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Smartphone as an intervention to intention-behavior of patient care

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ABSTRACT

Purpose: Smartphone intervention can be critical for healthcare professionals who often experience human life at risk. This study attempts to assist healthcare professionals to better understand the intervention role of smartphones in intention-behavior of patient care.

Research design/methodology: Exploratory in nature, this study uses various literatures and articles published in journals and magazines as well as primary data collected using a qualitative approach. Purposive sampling made it possible to conduct in-depth interviews with healthcare professionals, namely, doctors, nurses, and ward boys from hospitals and clinics of the Punjab region of India. The study uses a data saturation method to realize the adequacy of the sample size, and a grounded theory approach to analyze the interviews.

Findings: This study found a gap between intentions and behavior in patient care among healthcare professionals. A smartphone intervenes in the intention-behavior relationship of patient care in three modes, namely propinquity, applications, and communication. The smartphone propinquity pertains to the physical proximity of the healthcare professionals to the smartphone; the applications refer to those installed in the smartphone; and communication indicates calling and e-communications made using the smartphone.

Practical implications: This study will assist hospital management, governments, and other organizations in drafting a suitable policy for the use of smartphones by healthcare professionals. The manufacturers and software developers of smartphones can deliver devices and software that meet the needs of healthcare professionals for patient care. This study will help healthcare professionals to better understand the usage and effects of smartphones with respect to patients, and to decrease the gap between intention and behavior to improve patient care.

Originality: This study is unique in that there have been no comprehensive studies of smartphone intervention with respect to its influences on intention-behavior in patient care.

Introduction

A smartphone is not only a source of entertainment but also a disruptive device in various sectors such as healthcare, banking, and retailing. As the use of smartphones increases globally, their developers continue to produce a wide variety of applications for use by different sectors [22,42,43,46,47,68].

This study focuses on healthcare, which is one of the prominent sectors in technology adoption [50]. Healthcare professionals have been adopting smartphones in growing numbers at a very fast pace. Smartphones deliver various options for healthcare professionals to deliver better service. The U.S.-based market research firm Grand View Research [24] predicted that the global market for mobile health expects to reach $49 billion by 2020 with monitoring services remaining the dominant and fastest-growing segment. While Apple and Google healthcare technology providers already utilize mobile devices for a range of medical purposes, BlackBerry is also plunging into healthcare technology; it has invested in NantHealth, a healthcare information technology (IT) company, in order to expand the platform for a quick, easy, and secure diffusion of information anytime, anywhere. Healthcare professionals affirm that a smartphone helps them to collaborate with other doctors, provides easier access to patient data, and makes it convenient for them to record information and achieve greater productivity [18]. Greenspun et al. [25] conducted a survey of U.S. physicians and found that most doctors believed in the adoption of healthcare IT that helps in health information exchange and provides decision support tools, patient support tools, and mobile applications. It helps physicians to track and manage the health and wellness of patients, which, in turn, improves the efficiency of their clinical

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practices. Other features of smartphones for healthcare professionals include patient reminders, patient education, patient behavior modification, and decision support systems. Healthcare professionals have adopted smartphones and other personal digital assistants to enhance clinical activities, to achieve professional development, and to further their education. They are able to access their textbooks and many other resources such as drug formularies and medical calculators [8] on their smartphones. In the opinion of physicians, usage of the mobile Internet devices falls into two categories—communication and care. In communication, physicians are able to use many applications such as WhatsApp, Skype, MediTouch, and DICOM that help them in a number of ways, from maintaining patient records to communicating with other physicians and sharing information. Physicians are also able to use their smart devices as medical equipment with the help of applications such as: AliveECG, which is useful for converting a smartphone into a device for performing Heart Rate status; OsiriX, which is useful as a medical image viewer; iExaminer, which is used for examining patients' eyes and recording such examination for the maintenance of the patients' files, etc. [44]. There are numerous benefits that help in creating the intention to use the smartphone for the care of patients [42,50] and it is not necessary that an intention may lead to the same behavior [54,55,58]. We cannot ignore the fact that, despite such benefits, serious repercussions may occur due to the use of a smartphone during patient care. It's use is a source of distraction that may hamper decision making due to a dilution of concentration. Not only psychological consequences can occur but also the use of smartphones may increase the danger of contamination and can interfere in the functioning of medical equipment [7,11,13,23]. Therefore, the focus of smartphone applications for healthcare professionals should focus on health promotion, chronic disease management, improved physician-patient interaction, and efficient and quick access to healthcare services. These features would be beneficial for the patients and aid healthcare professionals in their work [35]. This research studies how a smartphone intervenes and affects the intention-behavior gap in patient care among healthcare professionals.

Research objective

The objective of this research is to understand the effects of the intervention of smartphones in the relationship of patient care intention to patient care behavior among healthcare professionals.

Conceptual background

An extensive review of literature, centered on the intervention of the smartphone in healthcare settings and the dimensions of its effect on the patient care intention and intention-behavior relationship provide the conceptual background of this study.

Intervention of smartphones in healthcare

Intervention is an act of intervening or interfering with the intention of modifying the outcome. In medicine, the definition of an intervention is any treatment, based upon clinical judgment and knowledge that a healthcare professional performs to enhance patient care outcomes [10]. The smartphones have affected the healthcare arena by intervening in the working of the healthcare professionals. Smartphones have been able to create smart doctors [41] and these smart doctors have adopted smartphones as a device for use in their medical practices. One of the greatest values of a smartphone is access to the Internet. The Internet offers many opportunities for healthcare professionals to share the research in their area for hard-to-reach members, and geographically dispersed people [64]. The sharing of information helps clinical nurse specialists to develop better communication and care systems for their patients, which, in turn, strengthens patient support [9,44]. It is very important to share timely information in order to reduce medical errors in critical care environments and having a smartphone helps to do so [60]. It also helps in undertaking quality improvement initiatives in the complex hospital environment. Assem and Pabbi [6] state that the sharing of knowledge makes an important contribution to providing high-quality health care to patients. Their study in Ghana found that there was no formal system for sharing knowledge in the hospitals, the majority of which sharing is through clinical meetings, presentations, and discussions through Internet-enabled mobile devices. But there is an absence of an organizational policy related to the use of Internet-enabled mobile devices. Most of the doctors own smartphones and they believe that it is one of the reliable sources for accessing points of care information. However, the major challenges to the use of smartphones for the purpose of communication are lack of connectivity, data subscription, and subscription fee [28].

Along with the benefit of communication, healthcare professionals these days are becoming dependent on many smartphone applications [57]. Smartphone applications are providing major help in most of the healthcare departments such as pediatrics, obstetrics, surgery, internal medicine, radiology, and dermatology. It helps the healthcare professionals with carrying out pain management, behavioral change, weight management, glucose control, and even treatment adherence [15–17,29,30,39,49,51] with the utilization of various applications. Healthcare professionals advocate the use of health-related applications for regular monitoring as well as for education, communication, and search of health information [45]. Smartphones improve the accuracy of patient documentation, lead to better diagnostic coding, and allow constant examination of side effects and safety through the reduction of medical errors [61]. Documentation prepared using a smartphone application was of higher quality and had lower error rates than documentation prepared using paper records. However, with the increasing use of smartphones, the issue of patient safety and confidentiality arises and the administration has to address it [18,61].

While smartphone usage in hospital settings enables doctors to share information immediately with other physicians and access and maintain patients' information anytime and anywhere to reduce errors, smartphones can also act as a distraction [7,23]. Using mobile phones can reduce focus, lower performance of tasks needing mental concentration, and affect decision making [67]. Using and keeping smartphones in critical care units may interfere with the functioning of medical equipment. If it distracts healthcare workers, it may lead to errors that may prove very expensive for the patients [23]. It can even spread infection [31]. For instance, Byrns et al. [11] have found that the mobile phones of staff members were highly contaminated with microorganisms and only a few staff members regularly cleaned their mobile phones. The staff members need proper guidelines to maintain the hygiene and cleanliness of their devices. It is suggested, therefore, to formulate a smartphone usage policy in order to keep the primary focus on providing patient care and maintaining a safe, hygienic, and secure work environment [2,13,32].

Intention of patient care and its dimensions

As discussed, the smartphone has both positive and negative interventions in the lives of healthcare professionals. According to the model proposed by the American Association of Critical Care Nurses (AACN, 2005), the level of patient care delivered by healthcare professionals such as nurses depends on competencies such as their clinical judgement, advocacy and morality, caring practices, collaboration, systems thinking, response to diversity, facilitation of learning, and clinical inquiry. These competencies may create their

intention to care for the patient and may lead to patient care behavior [58].

Hence, the creation of a complete systems thinking approach to patient care may lead to increased moral practices by students and staff in smartphone usage.

Intention-behavior gap

All the abovementioned competences are making it an intention of healthcare professionals to focus more on patient care, as is reflected in their behavior.

A person may not necessarily do whatever he or she intends to do [3],[55]. Many people intend to change or uphold a behavior but they are unable to pursue those intentions. Therefore, intentions cannot be an accurate forecaster of actual behavior [19,54]. Amireault et al. [5] found, when studying the moderators of the intention-behavior, that intention and past behavior were strong determinants of behavior and physical activity promotional programs act as a moderator to work on the creation of intention. There may or may not be any gap in the intention and the behavior of an individual. But if there is a difference between an intention and a behavior, it is not a random error; some intervening factor or force creates this gap [65]. A variance in intention of patient care and actual behavior due to self-efficacy, attitude, years of study at a hospital, receipt of resources from the hospital, habits, and barriers was found by applying the concept of the theory of planned behavior [34,52]. Hassan et al. [27] also mention that there is a huge gap between intention and behavior. They found a significant role of planning as a mediator and that it strengthens the behavior of an individual. Larsen et al. (2018) found why healthy eating intentions do not always turn into behavior and explained that automatic processes such as children's emotional eating habits and volitional regulation behavior work as moderators in the intention-behavior gap. Pappies [48] argued that intentions do not turn into behavior and that the elimination of this gap is achievable through the use of situational cues such as nudging, reminding of social norms, policy interventions, and training interventions during their impulsive behavior. Sheeran and Webb [55] emphasize the gap between intention and behavior and mention that intentions are strong constructs that uphold the organizational outcomes. Intentions can transform into behavior by initiating, maintaining, and attaining the pursuit of a goal.

Research methodology

Qualitative research is a means to better understand the underlying causes of gaps in healthcare systems. This approach helps to explore and discover factors in an enhanced manner [14]. As grounded theories draw from data, they are likely to provide deep insights, better understanding, and meaningful guides to action [56]. This study requires that one understands the prominent reasons for smartphone usage during patient care; therefore, it uses the qualitative methodology for data collection and analysis as it helps explore the factors and allows a better understanding of smartphone usage among healthcare professionals during patient care. In-depth interviews with doctors, nurses, and ward boys assist in understanding the phenomenon of smartphone intervention into patient care behavior. The base questions for the interviews reflect the basis of the objective of the study. The dimensions for questions use information from previous studies [1,7,12,23,65]. After transcription of the interviews, the data were coded. The coding process included developing codes and sub-codes. The researchers were aware of the risk of bias; hence, following Strauss and Corbin [56], this study used an extensive validation of various interpretations during the research process. The researchers made use of cross validation of their work by each other in the coding of all the scripts. Also, the researchers validated the codes with help of the respondents and experts using two doctors, two nurses, two ward boys, and two experts.

As argued by Urquhart and Fernández [59], grounded theory methodology has the advantage of relevance (built close to data), rigor (clear prescribed analysis procedures), and a clear path to build a theory. It is a flexible method and therefore more suitable for use in the field of socio-technical processes and in building theory in unexplored areas. The grounded theory approach [56] was used to analyze and build a theory based on the interview data. As a theory, it has been derived from data systematically gathered and analyzed through the research process. In grounded theory, the data collection, analysis, and theory so derived stand in close relation to each other. Strauss and Corbin [56] further argue that theory derived from data is more likely to resemble the "reality" than is theory derived by putting together a series of concepts based on experience or solely through speculation. Urquhart and Fernández [59] have also advocated the use of literature at the preliminary stage of research. The researchers for this project proceeded with open mindsets and no preconceived notions and, thus, have followed the above definition. The only area taken as a guiding force was the intention-behavior gap. The researchers began by interviewing healthcare professionals and analyzing the data of same. As new insights regarding smartphone usage during patient care emerged during the analysis, they were included in the study for the next steps. These insights included information on areas of smartphone use, ways of smartphone use during patient care, and possible new samples for data collection.

Researchers used a purposive sampling method in the study and conducted a total of 15 in-depth interviews. The sample included 7 doctors, 3 nurses, and 5 ward boys. The sample area focused on the hospitals and clinics of the Punjab region of India. The interviews lasted from 40 min to 1 h Depending upon the comfort of the respondent, the researchers recorded responses using an audio recorder as well as by manual writing during the interview. The data saturation method was used to realize the adequacy of the sample size [21]. This was realized when the analysis of data revealed that the patterns and concepts had become stable and were not able to generate any new code or results.

The research has followed King's [33] template analysis to create a hierarchy of codes, super codes, categories, and classifications. As defined by King [33], the core of template analysis is that the researcher prepares a list of codes known as templates. These templates represent the various themes identified in the textual data and can be added to, modified, and deleted per data emerging from the field. These templates are arranged in a manner so that they represent the relationship between the various themes in a hierarchical structure.

Data analysis

The collected primary data from the in-depth interviews were broken down into codes and sub-codes based upon the construct of the study. The smartphone intervention was categorized on the basis of the mode of intervention, type of intervention, level of intervention, desirable intervention, and undesirable intervention (Table 1). The respondents were coded as follows: Doctors (D1, D2, D3…), Nurses (N1, N2, N3…) and Ward Boys (WB1, WB2, WB3…).

Table 1 summarizes the findings of the study. The study categorizes the intervention on the basis of mode, type, level, and desirable and undesirable aspects based upon the primary data analysis.

Propinquity

Propinquity is the mode of intervention that pertains to the close proximity of the smartphone to the healthcare professional.

Table 1
Smartphone intervention.

Mode	Type	Level	Desirable	Undesirable
Propinquity	• Sense of urgency (missing notification/missing calls or reminders)	Depends upon • The timing of smartphone usage (performing critical surgeries/counseling patients)	• Delivering better service	• Risk of infection
	• Sense of responsibility (restricted/responsible use during patient care)	• The frequency of smartphone usage • The time period of use (duration of use during patient care)		• Interference in critical situations such as cardio-vascular bypass surgery
Applications	• Perceived usefulness of the applications	Depends upon	• Documenting records	• Risk of distraction from patient care
	• Perceived benefits drawn from the applications	• The level of the user	• Monitoring regularly	• Risk of diluting concentration
		• The kind of applications used *(health-related applications—OsiriX, iExaminer or general/entertainment applications)*	• Utilizing for education, communication, and research purposes	
			• Providing major help in the departments of pediatrics, obstetrics, surgery, internal medicine, radiology and dermatology • Assisting in smoking cessation, weight loss management, treatment adherence, and disease management • Reducing pre-operative anxiety among pediatric patients.	
Communication	• Sharing information	Depends upon timing of usage—such as critical point of care—to receive guidance	• Enhances real-time critical care and operating room collaboration	• Disturbing the inter-professional relationships
	• Receiving guidance		• Deliver better service	• Relying more on text/e-mail than verbal communication
			• Perform regular monitoring • Utilize for education, communication, and research purposes • Determine to reduce medical errors in critical care environments	

Healthcare professionals have shown a tendency to use smartphones at the workplace. This usage was dependent upon two types of situations. In one situation, the healthcare professionals display a *sense of responsibility*, and in the other, a *sense of urgency*.

Sense of responsibility

The healthcare professionals were aware of the distraction caused by smartphones when used at their workplace, especially while taking care of their patients. One of the doctors categorically denied using smartphones during patient care.

Statement-

D4-I don't like to use my smartphone during my working hours because this is causing mere distraction to me.

Some participants stated that they used a smartphone only in cases of emergency and avoided using it during working hours. Surgeons and doctors appear to be quite strict with their use of smartphones; whereas the nurses and ward boys have to seek permission from their seniors to use a smartphone and to bring it into critical care units.

Statement-

D5- I never pay attention to my smartphone until or unless there is an emergency situation like any patient is in dire need to help.

N2- My senior don't allow me to carry the phone, once one of my colleagues was scolded also.

Some healthcare professionals understand very well that smartphones can exert an influence by interfering with medical equipment and by causing distractions with notifications, messages, and calls in critical care units.

Statement-

WB3- No, doctors don't allow me to carry my phones in the operation theatre because once it created a problem.

The awareness about the effects of smartphone usage during patient care helps in the restricted and reasonable use of it. This helps to bring out more desirable effects than undesirable ones on the relationship between patient care intention and patient care behavior.

Sense of urgency

The respondents showed a sense of anxiety about missing important calls, messages, notifications, or reminders if the phone was not near them. This anxiety has led to the extensive use of smartphones, and has increased the frequency of its use including using it in critical care units and while performing surgery.

Statement-

WB1- I use my smartphone often during the work time because there could be any emergency at my home.

N1- I feel deprived when my smartphone is not with me.

Healthcare professionals believe that in the absence of superiors' restrictions, they may always carry their smartphone during patient care, feeling that the smartphone is always required to be nearby so that calls related to any emergency at the workplace, or even at home, can be attended to.

Statement-

WB2- Yes I would like to carry my phone along if Senior Doctor permits then only.

Healthcare professionals did show both a sense of urgency and a sense of responsibility toward the use of smartphones. This

study reveals an ambiguous environment regarding the use of smartphones during patient care. Some healthcare professionals use their smartphones without considering its effect on patients, whereas others were aware of it and used their smartphones in a responsible and restricted manner. Healthcare professionals used their or their superiors' subjective wisdom in usage or non-usage of smartphones during patient care.

Communication

Communication is another mode of intervention of smartphones. This study found that smartphones have a prominent use for participants, that is, communication. The statements of various respondents reveal that the intervention of communication was in the form of sharing information and seeking guidance. The communication level of intervention depended upon the timing of usage, such as seeking advice for critical care patients or using it in Intensive Care Units or operation theaters.

Information sharing

The use of smartphones makes it possible for healthcare professionals to share information among each other or with patients. Our interaction with healthcare professionals reveals that they pick up the calls of patients in order to deliver better service, but they also need to ensure that they are not ignoring the patients they are with. Along with this, Whatsapp, and other social media interactions prove to be a distraction in patient care.

Statement

D3- Yes, being a family doctor to few of my patients I always pick up their calls and advise them according to the situation.

D4- I am having a few work Whatsapp group and as well as a family group for sharing information.

Guidance seeking

Healthcare professionals gather information about various advancements by surfing the Internet as well as by consulting with their seniors. Our study participants expressed that the smartphone helped them to keep up-to-date with the latest happenings throughout the world. It helped them to access new ideas and enhanced knowledge. Also, it helped them to seek advice and guidance from their seniors and experts in their field. In other words, it helped them to become better clinicians.

Statement

D1- I always seek an advice from my experts by using smartphone via calls or message whenever I am having a doubt.

D7- Yes, it makes us better clinicians because with the help of smartphones we can gather information related to any disease as well as experts' advice.

Applications

Analysis also revealed another mode of intervention, that is, the applications installed in the smartphones of healthcare professionals. Besides propinquity and communication, the participants revealed their use of various applications in smartphones. These applications are a source of information, patient management, and entertainment. The participants expressed that the applications are an intervention due to their perceived usefulness and perceived benefits. This intervention depends largely on the kind of applications installed in the smartphone. The health-related applications are useful for patient care, whereas general applications are useful for personal needs. The use of applications has a direct impact on patient care as they help to make up-to-date medical information easily and readily available to healthcare professionals [4]. The mobile healthcare applications intervention helps in improving patients' health, especially in conditions of chronic disease. The applications make use of reminders to improve communication between patients and healthcare professionals as well as help in patients' self-management [38]. The applications provide advantages to healthcare professionals; however, presently their use is without a systematic understanding of the risks linked with doing so. There is a need for standard practices to ensure the quality and safety of these applications [62].

From the expressions received through the respondents, we find that most healthcare professionals have popular social media applications such as Facebook and Whatsapp installed in their smartphones. For higher levels of applications related to the medical profession and patient care, there was a more lukewarm response.

Perceived usefulness

Most of the participants expressed that they found these social media applications to be useful in their personal organization, social connections, and helped them to relax during stressful times. Though many respondents expressed that these applications were having no direct relevance for their profession, they still believed that sometimes certain applications can be useful in keeping in contact with patients and solving their queries.

Statements

D1- I have numerous applications in my phone like Whatsapp, Facebook, Youtube, Candy Crush (I like to play in my free time), Google (to surf and search)

D2- I use Whatsapp, Fitbit (to check my steps count, calorie intakes), Facebook only.

Perceived benefits

The difference that respondents underlined between benefits and usefulness was they believe that these applications can be useful in numerous ways, but they are able to draw only a few benefits from them. This was evident when some of the respondents emphasized that they used many applications to keep social contacts but did not use them for contacting and managing their patients.

Statements

D3-I find DICOM and Osiri X very useful for maintaining patients records but I don't draw out any benefit out of it because this task is done by my receptionist using the computer system.

D6-Yes, the virtual assistant system installed in my phone is very beneficial as it reminds me of my urgent meetings and reminders.

Discussion and propositions

Based on this study, we suggest certain theoretical propositions (P1, P2, P3…..). The propositions fall into two categories: *Intervention of Smartphone*, and *Transformation of Intention-Behavior of Patient Care* (Fig. 1).

Intervention of smartphone in patient care

The smartphone intervenes in the patient care environment via three means, that is, propinquity, communication, and applications.

Propinquity concerns the close proximity of the smartphone to the healthcare professional; the closer the distance, the more intervention will occur. This intervention can be in the form of interference with medical equipment, risk of infection, and/or better service delivery. Hence, the propinquity intervention is both desirable and undesirable. Desirable intervention will strengthen the relationship of patient care intention with patient care behavior but undesirable intervention will weaken this relationship. This

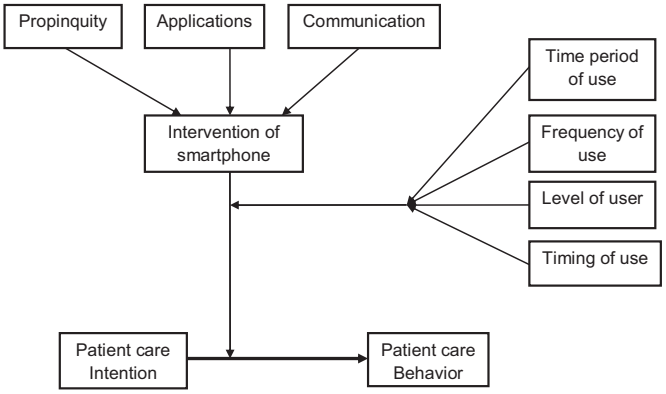

Fig. 1. Intervention of smartphone in intention-behavior of patient care.

practice of using a smartphone results in desirable effects such as timely access to relevant and urgent information [7,61]. However, it also leads to certain, undesirable effects such as infection and interference with critical care equipment such as pacemakers and ultrasonic devices [11,53].

P1. - *The more the smartphone propinquity, the higher the intervention of the smartphone in the relationship of patient care intention with patient care behavior.*

Communication through smartphones can also cause interventions to patient care. The more the communication, the more will be the intervention. Communication intervention comes in the form of information sharing and seeking guidance. Communication also intervenes in both desirable and undesirable manners. Desirable intervention will strengthen the relationship of patient care intention with patient care behavior, but undesirable intervention will weaken this relationship. The desirable effect of communication using a smartphone can include collaboration, better service delivery, regular monitoring of patient, and reduction in medical errors in critical care environments [6,9,26,28,36,60]. The communication mode of smartphone use has led to the undesirable effect of disturbing professional relationships and over-reliance on e-communication, which may lead to confusion [7,66].

P2. -*The more communication through a smartphone, the higher the intervention of the smartphone in the relationship of patient care intention with patient care behavior.*

Extending the argument from the above heading "Applications," it can be stated that applications installed in the smartphone are also a source of intervention in patient care. The more the applications are used, the more will be the intervention. Applications intervene due to their perceived usefulness and perceived benefits for the user. This intervention can be desirable or undesirable. Desirable intervention leads to the strengthening of the relationship between patient care intention and patient care behavior, whereas, undesirable intervention weakens this relationship. The use of applications produced desired effects such as the maintenance of documents and records, regular monitoring of patients, and help in smoking cessation, management of weight loss, disease, and pre-operative anxiety [16,30,40,44,45,51,57,63]. The undesirable effect of application use was recorded as causing distraction from patient care and risk of losing concentration [13,23,32].

P3. - *The more the applications are used, the higher the intervention of the smartphone in the relationship of patient care intention with patient care behavior.*

Based on the study we also propose that the strength of smartphone intervention depends upon the *time period of use, frequency of use, level of user,* and *timing of use.*

The time period of use pertains to the amount of time the healthcare professional spends using the smartphone during patient care. The more the time period of use, the more will be the strength of the intervention of the smartphone [37] in the relationship of patient care intention with patient care behavior.

P4. - *The more the time period of use of the smartphone, the higher its intervention in the relationship of patient care intention with patient care behavior.*

The usage frequency of the smartphone relates to the number of times it is utilized during patient care. More the frequency of use more will be the strength of the intervention of the smartphone [20] in the relationship of patient care intention with patient care behavior.

P5. - *The higher the frequency of use of the smartphone, the higher its intervention in the relationship of patient care intention with patient care behavior.*

The level of user indicates the user's expertise in using the smartphone. The higher the level of user, the more will be the strength of the intervention of the smartphone [16] in patient care.

P6. - *The higher the expertise level of the smartphone user, the higher the intervention of the smartphone in the relationship of patient care intention with patient care behavior.*

The timing of use pertains to the use of the smartphone at critical points of patient care (such as in operation theaters, Intensive Care Units, etc.). This timing of use can increase/decrease the strength of the smartphone intervention in patient care [23,53].

P7. - *The timing of use of the smartphone will have a positive/negative intervention of its use in the relationship of patient care intention with patient care behavior.*

Transformation of intention-behavior of patient care

This study found that a gap exists between patient care intention and patient care behavior of healthcare professionals due to the use of smartphones and expresses this gap as the non-transformation of patient care intention into patient care behavior. This indicates that healthcare professionals were not able to fully convert their patient care intentions into patient care behavior ([3,19,55]; Hassan et al., 2016; [48]).

P8. - *The intervention of a smartphone causes a gap between patient care intention and patient care behavior.*

Practical implications

The findings of this study will help in understanding the intervention of smartphones in the patient care intention-behavior of healthcare professionals through knowledge of the desirable and undesirable outcomes of their use during patient care and, hence, will provide improved patient care. The findings of the study may also be of use to various stakeholders of smartphones, specifically users, manufacturers, software developers, hospital managements, medical associations, and governments.

Policy formulation

Considering that healthcare is a critical area in human life and the fact that the use of smartphones have both positive and negative effects on patient care behavior, the findings of the study will

help in drafting a suitable policy by various associations, hospital managements, and government organizations for the use of smartphones among healthcare professionals.

The purpose of such policy should be to create a balance between the desirable and the undesirable effects of smartphone usage by the healthcare professionals. A smartphone usage policy could focus on alerting users of critical areas that prohibit the use of smartphones. These could be marked as strictly no mobile zones, delineating areas where smartphones can create interference with life-saving machinery.

The policy should be able to clearly define areas of smartphone usage and non-usage. The non-usage areas can include operation theaters, Intensive Care Units, and other critical care zones. The policy can also define exceptions and/or precautions regarding any acceptable use of smartphones in these areas. These exceptions can be critical surgery needing real-time advice, expert advice during critical patient care conditions, etc. These exceptions can include proper precautions to take while using smartphones such as sterilization of smartphones and maintaining proper distances from sensitive equipment and patients. Hospitals might maintain sterilization devices or mechanisms for general use to enable the sterilization of smartphones at regular intervals in order to restrict contamination.

The policy could also include timely sensitization events for the healthcare professionals toward smartphone usage and the spread of contamination due to it.

Technology adoption

Healthcare professionals need to realize that along with general applications there are certain applications that are actually useful for maintaining patient records and some that patients might utilize in order to create awareness for self-care.

Manufacturers and software developers of smartphones can develop devices and software to suit the needs of the healthcare professionals in patient care without interfering with critical care equipment.

Ethical behavior

Further, the study will help individual healthcare professionals understand their pattern of smartphone use and how it affects patients. The study has categorized the desirable and undesirable effects of smartphone use, which can assist the healthcare professional to understand the risky areas and the timing of usage of smartphones in the hospital while taking care of their patients. Thus, in the absence of any formal regulation from a government/regulatory body, this study will enable them to avoid usage of smartphones in the critical areas and timing during patient care. Hence, it will help them to uphold ethical norms and retain higher moral values while caring for patients.

The study will help reduce the gap between intention to and behavior of patient care among healthcare professionals, thus improving patient care. It can also help increase the desirable effects of smartphone use through better adoption of technology, thus improving healthcare services.

Limitations and future direction of the study

Every study has its limitations. Because we base this study on a limited number of respondents, it is difficult to make a more general prediction about the patient care behavior of healthcare professionals. Another limitation is its confinement to a limited area of Punjab, India. Hence, future studies could employ an ethnographic approach to study the behavior of healthcare professionals. Further, the proposed model can be empirically tested for generalizability.

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Not required

Supplementary material

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