good fit) or between 0.05 and 0.08 (acceptable fit) (Hu & Bentler, 1999; Tabachnick et al., 2007). The Akaike information criterion (AIC) was used to compare the models. Models with lower values of AIC are more likely to be replicated, include fewer parameters and demonstrate good model fit (Harrington, 2009).

4 | RESULTS

4.1 | General characteristics of participants

A total of 332 questionnaires were administered, resulting in a sample size of 315 participants after eliminating 17 questionnaires of participants who did not meet the eligibility criteria or had missing data. Table 1 presents the general characteristics of the participants. The mean age of the participants was 78.00 ± 6.15 years. About two thirds of the participants were female ($N = 219, 69.5\%$) and 75 years of age or older ($N = 211, 67.0\%$). Most participants were married ($N = 167, 53.2\%$) and living with family ($N = 182, 58.1\%$). More than one half of the participants had completed primary school ($N = 169, 53.7\%$).

A total of 26 older adults, with a mean age of 76.76 ± 5.39 years, participated in the test-retest reliability process. All the participants were female ($N = 26, 100.0\%$) and a majority were 75 years of age or older ($N = 17, 65.4\%$) and living with family ($N = 19, 73.1\%$).

4.2 | Descriptive statistics of K-CART

Mean scores of the K-CART domains ranged from $2.75 \pm .84$ for Resources to $3.69 \pm .71$ for Connection and Caring (Table 2). Descriptive statistics for each item are reported in Table 3. Item

TABLE 1 General characteristics of participants

Characteristics	Categories	Older adults (N = 26) ^a		Older adults (N = 315)	
		N (%)	Mean ± SD	N (%)	Mean ± SD
Gender	Male	-		96 (30.5)	
	Female	26 (100.0)		219 (69.5)	
Age	65-74	9 (34.6)	76.76 ± 5.39	104 (33.0)	78.00 ± 6.15
	75-84	15 (57.7)		161 (51.1)	
	≥85	2 (7.7)		50 (15.9)	
Marriage (N = 314)	Married	13 (50.0)		167 (53.2)	
	Bereavement or Divorce	13 (50.0)		147 (46.8)	
Family cohabitation (N = 313)	Living alone	7 (26.9)		131 (41.9)	
	Living with family	19 (73.1)		182 (58.1)	
Education level	Illiterate	7 (26.9)		58 (18.4)	
	Primary school	12 (46.2)		169 (53.7)	
	Middle school	6 (23.1)		59 (18.7)	
	≥ High school	1 (3.8)		29 (9.2)	
Working condition	Daily working	3 (11.5)		31 (9.9)	
	Occasional working	1 (3.9)		47 (14.9)	
	No job	22 (84.6)		237 (75.2)	

^aParticipants who took part in the test-retest reliability.

mean scores for K-CART ranged from 2.50 ± 1.21 to 3.96 ± 1.01 . The percentage of agreement for survey items ranged from 21.6% (item 10 "My community supports programmes for children and families") to 72.4% (item 5 "My community treats people fairly no matter what their background is"). The item mean scores and percentage of agreement reflect the perceptions of the participants in the study.

4.3 | Test-retest reliability

The test-retest reliability coefficients, measured over a 2-week period, are presented in Table 2. This study determined the ICC value for the overall scale to be 0.90 (95% CI = 0.78~0.95, $p < .001$), and the ICC values for the five K-CART domains ranged from 0.74 to 0.90, indicating the satisfactory stability of K-CART.

4.4 | Internal consistency reliability

The Cronbach's α coefficient for the overall K-CART was .91, and it ranged from .69 to .81 for the five K-CART domains (Table 2). The corrected item-total correlation coefficients indicated that each item was positively related to the total scale score ranging from .35 to .63 (Table 3). When individual items were deleted, the Cronbach's α coefficients ranged from .90 to .91, indicating that all items contribute to the overall scale; thus, no items were deleted.

4.5 | Content validity

A panel of eight experts in disaster research, practice and education, participated in the evaluation of content validity. The I-CVI ranged from 0.87 to 1.00 and the S-CVI/ave was 0.97, indicating satisfactory agreement among the eight experts.

4.6 | Confirmatory factor analysis

Confirmatory factor analysis was performed to identify the construct validity of K-CART, and it indicated acceptable goodness-of-fit indices (Table 4). The results of the goodness-of-fit indices used to assess the four-factor model were: $\chi^2 = 776.54$, $\chi^2/df = 3.83$, CFI = 0.77, TLI = 0.74, RMSEA = 0.09 and AIC = 19,821.75. These values did not meet the criteria for acceptability. After the error terms were corrected to improve the model fit, the modified four-factor model was deemed acceptable with the improved goodness-of-fit indices: $\chi^2 = 529.76$, $\chi^2/df = 2.73$, CFI = 0.86, TLI = 0.84, RMSEA = 0.07 and AIC = 19,592.98.

The results of the goodness-of-fit indices used to assess the five-factor model are presented in Table 4: $\chi^2 = 945.96$, $\chi^2/df = 3.27$, CFI = 0.78, TLI = 0.75, RMSEA = 0.08 and AIC = 23,391.91. These values did not meet the criteria for acceptability. After the error terms were corrected to improve the goodness-of-fit indices of the five-factor model, the modified model showed improved values and essentially met the criteria: $\chi^2 = 600.82$, $\chi^2/df = 2.27$, CFI = 0.89, TLI = 0.86, RMSEA = 0.05 and AIC = 23,096.77. Therefore, the

TABLE 2 Test-retest reliability and internal consistency of K-CART

Characteristics	Older adults (N = 26) ^a				Older adults (N = 315)				
	Mean ± SD		Retest	ICC (95% CI)	p	Cronbach's α	Correlation		
	Test	Test					1	2	3
CART	3.47 ± 0.64	3.75 ± 0.79	0.90 (0.78–0.95)	<.001	0.91				
1. Connection and Caring	4.03 ± 0.73	4.23 ± 0.62	0.85 (0.68–0.93)	<.001	0.69				
2. Resources	3.06 ± 0.86	3.40 ± 1.07	0.84 (0.65–0.93)	<.001	0.73	.378 [*]			
3. Transformative Potential	3.31 ± 0.78	3.59 ± 0.91	0.90 (0.77–0.95)	<.001	0.81	.526 [*]	.578 [*]		
4. Disaster Management	3.23 ± 1.02	3.74 ± 0.98	0.74 (0.42–0.88)	<.001	0.78	.388 [*]	.486 [*]	.636 [*]	
5. Information and Communication	3.82 ± 0.98	3.94 ± 0.99	0.87 (0.71–0.94)	<.001	0.75	.381 [*]	.469 [*]	.606 [*]	.605 [*]

Note: *p < .001.

Abbreviations: CI, confidential interval; K-CART, Korean version of the CART Assessment Survey.

^aParticipants who took part in the test-retest reliability.

results of this study suggest that the five-factor model of K-CART has good cross-cultural sample validity.

4.7 | Convergent and divergent validity

This study finally selected the modified five-factor model of K-CART, which comprises 26 items across five domains. The standardized factor weights and residuals for the modified five-factor model are shown in Figure 1. The factor loadings for all items, except for item 5 and item 13, exceeded the conventional loading level of 0.40, which justified aligning it with a construct factor loading. However, these items were not removed because the values of Cronbach's α showed little change if the items were deleted. The factor loadings for all items were ≥0.37 and statistically significant at the 0.001 level. The factor loadings of the domains ranged from 0.39 to 0.72 for Connection and Caring, from 0.55 to 0.71 for Resources, from 0.37 to 0.65 for Transformative Potential, from 0.67 to 0.73 for Disaster Management and from 0.63 to 0.68 for Information and Communication. The correlation coefficients for the five factors varied from .49 to .83 and were statistically significant at the .001 level.

5 | DISCUSSION

Assessing community resilience, especially in vulnerable communities, is important for an effective distribution of community resources, policy and programme development and improvement in disaster management (Mayer, 2019; Pfefferbaum, Van Horn, & Pfefferbaum, 2015). The current study sought to evaluate the psychometric properties of two Korean versions of the CART Assessment Survey for South Korea based on the original four-factor and expanded five-factor models of the CART survey. The authors of this study and the developers of the CART survey are unaware of other studies that developed and identified the psychometric properties of the instrument for use in Korean community settings.

This study took care to minimize contextual and cultural differences when converting the CART survey into another language by using rigorous translation and back translation methods in accordance with WHO guidelines. Stability, internal consistency reliability, content validity, and construct validity of the instrument were evaluated. The results suggested that the expanded model of K-CART with five domains has acceptable validity and reliability and was preferable to the model with four domains.

The findings of this study indicated that K-CART had a high level of reliability. The ICC values were in the acceptable value, verifying the stability of K-CART (Davis, 1992; Lynn, 1986; Polit & Beck, 2006); the test-retest reliability was evaluated by using the K-CART scale after a 2-week interval for 26 older adults. The corrected item-total correlation scores revealed statistically significant correlations between items and total score more than .3 (Field, 2009). In addition, the findings of content validity from a panel consisting

TABLE 3 Item performance and reliability of K-CART

Item	Mean \pm SD	% agreement	Corrected item-total correlation	Cronbach's α if item deleted	% at minimum	% at maximum
Domain 1. Connection and caring						
1. People in my community feel like they belong to the community.	3.83 \pm 1.01	64.4	.35	0.91	2.2	30.5
2. People in my community are committed to the well-being of the community.	3.53 \pm 1.09	54.6	.47	0.91	4.8	20.3
3. People in my community have hope about the future	3.21 \pm 1.16	41.9	.45	0.91	8.3	14.9
4. People in my community help each other.	3.91 \pm 1.02	68.9	.37	0.91	2.5	34.3
5. My community treats people fairly no matter what their background is.	3.96 \pm 1.01	72.4	.35	0.91	3.2	35.6
Domain 2. Resources						
6. My community has the resources it needs to take care of community problems.	2.64 \pm 1.16	25.1	.41	0.91	21.9	4.8
7. My community has effective leaders.	3.13 \pm 1.39	47.3	.46	0.91	20.0	18.7
8. People in my community are able to get the services they need.	2.76 \pm 1.14	27.9	.48	0.91	18.4	5.1
9. People in my community know where to go to get things done.	2.74 \pm 1.18	26.0	.48	0.91	19.0	7.6
10. My community supports programmes for children and families.	2.50 \pm 1.21	21.6	.51	0.91	26.0	6.7
Domain 3. Transformative potential						
11. My community works with organizations and agencies outside the community to get things done.	2.92 \pm 1.21	31.7	.57	0.91	17.5	10.2
12. People in my community communicate with leaders who can help improve the community.	2.97 \pm 1.24	34.9	.53	0.91	16.2	12.7
13. People in my community are aware of community issues that they might address together.	3.27 \pm 1.12	42.9	.38	0.91	7.0	15.6
14. People in my community discuss issues so they can improve the community.	3.20 \pm 1.08	41.9	.57	0.91	8.3	10.5
15. People in my community work together on solutions so that the community can improve.	3.62 \pm 1.04	59.7	.53	0.91	3.8	21.0
16. My community looks at its successes and failures so it can learn from the past.	3.08 \pm 1.12	33.7	.53	0.91	9.8	12.4
17. My community develops skills and finds resources to solve its problems and reach its goals.	2.90 \pm 1.15	28.3	.63	0.90	14.0	10.2
18. My community has priorities and sets goals for the future.	2.94 \pm 1.11	28.9	.61	0.91	11.1	9.5
Domain 4. Disaster management						
19. My community tries to prevention disasters.	3.57 \pm 1.19	61.0	.59	0.91	7.0	24.4
20. My community actively prepares for future disasters.	3.46 \pm 1.26	57.5	.59	0.91	10.8	22.9
21. My community can provide emergency services during a disaster.	3.19 \pm 1.14	41.3	.55	0.91	10.8	12.4
22. My community has services and programmes to help people after a disaster.	2.94 \pm 1.26	39.7	.56	0.91	17.5	9.8

(Continues)

TABLE 3 (Continued)

Item	Mean \pm SD	% agreement	Corrected item-total correlation	Cronbach's α if item deleted	% at minimum	% at maximum
Domain 5. Information and communication						
23. My community keeps people informed (via television, radio, newspaper, internet, phone, neighbours) about issues that are relevant to them.	3.63 \pm 1.20	62.9	.53	0.91	7.6	27.3
24. If a disaster occurs, my community provides information about what to do.	3.59 \pm 1.13	60.3	.49	0.91	6.0	22.9
25. I get information/communication from my community to help with my home and work life.	3.27 \pm 1.19	50.5	.54	0.91	11.4	13.0
26. People in my community trust public officials.	3.38 \pm 1.21	54.3	.59	0.91	11.7	17.1

Abbreviations: CI, confidential interval; K-CART, Korean version of the CART Assessment Survey.

TABLE 4 Model fit index from confirmatory factor analysis of K-CART

(N = 315)								
Model	χ^2	df	χ^2/df	p	CFI	TLI	RMSEA	AIC
Acceptable criteria	Lower		<3	<.05	\geq 0.90	\geq 0.90	<0.05	
4-factors model	776.54	203	3.83	<.001	0.77	0.74	0.09	19,821.75
Modified 4-factors model	529.76	194	2.73	<.001	0.86	0.84	0.07	19,592.98
5-factors model	945.96	289	3.27	<.001	0.78	0.75	0.08	23,391.91
Modified 5-factors model	600.82	264	2.27	<.001	0.89	0.86	0.05	23,096.77

Abbreviations: AIC, Akaike information criterion; CFI, Comparative fit index; K-CART, Korean version of the CART Assessment Survey; RMSEA, Root mean square error of approximation; TLI, Tucker-Lewis Index.

of eight experts in disaster field showed satisfactory agreement with the I-CVI ranged from 0.87 to 1.00 and the S-CVI/ave was 0.97.

This study used the results of CFA to compare the four-factor and five-factor models of K-CART and to test the construct validity of K-CART for Korean populations. In general, exploratory factor analysis explores datasets that identify the underlying domains and does not evaluate or verify hypothesized relationships and specific assumptions structured by theories. Since the CART survey was developed based on theory and established structures and relationships of domains, this study assumed that the construct validity of K-CART could be evaluated via CFA, which indicates how well the structure of the hypothesized scale is identified (Watson & Thompson, 2006).

This study's CFA results showed that the five-factor model had better goodness-of-fit indices than the four-factor model, the values of χ^2/df , CFI, TLI and RMSEA, all showed a more acceptable fit along with strong factor loadings. The results of this study demonstrated that the construct validity of the five-factor K-CART had more acceptable values than those of the original CART with four factors, in the Korean cultural context.

The CFA results of this study indicated a good model fit for the five-factor structure and meaningful loading patterns for the individual K-CART survey items. The K-CART survey was completed

by 315 older adults who had been exposed to an earthquake. The findings of this study were aligned with those reported by earlier CART studies, indicating that K-CART demonstrated validity. Therefore, the results of this study provide evidence indicating conceptual, semantic and constructional equivalence between the CART survey and the five-factor K-CART used in the Korean cultural context. In addition, the five-factor model of K-CART with 26 items demonstrated acceptable reliability. The internal consistency of K-CART, determined by Cronbach's α coefficient, was measured as .91. Cronbach's α coefficients for the five K-CART domains ranged from .69 (Connection and Caring) to .81 (Transformative Potential). Although the Cronbach's α coefficient for the Connection and Caring domain fell short, by a small margin, of the traditional 0.70 threshold, the figures of "Cronbach's α if item deleted" did not exceed that for the whole scale of K-CART, which indicates that all items contributed to K-CART. These results are similar to the Cronbach's α coefficients for the four-domain CART model, which was .94 for the overall scale and ranged from .69 to .92 across the four domains (Pfefferbaum et al., 2013a) and the Cronbach's α coefficients for the five-domain CART model, which ranged from .75 to .91 (Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015). Thus, the findings of this study demonstrated that

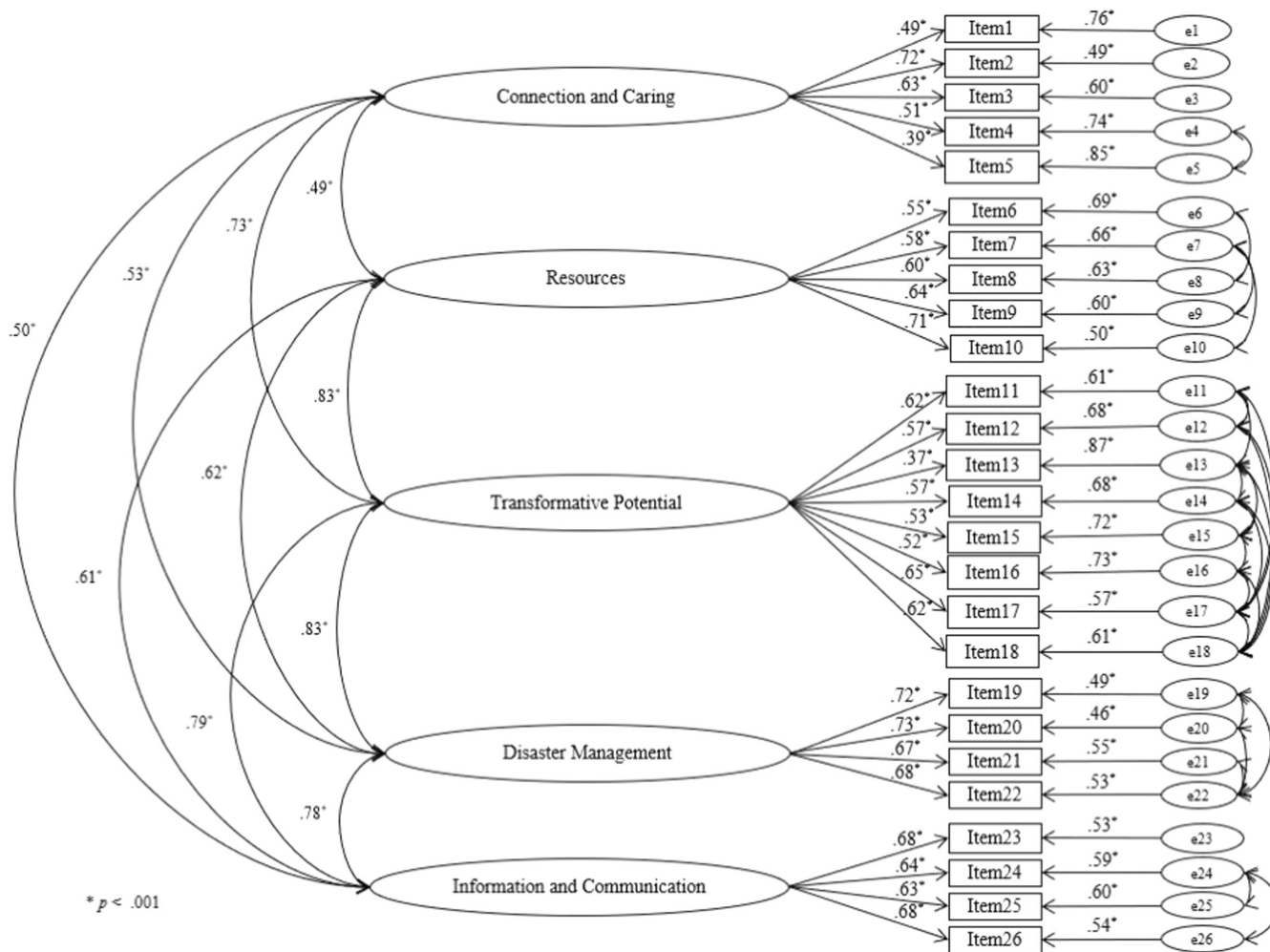


FIGURE 1 Standardized parameter estimates for the factor structure-modified model of K-CART

the item equivalence of K-CART showed overall reliability for use in Korean communities.

Korean communities Advancing Resilience Toolkit was initially developed with four domains (Connection and Caring, Resources, Transformative Potential and Disaster Management) and then was expanded to five domains by adding survey items related to Information and Communication. As with a previous CART study, there were statistically significant positive correlations in all the paired correlations among the five domains (Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015), which demonstrated acceptable reliability in the five domains of K-CART. These positive correlations are consistent with the hypothesized interrelationships between the domains.

The five-domain model, in comparison to the four-domain model, performed better statistically and is considered superior theoretically because of its inclusion of the fifth domain, which enables the model to capture more explicitly the contributions of information and communication. Information and communication are essential for community resilience and effective disaster management and can foster connection and caring, in part, by facilitating the identification and resolution of needs and the

expression of opinions among community members. Information and communication can also encourage local stakeholders to participate in community problem-solving, engage in critical thinking and address issues of trust in leadership. Communication channels are part of a community's resource base, enabling the transfer of information that contributes to critical reflection, skill building and transformation and that supports disaster management. For information to be valued by community members and thus to lead to, for example, adherence with public recommendations and directives, the information should be communicated by a trusted source. Community resilience is enhanced by the communication of clear, accurate, timely and effective information that occurs regularly and in relation to disasters (Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015). The importance of information and communication in community resilience and the confirmation of the five-factor model in this study support the inclusion of the Information and Communication domain in K-CART.

The CART and the K-CART survey items reflect the survey participants' perceptions of community resilience. High and low percentage of agreement scores are used to identify the primary strengths and challenges, respectively, associated with community

resilience. The K-CART survey item 5, "My community treats people fairly no matter what their background is," which had the highest mean score in this study, was identified as the primary community resilience strength. This finding is not surprising because older adults in Korea receive equal benefits and support based on welfare policies from local governments regardless of their background. Survey item 10, "My community supports programmes for children and families," which had the lowest mean score, was the primary community resilience challenge identified in the current study. The lack of specialized programmes for children and families in the community may have influenced the participants' views, thereby highlighting it as a high priority item.

Among the five K-CART domain scores, the Connection and Caring domain had the highest mean domain score (3.69) and the Resources domain had the lowest mean domain score (2.75). The results of this K-CART application are not unlike the results of a previous US study, using the four-domain model, in which the primary community resilience strength was in the Connection and Caring domain and the primary community resilience challenge was in the Resources domain. The finding that Connection and Caring was the domain with the highest perceived percentage of agreement score in this and the previous US study likely derives, in part at least, from the sense of connectedness that individuals feel if they perceive themselves to be valued by others and if their needs are fulfilled through affiliation with the community. Crises also may bring out the best in many community members, binding them in support of each other, even as they struggle for their own individual and family recovery. It is not surprising that Resources is the domain with the lowest perceived percentage of agreement score because of the central role of resources in disaster management, and because disasters likely have a devastating impact on a community's resource base, so much so that the community may be forced to look elsewhere for assistance (Pfefferbaum et al., 2016).

5.1 | Limitations

There were some limitations to this study. Although the participants were selected from earthquake-hit areas in eight villages in the Heunghae district using quota sampling to establish high generalization, the majority of the sample was female (69.5%) and 75 years of age or older (67.0%), thus potentially limiting the generalizability of study results. Future studies could contribute to generalizability by more appropriately reflecting the sex and age ratios in sample communities and including participants from a variety of community settings.

This study was conducted using face-to-face interviews. While survey interviewers were trained prior to conducting interviews, interviewer and/or responder bias cannot be ruled out. To identify and assess community resilience in chaotic disaster situations, it would be necessary to establish a systematic survey system to ensure that interviewers are properly qualified and fully trained in disaster preparedness.

Future studies also should consider potential correlates of community resilience and of the five CART domains. For example, other CART studies suggest that home ownership, participation in local activities and/or social support programmes (such as specific services for older adults in the case of this sample), and prior emergency or disaster experience may influence a community member's perception of community resilience (Holm et al., 2019; Pfefferbaum et al., 2016; Pfefferbaum, Pfefferbaum, Nitiéma, et al., 2015; Tanabe et al., 2020). An understanding of the role of correlates in the assessment of community resilience can improve the interpretation of study findings and guide the formulation of recommendations for policy and programme development in support of community resilience.

6 | CONCLUSION

The CART Assessment Survey is used to assess community resilience to disasters and other adversities, to identify relative community strengths and challenges and to compare community resilience before and after a disaster or intervention. This study demonstrated the psychometric properties of K-CART, which is the Korean version of the CART survey consisting of 26 items in five domains, which is found to be a potentially useful tool for measuring community resilience in disaster situations in South Korea. This study provided evidence that K-CART exhibits acceptable psychometric properties including content validity, construct validity, internal consistency and test-retest reliability. The use of K-CART is warranted in further research and other community settings, and the five CART domains can contribute to evaluating, understanding and building community resilience. Community leaders who use K-CART to assess community resilience can find guidance in preventing, preparing for, responding to and recovering from disasters and other adversities in South Korea. The K-CART can be efficiently used to build and strengthen community resilience through community participation, thus contributing to the improvement of public health services.

AUTHOR CONTRIBUTIONS

EM Kim, GS Kim, H Kim and B Pfefferbaum made substantial contribution to the conception and design, acquisition of data and analysis and interpretation of data. EM Kim performed the data collection. EM Kim, GS Kim, H Kim and B Pfefferbaum were responsible for the drafting of the manuscript. GS Kim supervised the study and made critical revisions to the paper for important intellectual content. All authors agreed on the final version and met at least one of the following criteria [recommended by the International Committee of Medical Journal Editors (ICMJE, <http://www.icmje.org/recommendations/>)].

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL APPROVAL

This study was obtained ethical approval by the institutional review board of the Yonsei University Health System in South Korea (IRB No. Y-2018-0111).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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