Distraction by smartphone use during clinical practice and opinions about smartphone restriction policies: A cross-sectional descriptive study of nursing students☆

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ABSTRACT

Background: Smartphone use in healthcare settings may distract healthcare providers and disrupt patient care. Moreover, it may lead to adverse events, thereby threatening patient safety.
Objectives: This study assessed nursing students' smartphone use as a source of distraction in clinical practice and identified their opinions about policies restricting smartphone use during patient care.
Design: A cross-sectional descriptive design was used with convenience sampling.
Participants: Third-year nursing students ($n = 312$) from two nursing schools in the Republic of Korea completed the survey in 2012.
Methods: A self-report questionnaire—based on addiction theories for problem behaviors and literature on the distraction caused by cellular phone use—was used to assess smartphone use, experiences of distraction caused by smartphone use, and opinions about restriction policies on smartphone use during clinical practice.
Results: Nearly half (46.2%) of the nursing students used smartphones at least sometimes during clinical practice and about a quarter of the respondents (24.7%) were at least sometimes distracted by smartphones during clinical practice. The majority of the respondents (83.7%) had witnessed nurses using smartphones at least sometimes during their work. A few respondents (15.7%) agreed or strongly agreed with the policy for restricting smartphone use in hospitals. Students who used smartphones more often tended to disagree with restriction policies for smartphone use in hospitals.
Conclusion: Awareness about the risks of smartphone use, especially regarding patient safety, is necessary for nursing students in school and hospital settings. Educators and faculty of nursing schools need to develop policies that encourage intelligent and safe use of smartphones during clinical practice.

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1. Introduction

Smartphones are increasingly becoming a daily necessity, providing users access to the Internet, banking services, and entertainment through various applications. Their most important features are accessibility, usefulness, multitasking, and portability. Thus, they have numerous potential benefits for health care providers (Dennison et al., 2013).

For clinicians, smartphones provide access to the Internet for drug references and professional guidelines, and can be used as bedside medical calculators. Communication between clinicians could be improved by sharing a variety of images, including x-rays, ultrasounds, Computed Tomography/Magnetic Resonance Imaging scans, and photos showing patients' wounds or conditions through instant messaging. Additionally, bedside education for patients could be facilitated by images or videos that can be accessed from a smartphone application (Baumgart, 2011). Robinson et al. (2013) reported that a majority of medical students (84%) held positive attitudes towards smartphones as future educational aids.

Nonetheless, research also suggests that smartphones could be a significant source of distraction during cognitive tasks (David et al., 2014; Fazeen et al., 2012), resulting in longer reaction time, reduced focus, and lowered behavioral performance (Porter, 2010). In particular, smartphone use in healthcare settings may distract healthcare providers from providing patient care, potentially leading to adverse events that threaten patient safety (Katz-Sidlow et al., 2012). Katz-Sidlow et al. (2012) found that 19% of medical residents and 12% of attending physicians reported that they had missed important clinical information because they were distracted by smartphones. Rising concerns regarding the adverse effects of smartphone use during clinical practice suggest the necessity of policies regarding smartphone use during patient care and of educating care providers about the potential risks of the resulting distraction.

Globally, previous studies have mainly focused on the benefits of smartphones use in education and training of healthcare professionals and the public (Dennison et al., 2013; Gill et al., 2012; Katz-Sidlow et al., 2012; Phillippi and Wyatt, 2011). There is a lack of research on attitudes towards and perceptions of smartphone use during clinical practice and on restriction policies for health care professionals (McBride, 2015).

Since nursing students will be nursing professionals in the future, their overuse and abuse of smartphones during school years may be indicative of the increased threat to patient safety when performing their roles as nurses. Therefore, the purposes of the study were to shed light on smartphone use among nursing students during clinical practicum, and their opinion about smartphone restriction policies in South Korea. The specific aims were to 1) determine the daily time spent on smartphone usage and the nature of activities smartphones are used for by nursing students; 2) determine the frequency of smartphone use and distraction caused by the same, and explore students' opinions on the policies that restrict smartphone use in clinical settings; 3) examine how distraction and witnessing of distraction caused by smartphone use are related to opinions on smartphone restriction policies; and 4) identify differences in the witnessing of nurses' distraction and opinions on restriction policies by location of nursing schools. By doing this, strategies to prevent adverse events resulting from smartphone use could be developed.

1.1. Distraction by Smartphones in Clinical Practice

Even though smartphones have several advantages, they may be considered a source of distraction and a safety risk in hospitals (Gill et al., 2012; McBride, 2012). The distraction caused by smartphones in the hospital is defined as "the experience of discontinuity or interruption of the clinician's primary task by an internally or externally initiated use of their smartphone or cellular device" (McBride, 2015, p. 8).

With an increase in the number of healthcare providers using smartphones, social media networking during work hours is observed more frequently (Papadakos, 2013). On observing the dangers of distractions, healthcare organizations have begun establishing policies that limit the use of smartphones during work hours to prevent adverse events resulting from neglect and distraction. The Emergency Care Research Institute, an independent nonprofit organization that investigates the best approaches for improving patient care identified "caregiver distractions from smartphones and other mobile devices" as the ninth highest on the list of "top ten health technology hazards for 2013," which is intended to encourage the safe use of health technology (Emergency Care Research Institute, 2012a). It also proposes comprehensive policies regarding smartphone use in hospitals and offers practical advice on developing safe smartphone policies in healthcare facilities (Emergency Care Research Institute, 2012b). The American Association of Nurse Anesthetists (2013) has addressed the issue of electronic distraction and has provided recommendations on use of such devices during patient care.

The number of registered smartphones in South Korea was 41,259,053 in March 2015, and over 80% among health care providers across ages are estimated to own a smartphone (Ministry of Science, ICT and Future Planning in South Korea, 2015). With the increase in smartphone use among healthcare providers, the likelihood of distraction increases.

However, smartphone use among healthcare providers has not been researched in South Korea. Further, clinicians' association guidelines for smartphone use in healthcare settings have not been developed even though South Korea ranks the highest in smartphone use worldwide.

2. Methods

2.1. Design

This study used a cross-sectional descriptive design to investigate nursing students' smartphone use during clinical practicum, and opinions regarding smartphone restriction policies in clinical settings.

2.2. Participants

Participants were third-year nursing students from two nursing schools located in a metropolis and small city in South Korea, with over six months of clinical practicum experience in hospital settings. The G*Power 3.0 program (Faul et al., 2007) was used to calculate the sample size. A total of 302 participants were required to detect an effect size of .04, with a power $(1 - \beta)$ of .85 and a two-tailed alpha of .05 (Cohen, 1988; Faul et al., 2007), considering an allocation ratio of 1:3 for the sample size for each group for the independent t test.

2.3. Survey Instrument: Scale on Attitude Towards Smartphone Use in Clinical Practicum

A structured questionnaire was developed in this study to assess nursing students' smartphone use and the distraction caused by the same during clinical practicum, and to examine their opinion on policies restricting smartphone use in healthcare settings. Items related to smartphone use and the resultant distraction were developed based on addiction theories about problem behaviors (Oulasvirta et al., 2012; Rush, 2011) and literature on distractions caused by cellular phones (Bianchi and Phillips, 2005; Smith et al., 2011). In order to assess nursing students' opinions about smartphone restriction, items were developed by reviewing the literature on smartphone use policies in healthcare settings (Gill et al., 2012).

The tool comprised 13 items examining smartphone use and resultant distractions in nursing students (5 items) and nurses (2 items), and smartphone restriction policy development (4 items). Two items were added to measure the daily time spent on a smartphone and to identify the main reasons for the use of a smartphone by nursing students. To demonstrate construct validity, the pattern of relationships was examined and an exploratory factor analysis with principal axis factoring followed by varimax rotation was performed. The overall sampling adequacy of the 11-item scale was assessed using the Kaiser–Meyer–Olkin test. Results showed an acceptable value of .726. The p value of the Bartlett test was less than .001, indicating that the factor analysis was appropriate. Three factors were extracted by selecting factors with an eigenvalue greater than 1. The item factor loadings after an exploratory factor analysis have been presented in Table 1. Although the factor loading for Question 5 was higher for the opinion regarding smartphone restriction policies as compared to that for smartphone use and distraction, this item was deemed to belong to the factor of smartphone use and distraction after discussion with experts because it assess smartphone distraction observed in others.

To assess the fit of the total 11-item scale, a confirmatory factor analysis was conducted. The goodness-of-fit index (GFI) of the model was 0.814 and adjusted GFI (AGFI) was .701. Factor loadings ranged from 0.398 to 0.833. The correlation coefficients across the latent variables ranged from 0.31 to 0.56, and the model was acceptable (Hu and Bentler, 1999).

Table 1
Exploratory factor analysis of the instrument.

Items	Perception of smartphone restriction policies	Smartphone use and distraction	Witness on nurses' using and distraction
Q1		.733	
Q2		.673	
Q3		.623	
Q4		.778	
Q5	.626	.425	
Q6			.790
Q7			.746
Q8	.761		
Q9	.634		.
Q10	.866		
Q11	.666		

The survey was pretested on 10 nursing students for acceptability and comprehensiveness. Among the 5 items measuring smartphone use and distraction caused during clinical practicum, 2 assessed smartphone use for oneself and that observed in other students. The remaining 3 items measured distraction experiences: the frequency of distraction by self-initiated (1 item) and externally initiated smartphone use (1 item), and the frequency of witnessing other nursing students (1 item) being distracted by smartphones during clinical practice. These items were scored on a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = usually, and 5 = always). Additionally, respondents were asked about witnessing nurses' smartphone use and distraction during work. Two items explored the frequency of witnessing nurses' smartphone use and resultant distraction.

Four items were developed to assess whether students believed that restrictions on smartphone use during clinical practice were needed for both nursing students and nurses and whether they wanted nursing students/nurses to stop using smartphones during clinical practice. Responses were scored on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral/uncertain, 4 = agree, and 5 = strongly agree). Lower scores indicate that the students did not agree with policies that restricted smartphone use in healthcare settings.

2.4. Data Collection

Approval for this study was obtained from the Institutional Research Ethics Review Board prior to data collection (No. 2012-07-016). Convenience sampling was adopted to identify hospitals in a metropolis and rural city, to explore the differences caused by the location of the hospital. Study participants were nursing students who had at least 6 months experience in clinical practicum, from two nursing colleges located in two different cities in South Korea. After obtaining permission to conduct the study from the nursing schools' directors, the researcher visited each school and explained the study's purpose and procedures to student representatives arranged by the directors of each school. Subsequently, the student representatives communicated the study purposes to the nursing students and explained that participation in the study was voluntary. Nursing students were informed that they could decline participation at any time without negative consequences.

The cover letter of the questionnaire explained the same, as well as the study purposes and instructions. The student representatives distributed the questionnaires and collected them back within a week to avoid any authoritative pressure in participating in the study. The researcher directly visited each school and retrieved questionnaires from the student representatives. A total of 500 questionnaires were distributed (small city: 400 questionnaires, metropolis: 100 questionnaires), out of which 312 questionnaires were returned (response rate = 62.4%) and analyzed.

2.5. Data Analysis

Analysis was performed using SPSS 20.0 (IBM, Armonk, NY) and AMOS 18.0 (IBM) for Windows. To demonstrate the construct validity of the tool developed in the study, an exploratory factor analysis and confirmatory factor analysis was performed. General characteristics of nursing students were summarized using frequencies and total percentages. The frequency of smartphone use and resultant distraction, and opinions about smartphone restriction policies were analyzed using the total percentages and frequency. The relationship between opinion on restriction policies and the frequency of distractions witnessed were analyzed using Pearson's correlation analysis. An independent t test was used to compare actually witnessing nurses' distractions and opinions about restriction policies by school location.

3. Results

A total of 312 completed questionnaires were returned. Of the sample, 89.1% were female and 10.9% were male. The mean age was 21.7 (±2.59) years (Table 2). Further, 74.4% respondents were from the nursing college in a small city and 25.6% were from a nursing college in the metropolis.

Overall, 27.2% of the respondents reported that they spent over five hours using a smartphone daily, while more than half (55.7%) reported spending as least three hours doing the same. Further, 53.5% respondents reported that they used their smartphones most often for social networking, while 22.1% used them primarily for internet searches.

3.1. Smartphone Use During Clinical Practice

When asked about smartphone use during clinical practicum, 46.2% respondents reported that they used a smartphone at least sometimes, while 63.2% respondents had witnessed other students using smartphones during clinical practicum at least sometimes (Table 3).

3.2. Distraction by Smartphone

Regarding distractions from smartphone use, 27.9% respondents reported that they had been distracted, at least sometimes, by externally initiated smartphone use, and 24.7% respondents were at least sometimes distracted by their own smartphone use during clinical practice. On the other hand, 42.9% respondents had always, often, or sometimes witnessed other students being distracted by smartphones (Table 3).

3.3. Witnessing Nurses' Smartphone Use and Resultant Distraction

A majority of the respondents (83.7%) reported that they had witnessed nurses using smartphones during work at least sometimes (always, usually, or sometimes), while over half of the respondents (52.3%) answered that they had always, often, or sometimes witnessed nurses being distracted by smartphone use during their work (Table 3).

3.4. Opinion About Smartphone Restriction Policies

Respondents' were asked for their opinions about policies restricting smartphone use during clinical practice. Although 46.4% respondents agreed or strongly agreed that they did not want students to use smartphones during clinical practice, only 29.2% respondents agreed

Table 2
Participants' sociodemographic characteristics (N = 312).

Sociodemographic characteristics		n (%)
Age (years)	20–25	288 (92.3)
	26–30	16 (5.1)
	31–35	8 (2.6)
	Mean (SD)	21.7 (2.59)
Sex	Male	34 (10.9)
	Female	278 (89.1)
Location of nursing college	Small city	232 (74.4)
	Metropolis	80 (25.6)
Daily time spent using a smartphone	<1 h	19 (6.1)
	1–3 h	119 (38.1)
	3–5 h	89 (28.5)
	>5 h	85 (27.2)
Most common smartphone activity	Social networking	167 (53.5)
	Internet searches	69 (22.1)
	Texting	27 (8.7)
	Phone calls	21 (6.7)
	Listening to music and watching movies	13 (4.2)
	Playing games	6 (1.9)
	Others	9 (2.9)

Table 3
Frequency of smartphone use and resultant distraction, and opinions about policies (N = 312).

Items		Frequency N (%)					M	(SD)
		Never	Rarely	Sometimes	Usually	Always		
Smartphone use and distraction								
Q1	Have you used a smartphone during clinical practicum?	98 (31.4)	70 (22.4)	63 (20.2)	78 (25.0)	3 (1.0)	2.41	(1.19)
Q2	Have you witnessed another student using a smartphone during clinical practicum?	46 (14.7)	69 (22.1)	63 (20.2)	113 (36.2)	21 (6.8)	2.98	(1.20)
Q3	Have you been distracted by another student's use of a smartphone during clinical practicum?	105 (33.7)	120 (38.4)	54 (17.3)	27 (8.7)	6 (1.9)	2.06	(1.01)
Q4	Have you been distracted by own use of a smartphone during clinical practicum?	123 (39.4)	112 (35.9)	45 (14.4)	28 (9.0)	4 (1.3)	1.96	(1.00)
Q5	Have you witnessed another student being distracted by smartphone use during clinical practicum?	66 (21.2)	112 (35.9)	68 (21.8)	50 (16.0)	16 (5.1)	2.48	(1.14)
Witnessing nurses' smartphone using and distraction								
Q6	Have you witnessed another nurse using a smartphone during work?	12 (3.8)	39 (12.5)	61 (19.5)	139 (44.6)	61 (19.6)	3.63	(1.05)
Q7	Have you witnessed nurses being distracted by smartphone use during work?	46 (14.7)	103 (33.0)	81 (26.0)	64 (20.5)	18 (5.8)	2.69	(1.12)
Items		Strongly disagree	Disagree	Neutral/Uncertain	Agree	Strongly agree	M	(SD)
Opinion about smartphone restriction policies								
Q8	I do not want other students to use smartphones during clinical practicum.	29 (9.3)	58 (18.7)	80 (25.6)	99 (31.7)	46 (14.7)	3.24	(1.18)
Q9	I do not want nurses to use smartphones while working.	17 (5.4)	77 (24.7)	120 (38.5)	77 (24.7)	21 (6.7)	3.02	(0.99)
Q10	A policy to restrict nursing students' smartphone use during clinical practicum is needed.	35 (11.2)	88 (28.2)	98 (31.4)	59 (18.9)	32 (10.3)	2.88	(1.14)
Q11	A policy to restrict nurses' smartphone use during work is needed.	47 (15.1)	105 (33.6)	111 (35.6)	33 (10.6)	16 (5.1)	2.57	(1.03)

or strongly agreed that a policy restricting nursing students' smartphone use during clinical practicum is needed. While 31.4% respondents agreed or strongly agreed that they did not want nurses to use smartphones at work, 15.7% respondents agreed or strongly agreed that a policy restricting nurses' smartphone using in healthcare settings is needed (Table 3).

3.5. Relationship Between Distraction Experiences and Opinion on Smartphone Restriction Policies

Respondents' opinion about policies was significantly related to the frequency of witnessing other students and nurses being distracted ($r = .511$, $p < .0001$) but not to their own experiences of distraction ($r = .109$, $p = 0.054$). A negative correlation was observed between the frequency of smartphone use and opinions about policies ($r = -.245$, $p < .0001$), as shown in Table 4.

3.6. Differences in Witnessing Nurses' Distraction and the Opinions on Smartphone Restriction Policies in Terms of School Location

The mean score of students witnessing nurses' distractions was 2.87 in the small city and 2.18 in the metropolis (a value closer to 5 implies more frequently). Regarding restriction policies for nurses, a lower mean score—2.64—was found for respondents from the nursing college in the metropolis, compared to 3.03 for respondents in the small city (a value closer to 5 implies greater agreement).

Considering these large differences, a variance analysis was conducted. Frequency of witnessing nurses' distractions by smartphones ($t = 4.84$, $p < .001$) and opinions about policies restricting nurses'

smartphone use ($t = 3.50$, $p = .001$) both significantly differed by school location (Table 5).

4. Discussion

Younger generations in developed countries find it difficult to imagine their lives without smartphones and other personal communication devices, especially because these devices constantly provide more functions and utilities (Wittmann-Price et al., 2012). However, the impact of smartphone use on nursing students—future nursing professionals—has not been sufficiently explored. A few studies have assessed nursing students' smartphone use during clinical practicum; however, they focused on its positive effects (Baumgart, 2011; Doswell et al., 2013; Mather et al., 2014; Phillippi and Wyatt, 2011; Wittmann-Price et al., 2012). The present study attempted not only to assess nursing students' smartphone use and distraction levels during clinical practice but also to examine their opinions regarding policies restricting the use of smartphones in healthcare settings.

In this study, 27.2% of the nursing students reported that they used a smartphone for more than 5 h daily. This finding suggests that they were at a high risk of developing smartphone addiction, according to existing evidence that individuals using smartphones for more than 300 min daily are at high risk of addiction (National Information Society Agency, 2014). Similarly, Aggarwal et al. (2012) reported that 24% of resident doctors considered themselves to be addicted to mobile phones and nearly 40% of resident doctors fulfilled the ICD-10 criteria for substance dependency. These results indicate a high risk of smartphone addiction among health care professionals, leading to potential distraction that could be detrimental to patient safety.

Table 4
Correlations between instances of distraction and opinions about policies.

	Opinions about policies restricting smartphone use
Distracted by own/another student's smartphone use (Q 3 and 4)	0.109
Witnessing another student and/or nurse being distracted by smartphone use (Q 5 and 7)	0.511[**]
Frequency of smartphone use during clinical practice (Q 1)	−0.245[**]

[**] $p < .0001$.

Table 5
Witnessing nurses' distraction caused by smartphone use, and opinions on smartphone restriction policies according to school location.

Location of nursing college	Witnessing distraction in nurses[a]		Smartphone restriction policy[b]	
	Mean (SD)	t (p)	Mean (SD)	t (p)
Small city	2.87 (1.08)	4.45 (<.001)	3.03 (0.83)	3.270 (.001)
Metropolis	2.23 (1.13)		2.66 (0.92)	

[a] The higher the value, the greater the frequency.
[b] The higher value, the greater the agreement.

The most common smartphone activity among the nursing students surveyed was social networking. A few studies on the impact of social networking have suggested that participation on social network sites (SNS) could improve adolescents' life satisfaction since it provides emotional reassurance by enhancing interactions with others (Park and Cho, 2015; Przybylski et al., 2013). Further, smartphone use during work provides nurses with opportunities to express their emotional distress to friends and family, thereby alleviating work-related fatigue and providing connections with others (Lin et al., 2013; McBride et al., 2015).

However, nurses' SNS use could result in unintended negative effects on the quality and safety of patient care due to distractions and interruptions (Piscotty et al., 2013). SNS addiction is considered a serious source of distraction among university students, and social networking was found to be the main reason for its aggravation (Park and Hwang, 2014; Salehan and Negahban, 2013).

Thus, nursing students should be aware of the potential risk of distraction by smartphones, which could threaten the safety of patients. In addition, SNS use could result in the ethical breach of patients' privacy and confidentiality. Consequently, the American Nurses Association, among others, have developed guidelines on ethical SNS use to spread awareness among nurses regarding the risks of social networking and to encourage professionalism (McCartney, 2012; National Council of State Boards of Nursing, 2011; Odom-Forren, 2012; Prinz, 2011; Ross, 2012; Salehan and Negahban, 2013).

In the present study, 83.7% of the nursing students had witnessed nurses' smartphones use during work, at least sometimes. This is consistent with McBride et al.'s (2015) study, wherein 78.1% of the registered nurses reported that they used their personal mobile phone during work, while only 6.4% reported never having done so. A number of nurses regularly sent personal emails and text messages (38.6%), read the news (25.7%), checked or posted on SNS (20.8%), shopped (9.6%), and played games (6.5%) while working; these findings indicate that smartphone use during clinical practice is common (McBride et al., 2015). Similarly, in the present study, more than half of the nursing students (52.3%) reported that they regularly (sometimes, often, and always) witnessed nurses' being distracted by smartphones during work.

Regarding distraction experiences, 27.9% and 24.7% of the nursing students reported that they had been distracted by externally and internally initiated smartphone use, respectively. However, 42.9% of the respondents reported that they had witnessed other students' distraction by smartphone use. It is apparent that nursing students tend to recognize others' distraction more than their own. These results were consistent with Smith et al. (2011) study, wherein 92.7% of the healthcare providers reported that they were not distracted by cellphones during cardiopulmonary bypass procedures, while 34.5% of health care providers reported that they witnessed other health care providers' distraction by cell phones during a procedure. This discrepancy could be attributed to individuals' lack of awareness about their own overuse, which may explain why they believed that they were not distracted (Smith et al., 2011).

Regarding the correlations between distraction experiences and opinions about restriction policies, nursing students who more readily noticed others' distractions by smartphones were more likely to regard policies that restrict smartphone use in clinical settings as necessary. However, for respondents' who recognized their own distraction experiences, this relationship was not significant. This could be explained by a self-serving bias, wherein students may have believed that they would not make errors in patient care due to smartphone use. Additionally, students who used smartphones more often during clinical practice were significantly less likely to regard policies restricting smartphone use in clinical settings as necessary. These results may indirectly suggest a high risk of addiction since respondents' dependency on smartphones implies that their use provides a feeling of satisfaction and that restriction policies would lower this satisfaction.

Nursing students residing in the small city were more likely than those residing in the metropolis to regard such policies necessary, perhaps because the former witnessed nurses being distracted by smartphones more frequently. This could be attributed to the type and size of hospitals where students were placed for their clinical practicum. For this study, the hospital located in the metropolis was a larger, tertiary, university-affiliated hospital providing acute care, whereas the smaller-city hospital was a smaller, secondary hospital, with fewer acute care cases and more patients with chronic conditions. Previous research in South Korea reported that safety culture was lower in the smaller hospitals than in larger hospitals (Kim et al., 2007; Lee and Kim, 2011; Nam and Lim, 2013).

Lower safety culture may induce more use of smartphone by nurses during work. Additionally, the workload and need for expedience between the two hospitals would differ, so there may be more opportunities to use smartphones during work hours in the smaller hospital. This difference could have influenced the differing opinions about the need for restriction policies.

The significant contribution of this study is that it sheds light on the level of smartphone use and distraction experiences by nursing students in healthcare settings. Smartphone use and distractions were relatively high but nursing students did not perceive that they were distracted by smartphone use. Even though the nursing students in this study were typically advised not to use their smartphones during clinical work, the present results indicate that a large number did not heed this advice. This indicates the need for more efforts to prevent harmful smartphone use in healthcare settings.

This study also identified that the factor influencing opinions about such policies was not the respondents' own experiences of distraction, but the witnessing of distraction in others. Additionally, students who used smartphones more frequently during clinical practicum were more opposed to developing policies restricting smartphone use. This result indicates the likelihood of smartphone addiction among nursing students, because dependency is one of the most prominent symptoms of addiction, which is characterized by spending a great deal of time on the smartphone and using it more often and for longer than one intends.

This finding suggests that nursing educators and faculty need to educate nursing students about the impact of distraction by smartphones on patient safety and quality of care. Education programs addressing the risk of distraction by smartphone use need to be developed and imparted to students early in their nursing education. Additionally, healthcare organizations could use the present findings to establish policies for responsible and safe smartphone use during patient care.

Thus, the results of this study can be applied not only to nursing students but also to nurses in healthcare settings, and other healthcare professionals, to educate them about harmful effects of smartphone use. Additionally, early detection of smartphone addiction and early intervention for nursing students are essential because nursing students who are more addicted to smartphones are more likely to be distracted at work after they become nurses. Thus, ultimately, this study could be used to enhance patient safety by decreasing smartphone use in clinical practice and restricting the distraction caused by smartphones.

This study had several limitations. First, convenience sampling was employed and participants were recruited from two nursing schools located in two cities. This limits the generalizability of the results. Second, hospital and nursing students' characteristics and the number of students participating from the two schools were not homogenous; this may also limit the generalizability of the findings. Therefore, a study with more controls and a larger sample needs to be conducted.

References

Aggarwal, M., Grover, S., Basu, D., 2012. Mobile phone use by resident doctors: tendency to addiction-like behaviour. Ger. J. Psychol. 15 (2), 50–55.
American Association of Nurse Anesthetists, 2013. Mobile device use, position statement number 2.18.2013. Available at http://www.aana.com/resources2/professionalpractice/Documents/PPMPS2.18MobileDeviceUse.pdf Accessed 25 October 2013.
Baumgart, D.C., 2011. Smartphones in clinical practice, medical education, and research. Arch. Intern. Med. 171 (14), 1294–1296.

Bianchi, A., Phillips, J.G., 2005. Psychological predictors of problem mobile phone use. CyberPsychology Behav. 8 (1), 39–51. http://dx.doi.org/10.1089/cpb.2005.8.39.

Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences. Vol. 2. Lawrence Earlbaum Associates, Hillsdale, NJ.

David, P., Kim, J., Brickman, J.S., Ran, W., Curtis, C.M., 2014. Mobile phone distraction while studying. New Media Soc. 22, 1–19. http://dx.doi.org/10.1177/1461444814531692.

Dennison, L., Morrison, L., Conway, G., Yardley, L., 2013. Opportunities and challenges for smartphone applications in supporting health behavior change: qualitative study. J. Med. Internet Res. 15 (4), e86. http://dx.doi.org/10.2196/jmir.2583.

Doswell, W.M., Braxter, B., Dabbs, A.D., Nilsen, W., Klem, M.L., 2013. mHealth: technology for nursing practice, education, and research. J. Nurs. Educ. Pract. 3 (10), 99–109. http://dx.doi.org/10.5430/jnep.v3n10p99.

Emergency Care Research Institute, 2012a. Top 10 health technology hazards for 2013. Health Devices 41 (11), 342–365.

Emergency Care Research Institute, 2012b. Judgment call: smartphone use in hospitals requires smart policies. Health Devices 41 (10), 314–329.

Faul, F., Erdfelder, E., Lang, A.G., Buchner, A., 2007. G* Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav. Res. Methods 39 (2), 175–191.

Fazeen, M., Gozick, B., Dantu, R., Bhukhiya, M., González, M.C., 2012. Safe driving using mobile phones. IEEE Trans. Intell. Transp. Syst. 13 (3), 1462–1468. http://dx.doi.org/10.1109/TITS.2012.2187640.

Gill, P.S., Kamath, A., Gill, T.S., 2012. Distraction: an assessment of smartphone usage in health care work settings. Risk Manag. Healthc. Policy 5, 105–114.

Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. 6 (1), 1–55. http://dx.doi.org/10.1080/10705519909540118.

Katz-Sidlow, R.J., Ludwig, A., Miller, S., Sidlow, R., 2012. Smartphone use during inpatient attending rounds: prevalence, patterns and potential for distraction. J. Hosp. Med. 7 (8), 595–599. http://dx.doi.org/10.1002/jhm.1950.

Kim, J.E., Kang, M.A., An, K.E., Sung, Y.H., 2007. A survey of nurses' perception of patient safety related to hospital culture and reports of medical errors. J. Korean Clin. Nurs. Res. 13 (3), 169–179.

Lee, N.J., Kim, J.H., 2011. Perception of patient safety culture and safety care activity among nurses in small-medium sized general hospitals. J. Korean Acad. Nurs. Adm. 17 (4), 462–473.

Lin, S., Tsai, K., Chen, M., Koo, M., 2013. Association between fatigue and internet addiction in female hospital nurses. J. Adv. Nurs. 69 (2), 374–383. http://dx.doi.org/10.1111/j.1365-2648.2012.06016.x.

Mather, C., Cummings, E., Allen, P., 2014. Nurses' use of mobile devices to access information in health care environments in Australia: a survey of undergraduate students. JMIR mHealth uHealth 2 (4), e56. http://dx.doi.org/10.2196/mhealth.3467.

McBride, D.L., 2012. The distracted nurse. J. Pediatr. Nurs. 27 (3), 275–276. http://dx.doi.org/10.1016/j.pedn.2012.02.002.

McBride, D.L., 2015. Distraction of clinicians by smartphones in hospitals: a concept analysis. J. Adv. Nurs. 71 (9), 2020–2030. http://dx.doi.org/10.1111/jan.12674.

McBride, D.L., LeVasseur, S.A., Li, D., 2015. Non-work-related use of personal mobile phones by hospital registered nurses. JMIR mHealth uHealth. 3 (1), e3. http://dx.doi.org/10.2196/mhealth.4001.

McCartney, P.R., 2012. Social networking principles for nurses. MCN. Am. J. Matern. Child Nurs. 37. National information society agency, Seoul, South Korea, p. 131. http://dx.doi.org/10.1097/NMC.0b013e3182430380

Ministry of Science, ICT and Future Planning in South Korea, 2015a. The statistics of fixed line and mobile phone in South Korea. Available at http://www.msip.go.kr/web/msipContents/contents.do?mId=MTQ2 Accessed 30 May, 2015.

Nam, M.H., Lim, J.H., 2013. The influences of the awareness of patient safety culture on safety care activities among nurse in small medium sized general hospitals. J. Digit. Converg. 11 (1), 349–359.

National Council of State Boards of Nursing, 2011. White paper: A nurse's guide to the use of social media. J. Pract. Nurs. 61 (3), 3–9.

National information society agency, 2014. National InformatizationWhite Paper. National information society agency, Seoul, South Korea.

Odom-Forren, J., 2012. Responsible social networking. J. PeriAnesthesia Nurs. 27 (1), 61–63. http://dx.doi.org/10.1016/j.jopan.2011.12.002.

Oulasvirta, A., Rattenbury, T., Ma, L., Raita, E., 2012. Habits make smartphone use more pervasive. Pers. Ubiquit. Comput. 16 (1), 105–114.

Papadakos, P.J., 2013. The rise of electronic distraction in health care is addiction to devices contributing. J. Anesth. Clin. Res. 4 (3), e112. http://dx.doi.org/10.4172/2155-6148.1000e112.

Park, S.Y., Cho, S.H., 2015. Formation of social relationship through SNS and adolescents' life satisfaction. J. Digit. Converg. 13 (2), 371–379.

Park, S.B., Hwang, H.S., 2014. An exploratory study on factors influencing on smart phone addiction: focused on the application use of university students. Korean J. Journal. Commun. Stud. 58 (4), 289–311.

Phillippi, J.C., Wyatt, T.H., 2011. Smartphones in nursing education. Comput. Inform. Nurs. 29 (8), 449–454. http://dx.doi.org/10.1097/NCN.0b013e3181fc411f.

Piscotty, R., Voepel-Lewis, T., Lee, S.H., Annis-Emeott, A., Lee, E., Kalisch, B., 2013. To tweet or not to tweet? Nurses, social media, and patient care. Nurs. Manag. 44 (5), 52–53. http://dx.doi.org/10.1097/01.NUMA.0000429012.15882.d9.

Porter, G., 2010. Alleviating the "dark side" of smart phone use. Technology and Society (ISTAS), 2010 IEEE International Symposium on. IEEE, pp. 435–440 http://dx.doi.org/10.1109/ISTAS.2010.5514609.

Prinz, A., 2011. Professional social networking for nurses. Am. Nurse Today 6 (7), 30–32.

Przybylski, A.K., Murayama, K., DeHaan, C.R., Gladwell, V., 2013. Motivational, emotional, and behavioral correlates of fear of missing out. Comput. Hum. Behav. 29 (4), 1841–1848.

Robinson, T., Cronin, T., Ibrahim, H., Jinks, M., Molitor, T., Newman, J., Shapiro, J., 2013. Smartphone use and acceptability among clinical medical students: a questionnaire-based study. J. Med. Syst. 37 (3), 1–7.

Ross, J., 2012. Social networking: possible risks to nurses. J. PeriAnesthesia Nurs. 27 (3), 212–213.

Rush, S., 2011. Problematic se of mart hones in the orkplace: An ntroductory tudy. BArts (Honours) Thesis. Central Queensland University, Rockhampton Available: http://hdl.cqu.edu.au/10018/914191.

Salehan, M., Negahban, A., 2013. Social networking on smartphones: when mobile phones become addictive. Comput. Hum. Behav. 29 (6), 2632–2639http://dx.doi.org/10.1016/j.chb.2013.07.003.

Smith, T., Darling, E., Searles, B., 2011. Survey on cell phone use while performing cardiopulmonary bypass. Perfusion 26 (5), 375–380. http://dx.doi.org/10.1177/0267659111409969.

Wittmann-Price, R.A., Kennedy, L.D., Godwin, C., 2012. Use of personal phones by senior nursing students to access health care information during clinical education: staff nurses' and students' perceptions. J. Nurs. Educ. 51 (11), 642–646. http://dx.doi.org/10.3928/01484834-20120914-04.