

# Personal Digital Assistants Herald New Approaches to Teaching and Evaluation in Medical Education

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## ABSTRACT

Since its arrival in 1994, the personal digital assistant (PDA) has made significant inroads in the handheld industry, with 50% of physicians anticipated as users by 2005 due to its functionality as a point-of-care medical informatics tool. However, its use in medical education is less well documented. Since 1998, PDAs have been used at Medical College of Wisconsin (MCW) as both a teaching and an evaluation tool for medical student and resident education. This article highlights the use of the PDA in medical education and describes current applications for monitoring clinical experiences of students/residents, and teaching resources for hypertension, cardiac auscultation, and community health. MCW's experiences with the PDA as a real time teaching and data collection tool serves as a model for other medical schools and for our students who are educated in the importance of self-monitoring one's clinical experiences and the need for continuous improvement as future physicians.

## BACKGROUND

Since its arrival in 1994, the PDA has made significant inroads in the handheld industry. The device's portability, storage capacity, usability, and price make it an excellent data management and reference tool. Combining these qualities with the innumerable drug databases, reference texts, medical calculators, and other shareware/freeware available for health care professionals

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make the PDA an effective tool for enhancing clinical practices. Taking advantage of the PDA's effectiveness for clinical practice, all Medical College of Wisconsin (MCW) third-year medical students have been provided with a PDA and medical informatics applications for their clinical years of training. What is unique about MCW's use of PDAs for medical students is that they also serve as a curriculum evaluation and instructional tool.

## PDAS AS TOOL TO MONITOR EDUCATIONAL EXPERIENCE QUALITY

The Liaison Committee on Medical Education (LCME), the accrediting body for US medical schools, has recently approved several accreditation requirements that can be achieved by using PDAs as a multi-purpose tool to address point-of-care medical informatics, teaching, and monitoring the equivalency of educational experiences across multiple clinical sites.<sup>1</sup> For example, there is a pressing need in today's dispersed training environments for clinical clerkship directors to ensure sufficient exposure to a breadth of patients and their level of experience (e.g., observe, participate in care), regardless of clinic location. LCME requires schools to monitor the degree to which students are achieving the educational objectives of its curriculum and, in particular, the appropriate balance and diversity of patient care experiences.<sup>1</sup> Often students in the same specialty do their in-patient rotations at one of several affiliated hospitals, or if students are in an ambulatory-based clerkship experience they may be placed at any of 20 different clinical locations and practice types ranging from solo practitioner to large multiple-specialty clinic. In an attempt to monitor the equivalency of educational experiences across all alternative clinical instructional sites within a given discipline, written logs have been repeatedly piloted at MCW and elsewhere with limited success due to high post log medical coding and data input costs.

With the creation of mobile database forms loaded onto PDAs, evaluation costs can be eliminated as ICD-9 codes are preloaded into the PDA so that what students enter is downloaded into readily analyzable databases. Equally important, the students may complete the PDA-based clinical experience form immediately following the patient encounter to increase accuracy. All data entered on the PDA may be immediately downloaded to a web-based data management system through linking stations at the clerkship site, the library, or via their home computer. To illustrate the PDA's power as a data collection tool for monitoring the quality of educational experiences and students' exposure to an appropriate balance of medical conditions and procedures, several PDA applications—developed by MCW faculty—will be described.

### *Medical Student Clinical Experience Log*

The Clinical Experience Log, developed by MCW's third year clerkship directors using Pendragon Forms Software™, provides a method to quickly monitor the balance and diversity of patient care experiences relative to each clerkship's objectives. As a clinical experience log rather than a patient log, students enter categorical data about the patient (e.g., age range, primary diagnosis). This data is consistent with HIPPA regulations—no patient identification number, name, or other detailed information that would connect the PDA file to the patient is entered. Figure 1 provides an example of one screen from the Clinical Experience Log. Data from this log has been used to inform clerkship directors about missed opportunities for teaching about diversity, women's health,<sup>2</sup> and geriatrics<sup>3</sup> in required clinical clerkships. For example, an analysis of students' clinical experiences in the required 1-month family medicine clerkship reveals that students are experiencing the breadth of consistent clinical experiences. Moreover, detailed analyses have revealed substantial consistency among students' clinical experiences at a wide variety of clinical sites, i.e., community practices and family practice residency program clinics.<sup>4</sup> Students report that PDA recording is "not a burden" as it takes only about 6.2 minutes to enter their clinical experience data associated with a half-day experience in an ambulatory clerkship.<sup>5</sup>

The PDA experience log data can also be returned to students to help them adjust their patient exposure to meet clerkship objectives. Since July 2000, the Director of Predoctoral Education for the Department of Family and Community Medicine has reviewed monthly summaries of the students' clinical experiences on their clerkship. More recently, students have

**Figure 1.** PDA screen for clinical experiences using Pendragon Forms™

Students complete the log as part of the third-year required clerkship experiences. This data can then be provided back to the clerkship director, the preceptor, and the student to monitor the student's educational experiences across clinical teaching sites and insure that students receive equivalent training.

been provided a report of their clinical experiences at both the middle and end of this 1-month clerkship. These individualized reports provide a summary of the demographics and diagnoses of the patients encountered, enabling the students and their clinical preceptors to adjust the students' remaining clinical experiences to achieve the desired breadth of patient demographics and diagnoses.

Building on these successes as a clerkship experience evaluation tool, three students per class are now using the PDA to audit the basic science curriculum for key topics including geriatrics, women's health,<sup>6</sup> tobacco,<sup>7</sup> stem cell, genetics, diversity, and other current topics. This data will be provided back to basic science course directors to help them assess redundancy/omissions of key topics by course.

### *Student History and Physical Skills*

Third-year medical students reported that they would like more opportunities to be observed performing physical exam skills and receive constructive feedback on their performance. In response, the director of the M3 Pediatrics clerkship developed a PDA application to structure and record observations of students in the newborn nursery. Using a formatted checklist, the students are directly observed in an interaction with a patient. Observation results are recorded on the instruc-

**Figure 2.** PDA as teaching resource for hypertension using Aportis Doc™



Students can access Joint Committee on Prevention Detection and Treatment of Hypertension definitions, prevention strategies for reducing hypertension, basic approaches to the pharmacological management hypertension, and common side effects of medications.

tor's PDA to cue the feedback and debriefing of student's performance at the close of the encounter.

### Residency Evaluation Tools: Med-Peds

Consistent with the Accreditation Council of Graduate Medical Education (ACGME) requirements to monitor resident's clinical experience, the combined Medicine-Pediatrics residency program sought to assess the efficacy of the med-peds resident's continuity clinic. Residents record their experiences with an application consisting of multiple answer lists, check boxes, and numeric entry questions quantifying experiences such as the number of patients seen by age groups, procedures performed, diagnoses seen, and the level of supervision.

### THE PDA AS A TEACHING RESOURCE

Expanding knowledge, patient workload, and time constraints challenge preceptors who must teach medical students during busy inpatient and ambulatory rotations. Therefore, we sought to expand the role of PDAs beyond monitoring learner's clinical experiences, to use the PDAs as a "teaching" and clinical resources tool. The PDA can provide timely, pertinent, and evidence-based information during the patient encounter in either a text or database file keyed to specific educational topics. For example, previous studies have found the PDA a useful teaching tool for focused medical problems such as hyperkalemia, anemia, and lower res-

piratory tract infections. Students respond enthusiastically to PDA application software for drug selection, name, and dose.<sup>8</sup>

Mobile databases or data entry forms can also be readily developed to record an observed assessment or to act as guides to lead a student through a particular patient encounter. Building on these trends, several applications developed by MCW faculty are highlighted to illustrate the PDA's versatility as a teaching resource for medical student education.

### Hypertension

The PDA can address learning objectives in the management of hypertension (HTN) by augmenting student clinical experience. The authors developed a PDA text file to help students (1) define HTN, (2) identify the prevention strategies for reducing hypertension, (3) outline basic approaches to the pharmacological management hypertension, and (4) identify common side effects of medications.

To create the PDA document, the authors reviewed the Sixth Report of the Joint Committee on Prevention Detection and Treatment of Hypertension (JNC VI). Pertinent information was typed into a text file using Microsoft NotePad™ and then converted to a portable document using AportisDoc™ that could be installed and read on a PDA.

Several software features enhance accessibility of this text document as a teaching/self-instruction tool. Preset bookmarks are placed throughout the text document, which allow the learner (or teacher) to instantly view any section of it. The software's find function also allows the user to search for a subject in any portion of the document. For example, the students can quickly access:

- A classification strategy for hypertension depending on the degree of blood pressure elevation and recommendations for follow up.
- Non-pharmacologic interventions including the DASH diet.
- The drugs of choice for treating patients with hypertension and other comorbidities.
- Common medication side effects and drug-drug interactions.

### Colorectal Cancer Screening

The colorectal cancer screening text file provides users with quick access to reliable summary information on colorectal cancer screening. Its purpose is to educate users on level of evidence supporting each screening method and on the associated strengths and limitations of each approach. The text file provides a comparison of

**Figure 3.** PDA teaching resource—cardiac auscultation

OR

By completing the form, students are prompted regarding key findings associated with specific murmurs/heart sounds.

screening recommendations in average risk patients, screening high-risk patients, cost effectiveness, evidence to support each method, strengths/weaknesses of methods as well as resources for additional information.

### Spiritual Assessment

Evidence regarding the importance of spirituality as a component of health has led to the creation of a spiritual assessment tool. This text file, when loaded onto a PDA, provides learners with a quickly accessible list of questions for the interviewing portion of a history and physical examination to assess the hospitalized patient's needs and support systems.

### Cardiac Auscultation

Previous research has shown that medical students and post-graduate trainees need to enhance their proficiency in cardiac auscultation.<sup>9,10,11</sup> In response to this need, the co-clerkship director in the Department of Internal Medicine developed a cardiac murmur form

(Figure 3), which is loaded onto student PDAs as a part of a required third-year medicine clerkship. This self-directed learning form includes the main clinical characteristics of six common systolic murmurs (e.g., mitral and tricuspid regurgitation, mitral valve prolapse, aortic stenosis), two diastolic murmurs (e.g., mitral stenosis) and two extra heart sounds (S3 and S4). For each murmur/sound, the PDA murmur form listed the best area of auscultation, timing, change with maneuvers and associated findings. After examining patients with cardiac abnormalities, students record their findings on their PDAs using a simple touch screen response (Yes/No/ Don't know).

Students reported a high frequency of use, high satisfaction with the tool, and perceived that PDA murmur forms enhanced their perception of their competence in cardiac auscultation. Preliminary data reveals that student performance on a paper/pencil knowledge test and cardiac simulator assessment approached criterion levels.

### PDA-Based Community Health Resources at Point-of-Care

Successful patient care requires students to have reliable access to and utilize community-based resources with their patients. Given that students may be in a number of different community locations on Family Medicine Clerkship, a community resource database was developed for the PDA using its own address book as a database repository. The database is divided into separate downloadable files by geographic region and is searched via the PDA's existing find function. For example, if the user was looking for a community-based resource related to local depression support groups, the student writes "depression" in the find query. Once queried, the PDA reports back depression-related resources with notes describing the focus of the resource and contact information.

### SUMMARY AND CONCLUSIONS

As the practice of medicine changes, so too must medical education. Today's learners must be facile in accessing currently available PDA compatible resources from books (e.g., *Washington Manual*, *Harrison's Principles of Internal Medicine*, *Red Book*, *Harriet Lane Handbook*) to evidence-based medicine "query and click" decision tools.<sup>12</sup> Medical educators must also utilize electronic teaching and curriculum evaluation tools at the point-of-care to continuously monitor and improve our training programs. PDAs offer a cost-effective, portable, and easy-to-use platform for point-of-care-based teaching and curriculum evaluation activities. However, like any technology, rapid advances

in software and hardware require continuous monitoring complimented by user education and support.

At MCW, faculty have created a variety of PDA teaching applications to facilitate knowledge and skill application in specific topics (e.g., hypertension, colorectal cancer screening, community-based resources) and in how to access and use the electronically accessible information available to improve patient care. Concurrently, educational administrators have been able to obtain real-time data about students' clinical experiences to ensure that they are encountering the breadth and depth of exposure to common diseases and acute/chronic illnesses. These real time teaching and data collection strategies provide both a model for other medical schools and for our students in self-monitoring and the need for continuous improvement as future physicians.

## ACKNOWLEDGEMENTS

We would like to acknowledge Barbra Beck, PhD; Josiah Halm, MD; MaryEllen Goodell, MD; Mark Lodes, MD; Ruth Rademacher, MD; Linda Rufer, MD; Gregorio Sicard, MD; and Christopher Sobczak, MD, for inclusion of their faculty development technology projects.

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