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Characteristics and service use of Medicare beneficiaries using Federally Qualified Health Centers

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Abstract

BACKGROUND—Federally Qualified Health Centers (FQHCs) provide primary care for millions of Americans, but little is known about Medicare beneficiaries who use FQHCs.

OBJECTIVE—To compare patient characteristics and health care service use among Medicare beneficiaries stratified by FQHC use.

RESEARCH DESIGN—Cross-sectional analysis of 2011 Medicare fee-for-service beneficiaries age 65 and older.

SUBJECTS—Beneficiaries with at least one evaluation and management (E&M) visit in 2011, categorized as FQHC users (≥ 1 E&M visit to FQHCs) or non-users living in the same Primary Care Service Areas as FQHC users. Users were sub-classified as predominant if the majority of their E&M visits were to FQHCs.

MEASURES—Demographic characteristics, physician visits, and inpatient care use.

RESULTS—Most FQHC users (56.6%) were predominant users. Predominant and non-predominant users, compared with non-users, markedly differed by prevalence of multiple chronic conditions (18.2%, 31.7% vs. 22.7%) and annual mortality (2.8%, 3.8% vs. 4.0%; all $p < 0.05$). In adjusted analyses (reference: non-users), predominant users had fewer physician visits (RR 0.81, 95% CI: 0.81–0.81) and fewer hospitalizations (RR 0.84, 95% CI: 0.84–0.85), while non-predominant users had higher use of both types of service (RR 1.18, 95% CI: 1.18–1.18; RR 1.09, 95% CI: 1.08, 1.10, respectively).

CONCLUSION—Even controlling for primary care delivery markets, non-predominant FQHC users had a higher burden of chronic illness and service use than predominant FQHC users. It will be important to monitor Medicare beneficiaries using FQHCs to understand whether primary-care only payment incentives for FQHCs could induce fragmented care.

Keywords

FQHC; Medicare; physician visits; hospitalizations

INTRODUCTION

Providing affordable and accessible primary care is essential for population health.^{1–6} Congress established the Federally Qualified Health Centers (FQHCs) program in 1989 to support health centers providing ambulatory primary-care services in underserved areas.⁷ By 2011, the number of FQHCs exceeded 5,000 in the U.S.

While FQHCs by definition see patients regardless of insurance status, Medicare is an important source of revenue for FQHCs. Medicare payment in the FQHC program has several unique features compared to payment of non-FQHC providers. Medicare's payment incentive to FQHCs encourages a comprehensive scope of primary care through an all-inclusive per-visit payment system.⁷ With a fixed per-visit payment to FQHCs, Medicare beneficiaries can receive needed preventive services and timely ambulatory care at FQHCs to detect and prevent health problems at an early stage. However, because FQHCs are paid only to provide primary care, FQHCs services alone may not meet the needs for patients with multiple chronic conditions requiring both primary care and specialty care.

Prior research on FQHCs has primarily focused on populations under age 65,^{8–10} specific conditions/diseases,^{11–21} a few selected centers,^{22–24} or care delivery from the health center provider perspective.^{25,26} There is no study of older adults who rely on FQHC services from a population-based perspective. As baby boomers age into Medicare, their medical needs may change and they may require different specialty care by different providers. Additionally, given the growth in FQHCs, overtime more Medicare beneficiaries may seek care from FQHCs. Thus, it is crucial to understand characteristics and service use of Medicare beneficiaries who use FQHCs.

For this cross-sectional study, we used 2011 Medicare fee-for-service claims of beneficiaries over age 65 to identify FQHC users, stratified by whether users had more than 50% of their ambulatory care visits to FQHCs. We examined FQHC users' patient characteristics and service use compared to non-FQHC users who resided in the same primary care service areas.

METHODS

Study Population

We first identified Medicare beneficiaries who were age 65 or older on January 1, resided in the 50 States or D.C., and had full Parts A and B coverage (12 months or until death month) without any Medicare Advantage enrollment from the 2011 denominator file. We further

restricted beneficiaries to those who lived in the community in 2011, excluding patients who had nursing home stay of at least 100 days. We assigned each beneficiary to a Primary Care Service Area (PCSA) based on his or her resident Zip Code according to the ZIP to PCSA crosswalk file.²⁷ PCSAs v3.1 were defined by aggregating 2010 Census tracts to form primary care market areas based on travel of Medicare beneficiaries to primary care providers for ambulatory primary care.²⁸ PCSAs have been used in previous research to measure primary care resources, utilization, access to care and associated outcomes.^{29–31}

We limited the study population to patients with at least one outpatient evaluation and management (E&M) visit in 2011 (CPT codes: 99201-99205, 99211-99215, 99381-99387, 99391-99397, 99304-99350, G0402, G0438 and G0439) from the 2011 Physician/Supplier Part B and Outpatient (for FQHCs) files. We classified FQHC users as those who had at least one E&M visit to any FQHC. We then sub-classified FQHC users as predominant users if more than 50% of their E&M visits were to FQHCs; other FQHC users (with < 50% of E&M visits for FQHCs) were classified as non-predominant users.

Because FQHCs are strategically located in areas with limited healthcare resources, we limited the non-users in this study to those beneficiaries who did not have any E&M visits to an FQHC and lived in the same PCSAs as the FQHC users, regardless of whether the PCSA has an FQHC or not. We further restricted our analyses to PCSAs in which at least 2% of area beneficiaries used FQHCs to have comparable non-users, selecting 2% as the threshold because, nationally, 2% of Medicare beneficiaries are FQHC users.

Patient Characteristics

We obtained patients' demographic information from the Medicare Beneficiary Summary File (age, sex, race and ethnicity, Medicare-Medicaid dual eligibility, Zip Code of residence, death in 2011). We used four groups of race and ethnicity (White, Black, Hispanic, Others) derived from the Research Triangle Institute (RTI) imputed race variable provided by Medicare. We linked patients' Zip Code of residence to the U.S. Census tract to obtain tract-level median household income and proportion of population below poverty.²⁷ We defined high poverty neighborhoods as those tracts with more than 20% of its population living below the federal poverty line. We also identified each patient's PCSA and classified it as an FQHC-PCSA if there is an FQHC physically located in that PCSA.²⁷

We identified 18 chronic conditions, those that typically require ongoing monitoring and management, based on diagnosis codes on inpatient or outpatient claims (see Appendix 1).

Use of services

We examined several aspects of health care use, including number of ambulatory care visits, number of physicians seen, acute short-stay hospitalizations, and hospitalizations for ambulatory care sensitive conditions (ACSCs).

From the 2011 outpatient claims we measured the total number of E&M visits and the number of unique physicians seen. From the 2011 Medicare Provider Analysis and Review file we identified any acute short-stay hospitalizations for our study patients. We categorized hospitalizations as medical or surgical based on the Medicare Severity DRGs. We also

measured hospitalizations for ambulatory care sensitive conditions (ACSC) defined by the Agency for Healthcare Research and Quality as prevention quality indicators.³² ACSC hospitalizations represent conditions for which hospitalization could potentially be avoided if the patient receives timely and adequate outpatient care. We measured three types of ACSCs – overall, acute (dehydration, bacteria pneumonia or urinary tract infection) and chronic (diabetes short-term complications, diabetes long-term complications, chronic obstructive pulmonary disease or asthma, hypertension, heart failure, angina without procedure, uncontrolled diabetes, lower-extremity amputation among patients with diabetes).

Statistical Analysis

We compared patients' characteristics and use of services by FQHC users vs. non-users by t-test or chi-square tests as appropriate. We repeated these analyses to test for any differences between predominant vs. non-predominant users. We estimated the relative use of services 1) between users and non-users (reference); 2) between predominant (reference) and non-predominant users; and 3) predominant users, non-predominant users and non-users (reference) using multivariate Poisson regression models, adjusting for individual characteristics and mortality (to account for different exposure time in 2011). Analyses were conducted using SAS V9.3 (SAS Institute Inc., Cary, NC). The Dartmouth College Institutional Review Board approved this study.

RESULTS

Medicare FQHC users resided in 6,359 out of a total of 7,144 PCSAs in the U.S. (Table 1); in 1,952 PCSAs, at least 2% of local beneficiaries used FQHC services. Compared to the 785 PCSAs with no FQHC users, the PCSAs with FQHC users have more minority and low-income populations. We limited our analyses to beneficiaries resided in those 1,952 PCSAs.

All descriptive differences presented were statistically significant at $p < 0.05$, except hospital days. Compared to non-users (Table 2), users were younger (age 65–69: 34.4% vs. 27.7%, mean age 74.0 vs. 75.3); more likely to be Black (13.6% vs. 9.6%) or Hispanic (13.2% vs. 6.2%); more likely to be enrolled in Medicaid (37.2% vs. 15.6%); resided in lower income tracts (average median household income \$41,170 vs. \$48,931); and were more likely to live in high poverty neighborhoods (39.8% vs. 29.7%). Most users had at least one chronic condition (54.6% vs. 50.8%).

The differences between the two types of FQHC users were noticeable (Table 2). Although they were similar in age and sex, the predominant users were more likely than non-predominant users to be minority (black: 14.8% vs. 12.1%; Hispanic: 14.7% vs. 11.3%), more likely to be enrolled in Medicaid (40.6% vs. 32.8%), and more likely to live in high poverty neighborhoods (41.3% vs. 37.9%). More predominant users had no chronic conditions identified from the claims (49.9% vs. 39.6%). The predominant users had lower 1-year mortality (2.8% vs. 3.8%).

Large differences between users and non-users were observed in the use of inpatient care (Table 3). Compared to non-users, FQHC users had more all-cause hospitalizations (322.3 vs. 309.5 per 1,000) with similar average hospital lengths of day (1.5 vs. 1.4 days). Although

FQHC users had fewer surgical hospitalizations (83.1 vs. 87.8 per 1,000), they had much higher number of hospitalizations for ambulatory care sensitive conditions (ACSCs) (77.0 vs. 66.0 per 1,000), especially for chronic ACSC conditions (47.9 vs. 39.5 per 1,000).

Service use also differed significantly between predominant and non-predominant FQHC users (Table 3). Predominant users had fewer physician visits (6.6 vs. 10.9), saw fewer different physicians (2.5 vs. 4.8), had shorter hospital lengths of stay (0.9 vs. 2.1 days), fewer hospitalizations for surgical procedures (45.1 vs. 132.5 per 1,000), and fewer hospitalizations for ACSCs (60.8 vs. 98.2 per 1,000) in general, and chronic ACSC conditions in particular (37.4 vs. 61.5 per 1,000).

Table 4 shows the relative use of different services between the different comparison groups from Poisson regression models, adjusting for individual and area characteristics and accounting for different exposure time in 2011. Model 1, all FQHC users vs. non-users, shows that FQHC users had significantly fewer physician visits (RR 0.98, 95% CI: 0.98–0.98), fewer all-cause hospitalizations (RR 0.98, 95% CI: 0.97–0.98), and fewer surgical admissions (RR 0.94, 95% CI: 0.93–0.95); however, users had more ACSC hospitalizations (RR 1.04, 95% CI: 1.03–1.06). Model 2 shows differences between the two types of FQHC users. Compared to predominant users, the non-predominant users had significantly more physician visits (RR 1.49, 95% CI: 1.48–1.49), more all-cause hospitalizations (RR 1.29, 95% CI: 1.27–1.30) and twice as many surgical admissions (RR 2.12, 95% CI: 2.07–2.17), but fewer ACSC hospitalizations (RR 0.91, 95% CI: 0.89–0.93).

Model 3 shows that, compared with non-users, predominant FQHC users had fewer physician visit (RR 0.81, 95% CI: 0.81–0.81) and fewer all-cause hospitalizations (RR 0.84, 95% CI: 0.84–0.85), while non-predominant users had the opposite use patterns, with more physician visits (RR 1.18, 95% CI: 1.18–1.18) and more hospitalizations (RR 1.09, 95% CI: 1.08–1.10). Predominant users had more hospitalizations for chronic (RR 1.14, 95% CI: 1.12–1.17) than acute (RR 1.03, 95% CI: 1.01–1.06) ACSC conditions, while non-predominant users had more hospitalizations for acute (RR 1.04, 95% CI: 1.01–1.07) than chronic (RR 0.99, 95% CI: 0.97–1.01) ACSC conditions.

DISCUSSION

We compared patient characteristics and utilization between Medicare FQHC users and non-users. Although users and non-users lived in the same PCSAs, there were significant differences in both individual characteristics and use of medical services between the two groups. Overall, compared to non-users, FQHC users were younger, more likely to be non-White, living in poor neighborhoods and have assistance from Medicaid. The users seemed to have fewer outpatient E&M visits than non-users but higher inpatient use for ambulatory care sensitive conditions, conditions that could be potentially prevented if timely and effective ambulatory care were provided.

After stratifying users by whether a majority of their E&M visits were provided by FQHCs, we found a significant proportion of users relied on other providers outside FQHCs in addition to the FQHCs for their ambulatory care. Those who predominantly used FQHCs

(predominant users) were more likely to be younger, poor, from minority groups, and have fewer chronic conditions. In contrast, non-predominant FQHC users had higher use of healthcare resources such as more outpatient E&M visits, more different physicians, longer hospital stays and more surgical procedures than predominant users. However, non-predominant users had lower ACSC hospitalizations than predominant users. This analysis suggests that FQHC Medicare users are a heterogeneous group: predominant users appear to be generally younger, healthier, and more disadvantaged, whereas non-predominant users appear to be somewhat sicker, using more healthcare resources and having more chronic conditions.

A previous study by Falik et al. found that FQHC Medicaid users had lower ACSC hospitalizations, but they only used five states' (Kentucky, Maine, Missouri, Pennsylvania and Washington) Medicaid claims.⁸ Wright et al. also found lower ACSC hospitalizations for FQHC dual-eligible users.³³ However, they included only patients in a PCSA with an FQHC for both users and non-users. As shown in Table 1, many FQHC users did not reside in a PCSA with an FQHC. Our users and non-users resided in the same primary care markets and we adjusted for FQHC-PCSA in our models. Although PCSAs are not used by HRSA in defining underserved areas, they represent much smaller and more homogeneous primary-care delivery markets than counties.^{27,34} In addition, our models adjusted for the various exposure periods due to different mortality among comparison groups.

To our knowledge, no one has examined older FQHC users from a population-based perspective. We show that FQHCs provide care to two distinct sub-groups of Medicare beneficiaries over age 65, and each group may have unique care needs based on the poverty, race/ethnicity, and chronic illness. Our results suggest that FQHCs may need to consider how to organize care to serve these two different populations effectively. The non-predominant users may be seeking care outside of the FQHC to obtain specialty services. The finding of fewer surgical admissions among predominant users compared to non-predominant users could indicate differential need for specialty care. Alternatively, access to specialists may contribute to utilization differences.

Our study has several limitations. Our cross-sectional analysis cannot determine the causal relationship of FQHC use with level of utilization because of potential residual confounding and because we do not know why people chose their providers – whether due to preference or issues of access. We restricted analyses to a subset of FQHC users to improve the match between users and non-users, but our approach may not fully address potential patient selection bias. Future work might be able to address this bias using alternative approaches, such as instrumental variable methods. Our poverty and income variables were ecologic measures but at small Census tract levels and tracts were the building blocks of the PCSAs.²⁷ Finally, we do not know whether the FQHC has been the source of continuous care for users or a stopgap when access to other providers was not available. A longitudinal follow-up study would help to shed the light about care transitions between FQHCs and other settings.

Our population-based study suggests that there may be two types of FQHC users with distinct care needs, depending more on their underlying health status than on their

demographic and/or socioeconomic status. The current FQHC payment policy could lead to unmet care needs or uncoordinated care as users decline in health and require more advanced specialty care.

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Appendix 1. Definition of 18 chronic conditions

Coronary artery disease: HCC81, HCC82, HCC83

Cancer: HCC7, HCC8, HCC9

Cerebral hemorrhage/stroke: HCC95, HCC96, HCC100

Congestive heart failure: HCC80

Connective tissue disorders: HCC38

Chronic obstructive pulmonary disease: HCC108

Diabetes: HCC15, HCC16, HCC17, HCC18, HCC19, HCC119

Drug/alcohol dependence/mental illness: HCC51, HCC52

Hematologic/thrombotic disease: HCC44, RxHCC100

HIV/AIDS: HCC1

Immune disease: HCC45

Liver disease: HCC25, HCC26, HCC27

Parkinson's/Huntington's: HCC73

Paralysis: HCC67, HCC68, HCC69

Renal disease: HCC130, HCC131, HCC132

Severe mental illness: HCC54, HCC55

Peripheral vascular disease: HCC105

Dementia: RxHCC54, RxHCC55

HCC: hierarchical condition category developed by the Centers of Medicare & Medicaid Services.

Except dementia, patients must have two outpatient claims (separated by 7 days) or one inpatient claim to be classified with the condition.

For dementia, any one claim from outpatient or inpatient claims.

ICD-9's for Each HCC - Label and Number	
Coronary artery disease	<p>HCC81: 410.01,410.11,410.21,410.31,410.41, 410.51,410.61, 410.71, 410.81, 410.91, 429.5, 429.6</p> <p>HCC82: 410.00,410.02,410.10,410.12,410.20, 410.22,410.30,410.32,410.40, 410.42, 410.50,410.52, 410.60, 410.62, 410.70, 410.72, 410.80, 410.82,410.90, 410.92,411.0, 411.1, 411.81, 411.89</p> <p>HCC83: 412, 413.0, 413.1, 413.9</p>
Cancer	<p>HCC7: 196.0, 196.1, 196.2, 196.3, 196.5, 196.6, 196.8, 196.9, 197.0, 197.1, 197.2, 197.3, 197.4, 197.5, 197.6, 197.7, 197.8, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.6, 198.7, 198.81, 198.82, 198.89, 199.0, 204.00, 204.01, 204.02, 205.00, 205.01, 205.02, 206.00, 206.01, 206.02, 207.00, 207.01, 207.02, 208.00, 208.01, 208.02, 209.70, 209.71, 209.72, 209.73, 209.74, 209.75, 209.79</p> <p>HCC8: 150.0, 150.1, 150.2, 150.3, 150.4, 150.5, 150.8, 150.9, 151.0, 151.1, 151.2, 151.3, 151.4, 151.5, 151.6, 151.8, 151.9, 152.0, 152.1, 152.2, 152.3, 152.8, 152.9, 155.0, 155.1, 155.2, 156.0, 156.1, 156.2, 156.8, 156.9, 157.0, 157.1, 157.2, 157.3, 157.4, 157.8, 157.9, 158.0, 158.8, 158.9, 162.0, 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 163.0, 163.1, 163.8, 163.9, 205.10, 205.11, 205.12, 205.20, 205.21, 205.22, 205.30, 205.31, 205.32, 205.80, 205.81, 205.82, 205.90, 205.91, 205.92, 206.10, 206.11, 206.12, 206.20, 206.21, 206.22, 206.80, 206.81, 206.82, 206.90, 206.91, 206.92, 207.10, 207.11, 207.12, 207.20, 207.21, 207.22, 207.80, 207.81, 207.82</p>

ICD-9's for Each HCC - Label and Number	
	<p>HCC9: 141.0, 141.1, 141.2, 141.3, 141.4, 141.5, 141.6, 141.8, 141.9, 142.0, 142.1, 142.2, 142.8, 142.9, 143.0, 143.1, 143.8, 143.9, 144.0, 144.1, 144.8, 144.9, 145.0, 145.1, 145.2, 145.3, 145.4, 145.5, 145.6, 145.8, 145.9, 146.0, 146.1, 146.2, 146.3, 146.4, 146.5, 146.6, 146.7, 146.8, 146.9, 147.0, 147.1, 147.2, 147.3, 147.8, 147.9, 148.0, 148.1, 148.2, 148.3, 148.8, 148.9, 149.0, 149.1, 149.8, 149.9, 160.0, 160.1, 160.2, 160.3, 160.4, 160.5, 160.8, 160.9, 161.0, 161.1, 161.2, 161.3, 161.8, 161.9, 164.0, 164.1, 164.2, 164.3, 164.8, 164.9, 165.0, 165.8, 165.9, 170.0, 170.1, 170.2, 170.3, 170.4, 170.5, 170.6, 170.7, 170.8, 170.9, 171.0, 171.2, 171.3, 171.4, 171.5, 171.6, 171.7, 171.8, 171.9, 176.0, 176.1, 176.2, 176.3, 176.4, 176.5, 176.8, 176.9, 181, 183.0, 183.2, 183.3, 183.4, 183.5, 183.8, 183.9, 191.0, 191.1, 191.2, 191.3, 191.4, 191.5, 191.6, 191.7, 191.8, 191.9, 192.0, 192.1, 192.2, 192.3, 192.8, 192.9, 194.0, 194.3, 194.4, 200.00, 200.01, 200.02, 200.03, 200.04, 200.05, 200.06, 200.07, 200.08, 200.10, 200.11, 200.12, 200.13, 200.14, 200.15, 200.16, 200.17, 200.18, 200.20, 200.21, 200.22, 200.23, 200.24, 200.25, 200.26, 200.27, 200.28, 200.30, 200.31, 200.32, 200.33, 200.34, 200.35, 200.36, 200.37, 200.38, 200.40, 200.41, 200.42, 200.43, 200.44, 200.45, 200.46, 200.47, 200.48, 200.50, 200.51, 200.52, 200.53, 200.54, 200.55, 200.56, 200.57, 200.58, 200.60, 200.61, 200.62, 200.63, 200.64, 200.65, 200.66, 200.67, 200.68, 200.70, 200.71, 200.72, 200.73, 200.74, 200.75, 200.76, 200.77, 200.78, 200.80, 200.81, 200.82, 200.83, 200.84, 200.85, 200.86, 200.87, 200.88, 201.00, 201.01, 201.02, 201.03, 201.04, 201.05, 201.06, 201.07, 201.08, 201.10, 201.11, 201.12, 201.13, 201.14, 201.15, 201.16, 201.17, 201.18, 201.20, 201.21, 201.22, 201.23, 201.24, 201.25, 201.26, 201.27, 201.28, 201.40, 201.41, 201.42, 201.43, 201.44, 201.45, 201.46, 201.47, 201.48, 201.50, 201.51, 201.52, 201.53, 201.54, 201.55, 201.56, 201.57, 201.58, 201.60, 201.61, 201.62, 201.63, 201.64, 201.65, 201.66, 201.67, 201.68, 201.70, 201.71, 201.72, 201.73, 201.74, 201.75, 201.76, 201.77, 201.78, 201.90, 201.91, 201.92, 201.93, 201.94, 201.95, 201.96, 201.97, 201.98, 202.00, 202.01, 202.02, 202.03, 202.04, 202.05, 202.06, 202.07, 202.08, 202.10, 202.11, 202.12, 202.13, 202.14, 202.15, 202.16, 202.17, 202.18, 202.20, 202.21, 202.22, 202.23, 202.24, 202.25, 202.26, 202.27, 202.28, 202.30, 202.31, 202.32, 202.33, 202.34, 202.35, 202.36, 202.37, 202.38, 202.40, 202.41, 202.42, 202.43, 202.44, 202.45, 202.46, 202.47, 202.48, 202.50, 202.51, 202.52, 202.53, 202.54, 202.55, 202.56, 202.57, 202.58, 202.60, 202.61, 202.62, 202.63, 202.64, 202.65, 202.66, 202.67, 202.68, 202.70, 202.71, 202.72, 202.73, 202.74, 202.75, 202.76, 202.77, 202.78, 202.80, 202.81, 202.82, 202.83, 202.84, 202.85, 202.86, 202.87, 202.88, 202.90, 202.91, 202.92, 202.93, 202.94, 202.95, 202.96, 202.97, 202.98, 203.00, 203.01, 203.02, 203.10, 203.11, 203.12, 203.80, 203.81, 203.82, 204.10, 204.11, 204.12, 204.20, 204.21, 204.22, 204.80, 204.81, 204.82, 204.90, 204.91, 204.92, 208.10, 208.11, 208.12, 208.20, 208.21, 208.22, 208.80, 208.81, 208.82, 208.90, 208.91, 208.92</p>
Cerebral hemorrhage/stroke	<p>HCC95: 094.87, 430, 431, 432.0, 432.1, 432.9 HCC96: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436 HCC100 (REMOVE ICD9 343.X): 342.00, 342.01, 342.02, 342.10, 342.11, 342.12, 342.80, 342.81, 342.82, 342.90, 342.91, 342.92</p>
Congestive heart failure	<p>HCC80: 402.01, 402.11, 402.91, 404.01, 404.11, 404.91, 415.0, 416.0, 416.1, 416.8, 416.9, 417.0, 417.1, 417.8, 417.9, 425.0, 425.1, 425.11, 425.18, 425.2, 425.3, 425.4, 425.5, 425.7, 425.8, 425.9, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9, 429.0, 429.1</p>
Connective tissue disorders	<p>HCC38: 136.1, 446.0, 446.1, 446.20, 446.21, 446.29, 446.3, 446.4, 446.5, 446.6, 446.7, 710.0, 710.1, 710.2, 710.3, 710.4, 710.5, 710.8, 710.9, 714.0, 714.1, 714.2, 714.30, 714.31, 714.32, 714.33, 714.4, 714.81, 714.89, 714.9, 720.0, 720.1, 720.2, 720.81, 720.89, 720.9, 725</p>
Chronic obstructive pulmonary disease	<p>HCC108: 491.0, 491.1, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 493.20, 493.21, 493.22, 496, 518.1, 518.2</p>
Diabetes	<p>HCC15: 249.40, 249.41, 249.70, 249.71, 250.40, 250.41, 250.42, 250.43, 250.70, 250.71, 250.72, 250.73 HCC16: 249.60, 249.61, 249.80, 249.81, 250.60, 250.61, 250.62, 250.63, 250.80, 250.81, 250.82, 250.83 HCC17: 249.10, 249.11, 249.20, 249.21, 249.30, 249.31, 250.10, 250.11, 250.12, 250.13, 250.20, 250.21, 250.22, 250.23, 250.30, 250.31, 250.32, 250.33</p>

ICD-9's for Each HCC - Label and Number	
	HCC18: 249.50, 249.51, 249.90, 249.91, 250.50, 250.51, 250.52, 250.53, 250.90, 250.91, 250.92, 250.93 HCC19: 249.00, 249.01, 250.00, 250.01, 250.02, 250.03, V58.67 HCC119: 362.02, 379.23
Drugs/alcohol dependence/mental illness	HCC51: 291.0, 291.1, 291.2, 291.3, 291.4, 291.5, 291.81, 291.82, 291.89, 291.9, 292.0, 292.11, 292.12, 292.2, 292.81, 292.82, 292.83, 292.84, 292.85, 292.89, 292.9 HCC52: 303.00, 303.01, 303.02, 303.03, 303.90, 303.91, 303.92, 303.93, 304.00, 304.01, 304.02, 304.03, 304.10, 304.11, 304.12, 304.13, 304.20, 304.21, 304.22, 304.23, 304.30, 304.31, 304.32, 304.33, 304.40, 304.41, 304.42, 304.43, 304.50, 304.51, 304.52, 304.53, 304.60, 304.61, 304.62, 304.63, 304.70, 304.71, 304.72, 304.73, 304.80, 304.81, 304.82, 304.83, 304.90, 304.91, 304.92, 304.93
Hematologic/thrombotic disease	HCC44: 238.72, 238.73, 238.74, 238.75, 282.41, 282.42, 282.60, 282.61, 282.62, 282.63, 282.64, 282.68, 282.69, 283.0, 283.10, 283.11, 283.19, 283.2, 283.9, 284.01, 284.09, 284.1, 284.2, 284.81, 284.89, 284.9, 286.0, 286.1, 289.52, 517.3 RxHCC100: 415.11, 415.12, 415.13, 415.19, 416.2, 451.11, 451.19, 451.81, 451.83, 453.0, 453.2, 453.3, 453.40, 453.41, 453.42, 453.50, 453.51, 453.52, 453.72, 453.74, 453.75, 453.76, 453.77, 453.82, 453.84, 453.85, 453.86, 453.87
HIV/AIDS	HCC1: 042, 079.53, V08
Immune disease	HCC45: 279.00, 279.01, 279.02, 279.03, 279.04, 279.05, 279.06, 279.09, 279.10, 279.11, 279.12, 279.13, 279.19, 279.2, 279.3, 279.41, 279.49, 279.50, 279.51, 279.52, 279.53, 279.8, 279.9, 284.11, 284.12, 284.19, 288.00, 288.01, 288.02, 288.03, 288.04, 288.09, 288.1, 288.2, 288.4
Liver disease	HCC25: 456.0, 456.1, 456.20, 456.21, 572.2, 572.3, 572.4, 572.8, 573.5 HCC26: 571.2, 571.3, 571.5, 571.6 HCC27: 070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 571.40, 571.41, 571.42, 571.49
Parkinson's/Huntington's	HCC73: 332.0, 332.1, 333.0, 333.4
Paralysis (NOT STROKE)	HCC67: 335.0, 335.10, 335.11, 335.19, 335.20, 335.21, 335.22, 335.23, 335.24, 335.29, 335.8, 335.9, 343.2, 344.00, 344.01, 344.02, 344.03, 344.04, 344.09, 344.81, 780.72, 806.01, 806.06, 806.11, 806.16, 952.01, 952.06 HCC68: 343.0, 344.1, 806.21, 806.26, 806.31, 806.36, 952.11, 952.16 HCC69: 334.0, 334.1, 334.2, 334.3, 334.4, 334.8, 334.9, 336.0, 336.1, 336.2, 336.3, 336.8, 336.9, 344.60, 344.61, 740.0, 740.1, 740.2, 741.00, 741.01, 741.02, 741.03, 741.90, 741.91, 741.92, 741.93, 742.0, 742.1, 742.2, 742.3, 742.4, 742.51, 742.53, 742.59, 742.8, 742.9, 806.00, 806.02, 806.03, 806.04, 806.05, 806.07, 806.08, 806.09, 806.10, 806.12, 806.13, 806.14, 806.15, 806.17, 806.18, 806.19, 806.20, 806.22, 806.23, 806.24, 806.25, 806.27, 806.28, 806.29, 806.30, 806.32, 806.33, 806.34, 806.35, 806.37, 806.38, 806.39, 806.4, 806.5, 806.60, 806.61, 806.62, 806.69, 806.70, 806.71, 806.72, 806.79, 806.8, 806.9, 907.2, 952.00, 952.02, 952.03, 952.04, 952.05, 952.07, 952.08, 952.09, 952.10, 952.12, 952.13, 952.14, 952.15, 952.17, 952.18, 952.19, 952.2, 952.3, 952.4, 952.8, 952.9
Renal disease	HCC130: 996.56, 996.68, 996.73, V45.11, V45.12, V56.0, V56.1, V56.2, V56.31, V56.32, V56.8 HCC131: 403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 584.5, 584.6, 584.7, 584.8, 584.9, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 585.9, 586, 753.14 HCC132: 078.6, 580.0, 580.4, 580.81, 580.89, 580.9, 581.0, 581.1, 581.2, 581.3, 581.81, 581.89, 581.9, 582.0, 582.1, 582.2, 582.4, 582.81, 582.89, 582.9, 583.0, 583.1, 583.2, 583.4, 583.6, 583.7, 583.81, 583.89, 583.9
Severe mental illness	HCC54: 295.00, 295.01, 295.02, 295.03, 295.04, 295.05, 295.10, 295.11, 295.12, 295.13, 295.14, 295.15, 295.20, 295.21, 295.22, 295.23, 295.24, 295.25, 295.30, 295.31, 295.32, 295.33, 295.34, 295.35, 295.40, 295.41, 295.42, 295.43, 295.44, 295.45, 295.50, 295.51, 295.52, 295.53, 295.54, 295.55, 295.60, 295.61, 295.62, 295.63, 295.64, 295.65, 295.70, 295.71, 295.72, 295.73, 295.74, 295.75, 295.80, 295.81, 295.82, 295.83, 295.84, 295.85, 295.90, 295.91, 295.92, 295.93, 295.94, 295.95

ICD-9's for Each HCC - Label and Number	
	HCC55 (REMOVE E ICD-9s): 296.00, 296.01, 296.02, 296.03, 296.04, 296.05, 296.06, 296.10, 296.11, 296.12, 296.13, 296.14, 296.15, 296.16, 296.20, 296.21, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.31, 296.32, 296.33, 296.34, 296.35, 296.36, 296.40, 296.41, 296.42, 296.43, 296.44, 296.45, 296.46, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.7, 296.80, 296.81, 296.82, 296.89, 296.90, 296.99, 297.0, 297.1, 297.2, 297.3, 297.8, 297.9
Peripheral vascular disease	HCC105: 440.0, 440.1, 440.20, 440.21, 440.22, 440.29, 440.30, 440.31, 440.32, 440.4, 441.2, 441.4, 441.7, 441.9, 442.0, 442.1, 442.2, 442.3, 442.81, 442.82, 442.83, 442.84, 442.89, 442.9, 443.1, 443.81, 443.82, 443.89, 443.9, 447.0, 447.1, 447.2, 447.3, 447.4, 447.5, 447.6, 447.70, 447.71, 447.72, 447.73, 447.8, 447.9, 448.0, 451.11, 451.19, 451.81, 451.83, 453.0, 453.2, 453.3, 453.40, 453.41, 453.42, 453.50, 453.51, 453.52, 453.72, 453.74, 453.75, 453.76, 453.77, 453.82, 453.84, 453.85, 453.86, 453.87, 557.1, 557.9
Dementia	RxHCC54: 331.0 RxHCC55: 046.0, 046.11, 046.19, 046.2, 046.3, 046.71, 046.72, 046.79, 046.8, 046.9, 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 290.8, 290.9, 294.0, 294.10, 294.11, 294.20, 294.21, 294.8, 294.9, 330.0, 330.1, 330.2, 330.3, 330.8, 330.9, 331.11, 331.19, 331.2, 331.6, 331.7, 331.81, 331.82, 331.89, 331.9

Appendix 2: Sensitivity analysis: Relative use of healthcare among Federally Qualified Health Center (FQHC) users vs. non-users

From areas with $\geq 2\%$ area beneficiaries used FQHCs

Relative rate (95% CI)	Model 1	Model 2	Model 3	
	FQHC Users	Non-predominant users	Predominant	Non-predominant
Reference	Non-users	Predominant users	Non-users	
1) Adjusted for demographic (age, sex, race and ethnicity) and socioeconomic status (dual eligibility, income, in high poverty neighborhood)				
Physician visits				
E&M	0.98 (0.98–0.98)	1.66 (1.66–1.67)	0.76 (0.76–0.76)	1.26 (1.26–1.26)
# Physicians	1.03 (1.03–1.03)	1.90 (1.90–1.91)	0.74 (0.74–0.74)	1.40 (1.39–1.40)
Hospital use				
Days	0.89 (0.89–0.89)	2.35 (2.34–2.36)	0.56 (0.56–0.56)	1.34 (1.33–1.34)
Hospitalizations				
Total	0.94 (0.94–0.95)	2.11 (2.08–2.13)	0.64 (0.63–0.64)	1.36 (1.35–1.37)
All medical	0.95 (0.95–0.96)	1.89 (1.87–1.92)	0.69 (0.68–0.69)	1.32 (1.31–1.33)
All surgical	0.93 (0.92–0.94)	2.93 (2.87–3.00)	0.50 (0.49–0.51)	1.47 (1.45–1.49)
ACSCs	0.99 (0.98–1.00)	1.68 (1.64–1.72)	0.76 (0.75–0.77)	1.30 (1.28–1.32)
Acute	1.00 (0.98–1.02)	1.62 (1.56–1.68)	0.78 (0.76–0.81)	1.29 (1.26–1.33)
Chronic	0.98 (0.97–0.99)	1.72 (1.68–1.77)	0.74 (0.73–0.76)	1.31 (1.28–1.33)
2) Adjusted for demographic (age, sex, race and ethnicity), socioeconomic status (dual eligibility, income, in high poverty neighborhood) and access (FQHC-PCSAs)				
Physician visits				

Relative rate (95% CI)	Model 1	Model 2	Model 3	
	FQHC Users	Non-predominant users	Predominant	Non-predominant
E&M	0.98 (0.98–0.98)	1.66 (1.66–1.67)	0.76 (0.76–0.76)	1.26 (1.26–1.26)
# Physicians	1.03 (1.03–1.03)	1.90 (1.90–1.91)	0.74 (0.74–0.74)	1.39 (1.39–1.40)
Hospital use				
Days	0.89 (0.89–0.89)	2.35 (2.33–2.36)	0.56 (0.56–0.56)	1.34 (1.33–1.34)
Hospitalizations				
Total	0.94 (0.94–0.95)	2.11 (2.08–2.13)	0.64 (0.63–0.64)	1.35 (1.34–1.36)
All medical	0.95 (0.95–0.96)	1.89 (1.87–1.92)	0.69 (0.68–0.69)	1.32 (1.31–1.33)
All surgical	0.93 (0.92–0.94)	2.93 (2.86–3.00)	0.50 (0.49–0.51)	1.47 (1.45–1.49)
ACSCs	0.99 (0.98–1.00)	1.68 (1.64–1.72)	0.76 (0.75–0.77)	1.30 (1.28–1.32)
Acute	1.00 (0.98–1.02)	1.62 (1.56–1.68)	0.78 (0.76–0.81)	1.29 (1.26–1.33)
Chronic	0.98 (0.97–1.00)	1.72 (1.68–1.77)	0.74 (0.73–0.76)	1.31 (1.28–1.33)

None of the models above adjust for the number of chronic conditions, which is the only covariate not included in the models in panel 2 of the above table.

E&M: Evaluation and management

ACSCs: Ambulatory care-sensitive conditions

All Models accounted for different exposure time in 2011

Table 1Characteristics of Primary Care Service Areas of Federally Qualified Health Center (FQHC) users[/]

Primary Care Service Areas (PCSAs)	All PCSAs	PCSAs without FQHC users	PCSAs with at least 1 FQHC user	PCSAs with ≥ 2% area beneficiaries used FQHCs
N	7,144	785	6,359	1,952
% Beneficiaries used FQHCs	2.0	0.0	2.3	7.8
% FQHC users in area (median)	0.5	0.0	0.7	6.2
# PCSAs with FQHCs	2,315	19	2,296	1,355
Race and ethnicity among 2010 Census population age ≥ 65 (median)				
% Black	1.1	0.2	1.3	1.2
% Hispanic	1.0	0.6	1.1	0.9
Median household Income	\$47,073	\$47,623	\$47,005	\$40,615
% Population below poverty (median)	12.7	10.4	13.1	17.2

[/] FQHC users: ≥ 1 evaluation and management (E&M) visits to FQHCs

Table 2

Characteristics of Federally Qualified Health Center (FQHC) users vs. non-users From areas with $\geq 2\%$ area beneficiaries used FQHCs

	Non-users ²		FQHC Users ¹	
	Total	Total	Predominant	Non-predominant
N	4,892,533	412,271	233,169	179,102
% Population	92.2	7.8	56.6	43.4
Age on 1/1/2011				
Mean	75.3	74.0	73.9	74.1
65–69 (%)	27.7	34.4	35.6	32.8
70–74	24.2	25.2	24.9	25.5
75–79	19.2	17.9	17.1	18.9
80–84	15.1	12.5	12.0	13.0
85	13.9	10.1	10.4	9.7
Sex				
Male	42.0	39.3	38.3	40.7
Race and ethnicity				
White	80.4	67.7	64.4	72.1
Black	9.6	13.6	14.8	12.1
Hispanic	6.2	13.2	14.7	11.3
Other	3.8	5.5	6.2	4.6
Enrolled in Medicaid	15.6	37.2	40.6	32.8
Income ³	\$48,931	\$41,170	\$40,606	\$41,904
High poverty ⁴	29.7	39.8	41.3	37.9
PCSA with FQHC	84.1	88.5	89.0	88.0
Number of chronic conditions				
0	49.2	45.4	49.9	39.6
1	28.1	30.5	31.9	28.7
≥ 2	22.7	24.1	18.2	31.7
Mortality (%)	4.0	3.2	2.8	3.8

¹ Had evaluation and management (E&M) visits to FQHCs;

Predominant users: > 50% E&M visits to FQHCs, non-predominant users: <=50% E&M visits to FQHCs

² No E/M visits to FQHCs and lived in the same PCSAs as users

³ Average median household income at tract-level

⁴ More than 20% tract-level population below poverty level

* All differences between users vs. non-users are statistically significant at $p<0.05$

* All differences between predominant users vs. non-predominant users are statistically significant at $p<0.05$

Table 3

Use of healthcare of Federally Qualified Health Center (FQHC) users vs. non-users From areas with $\geq 2\%$ area beneficiaries used FQHCs

	Non-users ²	FQHC Users ¹		
	Total	Total	Predominant	Non-predominant
N	4,892,533	412,271	233,169	179,102
Physician visits per beneficiary				
Average evaluation and management visits	8.6	8.5	6.6	10.9
Average # physicians seen	3.5	3.5	2.5	4.8
Hospital use				
Average hospital days	1.4	1.5	0.9	2.1
Hospitalizations per 1,000 beneficiaries				
Total	309.5	322.3	221.0	454.2
All medical	221.7	239.2	175.9	321.7
All surgical	87.8	83.1	45.1	132.5
Ambulatory care sensitive conditions	66.0	77.0	60.8	98.2
Acute Composite	26.2	28.8	23.0	36.3
Chronic Composite	39.5	47.9	37.4	61.5

¹ Had evaluation and management (E&M) visits to FQHCs;

Predominant: $> 50\%$ E&M visits to FQHCs, non-predominant: $\leq 50\%$ E&M visits to FQHCs

² No E/M visits to FQHCs and lived in the same Primary Care Service Areas as users

* All differences between users vs. non-users are statistically significant at $p < 0.05$;

Except # physicians seen and hospital days

* All differences between predominant users vs. non-predominant users are statistically significant at $p < 0.05$

Table 4

Adjusted relative use of healthcare among Federally Qualified Health Center (FQHC) users vs. non-users
From areas with $\geq 2\%$ area beneficiaries used FQHCs

Reference	Model 1	Model 2	Model 3	
	FQHC Users	Non-predominant users	Predominant	Non-predominant
	Non-users	Predominant users	Non-users	
Physician visits				
E&M	0.98 (0.98–0.98)	1.49 (1.48–1.49)	0.81 (0.81–0.81)	1.18 (1.18–1.18)
# Physicians	1.03 (1.03–1.03)	1.77 (1.77–1.78)	0.77 (0.77–0.78)	1.33 (1.33–1.34)
Hospital use				
Days	0.94 (0.93–0.94)	1.32 (1.32–1.33)	0.79 (0.79–0.80)	1.04 (1.04–1.05)
Hospitalizations				
Total	0.98 (0.97–0.98)	1.29 (1.27–1.30)	0.84 (0.84–0.85)	1.09 (1.08–1.10)
All medical	1.00 (0.99–1.01)	1.09 (1.07–1.10)	0.95 (0.94–0.96)	1.04 (1.03–1.05)
All surgical	0.94 (0.93–0.95)	2.12 (2.07–2.17)	0.60 (0.59–0.62)	1.25 (1.23–1.26)
ACSCs	1.04 (1.03–1.06)	0.91 (0.89–0.93)	1.09 (1.08–1.11)	1.01 (0.99–1.02)
Acute	1.04 (1.02–1.06)	0.99 (0.96–1.03)	1.03 (1.01–1.06)	1.04 (1.01–1.07)
Chronic	1.05 (1.03–1.07)	0.86 (0.83–0.88)	1.14 (1.12–1.17)	0.99 (0.97–1.01)

E&M: Evaluation and management

ACSCs: Ambulatory care sensitive conditions

All Models accounted for different exposure time in 2011; Adjustment: age, sex, race and ethnicity, dual eligibility, income, in high poverty neighborhood, in FQHC-PCSA, number of chronic conditions