

# TABLET USE WITHIN MEDICINE

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## ABSTRACT

This paper discusses the scholarly literature related to tablet computer use in medicine. Forty-four research-based articles were examined for emerging categories and themes. The most studied uses for tablet computers include: patients using tablets to complete diagnostic survey instruments, medical professionals using tablet computers to view radiology results in order to make a diagnosis or share results with patients at the bedside, and surgeons using tablet computers to view and manipulate patient specific three dimensional images during surgery. In addition, educational uses of tablet computers included: tablets to support patient education and medical residents using tablets as portable computers in clinical settings. These uses indicate that within medicine, tablet computers are being used for more than just providing convenient anytime anywhere access to reference material.

## KEYWORDS

iPad, tablet computer, medical education

## 1. INTRODUCTION

There have been many announcements regarding the use of the current generation of tablets, such as Apple's iPad, by students at medical schools; for example, Stanford School of Medicine (White, 2010) and Yale School of Medicine (Dodson, 2011). The primary purpose of these initiatives is to reduce the amount of paper curriculum materials by providing digital versions of textbooks and other curriculum documents. However, the use of tablets in medicine goes beyond providing easy access to reference materials and replacing textbooks. In this paper, the author examines the scholarly literature to determine how tablets are being used in medicine and medical education.

## 2. METHODOLOGY

The US National Library of Medicine National Institutes of Health database, PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), was searched on November 3, 2012 for "iPad" or "tablet computer" for articles published after January 1, 2011. The current generation of tablets were launched with Apple's release of the first generation iPad in March 2010. Articles regarding tablet computers published prior to January 1, 2011 represent opinions about the potential of the technology or refer to the older generation of tablet technology such as the Tablet PC, and as such, were excluded from this literature review. The search resulted in 92 articles. Articles not relating to tablet technology were excluded (e.g. articles relating to the ipaD gene function) leaving 65 articles to be reviewed. Of these articles, 21 were not research-based articles, such as: advertisements, lists of apps, commentary, or editorial. The remaining 44 research-based articles were reviewed for emerging categories and themes.

## 3. RESULTS AND DISCUSSION

Two methods of categorization emerged from the review: (1) how the tablet computers were used in the study (i.e. reference/patient education, data collection/diagnostic, or treatment), and (2) who used the devices in the study (i.e. patient, medical professional, or medical educator/student). Four articles did not fit within

the classification system. Table 1 illustrates the number of articles in each category. The results help to highlight that medical educator and student tablet use focuses on providing easy access to reference material, where as medical professional use of tablets focuses on collection of patient data, diagnostics, and treatment.

Table 1. Summary of number of articles in each category.

	Reference/ Patient education	Data Collection/ Diagnostic	Treatment	Total
Patient	★★★★★ 5	★★★★★ ★★ 7	★★★★ 4	16
Medical professional	★★ 2	★★★★★ ★★★★ 9	★★★★★ 5	16
Medical educator/ Student	★★★★★ 5	★★ 2	★ 1	8
Total	12	18	10	

### 3.1 Studied Uses for Tablets in Medicine

The most studied uses for tablets include: patients using tablets to complete diagnostic survey instruments (n=7), medical professionals using tablet computers to view radiology results in order to make a diagnosis or share results with patients at the bedside (n=7), and surgeons using tablet computers to view and manipulate patient specific three dimensional images during surgery (n=4). In addition, educational uses of tablet computers included: tablets to support patient education (n=5) and medical residents using tablets as portable computers in clinical settings (n=3). A description of each of these uses follows.

#### 3.1.1 Patient Use of Tablets to Complete Diagnostic Surveys

Several studies involved the use of tablet computers as a mechanism for patients to complete diagnostic surveys (Holzinger et al., 2011; Harrington et al., 2012; Tomori et al., 2012). Rather than asking the patients to complete a paper survey, patients are asked to complete an electronic version of the survey using a tablet. Upon submission, the survey results are automatically stored in the patients' electronic medical record making them immediately available to medical professionals. The benefits to this approach include: (1) immediate calculation of results allowing for faster diagnosis and treatment, (2) more accurate medical records as transcription errors are reduced, and (3) cost savings due to a reduction in printing and the labour associated with transcription. In addition, patients have indicated a preference for the electronic forms (Fritz et al., 2011). Furthermore, the flexibility of the electronic medium allows for surveys in multiple languages, and surveys based upon images for patients with low-literacy levels (Ahmad et al., 2012; Ruamviboonsuk et al., 2012).

#### 3.1.2 Medical Profession Use of Tablets to View Radiology Results

Initial consumer focus has been around tablets as consumption devices, i.e. computers that are used to access content anytime and anywhere. From a medical professional perspective, this translated into a physician's ability to access patient medical records and lab reports from anywhere: for example, an on-call radiologist using an iPad to complete an emergency diagnosis (John et al., 2012). As a result, there have been several tablet research studies involving testing the effectiveness of tablets as tools to view radiology reports for making diagnostic decisions (Christopher et al., 2012; Johnson et al., 2012; Shintaku et al., 2012). The studies compared the diagnostic results between LCD monitors and Apple iPad 2 tablets. In all but one case, the result was 'no significant difference' between the LCD monitor and Apple iPad 2. The one exception was when iPad 2 tablets were used in emergency computed tomography (CT) brain examinations where "the iPad display performed inferiorly to the diagnostic monochrome display" (Mc Laughlin et al., 2012, p.127). This points out the need for additional experimentation and testing leading to guidelines regarding appropriate uses for tablets as tools to support diagnostics.

### 3.1.3 Surgeons Use of Tablets during Surgery

An example of the use of tablets to support treatment in medicine involves the use of iPads in surgery. iPads have proven to be convenient, easy-to-use devices with long battery life, that surgeons can interact with directly while in surgery. The iPad is placed in sterile plastic bag or wrapped using sterile dressing, for example the use of 3M™ Tegaderm™ transparent film dressing to wrap the iPad (Murphy, 2012). The surgeons are then able to access and manipulate the touch screen without the need to remove their gloves. For example, a report by neurosurgeons describes how the iPad can be used to provide the surgeon with access to patient images without the need to leave the operation field. They concluded that accessing "imaging data with sterile gloves on the touch display was more convenient, more precise, and faster compared with other modalities" (Soehngen et al., 2012, p.381). Another example of the innovative use of iPads by surgeons is the use of the iPad camera to superimpose a picture of the patient on the operating table with three dimensional CT images of the patient taken pre-operatively in order to allow the surgeon to better visualize the location of tumors during laparoscopic surgery, that is surgery that is done through a scope without direct view of the tumor (Rassweiler et al., 2012).

### 3.1.4 Tablet Application to Support Patient Education

Tablets have been used to improve patient education. One study relating to cosmetic surgery involved showing patients several pictures demonstrating the possible outcomes of the surgery, both positive and negative. This led to increased patient satisfaction (Wang et al., 2012). In addition, there have also been studies where specialized mobile applications are developed to support public health initiatives such as food safety (Albrecht et al., 2012) and the effects of dietary sugar on dental caries in young children (Levine et al., 2012).

### 3.1.5 Student and Resident Use of Tablets to Support Clinical Learning

With the introduction of tablets at some medical schools, e.g. Yale University Medical School and Stanford University Medical School, and the requirement of students to purchase tablets at other schools, e.g. Brown Medical School (Husain, 2011); studies illustrating the uses and benefits of tablets in clinical learning and clinical teaching are emerging. A study of internal medicine residents at the University of Chicago demonstrated that residents' use of tablets "was associated with improvements in both perceived and actual resident efficiency" (Patel et al., 2012, p. 437), specifically that residents were able to order labs and provide patient education faster with the tablets than without them. In addition, a short article describes Junior Plastic Surgeon's use of tablets to upload photographs of the treatment area of patients, which is then modified with photo editing software to help visualize the different treatment options and plan surgeries (Sadri et al., 2012). These reports are encouraging, as they indicate a possible transition from the tablet as a multimedia enhanced textbook, to the iPad as a tool to improve resident education and patient care.

Although medical schools are requiring the use of tablets, there were only two studies indicating the effectiveness of tablets in undergraduate medical education, specifically: (1) the use of tablet-based resources to support dissection activities in anatomy classes (Mayfield et al., 2012), and (2) the use of images on tablets to teach digital pathology in low-resource countries (Fontelo et al., 2012). The widespread use of tablets in medical schools provides an unmet opportunity for further exploration into how tablets can be used to improve medical education.

## 4. CONCLUSION

As the current generation of tablet technology is not yet three years old, there have only been a small number of studies into the use of tablets within medicine or clinical teaching. As a result, there is only anecdotal evidence to suggest that the use of tablets in medicine or clinical teaching is beneficial. However, the research-based studies examined in this paper suggest that tablet use within medicine is evolving beyond the device as a convenient anytime anywhere method for accessing reference material, to a device that is used to collect patient data, assist with patient diagnosis, assist with patient treatment, and support teaching and learning within a clinical setting.

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