Informatics in Radiology (infoRAD)

Survey of Personal Digital Assistant Use in Radiology¹

William W. Boonn, MD • Adam E. Flanders, MD

There has been widespread adoption of personal digital assistants (PDAs) within medicine in recent years. However, information on the prevalence and usage of these devices among radiologists is limited. A survey was designed and mailed to randomly selected members of the Radiological Society of North America to determine the percentage of PDA users, their use patterns, and the types of applications that they would like to see in the future. The use patterns of attending radiologists were compared with those of trainees (residents and fellows). Overall usage was also compared with the relevant findings in two surveys of internal medicine users. It was found that slightly less than one-half of respondents used PDAs on a daily basis, a finding that was comparable to that in the internal medicine surveys. However, less than one-quarter of PDA users had radiology-specific applications installed on their devices, whereas a greater percentage of internal medicine users had software such as drug databases and clinical references on their PDAs. Radiology trainees had a higher rate of both PDA ownership and radiology application usage than did attending radiologists. It is likely that, as PDA hardware becomes more powerful, with higher display resolution, better wireless networking capabilities, and greater memory capacity, PDA ownership as well as radiology application usage will increase.

©RSNA, 2005

Abbreviations: ACP = American College of Physicians, ASIM = American Society of Internal Medicine, PACS = picture archiving and communication system, PDA = personal digital assistant, RIS = radiology information system

¹From the Department of Radiology, University of Pennsylvania Health System, 3400 Spruce St, Philadelphia, PA 19104 (W.W.B.); and the Department of Radiology, Thomas Jefferson University Hospital, Philadelphia, Pa (A.E.F.). Presented as an infoRAD exhibit at the 2003 RSNA Scientific Assembly. Received August 26, 2004; accepted October 1. W.W.B. is president of MedicalPocketPC.com; A.E.F. has no financial relationships to disclose. Address correspondence to W.W.B. (e-mail: william.boonn@uphs.upenn.edu).

©RSNA, 2005
**Introduction**

Personal digital assistants (PDAs) have become an increasingly valuable tool in clinical medicine (1–6). Several surveys have demonstrated widespread adoption of PDAs among clinical physicians (1,2); however, no current data exist on the use of PDAs by radiologists. Common PDA applications for clinicians include drug databases, patient tracking applications, medical references and calculators, and documentation and billing software (1–4).

The information needs of the radiologist differ from those of the clinical physician (7,8); therefore, we sought to determine the role of the PDA in radiology. We created a survey to determine how many members of the Radiological Society of North America (RSNA) used PDAs and what types of software applications they used, focusing especially on radiology-specific applications. We hypothesized that PDA use patterns would differ between those in radiology training and those already in practice. We also sought to compare the results of this survey with those of other published surveys to determine if there were any notable differences between PDA use in radiology and that in other clinical specialties.

In this article, we discuss our study in terms of materials and methods (study population, survey design and administration, statistical analysis) and results (response rate and demographics, hardware, use patterns, radiology applications, trainees versus attending physicians, comparison with other survey results). We also discuss the implications of our study results as well as possible limitations of the study.

**Materials and Methods**

**Study Population**

The RSNA has 34,048 members, including 18,020 active members, 6,703 training members, and 3,961 retired members. Members from North America total 25,508. Surveys were administered to 1,628 randomly selected active and training members in North America.

**Survey Design and Administration**

The survey was composed of 24 multipart questions and focused on PDA user demographics, hardware and software use patterns, user satisfaction, and potential for future use. Recipients were mailed the surveys and had the option to complete the survey by mail or via the Internet. Survey responses were anonymous.

**Statistical Analysis**

Responses to all survey questions were abstracted and compiled. For certain questions, data were also stratified according to career stage. Respondents who identified themselves as residents and fellows were classified as trainees, and the survey results for this population were compared with those for respondents who identified themselves as attending radiologists. \( \chi^2 \) tests were used to determine if use patterns differed significantly between trainees and attending physicians. SAS statistical software (SAS Institute, Cary, NC) was used for all statistical analyses.

Results were compared with those of published surveys from the Mayo Clinic Department of Internal Medicine (2003) (1) and the American College of Physicians–American Society of Internal Medicine (ACP-ASIM) Member Survey (2001) (2).

**Results**

**Response Rate and Demographics**

Of the 1,628 surveys sent out, 528 (32.4%) were completed and returned. The survey was sent out twice in an effort to obtain a more accurate member sample. Of the 528 respondents, 417 (79.0%) were men and 104 (19.7%) were women. (Seven respondents did not provide gender information.) In addition, 181 respondents (34.3%) were in academic practice and 319 (60.4%) were in private practice. Trainees (residents and fellows) accounted for 17.2% of the respondents \((n = 91)\) and attending or board-certified radiologists for 78.2% \((n = 413)\).
Two hundred thirty-eight of 528 respondents (45.1%) reported owning a PDA or using a PDA on a daily basis. Of those using PDAs, 38 (16.0%) reported using a Pocket PC (Microsoft, Redmond, Wash) PDA and 179 (75.2%) used a Palm OS (PalmSource, Sunnyvale, Calif) PDA. Ten respondents (4.2%) did not know which type of PDA they owned. Sixty-two percent of users had a PDA with a color display, and 79% of PDAs with color displays had a high-resolution screen (defined as having a resolution greater than $240 \times 320$ pixels). Only 16% of users had a PDA with built-in wireless networking capability. Most PDA users were satisfied with the performance of their PDA; 95.2% gave their PDAs a rating of 3 or higher on a scale of 1 to 5, with 1 being “not satisfied” and 5 being “very satisfied.” Respondents who did not use a PDA gave the following reasons for not doing so: never really found a need for one (83.3%), poor screen readability (19.7%), too awkward to use (16.7%), not enough applications (13.3%), and not enough radiology software available (12.9%). The most important factors influencing respondents’ purchase of a PDA were memory capacity, software availability, and screen resolution. Less important factors were purchase price, wireless data capability, and a built-in digital camera.

**Use Patterns**

Nearly all PDA users (98.3%) used the address book and calendar functionality of their devices. Only a small percentage (13.6%) used their devices for e-mail or Internet access, whereas 21.7% and 31.2% used their PDAs for general medical references and drug references, respectively (Fig 1).

**Radiology Applications**

Nearly one-fourth (24.6%) of PDA users had a radiology application installed on their devices. The most popular types of radiology applications were reference software applications, either with images (23.5%) or without images (23.1%). The American College of Radiology (ACR) Appropriateness Criteria were installed on 10.3% of PDAs. Applications that allowed access to a picture archiving and communication system (PACS) (2.1%) or radiology information system (RIS) (1.7%) or were used for dictation (4.7%) accounted for only a small percentage of the installed applications (Fig 2).

Respondents were asked to rate the importance of specific applications for future PDA use on a scale of 1 to 5, with 1 being “not important” and 5 being “very important.” More than one-half of respondents (65.1%) gave the ability to review and sign off on reports a rating of 4 or higher. Access to e-mail or the Internet (61.6%), access to radiology references with images (61.6%), and access to teaching materials (61.3%) were also given a rating of 4 or higher by a majority of respondents. The following applications had the fewest number of ratings of 4 or higher: viewing entire imaging studies (45.3%), capturing images with a built-in digital camera (40.3%), reading radiology textbooks (38.0%), viewing images directly from the PACS (36.4%), and monitoring workflow parameters within a radiology practice (32.5%).
Trainees versus Attending Physicians

Trainees were more likely to own PDAs than were attending physicians (61.5% vs 42.6%; *P* < .05) and were more likely to have radiology software installed on their PDAs (40.4% vs 19.5%; *P* < .03) (Fig 3). The following future PDA radiology applications were considered more important to trainees than they were to attending physicians (*P* < .05): accessing teaching materials, selecting protocols for imaging studies, viewing old radiology reports, reading radiology textbooks, accessing online journals, and performing dictation using voice recognition.

Comparison with Other Surveys

Comparisons were made with two surveys of internal medicine physicians regarding PDA ownership and use patterns. The first study surveyed 473 physicians in the Department of Internal Medicine at the Mayo Clinic (1) and stratified results between residents and attending physicians. The ACP-ASIM study (2) surveyed 489 members and was nonstratified. In the Mayo Clinic survey, 46% of respondents used PDAs. Thirteen percent of attending physicians and 53% of residents used their PDAs for drug references, whereas 5% of attending physicians and 27% of residents used them for medical references. In the ACP-ASIM survey, 47% of respondents used PDAs; 80% used them for drug references and 21% for medical references.

Discussion

Our survey indicates that slightly less than one-half of all RSNA members are using PDAs, which is similar to the rate of overall use in internal medicine (Mayo Clinic study = 46%, ACP-ASIM study = 47%). Of those RSNA members who own PDAs, approximately 25% have radiology software installed on their devices. In contrast, a higher percentage of users in internal medicine have medical software (eg, drug databases, medical references) installed on their PDAs.

There is a relative lack of PDA software designed for radiology compared with software designed for other medical specialties. A search for medical titles was performed on Handango (http://www.handango.com), a leading online distributor of PDA software. A search for “internal medicine” returned 225 entries; for “surgery,” 43 entries; for “cardiology,” 36 entries; and for “radiology,” only 11 entries.

When PDAs were first introduced, issues concerning memory capacity and low-resolution screens limited their usefulness to the radiologist. However, memory expansion capabilities now exceed 1 GB, and high-resolution screens can display up to 480 × 640 pixels, permitting viewing of referral-quality images and more detailed radiology references.

Among survey respondents, there was a demand for dynamic data access to review and sign radiology reports, view old reports, check e-mail, and access teaching file databases. Until recently, the technology to support such applications did not exist as a cost-effective, mobile solution.
However, development of modern PDA devices with wireless networking capabilities and RIS-PACS systems that support mobile access are making these features a reality (7–10).

As mentioned earlier, radiology trainees were more likely than attending physicians to own PDAs and to have radiology software installed on their devices. These findings are likely due to the widespread adoption of PDAs in medical schools and during residencies (6) as well as to a greater need among trainees for portable references and applications such as procedure tracking and case files. As these trainees enter practice, we project that overall use of PDAs by radiologists will continue to grow.

According to staff at the RSNA, our survey population represents an accurate sample of the RSNA membership and our level of response appears to be comparable to that of many surveys sent out by the RSNA (RSNA staff, oral communication, October 2003).

There are some possible limitations to this study. First, trainees might have been underrepresented, since they are traditionally less inclined to fill out and return questionnaires. Second, it could be argued that an older physician population might not accurately represent the population that most embraces PDA technology.

Conclusions

Radiology has been at the forefront of implementing technology to improve workflow and diagnosis of disease (eg, digital imaging, PACS, computer-aided diagnosis, voice recognition). Although overall usage of PDAs in radiology is similar to that in other specialties, it is surprising that the development and availability of PDA applications specific to modern radiology are lacking compared with those of applications specific to other specialties. Nevertheless, there are several factors that we believe will lead to increased use of radiology-specific PDA applications in the near future. First, recent advances in PDA technology, including high-resolution screens, greater storage capacity, and wireless networking, will allow the development of more sophisticated applications sought by radiologists. Voice recognition, wireless access to the RIS-PACS, and dynamic image viewing were not possible with older PDAs. Second, our study demonstrates increased use of PDAs among radiology trainees. As these residents and fellows move on into practice, overall PDA use as well as demand for radiology applications will continue to grow. Finally, the increased number of PDA infoRAD exhibits as well as the success of the recently launched Mobile Computing Pavilion at the RSNA annual meeting reflects the growing interest in this technology for the future of radiology.

References