

Investigating the Moderating Effects of Self-Efficacy, Age and Gender in the Context of Nursing Mobile Decision Support Systems Adoption: A Developing Country Perspective

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Abstract—Health professionals are increasingly using and relying on mobile applications to support their decisions in Jordan. Nursing staff have the opportunity to use a wide variety of already existed mobile applications to support their tasks when providing health services to both inpatients and outpatients.

This study investigated the factors that affect mobile applications' adoption by nursing staff to support their health decision making. The proposed factors are perceived usefulness, perceived ease of use, subjective norms, job relevance, and perceived external control. In addition, this study intended to investigate the moderating influence of, age, gender, and self-efficacy.

The proposed model was tested by collecting data 241 nursing staff in three public and private hospitals in Jordan. Results show that perceived usefulness and perceived ease are the most significant factors that influence the individual's behavioral intention to use and adopt the mobile application in their decision support processes.

Keywords—Mobile applications, Health DSS, Behavioral intentions, Nursing staff, TAM

1 Introduction

Decision support systems (DSSs) has significantly evolved in the last four decades [1, 2]. Turban [3] defined DSS as "an interactive, flexible, and adaptable computer based information systems (CBIS) that utilizes decision rules, models, and model base coupled with a comprehensive database and the decision makers own insights, leading to specific, implementable decisions in solving problems that would not be amenable to management science optimization models per se".

DSSs comprise a large body of research. It aid decision makers in many fields, because of the DSS characteristics; handling large amounts of data, processing data from different sources, and perform sophisticated analysis. DSSs give decision makers a flexibility in solving simple and complex problems, and increasing the quality of

decisions [4]. The significance of DSSs arises in its ability to support the solution of complex problems that are rapidly changing [5].

Mobile technologies have changed the way we communicate, seek for information, and perform our jobs [6]. This creates new opportunities for DSS research and decision makers in different fields. Location-based services allow mobile applications to offer a personalized and customized decision strategy for managers.

Health information systems (HISs) have recently started to provide user-centric health services. HISs can play a significant role in improving the clinical decision-making. Nursing is one of the important roles in hospitals. Nursing staff are promoting the overall quality of health-care. However, the nature of nursing job requires timely assistance with decision-making tasks.

Prior research, in the field of technology acceptance, argued that the users, of any information system, could only realize and achieve its benefits after adoption of this information system [7]. A plenty of research have investigated the factors that influence information systems' adoption. However, no prior research has investigated the factors that influence nursing staff adoption of mobile decision support systems. Moreover, no prior research has investigated how nursing staff adoption of mobile DSS would be moderated by factors like self-efficacy, age, and gender.

The purpose of this study is twofold. First, study investigated the factors that affect mobile applications' adoption by nursing staff to support their health decision making. Second, the study investigates the moderation effects of age, gender and self-efficacy, in the context of nursing mobile decision support systems adoption.

2 Literature Review

The proposed model includes the factors: perceived usefulness, perceived ease of use, subjective norms, job relevance, perceptions of external control, and behavioral intention to use NMDSSs, in addition to self- efficacy, age and gender as moderators. These factors were chosen because of their strong agreement as reported in previous studies, and because of their applicability and suitability in the context of NMDSSs. This research utilizes the modified technology acceptance model [8] to test the proposed model.

2.1 Mobile DSSs in health care

Mobile technology directly influenced mobile users [9], and it can be useful for decision support systems. Mobile phones are convenient tools, because of their ubiquity and accessibility, in addition to its usability, network connectivity, and internal smart card readability. Consequently, it is considered as an ideal tool for performing personal tasks.

Mobile devices can be used to assist its users when making decisions, by providing more dynamic and precise solutions [10]. The use of mobile technology in DSS empowers decision makers in their decision-making processes [9]. The decision making

process is improved using mobile phones, and can be carried out faster as it can be used anytime and anywhere [10].

The nature of decision-making process determines that it occurs in time-sensitive environments, and occurs in anywhere in the work field [11]. Traditional tools used in decision-making process might not fit these time and location requirements. Mobile phones can assist its users to solve problems, and make better decisions in anytime and any location.

Information Systems in healthcare has increased rapidly in the past ten to fifteen years [12]. Information systems increase users' productivity in different environments, including fieldwork environments. Burstein et al. [9] argued that in the fieldwork environments, where desktop devices are not beneficial, mobile technologies are more appropriate to support the decision-making process. Consequently, the use of mobile technology in health-care field has increased exponentially [14, 15].

Uncertainty environment requires special types of decision support systems. Information provided by these special systems must be valuable to facilitate decision-making process. Moreover, the method of providing this information to the decision makers must be an understandable and useful method.

3 Hypotheses Building

Technology acceptance model was used in previous research to predict users' acceptance and adoption of new technologies including DSSs [16, 17, 18, 19, 2]. In the present study, we developed a model to investigate and predict nursing staff acceptance of mobile DSS. The study extends the original TAM by adding external variables that determine nursing staff adoption of NMDSSs. The research model for this study is shown in figure 1.

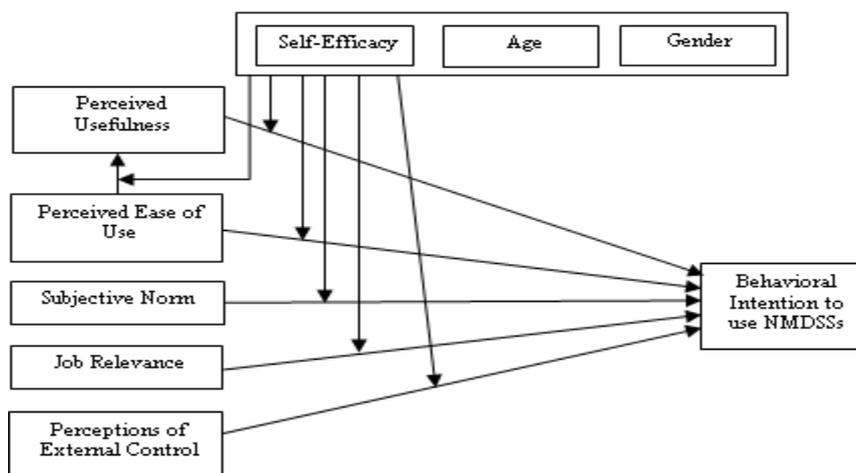


Fig. 1. the proposed research model

3.1 Perceived ease of use and perceived usefulness.

Previous literature in the field of technology acceptance has proposed the factors perceived ease of use (PEOU) and perceived usefulness (PU), and proved their influence on the behavioral intention to use and adopt new technologies [20].

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would improve his/her job performance" [7], while perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" [7]. The higher the individuals' beliefs about how easy it is to use the information system, the higher the intention to use this information system [21]. Prior research has also proved the effect of perceived ease of use on the perceived usefulness [22]. Therefore, this research proposes the following hypotheses:

H1: Perceived usefulness has a positive effect on the behavioral intention to use NMDSSs.

H2: Perceived ease of use has a positive effect on the behavioral intention to use NMDSSs.

H3: Perceived ease of use has a positive effect on the perceived usefulness to use NMDSSs.

3.2 Subjective norms

Subjective norms is defined as "the degree to which an individual perceives that most people who are important to him think he should or should not use the system" [15]. The theory of reasoned action (TRA) has proved the influence of subjective norms on the social influence. Subjective norms has a positive impact on behavioral intentions to adopt new systems [8, 15, 23]. Consequently, the following hypothesis is proposed:

H4: Subjective Norm has a positive effect on the behavioral intention to use NMDSSs.

3.3 Job relevance (JR)

Job relevance is defined as "the degree to which an individual believes that the target system is applicable to his or her job" [8]. This factor refers to the perception of individuals about the relevance between the proposed technology, and the job tasks [13]. Job relevance is a major variable in TAM2 [8]. Peker [23] found that job relevance has a positive effect on behavioral intention to use a technology. Consequently, the following hypothesis is proposed:

H5: Job relevance has a positive effect on the behavioral intention to use NMDSSs.

3.4 Perceptions of external control (POEC)

The perceptions of external control is defined as "the degree to which an individual believes that organizational and technical resources exist to support the use of the system" [24].

Prior research has investigated the impact of perceived external control on the perceived ease of use a new technologies. Venkatesh and Bala [22] has confirmed this effect. Thus, we expect that the perceptions of external control will positively influence the behavioral intentions to use NMDSSs:

H6: Perceptions of external control has a positive effect on the behavioral intention to use NMDSSs.

3.5 Moderating Effect of Self-Efficacy

Self-efficacy (SE) is the individuals' self-evaluation of their capability of achieving a goal [23]. In the context of mobile technology, self-efficacy is defined as the degree to which an individual believes that he or she has the ability to achieve a specific task/job using the mobile technology [41].

Previous studies have been conducted to investigate the impact of self-efficacy on the technology adoption intentions [25, 26]. Other studies looked at the moderation impact of self-efficacy factor that moderate the influence on the mobile technology adoption [32].

Peker [23] proposed self-efficacy as an individual characteristic of users. In the present study, we use self-efficacy as a moderator. The moderating effects of self-efficacy, on the study relationships, are investigated with the following hypotheses:

Hs1: Self-efficacy moderates PU-BI relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

Hs2: Self-efficacy moderates PEOU-BI relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

Hs3: Self-efficacy moderates PEOU-PU relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

Hs4: Self-efficacy moderates SN- BI relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

Hs5: Self-efficacy moderates JR- BI relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

Hs6: Self-efficacy moderates POEC- BI relationship in a way that it is stronger for nursing staff with a higher level of self-efficacy.

3.6 Moderating Effect of Age

Prior research concentrated on the importance of understanding how individual characteristics (e.g., age) influence intentions to use a technology. This understanding can help decision makers in introducing new technologies to different users more effectively[28]. Morris et al. [29] claimed that individual differences (e.g., age), among users, are important in understanding how and why users make different choices regarding the technology adoption. For instance, older people typically have had less experience to use new technologies, so that, it is critical for them to be introduced to new technologies.

A better theoretical understanding of age moderating effect is needed. In the field of NMDSS, user age is an important factor that affects the delivered services. Conse-

quently, age is expected to affect the intentions to use NMDSS services. Therefore, we examined age as a moderator that moderate the relationship between NMDSS adoption's determinants and the behavior intentions to adopt NMDSS. Thus, we propose the following research hypotheses:

Ha1: Age moderates PU-BI relationship in a way that it is stronger for younger nursing staff.

Ha2: Age moderates PEOU-BI relationship in a way that it is stronger for younger nursing staff.

Ha3: Age moderates PEOU-PU relationship in a way that it is stronger for younger nursing staff.

Ha4: Age moderates SN- BI relationship in a way that it is stronger for younger nursing staff.

Ha5: Age moderates JR- BI relationship in a way that it is stronger for younger nursing staff.

Ha6: Age moderates POEC- BI relationship in a way that it is stronger for younger nursing staff.

3.7 Moderating Effect of Gender

Gender is one of the individual characteristics that affect the intentions of individuals to adopt and use a new technology [23]. The influence of gender on information systems' adoption has received a considerable attention in the literature. Several studies have investigated the moderating impact of gender on information systems' adoption, in a variety of contexts, including mobile payment [30], mobile commerce [31], mobile marketing [32], and mobile learning [33]. In the context of DSS, several studies have examined the impact of gender differences on the adoption and use of DSS, for example, Aldhmour and Eleyan [2] studied the differences in individuals' perceptions toward adoption of DSS, and they found no significant differences between male and female users towards DSS adoption. In the present study, we believe that, it is necessary to study the moderating effect of gender on the behavioral intentions to use NMDSS, to get a better understanding of the differences between male and female nursing staff. Consequently, we propose the following research hypotheses:

Hg1: Gender moderates PU-BI relationship in a way that it is stronger for female nursing staff.

Hg2: Gender moderates PEOU-BI relationship in a way that it is stronger for female nursing staff.

Hg3: Gender moderates PEOU-PU relationship in a way that it is stronger for female nursing staff.

Hg4: Gender moderates SN- BI relationship in a way that it is stronger for female nursing staff.

Hg5: Gender moderates JR- BI relationship in a way that it is stronger for female nursing staff.

Hg6: Gender moderates POEC- BI relationship in a way that it is stronger for female nursing staff.

4 Methodology

4.1 Sample and Data collection procedure

A survey was used to collect data on nursing staff perceptions of intentions to adopt the NMDSSs. The survey link was distributed on a convenient sample of 350 nurses working in three big hospitals in Jordan. 249 respondents have returned the survey. Eight participants have been removed due to incomplete answers. This left 241 datasets for the statistical analysis, with 68.9 % valid return rate.

4.2 Measurement

The researchers conducted the data collection using a survey containing 22 questions. Each question was measured on a 7-point, Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The instruments used to measure the constructs were adopted from previous studies in order to ensure content validity [22]. The questions were then reworded to suit the study setting.

Before conducting the survey, a pretest was conducted using sample of 30 nursing staff. They were asked to measure the construct for the face validity. Furthermore, a number of professors, in Information Systems major, reviewed the instruments. Their feedback was considered in the final version of the survey. The final scales used in the survey are illustrated in the Appendix

5 Results

About 59.8% of the respondents were females, where 40.2% were males. The majority of respondents' age (53.5%) was less than 20. 24.5% of the respondents were 20 less than 30. 12.4% of the respondents were between 30 and less than 35 years old. 9.5% of the respondents were more than 35 years old.

The monthly income for the majority of the respondents (43.2%) was 250 less than 500 JD. 29.5% of the respondents' income was between 500 and less than 1000 JD. 25.3% of the respondents' income was less than 250 JD. 2.1% of the respondents' income was more than 1000 JD.

The majority of the respondents' experience (34.9%) was less than 5 years. 22.8% of the respondents were trainees. 25.3% of the respondents' experience was between 5 less than 10 years. 17% of the respondents' experience was more than 10 years. See table 1.

WarpPLS 5.0 software was used by this study to evaluate the proposed model. The study checked for constructs' reliability, items' loading, internal consistency and discriminant validity to evaluate the properties of the measurement model. Cronbach Alpha scores were used to test the constructs' reliability. Cronbach Alpha scores exceeded 0.6 for all of the constructs as demonstrated in table 2, and consequently, constructs' reliability was considered acceptable [34].

Table 1. Demographic profile of respondents (N=241)

Variable	Frequency	Percentage
Female	144	59.8
Male	97	40.2
Less than 20	129	53.5
20 -Less than 30	59	24.5
30 -Less than 35	30	12.4
More than 35	23	9.5
Less than 250JD	61	25.3
250 Less than 500	104	43.2
500 Less than 1000	71	29.5
More than 1000	5	2.1
Trainee	55	22.8
Less than 5 Years	84	34.9
5 Less than 10 Years	61	25.3
More than 10 Years	41	17

Table 2. The Alpha coefficients.

The study constructs	Alpha
1 Perceived Usefulness	0.870
2 Perceived Ease of Use	0.830
3 Subjective Norm	0.871
4 Job Relevance	0.764
5 Perceptions of external control	0.741
6 Behavioral Intention	0.935

All loadings are equal to or greater than 0.5, as explained in the Appendix. The study checked for the internal consistency by looking at the composite reliability scores. Composite reliability scores are recommended to exceed 0.7 [35] to be considered as acceptable. Table 3 shows that the composite reliability scores exceed the suggested threshold for each construct.

The study checked the discriminant validity by comparing the correlations among constructs, and the square root of the average variance extracted (AVE). The correlations among constructs should be less than the AVE scores to get an acceptable discriminant validity [36, 37]. Table 3 shows that AVE scores meet this condition, and consequently, the model has a good discriminant validity.

The final results showed a substantial share of the behavioral intention to use NMDSSs ($R^2=0.70$) is identified by the proposed determinants factors in the study. Meaning that 70% of the variance in behavioral intentions toward NMDSS usage is explained by the determinants' set collectively. Figure 2, and table 4 explain the study results.

Table 3. Composite reliability, AVE, and correlation of constructs values.

The study constructs	Composite Reliability	AVE	1	2	3	4	5	6
1 Perceived Usefulness	0.916	0.740	(0.860)					
2 Perceived Ease of Use	0.889	0.672	0.558	(0.820)				
3 Subjective Norm	0.912	0.722	0.427	0.364	(0.849)			
4 Job Relevance	0.868	0.692	0.515	0.424	0.610	(0.832)		
5 Perceptions of external control	0.840	0.576	0.535	0.590	0.409	0.437	(0.759)	
6 Behavioral Intention	0.958	0.884	0.703	0.631	0.459	0.529	0.579	(0.940)

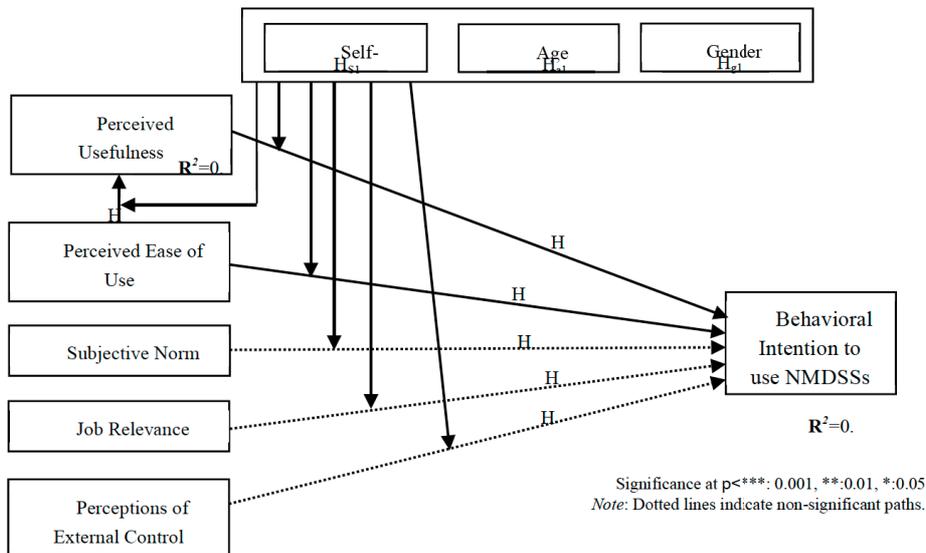


Fig. 2. Results of testing hypotheses

Table 4. Result of whole model hypotheses test.

Hyp	Dependent Variables	Independent Variables	Moderators	Path Coefficient	Supported
H ₁	PU	BI		0.432***	Yes
H ₂	PEOU	BI		0.242***	Yes
H ₃	PEOU	PU		0.507***	Yes
H ₄	SN	BI		0.009	No
H ₅	JR	BI		0.069	No
H ₆	POEC	BI		0.099	No
H _{s1}	PU	BI	Self-Efficacy	-0.015	No
H _{s2}	PEOU	BI	Self-Efficacy	-0.159**	Yes
H _{s3}	PEOU	PU	Self-Efficacy	-0.136*	Yes
H _{s4}	SN	BI	Self-Efficacy	-0.062	No
H _{s5}	JR	BI	Self-Efficacy	-0.043	No

H _{s6}	POEC	BI	Self-Efficacy	-0.071	No
H _{a1}	PU	BI	Age	0.056	No
H _{a2}	PEOU	BI	Age	0.027	No
H _{a3}	PEOU	PU	Age	0.001	No
H _{s4}	SN	BI	Age	-0.037	No
H _{a5}	JR	BI	Age	0.004	No
H _{a6}	POEC	BI	Age	0.010	No
H _{g1}	PU	BI	Gender	-0.004	No
H _{g2}	PEOU	BI	Gender	0.069	No
H _{g3}	PEOU	PU	Gender	-0.009	No
H _{g4}	SN	BI	Gender	0.149*	Yes
H _{g5}	JR	BI	Gender	0.018	No
H _{g6}	POEC	BI	Gender	-0.097	No

Significance at p<***: 0.001, **:0.01, *:0.05

6 Discussion and Implications

6.1 Key findings

The results show that there are factors that have a significant positive influence on the behavioral intentions to use NMDSSs. On the other hand, there are factors that do not.

Results of the first hypothesis show that perceived usefulness has a significant positive impact on the behavioral intentions to use NMDSSs (H1: $\beta=0.432$, $p < 0.001$). Individuals recognized that the use of mobile phone in nursing decision support would be beneficial and useful, and that was a good reason for them to adopt it. The reason could be the advantages associated with NMDSSs usage, such as ability to access to information in real-time and improving the nursing information flow. Banderker & Van Belle [38] stated, "Individuals (the doctors) agreed unanimously that the mobile technology device would be very useful and relevant to them, and the mobile technology device being useful by providing information to them".

This finding is consistent with prior research. Aldhmour and Eleyan [2] found that perceived usefulness has a positive impact on adoption of decision support systems. Hsiao et al. [18] found that perceived usefulness has a significant impact on pain management decision support systems acceptance. Wu et al. [39] found that perceived usefulness has a positive impact on behavioral intentions to use mobile healthcare systems. Moreover, Ketikidis et al. [13] found that perceived usefulness has a influence on the intentions to use health IT.

Perceived ease of use has a significant impact on the behavioral intentions to use NMDSSs (H2: $\beta=0.242$, $p < 0.001$). Individuals who recognized that the use of mobile technology, in nursing decision support, would be free of effort and easy, reported their desire to adopt it. Most of the respondents recognized that mobile technology is easy to use; the reason could be their previous usage, experience, and familiarity with the mobile technology.

This finding is consistent with previous research. Sun et al. [40] found that perceived ease of use has a positive impact on adoption of mobile health services. Hsiao et al. [18] found that perceived ease of use has a significant impact on pain management decision support systems acceptance. Wu et al. [39] found that perceived ease of use significantly affected behavioral intentions to use mobile healthcare systems. Moreover, Ketikidis et al. [13] found that perceived ease of use has directly predicted health IT usage intentions. However, this finding is not consistent with Aldmour and Eleyan [2] who reported contradictory results about the impact of perceived ease of use.

Perceived ease of use has a significant impact on the perceived usefulness of NMDSSs (H3: $\beta=0.507$, $p<0.001$). This implies that individuals, who perceived the NMDSS as an easy to use tool, will find it useful to use as well. This finding is consistent with Wu et al. [39] who found that perceived ease of use significantly affects perceived usefulness of mobile healthcare systems.

Subjective norms do not have any significant impact on the behavioral intentions to use NMDSSs (H4: $\beta = 0.009$, $p > 0.05$). The reason could be because others do not influence nursing staff in hospitals, when it comes to adopting NMDSSs. Nursing staff might only be affected by the senior management decisions to adopt NMDSS.

The study results on the subjective norms' effect is inconsistent with prior studies. Sun et al. [40] found that subjective norms positively influence the mobile health services' adoption. Ketikidis et al. [13] found that subjective norms has directly predicted health IT usage intentions.

Job relevance does not have a significant impact on the behavioral intentions to use NMDSSs (H5: $\beta=0.069$, $p > 0.05$). This implies that nursing staff, who believe that the NMDSS is applicable to their job; do not have more intentions to adopt it comparing with other nursing staff. Mobile phones consist a variety of mobile applications beside NMDSS; this might affect its relevance to the nursing job in hospitals.

This finding is inconsistent with Banderker and Van Belle [38] who found that job relevance significantly affect the adoption of mobile technology by public healthcare doctors. Moreover, the finding is inconsistent with Ketikidis et al. [13] who found that job relevance has directly predicted health IT usage intentions.

Perceptions of external control variables do not have a significant impact on the behavioral intentions to use NMDSSs (H6: $\beta=0.099$, $p > 0.05$). The reason could be that individuals believe that the use of mobile phone in decision support is incompatible with other applications currently used. Therefore, they do not perceive the control of NMDSSs over previous ways.

The study findings demonstrate that self-efficacy does not exert any significant effect in the current model except for the relationship between perceived ease of use and the behavioral intentions to use NMDSSs (Hs2: $\beta=-0.159$, $p < 0.01$), and the relationship between perceived ease of use and the perceived usefulness NMDSSs (Hs3: $\beta=-0.136$, $p < 0.05$). The reason could be that individuals perceive the NMDSS's task more inefficiently, due to challenges related to the mobile phones. Moreover, mobile phone still suffer from usability problems such as limited screen size. Banderker & Van Belle [38] stated, "Doctors expressed an initial concern that the limited screen

size of the mobile technology devices might make it less useful, the screen on this device would not be able to display information very legibly".

The study found no significant moderation impact for age. Meaning that, nursing staff age does not make any difference in the relationship between the study factors, and the intentions to use NMDSS. The reason for that could be the increasing awareness of nursing staff about the NMDSSs and other mobile applications, amongst all ages.

Finally, the study found only one significant moderation impact for gender, on the relationship between subjective norms and the behavioral intentions to use NMDSSs (H_{g4}: $\beta=0.149$, $p<0.05$). Indeed, subjective norms do not exert any significant effect on behavioral intentions; however, subjective norms do affect women's behavioral intentions significantly stronger than its impact on men's behavioral intentions.

6.2 Theoretical and Practical Implications

The study has many contributions for theory and practice. One theoretical contribution is extending TAM model and testing its validity and applicability in Jordanian health care context. The study determined the variables that influence the user intention to use NMDSS, such as subjective norm, job relevance and perceptions of external control.

The practical contribution of this study is assisting decision makers in health care, and nursing staff, in implementing NMDSS services successfully. Using the study results, decision makers in the health industry can be informed how to encourage nursing staff to adopt mobile DSS in a way that improve the quality of health care.

Designers of mobile applications that can be used by nursing staff to support their decisions, can use our results to know more about the importance of usefulness and easiness of their designed applications.

6.3 Limitations and Future Studies

The study has some limitations that we recommend future research to resolve. First, in this study, our objective was to investigate the moderating effects of gender, age and self-efficacy, in the context of nursing mobile decision support in Jordan. Although the moderators identified in this study were based on the extant literature, we found a little moderating impact for these factors in the proposed model. Future studies may look at additional moderators that are more related to the context of nursing staff adoption of mobile applications that support nursing staff decisions, such as experience years, education level and income.

Other limitation could be the small size of the nursing staff sample from only three hospitals in Jordan. Consequently, they might not represent the various segments of the nursing staff in healthcare in Jordan.

Finally, we recommend other researchers, to conduct additional research in this field, in order to identify other factors that can affect the behavioral intentions to adopt NMDSSs in Jordan, such as perceived quality, compatibility, perceived risk and perceived trust.

6.4 Conclusions

This study attempted to investigate the key factors that affect adoption of NMDSSs by nursing staff in Jordan. These factors include perceived usefulness, perceived ease of use, subjective norms, job relevance, perceptions of external control. In addition, this study intended to investigate the moderating effect of self-efficacy, age and gender.

Perceived usefulness and perceived ease are the most significant factors that influence the individual's behavioral intention to use and adopt the mobile application in their decision support processes. However, subjective norms, job relevance and perceptions of external control do not affect the individuals' intentions to adopt and use NMDSSs.

Perceived ease of use has the greatest direct effect on the perceived usefulness, followed by the effect of perceived usefulness, and the effect of perceived ease of use on the behavioral intention to use NMDSSs.

Self-efficacy has no significant moderating impact on the behavioral intention to adopt and use NMDSS, except on the relationship between perceived ease of use and the behavioral intentions to use NMDSSs, and the relationship between perceived ease of use and the perceived usefulness of NMDSSs.

Age has no moderating impact on the behavioral intention to adopt and use NMDSSs. Gender has no moderating impact on the behavioral intention to adopt and use NMDSS, except on the relationship between subjective norms and the behavioral intention to use NMDSSs.

7 References

- [1] Shim, J. P., Warkentin, M., Courtney, J. F., Power, D. J., Sharda, R., & Carlsson, C. (2002). Past, present, and future of decision support technology. *Decision support systems*, 33(2), 111-126. [https://doi.org/10.1016/S0167-9236\(01\)00139-7](https://doi.org/10.1016/S0167-9236(01)00139-7)
- [2] Aldhmour, F. M. and Eleyan, B. M. (2012) "Factors influencing the successful adoption of decision support systems the context of Aqaba special economic zone authority", *International Journal of Business & Management*, Vol. 7 No. 2, p163-178. <https://doi.org/10.5539/ijbm.v7n2p163>
- [3] Turban, E. (1990). *Decision support and expert systems: management support systems*. Prentice Hall PTR.
- [4] Tripathi, K. P. (2011). Decision support system is a tool for making better decisions in the organization. *Indian Journal of Computer Science and Engineering (IJCSE)*, 2(1), 112-117.
- [5] Laudon, K.C., & Laudon, J.P., (2007). *Management Information Systems*, USA, Prentice-Hall, PTR Upper Saddle River.
- [6] Kim, Y. H., Kim, D. J., & Wachter, K. (2013). A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention. *Decision Support Systems*, 56, 361-370. <https://doi.org/10.1016/j.dss.2013.07.002>
- [7] Davis, F. (1989). 'Perceived usefulness, perceived ease of use, and User Acceptance of Information Technology', *MIS Quarterly*. Vol. 13, No. 3, pp. 318-339. <https://doi.org/10.2307/249008>

- [8] Venkatesh, V. and Davis, F. (2000). 'A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies', *Management Science*. Vol. 46, No. 2, pp. 186-204. <https://doi.org/10.1287/mnsc.46.2.186.11926>
- [9] Burstein, F., Cowie, J., Zaslavsky, A., & San Pedro, J. (2008). Support for real-time decision making in mobile financial applications. *Information Systems and E-Business Management*, 6(3), 257-278. <https://doi.org/10.1007/s10257-008-0090-4>
- [10] Pérez, I. J., Alonso, S., Cabrerizo, F. J., & Herrera-Viedma, E. (2008). A decision support system based on mobile internet. In *XIV Congreso Español sobre Tecnologías y Lógica fuzzy*(pp. 241-247).
- [11] Power, D. J. (2013). Mobile decision support and business intelligence: an overview☆. *Journal of Decision Systems*, 22(1), 4-9. <https://doi.org/10.1080/12460125.2012.760267>
- [12] Lin, M. K. (2012). Evaluating the acceptance of mobile technology in healthcare: development of a prototype mobile ECG decision support system for monitoring cardiac patients remotely (Doctoral dissertation, University of Southern Queensland).
- [13] Ketikidis, P., Dimitrovski, T., Lazuras, L., & Bath, P. A. (2012). Acceptance of health information technology in health professionals: An application of the revised technology acceptance model. *Health informatics journal*, 18(2), 124-134. <https://doi.org/10.1177/1460458211435425>
- [14] Pedro, J. S., Burstein, F., Wassertheil, J., Arora, N., Churilov, L., & Zaslavsky, A. (2005). On development and evaluation of prototype mobile decision support for hospital triage. In *System Sciences, 2005. HICSS'05. Proceedings of the 38th Annual Hawaii International Conference on* (pp. 157-157). IEEE. <https://doi.org/10.1109/HICSS.2005.464>
- [15] Fishbein, M. and Ajzen, I. (1975). 'Belief, Attitude, Intentions and Behavior: An Introduction to Theory and Research', Boston: Addison-Wesley.
- [16] Jaafreh, A. and Al-Abedallat, A. (2011) "The Relationship between National Culture and DSS Usage in Jordanian Banking: A Proposed Conceptual Framework" *European Journal of Economics, Finance and Administrative Sciences*, ISSN 1450-2275 Issue 42.
- [17] Dulcic, Z., Pavlic, D., & Silic, I. (2012). Evaluating the intended use of Decision Support System (DSS) by applying Technology Acceptance Model (TAM) in business organizations in Croatia. *Procedia-Social and Behavioral Sciences*, 58, 1565-1575. <https://doi.org/10.1016/j.sbspro.2012.09.1143>
- [18] Hsiao, J. L., Chen, R. F., & Wu, W. C. (2013). Factors of accepting pain management decision support systems by nurse anesthetists. *BMC medical informatics and decision making*, 13(1), 16. <https://doi.org/10.1186/1472-6947-13-16>
- [19] Gustavsson, G. G. (2009). Applying the TAM to Determine Intention to Use a DSS. *Information Systems*, 62-67.
- [20] Dishaw, M.T. and Strong, D.M. (1999) Extending the Technology Acceptance Model with Task-Technology Fit Constructs, *Information and Management*, 36, 1, 9-21. [https://doi.org/10.1016/S0378-7206\(98\)00101-3](https://doi.org/10.1016/S0378-7206(98)00101-3)
- [21] Torres, C. A. (2011). Examining the Role of Anxiety and Apathy in Health Consumers' Intentions to Use Patient Health Portals for Personal Health Information Management. ProQuest LLC. 789 East Eisenhower Parkway, PO Box 1346, Ann Arbor, MI 48106.
- [22] Venkatesh, V. and Bala, H. (2008) 'Technology Acceptance Model 3 and a Research Agenda on Interventions', *Decision Sciences*, Vol. 39, No. 2, pp. 273-315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- [23] Peker, C. (2010). An Analysis of The Main Critical Factors that Affect the Acceptance of Technology in Hospital Management Systems. Unpublished Doctoral Dissertation. Ankara: Graduate School of Informatics of Middle East Technical University.

- [24] Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003). 'User acceptance of information technology: Towards a unified view', *MIS Quarterly*. Vol. 27, No. 3, pp. 425-478. <https://doi.org/10.2307/30036540>
- [25] Mun, Y. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International journal of human-computer studies*, 59(4), 431-449. [https://doi.org/10.1016/S1071-5819\(03\)00114-9](https://doi.org/10.1016/S1071-5819(03)00114-9)
- [26] Alenezi, A. R., Karim, A. M. A., & Veloo, A. (2010). An Empirical investigation into the role of enjoyment, computer anxiety, computer self-efficacy and internet experience in influencing the students' intention to use e-learning: A case study from Saudi Arabian Governmental Universities. *TOJET: The Turkish Online Journal of Educational Technology*, 9(4).
- [27] Islam, M. A., Khan, M. A., Ramayah, T., & Hossain, M. M. (2011). The adoption of mobile commerce service among employed mobile phone users in Bangladesh: self-efficacy as a moderator. *International Business Research*, 4(2), 80. <https://doi.org/10.5539/ibr.v4n2.p80>
- [28] Czaja, S. J., & Sharit, J. (1998). Age differences in attitudes toward computers. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 53(5), P329-P340. <https://doi.org/10.1093/geronb/53B.5.P329>
- [29] Morris, M. G., Venkatesh, V., & Ackerman, P. L. (2005). Gender and age differences in employee decisions about new technology: An extension to the theory of planned behavior. *IEEE transactions on engineering management*, 52(1), 69-84. <https://doi.org/10.1109/TEM.2004.839967>
- [30] Jose Liebana-Cabanillas, F., Sanchez-Fernandez, J., & Munoz-Leiva, F. (2014). Role of gender on acceptance of mobile payment. *Industrial Management & Data Systems*, 114(2), 220-240. <https://doi.org/10.1108/IMDS-03-2013-0137>
- [31] Li, S., Glass, R., & Records, H. (2008). The influence of gender on new technology adoption and use—mobile commerce. *Journal of Internet Commerce*, 7(2), 270-289. <https://doi.org/10.1080/15332860802067748>
- [32] Karjaluoto, H., Lehto, H., Leppäniemi, M., & Jayawardhena, C. (2008). Exploring gender influence on customer's intention to engage permission-based mobile marketing. *Electronic markets*, 18(3), 242-259. <https://doi.org/10.1080/10196780802265793>
- [33] Wang, Y. S., Wu, M. C., & Wang, H. Y. (2009). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British journal of educational technology*, 40(1), 92-118. <https://doi.org/10.1111/j.1467-8535.2007.00809.x>
- [34] Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). *Multivariate data analysis* (Vol. 5, No. 3, pp. 207-219). Upper Saddle River, NJ: Prentice hall.
- [35] Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information systems research*, 14(2), 189-217. <https://doi.org/10.1287/isre.14.2.189.16018>
- [36] Kock, N. (2015). PLS-based SEM algorithms: The good neighbor assumption, collinearity, and nonlinearity. *Information Management and Business Review*, 7(2), 113.
- [37] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 39-50. <https://doi.org/10.2307/3151312>
- [38] Banderker, N., & Van Belle, J. P. (2009). Adoption of Mobile Technology by Public Healthcare Doctors: A Developing Country Perspective. *International Journal of*

- Healthcare Delivery Reform Initiatives (IJHDRI), 1(3), 38-54. <https://doi.org/10.4018/jhdri.2009070103>
- [39] Wu, J. H., Wang, S. C., & Lin, L. M. (2007). Mobile computing acceptance factors in the healthcare industry: A structural equation model. *International journal of medical informatics*, 76(1), 66-77. <https://doi.org/10.1016/j.ijmedinf.2006.06.006>
- [40] Sun, Y., Wang, N., Guo, X., & Peng, Z. (2013). Understanding the acceptance of mobile health services: a comparison and integration of alternative models. *Journal of Electronic Commerce Research*, 14(2), 183.
- [41] Compeau, D. R. and Higgins, C. A. (1995). 'Application of social cognitive theory to training for computer skills', *Information Systems Research*, Vol. 6, No. 2, pp.118-143. <https://doi.org/10.1287/isre.6.2.118>

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Appendix (see next page)

Table A1: Modified survey questionnaire and factor loadings

<i>Construct</i>	<i>Item</i>	<i>Loading</i>
Perceived Usefulness	Using a mobile phone in decision support system will improve my performance in my job.	(0.936)
	Using a mobile phone in decision support system will increase my productivity in my job.	(0.948)
	Using a mobile phone in decision support system will enhance my effectiveness in my job.	(0.557)
	I find a mobile phone in decision support system will be useful in my job.	(0.935)
Perceived Ease of Use	I think that learn to use a mobile phone to apply decision support system for me is clear and understandable.	(0.622)
	I think that using a mobile phone in support of decision support system does not require a lot of my mental effort.	(0.891)
	I find that the use of a mobile phone in support of decision support system is easy to use.	(0.898)
	I find it easy to get the mobile decision support system to do what I want it to do.	(0.838)
Subjective Norm	I think People who influence my behavior think that I should use the mobile decision support system.	(0.871)
	People who are important to me think that I should use the mobile decision support system.	(0.874)
	I think senior management in hospital has been helpful in the use of the mobile decision support system.	(0.859)
	In general, the hospital I work in has supported the use of the mobile decision support system.	(0.792)
Job Relevance	I think that using mobile decision support system is important for accomplishing the tasks and duties assigned to me.	(0.919)
	I think using mobile decision support system in my job will be appropriate and relevant.	(0.924)
	I think that using of the mobile decision support system is pertinent to my various job-related.	(0.616)
Perceptions of external control	I think that I have control over using the mobile decision support system.	(0.870)
	I think that I have the resources necessary to use the mobile decision support system.	(0.840)
	I think that when resources opportunities and knowledge are necessary it will be easy for me to use the mobile decision support system.	(0.510)
	I think that the use of mobile decision support is incompatible with other applications that I use.	(0.762)
Behavioral Intention	I intend to use the mobile decision support system more frequently if the service is available.	(0.937)
	I predict that I will use the mobile decision support system in the future.	(0.946)
	I will deal with the mobile decision support system in the future, if the service is available.	(0.939)

Note: Measurement items were adapted from Venkatesh and Bala [22].