



THE EFFECT OF USING MOBILE APPLICATIONS ON FACILITATING NURSING INTERVENTION IN CRITICAL CARE UNITS

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ABSTRACT Background: Mobile applications and cellular phone usage at critical care units have grown exponentially in the recent years with introduction of new communication systems and newer and smaller phone models. **The aim** of this study was to assess the effect of using mobile application in facilitating nursing intervention in critical care units. **Design:** A descriptive exploratory design was utilized to achieve aim of the study. **Setting:** the study was conducted at critical care units at Bahtem Hospital. **Sample:** A convenient sample of 50 nurses were included in the study. **Tools:** Tool I: Structured interviewing questionnaire: included three parts. Part I: Socio demographic characteristics of nurses, Part II: Mobile phone data, Part III: Nurses' knowledge regarding mobile phone, electromagnetic waves and their effects. Tool II: Observational checklist of nurses' practices regarding use of mobile and mobile applications at CCU **Results:** The study results founded that half of studied nurses had satisfactory total knowledge level regarding mobile phone, electromagnetic waves and their effects, while the majority of them were using web services to download medical information and to translate incomprehensible medical terms, were using social media programs to send information to the medical team and were exchanging practical information within private groups (Whats App). **Conclusion:** there was a high statistically significant correlation between total level of knowledge of the studied nurses and their total practices of using of mobile phones applications at critical care units and there was a statistically significant correlation between total level of knowledge and total practices level. **Recommendations:** continuous health education about mobile phone applications should be planned to the staff and health care professional, Sharing and participation in the knowledge of the latest modern medical programs that contribute to raising the level of nursing in the health care provided to patients with intensive care.

KEYWORDS: Mobile Applications, Nursing Intervention, Critical care unit.



INTRODUCTION:

Mobile health represents the application of mobile technology to provide or use health services, share clinical information and collect data (Lewis, Ray, and Liaw, (2016): 2016). Mobile health offers the possibility to have a fast diagnosis, to provide a feedback system in order to monitor health status, promote healthy behavior and encourage changes of dysfunctional behaviors, provide easy access to treatment and rehabilitation, receive electronic prescriptions or obtain informed consent rapidly, thereby cutting waiting times. Some apps work as information providers, improving health consciousness and literacy, as they give users an easy and portable access to educational material (Kondylakis, etal. 2017).

Mobile health applications is the collective body of diverse information instruments, which include: test systems, prescription, emergency management, decision support systems (DSS), digital imagery and telemedicine that should have a positive impact on healthcare professional's decision-making processes. Through the integration of the mobile health application, daily hospital operations and practices could be safer (Sim, 2019).

Nurses use many different methods of electronic communication in the clinical setting to coordinate patient care. These methods can include e-mail, phone applications, and two ways or group texting options that reduce response time in emergencies and increase the frequency of provider responses to nurses (VanDusen, 2017).

There are many benefits of mobile health applications (MHA) for the patient benefits as increasing quality of health care, due to easily accessible healthcare related data, this could significantly improve coordination among healthcare profession, positively increase efficiency of primary health care, empower and encourage patient's active participation in decisions relating to health care and may be used for proper transfer of data on suggested preventive health care, through primary care channels. Moreover, it is a device which encourages technology transfer and knowledge exchange, as well as help in the decision making based on up to date (Al-sharo,et al .,2018).

Significant of study:

Mobile phone use has been increased globally, with an estimated 3.3billion users in 2018(Kuss, et al., 2018). The numbers of health applications have elevation in the last few years, and by the end of 2017, there were almost 325 000 health apps available on the leading application stores. Complementary to the rising number of applications, their demand is also growing. Approximately 3.8 billion apps were downloaded in 2017, which was 16% increase from 2016(Joshi,etal., 2017).

United states are among the countries with the highest number of smart phone users, with a combined 1.46 billion smart phones users (Ministry Communication and Information, 2021). Mobile technology help in revolutionizing health care and medical professionals are increasingly incorporate mobile technology into clinical practice, research, and education. By the future of health care 2022, an estimated 98% of physicians and 97% of nurses will be using mobile devices at the point of care (Baxter, et al., 2020)



Aim of the study:

Assess the effect of using mobile applications in facilitating nursing intervention in critical care units

Subjects and methods:

I-Technical design

Research Design:

A descriptive exploratory design was utilized to achieve the aim of this study.

Research Settings:

The study was conducted at critical care units in Bahtem hospital which is affiliated to the health insurance. It has multiple sections (CCU, open heart surgery unit, dialysis unit).

Subjects:

A convenient sample of fifty nurses (50) from both gender in critical care units were working at previously mentioned settings at time of data collection and agreed to participate in this study.

It was developed by the investigator based on the relevant and recent scientific literature review (*Atef, 2016*); (*Bautista and Lin, 2017*). It was written in Arabic language.

Tools of data collection:

Tool I : included three parts:

Part I: Socio demographic characteristics of nurses, it included age, gender, educational level, residence, marital status, academic qualification; work at any other hospital and monthly income.

Part II: This part included data about mobile phone of the nurses; phone and number of SIM he/she has, type of mobile phone, price of the phone, the duration of using mobile phone, average number of hours of using mobile phone per day, using modern programs and modern electronic devices at home, connected to the internet through a mobile phone). As well as, using mobile programs for social communication and using mobile applications for nursing work.

Part III: Nurses' knowledge regarding mobile phone electromagnetic waves and their effects

This part assessed nurses' level of knowledge regarding mobile phone, electromagnetic waves and their effects. It included 12 items; definition and function of mobile phone, advantages and disadvantages of using mobile phone at work, type of rays come from a mobile phone, duration of a phone call that may cause changes in the body, cause of mobile waves effect on the hearing system, cause of exposure to high-frequency electromagnetic radiation, the ideal distance between eye and mobile phone, effect of electromagnetic waves on health, effect of sleeping next to mobile phone and complications of long term use of



mobile phone.

Scoring system of nurses' knowledge regarding mobile phone, electromagnetic waves and their effects:

This part included 12 items, the score 2 for the correct and complete answer, score 1 for the correct and incomplete answer, and 0 for incorrect answer. These scores were summed and were converted into a percent score. The total knowledge score was (24) which was classified as satisfactory if the score $\geq 80\%$ of the total score and unsatisfactory $<80\%$ of total scores.

Tool II: Observational checklist of nurses' practices regarding use of mobile and mobile applications at CCU.

This tool was developed by the investigator based on an extensive literature review (Atef, 2016); (Calinici, 2017) to assess nurses' practice regarding their personal use of mobile phone, and using mobile applications during providing nursing interventions at CCU.

The tool included fourteen (14) items; 8 items assessed nurses' personal use of mobile phone: Nurses use phone easily within the care, nurses use a loud phone ring, it's allowed to use the phone at CCU, it's forbidden to speak on phone during care, it's forbidden to use mobile phones next to patients, there is special signals that prohibit use of phone at CCU or signals for patients with heart diseases that prevent the use of phones, using mobile phone leads to wasting time and negligence at work.

Six items assessed nurses' use of mobile applications during providing nursing interventions at CCU; use web services to download medical information for diagnosis or treatment, use internet to translate incomprehensible medical terms, use social media programs to send medical information to the medical team, there is privacy in sending and receiving information between nurses and health team, practical information are exchanged within individual private groups (Whats App), mobile phone is useful for speeding up the transmission of data at times other than the official working hours.

Scoring system of nurses' practices regarding use of mobile and mobile applications at CCU:

This tool included 14 items, it was scored on 3 point liker (scale 3= usually, 2= sometimes, and 1= rarely). These scores were summed and were converted into a percent score. The total knowledge score was (42) which was classified as users if the score $\geq 80\%$ of the total score and nonusers if the score $<80\%$ of total scores.

II. Operational item:

The operational item for this study includes preparatory phase, content validity of the developed tool, pilot study and field work.

The Preparatory phase:

This phase was conducted through reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.



Tools Validity and Reliability:

Validity is the extent to which the instrument actually measures what it's designed to measure (*Mueller and Knapp, 2018*). Content validity was conducted to determine whether the tools covered the aim, test its appropriateness, comprehensiveness, accuracy, correction, clearance, and relevance through a jury of 5 experts (assistant professors and lecturers of medical surgical nursing) from the Faculty of Nursing- Helwan University. Their opinion was elicited regarding tools consistency, rephrasing for some statements, and scoring system.

Reliability: concerns the faith that one can have the data obtained from the use of an instrument that is the degree to which any measuring tool controls for random error (*Mohajan, 2017*).

The reliability of the tools was assessed through 10% cases (pilot study) using the developed questionnaire. Measuring their internal consistency by determining Cronbach alpha coefficient

Pilot study:

A Pilot study was carried out on 10% of the sample (5 nurses) to test the applicability, clarity and efficiency of the tools, then the tools were modified according to the results of pilot study, and nurses who participated in pilot study weren't involved in the sample.

Field Work:

Field work included the following:

- An approval was obtained from the scientific ethical committee of Faculty of Nursing- Helwan University and the study subjects to give a written agreement to participate in the study.
- An official permission included the title and purpose of study submitted to the director of Bahtem hospital to get approval for data collection to conduct the study.
- Data collection of the study was started and completed within six months from the beginning of November 2020 to the end of to April 2021.
- First, the investigator introduced herself to the studied subjects and gave a brief explanation about the study and its purpose before any data collection.
- Each nurse was interviewed individually to gather the necessary data of the study.
- The investigator was going to the hospital two days/week (on Sunday & Wednesday) in the morning shift 9.00am to 12.00pm and afternoon shifts. 16.00pm to 18.00pm).
- The time to collect data from each nurse was about 45-60 minutes, beginning with structured interviewing questionnaire to assess socio demographic characteristics of nurses and mobile phone data which took 10-15 minutes, then nurses' knowledge regarding mobile phone, electromagnetic waves and their effects which took 10-15 minutes



- Assessing nurses' practices took 25-30 minutes by observing nurses' practices of personal use of mobile phone at CCU and nurses' use of different mobile applications as web, internet and translation services or downloadable applications as Whats app during providing care at CCU.

Administrative item:

An official permission for this the study was obtained by submission of official letter to the dean of the faculty of nursing, Helwan University and the director of Bahtem hospital.

Ethical consideration:

An approval was obtained from scientific ethical committee of the faculty of nursing - Helwan University. The investigator clarified the objective and aim of the study to the nurses prior to any data collection.

The investigator assured maintenance of anonymity and confidentiality of the nurses' data and the nurses have the right to withdraw from the study at any time. Ethics, values, culture, beliefs were respected.

IV) Statistical item:

Recorded data were analyzed using the statistical package for social sciences, (SPSS) version 20. Quantitative data were expressed as mean \pm standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Chi-square (χ^2) test of significance was used to compare proportions between qualitative parameters.
- Fisher's exact test: was used to examine the relationship between two qualitative variables when the expected count is less than 5 in more than 20% of cells.
- Pearson's correlation coefficient (r) test was used to assess the degree of association between two sets of variables.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following probability (P-value)
 - P-value ≤ 0.05 was considered significant.
 - P-value ≤ 0.001 was considered as highly significant.
 - P-value > 0.05 was considered insignificant.



RESULTS

Table (1): represents that 54% of the studied nurses are in the age group from 20 to less than 30 years with a mean age 29.60 ± 6.22 , 70% of them were married, additionally 98% of them were living in urban area, 58% of them were bachelor or postgraduate studies. 56% of nurses were not working at any another hospital, as well as 82% of nurses had enough monthly income.

Figure(1): represents 50% of the studied nurses had satisfactory total knowledge level regarding mobile phone, electromagnetic waves and their effects.

Table (2): illustrates that it's sometimes allowed to use the phone at CCU while it's sometimes forbidden to speak on a mobile phone during care as stated by 82% and 84% of the studied nurses respectively. As well; 92% of them reported that using mobile phone sometimes leads to wasting time and negligence of work. While, 84.0% of the studied nurses were rarely using a loud phone ring.

Table (3): revealed that there was a high statistically significant correlation between total practices of the studied nurses of using mobile applications and their monthly income, with (p value <0.001). While; there was a statistically significant correlation between total practices of the studied nurses of using mobile applications and their qualification at ($P<0.05$).

Table (4): presents that there was a high statistically significant correlation between total level of knowledge of the studied nurses and their total practices of using of mobile phones applications at critical care units at p-value ($p<0.001$), and there was a statistically significant correlation between total level of knowledge and total practices level at p value ($p=0.002$).

DISCUSSION

As regard to demographic data of studies nurses, the results of the present study revealed that more than half of the studied nurses were in the age group from 20 to less than 30 years. This result is in agreement with *Achampong, Keney and Attah (2018)* who applied their study in Africa to enumerate the number of healthcare professionals that use mobile smart phones and applications during clinical practices and showed that more than half of studied nurses were in the age group 20-24years.

The study results showed that more than two thirds of studied nurses were married. This may be due to the age of the studied nurses ranged from 20 to 45 years and usually by this age they are married according to the Egyptian society culture. This result disagrees with *Bautista and Lin, (2017)* who explored use of mobile instant messaging applications by Filipino nurses and stated that each gender had an equal number of the studied nurses.

Regarding residence of the studied nurses, the present study results indicated that most of the study nurses live in urban and less than half of them were working at other hospital. This result is in agreement with *Nowrouzi-kia and Fox, (2020)*, who studied factors associated with intent to leave in registered nurses working in acute care hospitals in Ontario and Canada, and found that the majority of nurses live bed side the private work.

Concerning qualification of the studied nurses, this study revealed that more than half of



them had bachelor degree or postgraduate studies. This result is contrasting to Nowrouzi -kit and Fox,(2020), who mentioned that less than half of nurses had a bachelor degree of nursing science. As regard to monthly income, the majority of the studied nurses had enough monthly income. This can be interpreted by about half of nurses were working at other hospital.

Regarding total knowledge level of the studied nurses, this study revealed that half of the studied nurses had satisfactory total knowledge level regarding mobile phone, electromagnetic waves and their effects. This could be due to the qualification of studied nurses as more than half of them had bachelor degree or postgraduate studies, which high lightened their awareness about electromagnetic waves and their effects.

Considering studied nurses' practices of their personal use of mobile phones at CCU, the study results clarified that it's sometimes allowed to use the phone at CCU as stated by the majority of the studied nurses. This study matches with Petersenet al.,(2018)who studied nurses' perception of influences of e- message system on cross sectional communication and illustrated that more than two thirds of nurses were accessing their social media, checking text messages and even making phone calls to finish phone activities at critical area and safety guidelines in healthcare systems allowing their use of mobile in units.

Regarding the same perspective, this study results reported that the majority of the studied nurses were rarely using a loud phone ring. This result agrees with *Sultana, Paul, and Nessa*, (2020), who applied their study for observing the effect of noise pollution on patients, and showed that majority of studied population are affected by noise levels as health care providers were using higher mobile phone ringing at hospital.

With respect to studied nurses' practices of using mobile applications at CCU, these study findings clarified that the majority of the studied nurses were usually using web services to download medical information. This result is congruent with *Ahmad, Musallam and Allah*, (2018), who applied a review literature on the nurses' use and access to internet health related information (HRI), and showed that more than two thirds of the studied subjects accessed health information at work and their healthcare institutions encourage nurses to access online resources.

Concerning the same context, these study results mentioned that the majority of the studied nurses were usually using internet to translate incomprehensible medical terms. This result is in agreement with Dew et al., (2018), who carried out a study titled“development of machine translation technology for assisting health communications”, and found that majority of study subjects used translate for incomprehensible terms and many of the text translation involved google translate as the primary translation tool.

This study indicated that the majority of the studied nurses were usually using social media programs to send information to the medical team. This study disagreement with *Caminiti et al.*, (2020), whose study evaluated perceptions regarding cell phone use in a teaching hospital setting among health care providers, medical students, and patients and showed that nearly two thirds of health care providers used their devices in the hospital setting for clinical purposes (such as communicating with other providers or looking up clinical data), for personal purposes (such as communicating with family members), or both clinical and personal purposes.



Additionally, these study findings clarified the majority of the studied nurses were usually exchanging practical information within private groups (Whats App). This finding is contrasting to *Bautista and Lin (2017)*, whose study showed that the most utilized mobile instant messaging applications by staff nurses were facebook, messenger and viber which were accessed on their own smart phones.

While, more than two thirds of the studied nurses stated that there is usually privacy in sending and receiving information via internet. The same result were reported by *Collins, (2019)*, whose study aimed to assess nurses' perceived usefulness of secure texting applications for the purposes of patients care, and revealed that more than half of nurses clearly understood the importance of privacy of patients' information.

This is supported by *Hussain and Khattak,(2019)*,who conducted a study entitled “impact of smart phone usage on work neglect with mediating role of cyber loafing and moderating role of work engagement” and showed the positive effects of using smart phone applications as enhanced communication of clinical information and negative effects included the high risk of breaching patient privacy and confidentiality.

As well as, more than two thirds of the studied nurses reported that that mobile phone is usually useful for speeding up transmission of data at times other than official working hours. The same result was mentioned by *Calinici, (2017)*, whose study titled “Nursing applications for education and practice” and showed that more than two thirds of nurses reported that they follow health care issues on social media outside of work.

As regard to correlation between total knowledge level of the studied nurses and their socio demographic characteristics, this study demonstrated that there were statistically significant relations between total knowledge level and gender, qualifications and monthly income, with the most of the studied nurses who had satisfactory knowledge level were female. This result is similar to *parasuraman,et al.,(2017)* whose study results identified that female participants were having more awareness than male participants.

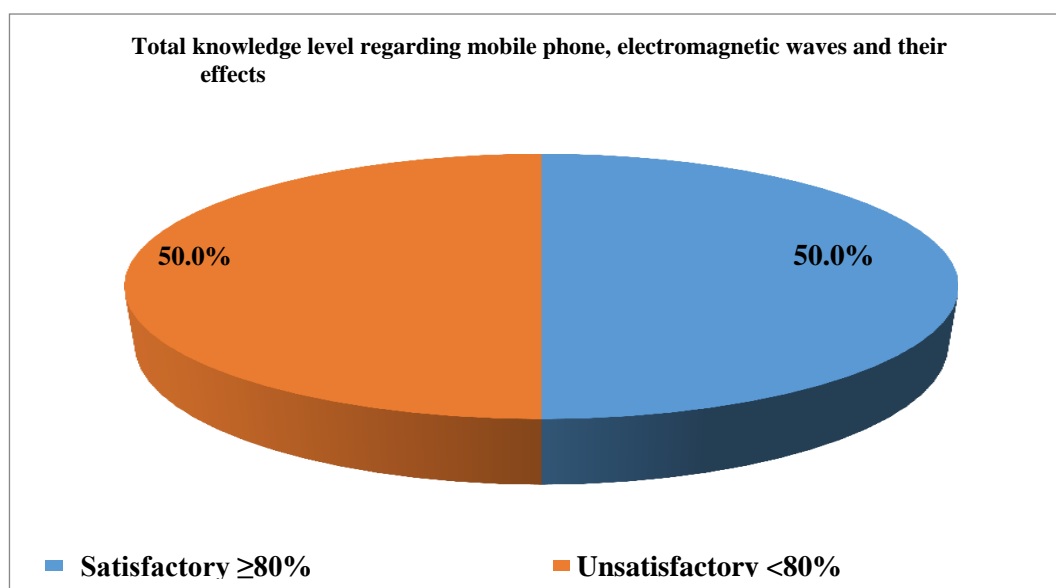
As well, *Aziz, (2020)*, who conducted a study to identify the knowledge and practices of 100 staff members in the environmental foundation in Erbil city in Iraq, and the study specified that there was a significant association between subjects' knowledge level and their level of education, and years of employment.

Considering correlation between total practice level of the studied nurses and their socio demographic characteristics, this study revealed that there was a high statistically significant correlation between total practices of the studied nurses of using mobile applications and their monthly income. While; there was a statistically significant correlation between total practices of the studied nurses of using mobile applications and their qualification.

Regarding correlation between total knowledge level of the studied nurses and their total practices at critical care units, there was a high statistically significant correlation between total level of knowledge of the studied nurses and their total practices of using of mobile phones applications at critical care units and there was a statistically significant correlation between total level of knowledge and total practices level. This can be interpreted by improving nurses' knowledge level will in turn enhance their practices regarding use of mobile applications at critical care units.

Table (1): Frequency and percentage distribution of studied nurses according to their socio-demographic characteristics (N=50).

Socio-demographic characteristics	No.	%
Age (years)		
20-30 years	27	54.0
31-45 years	23	46.0
Mean±SD	29.60±6.22	
Marital status		
Single	15	30.0
Married	35	70.0
Residence		
Urban	49	98.0
Rural	1	2.0
Qualification		
Diploma - Technical institute	21	42.0
Bachelor - Postgraduate studies	29	58.0
Work at other hospital		
Yes	22	44.0
No	28	56.0
Monthly income		
Enough	41	82.0

Figure (1): Percentage distribution of the studied nurses regarding their total knowledge level regarding mobile phone, electromagnetic waves and their effects (N=50)**Table (2): Frequency and percentage distribution of the studied nursing regarding their practices of using mobile applications at critical care units (N=50).**



Items	Rarely		Sometimes		Usually		Max. Score	
	No.	%	No.	%	No.	%	Mean	±SD
Use web services to download medical information.	5	10.0	7	14.0	38	76.0	2.66	0.37
Use internet to translate incomprehensible medical terms	4	8.0	7	14.0	39	78.0	2.70	0.38
Use social media programs to send information to the medical team	3	6.0	5	10.0	42	84.0	2.78	0.39
There is privacy in sending and receiving information via internet	2	4.0	14	28.0	34	68.0	2.64	0.37
Practical information are exchanged within private groups (Whats App)	3	6.0	4	8.0	43	86.0	2.80	0.39
Mobile phone is useful for speeding up transmission of data at times other than official working hours	2	4.0	12	24.0	36	72.0	2.68	0.38

Table (3): Correlation between socio-demographic characteristics of the studied nurses and total practices level of using mobile applications at intensive care unit (N=50).

Items	total practice				Fisher's Exact	
	on Users (n=43)		Users (n=7)			
	No.	%	No	%	FE	p-value
Age (years)						
20-30 years	22	51.2%	5	71.4%	0.995	0.318
31-45 years	21	48.8%	2	28.6%		
Gender					0.166	0.684
Male	9	20.9%	1	14.3%		
Female	34	79.1%	6	85.7%		
Marital Status					0.641	0.423
Single	12	27.9%	3	42.9%		
Married	31	72.1%	4	57.1%		
Residence					0.166	0.684
Urban	42	97.7%	7	100.0%		
Rural	1	2.3%	0	0.0%		
Qualification					4.060	0.044*
Diploma or technical institute	21	48.8%	0	0.0%		
Bachelor or postgraduate studies	22	51.2%	7	100.0%		



Work at other hospital						
Yes	19	44.2%	3	42.9%		
No	24	55.8%	4	57.1%	0.004	0.948
Monthly income						
Enough	40	93.0%	1	14.3%		
Not enough	3	7.0%	6	85.7%	20.23	<0.001**

* Significant if P Value ≤ 0.05 ** Highly significant if P Value ≤ 0.001

Table (4): Correlation between total knowledge level of the studied nurses and their total practices of personal use of mobile phones & using of mobile phones applications at critical care units(N=50).

Total level of practice	Total level of knowledge	
	R	p-value
Total practices of personal use of mobile phones at intensive care unit	0.039	0.790
Total practices of using of mobile phones applications at intensive care unit	0.525	<0.001**
Total practices level	0.460	0.002*

Pearson correlation coefficient * Significant if P Value ≤ 0.05 ** Highly significant if P Value ≤ 0.005

REFERENCES

- Achampong, E., Keney, G., and Attah Sr, N. (2018): The effects of mobile phone use in clinical practice in Cape Coast Teaching Hospital. Online journal of public health informatics, 10(2).
- Ahmad, M., Musallam, R., and Allah, A., (2018): Nurses and internet health-related information: review on access and utility. Clujul medical; 91(3); 266.
- Al-Sharo ,M., Shakah, M., Alkhaswneh, B.,Alju-Naeidi, Z.,and Alazzam M.,(2018): "Classification of big data: machine learning problems and challenges in network intrusion prediction," Int. J. Eng. Technol.; vol. 7, no. 4, pp. 3865–3869.
- Atef, D.,(2016):Health education program for faculty of nursing students about mobile phone healthy used, doctoralthesis; faculty of nursing ; helwan university.
- Aziz, K., (2020):. Staff's knowledge and practices in environmental foundation regarding prevention from mobile and tower health risks in Erbil City, Iraq; Indian Journal of Public Health Research & Development; 11(2).
- Bautista, J., and Lin, T., (2017): Nurses' use of mobile instant messaging applications: A uses and gratifications perspective. International Journal Nurse Practice; 23(5).
- Baxter, C., Carroll, J., Keogh, B., and Vandelanotte, C., (2020): Assessment of mobile health apps using built-in smartphone sensors for diagnosis and treatment: Systematic survey of apps listed in international curated health app libraries; JMIR mHealth and uHealth; 8(2), e16741



- Calinici, T., (2017): Nursing apps for education and practice. *J Health Med Informat*; 8(262), 2.
- Caminiti, C., Deng, L., Greenberg, P., Scolpino, A., Chen, C., Yang, E., and Oleske, S., (2020): The impact and perception of cell phone usage in a teaching hospital setting; *Journal of Patient Experience*; 7(6), 1627-1633.
- Collins, R., (2019): Nurses' perceived usefulness of secure texting applications for the purpose of patient care. *Online Journal of Nursing Informatics (OJNI)*;23(1).
- Dew, K., Turner, A., Choi, Y., Bosold, A., and Kirchhoff, K., (2018):Development of machine translation technology for assisting health communication: A systematic review. *Journal of biomedical informatics*; 85, 56-67.
- Hussain, S., and Khattak, J. K. (2019):Impact of smartphone usage on work neglect with mediating role of cyberloafing and moderating role of work engagement. *NUML International Journal of Business & Management*; 14(2), 43-60.
- Joshi, A., Generalla, J., Thompson, B., and Haidet, P., (2017): Facilitating the feedback process on a clinical clerkship using a smartphone application. *AcadPsychiatry* ; 41 (5): 651–5.
- Kondylakis, H., Koumakis, L., Hänold, S.,Nwankwol,I., Forgo,N,Marias,K., and Graf,N., (2017): Donor's support tool: enabling informed secondary use of patient's biomaterial and personaldata. *IntJMedInform.*;97:282292.doi: 10.1016/j.ijmedinf.2016.10.019.
- Kuss, D., Harkin, L., Kanjo, E., and Billieux, J., (2018): problematic smartphone use: investigating contemporary experiences using aconvergent gesign , *Int J Environ Res Public Health.*; 15(1).
- Lewis, J., Ray, P., and Liaw, S., (2016): Recent worldwide developments in electronic health and mobile health to more effectively manage cancer and other chronic diseases - A Systematic Review. *Yearb Med Inform.*; (1):93-108.
- Ministry of Communication and Information. (2021).Number of smartphone users from 2016 to 2021 :<https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/> last accessed 18/1/2022.last accessed 20/12/2021.
- Mohajan, H., (2017):Two criteria for good measurements in research: Validity and reliability. *Annals of Spiru Haret University. Economic Series*; 17(4), 59-82.
- Mueller, R., and Knapp, T., (2018): Reliability and validity. In *The reviewer's guide to quantitative methods in the social sciences*; (pp. 397-401).
- Nowrouzi-Kia, B., & Fox, M., (2020): Factors associated with intent to leave in registered nurses working in acute care hospitals: A cross-sectional study in Ontario, Canada. *Workplace health & safety*; 68(3), 121-128.
- Parasuraman, A., Yee, S., Chuon, B., and Ren, L., (2017): Smartphone usage and increased risk of mobile phone addiction: Aconcurrent study. *International journal of pharmaceutical investigation*; 7(3), 125.
- Petersen, H., Foged, S., Madsen, A., Andersen, O., and Nørholm, V., (2018): Nurses' perception of how an e-message system influences cross-sectoral communication: A qualitative study.*J Nurs Manag*; 26(5):509-517.
- Sim, I.,(2019): Mobile devices and health. *New England Journal of Medicine*; 381(10), 956-968.
- Sultana, A., Paul, A., and Nessa, M., (2020): The tatus of noise pollution in the major traffic intersections of khulna metropolitan city in bangladesh and its possible effect on noise-exposed people. *European Journal of Environment and Earth Sciences*; 1(5).
- Van Dusen, K., (2017): Calling on smartphones to enhance patient care. *Nursing*; 47(11), 1-2.