

Research Article

A Theoretical Model of Clinical Nurses' Intentions to Stay During Disasters: A Structural Equation Modeling Approach

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Background: With the increasing frequency and severity of disasters, retaining skilled nurses is essential for sustaining healthcare systems in times of crisis. Given that behavior is largely influenced by intention, a predictive model for nurses' intent to stay (ITS) is needed.

Aim: This study aimed to develop and validate a comprehensive structural model explaining clinical nurses' ITS during disasters. This model addresses the critical need to understand and enhance nurse retention during crises.

Methods: In this cross-sectional study, 549 nurses who worked during the COVID-19 pandemic participated. The data were collected through a web-based self-report survey from March 5 to 15, 2024. Factor analysis, model fit confirmation, and path significance were analyzed using SPSS/WIN 23.0 and AMOS 28.0. A two-step approach was employed to validate the hypothetical model.

Results: Group cohesion significantly impacted organizational commitment, empowerment, and job satisfaction. Adequate staffing and resources were crucial in influencing moral distress and organizational commitment. Both job satisfaction and organizational commitment directly affected the ITS, with group cohesion exerting an indirect effect. Path analysis demonstrated that adequate staffing and resources notably influenced organizational commitment, while adaptive leadership, adequate staffing, and disaster nursing competency significantly impacted job satisfaction. The model explained 71.4% of the variance in nurses' intention to stay during disasters.

Conclusion: The study highlights that organizational commitment is the strongest predictor of clinical nurses' intent to remain during disasters.

Implications for Nursing and/or Health Policy: To ensure a stable and skilled nursing workforce in disaster situations, it is essential to foster organizational commitment. Strategies should focus on enhancing group cohesion, providing adequate staffing and resources, and supporting organizational commitment among clinical nurses.

Keywords: COVID-19; disaster nursing; intent to stay; nurses; structural analysis

1. Introduction

The COVID-19 pandemic has triggered a global public health crisis, with 39 million confirmed cases and over 1 million deaths by October 2020 [1]. The medical supply

chain and infrastructure often suffer significant damage and the demand for medical services surges dramatically in disaster situations [2]. Moreover, shortage of skilled healthcare professionals can lead to a sharp increase in disease transmission rates and mortality [3].

The pandemic has exacerbated global concerns about nursing shortages due to heightened workloads [4]. In response, some regions temporarily deployed unlicensed student nurses [5]. However, this influx of unskilled personnel increased patient risks [6] and workload of experienced nurses [7]. Evidently, for an effective medical system during disasters, not only the quantitative aspect of having nursing staff but also the qualitative aspect of having skilled nurses should be ensured.

The pandemic and ongoing disasters have highlighted the importance of retaining skilled nursing staff, leading to studies on nurses' intentions to stay in such situations. Supervisor leadership [8], adequate staffing and resources [9], group cohesion [10], disaster nursing competence [11, 12], empowerment [13, 14], organizational commitment [15, 16], job satisfaction [17, 18], and moral distress [9, 15, 19] were identified as factors affecting nurses' intention to stay during disasters. However, these studies did not comprehensively consider predictive factors affecting retention intention within a systematic theoretical framework.

In disaster situations, various barriers that cannot be overcome by personal beliefs or willpower alone can hinder actions. Previous studies have shown that nurses' willingness to work can vary depending on the nature of the disaster, which could cause irreversible health issues for themselves or their families [15, 20, 21]. During the Ebola outbreak, the perceived social stigma against healthcare workers was a barrier for nurses to continue their work [22]. Therefore, when predicting nurses' behavior, it is essential to consider cognitive and affective responses to nursing tasks related to the disaster.

Cowden and Cummings [23] developed the theoretical model clinical nurses' intent to stay (ITS). This model builds upon existing theories [24, 25] and incorporates additional factors influencing intent, such as managerial, organizational, work-related, and individual characteristics. According to the ITS model, these factors impact both cognitive and affective responses to work, which, in turn, affect the ITS. By incorporating intention-influencing factors into the common variables and distinguishing between cognitive and affective factors, the ITS model provides a comprehensive and explanatory framework [23]. By adapting and refining this model to address the specific challenges and requirements of disasters, a valuable tool for predicting clinical nurses' ITS during such events can be developed.

1.1. Research Hypotheses. In this study, we hypothesized that during disasters, managerial (adaptive leadership), organizational (adequacy of staffing and resources), work-related (work group cohesion), and individual characteristics (disaster nursing competence) influence cognitive (empowerment and organizational commitment) and affective responses (job satisfaction and moral distress) to nursing tasks. These responses ultimately affect clinical nurses' ITS during disasters (Figure 1). This hypothesis was established following the ITS model [23] and an extensive literature review on clinical nurses' ITS in disaster situations.

x1–x15 = adaptive leadership; x16–x19 = staffing and resource adequacy; 20 = cohesion; x21 = engagement; x22–x25 = professional preparedness; x26 = willingness to exert effort; x27 = desire to maintain membership in the organization; x28 = acceptance of organizational values; x29 = meaning; x30 = competence; x31 = self-determination; x32 = impact; x33 = patient sources of moral distress; x34 = team/system sources of moral distress; x35 = COVID-19 specific sources of moral distress; X36–x41 = job satisfaction; y1 = intent to stay(unit); and y2 = intent to stay (organization).

2. Methods

2.1. Aim. The aim of this study was to propose and validate a structural model for comprehensively explaining clinical nurses' ITS during the COVID-19 pandemic.

2.2. Study Design. This study adopted a cross-sectional structural model validation design.

2.3. Sample and Setting. A sample size of 10–20 times the number of variables is generally recommended in structural equation modeling [26]. In this study, 559 was the target sample size, considering 43 measured variables and assuming a 30% dropout rate for the online survey [27]. Of the 559 completed questionnaires collected, 10 with missing responses were excluded, resulting in 549 questionnaires for the final analysis.

Following were the inclusion criteria: (1) experienced in working as a clinical nurse in South Korea during the COVID-19 pandemic period (from March 2020 to June 2023), (2) worked at a tertiary or general hospital during the pandemic, (3) at least one year of clinical experience, and (4) understood and agreed to participate in the study. The exclusion criteria were as follows: (1) did not work as a clinical nurse at a tertiary or general hospital in South Korea between the said period, (2) took a leave of absence or resigned before March 2020, and (3) worked in administrative rather than clinical departments.

The inclusion criteria of having at least 1 year of clinical experience was based on prior research, which suggests that the transition from student to nurse typically takes approximately a year and that stress experienced during this period could confound the results [28].

2.4. Data Collection. A web-based self-report survey (Google Forms) was conducted with the target participants having experience in working as clinical nurses during the COVID-19 pandemic. After obtaining institutional approval from the Chung-Ang University Institutional Review Board, participants were recruited through a banner advertisement on Nurscape (<https://www.nurscape.net>), the largest nursing community in Korea with 400,000 members. The advertisement, which included the participation link, was posted from March 5 to March 15, 2024.

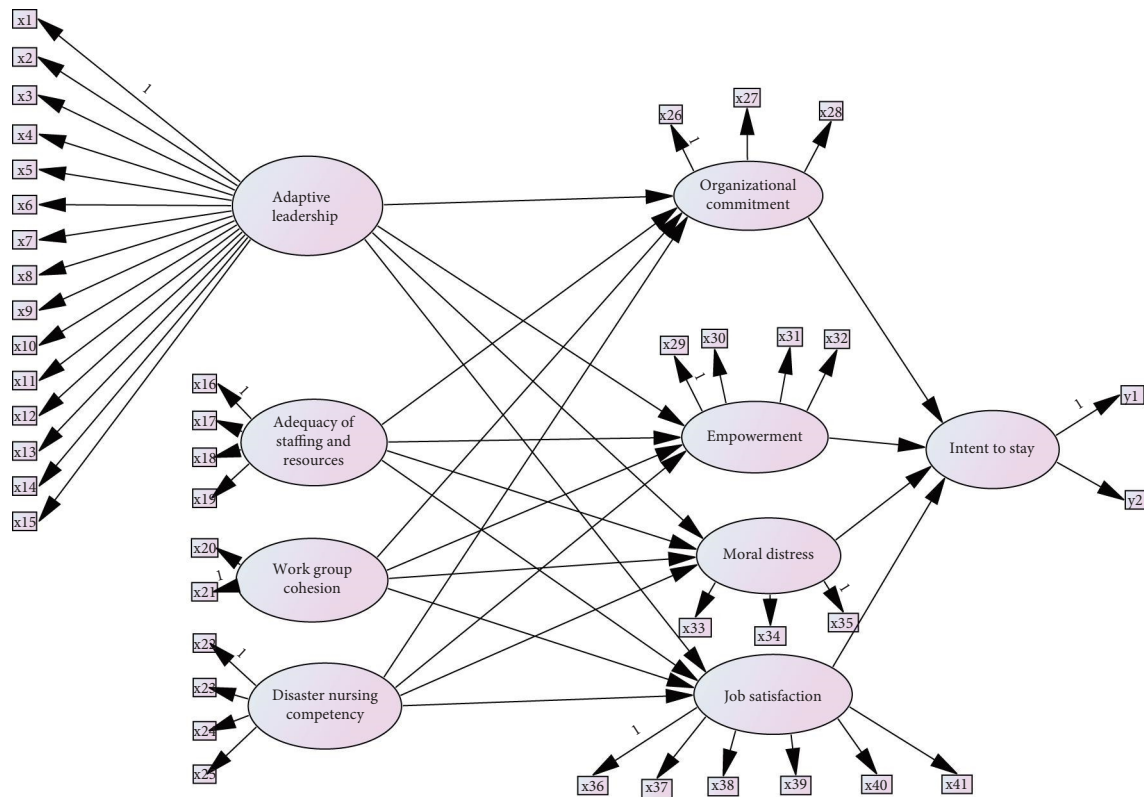


FIGURE 1: Hypothetical model.

Participants accessed the survey by clicking the participation link, which directed them to a research brochure and consent form detailing the study's purpose and methodology. Participation was voluntary, with the option to withdraw at any time. The research materials were used exclusively for the study, and confidentiality of the participants was ensured. Only those who read the brochure and consent form and voluntarily agreed to participate proceeded with the survey. The survey took approximately 20–30 min to complete.

2.5. Study Instruments. The tools used in this study were originally in English and translated into Korean following the World Health Organization's guidelines to ensure accuracy [29].

After the researcher translated the tools, a bilingual nurse and a nursing professor reviewed them to ensure precision. Then, they were back-translated into English by a professional, without access to the original English versions. The back-translated versions were compared with the originals and approved by the tool developers.

The final survey was reviewed for readability by four experienced clinical nurses and one nursing master's student before administering it.

2.5.1. General Characteristics. The general characteristics of the participants were obtained based on prior research [23, 30] and included age, total length of employment, length of employment during the COVID-19 pandemic, gender,

marital status, education level, type of hospital, position, hospital location, employment type, and work department. In addition, to assess disaster nursing experience, the survey asked whether the nurses had prior experience in disaster nursing before the COVID-19 pandemic.

2.5.2. Adaptive Leadership. Adaptive leadership was assessed using the Adaptive Leadership Behavior Scale (ALBS) by [31]. It consists of 15 items on a 5-point Likert scale. Scores range from 15 to 75, with higher scores indicating greater adaptive leadership behavior. The tool's reliability was validated by a Cronbach's alpha of 0.97 during development and 0.95 in this study.

2.5.3. Adequacy of Staffing and Resources. Staffing and resource adequacy implied whether there were sufficient staff and resources in the nursing environment [32]. For this, we used the Korean version of the Nursing Work Index (PES-NWI), translated by Cho et al. [33]. The K-PES-NWI includes 29 items across five subfactors. It uses a 4-point Likert scale, with scores ranging from 4 to 16, and higher scores indicating better adequacy. In this study, Cronbach's alpha was 0.88.

2.5.4. Work Group Cohesion. Group cohesion was measured using the Group Cohesion Scale (GCS) by Wongpakaran et al. [34] and adapted by Kim and Yang [35]. The GCS consists of seven items on a 5-point Likert scale, with scores

ranging from 7 to 35. Higher scores indicate greater cohesion. The tool's Cronbach's alpha was 0.85 in this study.

2.5.5. Disaster Nursing Competence. Disaster nursing competence was assessed for the perceived ability and knowledge to provide appropriate medical care during a disaster [36]. We used the Nash Duty to Care Scale (NDCS), adapted into Korean by Shin et al. [37]. The NDCS includes 19 items across four subfactors, using a 5-point Likert scale. Scores range from 19 to 95, with higher scores reflecting greater competence. The tool's Cronbach's alpha was 0.79 in this study.

2.5.6. Cognitive Response to Work

2.5.6.1. Empowerment. Empowerment was measured using the Korean version of the Psychological Empowerment Scale developed by Spreitzer [38] and adapted by Kim et al. [39]. This tool comprises four subfactors: meaning, competence, self-determination, and impact, each with three items, totaling 12 items. Responses are obtained on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Scores range from 12 to 60, with higher scores indicating higher psychological empowerment. At the time of its development, the tool's Cronbach's α was 0.72 [38], and in this study, 0.89.

2.5.6.2. Organizational Commitment. Organizational commitment was measured using the Organizational Commitment Questionnaire (OCQ) developed by Mowday et al. [40] and adapted into Korean by Lee [41]. This tool consists of seven items with a single subfactor. Responses are obtained on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Scores range from 7 to 49, with higher scores indicating stronger organizational commitment. In Lee's [41] study, the Cronbach's alpha was 0.91, and in this study, 0.94.

2.5.7. Affective Response to Work

2.5.7.1. Job Satisfaction. Job satisfaction was measured using a modified version of the Global Job Satisfaction survey [42] adapted by Pond and Geyer [43]. This tool consists of six items under a single subfactor. Responses are obtained on a 5-point Likert scale, ranging from 1 (very dissatisfied) to 5 (very satisfied). Scores range from 1 to 5, with the average of the six items indicating the overall job satisfaction level. Higher average scores signify higher job satisfaction. The Cronbach's alpha of the tool was 0.86 [43], and in this study, 0.90.

2.5.7.2. Moral Distress. Moral distress was assessed using the COVID-19 Moral Distress Scale (COVID-MDS) [44], which is a simplified and COVID-19-specific version of the existing Moral Distress Scale (MDS). The COVID-MDS comprises 12 items divided into three subfactors: moral distresses related to the team or system, patients, and the COVID-19

situation. Each item is rated on a 4-point Likert scale, assessing the frequency of the distressing situation (from 0 = never experienced to 3 = frequently experienced) and the intensity of distress felt (from 0 = none to 3 = severe). The final score is calculated by averaging the products of the frequency and intensity scores for each item, with possible scores ranging from 0 to 9 for each item. The Cronbach's alpha of the COVID-MDS at the time of development was 0.88, and in this study, 0.90.

2.5.8. Intention to Stay. Nurses' intention to stay was measured using a tool originally developed by [45], which was later revised and supplemented by Witton et al. [46]. This tool consists of 12 items divided into three subfactors: intentions to stay in the current job (department), in the organization, and in the nursing profession. Responses are obtained on a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The scores range from 12 to 48, with higher scores indicating a higher intention to stay in each area. In the study by Witton et al. [46], the reliability of each subfactor was not reported, but the overall tool had a Cronbach's alpha of 0.86. In this study, we used only the two subfactors: intention to stay in the current job (department) and intention to stay in the organization. The Cronbach's alpha was 0.94.

2.6. Ethical Consideration and Data Collection. The study adhered to the Declaration of Helsinki guidelines and was approved by the Chung-Ang University Institutional Review Board (Approval no. 1041078-20231218-HR-328). Detailed information about the research was provided to all participants in a written consent form, and the research was conducted only with those who voluntarily agreed to the terms specified in the consent.

2.7. Data Analysis and Synthesis. The data were analyzed using SPSS/WIN 23.0 (IBM Corp., Armonk, NY, USA) and AMOS 28.0 (IBM Corp.). Descriptive Statistics, *t*-tests, and analysis of variance (ANOVA) were used to analyze the participants' general characteristics and intention to stay based on these characteristics, with post hoc analysis performed using Tukey's test. Pearson correlation coefficients were employed to assess correlations between measured variables. The normality of the sample was verified using standardized skewness and kurtosis values, and multicollinearity among latent variables was checked using the variance inflation factor (VIF). Maximum likelihood estimation (MLE) was used to validate the structural model, and confirmatory factor analysis (CFA) was conducted to evaluate the validity of the measurement tools for the latent variables.

MLE was used to estimate the regression coefficients for path analysis, and their statistical significance was tested. MLE assumes multivariate normality in the data. Generally, in structural equation modeling, bootstrapping is used to verify the statistical significance of direct and indirect effects. Since bootstrapping estimates parameters and performs hypothesis testing through repeated sampling without

assumptions about the data distribution, the significance probabilities obtained from bootstrapping may differ from those derived through MLE.

To assess the fit of the hypothetical model, we examined χ^2 statistics (CMIN), normed χ^2 (CMIN/DF), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), standardized root mean square residual (SRMR), normed fit index (NFI), Tucker–Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The significance of the paths in the hypothetical model was tested using the standardized estimate, critical ratio, and p values, and the explanatory power of the endogenous variables was assessed using the squared multiple correlation (SMC). The significance of the direct, indirect, and total effects in the model was verified using the bootstrapping method.

3. Results

3.1. Participants' Demographic Characteristics and ITS. The general characteristics of the study participants are shown in Table 1. The total number of participants was 549, with an average age of 31.31 ± 0.19 years and an average work experience of 5.79 ± 0.18 years. The majority were women, unmarried, bachelor's degree holders, staff nurses, working in Seoul, on a three-shift schedule, and affiliated with internal medicine wards, with no prior experience of working during disasters. In addition, 321 (58.47%) worked at general hospitals, while 228 (41.53%) at tertiary hospitals. Significant differences in ITS were observed based on career ($F = 9.95$, $p < 0.001$), sex ($t = 73.31$, $p < 0.001$), marital status ($F = 75.84$, $p < 0.001$), type of hospital ($t = 75.13$, $p < 0.001$), position ($t = 76.35$, $p < 0.001$), work department ($F = 3.11$, $p = 0.005$), and prior disaster experience ($t = 80.15$, $p < 0.001$).

3.2. Descriptive Statistics and Correlation Matrix of Quality of Study Variables. The correlations among the variables are shown in Table 2. Intent to stay showed a significant positive correlation with adaptive leadership ($r = 0.62$, $p < 0.001$), adequacy of staffing and resources ($r = 0.60$, $p < 0.001$), group cohesion ($r = 0.69$, $p < 0.001$), disaster nursing competency ($r = 0.60$, $p < 0.001$), organizational commitment ($r = 0.84$, $p < 0.001$), empowerment ($r = 0.68$, $p < 0.001$), and job satisfaction ($r = 0.76$, $p < 0.001$). Only moral distress showed negative correlation with ITS ($r = -0.29$, $p < 0.001$). All the variables had absolute correlation coefficients below 0.9, indicating no multicollinearity [47].

3.3. The Hypothetical Model of Clinical Nurses' ITS During Disasters. CFA was used to assess the convergent and discriminant validity of the measurement model. The convergent validity of the measurement model is shown in Table S1. The composite reliability (CR) values ranged from 0.8 to 0.95 and the average variance extracted (AVE), from 0.55 to 0.88, except for disaster nursing competency, which had an AVE of 0.49. According to Fornell and Larcker [48], AVE is a conservative measure, and even if it does not meet the 0.5 threshold, convergent validity can be considered adequate if the CR exceeds 0.7. Therefore, in this study, the

construct reliability and standardized factor loadings for all latent variables met the required thresholds, ensuring convergent validity. The discriminant validity analysis of the measurement model is shown in Table S2. None of the confidence intervals of the correlation coefficients included 1.0, confirming the discriminant validity of the model.

The goodness-of-fit for the hypothetical structural model is shown in Table 3, and the path diagram of the hypothetical model is illustrated in Figure 2. The GFIs for the hypothetical model were $\chi^2/df = 2.13$, GFI = 0.86, AGFI = 0.75, SRMR = 0.04, NFI = 0.90, TLI = 0.94, CFI = 0.94, and RMSEA = 0.05, indicating that most of the indices met the recommended thresholds. Therefore, the goodness-of-fit of the hypothetical model was deemed acceptable, leading to the finalization of the model.

3.4. Theoretical Model of Clinical Nurses' ITS in Disaster.

The significance of the estimated coefficients in the hypothetical structural model was examined; 10 out of 20 paths were statistically significant, as shown in Figure 2. Organizational commitment was significantly influenced by the adequacy of staffing and resources ($\beta = 0.09$, $p = 0.035$) and group cohesion ($\beta = 1.38$, $p < 0.001$). Empowerment was significantly influenced by group cohesion ($\beta = 0.79$, $p < 0.001$), and moral distress was significantly affected by adequacy of staffing and resources ($\beta = -0.19$, $p < 0.001$). Job satisfaction was significantly influenced by adaptive leadership ($\beta = -0.42$, $p = 0.002$), adequacy of staffing and resources ($\beta = 0.24$, $p < 0.001$), group cohesion ($\beta = 1.61$, $p < 0.001$), and disaster nursing competency ($\beta = -0.37$, $p = 0.003$). During disasters, clinical nurses' ITS was significantly influenced by organizational commitment ($\beta = 0.97$, $p < 0.001$) and job satisfaction ($\beta = 0.33$, $p < 0.001$).

The results of the model effect analysis using bootstrapping are shown in Table S3.

Absolute value of skewness was less than 3 and that of kurtosis did not exceed 8 (Table S4), satisfying the assumption of multivariate normality [49]. Therefore, it is appropriate to prioritize interpreting the significance probabilities of the regression coefficient estimates obtained from path analysis over those from the effect analysis using bootstrapping. In the effect analysis of this model, the following variables were not statistically significant in the bootstrapping results but significant in the path analysis: adequacy of staffing and resources ($\beta = 0.12$) for organizational commitment and adaptive leadership ($\beta = -0.28$), adequacy of staffing and resources ($\beta = 0.28$), and disaster nursing competency ($\beta = -0.28$) for job satisfaction. Thus, as mentioned above, the direct effects of these variables can be considered significant.

Overall, the developed model explained 71.4% of clinical nurses' ITS during disasters.

4. Discussion

In disaster situations, when resources are scarce, support should be strategically prioritized to retain skilled staff [50]. This study developed a systematic model to predict clinical

TABLE 1: Participants' general characteristics and intent to stay ($N = 549$).

Variables	Categories	<i>n</i> (%)	Range	Mean $\pm$ SD	Intent to stay Mean $\pm$ SD	<i>t/F</i> (<i>p</i>) Turkey
Age	≤ 30	199 (36.25)	24–60	31.31 $\pm$ 0.19	22.15 $\pm$ 6.98	1.17 (0.310)
	31–40	319 (58.10)			21.57 $\pm$ 5.84	
	≥ 41	31 (5.65)			20.45 $\pm$ 6.48	
Total career	$\geq 1 < 4^a$	148 (26.96)	1–38	5.79 $\pm$ 0.18	20.55 $\pm$ 6.75	9.95 (< 0.001) b > a, c
	$\geq 4 < 7^b$	271 (49.36)			22.91 $\pm$ 5.63	
	$\geq 7^c$	130 (23.68)			20.55 $\pm$ 6.71	
Sex	Female	526 (95.81)	—	—	21.79 $\pm$ 6.34	73.31 (< 0.001)
	Male	23 (4.19)			20.00 $\pm$ 5.56	
Marital status	Single	418 (76.14)	—	—	22.14 $\pm$ 6.53	75.84 (< 0.001)
	Married	131 (23.86)			20.36 $\pm$ 5.36	
Education	Associate degree	54 (9.83)	—	—	21.35 $\pm$ 3.30	0.50 (0.609)
	Bachelor's degree	455 (82.88)			21.83 $\pm$ 6.49	
	Master's or above	40 (7.29)			20.90 $\pm$ 7.33	
Hospital type	General hospital	228 (41.53)	—	—	21.21 $\pm$ 6.56	75.13 (< 0.001)
	Tertiary hospital	321 (58.47)			22.42 $\pm$ 5.89	
Position	Staff nurse	482 (87.80)	—	—	22.00 $\pm$ 6.28	76.35 (< 0.001)
	Charge nurse and above	67 (12.20)			19.64 $\pm$ 6.17	
Location	Seoul Gyeonggi area	426 (77.60)	—	—	21.62 $\pm$ 6.40	0.81 (0.515)
	Gyeongsang area	68 (12.39)			21.57 $\pm$ 5.90	
	Chungcheong area	19 (3.46)			23.53 $\pm$ 6.74	
	Jeolla Jeju area	12 (2.19)			20.42 $\pm$ 3.85	
	Gangwon area	24 (4.36)			23.04 $\pm$ 6.53	
Shift types	3 shift	448 (81.60)	—	—	21.83 $\pm$ 6.40	1.98 (0.138)
	2 shift	47 (8.56)			22.40 $\pm$ 5.22	
	Etc. (fixed and part time)	54 (9.84)			20.17 $\pm$ 6.32	
Work unit	Internal medicine ward ^a	263 (47.91)	—	—	22.65 $\pm$ 5.96	3.11 (0.005) a > e
	Surgical ward ^b	130 (23.68)			21.12 $\pm$ 6.68	
	ICU ^c	72 (13.11)			22.02 $\pm$ 5.60	
	ER ^d	25 (4.55)			20.32 $\pm$ 6.53	
	Operating room/recovery room ^e	22 (4.01)			18.09 $\pm$ 5.49	
	Neonatal/pediatrics ^f	12 (2.19)			21.67 $\pm$ 7.70	
	Others (delivery room, obstetrics, gynecology, psychiatric ward, etc.) ^g	25 (4.55)			20.12 $\pm$ 7.28	
	Yes	55 (12.39)			19.55 $\pm$ 6.80	
	No	484 (87.61)			21.96 $\pm$ 6.21	
	Previous disaster experience					

Note: Among a, b, c, d, e, f, and g, there was a statistically significant difference only between a and e. Therefore, it was denoted as a > e.
Abbreviations: ER = emergency room, ICU = intensive care unit.

TABLE 2: Correlation between the variables (N=549).

	1	2	3	4	5	6	7	8	9
1. Adaptive leadership	1								
2. Adequacy of staffing and resources	0.58 (< 0.001)	1							
3. Work group cohesion	0.76 (< 0.001)	0.65 (< 0.001)	1						
4. Disaster nursing competency	0.66 (< 0.001)	0.66 (< 0.001)	0.72 (< 0.001)	1					
5. Organizational commitment	0.74 (< 0.001)	0.70 (< 0.001)	0.81 (< 0.001)	0.73 (< 0.001)	1				
6. Empowerment	0.69 (< 0.001)	0.63 (< 0.001)	0.77 (< 0.001)	0.70 (< 0.001)	0.79 (< 0.001)	1			
7. Moral distress	-0.27 (< 0.001)	-0.32 (< 0.001)	-0.20 (< 0.001)	-0.27 (< 0.001)	-0.31 (< 0.001)	0.71 (< 0.001)	1		
8. Job satisfaction	0.60 (< 0.001)	0.68 (< 0.001)	0.66 (< 0.001)	0.60 (< 0.001)	0.81 (< 0.001)	0.71 (< 0.001)	-0.27 (< 0.001)	1	
9. Intent to stay	0.62 (< 0.001)	0.60 (< 0.001)	0.69 (< 0.001)	0.60 (< 0.001)	0.84 (< 0.001)	0.89 (< 0.001)	0.76 (< 0.001)	0.97 (< 0.001)	1

TABLE 3: Fit indices of the hypothetical model.

	$\chi^2(p)$	χ^2/df	GFI	AGFI	SRMR	NFI	TLI	CFI	RMSEA
Reference Model	$p > 0.05$	≤ 3	≥ 0.90	≥ 0.80	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.90	0.05–0.10
Model	1756.113 (0)	2.13	0.86	0.75	0.04	0.90	0.94	0.94	0.05

Abbreviations: AGFI = adjusted goodness-of-fit index, CFI = comparative fit index, df = degree of freedom, GFI = goodness-of-fit index, NFI = normed fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, TLI = Tucker–Lewis index.

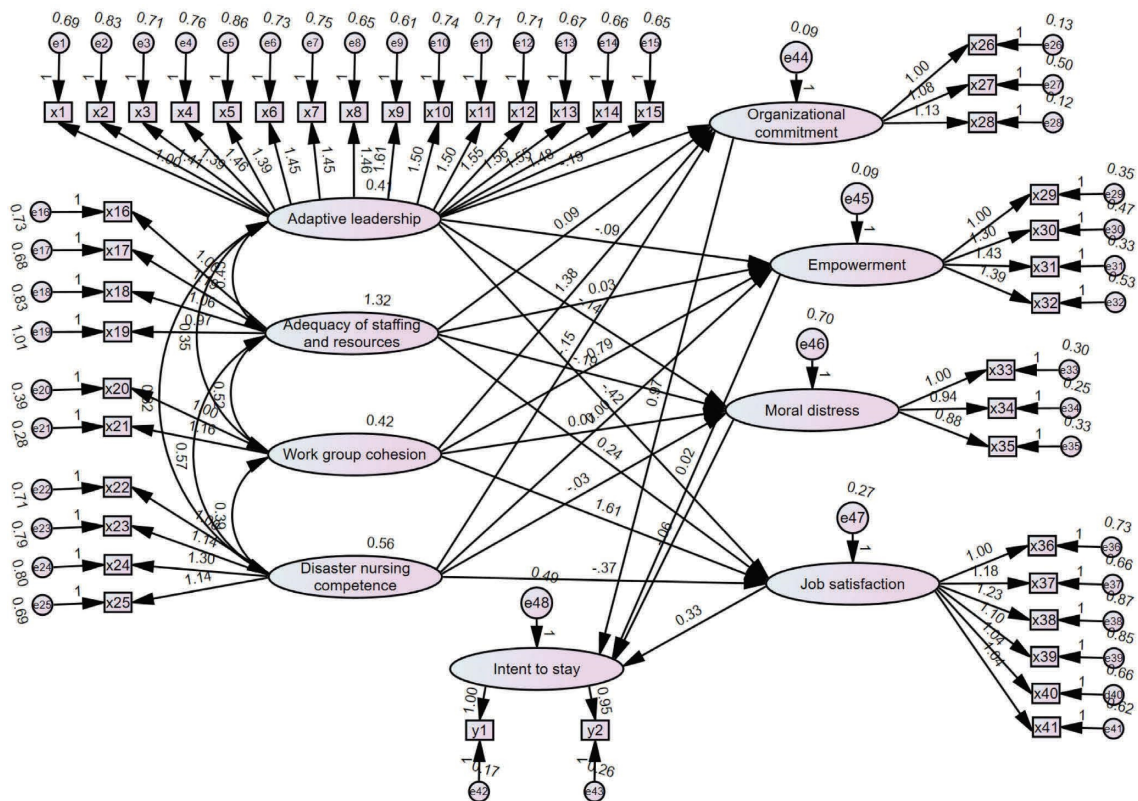


FIGURE 2: Path diagram of the hypothetical model.

nurses' ITS during disasters based on Cowden and Cummings' [23] framework and tested the relationships between variables.

The model showed good fit, supporting 10 of 20 hypotheses. Adaptive leadership negatively impacted job satisfaction, while adequate staffing and resources positively influenced organizational commitment and job satisfaction and reduced moral distress. Group cohesion positively affected organizational commitment, empowerment, and job satisfaction. Both organizational commitment and job satisfaction positively influenced nurses' ITS, with group cohesion having an indirect positive effect. These factors explained 71.4% of the variance in ITS.

Previous studies have highlighted the effectiveness of adaptive leadership in disaster situations, positively influencing clinical nurses' ITS [51, 52]. However, this study found that adaptive leadership reduced job satisfaction, contradicting previous research findings emphasizing its usefulness during COVID-19 [53]. This may be due to the specific challenges faced by Korean nurses during the pandemic, such as inadequate guidelines, staffing, and

training [7, 9]. In this study, 49.36% of the participants had four to seven years of experience, placing them in the "proficient" stage [54]. While these nurses generally holistically understand situations, they may still be novices in areas such as disaster nursing. Due to a lack of disaster experience, they might have preferred clear, systematic leadership over adaptive approaches, which may have caused confusion. However, these findings do not suggest that traditional leadership is better in disasters [52, 53]. Further research is needed to determine the most effective leadership style in crises, and programs should be developed to help nurse managers apply appropriate leadership strategies during such situations.

Adequate staffing and resources positively impact organizational commitment and job satisfaction for clinical nurses during disasters, aligning with previous studies in China and the UK [55, 56]. Sufficient support enhances organizational commitment, reduces turnover intentions, and fosters a positive view of the organization [57]. Moreover, it creates camaraderie and helps employees manage stress, increasing job satisfaction [58].

Conversely, inadequate staffing and resources increase moral distress, as seen in studies on ICU nurses during COVID-19 [59]. Disasters intensify issues related to moral distress by exacerbating resource shortages and creating ethical dilemmas [60]. While various strategies, such as educational interventions and debriefing methods, have been implemented to reduce moral distress [61, 62], these often lack rigorous testing and generalizability [63]. Further research focused on disaster-specific contexts is needed to develop effective programs for alleviating moral distress during crises.

Disaster nursing competency negatively impacted job satisfaction among clinical nurses. While higher competency generally leads to greater job satisfaction [64, 65], during the COVID-19 pandemic, it did not correlated significantly with Korean nurses' job satisfaction [66] and had a negative effect in this study. This may be due to insufficient compensation and safety [7, 9]. Nurses faced high workloads and self-sacrifice without adequate rewards [67]. This may lead to decreased job satisfaction. Further research is needed as the findings on the impact of disaster nursing competency on job satisfaction are controversial [66, 68]. While enhancing disaster nursing competency has been suggested to improve participation in disaster response and reduce healthcare costs [11, 12], it may not increase nurses' intention to stay with an organization. Given the positive correlation between disaster nursing competency and adequacy of staffing and resources and the latter's positive impact on job satisfaction, further research on how staffing and resource adequacy mediated the relationship between competency and job satisfaction is needed.

Organizational commitment, a cognitive response to work, influenced ITS, aligning with previous COVID-19 studies [69]. Normative commitment, a part of organizational commitment, is driven by a sense of duty [70]. During COVID-19, nurses' attachment to their hospitals and their sense of duty might have driven them to remain despite challenges.

Job satisfaction, an effective response to their work, also affected ITS, consistent with studies of Korean nurses during COVID-19 [18]. Higher job satisfaction boosts nurses' ITS when their expectations are met, while increased workload and stress reduce both satisfaction and intent [71]. To improve intention to stay, it is essential to enhance job satisfaction by addressing nurses' expectations and improve work conditions, especially during disasters [72]. Effective policies and strategies are needed to support nurses in these critical times.

Overall, organizational commitment emerged as the most influential factor affecting clinical nurses' ITS during disasters. Disasters such as COVID-19 threaten community health and stability [73], and solidarity with others can help reduce suffering and uncertainty [74]. According to uncertainty-identity theory, strong group cohesion and commitment can emerge as individuals align with their groups to manage uncertainty [75]. High group cohesion enhances organizational commitment, improving nurses' ITS. Various strategies to enhance group cohesion, such as leadership development, preventing workplace harassment

[76], and ensuring adequate resources and communication [77] have been studied; however, these strategies are challenging to implement in the short term. Therefore, hospital and nursing administrators should devise various strategies to enhance cohesion in nurses even during routine periods and invest time to achieve effective disaster workforce management.

4.1. Limitations. This study has several limitations. First, the data were collected using a web-based self-reported survey, making it difficult to control for response reliability and insincere answers. Second, convenience sampling was used to recruit participants, which may have led to a biased sample. Third, the study defined a disaster specifically as the COVID-19 pandemic, limiting the generalizability of the findings to other types of disasters. Finally, since the study retrospectively examined participants' ITS and related variables after the COVID-19 pandemic ended, there is a risk of recall bias.

5. Conclusion

As disasters become more frequent and severe, retaining a skilled nurse workforce is crucial. The study shows that organizational commitment and job satisfaction are key to nurses' ITS during crises. Organizational commitment is influenced by staffing adequacy and group cohesion, while job satisfaction is affected by adaptive leadership, staffing adequacy, and group cohesion. Although disaster nursing competency negatively impacted job satisfaction in this study, further research is needed on how staffing and resources mediate this relationship. Group cohesion, which strengthens during crises [69], directly and indirectly influences ITS by enhancing organizational commitment. Administrators should focus on strengthening cohesion and investing time for effective disaster workforce management.

This study is significant as it developed and validated a model based on Cowden and Cummings' ITS model [23] to explain clinical nurses' ITS during disasters. By examining the causal pathways between key factors, the study offers a comprehensive theoretical framework to better understand and predict nurses' retention in crisis situations. While it confirmed important factors influencing nurses' ITS, it also uncovered differences from the original theoretical model, suggesting the need for further research to validate these findings. The hypothesis-driven model provides a theoretical foundation for identifying factors that impact nurse retention, offering practical insights for developing strategies and policies to retain skilled nurses and sustain the healthcare system during disasters.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to legal restrictions imposed by the government of South Korea in relation to the "Personal Information Protection Act." However, they are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. (*Supporting Information*)

We have included supporting information for sections other than the main content of the manuscript to enhance readability. Most of the supporting information added are related to the verification procedures required in the process of structural equation modeling.

Table S1: Convergent validity of latent variables.

Table S2: Discriminant validity of latent variables.

Table S3: Direct, indirect, total effect of the hypothetical model.

Table S4: Descriptive statistics and validity of measured variables.

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