

ORIGINAL RESEARCH

Interpersonal Primary Care Continuity for Chronic Conditions Is Associated with Fewer Hospitalizations and Emergency Department Visits Among Medicaid Enrollees

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Background: Interpersonal primary care continuity or chronic condition continuity (CCC) is associated with improved health outcomes. Ambulatory care-sensitive conditions (ACSC) are best managed in a primary care setting, and chronic ACSC (CACSC) require management over time. However, current measures do not measure continuity for specific conditions or the impact of continuity for chronic conditions on health outcomes. The purpose of this study was to design a novel measure of CCC for CACSC in primary care and determine its association with health care utilization.

Methods: We conducted a cross-sectional analysis of continuously enrolled, nondual eligible adult Medicaid enrollees with a diagnosis of a CACSC using 2009 Medicaid Analytic eXtract files from 26 states. We conducted adjusted and unadjusted logistic regression models of the relationship between patient continuity status and emergency department (ED) visits and hospitalizations. Models were adjusted for age, sex, race/ethnicity, comorbidity, and rurality. We defined CCC for CACSC as at least 2 outpatient visits with any primary care physician for a CACSC in the year, and (2) more than 50% of outpatient CACSC visits with a single PCP.

Results: There were 2,674,587 enrollees with CACSC and 36.3% had CCC for CACSC visits. In fully adjusted models, enrollees with CCC were 28% less likely to have ED visits compared with those without CCC (aOR = 0.71, 95% CI = 0.71 – 0.72) and were 67% less likely to have hospitalization than those without CCC (aOR = 0.33, 95% CI = 0.32-0.33).

Conclusions: CCC for CACSCs was associated with fewer ED visits and hospitalizations in a nationally representative sample of Medicaid enrollees. (J Am Board Fam Med 2023;00:000–000.)

Keywords: Chronic Disease, Continuity of Patient Care, Cross-Sectional Studies, Healthcare Disparities, Logistic Regression, Medicaid, Primary Health Care

Background

Continuity of care is a core element of primary care practice associated with improved health outcomes.¹⁻⁴ Some outcomes associated with continuous

care over time between 1 patient and 1 clinician, or interpersonal continuity, include reduced mortality,⁵⁻⁷ favorable utilization patterns,⁵ lower costs of care,⁸ better adherence to screening and treatment,⁹⁻¹¹ and

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better self-rated health.^{12,13} Although continuity of care is strongly associated with a myriad of favorable clinical, utilization, and cost outcomes, continuity of care is on the decline in the US.¹⁴ One factor in this decline is the migration of the practice of medicine, including the practice of primary care, toward industrialization. Specifically, most care now takes place in an environment dominated by large health care systems or networks with staffing and scheduling models that do not prioritize interpersonal continuity.^{15,16} There may also be a tension between enhanced access (open access scheduling) to team-based care and continuity between each patient and his or her primary care clinician.¹⁷ Interpersonal continuity has not been fully translated into a measure of quality of care prioritized by payors or health care systems. However, progress has been made in recent years with the Bice-Boxerman Continuity of Care Index¹⁸ now a measure in the Merit-based Incentive Payment System.¹⁹ Further, many are placing increased value on nonrelationship based aspects of continuity, like team-based continuity^{20,21} and informational continuity.^{4,22}

Given the known inequities in health outcomes for a broad range of chronic conditions by the social construct of race, geographic location, and socioeconomic status, continuity of care may be even more impactful on achieving equity in chronic disease management and the resulting disparate health outcomes in these groups.

Measuring continuity of care can be difficult given the limitations of clinical electronic health records or claims data. There are several measures of continuity of care that have been studied in the health services research literature. Some of these measures, like the Bice-Boxerman continuity of care index, are expressed as a continuous index,⁸ while others are measured by some threshold criteria to meet the definition of continuous care.²³ Measures of continuity are typically defined at the patient level, but recently some measures have been developed at the provider level that are associated with improved health outcomes and lower costs.⁸ However, none of these measures have been

designed to specifically capture interpersonal continuity in the context of chronic disease management, and the need for such a measure was highlighted by a systematic review of continuity indices.²⁴

Working from the hypothesis that inequities in chronic disease outcomes could be narrowed through improved continuity of care, we set out to create a novel measure of interpersonal continuity of care for chronic ambulatory care sensitive conditions (CACSC), a proxy for chronic disease management visits, and to examine the association between this measure of continuity on emergency department utilization and hospitalizations. This work hypothesizes interpersonal continuity in the context of chronic disease management contributes to the complex medical and social knowledge that drives beneficial outcomes associated with continuity of care. This is supported by evidence showing complex patients benefit from personalized care that is delivered over time in the context of a relationship with a clinician.^{25,26} We used a large, nationally representative Medicaid claims database as the population for this study. We hypothesized that interpersonal continuity of care for chronic disease management would be associated with lower ED utilization and hospitalizations among patients with CACSCs.

Methods

Data Source

We conducted a cross-sectional study to examine effect of interpersonal primary care continuity or chronic condition continuity (CCC) for chronic disease management on emergency department (ED) visit and hospitalization among Medicaid enrollees with CACSCs. ACSC conditions are conditions for which quality ambulatory care could potentially prevent a hospitalization. CACSCs were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes (Appendix 1). Individual-level information was obtained from 2009 Medicaid Analytic eXtract (MAX) files; county-level rural/urban status was acquired from the 2009 to 2010 Area Resource File (ARF).²⁷ Physician taxonomy information was obtained by from the National Plan and Provider Enumeration System (NPPES) from the Centers for Medicare and Medicaid Services (CMS). ARF data and NPI data were merged with MAX data by matching county

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Study Population

The study population was drawn from 2009 Medicaid Analytic eXtract (MAX) files from 26 states (Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Pennsylvania, Tennessee, Texas, Virginia, Washington, and the District of Columbia). These files include all the inpatient, outpatient, long-term care, and prescription claims for all Medicaid enrollees in these states. They also include a personal file with individual demographic and enrollment information as well as a unique identifier that links claims for each individual across files. Medicaid enrollees were included in this study based on the following criteria: (1) 12 months of continuous enrollment in 2009, (2) aged 18 to 64 years old, (3) at least 1 billed claim from inpatient file or at least 2 billed claims from the outpatient file with a diagnosis of CACSC, and (4) not have enrolled in Medicare and Medicaid (dual eligibility). Institutional Review Board approval for this study was obtained from Morehouse School of Medicine.

Measures of Interest

The outcomes in this study were all-cause ED visit and all-cause hospitalization, which were both classified into yes/no variables. ED visits were identified by meeting any of the following codes for professional claims: (1) place of service code=23; (2) revenue codes = 450 to 459; or (3) current procedural terminology (CPT) codes=99281 to 99285. All-cause hospitalizations, both inpatient and observation, were identified from the inpatient file. The main predictor in the models is CCC which was classified into a yes/no variable. Eligible subjects were identified as having CCC if they had at least 2 outpatient visits with any primary care physician (PCP) for a CACSC (as the first or second diagnosis on the claim) in the year, and (2) had more than 50% of outpatient CACSC visits with a single PCP. These criteria were originally developed to designate a continuous relationship between a physician and a patient using claims data that would (1) meet a minimum threshold number of visits per year for adequate chronic disease management in a primary

care setting and 2) designate that a single physician would be identified to take leadership for the care management, care coordination, and relational knowledge that could potentially occur and develop in the context of the continuity relationship. PCPs were defined as providers of any of the following taxonomies: general practice, general internal medicine, preventive medicine, general pediatrics, and family medicine.

Covariates were age, sex, race, Elixhauser comorbidity index, and county-level rurality of residence. We categorized age into 4 groups (18 to 29, 30 to 39, 40 to 49, and 50 to 64), and race into 4 groups (non-Hispanic White, non-Hispanic Black, Hispanic, and other (ie, Asian, American Indian, Alaska Native, Pacific Islander, multiple races, or unknown). Elixhauser comorbidity, which is a validated approach that summarizes disease burden and predicts risks by using administrative claims data,²⁸ was categorized into 4 groups (0, 1 to 2, 3 to 4, and ≥ 5). We categorized county-level rurality of residence into 3 groups: large metropolitan (population > 1 million), small metropolitan (population between 250,000 and 1 million), and rural (population < 250,000) based on the 2012 to 2013 Rural/Urban Continuum Codes from the US Department of Agriculture's Economic Research Services.²⁹

Statistical Analysis

Descriptive statistics were generated to compare the distribution of the main outcome variables and the covariates between patients with CCC for CACSCs and those without using chi-square tests for categorical variables and t-tests for continuous variables. We performed multivariate logistic regression using ED visit and hospitalization as our outcome measures. In both models, CCC for ACS conditions was the main predictor and we adjusted for age, sex, race, Elixhauser comorbidity and rurality of residence. Multilevel modeling was initially considered to account for potential clustering on the state level. Since intraclass correlation coefficients (ICC) calculated for ED visits and hospitalizations were less than 5% which indicated less than 5% of variability in the outcomes can be accounted for by states, multilevel models were not utilized. Adjusted odds ratios (aOR), 95% confidence intervals (CI) of odds ratios and P values were calculated and presented. All P values were 2-sided and a P value < 0.05 was considered statistically significant. SAS Version 9.4 (SAS Institute, Cary, NC, USA) was used to perform all analyses.

Results

We identified 2,674,587 individuals with CACSCs for analysis based on the inclusion criteria. Table 1 describes and compares the characteristics of persons with and without CCC for CACSCs. Overall, 971,733 persons (36.3%) had CCC. Those with CCC for CACSCs had a larger proportion of older individuals, age 50 to 64 years (54.6% vs 46.3%), a lower rate of ED visits (42.1% vs 52.1%), lower hospitalization rates (16.8% vs 34.9%), and were more likely to live in rural areas

(20.5% vs 17.4%) compared with persons without CCC. There was a smaller proportion of Non-Hispanic Black individuals with CACSCs who had CCC compared with the racial composition of those without CCC (27.5% vs 29%). There were relatively fewer males in the CCC group compared with those without CCC. The magnitude of the difference in the distribution of sex, Elixhauser comorbidity index, and mean number of CACSCs were small; however, P values were statistically significant due to the large sample size.

Table 1. Description of Medicaid Beneficiaries with Chronic Ambulatory Care Sensitive Conditions (CACSC) with and without Interpersonal Primary Care Continuity/Chronic Condition Continuity (CCC) in 26 States in 2009 (n = 2,674,587)

Variable	CCC		P value
	Yes (n = 971,733) Mean (sd)/n (%)	No (n = 1,702,854) Mean (sd)/n (%)	
Age (years)			<0.0001
18 to 29	78,892 (8.1)	242,808 (14.2)	
30 to 39	125,378 (12.9)	263,895 (15.5)	
40 to 49	236,775 (24.4)	407,958 (24.0)	
50 to 64	530,688 (54.6)	788,193 (46.3)	
Sex			<0.0001
Female	588,896 (60.6)	1,059,783 (62.2)	
Male	382,837 (39.4)	643,071 (37.8)	
Race			<0.0001
Non-Hispanic White	427,790 (44.0)	759,212 (44.6)	
Non-Hispanic Black	266,947 (27.5)	493,267 (29.0)	
Hispanic	119,292 (12.3)	189,256 (11.1)	
Other	157,704 (16.2)	261,119 (15.3)	
Elixhauser Comorbidity Index (0 to 31)			<0.0001
0	1,646 (0.2)	14,773 (0.9)	
1, 2	604,729 (62.2)	1,035,786 (60.8)	
3, 4	248,486 (25.6)	407,570 (23.9)	
≥5	116,872 (12.0)	244,725 (14.4)	
ED visit			<0.0001
Yes	408,831 (42.1)	887,794 (52.1)	
No	562,902 (57.9)	815,060 (47.9)	
Hospitalization			<0.0001
Yes	163,492 (16.8)	594,741 (34.9)	
No	808,241 (83.2)	1,108,113 (65.1)	
Rurality of residence			<0.0001
Large metro	500,523 (51.5)	936,361 (55.0)	
Small metro	271,649 (28.0)	470,034 (27.6)	
Rural	199,561 (20.5)	296,459 (17.4)	
Number of ACS conditions	1.6 (1.2)	1.6 (1.4)	<0.0001
Counties represented	1,795	1,805	NA

Notes: P values were calculated using chi-square tests for categorical variables and t test for continuous variables. Other races include Asian, American Indian, Alaska Native, Pacific Islander, multiple races, or unknown.

Abbreviations: ACS, Acute Coronary Syndrome; CACSC, chronic ambulatory care sensitive conditions; CCC, chronic condition continuity; ED, emergency department; SD, standard deviation.

Table 2. Association of Chronic Condition Continuity (CCC) Status on Emergency Department (ED) Visit (Yes/No) among Medicaid Beneficiaries with Chronic Ambulatory Care Sensitive Conditions (CACSC) in 2009 in 26 States Using Multivariable Logistic Regression

Variable	aOR (95% CI)	P value
CCC status		
Yes	0.717 (0.714, 0.721)	<0.0001
No	Ref	
Age (years)		
18 to 29	Ref	
30 to 39	0.764 (0.757, 0.772)	<0.0001
40 to 49	0.573 (0.568, 0.578)	<0.0001
50 to 64	0.396 (0.392, 0.399)	<0.0001
Sex		
Female	1.268 (1.262, 1.275)	<0.0001
Male	Ref	
Race		
Non-Hispanic White	Ref	
Non-Hispanic Black	1.159 (1.152, 1.166)	<0.0001
Hispanic	0.794 (0.787, 0.801)	<0.0001
Other	0.795 (0.789, 0.802)	<0.0001
Elixhauser Comorbidity Index (0 to 31)		
0	Ref	
1, 2	0.454 (0.439, 0.469)	<0.0001
3, 4	0.970 (0.939, 1.003)	0.075
≥5	2.591 (2.505, 2.679)	<0.0001
Rurality of residence		
Large metro	0.906 (0.900, 0.913)	<0.0001
Small metro	0.977 (0.970, 0.984)	<0.0001
Rural	Ref	

Notes: Other races include Asian, American Indian, Alaska Native, Pacific Islander, multiple races, or unknown. Abbreviations: aOR, adjusted odds ratio; CACSC, chronic ambulatory care sensitive conditions; CCC, chronic condition continuity; CI, confidence interval.

Medicaid beneficiaries with CCC were 28% less likely to have an ED visit compared with those without CCC (aOR=0.72, 95% CI=0.71 – 0.72) after adjusting for age, sex, race, ECI, and rurality of residence (Table 2). Age was predictive of ED visits, and older age groups were consistently associated with smaller odds of ED visits. After controlling for other factors in the model, women had 27% higher odds of ED visits compared with males (aOR=1.27, 95% CI=1.26–1.28). There were racial and ethnic disparities in ED visits in the sample, non-Hispanic White individuals were the reference group in the model, and non-Hispanic Black individuals were more likely to have ED visits

(aOR=1.16, 95% CI=1.15–1.17) and Hispanic individuals were less likely to have ED visits (aOR=0.79, 95% CI=0.79–0.80) compared with White individuals. An Elixhauser comorbidity index ≥5 was associated with an increase of 159% in the odds of ED visits compared with ECI=0 (aOR=2.59, 95% CI=2.51–2.68); and people living in large metropolitan areas (aOR=0.91, 95% CI=0.90–0.91) or small metropolitan areas (aOR=0.98, 95% CI=0.97–0.98) were less likely to have ED visits than those living in rural areas.

Medicaid beneficiaries with CCC were 67% less likely to have a hospitalization than those without CCC (aOR=0.33, 95% CI=0.33–0.33; Table 3).

Table 3. Association of Chronic Condition Continuity Status (CCC) on Hospitalization (Yes/No) Among Medicaid Beneficiaries with Chronic Ambulatory Care Sensitive Conditions in 2009 in 26 States Using a Multivariable Logistic Regression Model

Variable	aOR (95% CI)	P value
CCC status		
Yes	0.330 (0.327, 0.332)	<0.0001
No	Ref	
Age (years)		
18 to 29	Ref	
30 to 39	0.603 (0.596, 0.609)	<0.0001
40 to 49	0.461 (0.456, 0.466)	<0.0001
50 to 64	0.409 (0.405, 0.413)	<0.0001
Sex		
Female	1.090 (1.083, 1.097)	0.004
Male	Ref	
Race		
Non-Hispanic White	Ref	
Non-Hispanic Black	0.972 (0.965, 0.980)	<0.0001
Hispanic	0.974 (0.964, 0.984)	0.001
Other	0.975 (0.966, 0.984)	<0.0001
Elixhauser Comorbidity Index (0 to 31)		
0	Ref	
1, 2	2.872 (2.716, 3.037)	<0.0001
3, 4	12.987 (12.279, 13.376)	<0.0001
≥5	56.346 (53.257, 59.614)	<0.0001
Rurality of residence		
Large metro	1.227 (1.216, 1.237)	<0.0001
Small metro	0.993 (0.983, 1.002)	0.127
Rural	Ref	

Notes: Other races include Asian, American Indian, Alaska Native, Pacific Islander, multiple races, or unknown. Abbreviations: aOR, adjusted odds ratio; CCC, chronic condition continuity; CI, confidence interval.

Compared with those 18 to 29 years, older age groups were associated with decreasing odds of hospitalization. Females had slightly higher odds of hospitalization than males (aOR=1.09, 95% CI=1.08-1.10); non-Hispanic Black individuals (aOR=0.97, 95% CI=0.97-0.98), Hispanic individuals (aOR=0.97, 95% CI=0.96-0.98) and those of other races (aOR=0.98, 95% CI=0.97-0.98) all had lower odds of hospitalization than non-Hispanic White individuals. Higher ECI groups were related to considerably higher odds of hospitalization compared with ECI=0. Persons living in big metropolitan areas were 23% more likely to have hospitalizations than those living in rural areas (aOR=1.23, 95% CI=1.22-1.24).

Discussion

This cross-sectional analysis of a 26-state dataset of Medicaid claims is the first to define and test a novel measure of interpersonal continuity for chronic condition management in a primary care setting. Although we know that continuity of care has significant positive impacts on chronic disease outcomes, there had not been a previous measure of continuity of care for management of chronic illness. This study fills this gap in the health services literature and provides a practical measure that can translate to a clinical quality setting and/or a measure that could be applied in a value-based payment model. We found that Medicaid beneficiaries with CACSCs who have CCC are 28% less likely to have an ED visit and 67% less likely to be hospitalized than those without CCC, even after adjusting for medical complexity, demographic characteristics, and rural/urban status. We interpret the more favorable utilization patterns we observed for patients with CCC as a marker of higher quality and more effective chronic disease management in the primary care setting. We hypothesize that the continuity relationship that develops over time during chronic disease management contributes to a clinician's complex medical and social knowledge of the patient, improved patient engagement, increased trust and feelings of safety, and effective goal setting and prioritization for the patient-provider dyad, which could lead to improved health care utilization outcomes. It is also possible that patients with continuity are also more adept at self-management and health care navigation, and thus able to avoid adverse utilization such as emergency

department visits and hospitalizations. Further qualitative work with patients with chronic conditions who have had and have not had CCC may be helpful to discern whether patient characteristics are driving these outcomes.

Aligning systems of care and payment structures to incentivize CCC for chronic disease management could improve health outcomes and advance health equity for patients with chronic diseases. Unfortunately, overall rates of CCC, which we defined as meeting a minimal threshold of at least 2 outpatient primary care visits with a single PCP for chronic disease management and a plurality of chronic disease management with a single PCP, were low. Only 36% of Medicaid enrollees with CACSCs met these basic criteria, and there was variation of CCC rates across racial and ethnic subgroups, by medical complexity, and among rural versus urban dwelling beneficiaries. The rate of CCC observed in our study is higher than the prevalence of the general interpersonal continuity of care measure for Medicare beneficiaries (17.3%) developed by Wolinsky et al.³⁰ This is observed in a context of an overall decline of continuity in the US across all payors.¹⁴ It is important to note that other health systems, like the National Health Service in the United Kingdom, that prioritize continuity of care have higher rates of continuity.³¹

One reason for the low rate of CCC that we observed may be lack of measurement and incentivization of interpersonal continuity for chronic disease management by payors. In addition, there may be patient-, provider-, and system-level factors that influence the low rates of continuity for chronic disease management and the variation we observed across racial and geographic subgroups. For example, there may be differing cultural and individual preferences around continuity of care that influence a patient's engagement level of or prioritization of a continuity relationship with an individual provider.³² For racial and ethnic minority patients, and patients in rural or socioeconomically disadvantaged neighborhoods, there may be factors on both the individual and neighborhood level that impede access to continuous care with a chosen provider. Individual-level barriers to interpersonal continuity might include access to transportation, work time constraints, caregiving demands, poor social support, or financial limitations. At the community level, Medicaid beneficiaries are more likely to live in more rural or socially disadvantaged places where

they may face transportation disadvantage and limited access to primary care.^{33,34} Similarly, PCPs may hold a variety of preferences around prioritization of continuity for patients for chronic illness management versus acute care needs. For Medicaid beneficiaries, there are additional system level barriers directly related to narrow networks of care providers who accept Medicaid and availability of primary care physicians who are accepting new patients.³⁵

Our novel CCC measure could be utilized as a clinical quality measure for chronic disease management because it has distinct criteria that are measurable by practices or payors and is associated with better health outcomes. Although this measure is calculated at the patient level, it could be applied to a physician's panel of patients with chronic conditions as a proportion. This is how many other quality indicators are expressed (eg, percentage of patients with hypertension at goal, percentage of patients with diabetes with a hemoglobin A1C at goal). In addition, it represents a more holistic measure of quality-of-care delivery as opposed to disease specific, reductionistic measures that may not be associated with improved broad health outcomes.³⁶

We noted significant variation in CCC by race/ethnicity and geography. These disparities in continuity of care for chronic condition management present opportunities to explore the underlying reasons for variation in CCC among Medicaid enrollees, especially because these individuals are all socioeconomically disadvantaged and have comparable health care coverage with access to similar networks of care providers. Future work is needed to understand the cultural and/or regional preferences and values of both patients and primary care physicians around continuity of care. Understanding such values could potentially inform the design of patient, provider, practice, or health system level interventions to support CCC for chronic disease management. Such interventions may have an impact on reducing persistent racial and geographic inequities in chronic disease outcomes.

Further work is also needed to examine how this measure translates to a practice setting and test the measure's explanatory power for utilization patterns and other chronic disease health outcomes. In addition, an understanding of the variation in CCC at the provider, practice, and population levels is

needed. An investigation of the association of this CCC measure on health care costs would incentivize payors to link payment to such measures more broadly. Last, replicating these findings among other groups of beneficiaries, including Medicare and private payors, is an essential next step.

This study has several limitations that should be noted when interpreting the results. Although our sample is large and represents approximately 80% of all Medicaid beneficiaries in the US in 2009, it may not be representative of Medicaid enrollees in all states. Although the data used to support this study was from 2009, we do not believe our results would differ were we to use more recent data and we believe the mechanisms and impacts of CCC existing in 2009 are applicable to current primary care health services delivery models. The original analysis plan for this study proposed using CCC status from 2008 and outcome measurement in 2009 to reduce the chance of reverse causality. However, due to lack of availability of NPI in the 2008 MAX files, this study was conducted cross-sectionally and therefore future studies are needed to examine the impact of CCC in an earlier time period on subsequent utilization outcomes. It is also important to point out that only continuity of care with physicians was included in this measure as advanced practice providers are not identified by specialty taxonomy in the NPPES. Further work is also needed to understand the impact of this measure on utilization both pre- and post-COVID-19 pandemic as data becomes available, as well as to understand how the rates of CCC have changed over time, especially in the context of the Affordable Care Act in 2009 and subsequent Medicaid Expansion in 2014. The county was our chosen geographic unit of analysis given that this is a national study, but we recognize heterogeneity in socio-ecologic characteristics and access to care within counties; further analysis at the state or metropolitan level conducted at a more granular level of geography using geographically weighted regression could build on the work presented here. Last, this study examined the impact of CCC among a subset of CACSCs and further work is needed to understand this measure among patients with multiple chronic conditions and other chronic diseases that are not identified as CACSCs.

In summary, this article presents a novel measure of interpersonal primary care continuity for chronic

condition management using a nationally representative sample Medicaid beneficiaries. Our main results showed that Medicaid beneficiaries with chronic ambulatory care sensitive conditions who had continuity with a single PCP for chronic condition management had significantly lower odds of having an emergency department visit (28%, $P < .0001$) or hospitalization (67%, $P < .0001$), even after adjusting for medical complexity, demographic characteristics, and rural status. This work contributes to a gap in the literature, as there are currently no practical measures of continuity of care in the context of chronic condition management that can easily translate across health services research literature to implementation in a clinical quality or quality payment incentive setting. This measure responds to the identified need for holistic measures of care quality and value in primary care settings that can drive improved health outcomes. The variation in continuity of care for chronic condition management across racial-ethnic groups and geography we observed in this study presents a potential pathway toward health equity for persistently disparate chronic condition outcomes. Achieving high quality chronic disease management across these groups could potentially be supported by implementing care models that improve and equalize rates of CCC across places and populations.

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Appendix.

Appendix 1. ICD-9-CM Codes for Chronic Ambulatory Care Sensitive Conditions

Condition	ICD-9-CM codes
Convulsions	345, 780.3
Chronic Obstructive Pulmonary Disease	491, 492, 494, 496
Asthma	493
Congestive Heart Failure	428, 402.01, 402.11, 402.91, 518.4
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90
Angina	411.1, 411.8, 413
Diabetes	250.1, 250.2, 250.3, 250.8, 250.9, 250.0
Hypoglycemia	251.2

Abbreviation: ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification.