

# Survey of Korean daycare personnel on safe sleep practices related to sudden unexplained infant death: a cross-sectional exploratory study

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**Purpose:** Safe sleep practices (SSP) are among the main strategies to reduce sleep-related sudden unexplained infant death (SUID). Daycare personnel must be knowledgeable and trained in SSP related to SUID. This study explored the experience, knowledge, and confidence regarding SSP associated with SUID of daycare personnel. **Methods:** A cross-sectional survey was conducted with 395 staff members at 61 daycare centers to measure their experience related to SSP (10 items), related to sleep position and location, bedding materials, and other topics; knowledge of SSP (18 items); and confidence in SSP (1 item) related to SUID. **Results:** A substantial proportion (23.6%) of respondents used the lateral or prone positions for infant sleep. On average, 4.5 bedding materials were used for infant sleep. Participants showed a lack of knowledge about SSP as indicated by a 56.6% knowledge of SSP related to SUID correct answer rate. Personnel who received SUID education were more knowledgeable and had more confidence regarding SSP than those who did not. More knowledge and confidence related to SSP were associated with better adherence to SSP. **Conclusion:** Standard SSP guidelines should be developed based on South Korea's culture of childcare for educating both childcare professionals and parents at home.

**Key words:** Child care; Child day care centers; Sleep; Sudden infant death; Knowledge

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## INTRODUCTION

When an infant's death suddenly and unexpectedly occurs, a thorough investigation, including an autopsy, scene investigation, and medical history review, is undertaken to identify the cause of death [1]. When the cause of an infant's death during sleep remains unknown, even after excluding all possible causes, sudden infant death syndrome (SIDS) is diagnosed [1]. Factors related to SIDS can primarily be explained using the triple risk model, which explains that SIDS can occur when infants with vulnerabilities (e.g., preterm birth and congenital anomalies) are exposed to exogenous stressors (e.g., an unsafe sleep environment) during critical developmental periods [2].

Safe sleep practices (SSP) comprise one of the main strategies to reduce the occurrence of SIDS that can be adopted at the individual or social level [3]. According to the Safe Sleep

Guidelines [3] published by the American Academy of Pediatrics (AAP) and previous studies on the topic [4,5], factors associated with SIDS or sleep-related sudden unexplained infant death (SUID) include the prone or lateral sleep positions, sharing a bed, sleeping on a soft surface, and wearing excessive clothing, in addition to preexisting vulnerabilities in infants such as a recent viral infection, fever, or developmental problems. Therefore, childcare professionals should be aware of the significance of SSP for infants in their job settings, including at clinics and daycare centers.

Daycare centers are facilities where children of any age, including infants, are provided routine or daily care, including sleeping and eating. Providing a proper sleep environment for children and infants is one of the most important services provided by daycare centers [6,7]. Therefore, daycare personnel must be knowledgeable about SSP and have basic knowledge and skills about the general health issues of children.

The daycare enrollment rate of children under the age of 1 year in South Korea is 17.05%, which is higher than the Organization for Economic Co-operation and Development average of 8.64% [8]. One possible explanation for this relatively high rate is the child allowance policy of the Korean government, which provides parents with a financial allowance for monthly daycare enrollment for their infants; this policy was implemented to mitigate the prolonged low fertility rate in recent years [9]. Since parents in Korea have the option to send their infants to daycare centers with financial support once maternal leave ends, the mother can return to work, which may influence prospective parents to choose to have a child because they can keep their jobs. An increase in the enrollment of young infants is inevitable due to the high proportion of working mothers in Korea's modern industrial society, and this in turn increases the importance of the role of daycare personnel concerning infant health promotion and SSP.

Daycare centers, as a young child's main environment for play and activities, should be properly curated. Sleeping or nap time is typically viewed as a relatively quiet break time for infants and personnel rather than a time during which personnel must monitor the children and continue to provide crucial care [10]. Since existing sleep guidelines are designed for primary caregivers at nighttime in a home environment, there is a need for sleep guidelines tailored to daycare centers for use by daycare personnel.

Sleep practices vary by home structure and sleep-related furniture [11]. Korea has a unique home culture in which the floor is used as a clean area, unlike in other countries, and Korean house structures are usually designed with this in mind [12]. Accordingly, most families use the floor for infants to sleep on by spreading a bedsheet directly on the floor [12]. Sometimes family members, such as the baby's mother, may sleep right next to the infant by simply adding more sheets. The building structures of daycare centers, however, are quite different from regular family homes. Sleep practices could vary by center, and floor sleep is not a viable option at all centers [13]. Since SUID could occur at any time or place, daycare personnel should be prepared to adhere to SSP at centers and have a satisfactory confidence level with regard to SSP. The phenomenon of SSP related to SUID in Korean daycare centers must therefore be investigated in this cultural context. Multiple previous studies have examined issues with the operation of facilities, such as facility management and the establishment of emergency contact networks [14], and overall practices at daycare facilities [15,16]. These previous studies support the need for compliance with SSP among caregivers, including daycare personnel, mothers, and health professionals, and knowledge and confidence related to SSP are asso-

ciated with the performance of SSP [17-19]. A better understanding of SSP may contribute to improvement in the quality of sleep environments in the childcare field. However, there has been little research to gain a detailed understanding of the practice of SSP at Korean daycare centers. This study was conducted to 1) investigate daycare personnel's experience with SSP (E-SSP), 2) measure daycare personnel's knowledge of SSP related to SUID (K-SSP) and confidence with SSP related to SUID (C-SSP), and 3) explore the associations of E-SSP with K-SSP, C-SSP, and the demographic characteristics of daycare personnel.

## METHODS

**Ethics statement:** This study was approved by the Institutional Review Board (IRB) of Inha University (No. 191119-3A). Informed consent was obtained from all participants.

### 1. Study Design

A cross-sectional exploratory survey was performed to examine the experience, knowledge, and confidence of daycare personnel concerning SSP related to SUID. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [20].

### 2. Participants and Data Collection

The target population of this study comprised daycare center personnel who cared for infants aged 0 to 12 months. The inclusion criteria in this study were professionals with a daycare staff certificate and at least 6 months of work experience. The participants were initially recruited from 85 daycare centers in the metropolitan area where the researchers' affiliated university is located. The chairs of each daycare center agreed to participate in the survey study on behalf of the institution.

A total of 578 daycare personnel affiliated with the daycare centers were identified as potential participants, of whom 437 personnel (75.6%) from 61 daycare centers (71.8%) voluntarily agreed to participate in the study, provided written informed consent, and completed the survey. The anonymity of each center and individual staff member for participation in the study was guaranteed, and all responses to survey items remained confidential. Data collection was conducted over 2 months from March to May 2020 via standard mail to minimize direct human contact and prevent the possible spread of the coronavirus disease 2019. To encourage the participants to complete and return the survey, multiple reminder notices were periodically sent to the daycare centers. After excluding

all data from respondents who did not meet the inclusion criteria or who had missing data for more than 20% of the variables, 395 personnel (68.3%) were included in the statistical analysis. The actual number of participants ranged from 344 to 395 depending on the category.

### 3. Survey Variables

This study conducted a survey that included questionnaires about the respondents' knowledge and confidence regarding SSP related to SUID. The questionnaires were developed for pediatric nurses in a previous study [21] and modified to address the roles of daycare personnel and the daycare center environment rather than hospitals or clinical settings. The questionnaire consisted of 39 items to measure 1) E-SSP (10 items), 2) K-SSP (18 items), 3) C-SSP (1 item), and 4) the demographic characteristics of daycare personnel (10 items).

#### 1) Experience with safe sleep practices related to sudden unexplained infant death

E-SSP was measured using 10 items on their adherence to SSP at their daycare centers including the most common sleep positions of infants with corresponding reasons, sleep location, pacifier use, room temperature, use of a portable heater, mattress firmness, bedding materials, and health information collected at the time of the infant's registration. For bedding materials, the number of comforters (*ibul*), lining sheets (*yo*), pillows, cushions, stuffed animals (dolls), swaddles, towels, and extra diapers on the bedding surface or near the sleeping location were quantitatively measured. The mattress firmness was measured using a scale ranging from 1 (extremely soft) to 5 (extremely firm).

#### 2) Knowledge of safe sleep practices related to sudden unexplained infant death

K-SSP was measured in 2 different areas: SSP related to SUID (kn-SSP) according to AAP criteria and infant cardiopulmonary resuscitation (kn-ICPR). There were 13 items to assess SSP related to SUID in terms of kn-SSP: sleep position (2), room temperature (2), mattress firmness (1), the use of comforters (1), swaddling (1), clothing (1), the use of bedrail cushions (1), the presence of a home monitor (1), position maintenance products (1), second-hand smoke (1), and asphyxiation (1). Five items were used to assess kn-ICPR and included items on airway management (1), the infant cardiopulmonary resuscitation ratio for a single rescuer (1), chest compression rate (1), chest compression hand position (1), and removal of a foreign body from the airway (1). Possible scores ranged from 0 to 18 points, with 1 point for each correct answer and 0 point for each incorrect answer.

#### 3) Confidence regarding safe sleep practices related to sudden unexplained infant death

A visual analog scale was used to measure C-SSP. Scores were measured using a 5-point scale ranging from 1 to 5 points to determine the confidence level.

#### 4) Demographic characteristics

The demographic characteristics that potentially influenced experience, knowledge, and confidence regarding SSP related to SUID were determined based on the findings of previous studies [15,22]. They included age, work experience, marital status, experience raising children, education level, certification or license type, and previous experience with SUID education and infant cardiopulmonary resuscitation. Multiple responses were acceptable for several of the items.

### 4 Data Analysis

Data from the survey were screened for completeness and only included in the analysis if the proportion of missing data was within 20%. Descriptive correlational statistics were applied to measure E-SSP, K-SSP, and C-SSP using IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA), and a *p*-value less than .05 was considered to indicate statistical significance. To examine the participants' adherence to SSP, five key SSP items (sleep position, sleep location, mattress firmness, pacifier use, and portable heater use) were selected according to the Strength-of-Recommendation Taxonomy rating of the AAP recommendation [23]. If the participants responded correctly to three or more out of the five key items, they were classified into the advanced group (AG), while those who had correct responses for two or fewer of the five key items were classified into the regular group (RG). Adherence to SSP was then compared between the groups by demographic characteristics using logistic regression analysis.

## RESULTS

### 1. Demographic Characteristics of Participants

The demographic characteristics of the daycare personnel are shown in Table 1. All of the participants were female. The mean age was 37.9 years (standard deviation [SD]=9.9 years) and the mean amount of work experience was 7.2 years (SD=5.2 years). Approximately 57% of the participants were married, and approximately 53% had experience raising a child or children. Although most of the participants had an associate's degree or higher, 13.7% were high-school graduates only. The most common certificate type was a level 1 certificate (71.4%), followed by a level 2 certificate (33.4%) and a sec-

**Table 1.** Demographic Characteristics of Daycare Personnel and Infant Health Information

Variables	Number	Categories	n (%) or M±SD
Age (year)	373		37.9±9.9
Work experience (year)	395		7.2±5.2
Marital status	392	Single Married	169 (43.1) 223 (56.9)
Experience raising a child or children	371	No Yes	175 (47.2) 196 (52.8)
Education level	387	High school Associate’s degree or higher	53 (13.7) 334 (86.3)
Certificate type*	395	Childcare teacher level 1 Childcare teacher level 2 Childcare teacher level 3 Kindergarten teacher level 1 Kindergarten teacher level 2 Other <sup>†</sup>	282 (71.4) 132 (33.4) 14 (3.5) 16 (4.1) 65 (16.5) 7 (1.8)
Received education on SUID	394	No Yes Origin of information*	93 (23.6) 301 (76.4) Education program Poster/pamphlet Book/textbook Television Internet
Received education on infant CPR	395	No Yes Origin of information*	12 (3.0) 383 (97.0) Education program Poster/pamphlet Book/textbook Television Internet
Infant health information collected at registration	392	No Yes*	3 (0.8) 389 (99.2) Immunization history Underlying disease Motor development status Medication history Feeding and nutritional status Body size at registration Experience of hospitalization Daily sleep position Daily bedding use Body size at birth Gestational age at birth

\*Multiple responses possible; <sup>†</sup>Social worker (n=4), middle school teacher (n=1), registered nurse (n=1), nurse aide (n=1); CPR, cardiopulmonary resuscitation; M, mean; SD, standard deviation; SUID, sudden unexplained infant death.

and kindergarten teacher certificate (16.5%). A total of 301 (76.4%) daycare personnel received education on SUID, and 383 (97.0%) received education on infant cardiopulmonary resuscitation.

Of the 392 daycare personnel, 389 (99.2%) responded that they collected the health information of infants at the time of registration: 92.3% of the participants stated that they collected information on immunization history, 90.8% did so for

underlying diseases, 64.5% collected information on motor development status, 63.8% did so for medication history, and 63.3% collected information on feeding and nutritional status.

## 2. Experience of Safe Sleep Practices Related to Sudden Unexplained Infant Death

Data on E-SSP are shown in Table 2. The most commonly cited sleep position was the supine position (76.4%), followed by the lateral (22.0%) and prone (1.6%) positions. The most common reasons the participants cited for not placing infants in a supine position were to improve the infant's sleep (82.2%), to prevent regurgitation (13.3%), to prevent SUID (5.6%), or to adhere to a different personal preference (2.2%). While almost every participant (98.0%) answered that the floor was their favored sleep location for infants, 69.0% responded that they would use an additional mattress brought from home. Only 6.4% of personnel responded that they would give a pacifier to the infant when sleeping. A total of 21.5% of the respondents said they used a portable heater while infants slept. The mean score for mattress firmness was 3.2 (SD=0.9).

Table 3 shows the types of bedding materials and their

amounts reported by daycare personnel. Daycare personnel reported using a mean number of 4.5 (SD=1.9) bedding materials in the infants' sleep areas, and the three most-cited bedding materials were an infant comforter (97.3%), a sheet (96.8%), and an infant pillow (91.4%). The bedding materials with the highest mean quantity were extra diapers (1.8±0.8), stuffed animals (1.6±0.8), and adult pillows (1.5±0.6) (Table 3).

## 3. Knowledge of Safe Sleep Practices and confidence with Safe Sleep Practices Related to Sudden Unexplained Infant Death

The mean total score for K-SSP was 10.2 points (SD=2.4 points), and the average correct answer rate was 56.6% (SD=13.2). The mean C-SSP score of the daycare personnel was 3.3±0.8 points (Table 3). Our detailed analysis showed that, for kn-SSP, the mean correct answer rate was lower than 50% for five items: swaddling (44.1%), the use of products for position maintenance (43.5%), room temperature (20.0%), sleep clothing (17.0%), and the use of a home monitor (11.4%). For kn-ICPR, removal of a foreign body from the airway showed the lowest correct answer rate at 18.2%.

**Table 2.** Experience of Safe Sleep Practices Related to Sudden Unexplained Infant Death

Variables	Number	Categories	n (%) or M±SD
Sleep position	382	Supine	292 (76.4)
		Lateral	84 (22.0)
		Prone	6 (1.6)
Reasons for not using the supine position*	101	To improve infant sleep	74 (82.2)
		To prevent regurgitation	12 (13.3)
		To prevent SUID	5 (5.6)
		Personal preference	2 (2.2)
Sleep location	395	Crib	8 (2.0)
		Floor	387 (98.0)
		Additional mattress use (yes)	267 (69.0)
Individual bedding brought from home	393	No	11 (2.8)
		Yes	382 (97.2)
Pacifier use	393	No	368 (93.6)
		Yes	25 (6.4)
Room temperature	384	Uncertain	62 (16.1)
		Certain	322 (83.9)
		Temperature (°C)	23.6±2.2
Use of portable heater	391	No	307 (78.5)
		Yes*	84 (21.5)
		Stove/heater	74 (88.1)
		Electric mattress	9 (10.7)
Mattress firmness	385		3.2±0.9 (range, 1-5)

\*Multiple responses possible; M, mean; SD, standard deviation; SUID, sudden unexplained infant death.

**Table 3.** Experience, Knowledge, and Confidence Regarding Safe Sleep Practices Related to Sudden Unexplained Infant Death

Variables	Categories	n (%)	M±SD
E-SSP*	Infant comforter	332 (97.3)	1.1±0.4
	Sheet	331 (96.8)	1.2±0.4
	Infant pillow	320 (91.4)	1.1±0.4
	Stuffed animal (doll)	98 (29.2)	1.6±0.8
	Cushion	102 (26.9)	1.4±0.7
	Extra diaper	78 (24.7)	1.8±0.8
	Swaddle	56 (14.8)	1.3±0.7
	Towel	48 (14.2)	1.4±0.7
	Adult comforter	36 (9.4)	1.4±0.7
	Adult pillow	28 (7.3)	1.5±0.6
	Total		4.5±1.9
K-SSP (n=395)	kn-SSP		
	Room temperature 1	369 (93.4)	
	Second-hand smoking	367 (92.9)	
	Asphyxia	355 (89.9)	
	Mattress firmness	286 (72.4)	
	Sleep position 1	279 (70.6)	
	Sleep position 2	254 (64.3)	
	Use of comforters	250 (63.3)	
	Bedrail cushion	206 (52.2)	
	Swaddling	174 (44.1)	
	Position maintenance products	172 (43.5)	
	Room temperature 2	79 (20.0)	
	Clothing	67 (17.0)	
	Home monitor	45 (11.4)	
	Mean of corrected answers	7.4±2.0	56.5±15.4 <sup>†</sup>
	kn-ICPR		
	Chest compression rate	313 (79.2)	
	Chest compression hand position	279 (70.6)	
	Infant CPR ratio for single rescuer	238 (60.3)	
	Airway management	218 (55.2)	
	Removal of a foreign body from the airway	72 (18.2)	
	Mean of corrected answers	2.8±1.2	56.7±24.0 <sup>†</sup>
	Mean of corrected answers (total)	10.2±2.4	56.6±13.2 <sup>†</sup>
C-SSP (n=389)			3.3±0.8

\*The frequencies of categories in E-SSP vary from 316 to 382; <sup>†</sup> Mean percentile score; C-SSP, confidence regarding safe sleep practices related to sudden unexplained infant death; E-SSP, experience with safe sleep practices related to sudden unexplained infant death; kn-ICPR, knowledge on infant cardiopulmonary resuscitation; K-SSP and kn-SSP, knowledge of safe sleep practices related to sudden unexplained infant death; M, mean; SD, standard deviation.

The mean score for K-SSP was higher among daycare personnel with SUID education than among those without SUID education (10.4±2.3 points vs. 9.4±2.3 points;  $t=-3.57, p<.001$ ). However, no significant differences were observed according to the experience of raising a child or children ( $t=-0.69, p=.489$ ), work experience ( $t=-0.28, p=.779$ ), education level ( $t=-1.37, p=.717$ ), or previous education experience related to infant cardiopulmonary resuscitation ( $t=-0.77, p=.443$ ). The mean scores for C-SSP were significantly higher among participants with experience raising a child or children (3.4±0.8 points vs.

3.1±0.8 points;  $t=-3.75, p<.001$ ), more than 7 years of work experience (3.4±0.8 points vs. 3.2±0.8 points;  $t=-2.56, p=.011$ ), and previous education experience related to SUID (3.4±0.8 points vs. 3.1±0.8 points;  $t=-3.44, p=.001$ ) compared to their counterparts with no experience raising a child (Table 4).

#### 4. Factors that Affected Safe Sleep Practices Related to Sudden Unexplained Infant Death

Table 5 shows the differences in K-SSP and C-SSP scores ac-

ording to the level of adherence to SSP. Among the 367 participants, 265 (72.2%) belonged to the AG, meeting 3 or more out of the 5 criteria. The AG had a significantly higher mean K-SSP score than the RG (10.4±2.5 points vs. 9.6±2.1 points;  $t=-2.74, p=.007$ ); however, no significant differences were observed in the mean C-SSP scores ( $t=1.19, p=.235$ ) between the groups.

Significant differences were also observed between the groups according to marital status ( $\chi^2=11.09, p=.001$ ) and experience with raising a child or children ( $\chi^2=8.95, p=.003$ ). A difference was also observed according to education level ( $\chi^2=3.48, p=.062$ ), but it was not statistically significant. Previous education experience related to SUID had no relationship with the classification group ( $\chi^2=1.92, p=.166$ ) (Table 5). After adjusting for K-SSP scores, C-SSP scores, and demographic characteristics using logistic regression analysis, a higher K-SSP score corresponded to a 1.17 times higher likelihood of adhering to SSP (adjusted odds ratio=1.17; 95% confidence interval=1.06-1.31). No significant differences were observed in adherence to SSP according to C-SSP score, marital status, experience raising a child or children, work experience, education level, and SUID education experience.

## DISCUSSION

In order to reduce SUID, SSP and a safe sleep environment are critically important at any location where infant care is provided. This study was conducted to examine the experience, knowledge, and confidence regarding SSP related to SUID of personnel at daycare centers in Korea, and 5 major findings were observed as a result of this survey.

First, a high proportion (23.6%) of the respondents reported that they placed infants in a lateral or prone position when sleeping. While this proportion is lower than that of the US (37.9%-49.1%) [24] and Australia (44%) [22], the lateral or prone position for infant sleep, including during daytime naps, may increase the chance of suffocation due to rebreathing high concentrations of CO<sub>2</sub> gas and restricting body movements including movement of the face and neck [25]. Public health authorities such as the AAP and National Institute for Children's Health Quality recommend the supine position only as an SSP to reduce SUID. The survey participants replied, however, that the main reasons they used these unsafe sleep positions were to improve infants' sleep (82.2%), prevent regurgitation (13.3%), and prevent SUID (5.6%). These responses indicate a lack of knowledge about safe sleep positions, sleep mechanisms, and SUID among daycare personnel. In Western societies including Australia, the UK, and the US, the supine position has been extensively promoted to the public in "back-to-sleep" campaigns to reduce accidental suffocation and SUID since the early 1990s. Legal regulations regarding SSP at daycare centers have also been established, although the issue of compliance is still under debate [26,27]. Our findings related to the use of unsafe sleep positions at daycare centers suggests a need for public and professional promotion of infant SSP and systemic education and regulation on SSP at daycare centers.

Second, according to the participants in this study, an average of 4.5 bedding materials was used for infant sleep at daycares. Excessive or soft bedding materials used in the sleeping areas of infants are known to increase the risk of SUID [1,28], and, for this reason, the AAP warns against placing pillows,

**Table 4.** Knowledge and Confidence Regarding Safe Sleep Practices Related to Sudden Unexplained Infant Death by Demographic Characteristics

Variables	Categories	K-SSP (n=395)		C-SSP (n=387)	
		M±SD	t (p)	M±SD	t (p)
Experience raising a child or children	No	10.1±2.2	-0.69 (.489)	3.1±0.8	-3.75 (<.001)
	Yes	10.3±2.5		3.4±0.8	
Work experience (year)	<7	10.2±2.3	-0.28 (.779)	3.2±0.8	-2.56 (.011)
	≥7	10.2±2.5		3.4±0.8	
Education level	High school	9.8±2.6	-1.37 (.717)	3.4±0.8	0.53 (.602)
	Associate's degree or higher	10.3±2.3		3.3±0.8	
Received education on SUID	No	9.4±2.3	-3.57 (<.001)	3.1±0.8	-3.44 (.001)
	Yes	10.4±2.3		3.4±0.8	
Received education on infant CPR	No	9.7±2.2	-0.77 (.443)	3.3±0.8	0.16 (.870)
	Yes	10.2±2.4		3.2±0.8	

Missing data were not included; CPR, cardiopulmonary resuscitation; C-SSP, confidence regarding safe sleep practices related to sudden unexplained infant death; K-SSP, knowledge of safe sleep practices related to sudden unexplained infant death; M, mean; SD, standard deviation; SUID, sudden unexplained infant death.

**Table 5.** Comparison of Adherence to Safe Sleep Practices, Knowledge and Confidence Regarding Safe Sleep Practices, and the Demographic Characteristics of Daycare Personnel

Variables	Categories	Number	SSP performance		$\chi^2$ or t (p)	aOR (95% CI)
			Regular group (n=102, 27.8%)	Advanced group (n=265, 72.2%)		
			n (%) or M±SD	n (%) or M±SD		
K-SSP		367	9.6±2.1	10.4±2.5	2.74 (.007)	1.17 (1.06-1.31)
C-SSP		365	3.2±0.9	3.3±0.8	1.19 (.235)	1.04 (0.77-1.40)
Marital status	Single*	160	59 (36.9)	101 (63.1)	11.09 (.001)	2.78 (0.90-8.59)
	Married	204	43 (21.1)	161 (78.9)		
Experience raising a child or children	No*	165	59 (35.8)	106 (64.2)	8.95 (.003)	0.89 (0.30-2.69)
	Yes	179	38 (21.2)	141 (78.8)		
Work experience	< 7 years*	196	57 (29.1)	139 (70.9)	0.35 (.555)	0.67 (0.39-1.14)
	≥ 7 years	171	45 (26.3)	126 (73.7)		
Education level	High school*	52	9 (17.3)	43 (82.7)	3.48 (.062)	0.71 (0.32-1.59)
	Associate's degree or higher	308	92 (29.9)	216 (70.1)		
Received education on SUID	No*	86	29 (33.7)	57 (66.3)	1.92 (.166)	1.02 (0.58-1.80)
	Yes	280	73 (26.1)	207 (73.9)		

\*Reference group; Missing data were not included; aOR, adjusted odds ratio; CI, confidence interval; C-SSP, confidence regarding safe sleep practices related to sudden unexplained infant death; K-SSP, knowledge of safe sleep practices related to sudden unexplained infant death; M, mean; SD, standard deviation; SSP, safe sleep practices related to sudden unexplained infant death; SUID, sudden unexplained infant death.

cushions, stuffed animals, and other soft items in infants' sleeping areas [3]. Since almost all sleep takes place on the floor, a bedsheet for the floor and a comforter used during infant naps may be most appropriate for Korean daycare centers. However, extra toys, adult pillows, and diapers near beds were also cited as popular materials, all of which should be removed from infants' bedding areas. The use of infant pillows is in need of further investigation. Infant pillows are not common in Western cultures, and it is considered an SSP to avoid the use of any pillow to prevent suffocation or SIDS [29]. However, the use of pillows is very popular in childrearing in Korea for children of all ages, including infants [30], despite a lack of thorough studies on this practice. In addition, given that 97.2% of daycare personnel responded that they used individual bedding materials for each infant brought from home, it is possible that parents may tend to use unsafe sleep practices involving unnecessary additional bedding materials at home. Further efforts should be taken to emphasize the risks related to excessive bedding materials such as pillows, toys, cushions, or diapers and educate parents and daycare personnel on SSP regardless of the sleep location.

Third, daycare personnel showed a lack of knowledge about SSP related to SUID as indicated by the correct answer rates of 56.5% for kn-SSP and 56.7% for kn-ICPR. In our previous study of 136 pediatric nurses, a slightly higher correct answer rate was reported at 62.6% for kn-SSP and 62.5% for kn-ICPR [21]. The knowledge level about K-SSP among both groups of

professionals is quite low. One possible explanation for this is an overall lack of systemic educational programs and promotion regarding SSP related to SUID for childcare professionals and parents in Korea. Even though education programs and promotional efforts have been undertaken to some extent, established guidelines related to SSP and SUID reduction strategies have not been implemented in Korea. Given that sleep is largely a culturally determined phenomenon, SSP standards based on the culture of childcare in Korea should be devised, and education should be provided for childcare professionals in various settings and for parents at home.

These findings are supported by the fact that daycare personnel who received SUID education were more knowledgeable about SSP and infant cardiopulmonary resuscitation and more confident with SSP than those who did not receive such education. More knowledge about SSP and infant cardiopulmonary resuscitation and higher confidence regarding SSP were also associated with better adherence to SSP. Experience raising a child or children and the amount of work experience did not affect knowledge about SSP, but they did increase confidence with SSP. A likely positive effect was also observed related to marital status and experience raising a child or children on better adherence to SSP. However, only previous SUID education positively influenced knowledge and confidence related to SSP, and only higher knowledge was related to better adherence to SSP. These findings are consistent with those of a US study on 1,212 teachers at daycare centers



and home daycare settings in which a higher degree of knowledge of safe sleep positions was observed among those who received SUID-related education (80.5%) compared to those who did not (64.8%) [24]. This clearly reflects the intertwined nature of education and knowledge about SSP and adherence to SSP related to SUID.

The final major finding of the study is the limited amount of health data collected for each infant at daycare centers. While almost every center (99.2%) collected health information at the time of infant registration, the contents of the health information collected varied among daycare centers. While vaccination history, health history, and information on nutrition and growth were relatively commonly collected, the daily sleep practices of infants were not collected according to more than half of the daycare personnel, which includes data on sleep position and bedding materials. This is a remarkable finding, given that 99.2% of personnel said that parents brought bedding materials for their infants from home. Infant vulnerability is known to be a crucial factor responsible for sleep-related SUID [1-3]. Therefore, it is very important for daycare personnel to acknowledge the value of data on infants' health information and sleep rituals at home to promote SSP at daycare centers.

Despite these five significant findings, this study has two notable limitations: volunteer bias due to the self-reported survey design and the possible lack of validity resulting from the absence of standardized tools. A more systematic survey design conducted at the national level using a concrete and standardized measurement scale that guarantees the anonymity of the respondents would increase the integrity of our findings on SSP related to SUID.

## CONCLUSION

A survey was conducted to explore the experience, knowledge, and confidence regarding SSP related to SUID of daycare personnel in Korea, and five major findings were observed from the survey.

These findings include the substantial degree of unsafe sleep positions used in daycares, including the use of non-supine sleeping positions; the excessive use of bedding materials near infants' sleeping areas; a lack of knowledge on SSP; and the positive relationship between education on SSP, knowledge on SSP, and SSP adherence related to SUID among daycare personnel of Korea. These findings suggest a need for structured guidelines on SSP and SUID reduction strategies that could be developed and promoted for professionals at childcare facilities, such as hospitals or daycare centers, as well as for parents at home.

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## Authors' contribution

Conceptualization: all authors; Data collection: all authors; Formal analysis: all authors; Writing-original draft, Writing-review and editing: all authors; Final approval of published version: all authors.

## Conflict of interest

Young Mee Ahn has been the editor of *Child Health Nursing Research* since 2013. She was not involved in the review process of this article. Otherwise, no existing or potential conflict of interest relevant to this article was reported.

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## Data availability

Please contact the corresponding author for data availability.

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