Pediatricians and Personal Digital Assistants: What type are they using?

Aaron E. Carroll[1,2], MD, MS and Dimitri A. Christakis, MD, MPH[3,4]
[1]Robert Wood Johnson Clinical Scholars Program, University of Washington, Seattle, WA
[2]Department of Pediatrics, Indiana University School of Medicine, Indianapolis, IN
[3]Department of Pediatrics, University of Washington, Seattle, WA
[4]Child Health Institute, University of Washington, Seattle, WA

ABSTRACT

Increasing attention is being focused on the potential benefits of personal digital assistants (PDA) in medical practice. Although some work has been done to investigate their use, it is still unclear what types of PDAs are being used by pediatricians, and if they are using different types in different ways. Our goals were to determine: (1) which kinds of PDAs were being used by pediatricians; (2) if the personal or professional characteristics of pediatricians differ by type of PDA they are using; (3) if the types of applications they employ differ by the type of PDAs they are using.

We randomly selected 2130 pediatricians from the AMA masterfile of United States licensed physicians and surveyed them. Of those respondents that reported using a PDA, 90.1% use a Palm OS based system, 8.6% use a Pocket PC based system, and 1.3% used neither. Of those respondents who were resident physicians and PDA users, almost all (99%) use Palm OS PDAs. There were significant associations between the PDA platform being used and types of applications being run on them.

More than one third of pediatricians are using PDAs in clinical practice. Palm OS based systems are much more prevalent in clinical practice, and the choice of newer pediatricians.

INTRODUCTION

Personal digital assistants (PDA) are a form of portable, point-of-care technology that enables clinicians to practice medicine in new ways. Over time, they are finding their way into numerous aspects of clinical practice. For instance, they can be used to record patient encounters,[1-3] procedures,[4] provide decision support,[5, 6] and wirelessly access clinical information. Some research studies have even investigated the potential of PDAs to affect the quality of health care.[7, 8]

Past attempts to estimate the use of PDAs in healthcare have been limited by selective sampling or potential biases.[9] Some information can be gathered from press releases, but no information has withstood the scrutiny of peer review.[10-12] We recently conducted a survey, however, which reported that 35% of practicing pediatricians currently use a PDA in a work setting.[13] This same work also reported the beliefs of pediatricians concerning PDA strengths and weaknesses, and as well as some demographic or practice characteristics that were associated with PDA use. What remained unanswered was what type of PDAs pediatricians were using, and whether their use of them differed by the type of PDA. Since user acceptance of programs is a key factor in their success or failure, such data would be very informative both to developers and purchasers.[14, 15]

We undertook this research to determine: (1) which kinds of PDAs were being used by pediatricians; (2) if the personal or professional characteristics of pediatricians differ by type of PDA they are using; (3) if the types of applications they employ differ by the type of PDAs they are using.

METHODS

We randomly sampled 2130 pediatricians from the AMA masterfile of United States Physicians through Direct Medical Data (Skokie, Illinois). The American Medical Association (AMA) Masterfile is recognized as the most complete and accurate list of licensed physicians in the United States. We estimated that if we had a response rate of 50%, yielding 1000 responses, we could estimate the prevalence of PDA use with 95% confidence with an interval of +/- 3%. Resident physicians were included in the sample.

We mailed all potential participants the survey along with a cover letter, prepaid return envelope, and $1 incentive. We assured all recipients that participation was voluntary and that responses would remain anonymous. If recipients did not wish to participate, we asked them to return the survey unanswered. Those potential participants who did not respond were sent up to two additional mailings. All mailings were sent between July and October, 2002.

This study was approved by the University of Washington Institutional Review Board.

Survey
We estimated that it would take participants about 5 minutes to complete the survey. We asked recipients to indicate whether they use a PDA or computer at home or at work. If they indicated they used a PDA, we asked them to supply its make and model. We also asked them what type of applications they used on the PDA at work.

We ended the survey with six questions asking participants to supply their percent of time in general versus specialty practice, year of medical school graduation, training status, gender, primary practice description, and primary practice community.

Statistical Analysis
For analysis, we grouped PDAs in two groups: those using Palm operating system (OS) and those using Pocket PC OS. We used multivariate logistic regression to assess relationships between demographic and professional characteristics and type of PDA employed. We then assessed these same demographic and professional characteristics in univariate logistic regression. Those that were independently and significantly associated with PDA type were included in later multivariate models assessing potential relationships between each type of clinical application and the types of PDAs being used.

In an exploratory analysis, we chose potential covariates *a priori*, based on factors that we felt might influence the use of a PDA. These included gender, training status, primary practice setting, primary practice location, and percent time spent in generalist practice. When performing logistic regression, we report odds ratios (aOR) and 95% confidence intervals (95% CI). We performed all calculations using the STATA 7.0 statistical package (STATA Corporation, College Station, Texas).

RESULTS

Sample
Of the 2,130 mailed surveys, 164 were returned by the post office with no forwarding address, and 91 were returned by non-practicing pediatricians. We received 1,185 surveys from the 1,875 eligible participants, yielding an effective response rate of 63.2%. Because of missing data, not all totals equaled 1,185. There were no significant differences between respondents and non-respondents with respect to gender, and type of practice as defined in

the AMA Physician Masterfile. Respondents, on average, had graduated from medical school one year later than non-respondents (P<0.02).[13]

Types of PDAs used by pediatricians
Of the 397 respondents that reported using a PDA at work, 90.1% use a Palm OS based system, 8.6% use a Pocket PC based system. 1.3% used a system classified as "other" and were excluded from later analysis. The breakdown of PDA make and models can be seen in Figure 1.
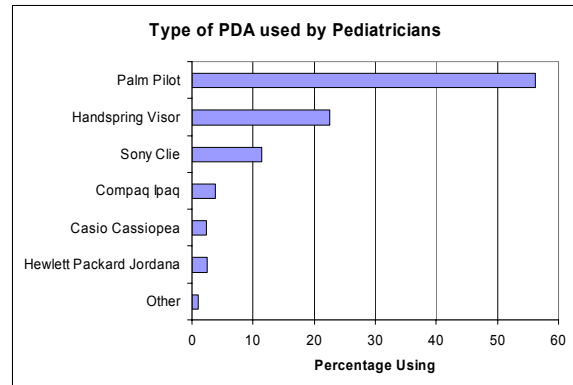

Figure 1: Percentages of pediatrician PDA users using different types of PDAs.

Factors associated with the type of PDA used
In general, some professional and demographic characteristics were found to be associated with the type of PDA being used. When looking at resident physicians, or those still undergoing postgraduate training, 99% reported using Palm OS PDAs. This compares to the practicing population of pediatricians, 89% of whom use Palm OS PDAs. 87% of males reported using the Palm OS, while 94% of females reported the same. Other covariates did not seem to have much effect on the type of PDA chosen for use.

Covariate	aOR	95%CI
Resident	6.50	0.82-51.88
Urban Practice Setting	1.05	0.43-2.60
Private Practice	0.97	0.38-2.50
Male	0.48	0.20-1.16
% Time Generalist Practice	0.97	0.95-1.00

Table 1: Covariates from the multivariate logistic regression. Odds ratios (aOR) for use of the Palm OS and 95% Confidence Intervals (95% CI) are presented.
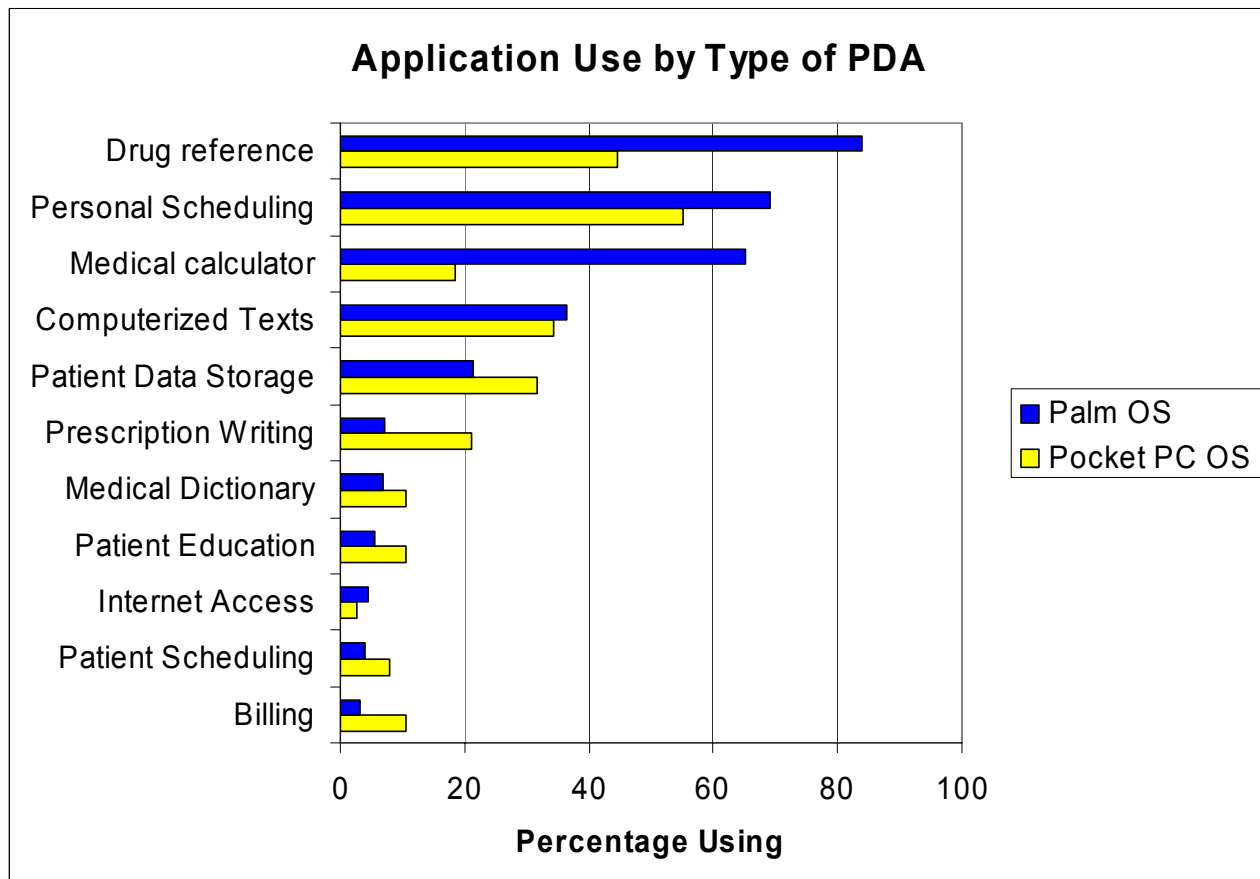
Figure 2: Application Use by Type of PDA

When assessed in univariate logistic models, all covariates except the amount of time spent in generalist practice were found to be significant.

In a multivariate model, although residency had a large aOR, it did not achieve statistical significance. None of the other covariates were statistically significant. (Table 1)

Types of applications used on PDAs
There were clear differences in the numbers of PDA users who used medical applications and the types of applications being used when examined with respect to PDA type. (Figure 2) While 83.9% of Palm OS PDA users employed drug reference applications, only 44.7% of Pocket PC OS PDA users did. On the other hand, while only 7.0% of Palm OS PDA users reported using their PDAs for prescription writing, 21.1% of Pocket PC users did. In general, few users used either type of PDA for billing, patient scheduling, internet access, patient education, or for medical dictionaries.

In an analysis adjusting for the use of other types of programs, a number of applications were found to be significantly associated with PDA type. Palm OS PDA users were significantly more likely to be users of drug reference applications (aOR 5.78, 95%CI 2.37-14.06) and medical calculator programs (aOR 7.40, 95% CI 2.91-18.84). Palm OS PDA users were also significantly more likely to use their PDA to access the internet (aOR 11.69, 95% CI 1.78-76.71), although few did overall. (Table 2)

CONCLUSION

Over one-third of pediatricians are currently using PDAs in their clinical practices. The vast majority (90.4%) of those users are using PDAs running the Palm OS. We also found that resident physician PDA users were almost exclusively (99%) using Palm OS PDAs. We found significant associations between the use of a Palm OS PDA and certain applications such as drug referencing programs, medical calculators, and internet accessing programs.

This study is subject to the typical limitations of self-report surveys, such as response bias. We did have a response rate of 63.2%, however, which is well above the mean for published survey studies of physicians.[16] Furthermore, respondents were not significantly

Application Type	Odds of Use	95% CI
Drug Reference	5.78	2.37-14.06
Medical Calculator	7.40	2.91-18.84
Patient Education	0.24	0.042-1.38
Prescription Writing	0.41	0.145-1.23
Billing	0.44	0.02-10.58
Personal Scheduling	1.99	0.82-4.80
Medical Dictionary	0.26	0.06-1.10
Computerized Textbook	0.45	0.18-1.16
Internet	11.69	1.78-76.71
Patient Scheduling	0.92	0.13-6.26
Patient Data Storage	0.48	0.19-1.20

Table 2: Association between use of Palm OS PDA and type of application. Odds ratios (aOR) and 95% confidence intervals (95% CI) are presented.

different from non-respondents. It is also possible that responses to surveys do not reflect actual practice. However, our questions were simple and straightforward, and the potential for social desirability in responses is low. As with all cross-sectional surveys, our results cannot establish any causal relationships between personal or professional characteristics and PDA use. The same holds true for any relationships between application use and PDA type.

The need for better design and implementations of technology in health care has been well described.[15,17,18] About one-third of computer systems built internally by corporations for their employees are either scrapped or rejected after they are completed.[19] Without better research we are still not sure if the use of any information technology carries actual benefits, or even harms.[20] Even before such research occurs, though, we need a better understanding of the current state of our healthcare "users", and where their needs lie.

The success of future applications and systems is certainly dependent on user acceptance of them.[14, 15] Our results suggest that the vast majority of pediatricians are still using PDAs with the Palm OS. Even more significant is that almost all of the newest doctors are using Palm OS based PDAs.

On the other hand, there seem to be fewer Pocket PC PDA users employing medical software in general. Whether this is due to a relative lack of application choices available to that platform, or a true difference in the type of user, cannot be derived from this cross-sectional study. Further study would be needed to ascertain this relationship.

In general, however, a majority of users are employing applications for drug reference and medical calculations. Medication errors have been found to be the most common type of medical error in the pediatric inpatient setting.[21] Therefore, it may be wise for future applications and systems to attempt to use PDAs to reduce medication errors. Since such programs already have widespread acceptance among PDA users, they may have a higher probability of showing a significant improvement in care.

Since the majority of recent medical school graduates are using Palm OS based PDAs, it is likely that the overall percentage of pediatricians using Palm OS PDAs will remain steady at the current time. If current trends continue, in the near future the PDA may be a commonly used tool in the practice of pediatrics. Such information may be useful to those designing future PDA applications which may be more widely accepted by pediatricians. Research that

will evaluate the potential benefits and harms of PDA use is warranted.

ACKNOWLEDGEMENTS

REFERENCES

1.   Marshall M, Sumner W, 2nd. Family practice clerkship encounters documented with structured phrases on paper and hand-held computer logs. Proc AMIA Symp 2000:547-50.

2.   Eastes L. Use of the personal digital assistant for point-of-care trauma documentation. J Emerg Nurs 2001;27(5):516-8.

3.   Bird SB, Zarum RS, Renzi FP. Emergency medicine resident patient care documentation using a hand-held computerized device. Acad Emerg Med 2001;8(12):1200-3.

4.   Fischer S, Lapinsky SE, Weshler J, Howard F, Rotstein LE, Cohen Z, et al. Surgical procedure logging with use of a hand-held computer. Can J Surg 2002;45(5):345-50.

5.   Ruland CM. Clinicians' use of a palm-top based system to elicit patient preferences at the bedside: a feasible technique to improve patient outcomes. Proc AMIA Symp 2000:739-43.

6.   Roth AC, Leon MA, Milner SM, Herting RL, Jr., Hahn AW. A personal digital assistant for determination of fluid needs for burn patients. Biomed Sci Instrum 1997;34:186-90.

7.   Carroll AE, Tarczy-Hornoch P, O'Reilly E, Christakis DA. The Effect of Point-of-Care Personal Digital Assistant Use on Resident Documentation Discrepancies. Submitted for Publication.

8.   Shabot MM, LoBue M, Chen J. Wireless clinical alerts for physiologic, laboratory and medication data. Proc AMIA Symp 2000:789-93.

9.   Rothschild JM, Lee TH, Bae T, Bates DW. Clinician use of a palmtop drug reference guide. J Am Med Inform Assoc 2002;9(3):223-9.

10.   http://www.harrisinteractive.com/news/newsletters/healthnews/HI_HealthCareNews2001Vol1_iss25.pdf.

11.   http://www.acponline.org/college/pressroom/handheld_survey.htm.

12.   http://www.aap.org/research/ps51.htm.

13.   Carroll AE, Christakis DA. Pediatricians' use of and attitutes about personal digital assistants. Submitted for Publication.

14.   Nikula RE. Why implementing EPR's does not bring about organizational changes--a qualitative approach. Medinfo 2001;10(Pt 1):666-9.

15.   Berg M. Implementing information systems in health care organizations: myths and challenges. Int J Med Inf 2001;64(2-3):143-56.

16.   Asch DA, Jedrziewski MK, Christakis NA. Response rates to mail surveys published in medical journals. J Clin Epidemiol 1997;50(10):1129-36.

17.   Weir C, McCarthy C, Gohlinghorst S, Crockett R. Assessing the implementation process. Proc AMIA Symp 2000:908-12.

18.   Pare G. Implementing clinical information systems: a multiple-case study within a US hospital. Health Serv Manage Res 2002;15(2):71-92.

19.   Gibbs WW. Taking Computers to Task. Sci Am 1997;277(1):82-9.

20.   Tierney WM, Overhage JM, McDonald CJ. A plea for controlled trials in medical informatics. J Am Med Inform Assoc 1994;1(4):353-5.

21.   Kaushal R, Bates DW, Landrigan C, McKenna KJ, Clapp MD, Federico F, et al. Medication errors and adverse drug events in pediatric inpatients. JAMA 2001;285(16):2114-20.