Angina on the Palm

Randomized controlled pilot trial of Palm PDA software for referrals for cardiac testing

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ABSTRACT

OBJECTIVE Personal digital assistants (PDAs) are popular with physicians: in 2003, 33% of Canadian doctors reported using them in their practices. We do not know, however, whether using a PDA changes the behaviour of practising physicians. We studied the effectiveness of a PDA software application to help family physicians diagnose angina among patients with chest pain.

DESIGN Prospective randomized controlled pilot trial using a cluster design.

SETTING Primary care practices in the Toronto area.

PARTICIPANTS Eighteen family physicians belonging to the North Toronto Primary Care Research Network (Nortren) or recruited from a local hospital.

INTERVENTIONS We randomized physicians to receive a Palm PDA (which included the angina diagnosis software) or to continue conventional care. Physicians prospectively recorded the process of care for patients aged 30 to 75 presenting with suspected angina, over 7 months.

MAIN OUTCOME MEASURES Did the process of care for patients with suspected angina improve when their physicians had PDAs and software? The primary outcomes we looked at were frequency of cardiac stress test orders for suspected angina, and the appropriateness of referral for cardiac stress testing at presentation and for nuclear cardiology testing after cardiac stress testing. Secondary outcome was referrals to cardiologists.

RESULTS The software led to more overall use of cardiac stress testing (81% vs 50%). The absolute increase was 31% ($P = .007$, 95% confidence interval [CI] 8% to 58%). There was a trend toward more appropriate use of stress testing (48.6% with the PDA vs 28.6% control), an increase of 20% ($P = .284$, 95% CI -11.54% to 51.4%). There was also a trend toward more appropriate use of nuclear cardiology following cardiac stress testing (63.0% vs 45.5%), an absolute increase of 17.5% ($P = .400$, 95% CI -13.9% to 48.9%). Referrals to cardiologists did not increase (38.2% with the PDA vs 40.9%, $P = .869$).

CONCLUSION A PDA-based software application can lead to improved care for patients with suspected angina seen in family practices; this finding requires confirmation in a larger study.

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EDITOR'S KEY POINTS

- This pilot study is the first randomized controlled trial comparing referral for testing for angina with family doctors' use of a personal digital assistant (PDA) and software to calculate risk.
- Users of PDAs referred patients for cardiac testing more often than control subjects did (81% versus 50%). There were trends toward more appropriate referrals for stress tests and nuclear cardiology among PDA users.

Hand-held computers are increasingly being used in health care: a recent Canadian survey found that 33% of physicians used personal digital assistants (PDAs) in their practices.[1] No randomized controlled trial (RCT), however, has yet reported whether using a hand-held computer changes the behaviour of practising physicians. We report the results of the first pilot RCT on this subject to our knowledge.

We used a recent guideline on diagnosis and management of angina[2] as the basis for a PDA software application. This application assesses patients' risk of angina, using the Diamond-Forrester risk-stratification model,[3] and suggests appropriate diagnostic management. Further management suggestions are derived using test results, such as the Duke prognostic score[4] for electrocardiographic exercise stress testing.

The study's aim was to explore whether this diagnostic software would improve care for suspected angina. Primary outcomes were:

- frequency of ordering cardiac stress tests for diagnosis of suspected angina and
- appropriateness of cardiac stress testing at presentation, and of nuclear cardiology after cardiac stress testing.

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METHOD

We defined appropriate cardiac stress testing as referral for testing when there was an intermediate or high probability of angina, and no referral when there was a low probability of angina.[2,3] Appropriate referral for nuclear cardiology was referral after a cardiac stress test indicated intermediate prognostic risk using the Duke score.[2,4] Secondary outcomes included referrals to cardiologists.

We recruited 18 family physicians practising in Toronto, Ont. Eleven were members of the North Toronto Primary Care Research Network (Nortren), and seven were from a local hospital's department of family medicine. Written informed consent was obtained from all participants. Participants were allocated randomly to study groups using a simple block design. Nine physicians received Palm OS–based hand-held computers loaded with the angina software, and nine were instructed to continue to manage patients presenting with chest pain in their normal manner. Physicians randomized to the PDA group received a brief introduction to the technology and a short manual on use of the angina software (the manual is posted at **http://dfcm19.med.utoronto.ca/research/nortren/angina_manual.htm**).

Eligibility criteria for patient enrolment were being between 30 and 75 years old and presenting at the office to see their family physicians with symptoms judged by the physicians to be possible new-onset angina. Physicians recorded the identities of all such patients prospectively over 7 months, from mid-November 2001 to mid-June 2002; monthly reminders were sent to all physicians to maximize patient recruitment and to minimize recall bias. The medical records of patients identified by their family physicians were audited at the end of the recording period.

Ethics approval for the study was received from the North York General Hospital's Research Ethics Board.

Results were analyzed using SAS software (version 8.2). Nominal variables were compared using the chi-square test (or Fisher's exact test when appropriate), and accounted for clustering. All reported *P* values are two tailed.

RESULTS

Both groups of physicians were similar in terms of personal and professional characteristics. One physician recruited to the control arm of the study withdrew, and was excluded from the analysis. Patients' risk factors for cardiovascular disease were also found to be similar. Of the 76 patients enrolled over 7 months, 65 were eligible for inclusion in the analysis.

Fourteen of the 28 patients in the control arm (50%) and 30 of the 37 patients in the PDA arm (81%) were referred for cardiac stress tests ($P = .007$), an absolute difference of 31% (95% CI 8% to 58%). We also found a trend toward more appropriate referrals for cardiac stress tests among physicians using PDAs (**Table 1**), with an absolute increase of 20% ($P = .284$, 95% CI −11.54% to 51.4%).

We did not find a calculated Duke prognostic risk score in any of the electrocardiographic exercise stress test reports in charts. Using the data available in the reports, a Duke score could be calculated for 31 of the 38 cardiac stress tests done (82%); six tests were ordered but not done. Referral for nuclear cardiology after cardiac stress testing was appropriate for 45.5% of the patients in the control arm and 63% of the patients in the PDA arm (**Table 1**), an absolute increase of 17.5% ($P = .400$, 95% CI −13.9% to 48.9%).

Referrals to cardiologists did not differ between the two groups. We could determine whether a referral was made for 56 patients (86%); referral rates were 41% in the control group, and 38% in the PDA group ($P = .869$). A referral was more likely to have been made if the final diagnosis was angina (likelihood ratio for referral 15.455, 95% CI 2.124 to 112.431); in other words, family physicians appeared to refer appropriately.

DISCUSSION

Guidelines recommend cardiac stress testing as the initial investigation for most cases of suspected angina.[2,5,6] Previous studies of angina management in primary care found that only 34% and 6.4% of patients were referred for this test.[7,8] A systematic review of personal computer–based diagnostic decision aids reported that these were unlikely to change practice, as only one in five trials was positive.[9] We found a statistically significant increase in referrals for exercise stress tests with the PDA guideline. As well, results indicate a trend toward more appropriate referrals for cardiac stress testing, when appropriateness could be estimated. There was also a trend toward more appropriate referrals for nuclear cardiology testing.

Weaknesses of this study included the small physician sample size, the fact that many of the physicians belonged to a research network, and the fact that all physicians were located in the Toronto area. This will limit the findings' generalizability. We are planning a larger trial in a variety of geographic locations, which will improve the external validity of the results.

In conclusion, results of this pilot trial indicate that providing family physicians with an interactive guideline on PDAs can improve care for patients presenting with suspected angina, particularly in relation to referral for exercise stress testing.

Table 1. Appropriate diagnostic tests

DIAGNOSTIC TEST GROUP	TEST GIVEN APPROPRIATELY NO. (%)	TEST GIVEN INAPPROPRIATELY NO. (%)	APPROPRIATENESS OF TEST UNKNOWN NO. (%)	95% CONFIDENCE INTERVAL	*P* VALUE
Cardiac stress testing				-11.54%-51.4%	.28
• Personal digital assistant	18 (48.6)	10 (27.0)	9 (24.3)		
• Control	8 (28.6)	10 (35.7)	10 (35.7)		
Nuclear cardiology testing				-13.9% to 48.9%	.4
• Personal digital assistant	17 (63.0)	5 (18.5)	5 (18.5)		
• Control	5 (45.5)	4 (36.4)	2 (18.2)		

A full version of this article is available at **http://individual.utoronto.ca/mgreiver/angina.pdf.** ❦

Contributors

Dr Greiver *was principal investigator for this study. She contributed to concept and design of the study, acquisition of data, and analysis and interpretation of data. She wrote the first draft of the article and approved the final version.* **Dr Drummond** *contributed to concept and design of the study, assisted with analysis and interpretation of data, revised the draft for important intellectual content, and approved the final version.* **Dr White** *contributed to concept and design of the study, assisted with analysis and interpretation of data, revised the draft for important intellectual content, and approved the final version.* **Mr Weshler** *contributed to concept and design of the study, assisted with interpretation of data, revised the draft for important intellectual content, and approved the final version.* **Dr Moineddin** *contributed to the analysis and interpretation of data, revised the draft for important intellectual content, and approved the final version.*

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