

Impact of Mobile Devices on Clinical Laboratory Data

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Advances in hand-held mobile devices (smart phones and tablets) have the potential to alter the practice of healthcare. How this technology revolution impacts the delivery of health care, in particular, biomedical/clinical laboratory practice has yet to be clearly elucidated. The question addressed in this study was to investigate the impact of wire-less technology on the profession by soliciting input directly from biomedical/clinical laboratorians. Using questionnaires laboratorians were queried how hand-held mobile devices would assist in improving diagnosis, treatment strategies and therapeutic outcomes in patients. It questioned whether the healthcare community feels these devices will make healthcare more cost effective and affordable. The questionnaire was distributed to biomedical/clinical laboratorians globally. One hundred and six questionnaires were analyzed and the overall response rate was found to be significant (P value ≤ 0.05). The respondents concluded the use of hand-held mobile devices have and will continue to improve the efficiency of disseminating laboratory data. Devices will assist in biomedical/clinical assessment of patients through more efficient reporting of test results, eventually providing data directly to the patient. Respondents noted such devices should allow for improved access to web-based medical literature, test procedures, treatment protocols and clinical guidelines. Respondents also reported devices should improve laboratory work productivity and efficiency. This study will to continue to monitor the impact of hand-held mobile devices in other healthcare fields in order to elucidate the impact of mobile devices on healthcare delivery and practice.

Key words: *wireless technology, smartphone devices, laboratory data*

Introduction

Hand-held mobile devices such as smart phones and tablets are used across the world in increasing number. Current projections show the number of hand-held mobile devices will have exceeded the Earth's population by the end of 2015.¹ The widespread use of hand-hand mobile devices has had a significant impact on the

healthcare field. Hand-held mobile devices have the potential to reduce healthcare costs by up to \$197 billion dollars (U.S.) over the next 25 years by reducing the need for office visits and duplicated laboratory tests.² Besides lessening unnecessary costs, hand-held mobile devices also have the potential to reduce the number of errors in the workplace thus leading to better results for patient outcomes as improved healthcare.³

Currently, different hand-held mobile device applications have been developed to facilitate healthcare

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practices. The most simple of these allow patients to continuously monitor their own vital signs: such as, blood pressure, body temperature, heart rate, blood oxygen and glucose levels, and other physiological measures. In addition, there has been a significant transformation on the role of hand-held mobile devices expansion into the realm of medical devices. For example, ultrasounds can now be performed using an attachment for mobile phones. Cardiac monitoring may now be performed through a small patch and viewing results on hand-held mobile devices locally or remotely by a physician. Despite the rapidly growing number of advancements in hand-held mobile healthcare technology, utilization in the field of healthcare is not widespread. With that said these technologies have the potential to improve the quality of patient care as well as their outcomes.

We developed a survey to assess why these powerful new tools are not being utilized to their full potential in the health care setting by canvassing a number of different health care professionals such as nurses, physical therapists, pharmacists, physicians, and biomedical/clinical laboratorians. In addition, the survey also examined the potential uses of wireless devices (defined as smart phones and tablets), their impact and whether physicians thought these devices would improve overall healthcare. We report here the results of survey distribution following evaluation only from laboratory personnel. The survey investigated current views on the usage of hand-held mobile devices in healthcare, specifically the biomedical/clinical laboratory. In addition, the current breadth of hand-held mobile device usage and reasons for their lack of wide spread use with respect to the clinical laboratory were assessed.

Methods

To investigate the impact of hand-held mobile devices in the biomedical/clinical laboratory a survey was developed to assess how these technologies are currently used in a healthcare setting focused on laboratory based medicine. The survey focused on hand-held mobile devices' perceived effect, current views on their use in the biomedical/clinical laboratory and reasons why their use would be limited. This survey was distributed to clinical laboratorians as well as others working in related healthcare fields. The results from assessment of related healthcare fields such as rehabilitation sciences has recently been published.⁴

The questionnaire collected demographic data such

as the participant's job title and the length of time they held their position were used to categorize responses. All participation in the survey was voluntary and results were gathered through Qualtrics, an on-line survey software. Names, titles and the specific location e.g., country of origin of the responders were voluntary and not collected due to privacy concerns. Qualtrics aggregated responses, and data analysis was conducted using Microsoft Excel. The responses were categorized as follows: strongly agree - value of 5 through to strongly disagree - value of 1. These results were modified to make qualitative data that were analyzed to support our theories established in the introduction.

Results

Views on Hand-Held Mobile Device Use in Healthcare

Overall, the healthcare community most strongly agreed that hand-held mobile devices would have the best potential use in accessing medical literature and scientific articles (4.52 ± 0.67) as well as treatment protocols and guidelines (4.46 ± 0.66). It is likely the approval for these uses were the greatest because this is where hand-held mobile devices are currently used the most. Literature access does not require Health Insurance Portability and Accountability Act of 1996 (HIPPA) compliance as controlled data transfer like other uses of mobile devices do. In the United States this law protects patients from disclosure of their personal and medical data and is only shared between a patient and his/her physician. This response was trailed by two similar device uses: distance monitoring of health status and compliance in rural areas to improve accessibility (4.44 ± 0.72) and providing improved healthcare delivery to rural and underserved areas (4.39 ± 0.72). All other issues such as monitoring public health crises, training healthcare workers, collecting community health data, and viewing electronic medical records had similar scores. However, the use with the lowest score was disseminating laboratory data directly to hand-held mobile devices (4.03 ± 1.14).

Current Modes of Hand-Held Mobile Device Usage in Healthcare

The current modes of hand-held mobile device us-

age in healthcare were assessed. The results are presented in **Table 1**. For the category of “Other” participants responses offered additional uses such as viewing laboratory orders and instructions, data collection and reporting, and use at the patient’s bedside. It is important to note that roughly a quarter of participants do not use hand-held mobile devices in their workplace. When queried why they do not utilize hand-held mobile devices, the most common responses included financial or infrastructure limitations, concerns for patient privacy, infectious disease risk, or inertia in dealing with new tech-

nology. For those reporting they use hand-held mobile devices in their work place, an overwhelming majority of participants agreed that the use of hand-held mobile devices enhanced the quality of patient care. A small group expressed it made no difference to the quality of patient care, while no respondents stated hand-held mobile devices decreased the quality of patient care (See Table 1). Similarly, nearly all participants that used hand-held mobile devices would encourage their use in a similar manner at other institutions.

Table 1. Modes of Hand-Held Mobile Device Usage in Healthcare

<i>Method of Use</i>	<i>Response%</i>	<i>Responses</i>
Accessing medical literature, e.g., textbooks, scientific articles & web based information	53%	55
Communication between physicians	35%	36
Reviewing treatment protocols/guidelines	21%	22
Distance, or remote, patient monitoring of health status and compliance	18%	19
Accessing electronic medical records	23%	24
Disseminating laboratory data	18%	19
Communication between physicians and clinical laboratory scientists	26%	27
Communication between physician and patient	11%	11
Monitoring and preventing public health crises and/or emergencies	13%	14
Providing improved healthcare delivery to rural, underserved areas	8%	8
Collecting community and clinic health data	12%	12
Training and educating health care workers	30%	31
Other (please specify)	11%	11
Mobile devices are not used at my work establishment	25%	26

As detailed in **Figure 1** participants were asked questions about the use of hand-held mobile devices in the biomedical/clinical laboratory in three categories: (a) potential advantages, (b) potential disadvantages, and (c) impact on cost. All potential advantages had (an agree-

ment level) over a 4, except the statement that hand-held mobile devices would make the job of the biomedical/clinical laboratorian easier and more efficient (3.45 ± 1.31). Of the potential interest, it was not thought that using hand-held mobile devices to disseminate labora-

tory data would eliminate jobs in the field of biomedical/clinical laboratory science (1.75 ± 0.89). However, the issues of hand-held mobile devices being a threat to patient privacy (2.70 ± 1.25) and a distraction to the physician (2.74 ± 1.31) were more controversial, with scores in the range of disagreement. There was no clear consensus that the use of hand-held mobile devices to

transmit laboratory data would have an effect on the cost of healthcare. The statement that hand-held mobile devices used to transmit laboratory data would increase the cost of healthcare was disagreed with more than the view that these devices would decrease the cost of healthcare, showing statistics of (2.31 ± 1.10) and (2.75 ± 1.27) respectively.

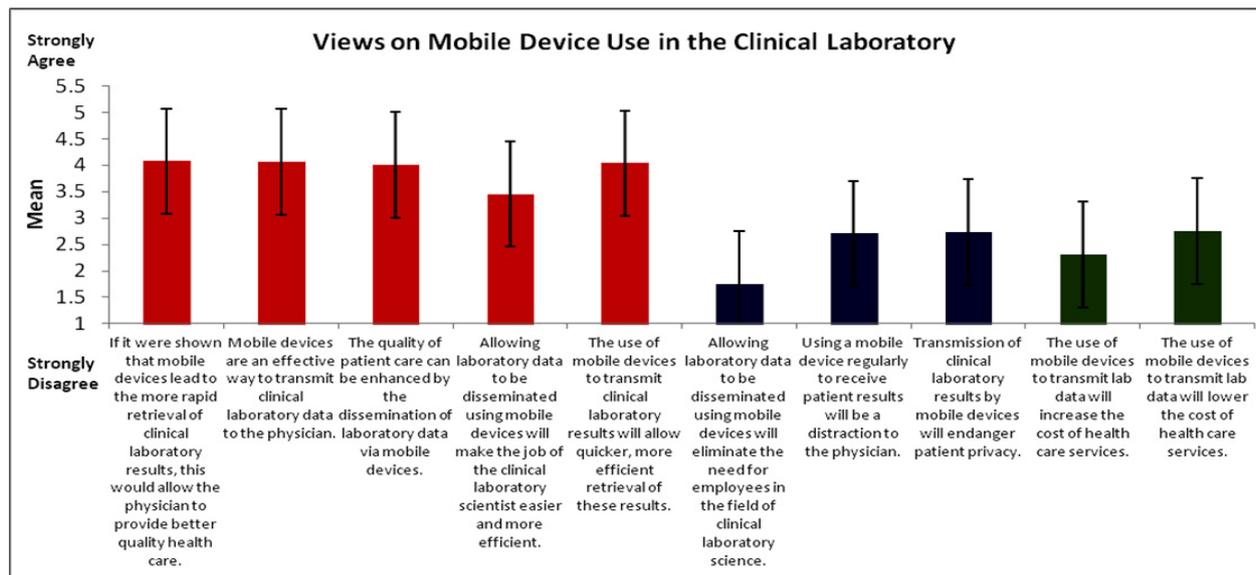


Fig.1 Survey Response Assessment for Hand-Held Mobile Device Use in the Clinical Laboratory (N=106), Code: Red - positive response, mobile devices beneficial; Blue - mobile devices will have negative effects; Green - mobile devices will influence the cost of health care.

Survey Link: https://s.qualtrics.com/SE/?SID=SV_9LhEEPoHyZoK7eI&Preview=Survey&BrandID=clemson.

Discussion

Overall, our results show amongst laboratorians there is approval for the use and expansion of hand-held mobile devices in healthcare. Current approval of hand-held mobile devices is highest when usage targets accessing medical literature and other electronic resources. Based on these responses it is likely hand-held mobile device usage will continue to expand especially in accessing online documentation that supports enhanced clinical practices. However, before hand-held mobile devices can expand into other settings, the concerns discouraging their use must be addressed. These issues are security and HIPAA (defined above) requirements. Compliant platforms for transferring data without threatening patient privacy must be developed, older systems need to be modernized allowing interface with hand-held mobile devices, and methods for using hand-held mobile devices without risking the transfer of infectious agents need to be developed. Additionally,

limitations in technical skills amongst health care personnel can act as a deterrent against adopting hand-held mobile devices for people in the healthcare community.⁵ One of the primary factors in ensuring the growth of hand-held mobile devices in healthcare has been found to be acceptance by the users of the system.⁶ It is important to look at current views toward the usage of hand-held mobile devices to ensure we can accommodate these views as device usage expands in healthcare.

Two important additional factors have been brought to our attention when reviewing and evaluating our survey data: (1) it is conceivable that resistance to the initial and wide-spread use of smart phones and wireless devices may depend on the size of the device itself meaning the size of the screen may challenge the sight of senior laboratory professionals or others with sight problems because the presentation of the data/images are too small meaning individuals will strain to make out precise laboratory data starting with patient identification. With this issue acknowledged the trend in smart phone devices, in general, is to have the larger screens.

Such is the case with the introduction of devices like the (iPhone 6s and comparable android phones) to (2) where devices will be worn rather than carried as in the introduction of the iWatch due for April 2015 release. This new device does not address the issue of screen size as it addresses the personalized nature of allowing the wearer to have basic health parameters consistently monitored such as heart rate, pulse and inactivity meaning if the wearer remains sedentary for a sustained period of 90 minutes an alarm will warn the wearer to this fact, thus allowing the wearer to become more physically active, if he or she decides to do so.

Those currently using hand-held mobile devices (smart phones and tablets) in their practices almost exclusively thought that hand-held mobile devices enhance the quality of patient care and encourage increased use of mobile devices at other institutions. This is also reflected when in evaluating the data comparing use of these mobile hand-held devices into two specific populations: (1) those that use them in their work and (2) those that do not. On questions regarding the use of hand-held mobile devices for disseminating, collecting, or viewing medical data, participants who used hand-held mobile devices were significantly more likely to offer strong approval of their use ($p < 0.05$). Combined with the nearly unanimous belief that hand-held mobile device usage improved the quality of care indicates hand-held mobile devices are and will be an important asset for the field of medicine. However, existing opinions by those that not using hand-held mobile devices are preventing a wider acceptance of mobile devices into healthcare and deterring their full potential benefits.

While this survey was able to assess the current usage and views of hand-held mobile devices, further research must be conducted to determine what factors are preventing wider usage of hand-held mobile devices. Important questions remain to be investigated - what is preventing hand-held mobile device use, given the positive impact they have on patient care. Based on this survey, lack of hand-held mobile device use is generally the result of financial and infrastructure limitations or concerns about patient privacy. A number of solutions have been proposed with the United States Government Agency - Department of Health and Human Services (DHHS) recommending measures to protect patient health information on hand-held mobile devices.⁷ Cost issues are being addressed by legislation like the Health Information Technology for Economic and Clinical Health Act, which offers financial incentives for “meaningful” use of electronic health records, and financial penalties for those not using them.⁸ Since solutions cur-

rently exist, the limiting factor for the increasing the rate of hand-held mobile technology adoption into healthcare is the lack of education focusing on their usage. Further research addressing how best to deliver solutions targeting healthcare personnel such that they may improve their adaptation to mobile technology should be conducted.

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