Mobile App versus Web App: a Comparison Using 2008-2012 "PubMed for Handhelds" Server Data

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Abstract

Recent surveys show that mobile apps are more popular than Web apps. Apple's iTunes Store, now has about 800,000 apps and reported to have about 40 billion downloads. Android apps, although fewer, is available to the most number of smartphones today. About 40,000 apps are medical or health related. We developed a PubMed4Hh mobile app for iPhone/iPad users to search MEDLINE/PubMed with same features as our Web-based search tools, in use since 2002. Five-year (2008-2012) server data for PubMed4Hh and Web app were analyzed. Searches using the mobile app significantly increased compared to the same five-year time period. Month-by-month comparison showed a 3 to 5-fold increase in queries. The six-month total accesses comparison increased 280% from the previous four-year average. A review of 500 randomly selected queries revealed that the majority of queries were clinical questions ((97.8%) and 61% of these queries are searches related to therapy.

Introduction

The GSM Association (GSMA), the organization of mobile operators and networks worldwide, predicted in February 2013 that there will be 7.4 billion mobile devices in use later this year, more devices than the world's total population.[1] A recent Pew Internet Mobile Health 2012 report showed that 85% American adults owned a cell phone while 53% owned smartphones.[2] One-third of smartphones owners searched for health information. People are spending more time using mobile apps than browsing the Web. This phenomenon was foreshadowed by reports that in 2011 smartphones outsold PCs. In the social networking world, Nielsen surveys showed that total time using apps to access social networks increased to 41 billion minutes yearly, outpacing Web access sevenfold.[3] In response to these events, social networking companies are devoting more development resources to mobile devices.

About 40,000 of mobile apps are considered to be medical or health related, worth more than $150 million in 2011, with an estimated growth rate of about 25% yearly.[4] In 2012, Research2Guidance estimated that 247 million mobile phone users were expected to download health apps.[5] These paid apps ranged from less than dollar to close to $1000.[6] A recent survey (October to December 2012) by AmericanEHR showed that 71% of respondents are using smartphones to research information about medications, 75% use them communicate with other physicians or medical staff, 83% send and received e-mail by smartphones, while 78% use mobile apps.[7]

Mobile apps can be behavior changing --Vanderbilt University Medical Center's enhanced hand hygiene campaign app, together with other observational methods helped promote increased hand washing compliance from a low 53% in 2003 to 91% today.[8] However, a Boston University's New England Center for Investigative Reporting study showed that of 1500 paid apps they reviewed, more than 20[%] claimed to have therapeutic effects through sound, vibration, and light emitted by the device.[6] Experts believe these types of apps were ineffective and even dangerous.[6,9] Since 2012, the FDA, by law, has started regulating mobile app that claim to have diagnostic or healing properties.[10,11]

Several reports show that mobile apps are preferred more than Web apps because of better usability, convenience, and speed.[12,13,14,15,16] Our own experience seem to agree with these reports. "PubMed for Handhelds" (PubMed4Hh) was in the iTunes Store in late July 2012. An Android version, not as fully featured as the iOS app was published in early December. We immediately noticed a surge in searches that progressively amplified over the succeeding weeks. Using log data from the past five years, this study attempted to examine and describe the effects of PubMed4Hh app on server queries.

Methods

We examined two time periods before and after the availability of PubMed4Hh, each period six months long. Period A was from August 1, 2011 to January 31, 2012; Period B was from August 1, 2012 to January 31, 2013. For each period, we collected server access data from both PubMed4Hh app and Web app. Only accesses from these same three search tool (PICO, *ask*MEDLINE and BabelMeSH) in both mobile app and Web were utilized. Log data were

transferred from the original Apache Web server log files to a MySQL database. Internal (NLM) access data from security scans, development access tests, and empty searches were deleted.

To compare monthly access trends during the year, we collected data for the past five years (2008 to 2012) and sorted them by month. To analyze hourly access, we selected January 2013 as a full month data source and also selected January 06 to 13, 2013 as a full-week data source. A script parsed by date, time, and search parameters to determine hourly access then entered the results into an Excel database. Because hourly access is affected by users' local time, we separated accesses from non-US users and US/Canada users, where more than 50% of searches originated.

Five hundred queries were randomly selected using MySQL's default randomization algorithm from 28,000 previous searches to determine whether they were clinical or non-clinical queries by one of the authors (PF). Clinical queries were sorted further to determine if they could be classified as searches for Therapy, Diagnosis, Etiology, Prognosis or Undetermined.

Results and Discussion

Table 1 shows the increase in total searches and individual search tools featured in PubMed4Hh. A 2.8-fold increase in total searchers (110942 vs. 39540) was observed in Period B, after the App was published, compared to Period A (before the App was published). A comparison of the individual search tools and percentage increases between Period A and Period B with calculated growth percentages are as follows: PICO, 30619 vs. 63414 (207%); askMEDLINE, 5460 vs. 31610 (579%) and BabelMeSH, 3461 vs. 15918, (460%) respectively.

	PICO	*ask*MEDLINE	BabelMeSH	Total
Period A (before app)	30619	5460	3461	39540
Period B (after app)	63414 (279%)	31610 (579%)	15918 (460%)	110942 (280%)

Table 1. Comparison of six months total access before and after the App. Number in parenthesis indicated increase

Figure 1 illustrates the sudden surge in queries in August after the release of PubMed4Hh App on July 29, 2012. It flattens in October and the rest of the quarter for 2012 but goes up again in January 2013 (Figure 2), and increasing monthly (not shown in the graph) thereafter. This graph also shows the steady but gradual increase in total queries each year that is also shown in more detail in Figure 3 below. Year 2011, stands out because of the wide swings in searches through the year. The steady drop in queries canceled out the high numbers of searches early in the year after another surge in September. We are unable to explain these somewhat wide variations that resulted a total access for 2011 was only slightly higher that the previous year.

In general, the increase in previous years without App is steady. Before the App, the trend of increases was upward but gradual. However, after the App was published, the increase of PubMedHh searches is clearly evident and significant. When an App is listed in iTunes, its visibility increases. People write about it in social media and reviews are written, so it is possible that some of the growth could have come from the increasing of the popularity for PubMedHh, leading to new users.
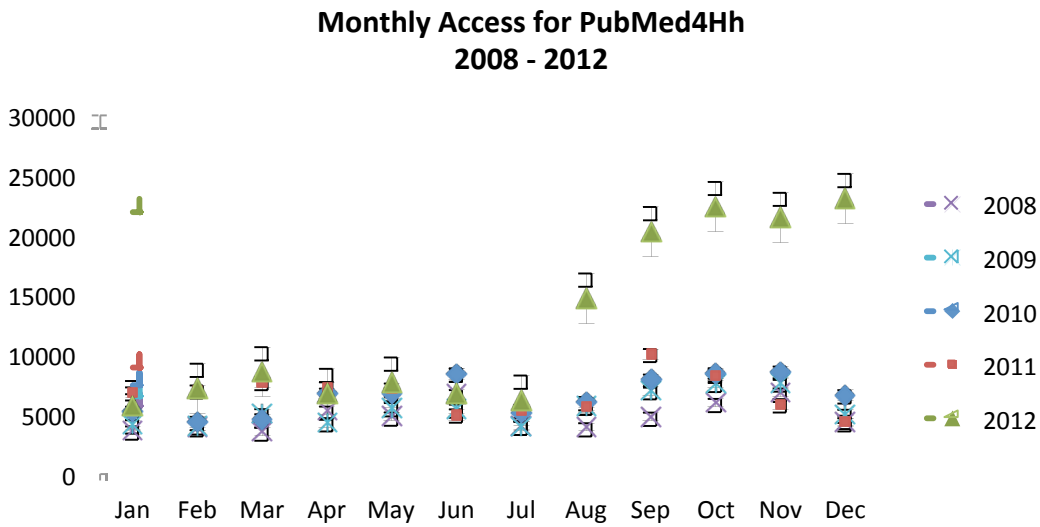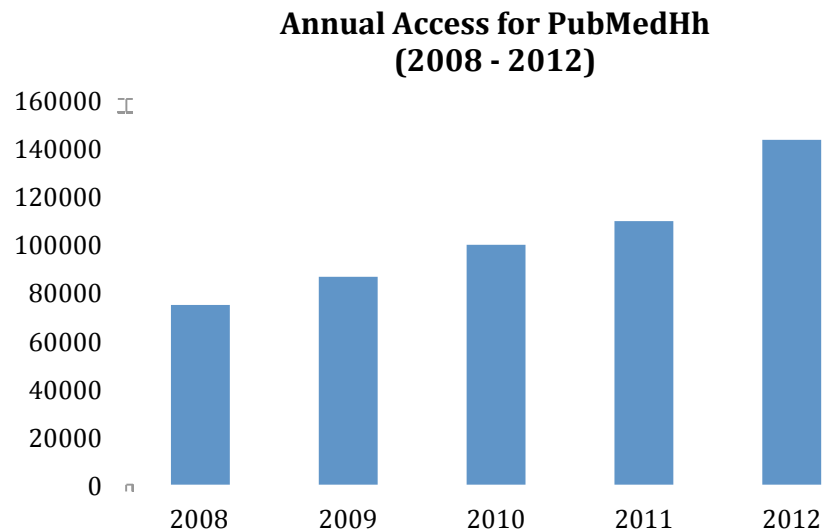
Figure 1. A comparison of five years (2008-2012) of monthly access for PubMed4Hh.
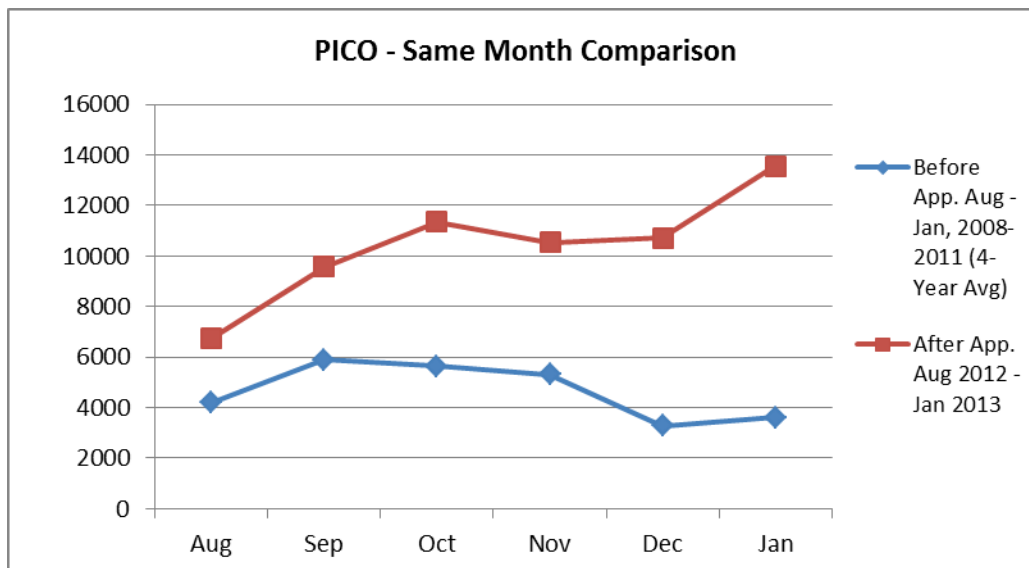
Figure 2. PICO same month comparison

**Annual Access for PubMedHh
(2008 - 2012)**

Figure 3. Five years annual access chart for all PubMed4Hh features

We also examined hourly averages for one week from January 7 to January 13, 2013 for PICO only shown in Figure 4. The hourly access graph demonstrates that the parallel search times for both mobile App access and Web access. The configuration seems to coincide with the typical working day pattern in the US and Canada. The three peaks also coincide with clinic hours and morning rounds in hospitals in the Northern Hemisphere. It has multiple peaks access times, the highest occurring around 2pm EST, may be accounted for by clinical activity in the North American region. The lowest access time occurs from 1AM to 5AM EST.

Figure 4 illustrates what was described above as the general trend that the mobile App is used more than the Web app to access PubMed4Hh servers. The weeks selected, Jan 7-13, 2013, has no holiday observed in the US or Canada, so the data represents a typical working week for healthcare personnel. In Figure 4, the number of access from the PubMed4Hh App is more than those coming from Web access in almost each hour of the day. The average 24-hour difference for the weeklong observation period was 112 searches as shown in the figure.

PICO Hourly Avg Comparison (1/7 to 1/13/2013)
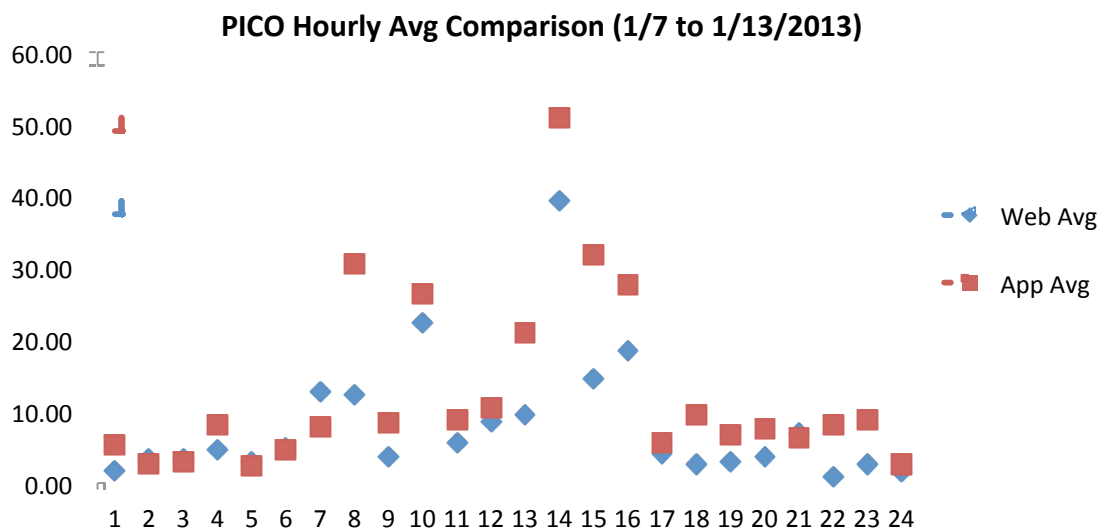
**Figure 4.** PICO hourly averages from January 7 to January 13, 2013.

From 2008 to 2011, mobile access the PubMed for Handhelds Web app ranged from around 18% to 30%. After PubMed4Hh was released, the accesses through wireless handheld devices rose to 46% (Figure 5). This percentage

might still be an underestimate because devices that use an organization or academic institution's Wi-Fi network would not be included. These percentages were derived from mobile devices accessing the server from known cellular networks worldwide. The 20% increase for 2012 only includes mobile queries from the mobile app for the August to December, less than six months. It will likely be higher if a full year's data is calculated.
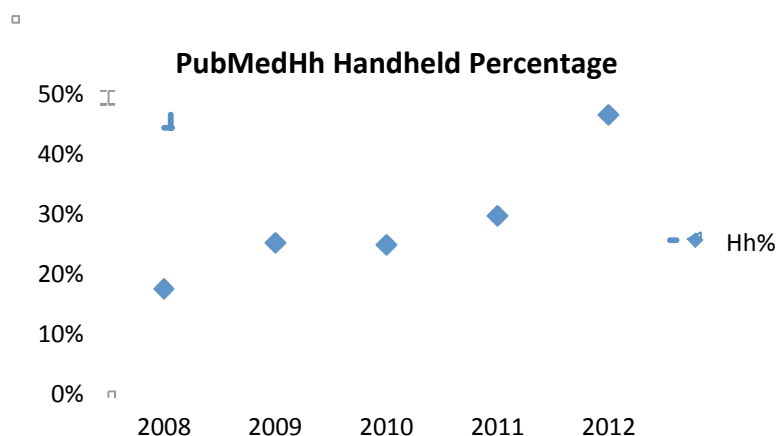
Figure 5. Mobile device access from 2008 to 2012.

Five hundred queries were randomly selected using MySQL's default randomization algorithm from 28,000 previous searches to determine the distribution of clinical and non-clinical queries. Clinical queries were sorted further to define if they could be classified as searches for Therapy, Diagnosis, Etiology, Prognosis or Undetermined. Four hundred eighty nine queries were deemed as clinical searches (97.8%), and only 11 queries were non-clinical questions (2.2%). Among clinical queries, 307 queries were searches on therapy (61.4%), 43 for diagnosis (8.6%), 5 queries for etiology (1%), 17 queries on prognosis (3.4%), and 117 queries were undetermined (Figure 6). 106 of 117 unclear queries are clinical queries, but they cannot be determined to one category type. Most of the undetermined queries used MeSH terms pertaining to diseases or conditions terms or phrases and are likely to be related to Therapy. These observations are consistent with previous studies that showed that the majority of queries relate to therapy.[17]
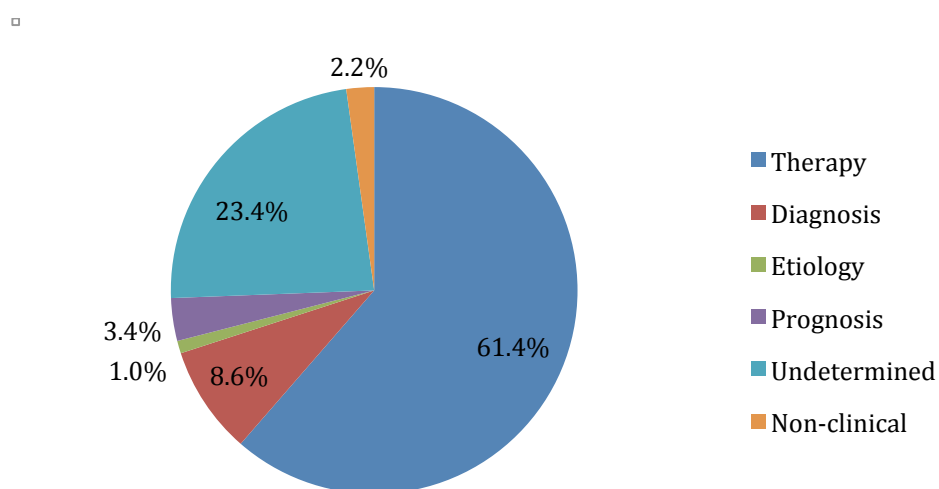
Figure 6. Query types of randomly selected search queries

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The data reported here only pertains to one server, PubMed for Handhelds, and may not apply to other mobile directed servers although the surveys and studies cited seem to validate the observations in this study. The period of evaluation after the release of the PubMed4Hh spans only for five months but our frequent daily reviews seem to indicate an even higher number of queries through the mobile app. Moreover, total downloads, more than 5300 as of March 14, continuous to increase daily. Android downloads is also increasing although not as high as the iOS version. However, the download to active use ratio remains at 77%.

Conclusion

Our results seem to concur with previous reports and surveys that mobile apps are preferred more than Web apps. The general trend is that professional healthcare providers rely on PubMed for informing clinical decisions more and more. Meanwhile, the number of users preferring PubMed4Hh App is more than those who use the Web version of PubMedHh to search MEDLINE/PubMed. Analysis of server data from the previous five years, sorted hourly, monthly and annually show that mobile apps significantly increased the usage of the all featured search tools, including PICO, *ask*MEDLINE, BabelMeSH, and Consensus. Most queries (97.8%) are clinical questions, and the majority of queries (61.4%) search for journal articles on therapy.

References

1. The Mobile Economy 2013. http://www.gsmamobileeconomy.com/read/
2. Pew Internet Mobile Health 2012. Nov 8, 2012. http://www.pewinternet.org/Reports/2012/Mobile-Health.aspx
3. Among U.S. Social Network Users, Smartphone Apps Trump the Mobile Web, Dec 2, 2012. http://allthingsd.com/20121202/among-u-s-social-networks-smartphone-apps-trump-the-mobile-web/
4. Kalorama Tracks Mobile Medical App Market. Jun 12, 2012. http://www.healthdatamanagement.com/news/mobile-medical-apps-applications-market-kalorama-44597-1.html
5. Research2guidance. http://www.research2guidance.com
6. Lacking regulation, many medical apps questionable at best. New England Center for Investigative Reporting at Boston University, November 18, 2012. http://necir-bu.org/investigations/medical-apps/
7. Mobile Usage in the Medical Space Report & Infographic. AmericanEHR blog. March 6, 2013. http://www.americanehr.com/blog/2013/03/mobile-usage-in-the-medical-space-infographic/
8. New iPhone "app" helps Vanderbilt University Medical Center monitor hand washing compliance. Jun 18, 2012. http://phys.org/wire-news/101456838/new-iphone-app-helps-vanderbilt-university-medical-center-monito.html
9. Warning for patients: Look out for bogus mobile health apps, Nov 16, 2012. http://healthcaretechreview.com/mobile-health-apps-bogus/
10. Overview of Medical Device Regulation. http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/MDUFAIII/ucm321367.htm
11. FDA regulators face daunting task as health apps multiply, Jun 27, 2012. http://usatoday30.usatoday.com/news/health/story/55766260/1
12. Smartphone apps more popular than mobile apps. Dec 3, 2012. http://www.bizjournals.com/washington/blog/techflash/2012/12/smartphone-apps-more-popular-than.html
13. Mobile Apps More Popular than Web Says Flurry Study. http://www.honeytechblog.com/mobile-apps-popular-web-flurry-study/
14. Mobile Apps Put the Web in Their Rear-view Mirror, Jun 20, 2011. http://blog.flurry.com/bid/63907/Mobile-Apps-Put-the-Web-in-Their-Rear-view-Mirror
15. Search Engine Apps More Popular than Brand Apps reports Streets Smart SEO, Dec 18, 2012. http://www.prbuzz.com/politics-a-public-affairs/85267-search-engine-apps.html
16. Mobile Usability Update, Sep 26, 2011: http://www.nngroup.com/articles/mobile-usability-update/
17. Crowley SD, Owens TA, Schardt CM, Wardell SI, Peterson J, Garrison S, Keitz SA: A Web-based compendium of clinical questions and medical evidence to educate internal medicine residents. Acad Med 2003, 78:270-274.