

# Computer Use in the HIV Primary Care Clinic: Patient and Provider Perspectives

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## Abstract

**Background:** Patients infected with HIV face unique psychosocial stressors thus good quality patient-provider relationships are essential.

**Objective:** The objective of this study was to determine whether computers use by providers during outpatient visits for HIV-infected patients negatively affected the encounter.

**Design/Participants:** Two hundred HIV-infected patients and twenty HIV providers were surveyed at an adult HIV clinic in a cross sectional survey study.

**Main Measures:** Main measures used for this study were demographic variables and survey questions based on effects of computer use on interpersonal contact and communication using a Likert Scale.

**Results:** The majority of patients felt that it was appropriate for a provider to use a computer during the visit and were satisfied with the care they received. However, patients who did not own a personal computer, were female, had lower educational status, had detectable viral load, had lower CD4 cell count or had not disclosed their HIV status were more likely to negatively perceive provider computer use. Most providers felt that they missed non-verbal cues when using the computer (70%) and that computer use in the exam room did not improve the relationship with the patient (75%).

**Conclusion:** Providers can be assured that patients do not view the computer as negatively as they do. The study identified specific patient populations which may benefit from providers using the computer less in the exam room.

**Keywords:** HIV; Computer; Electronic medical record; Patient-provider relations; Patient provider communication

## Introduction

In the United States, in the 1970s, the first Electronic Medical Record (EMR) systems were developed with the goal to track and record patient data for the next visit. With the Health Insurance Portability and Accountability Act (HIPAA) in 1996, there was growing interest to expand the utility of EMR on how it could be used to adhere to laws of privacy and security of health information. In 2009, the Health Information Technology for Economic and Clinic Health (HITECH) Act was passed, which gave twenty billion dollars to promote and expand health information technology in health care.

Center for Medicare and Medicaid Services also provided incentive programs for hospitals and clinics to use EMRs. The Office of the National Coordinator for Health Information Technology reported that from 2008 to 2015, EMR adoption doubled from 42% to 87% in office-based practices using any type of EMR [1]. Thus, in the past 40 years, there has been a rapid development and intake of the EMR into health care in the United States.

EMR use is now a major component of ambulatory care [2,3] as it increases efficiency [4,5] and is thought to improve quality of care [6]. As providers spend more time in front of the computer while

interacting with the patient [7], there is concern that it will affect the patient provider communication through less eye contact and missed nonverbal communication [8-10].

The patient-provider relationship is a significant component of the delivery of healthcare and more so for patients infected with the human immunodeficiency virus (HIV). These individuals face unique psychosocial stressors, including the chronic nature of the disease, need for strict adherence to medication regimens, and often multi-layered stigma [11]. Research has shown that a patient-centered approach and good quality patient-provider relationships for the care of HIV-infected patients promoted adherence to medication therapy [12-16] and was associated with an undetectable HIV viral load [17].

Research on computer use during the clinical encounter in the outpatient setting has demonstrated a positive to neutral effect on patient satisfaction [18-20] although no published studies have addressed computer use and the impact on the patient-provider relationship among HIV-infected patients. We further explore this complex interaction from both provider and patient perspectives by assessing the perceptions of both HIV-infected patients and providers on computer use during an outpatient encounter. These assessments were based on factors known to be associated with patient satisfaction [21] and the effects of computer use on interpersonal contact [22].

## Methods

### Patient participants

All patient participants were recruited from December 2014 to January 2015 at an adult ambulatory HIV clinic at an academic medical center, Yale New Haven Hospital, in New Haven, Connecticut, United States. The EMR system and computers were installed at this site in the year 2000, approximately 14 years prior to the study. The installment of the EMR system into the clinic was mandatory for all ambulatory clinics at Yale New Haven Hospital.

Patients were eligible to participate in the study if they were infected with HIV, had a routine or urgent care appointment with a provider (including attending physicians, resident physicians, physician assistants, or nurse practitioners; excluding nursing visits), were able to provide verbal informed consent, and were able to read and comprehend English. The study was approved by the Yale University Institutional Review Board.

Eligible participants were asked to participate at the time they arrived for their appointment or immediately after their encounter with their provider. After providing verbal informed consent, an anonymous survey was completed by the participants following their encounter with their provider. Surveys were compiled and coded by number prior to data entry. One researcher administered all of the surveys to minimize multiple surveys by any one participant.

### Provider participants

All provider participants were recruited from the same adult ambulatory outpatient HIV clinic from February 2015 to August 2015. Providers are required to input data into the EMR for the clinic visits for purpose of billing and to be compensated for the clinic visits. The input of data is fixed, as visits require entry of data such as history, vital signs, physical exam, and concerns addressed during visit, and entry of orders such as blood work and prescription medications. However, the timing of when data is entered into the EMR varies by provider, based on provider preferences and visit with the patient. For example, some providers input data with the patient in the exam room to be efficient and complete work, while others input data after the visit in an effort

to maintain the patient-provider relationship. Provider recruitment did not begin until after the patient participant recruitment was completed. Providers were eligible if they were attending physicians, resident physicians, physician assistants, or nurse practitioners; nurses and medical assistants were excluded.

Providers were approached before or after their clinic sessions. After providing verbal informed consent, an anonymous survey was completed by the participant. Surveys were compiled and coded by number prior to data entry. One researcher administered all of the surveys to minimize multiple surveys by any one participant.

### Surveys

Distinct surveys were designed for the patient and provider arms of the study. The patient survey was composed of forty-four questions, which included demographics, extent of personal computer use, self-report of HIV viral load and CD4 cell count, as well as twenty-five items related to computer use during the clinical encounter and the patient-provider relationship. The provider survey comprised a total of thirty-one items, which included questions regarding demographics, computer use, as well as twenty-two items related to computer use during the clinical encounter and patient-provider relationship. A majority of the questions related to computer use during the clinical encounter and patient-provider relationship were the same for both surveys. Responses for both surveys were based on a four-point Likert scale [23] without a neutral option. Neutral option was omitted to avoid the respondents' behavior of survey satisficing and answer choice ambivalence [24].

### Statistical analysis

The characteristics of survey participants were summarized using frequency and percentage for categorical variables, and mean (standard deviation) and median (range) for continuous variables as appropriate. The comparison of responses between patients and providers were conducted using Chi-squared test or Fisher's exact test. The four-scale responses were dichotomized as binary outcomes, (i.e. Agree vs. Disagree) for logistic regression analysis. Logistic regression analyses were performed to examine the association of patients' characteristics and their response. Odds ratio and 95% confidence interval were presented. Statistical analysis was performed using SAS 9.4 (SAS Institute, Cary, NC). Significance level was set at P less than 0.05, two-sided.

## Results

### Patient characteristics

Two hundred patient participants were surveyed with a median age of 52 years (range 20 to 76 years). Thirty-seven percent of patients were female and approximately half of the patients (52%) were African American. The majority of patients had a self-reported undetectable viral load (74%) and CD4 cell count greater than 200 cells/ $\mu$ L (71%). Most patients (86%) had disclosed their HIV status to another person, including a family member, significant other, friend, or colleague. Only a small percentage of patients (5%) were cared for by resident physicians. Other demographic factors are outlined in table 1.

Table 2 summarizes the patient's response to select questions in the patient survey. Patients expressed a general positive attitude toward computer use in the exam room. Among the 200 patient participants, 192 (96%) responded that their providers used the computer during their visit. Among this subgroup, personal computer use, gender, education level, HIV viral load, CD4 cell count, and HIV disclosure

**Table 1:** Demographics, Computer Use, and Medical Characteristics of Patient Participants.

		Number (N)	Percent (%)
Age	Years, Mean (SD)	50 (13)	-
	Median (min, max)	52 (20,76)	
Gender	Male	125	63
	Female	75	37
Race	Caucasian	52	26
	African American	105	52
	Other	27	14
	No answer	16	8
Education	Less than High School	50	25
	High School Graduate	77	39
	High School Graduate	73	36
Personal Computer Use	Yes	126	63
	No	70	35
	No answer	4	2
Employment	Employed	49	25
	Unemployed	134	66
	No answer	17	9
Viral Load	Undetectable	147	74
	Detectable	30	15
	Unsure/No Answer	23	11
CD4 Cell Count	Greater than 200	143	71
	Less than 200	22	11
	Not Sure	35	18
HIV Disclosure Status	Disclosed	171	86
	Not Disclosed	29	14
Provider Training	Resident	10	5
	Attending/PA/NP	144	72
	Unsure/No Answer	46	23

PA: Physician Assistant; NP: Nurse Practitioner

status all served as significant predictors of whether a patient agreed with survey questions.

Patients with personal computers voiced less concern for computer use by providers compared to those without personal computers. Patients without personal computers were more likely to agree that, "My provider spends less time listening to me when he/she uses the computer (Odds Ratio (OR) 4.2, 95% Confident Interval (CI) 1.7-10.7, P=0.003)." They were also more likely to agree that "My visit is less personal because my provider uses the computer (OR 2.5, CI 1.3-5.0, P=0.009)." Additionally, patients expressing less frequent computer use were more likely to agree that, "I wish my provider would let me see what he/she is doing on the computer" (Monthly use vs Daily use: OR 1.1, CI 0.3-4.6; Weekly use vs Daily use: OR 5.4, CI 1.7-17.6; P=0.02). Furthermore, monthly users were more likely than daily users to agree that "I wish my doctor would not use computer during my visit" (Monthly use vs Daily use: OR 8.9, CI 2.0-39.0, P=0.01).

When disaggregating data by gender, female patients were consistently more likely to disagree with several questions related to computer use and screen use during the visit compared to male patients. A higher proportion of women disagreed with the statements, "I understand my lab results better when my provider uses the computer and shows it to me on the computer screen" (OR 0.3, CI 0.1-0.7, P=0.004) and, "I understand my medical problems better when my provider uses the computer and shows it to me on the computer screen" (OR 0.3, CI 0.2-0.8, P=0.008) compared to men. Additionally,

**Table 2:** Select Survey Responses: Patient Attitude towards Provider Computer Use in the Exam Room.

Questions	Agree	Disagree
<b>Computers and Communication</b>		
When my provider is using and looking at the computer:		
I can talk easily with my provider	95	5
I feel uncomfortable	13	87
my provider spends less time listening to me	13	87
my provider makes good eye contact with me	88	12
my provider is able to listen to me	94	6
my relationship with my provider is better	73	27
my visit is less personal	26	74
<b>Computers and Time</b>		
My provider spends enough time talking to and examining me while using the computer	83	17
<b>Computers and Privacy</b>		
I feel comfortable:		
disclosing private information about myself while my provider uses the computer	88	12
with my provider using a computer to track information about me	93	7
<b>Computers and Education</b>		
I understand:		
my lab results better when my provider shows it to me on the computer screen	87	13
my medical problems better when my provider shows it to me on the computer screen	81	19
what medications to take when my provider uses the computer	72	28
<b>Computers and Satisfaction</b>		
I am satisfied with:		
the amount of attention given to me by my provider	97	3
the way my provider listened to my concerns	96	4
the way my provider explained my health to me	96	4
the medical care I receive from my provider	97	3

female patients were less likely to agree that, "I understand what medications to take and how to take it better when my provider uses the computer" (OR 0.5, CI 0.2-0.9, P=0.02) compared to male patients.

In contrast to the differences between women and men, patients with high school degree or above (such a college or master's degree) demonstrated less dissatisfaction with computer use in the exam room compared to those who had not completed either middle school or high school. Those with higher educational degree agreed less with the statement, "My visit is less personal because my provider uses the computer" (High School Degree vs No High School Degree, OR 0.3, CI 0.1- 0.7, Bachelor's Degree or Above vs No High School Degree, OR 0.4, CI 0.2-1.0, P=0.02), and were more likely to agree that their provider was skilled at using the computer (High School Degree vs No High School Degree, OR 9.1, CI 1.0-80.7, P=0.04). Additionally,

patients with higher educational degrees expressed higher concurrence with the notion that they better understand their lab results when the provider used a computer and showed it to them on a computer screen (Bachelor's Degree or Above vs No High School Degree, OR 6.3, CI 1.9-21.0, P=0.006).

Patients with an undetectable HIV viral load were more likely to agree that their provider is skilled at using the computer (OR 0.1, CI 0.008 - 1.02, P=0.022). Compared to patients with a CD4 cell count of less than 200 cells/ $\mu$ L, patients with a higher CD4 cell count (>500 cells/ $\mu$ L) agreed that they could talk easily with their provider when he/she is looking at the computer (OR 7.5, CI 1.6-34.7, P=0.02). Similarly, these patients less often agreed that "My visit is less personal because my provider uses the computer" compared to those who had CD4 cell count less than 200 cells/ $\mu$ L (OR 0.3, CI 0.09-0.8, P=0.04), but agreed at a higher percentage that they understand their medical problems better when their provider uses a computer and shows it to them on a computer screen (OR 1.7, CI 0.8-4.9, P=0.005).

Patients who had not disclosed their HIV diagnosis to others were more likely to answer negatively to the questions regarding provider computer use. They were less likely to agree that, "My provider spends enough time talking to me and examining me while using the computer" (OR 0.3, CI 0.1-0.6, P=0.003) and to the statement "I feel comfortable disclosing private information about myself while my provider uses the computer (OR 0.3, CI 0.1-0.8, P=0.02)."

### Provider characteristics

Twenty HIV providers completed the survey (Table 3). A majority of the providers were female (70%) and had practiced an average of 14 years (range 0.5 to 50 years). Ninety percent of providers felt comfortable using a computer and 95% (19/20) used the computer in the exam room while seeing a patient. One provider did not use the EMR. This provider was supervising physicians-in-training and was not responsible for direct data entry into the EMR as the provider's primary role was teaching.

### Provider survey results

Providers had mixed views regarding computer use during the visit (Table 4). Overall, providers were satisfied with the care they provided, the time spent listening to patients (75%), the medical care provided to patients (90%), and the attention given to patients (80%).

### Patient and provider comparison

Patient and provider responses were compared for the questions that were consistent across both surveys. Compared to patients, providers demonstrated more consistently negative responses to questions regarding computer use during the clinical encounter.

**Table 3:** Demographic, Computer Use, and Medical Characteristics of Provider Participants.

		Number (N)	Percent (%)
<b>Gender</b>	Male	6	30
	Female	14	70
<b>Duration worked as provider</b>	Years, Mean (SD)	14 (13)	-
	Median (min, max)	10 (0.5, 50)	-
<b>Comfort level of computer use</b>	Comfortable	18	90
	Uncomfortable	2	10
<b>Use of computer in exam room</b>	Yes	19	95
	No	1	5

**Table 4:** Select Survey Responses: Provider Attitudes Toward Provider Computer Use in the Exam Room.

Questions	Agree	Disagree
<b>Computer and Communication</b>		
When I use the computer in the exam room:		
I can talk easily with my patient	60	40
I am able to focus on listening to my patients	50	50
I miss non-verbal patient cues	70	30
I am able to make good eye contact with my patient	50	50
it makes the visit feel less personal	60	40
<b>Computer and Time</b>		
Because I use the computer in the exam room:		
the visit is more efficient	75	25
<b>Computer and Privacy</b>		
While I use the computer, I feel comfortable:		
asking my patients questions about drug and alcohol use*	63	37
asking my patients about their sexual history*	58	42
listening to my patient speak about their sexual history*	32	68
<b>Computer and Education</b>		
The computer helps:		
my patient understand their lab result better when I use the computer screen	85	15
educate my patients	65	35
<b>Satisfaction with Care</b>		
I am satisfied with:		
the amount of attention I give to my patients	80	20
the medical care I provide to my patients	90	10
the amount of time I spent listening to my patients	75	25

\*Missing data for 1 provider participant

Patients expressed more overall satisfaction with the visit and found the encounter more positive compared to providers (Table 5). Additionally, a higher percentage of patients (56%) agreed that, "I can talk easily with my provider while provider uses the computer" compared to providers (15%) who assessed a similar statement, "I can talk easily to my patients while using the computer" (P<0.001). Almost two-thirds of patients (60%) agreed that, "I am satisfied with the attention given to the patient by the provider," compared to less than one-third of providers (P=0.002).

### Discussion

While most providers used the computer in the exam room, they demonstrated more negative perceptions of this topic compared to HIV-infected patients. These results align with systematic reviews that found computer use had neutral to positive effect on the patient-provider relationship in the outpatient setting [18-20].

Patients who did not use personal computers showed greater distaste for computer use in the exam room, perceiving this factor as negatively affecting the encounter in some way. For example, patients reporting weekly or monthly computer use were more likely to carry negative perceptions of computer use compared to those who used the computer daily. Research shows that approximately half of HIV-

**Table 5:** Comparison of Patient and Provider Response to Select Survey Questions.

Provider survey/ patients N=220	Group		
	Patient (N=200)	Provider (N=20)	P Value
<b>I am satisfied with the amount of attention given to the patient by the provider.</b>			
1. Strongly agree	119 (60.41%)	6 (30.00%)	0.002
2. Agree	72 (36.55%)	10 (50.00%)	
3. Disagree	2 (01.02%)	3 (15.00%)	
4. Strongly disagree	004 (02.03%)	001 (05.00%)	
<b>I am satisfied with the medical care given to the patient by the provider.</b>			
1. Strongly agree	122 (61.62%)	007 (35.00%)	0.042
2. Agree	069 (34.85%)	011 (55.00%)	
3. Disagree	003 (01.52%)	001 (05.00%)	
4. Strongly disagree	004 (02.02%)	001 (05.00%)	
<b>I can talk easily with my patient/provider with the use of computer.</b>			
1. Strongly agree	113 (56.50%)	003 (15.00%)	<0.001
2. Agree	076 (38.00%)	009 (45.00%)	
3. Disagree	007 (03.50%)	005 (25.00%)	
4. Strongly disagree	004 (02.00%)	003 (15.00%)	
<b>The provider is able to listen to the patient while using the computer.</b>			
1. Strongly agree	086 (43.22%)	002 (10.00%)	<0.001
2. Agree	101 (50.75%)	008 (40.00%)	
3. Disagree	010 (05.03%)	007 (35.00%)	
4. Strongly disagree	002 (01.01%)	003 (15.00%)	
<b>The provider makes good eye contact with the patient while using the computer.</b>			
1. Strongly agree	089 (44.72%)	002 (10.00%)	<0.001
2. Agree	086 (43.22%)	008 (40.00%)	
3. Disagree	020 (10.05%)	008 (40.00%)	
4. Strongly disagree	004 (02.01%)	002 (10.00%)	
<b>The provider has a better understanding of patient's health care concerns because of the use of computer.</b>			
1. Strongly agree	075 (38.46%)	003 (15.00%)	0.002
2. Agree	085 (43.59%)	006 (30.00%)	
3. Disagree	026 (13.33%)	008 (40.00%)	
4. Strongly disagree	009 (04.62%)	003 (15.00%)	
<b>The relationship between patient and the provider is improved because of the use of computer.</b>			
1. Strongly agree	053 (26.90%)	002 (10.00%)	<0.001
2. Agree	091 (46.19%)	003 (15.00%)	
3. Disagree	042 (21.32%)	012 (60.00%)	
4. Strongly disagree	011 (05.58%)	003 (15.00%)	
<b>The visit feels less personal because the provider uses the computer.</b>			
1. Strongly agree	013 (06.57%)	003 (15.00%)	0.009
2. Agree	040 (20.20%)	009 (45.00%)	
3. Disagree	090 (45.45%)	007 (35.00%)	
4. Strongly disagree	055 (27.78%)	001 (05.00%)	

infected patients with personal computers seek health information and knowledge on the Internet [25], using it as a source of coping, empowerment, and support [26]. Patients in this study with personal computers validate these findings, and may recognize and value the positive effect of computers on their ability to cope with their illness.

Similarly, women were more likely to respond negatively to questions regarding computer screen use as a mode of communication compared to men. A study that assessed gender differences in learning among physiology students showed that the majority of male students

preferred a multi-modal way of learning, which included a combination of visual (learning from charts or flow diagrams), auditory (learning from speech), reading-writing (learning from reading and writing), and/or kinesthetic (learning from touch, smell, sight, and taste), while the majority of women preferred a single learning modality [27]. In our study, providers likely provided both auditory and visual approaches when teaching patients using the computer screen during the visit. Female patients may prefer less use of the computer screen for health education, however more research is necessary.

Patients with higher level of education expressed more positivity regarding computer use in the exam room compared to those with lower education levels. However, one study on tablet computer use in the exam room found the opposite: those with higher education levels (high school degree or higher) perceived use of tablet computers by providers as less secure compared to those who had not completed high school [28]. More research can help clarify the impact of education level on patient perception of computer use in the exam room.

Patients with an undetectable viral load more often agreed their provider was skilled at using the computer. Similar to those with higher educational level, patients with higher CD4 cell counts also perceived computer use as a positive factor at a higher rate compared to patients with lower CD4 cell counts. A positive patient-provider relationship has been shown to be associated with improved adherence to antiretroviral therapy [14,16], and interventional trials have shown that improved patient-provider communication results in better disease outcomes [29,30]. While different factors of patient-provider communication play a role in the patient-provider relationship, computer use represents a small but critical part of this communication – future research should focus on dissecting which aspects of computer use patients find helpful and which lead to improved adherence and better health outcomes for patients, such as undetectable viral load and higher CD4 cell counts.

Patients in this study who disclosed their HIV status expressed more satisfaction with the amount of time the provider spent with them, aligning with research by Holt et al who found that HIV-infected patients use disclosure of their diagnosis as mechanism for coping, increased emotional support, and self-acceptance of having a chronic condition [31]. Patients who had not disclosed their HIV status were more likely to carry shame and guilt [32]. Reasons for non disclosure of HIV include lack of social support and fear of being stigmatized [32]. The findings in this study may be attributed to the fact that those who have not disclosed their HIV status may not have an adequate support system and rely solely on their providers for discussion about HIV, suggesting that these patients may benefit from less computer use in the exam room.

### Provider findings

Providers are often concerned that the use of computers in the exam room negatively affect communication with their patient [33]. Similarly, despite most providers in this study using computers in the exam room, a majority of them felt that computer use made the visit less personal. The providers in this study likely chose to use the computer while interacting with patients due to the benefits of efficiency outweighing the risk of negatively affecting patient provider communication.

Our study showed a difference in perception between HIV-infected patients and their providers regarding computer use in the exam room, as providers expressed more concern about computer use than patients. Currently, computer training for providers focuses solely on how to use the EMR system interface for specific tasks, such as documentation and billing [34]. More formalized training for physicians on how to interact and communicate with patients while using the computer may help ease this tension.

### Limitations

An initial limitation to this study was the lack of measurement or control around the degree of computer use by providers. This wide range of usage by providers likely affected how the provider interacted with the patient. Second, values such as HIV viral load and CD4 cell

count were self-reported and not validated with external resources. Third, participating patients in the study were invited prior to or just after their encounter with the provider. The patients who were approached prior to their encounter may have been more aware of the provider using the computer in the exam room compared to those who were approached after their encounter, thus influencing the results. However, all patients gave informed consent and completed surveys immediately following their encounter. Lastly, despite having one researcher distribute the surveys, the surveys were completed anonymously, creating a risk of duplicate responses.

In conclusion, most HIV-infected patients were satisfied by the care they received when the provider used the computer in the exam room. However, patients that held a negative perception of computer use in the exam room included those who do not own personal computers, are women, have not achieved high school diploma or higher, have detectable HIV viral load, have low CD4 cell count, or have not disclosed their HIV status. These findings suggest that patients with these characteristics may benefit from less computer use by their provider in the exam room. Since providers viewed computer use as more negatively affecting the relationship compared to patients, the results of this study may provide reassurance that only a small subset of patients share this belief.

### Conflicts of Interest

Dr. Lydia Barakat has served as a consultant for Gilead Sciences and received an honorarium. Yale University receives grant support from Pfizer, Gilead, Abbvie, ViiV, and Bristol Myers Squibb for studies that Dr. Michael J. Kozal serves and served as the principle investigator. Dr. Kozal is an employee of the federal government and does not receive any salary support from these grants. All other authors declare that they do not have a conflict of interest.

### References

- Office of the National Coordinator for Health Information Technology (2016) Office based Physician Electronic Health Record Adoption, Health IT Quick-Stat #50. December 2016.
- Hsiao CJ, Hing E (2012) Use and characteristics of electronic health record systems among office-based physician practices: United States, 2001-2012. NCHS Data Brief 111: 1-8.
- Schoen C, Osborn R, Squires D, Doty M, Rasmussen P, et al. (2012) A survey of primary care doctors in ten countries shows progress in use of health information technology, less in other areas. *Health Aff (Millwood)* 31: 2805-2816.
- Howard J, Clark EC, Friedman A, Crosson JC, Pellerano M, et al. (2013) Electronic health record impact on work burden in small, unaffiliated, community-based primary care practices. *J Gen Intern Med* 28: 107-113.
- Joos D, Chen Q, Jirjis J, Johnson KB (2006) An electronic medical record in primary care: impact on satisfaction, work efficiency and clinic processes. *AMIA Annu Symp Proc* 2006: 394-398.
- Kern LM, Barrón Y, Dhopeswarkar RV, Edwards A, Kaushal R, et al. (2013) Electronic health records and ambulatory quality of care. *J Gen Intern Med* 28: 496-503.
- Sinsky C, Colligan L, Li L, Prgomet M, Reynolds S, et al. (2016) Allocation of Physician Time in Ambulatory Practice: A Time and Motion Study in 4 Specialties. *Ann Intern Med* 165: 753-760.
- Vergheze A (2008) Culture shock--patient as icon, icon as patient. *N Engl J Med* 359: 2748-2751.

9. Mitchell E, Sullivan F (2001) A descriptive feast but an evaluative famine: systematic review of published articles on primary care computing during 1980-97. *BMJ* 322: 279-282.
10. Lee WW, Alkureishi ML (2017) The Impact of EMRs on Communication Within the Doctor- Patient Relationship. In: Papadakos PJ, Bertman S (eds) *Distracted Doctoring: Returning to Patient-Centered Care in the Digital Age*. Cham: Springer International Publishing 101- 120.
11. Andrinopoulos K, Clum G, Murphy DA, Harper G, Perez L, et al. (2011) Health related quality of life and psychosocial correlates among HIV-infected adolescent and young adult women in the US. *AIDS Educ Prev* 23: 367-381.
12. Altice FL, Mostashari F, Friedland GH (2001) Trust and the acceptance of and adherence to antiretroviral therapy. *J Acquir Immune Defic Syndr* 28: 47-58.
13. Bakken S, Holzemer WL, Brown MA, Powell-Cope GM, Turner JG, et al. (2000) Relationships between perception of engagement with health care provider and demographic characteristics, health status, and adherence to therapeutic regimen in persons with HIV/AIDS. *AIDS Patient Care STDS* 14: 189-197.
14. Roberts KJ (2002) Physician-patient relationships, patient satisfaction, and antiretroviral medication Adherence among HIV-infected adults attending a public health clinic. *AIDS Patient Care STDS* 16: 43-50.
15. Schneider J, Kaplan SH, Greenfield S, Li W, Wilson IB (2004) Better physician patient relationships are associated with higher reported adherence to antiretroviral therapy in patients with HIV infection. *J Gen Intern Med* 19: 1096-1103.
16. Martini M, D'Elia S, Paoletti F, Cargnel A, Adriani B, et al. (2002) Adherence to HIV treatment: results from a 1-year follow-up study. *HIV Med* 3: 62-64.
17. Beach MC, Keruly J, Moore RD (2006) Is the quality of the patient-provider relationship associated with better adherence and health outcomes for patients with HIV? *J Gen Intern Med* 21: 661-665.
18. Alkureishi MA, Lee WW, Lyons M, Press VG, Imam S, et al. (2016) Impact of Electronic Medical Record Use on the Patient-Doctor Relationship and Communication: A Systematic Review. *J Gen Intern Med* 31: 548-560.
19. Lee WW, Alkureishi MA, Ukabiala O, Venable LR, Ngooi SS, et al. (2016) Patient Perceptions of Electronic Medical Record Use by Faculty and Resident Physicians: A Mixed Methods Study. *J Gen Intern Med* 31: 1315-1322.
20. Irani JS, Middleton JL, Marfatia R, Omana ET, D'Amico F (2009) The use of electronic health records in the exam room and patient satisfaction: a systematic review. *J Am Board Fam Med* 22: 553-562.
21. Beck RS, Daughtridge R, Sloane PD (2002) Physician-patient communication in the primary care office: a systematic review. *J Am Board Fam Pract* 15: 25-38.
22. Rouf E, Whittle J, Lu N, Schwartz MD (2007) Computers in the exam room: differences in physician-patient interaction may be due to physician experience. *J Gen Intern Med* 22: 43-48.
23. Likert R (1932) A Technique for the Measurement of Attitudes. *Arch Psychol* 22: 55.
24. Krosnick JA (1991) Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology* 5: 213-236.
25. Kalichman SC, Benotsch EG, Weinhardt L, Austin J, Luke W, et al. (2003) Health-related Internet use, coping, social support, and health indicators in people living with HIV/AIDS: preliminary results from a community survey. *Health Psychol* 22: 111-116.
26. Reeves PM (2000) Coping in cyberspace: the impact of Internet use on the ability of HIV-positive individuals to deal with their illness. *J Health Commun* 5: 47-59.
27. Wehrwein EA, Lujan HL, DiCarlo SE (2007) Gender differences in learning style preferences among undergraduate physiology students. *Adv Physiol Educ* 31: 153-157.
28. Strayer SM, Semler MW, Kington ML, Tanabe KO (2010) Patient attitudes toward physician use of tablet computers in the exam room. *Fam Med* 42: 643-647.
29. Greenfield S, Kaplan SH, Ware JE Jr, Yano EM, Frank HJ (1988) Patients' participation in medical care: effects on blood sugar control and quality of life in diabetes. *J Gen Intern Med* 3: 448-457.
30. Griffin SJ, Kinmonth AL, Veltman MW, Gillard S, Grant J, et al. (2004) Effect on health-related outcomes of interventions to alter the interaction between patients and practitioners: a systematic review of trials. *Ann Fam Med* 2: 595-608.
31. Holt R, Court P, Vedhara K, Nott KH, Holmes J, et al. (1998) The role of disclosure in coping with HIV infection. *AIDS Care* 10: 49-60.
32. Hult JR, Wrubel J, Branstrom R, Acree M, Moskowitz JT (2012) Disclosure and nondisclosure among people newly diagnosed with HIV: an analysis from a stress and coping perspective. *AIDS Patient Care STDS* 26: 181-190.
33. Linder JA, Schnipper JL, Tsurikova R, Melnikas AJ, Volk LA, et al. (2006) Barriers to electronic health record use during patient visits. *AMIA Annu Symp Proc* 2006: 499-503.
34. Pantaleoni JL, Stevens LA, Mailes ES, Goad BA, Longhurst CA (2015) Successful physician training program for large scale EMR implementation. *Appl Clin Inform* 6: 80-95.