Impact of Health IT on Primary Care Workflow and Financial Measures

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Study Description

Purpose: To estimate the cost and workflow impact of rapid implementation of an electronic health record (EHR) in primary care practices, reducing the uncertainty that health care providers currently face when considering EHR adoption.

Setting: 26 HealthTexas primary care practices as part of the Baylor Health Care System, (in North Texas) implementing the electronic health record between January 2004- December 2009.

Methods: We examined pre- and post-implementation billing and administrative data to determine impact on workflow & financial outcomes.

Study Design: Quasi-experimental, i.e., natural, retrospective -- "…the experimental effect is in a sense twice demonstrated, once against the control and once against the pre-X values in its own series" (Stanley and Campbell, 1966).

Study Data

- Data related to individual patient visits and revenues were collected from the network billing and collection administrative system.
- Charges were captured at the procedure code level, and linked to the RVU values, obtained from Ingenix.
- A single year's RVU scale (2009) was used for all years to make cross-year comparisons on a standardized basis.
- Specific practice costs and non-physician staffing data, in conjunction with physician staffing data were also captured to compute the measures examined.

Study Design

Interrupted time series design with switching replications used here is well-suited to quality improvement research (Cable, 2001).

The threat of historical events to internal validity and causal interpretation is reduced compared to single-group pre-post test designs, since the intervention occurs at different times across the full set of included practices; and the design's application to evaluations in "real world settings" that are generalizable to other settings, provides external as well as internal validity. Similarly, the threat to internal and external validity that arises from selection bias is avoided when all practices receive the treatment. The careful application of these time-series methods adheres to proposed guidelines for stronger evidence in the field of quality improvement.

Outcome Measures

Workflow:

- Non-physician Staff per Physician Full-time Equivalent (FTE) (**staffing**).
- Work Relative Value Unit (RVU) per Visit (**intensity**).
- Work RVU per Physician FTE (**productivity**).
- Visits per Physician FTE (**volume**).

Financial:

- Practice Expense per Work RVU.
- Practice Expense per Total RVU.
- Payment Received per Work RVU.
- Net Income per Work RVU.

Covariates

Patient:

- Age.
- Sex.

Physician:

- Time at HTPN.
- Number of physicians.
- Specialty: Family Practice, Internal Medicine, or Mixed.
- Year of adoption: 2006/2007 versus 2008.

Treatment and Secular Effects

Period of implementation:

- Prior to implementation.
- 1-6 months post-implementation.
- 7-12 months post-implementation.
- Post 12 months.

Secular:

- Observation period of study: 1-72 months.

Statistical Approach

Mixed Linear Model: to analyze 26 practices by month for 72 months from January, 2004 through December, 2009.

Longitudinal data that are correlated within practice, violating independent assumption with simple random sampling:

- Random Intercept.
- Random coefficient.

Statistical Model

We estimated the effects for the following linear model for our work flow and financial measure outcome variables:

$Y_{it} = \beta_0 + \beta_{AEHR}*EHR + \beta_T*T_{it} + \beta_H*H + \varepsilon_{it}$

where Y_{it} is the work flow or financial measure for practice i (i = 1 to 26 practice); at time t (in months since the beginning of our study in January, 2004).

H is a vector of patient and practice level covariates (including the practice characteristics.

β_T represents the pre-implementation secular trend. Testing H_0: $\beta_{AEHR} = 0$ for each of the three time periods against the pre-implementation period, we can determine if EHR affects these work flow and financial measures – beyond what we would have observed if the trend had persisted post-implementation.

Means and standard errors for the work flow and financial variables on an annual basis

	Overall	2004	2005	2006	2007	2008	2009
Practice-months (n)	1844	302	312	312	312	309	297
	Mean (SE)	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**
Workflow							
Staff per Physician FTE (n)	3.423 (0.025)	3.554 (0.067)	3.354 (0.060)	3.372 (0.057)	3.430 (0.063)	3.449 (0.059)	3.383 (0.057)
Work RVU per visit (RVU)	1.052 (0.003)	1.051 (0.006)	1.064 (0.006)	1.065 (0.007)	1.045 (0.007)	1.035 (0.006)	1.050 (0.006)
Visits per Physician FTE (RVU)	396.34 (2.425)	396.77 (6.226)	390.56(5.892)	402.51 (5.871)	395.69 (6.048)	393.22 (5.663)	399.42 (5.951)
Work RVU per Physician FTE (RVU)	412.29 (2.356)	412.42 (5.943)	410.77(5.743)	423.09 (5.601)	408.65 (5.764)	403.63 (5.653)	415.21 (5.925)
Financial							
Practice Expense per Work RVU ($)	70.35 (0.309)	65.61 (0.821)	66.83 (0.755)	67.79 (0.653)	71.35 (0.686)	74.94 (0.776)	75.71 (0.631)
Practice Expense per Total RVU($)	28.52 (0.103)	27.61 (0.283)	27.82 (0.755)	27.73 (0.198)	28.65 (0.224)	29.79 (0.284)	29.54 (0.224)
Payment Received per Work RVU ($)	107.44 (0.395)	102.44 (0.990)	103.69(0.934)	103.38 (0.952)	110.26 (0.904)	109.15 (0.917)	111.78 (0.999)

Regression coefficients for change in work flow measures after EHR implementation

	1-6 months		7-12 months		>12 months	
	Regression Coefficient (SE)	p-value	Regression Coefficient (SE)	p-value	Regression Coefficient (SE)	p-value
Staff per Physician FTE	0.19 (0.04)	<0.001	0.10 (0.04)	0.018	0.12 (0.05)	0.007
Work RVU per visit	-0.001 (0.006)	0.921	0.017 (0.01)	0.02	0.003 (0.001)	0.683
Visits per Physician FTE	-31.99 (4.70)	<0.001	-29.63 (5.08)	<0.001	-17.86 (5.36)	0.001
Work RVU per Physician FTE	-32.84 (4.49)	<0.001	-22.29 (4.86)	<0.001	-16.62 (5.15)	0.001

Regression coefficients for change in financial measures after EHR implementation

	1-6 months		7-12 months		>12 months	
	Regression Coefficient (SE)	p-value	Regression Coefficient (SE)	p-value	Regression Coefficient (SE)	p-value
Practice Expense per Work RVU	3.81 (0.66)	<0.001	4.05 (0.71)	<0.001	4.19 (0.75)	<0.001
Payment Received per Work RVU	-3.03 (0.47)	<0.001	-3.51 (0.51)	<0.001	-4.70 (0.54)	<0.001
Net Income per Work RVU	-3.91 (1.49)	0.009	-4.25 (1.74)	0.146	-3.92 (2.05)	0.056

Results

Workflow: Productivity (work RVUs per physician FTE) decreased significantly after EHR implementation. Productivity was lowest during the first 6 months following implementation (8% lower), but regained half this ground by 12 months. Volume (visits per physician FTE) followed a similar pattern.

Financial: Practice expense per work RVU showed increases of approximately $4.00 per month over and above the secular trend in each of the 3 periods examined. Based on the monthly mean of 412.3 work RVUs per physician FTE, the increased expense is approximately $1,650 per physician FTE per month. This differential persists for net income per work RVU.

Conclusions

- Based on our results and other recent reports of financial and productivity effects of EHR implementation in ambulatory care settings, it does not appear that physician practices considering EHR adoption need worry about substantial decreases in productivity or financial performance.

- While short term decreases are likely (and likely inevitable), we saw substantial recovery in both work flow and financial measures by 12 months post-implementation and other studies report gains in productivity and patient volumes, and decreases in various practice expenses.

Conclusions (Continued)

- Financial Alignment is needed between those stakeholders paying for EHRs and those receiving potential benefit:
  - Medicare and Medicaid Meaningful Use Incentive Payments.
  - Private insurer pilots.
- Some economies of scale can be achieved with larger practices due to fixed and variable nature of some costs.
- Competitive Forces in the market place will hopefully prevail.
- Support for and coordination of the medical and technical skills required to ensure successful EHR implementation and physician satisfaction are needed:
  - Regional Extension Centers.
  - Emphasize relationship with software vendor(s).
- Examine division of labor/work flow within practices to increase productivity and employee satisfaction.
- Promise of EHR includes clinical decision support & effectiveness research.

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