

# Medical students' awareness of Personal Digital Assistant Devices' impact on their health

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## ABSTRACT

**Aims:** 1. To evaluate medical students' awareness of personal digital assistant devices impacts on their overall health. 2. To estimate medical students' hours on digital devices. 3. To determine the most common effect of personal digital assistant devices on medical student health. **Settings and Method:** This descriptive cross-sectional study was conducted at the college of medicine of a in Riyadh, Saudi Arabia. The participants were medical students, and a questionnaire consists of 3 sections was used. A sample of 289 medical students participated in the study. Kruskal-Wallis test was used to analyze the relationship between the knowledge score and the year of study. **Statistical Analysis used and Results:** The research included medical students whose ages ranged from 19 to 25 years with a median (IQR) of 22.00 (21.00-23.00). Approximately, 56% of the participants were males, and the majority of the students were from year 3. The average hours spent daily while using PDA for studying was 5 hours with SD 2.7. 167 (58%) of the students reported that studying using PDAs has affected their life. The most experienced effects reported was dry eyes and vision problems 53 (54%). **Conclusions:** The current study revealed that the majority of medical students have adequate knowledge of PDAs' effects on their health despite their continuous use. More attention should be paid to reduce the effects on their health by raising campaigns to increase the awareness of all the students and the community.

**Keywords:** Awareness, effects, health, knowledge, medical students

## Introduction

As a result of the enormous industrial and technological revolution that has invaded the world recently, Personal Digital Assistant Devices (PDAs), computer-based programs designed to assist a user by performing basic tasks,<sup>[1]</sup> has developed and is still developing to meet its many different needs with ease, less time, and effort. Furthermore, it has contributed to the development of

many domains, most notably the communication that has made the world connected as if they are in a small spot all together. PDAs' significance goes back to the complicated and advanced features they have. They carry many advantages that have helped the prosperity of society by providing information and making it more easily accessible through quick texting and recording. Many studies that had been conducted between 1983-2005 appeared that with time, more digital technology devices are being used. The former studies indicate that with the progressive development of the human lifestyle, PDAs are developing to fit the needs of the customer making it hard for all to abandon.<sup>[2]</sup>

At the present time, keeping up with technology development has become a necessity including students since it facilitates

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the learning process.<sup>[2,3]</sup> Nowadays, the majority of students use Personal Digital Assistant devices like laptops or iPads for various reasons. Starting with taking notes, many programs are available for the convenience of students as they enable them to take notes and record the lectures for future need.<sup>[2,3]</sup> Moreover, internet accessibility makes the learning process informative as the students can search for online libraries and websites for more information. Finally, Personal Digital Assistant devices strengthen students' collaboration. To give an illustration, students can use a wide array of tools, such as Google services as they provide schedules, diagrams, summaries with the ability to share it with each member of the group.<sup>[4]</sup> The use of personal digital assistant devices between the medical students is increasing and that goes back to their main features mentioned previously. Besides the personal digital assistant devices' main uses in the class, a study showed that it helped in improving the academic performance of the students.<sup>[5]</sup> Moreover, personal digital assistant devices are an effortless way to communicate and share information between medical students. Despite all the previous advantages, personal digital assistant devices can be used in both ways, benefiting and harming students. A study that was conducted in Saudi Arabia shows that besides being an external distraction in class, personal digital assistant devices affect the medical students' concentration negatively during the lecture.<sup>[6]</sup> Another study showed that personal digital assistant devices influence the student's health as it makes their health more susceptible to diseases.<sup>[7]</sup>

Regardless of personal digital assistant devices' fundamental role and their importance, they have serious impacts on human body systems and their functions. First, electronic devices including PDAs have radiation that extends from low to high Range. This radiation is affecting the human's inner parts such as the eyes, ears, and the nervous system, and especially the brain. Many medical students are not aware that they are progressively bounded by technologies that release radiation in the equivalent radiofrequency percentage of the electromagnetic range.<sup>[7]</sup> Second, another drawback of the personal digital assistant device is the appearance of visual symptoms. A study showed that from 64% to 90% of computer users had encountered visual symptoms which might compromise their vision such as asthenopia, photophobia, keratoconjunctivitis sicca, headaches, diplopia, and unclear vision when they are looking into adjacent objects after using the computer longer than 11 hours.<sup>[8]</sup> Finally, multiple research shed the light on the effects of electronic devices including PDAs on specific anatomical parts of the brain such as the white and gray matter. Numerous studies showed decay in the gray matter areas in internet addicts.<sup>[9-12]</sup> One of the areas that were affected is the frontal lobe, that has the role of prioritizing and forming decisions which is known for decision-making. A discovery of specific concern was harm to a part known as the insula, which elaborates in our capacity to improve empathy and consideration for others and our capability to assimilate physical signals with feelings. While several other studies focused on the white matter and the impacts of electronic devices involving PDAs on it. Those studies showed that there

is abnormal integrity in the white matter in people who are internet addicts.<sup>[10-14]</sup>

In Spite of all these impacts which are mentioned in research and studies, up to 2018, there has been inadequacy in research which study the medical students' awareness, knowledge or perception of a situation or fact<sup>[15]</sup>, about the effects of personal digital assistant devices on their health. Current study assessed the extent of the medical students' awareness about personal digital assistant devices and their influence on health.

## Subjects and Methods

### Study design and area and settings

This descriptive cross-sectional study was conducted at the college of medicine of a university in Riyadh, Saudi Arabia between September – 2018 and March – 2020. To be qualified for the study, firstly, the participants must be medical students from the same university from year 3, year 4, year 5, and year 6 and both male and female were included. Second, they ought to use personal digital assistant devices for study purposes. The study's data can be used for various studies and its findings can establish new recommendation and research papers. The date of approval is 6/5/2019.

### Identification of study participants

As mentioned previously, our targeted population were medical students from KSAU-H in Riyadh. Together male and female students from year 3, year 4, year 5, and year 6. Stream one students who enter medical school directly with no previous bachelor's degree, and stream two students who have a bachelor's degree were both included. Furthermore, we calculated our required sample size by Raosoft calculator. The recommended sample size was 289 with a margin of error of 5%, a confidence level of 95%, and a population size of 1156. Before distributing the survey questionnaires on our convenience sample of 289 medical students, consent was acquired from the dean of the college of medicine and the medical students. Before collecting data, 3 researchers explained the aim of this study to all qualified participants of college of medicine. To ensure confidentiality, the researchers informed all of the participants that they would stay unidentified, the participation was voluntary, and that they had the opportunity to decline to contribute at any time or not to finish the survey questionnaire.

### Data collection process

A self-administered online questionnaire was used in the research. The survey has 3 sections, "demographic information", "PDAs usages" and "Assessing the knowledge of the PDAs effects". The first section of the questionnaire collected the demographic information, such as age, year of study, and gender. Also, a clinical characteristic was collected such as the weight and height for BMI. The second section included 7 questions about the student's usage of PDAs, for example, which PDA did the

student use and for how many hours did he/she use it a day. The last section of the questionnaire was an 11-questions section to measure the student's awareness about the PDAs effects on health. The 11 questions were organized depending on body systems. In order to answer the question, the students should choose between 5 responses: "strongly agree", "agree", "I do not know", "disagree", and "totally disagree". The students who choose "strongly agree" or "agree" were scored 1 while the ones who choose "I do not know", "disagree", and "totally disagree" were scored 0. After that, we assessed the overall score to measure the students' knowledge. These answers were scored from 0 to 4 to assess the overall score to measure the students' knowledge. The questionnaire was validated using a Pilot test with a sample of 17 students that is 5% of the total sample size. with a maximum score being 10 and the minimum 4). Some biases that were faced in the online questionnaire is under-represented sample who have poor internet access or does not prefer internet questionnaire. Moreover, the online questionnaire is often based on self-selection which means that it was completely left to individuals to select themselves for the survey. The data were categorized into 4 groups depending on the year of study. Each group had a specific mean that is used to measure the knowledge level for the students in the same year of study. From that, the knowledge level was compared from each year of study to the other. Participation was voluntary, and participants had the right to withdraw at any stage of the study. In addition, the study was made to ensure participant safety and no psychological harm would affect them. The questionnaire was provided with a consent form. To ensure confidentiality, there were no names require.

## Data analysis

Data analyses were carried out by software SPSS version 20. For quantitative variables such as age, height, weight, and PDA usage hours were calculated and reported in terms of mean and the standard deviation, where data does not follow normal distribution Median with interquartile ranges were reported. Frequencies and percentages were calculated to report qualitative variables such as gender, year of study, and streams. Non-parametric tests were conducted to assess the associations of important qualitative variables with knowledge scores as it was not normally distributed. Man – Whitney U test was used to assess the significance difference in knowledge score between male and female gender. In addition, the test was used to evaluate the association between the stream levels and the knowledge score. Kruskal – Wallis test was performed to assess the significance between the knowledge score by the year of study. The student's knowledge score was evaluated by using the total scores in which a student who scored  $\leq 5$  was considered as poor knowledge whereas  $\geq 6$  was considered as adequate knowledge about PDAs effects on health.

## Results

### Demographic characteristics

The demographic characteristics of the students are displayed

in Table 1. The study has a total of 289 participants. The median (Interquartile range) age of the study participants was 22.00 (21.00 – 23.00) years old with male being the dominant gender (n = 161, 56%). Eighty-four (29%) of the participants were from year 3. Sixty-one (21%) were from year 4. Eighty-two (28%) were from year 5. Sixty-two (22%) were from year 6. Majority of the participants were from stream 1 with a percentage of 259 (90%). The mean BMI of the study was  $25 \pm 5.40$  which consider overweight. 138 (48%) do not exercise. 151 (52%) exercise weekly.

### Usage of personal digital assistant devices (PDAs)

The most device being used by students for the purpose of studying were laptops with a total of 272 (94%) whereas mobile phones were the least devices being used for the same purpose with the percentage of 1 (n = 3). Out of 289 participants, 149 (51.60%) students used both papers and PDAs but preferred PDAs more during studying. However, we recorded 0 responses from students who used papers/books only for studying. The mean (SD) years when students started using PDAs are 4 (2.30) years. The mean (SD) hours students spent on PDAs daily is 5 (2.70) hours. 167 (58%) of the students believed that studying using PDAs have affected their life. In contrast, 122 (42%) believed the contrary. 167 participants had reported the effects of PDAs they had as the following: 94 (32%) were affected mentally, 90 (31%) were affected physically, and 40 (14%) were affected socially. The most effect the students experienced while using

**Table 1: Demographic characteristics**

Variable	n (%) mean (SD) n=289
<b>Section 1: Basic Demographics</b>	
Age (in year)	
Median (Q1-Q2)	22.00 (21.00 - 23.00)
Year of study	
3 <sup>rd</sup>	84 (29%)
4 <sup>th</sup>	61 (21%)
5 <sup>th</sup>	82 (28%)
6 <sup>th</sup>	62 (22%)
Gender	
Male	161 (56%)
Female	128 (44%)
Stream	
Stream 1	259 (90%)
Stream 2	30 (10%)
Height (cm)	
Mean (SD)	168.20±9.00
Weight (kg)	
Median (Q1-Q2)	70.00 (58 - 80.5)
Body Mass Index (kg/m.sq)	
Mean (SD)	25.00 (5.4)
During last week, how many hours did you exercise?	
No exercise	138 (48%)
30 min-2 hours	92 (32%)
3-5 hours	34 (12%)
6-9 hours	17 (6%)
More than 9 hours	06 (2%)

**Table 2: Use of Personal Digital assistance (PDAs)**

Section 2: Use of Personal Digital assistance (PDAs)	
PDA you use for studying at home and collage	12 (4%)
PC	272 (94%)
Laptop	14 (5%)
Tablet	03 (1%)
iPhone/phone	
you prefer studying by PDAs/or paper based	
Only PDAS	76 (26.3%)
Only papers\books	-
both, more PDAs	149 (51.6%)
both, more papers\books	64 (22%)
When did you start using PDAs to facilitate your learning (year ago)?	4.0 (2.3)
Mean (SD)	
Number of hours/days do you spend on PDAs while studying (on average)	5.00 (2.7)
Mean (SD)	
Do you believe that studying using PDAs has affected your life?	
Yes	167 (58%)
No	122 (42%)
How does it affect	
Mentally	94 (32.5%)
Physically	90 (31.%)
Socially	40 (14%)
No	86 (30%)
I don't know	36 (12.5%)
please specify and describe the effect you had	
dry eyes/vision problem/other eyes related problems	53 (54.6%)
Headache/migraine	19 (20%)
Backache/neck ache	04 (4.0%)
Tiredness/fatigue	12 (12.4%)
Physical problem/less active/overweight/muscular pain	23 (24%)
Mental problem/less focused/less attentive/weak memory/sleep disturbance/slow learning ability	05 (5.2%)
Less socially active/isolated	
Rate the degree of severity of the effect you had	
Mean (SD)	5.20 (2.12)

the PDAs was eye-related problems such as myopia and dry eyes with a total of 53 (54%) responses. Followed by concentration difficulties and weak memory with 23 (24%). Other effects are labeled in Table 2.

### Assessment of knowledge about PDAs effects

Table 3 labels the current status of knowledge among the medical students of a university in Riyadh, Saudi Arabia. Each question has 5 responses “strongly agree”, “agree”, “I do not know”, “disagree”, and “totally disagree”. Knowledge was assessed by asking questions about the PDAs effects on health. knowledge score ranged from 11 (maximum) to 0 (minimum). A cut off level of  $\leq 5$  was considered as poor knowledge whereas  $\geq 6$  was considered as adequate knowledge. Knowledge scores for individuals were calculated and summed up to give

**Table 3: Knowledge scores**

	Knowledge score median	Knowledge score IQR
Gender:		
Male (n=161)	7.0	(5-9)
Female (n=128)	8.0	(6 - 9)
Mann-Whitney: P	0.038	Significant
Year of study:		
Year 3 (n=84)	7.0	(5-9)
Year 4(n=61)	8.0	(6 - 9)
Year 5 (n=82)	7.0	(5 - 9)
Year 6 (n=62)	7.0	(6 - 8.25)
Kruskal-Wallis P	0.525	Insignificant
Stream:		
Stream 1 (n=259)	7	(6 - 9)
Stream 2 (n=30)	8	(6.57 - 9)
Mann Whitney P	0.463	Insignificant

the total knowledge score. The mean (SD) knowledge score for the entire cross-sectional study was 7.15 (2.386). For female, the median (IQR) knowledge score was 8.0 (6.0–9.0) whereas the male students mean was 7.0 (5.0–9.0). The median knowledge scores between male and female were found to be significantly different. For all the years, stream 2 median (IQR) scored 8.0 (6.75–9.0) whereas stream 1 scored 7.0 (6.0–9.0), there is no significant difference between two streams in terms of knowledge score. The knowledge median (IQR) score for the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> year students were 7.0 (5.0–9.0), 8.0 (6.0–9.0), 7.0 (5.0–9.0), and 7.0 (6.0–8.25), respectively. There is no significant difference found in knowledge score among all four 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> years of students.

### Discussion

The purpose of the present study was to assess the medical students' knowledge about PDAs' effects on their health. We found that medical students had reasonably good knowledge. Among 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> year students the median knowledge scores fall between 7.0 and 8.0, which considered high knowledge as it was above 5. In addition, a previous medical background may play a role in the students' knowledge our research revealed no significant association between stream levels and knowledge scores. Stream 2 knowledge median (IQR) score was 8 (6.57 – 9.0) while stream 1 median (IQR) knowledge score was 7 (6.0 – 9.0). Moreover, an association between gender and knowledge score was observed significantly different with the female's median (IQR) was 8.0 (6.0 – 9.0) higher than the male's median (IQR) was 7.0 (5.0 – 9.0).

In our study, approximately 149 (51.6%) (of the students rely completely on PDAs only while studying and 64 (22%) use both PDAs and books. This finding discloses that although the overall knowledge score was high, majority of the medical students are using PDAs despite their impact. This finding supports a study in Oman showed that 90% of the students were knowledgeable regarding the electromagnetic waves



effect on their health. However, 100% of the students were still using PDAs.<sup>[16]</sup> Moreover, 58% of the students reported that using PDAs has affected their lives. The mental effect was the topmost effect followed by physical effect. These findings are crucial as they represent how PDAs are influencing the student's health which may worsen through the years as a long-term impact. A study concluded that with the increase in the computer users number there is an increase in the risk of having cvs Vision Syndrome (CVS) which is a syndrome with symptoms like headache, eye strain, double vision, dry eyes, eye fatigue.<sup>[17]</sup> Additionally, our study discovered that eye-related problems, such as dry eyes and vision problems, were reported as the highest effect the students experienced as a result of the long-spending hours on PDAs. A study showed that using the PDAs has a negative effect on the medical students' academic performance.<sup>[18]</sup> In our study, 24% of the students reported that they experienced a decrease in their concentration level and weak memory problem, which can affect their academic performance. In another study, medical students who were using PDAs reported symptoms like sleep disturbances, loss of attention, arm and neck muscle spasm, and headache.<sup>[17]</sup> Therefore, it is necessary to set specific regulations and guidelines regarding PDAs usage to all students to reduce these effects as a study recommended to introduce more safety measures to avoid adverse effects.<sup>[16]</sup>

Our study demonstrates that students use PDAs for 5 hours a day on average, and this number could be higher or lower depending on the daily tasks the student works on. In Oman, medical students use their PDAs on average of 4 hours a day.<sup>[16]</sup> In the USA, it has been found that adults spent 4-6 hours a day on PDAs.<sup>[19]</sup> In Jeddah, Saudi Arabia, it was reported that medical students use PDAs on average of 6 hours a day.<sup>[20]</sup> In the future, PDAs usage will increase due to global technological development. Medical students will become residents and it had proven that residents/fellows use PDAs more than medical students,<sup>[21]</sup> highlighting the need to acknowledge the students more about using the PDAs in a healthy way with reasonable hours. Additionally, a study that had been conducted for 4 years proved that medical students' health decreases during the 4 college years with an obvious physical change in the students' fitness.<sup>[22]</sup> In our study, almost half of the students reported that they don't exercise, which considered important as it shows that half of the medical students are not adapting a healthy lifestyle besides their long sitting hours on PDAs. This signifies the need to increase medical students' awareness about PDAs' impacts on health.

## Conclusion and Recommendation

Regardless of continuous use of PDAs' among medical students of King Saud bin Abdulaziz University for Health Sciences, the results of this study revealed a satisfactory level of knowledge about PDAs' effects on their physical, mental health and social life. To a profitable evaluation of knowledge and attitude of medical students towards PDAs' impacts, the key points for

future consideration regarding replication of this kind of research can be planned on a large scale involving various public and private medical colleges and universities with different academic years. In addition, to accomplish a noteworthy decrease in the prevalence of PDAs' effects on health, primary care physicians carry the responsibility for educating the general population about the effects of PDAs on their overall health. They can share their knowledge to younger medical students by teaching them how PDAs can affect their life. Additionally, raising awareness can be done by different means one of which is that the research plays a role in increasing the standard of care that physicians can provide to their patient. Eventually, enhance the community awareness about adopting healthy practices while using PDAs' such as paying attention to their postures, taking regular breaks, and exercising regularly will decrease in the prevalence of PDAs' effects on health.

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## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

## Key Messages

More attention should be paid to reduce the prevalence of PDAs' effects on health by raising campaigns to increase the awareness in medical and public institutions. Similarly, enhance the community awareness about adopting healthy practices while using PDAs' such as paying attention to their postures, taking regular breaks, and exercising regularly.

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## Conflicts of interest

There are no conflicts of interest.

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