

ORIGINAL RESEARCH

Assessing the Impact on Patient–Physician Interaction When Physicians Use Personal Digital Assistants: A Northeastern Ohio Network (NEON[®]) Study

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Background: The effects of the use of technological devices on dimensions that affect the physician–patient relationship need to be well understood.

Objectives: Determine patients' perceptions of physicians' personal digital assistant (PDA) use, comparing the results across 8 physician–patient dimensions important to clinical interactions.

Results: Patients completed anonymous surveys about their perceptions of physician PDA use. Data were collected during 2006 and 2007 at 12 family medicine practices. Survey items included physician sex, patient demographics, if physicians explained why they were using the PDA, and Likert ratings on 8 dimensions of how a PDA can influence physician–patient interactions (surprise, confidence, feelings, comfort, communication, relationship, intelligence, and satisfaction). The survey response rate was 78%. Physicians explained to their patients what they were doing with the PDA 64% of the time. Logistic regression analyses determined that patients of male physicians, patients attending private practices and underserved sites, patients with Medicaid insurance, and patients who observed their physician using a PDA during both the index visit and at least one prior visit were more likely to receive an explanation of PDA use. Most importantly, physician–patient communication was rated significantly more positive if an explanation of PDA use was offered.

Conclusion: Patients rate interactions with their physicians more positively when physicians explain their PDA use. (J Am Board Fam Med 2009;22:353–9.)

Physicians should be able to identify and take advantage of therapeutic elements present during their interactions with patients.¹ When properly

managed, physician–patient interactions in and of themselves can have distinct therapeutic benefits that impact patient outcomes.^{1,2} One of the most important determinants of patient satisfaction is the physician–patient relationship, especially in relation to the physician's communication skills, ability to engage the patient, and their development of empathy.³ Effective communication skills result in more satisfied patients and better outcomes, whereas poor communication skills lead to patient dissatisfaction and poorer outcomes, especially when the patient perceives insensitivity from their physician.^{4–6} However, in the Information Age, the practice of modern medicine often relies more on technologically enhanced diagnostic and therapeutic techniques and sometimes seems to minimize the potential healing benefits of the physician–patient relationship.¹

A recent advance in clinical management is the increased use of electronic medical devices during research and practice.⁷ One example is the personal

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digital assistant (PDA). Physicians' use of PDAs continues to increase and, depending on the setting, ranges from 45% to 87%.^{8,9} Physicians report that PDAs improve access to medication information, improve practice efficiency, and influence clinical decision making and patient management options.⁹⁻¹² However, at the same time, physicians gazing at a computer monitor and typing on a keyboard during the physician-patient interaction have been shown to affect the interaction negatively because of a significant decrease in dialogue.¹³

Considering present trends, electronic medical devices undoubtedly will continue to play a prominent role in health care delivery. Therefore, it is important to determine the comprehensive effects of the use of electronic devices on all the dimensions that affect the physician-patient relationship.¹⁴ It is critical to determine whether electronic devices used at the point of care negatively affect the physician-patient relationship¹⁴ and, if they do, what solutions can be implemented to overcome this barrier? There also are significant concerns that the benefits from the use of electronic medical devices will not be distributed equally across socio-demographic groups determined by sex, race, and socioeconomic status.¹⁵

Given the potential positive and negative effects of physician PDA use on the physician-patient relationship, the objectives of this study were to (1) determine patient perceptions of physician PDA use during primary care health encounters; (2) compare the results across a variety of physician-patient dimensions critically important to mutually beneficial clinical interactions; (3) compare results across 3 different types of clinical settings; (4) identify independent predictors of physicians who communicate to patients why they are using a PDA in the examination room; and (5) evaluate the effect of sociodemographic groups.

Methods

The study sites were 12 primary care medical practices that are members of the Northeastern Ohio Network, the practice-based research network of the Department of Family Medicine at the Northeastern Ohio Universities Colleges of Medicine and Pharmacy in Rootstown, OH. Data were collected between the autumn of 2006 and the spring of 2007. The participating clinical sites included 6

family medicine residency training programs affiliated with the medical school, 3 clinics for the medically underserved, and 3 community-based primary care physician offices. Eligible patients were adults 18 years of age and older, able to speak and read English, who had witnessed their physician using a PDA during their index physician-patient encounter or a previous visit.

After an office visit was completed, a trained research assistant approached eligible patients in the waiting room before they left the office and asked them about their willingness to complete an anonymous survey about their perception of their physician's use of a PDA. During data collection, the research assistant carried a PDA in case patients did not know what one was. Survey items included patient age, race, sex, education, insurance status, physician sex, whether the physician used a PDA during the present office visit or during a previous office visit, and whether the physician explained to the patient why the PDA was being used.

In addition, patients evaluated 8 patient-centered dimensions of the physician-patient relationship using a 5-point Likert-scale: (1) How *surprised* were you that your doctor used a PDA? (2) How did the PDA affect your *confidence* in your doctor? (3) How did the PDA make you *feel* about your doctor? (4) How *comfortable* were you with your doctor using a PDA? (5) How did the PDA affect your *communication* with your doctor? (6) How did the PDA change your *relationship* with your doctor? (7) How *smart* do you think your doctor is because he/she used a PDA? and (8) How did the PDA affect your *satisfaction* with the visit? Patients who were uncomfortable with their physician using a PDA were asked to report the reasons why they felt uncomfortable. To help physicians adhere to their normal practice routines, the physicians who participated were told only that there was a study being conducted in their practice, but were not informed about the nature of the study. All the participating physicians were experienced in having research studies conducted at their sites.

Percentages and measures of central tendency and dispersion were used to describe the study population and responses to the Likert-scaled items. Multivariate logistic regression was used to determine relationships among the items and to determine which factors, if any, predicted whether or not physicians explained to patients what they were doing with the PDA.¹⁶ Patient sex, race, and

age were automatically included in the logistic regression model to test and control for the effects of basic patient demographics. To determine the remaining factors to be included in the model, bivariate comparisons between the outcome (the physician did or did not explain PDA use) and the remainder of the survey items were measured using χ^2 and t tests. Based on a strategy by Hosmer and Lemeshow,¹⁶ variables whose bivariate tests resulted in $P < .25$ were included in the initial logistic model. Variables whose bivariate tests resulted in $P > .25$ were excluded from the model.

The Institutional Review Boards at the Northeastern Ohio Universities Colleges of Medicine and Pharmacy (Rootstown, OH); The University of Akron (Akron, OH); and Forum Health (Youngstown, OH) reviewed and approved the study protocol.

Results

Of the 366 patients approached who were eligible to participate in the study, 284 completed the survey and 82 refused, for a response rate of 78%. The refusal rate was 30% at the community-based sites, 21% at the residency programs, and 14% at the underserved clinics. An additional 196 patients were willing to complete a survey, but were ineligible because they never witnessed their physician use a PDA during any of their office visits. There were only 3 eligible patients who did not know that the PDA was a handheld computer. Before these patients completed the survey, the research assistant informed the patients what a PDA was. The description of the study sample is presented in Table 1. The family medicine residencies contributed the most respondents, followed by community-based sites and underserved sites, respectively. There were more female respondents (78%) completing surveys than the average number of women who were patients at these sites (66%). Blacks and whites were the only races for whom data were analyzed because of insufficient sample sizes for other races. The majority of patient office visits (73%) involved male physicians as the principal health care provider. There were 64 patients who observed their physician using a PDA for the first time during the index visit. There were 102 patients who observed their physician using a PDA both during the index visit and during at least one previous visit. There were 118 patients who did not observe physician PDA use during the index visit, but had observed PDA use at least once during a prior visit.

Table 1. Description of the Study Sample of Patients Who Completed the Portable Digital Assistant Survey (n = 264)

Type of Site	n (%)
Community-based	68 (24)
Family medicine residency	189 (67)
Underserved	27 (10)
Patients' sex	
Male	63 (22)
Female	221 (78)
Patients' race	
White	216 (76)
Black	65 (23)
Other	3 (1)
Patients' age (years)	
Mean	44.3
SD	17.0
Range	18–88
Patients' insurance status	
Private only	89 (31)
Medicaid only	74 (26)
Free/self pay/sliding scale	64 (23)
Medicare only	25 (9)
Medicare/private	17 (6)
Medicaid/Medicare	15 (5)
Patients' highest level of education (years)	
0–8	8 (3)
9–11	23 (8)
High school graduate	91 (32)
Technical school graduate	22 (8)
13–14	86 (30)
15–16	42 (15)
17–18	12 (4)
Physicians' sex	
Male	206 (73)
Female	78 (27)
Patient-physician gender pair	
Female patient/male physician	152 (54)
Female patient/female physician	69 (24)
Male patient/male physician	54 (19)
Male patient/female physician	9 (3)

Table 2 displays the response categories, means, standard deviations, and ranges for the 8 patient-centered, Likert-scaled questions designed to tap into various dimensions of the physician-patient relationship. For all 8 questions, a higher response number indicates a more positive response. For all of the dimensions reported in Table 2, patients positively rated their interactions with their physician when the physician used the PDA. Three patients responded that they were uncomfortable

Table 2. Descriptive Statistics for the Likert-Scaled, Patient-Centered Survey Items

Response Options	N (%)	Mean (SD)
How surprised were you that your doctor used a PDA? (N = 284)		
1 = Extremely surprised	4 (1)	4.2 (1.1)
2 = Very surprised	18 (6)	
3 = No effect	63 (22)	
4 = A little surprised	43 (15)	
5 = Not surprised at all	156 (55)	
How did the PDA affect your confidence in your doctor? (n = 282)		
1 = Much less confidence	4 (1)	3.5 (0.9)
2 = A little less confident	9 (3)	
3 = No change in confidence	178 (63)	
4 = A little more confident	36 (13)	
5 = Much more confident	55 (20)	
How did the PDA make you feel about your doctor? (n = 283)		
1 = Many more bad feelings	0 (0)	3.6 (0.8)
2 = Some bad feelings	4 (1)	
3 = No change in feelings	171 (60)	
4 = Some good feelings	51 (18)	
5 = Many more good feelings	57 (20)	
How comfortable were you with your doctor using a PDA? (n = 283)		
1 = Much less comfortable	2 (1)	3.5 (0.9)
2 = Somewhat less comfortable	7 (2)	
3 = No change in comfort	171 (60)	
4 = Somewhat more comfortable	45 (16)	
5 = Much more comfortable	58 (20)	
How did the PDA affect your communication with your doctor? (N = 284)		
1 = Much worse	0 (0)	3.4 (0.7)
2 = Somewhat worse	7 (2)	
3 = No effect	206 (73)	
4 = Somewhat better	35 (12)	
5 = Much better	36 (13)	
How did the PDA change your relationship with your doctor? (N = 284)		
1 = Much less personal	0 (0)	3.2 (0.6)
2 = Somewhat less personal	10 (4)	
3 = No change	237 (83)	
4 = Somewhat more personal	19 (7)	
5 = Much more personal	18 (6)	
How smart do you think your doctor is because he/she used a PDA? (N = 284)		
1 = Much less smart	0 (0)	3.5 (0.8)
2 = Somewhat less smart	5 (2)	
3 = No change	171 (60)	
4 = Somewhat more smart	60 (21)	
5 = Much more smart	48 (17)	
How did the PDA affect your satisfaction with the visit? (N = 284)		
1 = Much less satisfied	0 (0)	3.4 (0.8)
2 = Somewhat less satisfied	5 (2)	
3 = No effect	190 (67)	
4 = Somewhat more satisfied	49 (17)	
5 = Much more satisfied	40 (14)	

PDA, personal digital assistant.

with the physician using a PDA and gave the reasons why they were uncomfortable: (1) “I feel that sometimes they can overlook things on a computer that they would not overlook on paper”; (2) “It gives you the first thought that they may not know what they are doing”; and (3) “What would happen if the computer lost my records?” Physicians explained to their patients what they were doing with the PDA 64% of the time (179 of 279, 5 missing responses).

Factors that satisfied the inclusion criteria for being in the initial multivariate logistic model were physician sex; patients with only Medicaid insurance; patients with only Medicare insurance; the type of clinic; patients who observed their physician using the PDA during both the index visit and during at least one previous visit; and the Likert-scaled items on confidence, feelings, comfort, communication, relationship, and satisfaction. Patients who were first-time observers of physician PDA use, patients with only Medicare insurance, and the Likert-scaled items for confidence and satisfaction were dropped from the model because they were not significantly related to physician explanation of PDA use when controlling for the other initial factors tested. Bivariate correlations among the remaining patient-physician dimensions of feelings, comfort, communication, and relationship indicated possible multicollinearity (Pearson r ranging from 0.4 to 0.8, depending on the pair of variables tested). Communication best represents the “team” approach currently used by patients and physicians as they seek to resolve health care issues, and it also had the strongest bivariate relationship with the dependent variable (explaining the use of a PDA) and thus was selected for inclusion in the logistic model. The items concerning feelings, comfort, and relationship were dropped from the model.

Table 3 presents the multivariate logistic model. Controlling for all of the other variables in the model, male physicians were nearly twice as likely as female physicians to explain their use of the PDA to the patient. Private-practice, community-based physicians and physicians caring for patients in sites for the medically underserved were more than 3 times as likely to explain PDA use to their patients than residency-based physicians. Medicaid patients were nearly 2.5 times more likely than patients with other types of insurance to receive an explanation of their physicians’ PDA use. Patients who observed their physician using a PDA during both the

Table 3. Predictors of Physician Explanation of Personal Digital Assistant (PDA) Use, Controlling for Patient Demographics (Logistic Regression Model)

Variable	Odds Ratio (95% CI)
Patient sex	1.355 (0.695, 2.643)
Patient race	1.725 (0.888, 3.352)
Patient age	0.988 (0.971, 1.006)
Male physician	1.875 (1.013, 3.470)
Private site	3.167 (1.519, 6.604)
Underserved site	3.522 (1.258, 9.861)
Medicaid	2.543 (1.206, 5.362)
Patients who observed PDA use*	2.238 (1.237, 4.046)
Communication	2.187 (1.345, 3.487)

*Patients who observed physician PDA use both during the index visit and at least one previous visit.

index visit and at least one previous visit were more than 2 times more likely to receive an explanation of PDA use. First-time observers of physician PDA use were *not* more likely to receive an explanation of PDA use. Most importantly, physician communication was rated more positively by the patient if the physician explained why the PDA was being used. There were no significant effects by patient sex, race, or age.

Discussion

During the past few years, the physician-patient relationship has evolved from the physician assuming principal responsibilities for patients’ health care to a situation where patients and physicians often work together to resolve health care issues.¹⁷ The manner in which physicians use computers at the point of care has the potential to profoundly affect the physician-patient relationship, positively or negatively, depending on the behavior of the physician.^{1–6,9–14} Communication issues are one of the most important aspects of the interaction between the physician and the patient. Approximately 75% of primary care patients prefer that treatment decisions are made in conjunction with their physician.¹⁸ Empathy, reassurance, support, providing explanations, positive reinforcement, and information sharing all have been associated with positive health outcomes.¹⁹ Compared with a control group, patients of physicians who completed a program to enhance the communication skills of health care professionals had shorter hospital stays, improved outcomes, and rated more highly the qual-

ity of communication with health care providers.²⁰ At the same time, it has been shown that computers in the examination room can affect physician-patient communication negatively by limiting dialogue.¹³ Mueller and colleagues²¹ found that 57% of new internal medicine faculty reported that they would benefit from additional communication training.

Our study found that patients rate their interactions and communications with physicians more positively when their physician explains why they are using the PDA. It is possible that the process of informing patients about the details of office visit procedures may facilitate the overall quality of patient-physician communication and ultimately improve patient care. It would seem that what is important is patient perceptions of the quality of the interaction with their physician in terms of patient-perceived “better communication” and “personability” of the interaction.

Female physicians are often better communicators than male physicians,²² but our study found that male physicians were nearly twice as likely as female physicians to explain PDA use. One possible explanation for our results regarding physician sex is that there is some indication that male physicians are trying harder to establish a more patient-centered approach during clinical management.²³ In addition, Aruguete and Roberts²⁴ found that study participants recalled more information when a male physician was controlling rather than affiliative, suggesting that communication style may be more important than the sex of the physician.

Finally, it is possible that both the sex of the physician and residency site factors results are caused by different levels of practice experience between residencies, private practices, and clinics for the underserved. All of the participating physicians from private practice and underserved clinics were experienced physicians with years of practice using a PDA during patient care. However, in the residency sites, nearly all the physician-patient interactions were with third-year family medicine residents who were younger and less experienced than the other participating physicians. Physician age and years of practice were not explicitly collected from patients because many patients of residency sites would be unable to accurately identify attending physicians versus residents, and, at sites with multiple physicians, some patients may not be

able to accurately identify the name of the physician who treated them.

Concern has been expressed that the benefits of the use of electronic medical devices will not be distributed equally across demographic and socioeconomic groups, ie, the more well-to-do may be expected to receive more benefits.¹⁵ However, we did not find an unequal distribution in our study. There were no significant differences between receiving an explanation of PDA use from the physician with respect to patient age, sex, or race. A somewhat surprising result was that patients who only had Medicaid insurance were 2.5 times more likely to receive an explanation of PDA use than patients with other types of insurance. One possible hypothesis concerning this finding is that physicians may take greater care to explain what they are doing with electronic medical devices when managing a more vulnerable patient population. Another possibility is that the physician may think that the uninsured patient is more likely never to have ever seen a PDA.

The goal of this study was to understand the impact of a PDA on the physician-patient relationship so that we can begin to design more effective strategies to enhance physician-patient interactions while minimizing the pitfalls and maximizing the benefits of using technological and electronic devices in the examination room. Based on our results, we recommend that (1) physicians *always* explain to patients what they are doing when using electronic medical devices in the examination room; (2) attending physicians located at training sites should encourage their residents to explain their PDA use to their patients; and (3) more physicians learn about and demonstrate the factors that have been shown to promote healthy and unhealthy communication patterns with their patients, including cultural awareness and literacy issues.

Three limitations of the study are noted. First, a higher percentage of female patients participated in the study (78%) than the total average female composition of the clinical sites (66%). Second, the effect of races other than black and white could not be evaluated because only 3 patients of other races participated. Third, only 27 patients were recruited from underserved sites. In terms of the underserved, our principal reason for soliciting this population was to ensure that we could test the effect of no insurance. We were successful in doing this by

combining the 27 underserved patients with 29 residency patients and 8 private-practice patients without insurance.

Conclusion

Patients rate their interactions and communications with physicians more positively when their physician explains why they are using a PDA. It is possible that improved communication ultimately improves patient care.

References

1. Lipkin M, Putnam SM, Lazare A. The medical interview: clinical care, education, and research. New York (NY): Springer-Verlag; 1995.
2. Barrier PA, Li JTC, Jensen NM. Two words to improve physician-patient communication: what else? *Mayo Clin Proc* 2003;78:211-4.
3. Suchman AL, Roter D, Green M, Lipkin M Jr. Physician satisfaction with primary care office visits: collaborative study group of the American Academy on Physician and Patient. *Med Care* 1993;31:1083-92.
4. Coulehan JL, Block MR. The medical interview: mastering skills for clinical practice. 4th edition. Philadelphia (PA): F.A. Davis Company; 2001.
5. Beckman HB, Markakis KM, Suchman AL, Frankel RM. The doctor-patient relationship and malpractice: Lessons from plaintiff depositions. *Arch Intern Med* 1994;154:1365-70.
6. Vincent C, Young M, Phillips A. Why do people sue doctors? A study of patients and relatives taking legal action. *Lancet* 1994;343:1609-13.
7. Gaertner J, Elsner F, Pollmann-Dahmen K, Radbruch L, Sabatowski R. Electronic pain diary: a randomized crossover study. *J Pain Symptom Manage* 2004;28:259-67.
8. Garritty C, El Emam K. Who's using PDAs? Estimates of PDA use by health care providers: a systematic review of surveys. *J Med Internet Res* 2006;8:e7.
9. Dee CR, Teolis M, Todd AD. Physicians' use of the personal digital assistant (PDA) in clinical decision making. *J Med Libr Assoc* 2005;93:480-6.
10. Rothschild JM, Lee TH, Bae T, Bates DW. Clinician use of a palmtop drug reference guide. *J Am Med Inform Assoc* 2002;9:223-9.
11. Jones D, Curry W. Impact of a PDA-based diabetes electronic management system in a primary care office. *Am J Med Qual* 2006;21:401-7.
12. McCord G, Smucker W, Selius B, et al. Answering questions at the point of care: Do residents practice EBM or manage information sources? *Acad Med* 2007;82:298-303.
13. Margalit RS, Roter D, Dunevant MA, Larson S, Reis S. Electronic medical record use and physician-patient communication: an observational study of Israeli primary care encounters. *Patient Educ Couns* 2006;61:134-41.
14. Garrison GM, Bernard ME, Rasmussen NH. 21st-century health care: the effect of computer use by physicians on patient satisfaction at a family medicine clinic. *Fam Med* 2002;34:362-8.
15. Lobach DF, Willis JM, Macri JM, Simo J, Anstrom KJ. Perceptions of Medicaid beneficiaries regarding the usefulness of accessing personal health information and services through a patient Internet portal. *AMIA Annu Symp Proc* 2006:509-13.
16. Hosmer DW, Lemeshow S. Applied logistic regression. New York (NY): John Wiley & Sons; 1989.
17. Chhanabhai P, Holt A. Consumers are ready to accept the transition to online and electronic records if they can be assured of the security measures. *Med Gen Med* 2007;8:9.
18. Schwenk TL, Evans DL, Laden SK, Lewis L. Treatment outcome and physician-patient communication in primary care patients with chronic, recurrent depression. *Am J Psychiatry* 2004;161:1892-901.
19. Beck RS, Daughtridge R, Sloane PD. Physician-patient communication in the primary care office: a systematic review. *J Am Board Fam Pract* 2002;15:25-38.
20. Trummer UF, Mueller UO, Nowak P, Stidl T, Pelikan JM. Does physician-patient communication that aims at empowering patients improve clinical outcome? *Patient Educ Couns* 2006;61:299-306.
21. Mueller PS, Barrier PA, Call TG, et al. Views of new internal medicine faculty and their preparedness and competence in physician-patient communication. *BMC Med Educ* 2006;6:30.
22. Hall JA, Roter DL. Do patients talk differently to male and female physicians? A meta-analytic review. *Patient Educ Couns* 2002;48:217-24.
23. Roter DL, Hall JA. How physician gender shapes medical care. *Mayo Clin Proc* 2001;76:673-6.
24. Aruguete MS, Roberts CA. Gender, affiliation, and control in physician-patient encounters. *Sex Roles* 2000;42:107-18.