

Supplementary Materials for

Liss DT, Reid RJ, Grembowski D, Rutter CM, Ross TR, Fishman PA. Changes in office visit use associated with electronic messaging and telephone encounters among patients with diabetes in the PCMH. *Ann Fam Med*. 2014;12(4):338-343.

SUPPLEMENTARY APPENDIX

Diabetes Case Definition

The study population included all adults with diabetes mellitus (type 1 or 2) who were age 18-75 on the first day of PCMH implementation at their primary care clinic. Our case definition for diabetes included individuals meeting any of the following criteria during the 24 months preceding PCMH implementation: two outpatient International Classification of Diseases, Ninth Revision (ICD-9) diagnoses of diabetes (250.xx); one inpatient ICD-9 diabetes diagnosis (250.xx); one hemoglobin A1c test result $\geq 6.5\%$; one or more filled prescriptions for insulin or oral diabetic agents; during a one-year time frame, two fasting glucose test results ≥ 126 mg/dL, two non-fasting glucose test results ≥ 200 mg/dL or one of each type of glucose test result. We excluded women with polycystic ovarian disease (ICD-9 256.4) or gestational diabetes (ICD-9 648.8x), as well as all diabetic women with pregnancy or delivery-related codes.

Regression Model Covariates

We collected covariate data on patients' age, sex and ecologic census-tract measures of education and income¹ at PCMH baseline. Time-varying variables characterized insurance type (commercial, Medicare, Medicaid/state-subsidized) and plan generosity regarding provider choice (HMO vs. point-of-service plan), pharmaceutical coverage and well-care visit copayment waiver. Each patient-quarter was classified by study period and calendar quarter. We also created a dichotomous indicator of secure messaging use during baseline.

We defined time-varying morbidity burden using Resource Utilization Band (RUB) variables from Johns Hopkins Adjusted Clinical Groups (ACG) System case mix software.² RUB measures classify co-morbidity patterns on a six-point scale, from very low to very high, based on groupings of the complement of ICD-9 diagnoses during the previous 12 months. We

recoded the three lowest RUB values to a value of moderate based on two assumptions: (1) patients with diabetes have at least moderate morbidity burden based on ACG classification schema, and; (2) our case definition for diabetes comprehensively captured pre-existing diabetes through two years of diagnosis, laboratory and prescription data.

We created a time-varying variable for each of the following clinical outcome benchmarks in diabetes care:³ hemoglobin A1c below 8.0%; blood pressure below 140/80 mm Hg; and LDL cholesterol below 100 mg/dL. If an individual had outcome data collected during the prior year, we used the most recent result to determine whether he or she achieved each respective outcome benchmark. If outcome data had not been collected during the prior year, individuals received a separate code indicating they had not completed recommended care processes.³

After linking patients to their paneled primary care physicians, we categorized physicians' proportion of total encounters—the sum of secure message threads, telephone encounters and office visits—conducted via secure message and telephone. We identified low physician secure message use (<30%) using Group Health's organizational target;⁴ medium (30-50%) and high (>50%) secure messaging use were empirically defined. We also empirically defined quarterly physician telephone encounter use as low (<5%), medium (5-10%) or high (>10%).

Further Details on Log-Linear Regression Analysis in This Study

We estimated multivariable log-linear regression models to assess how patients' office visit use was associated with secure messaging and telephone encounter use. Whereas β coefficients in traditional linear regression models represent the absolute change in Y associated with a one-unit increase in X_i , β coefficients in our log-linear models represented the *proportional* change in Y associated with a proportional increase in X_i .

In interaction analysis, potential effect modifiers for study period and selected patient characteristics (age, sex, morbidity, insurance type, plan generosity) were included in two patient-level interaction terms: one for secure messaging, and one for telephone encounters. In addition, we tested whether primary care physician behaviors modified patient-level associations through two interactions: one between physician secure messaging and patient secure messaging, and one between physician telephone use and patient telephone use. After estimating the interaction model, we obtained linear combinations of coefficients and reported whether interaction effects were statistically significant.

References

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4. Hsu C, Coleman K, Ross TR, et al. Spreading a patient-centered medical home redesign: a case study. *The Journal of Ambulatory Care Management*. Apr 2012;35(2):99-108.