ORIGINAL ARTICLES

Patients with Multiple Chronic Conditions Do Not Receive Lower Quality of Preventive Care

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BACKGROUND: The implications of measuring and rewarding performance for patients with multiple chronic conditions have not been explored empirically.

OBJECTIVE: To examine whether the number of chronic conditions was associated with patient's receipt of recommended preventive care.

METHODS: We evaluated the association between the likelihood of receiving recommended preventive care and the number of chronic conditions in the diabetic population by analyzing the 2003 Medical Expenditure Panel Survey using logistic regression. Demographic characteristics and the number of chronic conditions were compared using χ^2 tests.

OUTCOME MEASURES: Hemoglobin A1C test and diabetic eye exam.

RESULTS: In 2003, approximately 14.2 million non-institutionalized Americans had diabetes and 23% of them had five or more chronic conditions besides diabetes. Those patients were 67% (p<0.05) and 50% (p<0.001) more likely to receive hemoglobin A1C test and eye exams compared with diabetic patients with no additional chronic conditions. After adjusting for the number of office-based physician visits, a larger number of chronic conditions did not significantly affect the likelihood of receiving recommended care. Diabetic patients with more chronic conditions had more frequent office-based physician visits (p<0.0001), and patients with 11 or more annual office-based physician visits were 43% (p<0.05) and 40% (p<0.01) more likely to receive hemoglobin A1C test and eye exam, respectively, compared with diabetic patients who had less than two office-based physician visits.

CONCLUSIONS: Diabetic patients with more chronic conditions may receive better quality of preventive care, partly due to their higher number of office-based physician visits.

KEY WORDS: quality of care; chronic conditions; performance measures.
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INTRODUCTION

During the past several decades, substantial resources have been invested in the development of clinical practice guidelines (CPGs), adherence to which should decrease improper variation and improve quality of care[1]. In recent years, an increasing number of health plans have begun profiling physician adherence to specific guideline components (known as "process" measures of quality) and also rewarding providers financially, based on these same quality measures[2]. Such process measures in pay for performance are generally derived from single CPG recommendations[1].

While most CPGs address single diseases[3], about 61 million Americans have multiple chronic diseases[4,] and they utilized 67% of pharmacy services[4] and 49% of total health care expenditures[4]. Physicians could be overwhelmed by the number of recommendations for patients with multiple chronic conditions[5], and forced to prioritize procedures due to time and financial constraints[6,7]. Previous research found that patients with multiple chronic conditions frequently receive uncoordinated care[8], and physicians reported difficulty in organizing care for people with multiple chronic conditions[9]. From a patient's perspective, receiving multiple pharmacological and lifestyle interventions may increase reluctance to adhere, tolerate and pay for already overwhelming recommendations[10].

The widespread implementation of pay for performance, which rewards physicians' CPG adherence based on single elements of care, has brought to the fore the limitations of single disease guidelines[3,5] and raised concerns about patients with multiple diseases for whom physicians' strict adherence to sets of CPGs may be infeasible or inappropriate . In addition, if physicians' CPG adherence is appropriately lower for patients with comorbidities for either patient-or physician-driven reasons, then physicians who treat more complicated patients will be unfairly penalized with the implementation of pay-for-performance, creating an incentive to avoid such patients.

Some studies found that patients with higher comorbidity are less likely to receive preventive services[11,12], while others suggested to the contrary[13,14]. The generalizability of these studies, however, has been questioned because data were limited to specific locations[11,13,14], senior or minority group[11,13], or the sample size was too small[12].

In this paper, we evaluated the quality of care among diabetic patients as measured by patients' receipt of recom-

mended preventive care. We sought to examine whether greater numbers of chronic conditions were associated with patients' receipt of recommended preventive care. We further sought to investigate what drives the quality differences between patients with greater vs. lower numbers of chronic conditions, and draw out the implications of implementing pay for performance among patients with multiple chronic conditions.

We focused on patients with diabetes based on the following grounds. First, diabetes measures are commonly used to profile the quality of health plans and providers[6]. Second, CPGs for diabetes and the associated clinical process measures of quality are well-established[15]. Third, diabetes causes significant health problems and financial burden; approximately 16 million Americans have diabetes[16,17], costing $91 billion in 2002[18].

METHODS

Overview

We conducted a cross-sectional analysis using the 2003 Medical Expenditure Panel Survey[19,20]. Our study assessed the association between the number of chronic conditions and the likelihood of patients receiving recommended care by using logistic regressions.

Medical Expenditure Panel Survey

In order to address the study question, we analyzed the Medical Expenditure Panel Survey (MEPS)[19,20], which is a nationally representative survey of health care use, including sources of payment, medications, expenditures, and insurance coverage for the non-institutionalized civilian U.S. population, conducted by the Agency of Health care Research and Quality (AHRQ). The households selected for the MEPS are a subsample of those drawn for the National Health Interview Survey (NHIS) conducted by the Center for Disease Control and Prevention and National Center for Health Statistics. NHIS uses a stratified, multistage probability cluster sampling design to obtain a representative sample of the U.S. population and oversamples African-American and Hispanic ethnicity. The overall response rate of 2003 MEPS was 64.5%[19]. The MEPS data include sampling weights that reflect the sampling frame and adjustment for non-response. The overall sample in the 2003 MEPS included approximately 34,000 community dwelling individuals, representing 290 million non-institutionalized people in the United States. Information on disease incidence came from the MEPS Medical Condition File[20], which were derived based on patients recall, and recorded by interviewers as verbatim, and then coded by professional coders to ICD-9-CM codes for each medical event reported by respondents. The error rate of the coders did not exceed 2.5%. Our analysis did not include patients younger than 18, because the definition of chronic conditions for children under 18 is different from that of the general population[21].

Medical Conditions

Definition of Diabetic Condition. To avoid underreporting problems and maximize sample size, we defined diabetics as patients who had any medical event in 2003, such as emergency room visit, outpatient visit, office-based physician visit, hospitalization, prescription drug refill, or home health events associated with International Classification of Disease, Ninth Revision (ICD-9) code 250.xx.

Definition of Chronic Conditions. We defined chronic conditions based on previous studies[21,22]. Specifically, a condition that lasted or was likely to last one year or longer, causing functional limitation and/or the need for ongoing medical care, was defined as chronic. Five internists determined whether ICD-9 codes as listed in the MEPS dataset satisfy the definition of chronic conditions, and 177 codes were classified as chronic in adults[22].

To count the number of distinct chronic conditions per person, we employed the Agency for Healthcare Research and Quality (AHRQ)'s Clinical Classification Code (CCC[20]), which grouped all ICD-9 codes into 259 mutually exclusive, clinically homogeneous classes. Therefore, patients were regarded as having two chronic conditions if they had two conditions whose ICD-9 codes were classified as chronic, and if those two conditions were in different CCC classes. We applied CCC classes to MEPS Medical Condition File, which contains ICD-9 codes based on patients recall, and we counted the number of individual patients' chronic conditions.

CCC has been previously used to measure comorbidity for predicting hospital utilization and mortality, and examine out-of-pocket spending for patients with chronic conditions[22].

Number of Office-based Physician Visits. We counted the number of office-based physician visits, based on a speculation that patients with more physician interactions in an office setting would be more likely to receive recommended care, simply because of patient availability. We obtained the number of office-based physician visits per person from the MEPS full-year consolidation file. However, the MEPS full-year consolidate file does not identify whether patients received care by visiting same providers or multiple different providers. We also estimated the number of non-diabetic office-based physician visits, which excluded any office visits that were related with diabetes as indicated by ICD-9 code 250.xx. Non-diabetic office-based physician visits were used in sensitivity analysis to examine the robustness of our results.

Quality Measures

We compared the likelihood of receiving diabetes care, measured by hemoglobin A1C (HbA_{1C}) test twice a year (yes/no) and a dilated eye exam once a year (yes/no), based on the American Diabetic Association (ADA) recommendations[15]. All of the quality measures were based on **self-report**.

We did not include the likelihood of receiving a pap smear test, despite strong evidence of benefit suggested by United States Preventive Services Task Force[23], because pap smears are not recommended for patients age 65 and older, the age category for 50% of the patients in our sample (Table 1); thus we will exclude about 75% of our sample (50% male, and then remaining 50% of them are women age 65 and older). Colorectal cancer screening was excluded in our analysis, because MEPS does not allow us to distinguish between sigmoidoscopy and colonoscopy[23]. An annual foot exam was also excluded from our analysis, because the definition of "foot

Table 1. Demographic Characteristics of Non-institutionalized Diabetic Patients in U.S. Population

	Number of chronic conditions other than diabetes				Total	p value
	0	1~2	3~4	5≥		
Age						<0.0001
Older than 65	16	40	51	54	41	
65 and younger	85	60	49	46	59	
Sex						<0.0001
Male	56	40	40	31	41	
Female	44	60	60	69	59	
Race						0.002
White	66	74	81	81	77	
Black	22	19	13	15	16	
Others	11	8	6	4	7	
Insurance						<0.0001
Private	65	65	65	57	63	
Public	30	32	32	40	30	
Uninsured	5	3	3	3	7	
Education						0.95
<High school	43	42	42	43	42	
High school	35	30	32	35	32	
>High school	23	28	26	23	26	
Annual number of office-based physician visits						<0.0001
0~2	59	25	15	6	23	
3~5	22	32	27	12	28	
6~10	13	25	29	27	29	
11≥	5	18	29	54	20	
Diabetic population						
	17	24	36	23	100	

All the numbers are in percent, except the p-values
P-values were estimated based on χ^2 tests

exam" in MEPS was not clear: since respondents could confuse "visual foot inspection," which is recommended at every visit for people with neuropathy, with "comprehensive foot exam," which is recommended by ADA[15].

Statistical Analyses

Demographic characteristics and the number of chronic conditions were compared using χ^2 tests. We analyzed the likelihood of receiving CPG-concordant care as a function of the number of chronic conditions and other patient characteristics using logistic regression. Age, race (white, black, others), insurance (none, private, or public plans) and education were included in our analysis as independent variables, because previous studies suggested that those variables were associated with quality of care[24,25]. Insulin use was included in the analysis, because insulin users were more likely to have advanced diabetes, compared with patients who do not use insulin. The number of chronic conditions other than diabetes, and the number of office-based physician visits were categorized into their quartiles to maximize statistical power. The age variable was dichotomized with 65 as a cut-off, because of the skewed nature of its distribution. We specified these variables as continuous and compared the results of logistic regression under continuous vs. categorical specifications, and the results were not different at statistically significant level.

Due to the clustered and correlated nature of the survey data, statistical analysis was performed using survey-specific procedures in SAS version 9.1 (SAS institute Inc, Cary, NC) to account for multistage sampling designs. Appropriate sampling weight, clustering, and stratification information, which are all publicly available, have been applied in the model estimation.

RESULTS

Descriptive Statistics

The sample from the 2003 MEPS data included about 1,700 diabetic patients age 18 and older, representing 14.2 million non-institutionalized civilian diabetic U.S. patients. About
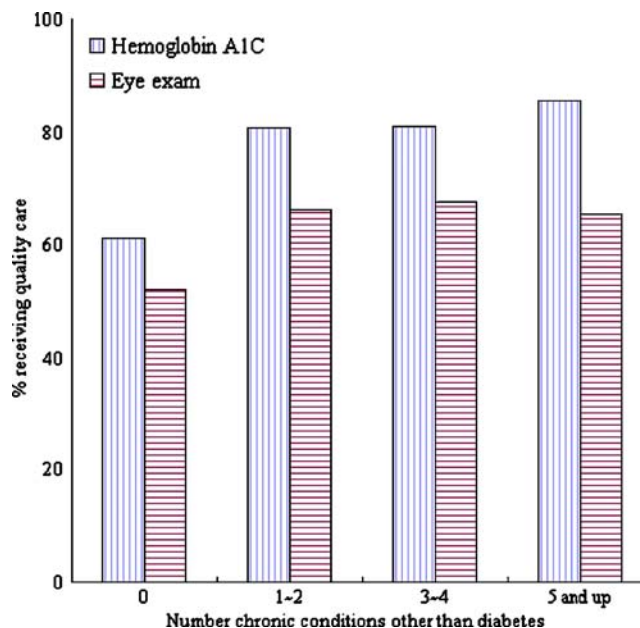

Figure 1. Association between the number of chronic conditions and quality measures. P values for hemoglobin A1C test and eye exam vs. number of chronic conditions were less than 0.001, based on χ^2 test.

23% of them, or 3.3 million diabetic patients, have 5 or more additional chronic conditions (Table 1). The number of chronic conditions other than diabetes was strongly associated with the number of office-based physician visit, as demonstrated by Table 1 (p<0.0001). Diabetic patients who have five or more additional chronic conditions are more likely to be older, female, white, publicly insured, and have more office-based physician visits than diabetic patients with no additional chronic conditions (p<0.01). Differences in the sample size for eye exam (1,396) and HbA$_{1C}$ (1,070) test are due to non-response.

Number of Chronic Conditions, and the Likelihood of Receiving Recommended Services

Figure 1 illustrates that the use of recommended care is positively correlated with the number of chronic conditions other than diabetes (p<0.001). Tables 2 and 3 summarized the results of regression analyses, analyzing the association between demographic characteristics and the likelihood of receiving HbA1C test and eye exam, respectively. Model 1 (Table 2) and Model 4 (Table 3) are base models which examine the association between the number of chronic conditions and the likelihood of receiving quality of diabetes care, after adjusting for demographic characteristics. Model 1 and Model 4 show that higher number of chronic conditions other than diabetes is strongly associated with the increased use of diabetes management (HbA$_{1C}$, p<0.05, Model 1, Table 2; eye exam, p<0.01, Model 4, Table 3).

Number of Office-based Physician Visits, and the Likelihood of Receiving Recommended Services

After controlling for the number of office-based physician visits, the number of chronic condition other than diabetes became less significant predictor of using recommended services (Model 2, Table 2; Model 5, Table 3). Patients with higher number of office-based physician visits were more likely to receive diabetes management services (HbA$_{1C}$, p<0.05, Model 2, Table 2; eye exam, p<0.01, Model 5, Table 3) demonstrate that the number of office-based physician visits attenuated the association between the number of chronic conditions and the utilization of diabetes management services, which suggests that the positive correlation between the number of chronic conditions and the increased use of recommended services are driven by the fact that diabetic patients with higher number of conditions have more frequent office-based physician visits, as demonstrated by Table 1.

Table 2. Results of Multivariate Logistic Regression Analysis Adjusted by Number of Additional Chronic Conditions and Other Demographic Characteristics on the Likelihood of Receiving HbA1C Test in the Non-institutionalized, Adult, Diabetic US Population

HbA1C test	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Age			
65 and older vs. younger than 65	1.09 (0.89–1.33)	1.06(0.87–1.30)	0.89 (0.64–1.22)
Sex			
Male vs. female	0.98 (0.82–1.18)	0.99 (0.82–1.20)	1.01 (0.84–1.22)
Race			
Other vs. white	1.24 (0.72–2.13)	1.22 (0.67–2.22)	1.01 (0.58–1.77)
Black vs. white	0.96 (0.64–1.42)	1.01 (0.67–1.54)	1.04 (0.69–1.57)
Education			
<High school(HS) vs. >HS	0.73 (0.57–0.94)*	0.76 (0.59–0.97)*	0.74 (0.57–0.95)*
HS vs. >HS	0.99 (0.80–1.22)	0.97 (0.78–1.20)	1.02 (0.82–1.28)
Insurance			
Private vs. uninsured	1.22 (0.95–1.56)	1.16 (0.91–1.49)	1.1 (0.83–1.46)
Public vs. uninsured	1.33 (0.95–1.86)	1.28 (0.91–1.79)	1.32 (0.62–1.53)
Insulin use			
Yes vs. no	0.93 (0.82–1.18)	0.9 (0.72–1.11)	0.86 (0.70–1.07)
Number of additional chronic conditions			
1~2 vs. none	1.18 (0.88–1.59)	1.22 (0.90–1.65)	1.05 (0.77–1.45)
3~4 vs. none	1.1 (0.83–1.44)	1.03 (0.77–1.36)	1.11 (0.80–1.54)
5 and up vs. none	1.67 (1.13–2.46)*	1.34 (0.89–2.01)	1.54 (1.01–2.33)*
Total number of office-based physician visits			
3~5 vs. 0~2	–	0.8 (0.53–1.21)	–
6~10 vs. 0~2	–	1.62 (1.15–2.28)†	–
11 ≥ vs. 0~2	–	1.43 (1.02–2.01)*	–
Total number of non-diabetes related office-based physician visits			
2–3 vs. 0–1	–	–	0.9 (0.63–1.28)
4–7 vs. 0–1	–	–	1.2 (0.84–1.70)
8 and up vs. 0–1	–	–	1.48 (1.04–2.12)*

‡Significant at P<0.001; †significant at P<0.01; *significant at P<0.05 .

Model 1 shows the association between the number of chronic conditions and the likelihood of receiving HbA1C test, adjusted by demographic characteristics.

Model 2 shows the association between the number of office-based physician visits and the likelihood of receiving HbA1C test, adjusted by demographic characteristics and the number of chronic conditions.

Model 3 shows the association between the number of non-diabetes related office-based physician visits and the likelihood of receiving HbA1C test, adjusted by demographic characteristics and the number of chronic conditions.

Table 3. Results of Multivariate Logistic Regression Analysis Adjusted by the Number of Additional Chronic Conditions and Other Demographic Characteristics on the Likelihood of Receiving Eye Exam in the Non-institutionalized, Adult, Diabetic US Population

Eye exam	Model 4	Model 5	Model 6
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age			
65 and older vs. younger than 65	1.27 (1.07–1.50)‡	1.25 (1.06–1.48)†	1.28 (1.08–1.52)†
Sex			
Male vs. female	0.83 (0.72–0.96)*	0.83 (0.72–0.96)*	0.84 (0.72–0.98)*
Race			
Other vs. white	0.97 (0.72–1.32)	0.95 (0.69–1.29)	0.9 (0.65–1.25)
Black vs. white	0.92 (0.71–1.20)	0.96 (0.74–1.24)	1.01 (0.77–1.32)
Education			
<High School(HS) vs. >HS	0.71 (0.57–0.88)†	0.72 (0.58–0.90)†	0.73 (0.58–0.91)†
HS vs. >HS	1.22 (1.01–1.48)*	1.21 (0.99–1.48)	1.27 (1.05–1.54)*
Insurance			
Private vs. uninsured	1.32 (1.04–1.66)	1.29 (1.01–1.64)*	1.31 (1.03–1.68)*
Public vs. uninsured	0.99 (0.76–1.28)	0.95 (0.74–1.24)	0.89 (0.67–1.18)
Insulin use			
yes vs. no	1.16 (0.99–1.36)	1.14 (0.97–1.33)	1.01 (0.93–1.29)
Number of additional chronic conditions			
1~2 vs. none	0.88 (0.69–1.13)	0.92 (0.71–1.17)	0.85 (0.65–1.11)
3~4 vs. none	1.06 (0.85–1.32)	1.03 (0.83–1.29)	1.04 (0.83–1.31)
5 and up vs. none	1.5 (1.15–1.95)†	1.27 (0.95–1.70)	1.37 (1.02–1.84)*
Total number of office-based physician visits			
3~5 vs. 0~2	–	0.81 (0.65–1.01)	–
6~10 vs. 0~2	–	1.18 (0.93–1.49)	–
11 ≥ vs. 0~2	–	1.4 (1.11–1.76)†	–
Total number of non-diabetes related office-based physician visits			
2–3 vs. 0–1	–	–	0.8 (0.63–1.02)
4–7 vs. 0–1	–	–	0.98 (0.76–1.27)
8 and up vs. 0–1	–	–	1.39 (1.06–1.81)*

‡Significant at P<0.001; †significant at P<0.01; *significant at P<0.05.

Model 4 shows the association between the number of chronic conditions and the likelihood of receiving eye exam, adjusted by demographic characteristics

Model 5 shows the association between the number of office-based physician visits and the likelihood of receiving eye exam, adjusted by demographic characteristics and the number of chronic conditions

Model 6 shows the association between the number of non-diabetes related office-based physician visits and the likelihood of receiving eye exam, adjusted by demographic characteristics and the number of chronic conditions

Sensitivity Analysis

Since the number of office-based physician visits aggregated any office-based physician visits regardless of the nature of the visits, we estimated the number of non-diabetes associated office-based physician visits by excluding any office-based physician visits with ICD-9 code 250.xx, based on a speculation that the number of diabetes-related visits and diabetes management services are not independent. Models 3 and 6 suggest that patients with higher number of non-diabetes related visits were still strong predictors in receiving recommended diabetes cares, increasing the odds of receiving HbA$_{1C}$ by 48% (p<0.05, Model 3, Table 2) and eye exam by 39% (p< 0.05, Model 6, Table 3).

DISCUSSION

Our results suggest that in the diabetic population, patients with more number of chronic conditions are more likely to receive better quality of care: they received more diabetes management services. Our result is consistent with previous studies, which suggested that patients with multiple diseases are more likely to receive preventive care[13,14], and Rosen and colleagues' study[25], which found that diabetic patients with multiple diseases are more likely receive recommended chronic care. We found that the higher quality of care for these diabetic patients was associated with their frequent office-based physician visits, and the finding was robust when we excluded diabetes-related office-based physician visits.

The result of our study is opposite to that of previous studies[11,12], which concluded that cancer screening rate decreased as comorbidity increased. The difference may be driven by the fact that they defined the comorbidity based on Charlson comorbidity index, which gives more weight to patients with serious conditions, whereas we added the number of chronic conditions to estimate the competing demand for recommended care. Their studies were focused more on how patients' health status (i.e., good, mild, severe) affect cancer screening, whereas we explores how competing demand and prioritization affect diabetes quality of care. Our finding is opposite to Frayne and colleagues' study[26], which focus on the impact of mental illness on diabetes care. Since mental illnesses tend to impair diabetic patients' self-care and communication[27], findings from these patients are less likely to be generalizable to our target population, i.e., diabetic patients with any chronic conditions. Our findings are somewhat at odds with Schectman et al.'s study[28], which showed that the number of visits are not correlated with quality of care. Yet, it might be possible that our patients are seeing different providers and this led to better quality of care.

Because of time constraints and competing demand[6,7], one might assume that patients with multiple chronic conditions

are less likely to receive recommended care, which could influence the amount of financial reward for physicians under the pay-for-performance system. We found that those patients actually receive more preventive care services, because those patients are making more office-based visits, and being more available to physicians. If patients in our analysis were seeing same providers, instead of seeing multiple different providers, then our study suggests that implementing pay-for-performance may not necessarily punish physicians who care for patients with multiple chronic conditions. We could not examine whether those patients were seeing single or multiple providers, due to data limitation.

Still, it remains unclear whether receipt of several recommended service is in the best interest of patients, given the burden of complying with several sets of protocols. Moreover, the consequences of applying multiple sets of CPGs may manifest patient behaviors that we were not able to examine in our data, including reduced patient adherence to medication recommendations or behavioral changes indicated by the relevant CPGs.

There are several limitations as to this explanatory analysis. First, we could not observe physicians' pattern of prioritizing treatment based on the severity of underlying conditions, because ICD-9 codes do not report the severity of the diseases. Also, we did not consider the intensity of office visits because of data limitations; mean length of office visits to physicians ranges from 13.9 to 21.4 minutes per visit[29], which might reflect the variation in intensity of visit.

Second, we counted the number of chronic conditions to quantify competing demands for physicians. However, we recognize that counting the number of chronic conditions without accounting for severity of illness over-simplifies the reality.[30,31]

Third, our analysis does not include other "process" measures of diabetes quality of care, such as microalbuminuria test and serum cholesterol level (LDL-C) screening, because MEPS does not provide such information. We also could not include "outcome" measures for diabetes, like $Hb_{A1C}<7.0\%$, due to data limitations. It is not clear whether patients who receive better quality of care measured by our analysis also receive better quality of care in these other quality measures.

Finally, all of our outcome measures were based on self-report, thus patients with better recall are more likely to report more diagnoses, which could lead to a positive correlation between the number of chronic conditions and the quality of care received. Our statistical analysis shows that correlations between quality of care received (eye exam, HbA1C test, PSA, and pap smear; result not shown) and the number of chronic conditions were inconsistent, which implies that our results are less likely to be driven by recall bias. Also, due to data limitation, our study fails to identify whether patients were seeing single provider or multiple providers, which could influence patients' quality of care. Future research, using patients billing data, is needed to reinforce our findings.

CONCLUSION

In summary, we found that diabetic patients with multiple chronic conditions may receive better quality of preventive care, partly due to their higher number of office-based physician visits. To the extent that our findings reflect a general pattern in receiving recommended preventive care for chronically ill populations, they suggest that current incentive programs would not necessarily disadvantage those who care for patients with multiple chronic conditions, if patients in our analysis were seeing single provider. Given that we found nearly a quarter of patients to have reported 5 or more comorbidities, however, further work is needed to examine appropriate clinical prioritization in these instances.

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