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Refereed paper

Record media used by primary care providers in medically underserved regions of upstate New York was not pivotal to clinical result in the Informatics for Diabetes Education and Telemedicine (IDEATel) project

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ABSTRACT

Purpose To examine integration of electronic medical records (EMRs) by primary care providers (PCPs) in a diabetes telemedicine project (IDEATel) in medically underserved rural areas and assess if access to digital records is associated with diabetes intermediate outcomes.

Method PCPs (*n*=61) with patients in IDEATel participated in structured interviews to determine current (2006 to 2007) and projected (2007 to 2008) use of paper and/or electronic medical data. T-tests examined group differences.

Results 28% (17/61) of PCPs had comprehensive EMRs, but most electronic data were non-interoperative between offices; 6% of PCPs solely used paper; 92% of PCPs used mixed paper/electronic records. Half of 61 PCPs anticipated no migration within one year to an electronic record for common patient data, while one third anticipated that function would become greatly more electronic. Among 31 PCPs interviewed in depth in person, 70% (7/10) in private practice and 69% (9/13) in networks anticipated greater electronic media migration through system change, whereas 100% of responding academic PCPs (*n*=6) expected only system modifications. PCPs were most interested in data exchange for chronic disease management (94%), regional benchmarking (84%) and quality improvement (87%). Patient personal electronic health records

were rarely mentioned. IDEATel patients of PCPs with or without access to comprehensive EMRs achieved similar haemoglobin A1c, blood pressure, LDL-cholesterol, and body mass index, but the small number invokes cautious interpretation.
Conclusions Our findings suggest an effective and complementary element of national health information technology (HIT) strategy, telemedicine, can be implemented by PCPs with success despite the lack of a concurrent EMR for efficient data exchange.

Keywords: diabetes, health information technology, telemedicine

Introduction

The US Department of Health and Human Services HIT goals aim to improve patient safety, consumer-centricity, quality, efficiency and cost-effectiveness of health care.[1] To achieve these objectives, the HIT strategy includes development of personal electronic health records (PHRs) together with interoperative, comprehensive[2] EMRs capable of at least four functions; computerised orders for prescriptions, computerised orders for tests, test results (lab and/or images) and clinical notes.[2–14]

Eighty percent of Americans get most of their health care solely from a PCP,[15–18] and 90% of patients cared for by family physicians have two or more medical problems;[19] those over 65 average nearly four problems per visit.[15] In one recent survey 74% of PCPs reported difficulties locating consultant reports, medical records and test results during patient visits.[10] Hypertension and diabetes are among the most common chronic diseases treated by PCPs. Whereas 87% of PCPs endorse multidisciplinary teams to improve quality of care,[10] access remains difficult, especially in rural areas where diabetes nurse educators and dietitians are not available. Telemedicine has the potential to increase access to diabetes team care in underserved areas. HIT strategy assumes that the integration of EMRs would facilitate integration of technologies such as telemedicine into practice in order to further improve care.

The Informatics for Diabetes Education and Telemedicine (IDEATel) project was a randomised trial to evaluate the effectiveness of home 'televisits' to improve diabetes care for Medicare beneficiaries.[20,21] IDEATel enrolled PCPs who were either in private practice or affiliated to 19 regional healthcare entities serving federally-designated primary care Health Professional Shortage Areas (HPSAs) and Medically Underserved Areas (MUAs) across 30 000 contiguous square miles of upstate New York. PCPs provided written informed consent to sponsor patients into IDEATel and to receive study communications and recommendations. Recommendations were sent by mail, fax or electronically per PCP preference. Most rural PCPs preferred mail or fax. Patients provided written informed consent, resided in a primary care HPSA or MUAs, were 55 years of age or older, were Medicare eligible, had diabetes mellitus, and spoke English or Spanish. Exclusion criteria were moderate or severe cognitive, visual, or physical impairment, severe comorbid disease, or life expectancy of under two years. Evaluation data, including weight, height, blood pressure, haemoglobin A1c and lipid levels were obtained annually as previously described.[20,21] Each enrolled patient was randomised within their PCP's 'block' to receive either usual care alone or a home telemedicine unit (HTU).[20] The HTU was used to send blood glucose and blood pressure data, and to provide videoconferencing with a nurse case manager and dietitian, and electronic educational services. The intervention improved glycaemic, blood pressure and lipid control[21] and was highly acceptable to patients and providers.[22]

This paper examines actual 2006 to 2007 and anticipated 2007 to 2008 apportionment between paper and electronic records among 61 PCPs in predominantly rural upstate New York who participated in IDEATel. Intermediate diabetes outcomes in the elderly subjects are examined for association with PCPs' office record data media.

Methods

Participants and procedures

All PCPs (n=230) with at least one patient enrolled in the rural (upstate New York) cohort of the IDEATel project in January 2006 received one direct mail request for interview. Initial responders (n=31/230; 13%) were interviewed in depth, in person, by a family medicine physician experienced with paper records and EMR systems. Six of the office-based interviews (22%) conducted in different practice settings were attended also by a second investigator to verify instrument reliability and face validity. To assure external validity, 40 additional eligible PCPs were randomly selected and telephoned by the interviewer, resulting in an additional 30 abbreviated telephone interviews. These interviews were limited to questions from the

survey about current and projected data media apportionment. Interviews were conducted between January 2006 and February 2007. T-tests and Pearson Chi-square tests were used to determine similarity of PCP characteristics depending upon method of enrolment in the survey. This study was reviewed by the appropriate Institutional Review Boards for the Protection of Human Subjects.

Structured interviews

The Medical Record Institute's (MRI) denotation of HIT was used: (1) automated medical record (AMR) – a paper-based record with some computer-generated documents; (2) computerised medical record (CMR) – makes the documents of the AMR electronically available; (3) EMR – restructures and optimises the documents of the previous levels ensuring interoperability of all documentation systems; and (4) PHR – a patient-centred record with information from multiple institutions.[23,24]

The structured interview categorised processes, data elements and information flow for 13 functions typically recorded in primary care encounters. These included billing, diagnoses, encounters, laboratory and imaging results, health maintenance tracking, orders, problems lists, medication lists, consultations and scheduling. The instrument characterised the record media for each function (paper, electronic, or both) at the time of interview and those anticipated 12 months hence. Face validity of the content was verified by collegial review. The instrument captured data media preferences, identified personnel and processes employed to transform business and clinical operations into data, identified the function and brand of HIT products in use and those anticipated one year hence, enumerated branded sales presentations by HIT vendors in the previous six months, and queried interests for future collaboration in health services research facilitated by electronic communication. The instrument was organised for tabulation to report categorical responses as frequencies and percentages. T-tests were performed to investigate differences between intervention and control groups in PCPs' access to EMR status.

Results

Characteristics of PCPs

Table 1 displays characteristics of the 61 PCP participants who were interviewed in person (n=31) or by telephone (n=30). Of 31 PCPs interviewed in person, 14 were privately employed among ten practices, nine were employed by networks, and eight were employed between three family medicine academic departments. Among 30 PCPs completing (abbreviated) telephone interviews, 12 were privately employed in separate practices and 18 were employed among 12 networks. T-tests for continuous variables and Pearson Chi-square tests for categorical variables verified that only PCP employment had a significant P-value, but caution should be used in making inferences as two of the cells had an expected count of fewer than five.

Record media used by PCPs

The Centers for Disease Control define a comprehensive EMR by four attributes: computerised entry of prescriptions, computerised entry of test orders,

Table 1 Characteristics of PCPs according to type of interview

	Office (n=31)	Telephone (n=30)
Age in years (%):		
34 and under	4	6
35–54	81	67
55–74	15	28
Gender (%):		
Female	28	25
Male	73	75
PCP type (%):		
DO	13	3
MD	84	83
NP	3	10
PA	–	3
PCP practice type (%):		
Academic	26	–
Network	29	62
Private, solo or small group	45	38
PCP care panel size (mean (SD)):	2500.74 (1916.28)	4247.06 (4221.98)
$\leq$2000	52%	29%
2001–4000	33%	47%
4001–6000	7%	12%
$\geq$6001	7%	12%
Hours of clinical practice/work (mean (SD)):	44.59 (31.56)	55.00 (20.00)

computerised entry of test results (either laboratory or imaging, or both) and computerised entry of clinical encounter notes. The electronic handling of these four functions across 61 PCPs representing academic (n=8), network (n=27) and private (n=26) practice were assessed. While office records of 28% of PCPs collectively qualified as a comprehensive emulated (CMR) or frank EMR sub-grouping of PCPs by employment type revealed distinct strata of EMRs' functionality, with 75% of PCPs employed in academic primary care using records satisfying the criteria for comprehensiveness, but only 15% of PCPs employed in networks and 27% of those privately employed doing so. For the PCPs who were working in academic, network and private settings: 100%, 41%, and 42% respectively had access to electronic prescribing; 88%, 18%, and 27% had access to computer entry for test orders; 88%, 70% and 65% had access to electronic laboratory and/or imaging test results and 88%, 44% and 35% had computer access to enter encounter notes.

Among the 31 PCPs interviewed in depth, in person, EMR comprehensiveness was accomplished mainly with one-way information flow (e.g. laboratory results were often received electronically from the most local hospital only, then printed and scanned into the EMR system). When responses elicited by an open-ended question were then rank ordered by the PCPs, the motivators for adoption of EMR most frequently ranked first were: gains in time efficiency (35%), increased quality of care (23%), and financial gains from incremental billing capture/better pay-for-performance documentation (19%). The inhibitors to adoption of EMR most often ranked first were: cost (32%), initial decrease in productivity (16%), lack of IT support (13%), and no inhibitor(s) (13%).

The authors hypothesised that cataloguing data elements across paper and electronic records would reveal human resource efficiencies in the office flow associated with electronic media. Instead, wide variation was observed among practices in how, by whom, and when information was processed into the visit records, whether the medium was paper or electronic. Ninety-two percent of the PCPs had mixed paper and electronic handling of visit-related data, with six percent of PCPs using paper records only and three percent using electronic records exclusively, to record 13 information categories commonly populated from a patient encounter.

Table 2 identifies medical record media at the time of interview and anticipated migration within one year to an electronic record for each of 13 common primary care visit functions. Nearly half of the 61 PCPs anticipated no migration to electronic record media while nearly one third anticipated greatly increased electronic handling for each of the 13 queried data elements. Among the 31 PCPs interviewed in depth, 70% of PCPs in private practice and 69% of network-employed PCPs projected migration to electronic records by a system change. All of the academic PCPs who anticipated greater electronic media expected only system modifications.

Electronic data exchange: applications and research interests

Among the 31 PCPs interviewed in depth, interest in electronic data exchange was queried without category prompting. These PCPs desired data exchange most often for chronic disease management (94%), standards development for quality assurance improvement (87%), and regional practice benchmarking (84%). Only network-employed PCPs (67%) desired general electronic information exchange with other practices. PCP interest in information exchange for research services-based chronic disease management spanned many indications, but was low for any diagnosis except hypertension (20 mentions/31 PCPs; 64%).

Relation of PCPs' use of comprehensive EMR to IDEATel participants' diabetes intermediary outcomes

Table 3 shows PCPs' access to a comprehensive frank, or emulated (CMR), EMR was not associated with better intermediary diabetes outcomes (haemoglobin A1c, blood pressure, and LDL-cholesterol levels) for their patients enrolled in the IDEATel clinical trial in 2006 to 2007.

Discussion

Comprehensive digital records did not drive quality of care

The rural PCPs in this sample of IDEATel participants report similar experience with EMRs to that found in other US surveys of EMR adoption.[2–13] Within this sample of 61 PCPs there was parity of clinical results in their management of diabetes in 2006 to 2007 irrespective of use of a comprehensive EMR or degree of access to digital records. This supports the conclusion from examination of 50 New Jersey Family Medicine practices that EMR technology, of itself, does not guarantee better practice quality for management of diabetes measured by adherence to guidelines for process, treatment and intermediate outcomes.[25,26]

Table 2 Record media by function and PCP employment type: current (2006–2007) and projected (2007–2008)

	Academic (*n*=8)						Network (*n*=27)						Private (*n*=26)						Combined (*n*=61)					
	Current media			Projected electronic			Current media			Projected electronic			Current media			Projected electronic			Current media			Projected electronic		
	P	E	B	S	M	G	P	E	B	S	M	G	P	E	B	S	M	G	P	E	B	S	M	G
Function (%)																								
Billing	0	38	62	50	38	12	7	11	81	52	12	36	8	23	69	59	14	27	6	20	74	55	16	29
Compliance (no shows)	25	75	0	62	50	0	30	44	26	56	12	32	43	35	22	58	5	37	34	45	21	58	15	29
Dx coding	0	38	62	52	50	12	7	7	85	52	12	36	7	27	65	59	14	27	6	20	74	53	18	29
Encounters	12	88	0	75	25	0	59	18	22	52	8	40	62	31	8	54	8	36	54	33	13	56	9	33
Generated items (e.g. letter, form, report)	12	50	38	75	12	12	70	11	18	48	12	40	70	22	9	63	0	37	62	21	17	58	8	35
Health maintenance	28	71	0	25	62	12	72	16	13	52	8	40	70	17	13	47	10	42	65	24	11	46	17	36
Imaging	0	25	75	88	0	12	33	4	63	48	16	36	35	15	50	54	4	41	30	8	59	56	9	34
Lab. results	0	25	75	50	25	25	33	4	63	44	24	32	27	4	62	45	14	41	26	10	64	45	20	34
Orders	25	38	38	50	38	12	81	7	11	56	12	32	73	27	11	59	0	41	70	20	38	56	11	33
Problem list	12	88	0	100	0	0	74	18	7	56	8	36	62	31	8	64	4	32	61	33	6	65	5	29
Rx	12	75	12	75	25	0	59	18	22	48	16	36	58	35	8	59	9	32	52	33	15	56	14	29
Scheduling	0	100	0	88	12	0	15	74	11	64	8	28	26	70	4	58	0	42	17	76	7	65	6	29
Text (e.g. consult, OT, report)	0	25	75	88	0	12	59	4	37	56	8	36	60	8	32	50	14	36	52	8	40	58	9	33

Key:
Current media: P = paper; E = electronic; B = both
Projected electronic: S = same degree as currently; M = somewhat more electronic; G = greatly more electronic

Table 3 IDEATel patient demographics and intermediary outcomes of diabetes care (2006–2007) by PCP access to comprehensive CMR/EMR

Patient characteristics (n=119)	PCP access to comprehensive electronic CMR/EMR (n=37)		PCP access to non-comprehensive system (n=82)	
	Control (n=22)	Intervention (n=15)	Control (n=44)	Intervention (n=38)
Age (years) (mean (SD))	71.23 (7.50)	72.07 (5.36)	74.14 (7.55)	74.95 (7.74)
55–64 (%)	8	3	5	5
65–74 (%)	8	27	27	17
75–84 (%)	8	11	15	20
≥ 85 (%)	5	–	7	5
Education (mean years (SD))	12.41 (2.52)	10.21 (2.64)	13.30 (3.53)	12.13 (3.43)
Household income (dollars)				
≤ 5000 (%)	–	–	1	2
5001–10 000 (%)	5	22*	7	2
10 001–20 000 (%)	14	5	12	9
20 001–30 000 (%)	22	11	6	13
30 001–40 000 (%)	8	–	2	2
> 40 000 (%)	8	3	18	10
Data missing (%)	3	–	6	7
Gender (%)				
Female	24	32**	29	23
Male	35	8	24	23
Race (%)				
African/American (non-Hispanic)	19	14	2	1
White (non-Hispanic)	41	24	50	44
Hispanic	–	–	1	–
Other	–	3	–	1
HbA1c (% mean (SD))	6.90 (0.83)	7.16 (1.30)	6.67 (1.00)	7.15 (1.31)
< 7.0 (%)	38	16	40	23
7.0–7.9 (%)	14	16	10	15
≥ 8.0 (%)	8	8	5	7
BMI (kg/m^2) (mean (SD))	35.26 (7.35)	36.58 (6.55)	33.78 (7.30)	33.33 (6.18)
Systolic BP (mmHg) (mean (SD))	134.21 (21.30)	143.83 (19.74)	136.65 (18.38)	138.37 (20.29)
Diastolic BP (mmHg) (mean (SD))	67.10 (13.61)	69.47 (10.66)	69.10 (9.82)	65.39 (9.32)
LDL -chol.(mg/dl) (mean (SD))	88.64 (28.09)	88.13 (27.77)	86.84 (31.38)	86.32 (33.57)

* P = 0.050 when comparing the control to the intervention within PCP access to comprehensive electronic CMR/EMR. Seven cells (70%) have an expected count of less than five.
** P = 0.018 for gender when comparing the control to the intervention within PCP access to comprehensive electronic CMR/EMR
NOTE: DUE TO SMALL SAMPLE SIZES THESE RESULTS SHOULD BE INTERPRETED WITH CAUTION. Pearson Chi-square used for categorical data and t-tests used for continuous data.

HIT adoption by PCPs in rural, medically-underserved, upstate New York

The finding that 28% of IDEATel PCPs distributed across 30 000 square miles of upstate New York during 2006 to 2007 were using comprehensive EMR or emulated (CMR) methods is consistent with other surveys of HIT adoption among less selected PCP samples.[2–9,11,13] The present survey's in-depth scope showed academic PCPs' access to a comprehensive EMR was five times that of network-employed PCPs and three times that of PCPs employed in private practice. Wide variability was documented not only in the form but also in the processing of record handling, driven by factors such as PCP preference and organisational model (and concomitant practice), and public third-party, highly-regulated models for checks and balances on financial, security, and privacy operations. In general the 61 PCP records were electronic for traditional practice management functions (scheduling, diagnosis coding, and billing) and partially electronic for laboratory and/or imaging results, but sparsely digital for other office data elements and clinical functions. Moreover, intended migration to electronic handling of such elements during the following 12 months was low.

Despite modest adoption of comprehensive EMRs, the 31 PCPs interviewed in depth were knowledgeable about benefits, countervailing liabilities, acquisition and maintenance expenses and other costs of instituting EMR, and of the contemporary proposals for reimbursement incentives to use HIT. While EMRs avail instantaneous data exchange, PCPs' perception of the benefit of this feature was low, and only 19% of PCPs interviewed in depth offered sharing of information with other practices under the survey topic of 'other applications and research issues'.

EMR in rural areas: path to adoption

Lower adoption of EMRs is associated with diminishing practice size, solo practice and rurality.[1,8,27] EMRs represent atypical expensive medical technology because their use does not introduce unequivocal gains in treatment effectiveness, but may incur upon practices and patients the liabilities,[1] but not the bulk of the financial reward, for efficiency gained through HIT.[1,28] The estimated return on equity of five years for an EMR system,[28] when considered along with the present finding of relatively low EMR deployment among rural PCPs, suggests that efforts to sell electronic medical recording on the basis of PCPs' workflow efficiencies and pay-for-performance incentives may not be sufficiently compelling reasons for small, private practices in rural underserved areas to institute it. For similar reasons, the smaller networks of employed PCPs supported by dispersed, predominantly rural populations may choose not to upgrade early efforts at digitisation to attain a comprehensive, emulated (CMR), or frank EMR. Acquisition and maintenance costs, or even too many similar product choices, have been identified as reasons for slow adoption[29,30] of HIT including EMRs in primary care. EMR vendors' value proposition of 'flexibility' (i.e. 'mass-customisation') in response to wide variability in PCPs' management of medical records may blunt differentiation of new system benefits from those of legacy systems, and may be counterproductive to the pursuit of more standards-based elegance that could foster EMR interoperability. This in-depth survey suggests that PCPs in rural, underserved areas may be too dispersed geographically to be reached with compelling frequency with an insular, branded-product sales model by the current plethora[29] of mainly boutique-sized, modestly capitalised [30] medical HIT vendors. For example, 39% of responding PCPs interviewed in depth, in person had not had a single qualified sales presentation for an EMR product within the previous six months (range 0–5).

Discontinuous improvement in primary care is expected from HIT as a consequence of the ability to better track process of care indicators and due to expensive EMRs' software capability to embed Quality of Care (QOC) guidelines for synchronous use in PCPs' decision-making during a patient encounter. As recently as 2004, however, there was no consistent association between EMR use and quality of ambulatory care in the USA.[31] It remains unclear if a consistent and positive association can emerge in fee-for-service primary care in the USA,[32,33] or if the uncertainty of association of EMR use with QOC in the USA is due to legacy EMR systems' underdeployment, or PCPs' underemployment of QOC tools in available EMRs. QOC guidelines are underused in primary care in the USA,[34] but are better incorporated in European and some Australasian countries.[34,35] The nation most pervasively integrating EMR and quality measures with good results in primary care is the UK, where PCPs have a role as strong gatekeepers in the dispersion of national healthcare resources. NHS underwriting first centrally obviated both EMR incompatibility across practices and individual practice acquisition and maintenance costs for EMR,[36,37] and now rewards PCPs meeting quality of care indicator targets for chronic disease management with meaningful financial incentives.[38,39] Lessons from Britain's more than 20-year development of a robust HIT strategy may have informed the US $19 billion enabling legislation, the American Recovery and Reinvestment Act of 2009 (ARRA 2009), designed to integrate EMR routinely into primary care over the next several years through regulation and financial incentives.[40] It remains for regulation to be crafted that could provide acceptable intersection of government interests for public health

and those of fee-for-service PCPs. Inexpensive, internet-based, secure, video/teleconferencing telemedicine could achieve much needed QOC benefits now, especially for treatment of chronic diseases such as diabetes among rural, primary care practices in medically underserved areas (albeit asynchronously) through periodic QOC guidelines-based reviews between PCPs and consultants for difficult-to-treat patients.

Personal electronic health recording is integral to HIT strategy but deployment lags behind EMR.[12] Few PCPs made unprompted mention of PHR. ARRA 2009 provides enabling legislation that extends some privacy protection to consumers who participate in PHRs that are designed by an electronic service provider specifically for a Health Insurance Portability and Accountability Act of 1996 (HIPAA)-covered entity.[40,41]

Limitations and strengths

The major limitation of this study is the relatively low response rate (61/230; 26%) among eligible PCPs. This response rate was similar to a survey by direct mail of EMR usage among family physicians in Florida[8] but about half that of national mail or phone surveys of EMR deployment in ambulatory medical practice.[3,4,6,11,13] This was anticipated and compensated for in the study design. PCP response to the direct mail invitation to participate was predicated on inferred participation in future services-based research using electronic data exchange. The majority of PCPs participating in IDEATel a) had no other clinical research experience, and b) were anticipated not to have an interoperative EMR because of their reported preferences for receiving IDEATel study communications by fax or postal service.[22] The sample of PCPs was closed after 61 interviews, when the sub-sample of responders to the direct mail was balanced with a sub-sample of prompted (telephoned) responders, both of which had similar practice characteristics and demographics. The data are inferred to be relatively robust in that the inquiry was not an anonymous-response usage and attitude survey by a commercial vendor, nor a medical society's designated-vendor product that limited inquiry to a particular specialty or provider credential. This report adds to the sparse[42] scientific literature exploring HIT adoption in rural, underserved settings.

Conclusions

EMR adoption among PCPs in predominantly rural upstate New York is not approaching a 'tipping point' as is claimed for the USA generally.[29,30,43] Cost was the most common inhibitor to instituting EMR, but was prime for only one third of this sample of PCPs. Although underpowered, results for the small sample of PCPs interviewed in depth in this survey showed no relationship between EMR access and intermediary outcomes of diabetes for their patients enrolled in home telemedicine-based case management (IDEATel). The implication of the IDEATel experience in predominantly rural, medically underserved, upstate New York, is that telemedicine can be used by PCPs without regard to their degree of EMR utilisation. This suggests that, in the near term, productive US federal steering could strongly encourage deployment of HIT strategy tools such as telemedicine that can be implemented successfully in medically underserved areas, despite the lack of concurrent electronic medical recording, for efficient data exchange.

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CONFLICTS OF INTEREST

None.

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