

Declining Use of Primary Care Among Commercially Insured Adults in the United States, 2008–2016

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Background: Primary care is known to improve outcomes and lower health care costs, prompting recent U.S. policy efforts to expand its role. Nonetheless, there is early evidence of a decline in per capita primary care visit rates, and little is understood about what is contributing to the decline.

Objective: To describe primary care provider (PCP) visit trends among adults enrolled with a large, national, commercial insurer and assess factors underlying a potential decline in PCP visits.

Design: Descriptive repeated cross-sectional study using 100% deidentified claims data from the insurer, 2008–2016. A 5% claims sample was used for Poisson regression models to quantify visit trends.

Setting: National, population-based.

Participants: Adult health plan members aged 18 to 64 years.

Measurements: PCP visit rates per 100 member-years.

Results: In total, 142 million primary care visits among 94 million member-years were examined. Visits to PCPs declined by 24.2%, from 169.5 to 134.3 visits per 100 member-years, while the proportion of adults with no PCP visits in a given year rose from

38.1% to 46.4%. Rates of visits addressing low-acuity conditions decreased by 47.7% (95% CI, –48.1% to –47.3%). The decline was largest among the youngest adults (–27.6% [CI, –28.2% to –27.1%]), those without chronic conditions (–26.4% [CI, –26.7% to –26.1%]), and those living in the lowest-income areas (–31.4% [CI, –31.8% to –30.9%]). Out-of-pocket cost per problem-based visit rose by \$9.4 (31.5%). Visit rates to specialists remained stable (–0.08% [CI, –0.56% to 0.40%]), and visits to alternative venues, such as urgent care clinics, increased by 46.9% (CI, 45.8% to 48.1%).

Limitation: Data were limited to a single commercial insurer and did not capture nonbilled clinician-patient interactions.

Conclusion: Commercially insured adults have been visiting PCPs less often, and nearly one half had no PCP visits in a given year by 2016. Our results suggest that this decline may be explained by decreased real or perceived visit needs, financial deterrents, and use of alternative sources of care.

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Primary care is widely recognized as key to improving outcomes and reducing cost growth in health care (1–3). In the past decade, the United States has invested in payment and delivery reforms, such as accountable care organizations and patient-centered medical homes, to expand the role of primary care (4–7). Yet, there is early evidence of a decline in primary care provider (PCP) office visits (8–10)—the most common way individuals access primary care—and we know little about how U.S. adults are using these visits or what is contributing to the decline.

A decline in primary care visit utilization might be explained by a variety of factors. For instance, adults may face increasing financial and geographic barriers to access primary care owing to growing out-of-pocket costs or capacity constraints (11, 12). Adults seeking convenience might increasingly choose alternatives to the traditional primary care visit as non-face-to-face care with PCPs, online medical information, and such venues as urgent care clinics become more readily available (13–19). Understanding how commercially insured adults are using primary care and alternative sources of care may clarify such mechanisms and help to guide policy and care delivery reforms to sustain the benefits of primary care (10).

To this end, we examined ambulatory visit trends between 2008 and 2016 in a large, national cohort of commercially insured adults. Specifically, we assessed PCP visit trends accounting for sociodemographic shifts, then examined visit utilization patterns, how visit rate trends varied by visit type and by member and area-level characteristics, trends in out-of-pocket costs, and the use of specialist visits and alternative care venues.

METHODS

Study Sample

In this repeated cross-sectional study, we examined 100% claims data from adults enrolled with a large, national, commercial health insurer between 1 January 2008 and 31 December 2016. This insurer includes enrollees in all 50 states and the District of Columbia with about 20 million members each year. It offers a range of benefit designs, including preferred provider organization, point-of-service, health maintenance organization, and high-deductible health plans. These data have been used previously in studies on ambulatory care (20–23). We included members in each year who were 18 to 64 years of age and were enrolled for at least 1 month in that year. We defined member-years as the number of months these members were enrolled divided by 12. We excluded 43 members who had had 100 or more primary care visits in a given year because of concerns about accuracy of the data.

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Clinician Characteristics

We defined PCPs (physician, nurse practitioner [NP], or physician assistant [PA]) on the basis of National Provider Identifier (NPI) with specialty in general practice, medicine, family practice, geriatric medicine, internal medicine, adolescent medicine, or pediatrics. We defined specialists as clinicians with any other specialty involving direct patient care in the outpatient setting (for example, cardiology). In a sensitivity analysis to address the possibility that some women see gynecologists for their primary care, we reclassified gynecologists as PCPs.

Visit Types and Characteristics

We identified visits using Current Procedural Terminology (CPT)/Healthcare Common Procedure Coding System evaluation and management codes 99201 to 99205 and 99211 to 99215 (problem-based visit), 99381 to 99387 and 99391 to 99397 (preventive visit), 99281 to 99285 (emergency department encounter), and 99441 to 99449 (telephone or online consultation). Building on prior work (15, 23, 24), we used Centers for Medicare & Medicaid Services place-of-service codes, NPIs, tax identification numbers, and CPT codes to further categorize visits across the following venues: office or outpatient visit, emergency department, urgent care, retail clinic, and telemedicine.

We estimated the mean out-of-pocket cost per visit (winsorized at top and bottom 1%) by summing the deductible, copayment, and coinsurance for each visit after adjusting for inflation (urban Consumer Price Index based on 2016 dollar amounts) (25). We determined whether a given visit was subject to a deductible. For each visit, we captured the primary diagnosis using the International Classification of Diseases, Ninth and 10th Revisions (10th Revision cross-walked to the Ninth Revision) (26), then identified visits with primary diagnosis of a low-acuity condition (**Appendix Table 1**, available at Annals.org).

Member Sociodemographic, Area-Level, and Clinical Characteristics

We captured member age (18 to 34 years, 35 to 44 years, 45 to 54 years, or 55 to 64 years), sex, area-level median household income (0% to 200%, 201% to 300%, 301% to 400%, or >400% above the federal poverty level for a family of 4 in 2015, based on cross-walk with member ZIP code), geographic setting (metropolitan vs. nonmetropolitan, using metropolitan statistical areas [27]), and U.S. census region (Northeast, Midwest, South, West). We measured presence of chronic conditions using the Charlson Comorbidity Index at the member-year level, categorizing member-years with no claims as having no chronic conditions. In a sensitivity analysis, we excluded the 19% to 24% of members with no medical claims in a given year from our chronic condition estimates. In a subanalysis limited to 3-digit ZIP codes with at least 500 members residing there in every year of the study period (8028 of 8243 ZIP codes [97%]), we stratified 3-digit ZIP codes using their base-

line per capita PCP visit rates in 2008 and divided them into quartiles to compare trends in areas with high versus low baseline visit rates.

Statistical Analysis

Using 100% claims data, we compared characteristics of members enrolled in 2008 and 2016; we also compared the distribution of member age, sex, geographic setting, and U.S. census region in our sample to that of all privately insured U.S. adults aged 18 to 64 years in the U.S. Census Bureau's Current Population Survey. We calculated the primary care visit rate per 100 member-years for each calendar year across all adults and stratified by visit type, clinician type, and member characteristics. We summarized changes over time using the rate in 2008, the rate in 2016, and the absolute difference between these 2 rates. Among members continuously enrolled for 12 months, we also determined the percentage who had 0 versus 1 or more visits in each year with a PCP or with a specialist.

To further quantify trends over the 9-year period, we restricted the database to a 5% sample to maintain computational feasibility. We randomly selected 5% of health plan enrollees in each year to create the sample and used this sample for each of the following models (the **Appendix**, available at Annals.org, provides more detail). For the overall PCP visit rate, we created a Poisson regression model at the member-year level with the number of PCP visits as the outcome and an offset in the model to account for member-time in the plan in a given year. The model was adjusted for potential overdispersion by scaling according to the Pearson residuals. We treated time as a continuous predictor and presented results as the percentage change in visits across 9 years. To ensure that this trend was not confounded by changes in member characteristics over time, we then adjusted the Poisson model for patient age, sex, area-level income, geographic setting, and region.

We used Poisson regression (as above, but not adjusted for patient and area characteristics) to quantify time trends for each primary care visit type and characteristic (problem-based, preventive, primary diagnosis of low-acuity condition, and administered by PA or NP). To assess whether PCP visit trends varied significantly among member subgroups, we used Poisson models that included an interaction term between year and a given categorical variable. Finally, we used Poisson regression to assess trends in visits to specialists and alternative venues.

We performed all analyses using SAS software, version 9.4 (SAS Institute, Inc). Reported *P* values were 2-sided and considered significant at less than 0.05 (28).

Role of the Funding Source

The study was not funded, and it was exempted from review by the Harvard University institutional review board.

RESULTS

During the 9-year study period, there were 142 million primary care visits among 94 million member-years. Per study year, our data included approximately 13 million adults and 250 000 primary care clinicians. Member characteristics were similar between 2008 and 2016 (Table 1). Compared with all privately insured 18- to 64-year-old U.S. adults as estimated in the U.S. Census Bureau's Current Population Survey, adults in our sample were more likely to live in the Northeast or South than the Midwest, but were otherwise similar (Appendix Table 2, available at [Annals.org](#)). Primary care visit rates declined from 169.5 visits per 100 member-years in 2008 to 134.3 in 2016, corresponding to a regression-estimated decline of 24.2% (95% CI, –24.5% to –24.0%) across the 9 years (Table 2). When we adjusted for changes over time in population age, sex, area-level income, setting, and region, the overall decline was unchanged (–24.2% [CI, –24.5% to –23.9%]) (Appendix Table 3, available at [Annals.org](#)). In a sensitivity analysis reclassifying gynecologists as PCPs, the decline

was similar (unadjusted, –24.5% [CI, –24.8% to –24.2%]; adjusted, –24.4% [CI, –24.6% to –24.1%]).

Member-Level Visit Utilization Patterns

Between 2008 and 2016, we found an increase in the proportion of adults with no medical visits (from 26.1% to 32.5%) and no PCP visits (from 38.1% to 46.4%) (Figure 1). All age groups experienced a similar increase in these proportions over the study period. Among persons aged 18 to 34 years, 48.2% had no PCP visits in 2008 compared with 56.7% in 2016; among those aged 55 to 64 years, 26.6% had no PCP visits in 2008 compared with 33.9% in 2016 (Appendix Figures 1 to 3, available at [Annals.org](#)).

Visit Characteristics

Problem-based visits declined by 30.5% (CI, –30.8% to –30.2%), from 154.5 to 112.8 visits per 100 member-years (–41.7 visits), whereas preventive visits increased by 40.6% (CI, 39.8% to 41.4%), from 15.1 to 21.5 visits per 100 member-years (6.4) (Figure 2). Visits addressing low-acuity conditions decreased from 33.4 to 18.1 visits per 100 member-years (–15.3 visits; change, –47.7% [CI, –48.1% to –47.3%]). Physician assistants and NPs provided a small but growing number of primary care visits, from 1.6 visits per 100 member-years in 2008 to 11.0 visits per 100 member-years in 2016 (9.4 visits; change, 567.5% [CI, 553.8 to 581.6]).

Mean out-of-pocket costs increased from \$29.7 to \$39.1 (31.5%) for problem-based visits and declined from \$20.1 to \$4.9 (–75.5%) for preventive visits (Figure 2). Over this period, a greater share of all PCP visits was subject to a deductible (from 9.2% of visits in 2008 to 25.2% in 2016).

Member Sociodemographic, Area-Level, and Clinical Characteristics

The decline in visits was present ($P < 0.001$) across all member characteristics (Table 2). The decline was larger among adults aged 18 to 34 years (–28.0 visits; change, –27.6% [CI, –28.2% to –27.1%]) and those with no chronic conditions (–32.9 visits; change, –26.4% [CI, –26.7% to –26.1%]). When we excluded the 19% to 24% of members with no medical claims in a given year from our chronic condition estimates, our conclusions were unchanged (Appendix Table 4, available at [Annals.org](#)). Similarly, the decline was larger for adults in the lowest-income areas (–46.7 visits; change, –31.4% [CI, –31.8% to –30.9%]), those in metropolitan areas (–39.6 visits; change, –26.8% [CI, –27.1% to –26.4%]) and those in the South (–47.5 visits; change, –29.4% [CI, –29.8% to –29.1%]). We observed declines in geographic areas with both high and low baseline rates of primary care visits (top quartile: –38.6 visits; change, –23.3% [CI, –23.9% to –22.6%]; bottom quartile: –28.4 visits; change, –26.0% [CI, –26.6% to –25.4%]).

Specialists and Alternative Venues

Visit rates to specialists did not change significantly over this time—an increase of 3.7 visits (change, –0.08%

Table 1. Member Characteristics, 2008 and 2016*

Characteristic	Members, n (%)	
	2008	2016
Age		
18–34 y	3 429 563 (34)	3 691 347 (35)
35–44 y	2 434 899 (24)	2 215 747 (21)
45–54 y	2 515 670 (25)	2 384 858 (23)
55–64 y	1 835 161 (18)	2 176 682 (21)
Sex		
Female	5 317 195 (52)	5 444 451 (52)
Male	4 898 098 (48)	5 024 183 (48)
Number of chronic conditions†		
≥1	1 165 635 (11)	1 108 976 (11)
0	9 049 657 (89)	9 359 658 (89)
Area-level income‡		
0%–200% FPL	2 671 458 (26)	2 861 656 (27)
201%–300% FPL	3 693 484 (36)	3 665 661 (35)
301%–400% FPL	2 266 518 (22)	2 332 190 (22)
>400% FPL	1 549 107 (15)	1 588 188 (15)
Geographic setting§		
Metropolitan	7 833 574 (77)	7 936 336 (76)
Nonmetropolitan	2 362 010 (23)	2 523 570 (24)
Region		
Northeast	2 567 200 (25)	2 555 736 (24)
Midwest	1 507 637 (15)	1 315 421 (13)
South	4 286 962 (42)	4 647 174 (44)
West	1 853 493 (18)	1 950 302 (19)

FPL = federal poverty level.

* Analyses performed using a 100% sample. Based on 10 215 292 member-years for 2008 and 10 468 634 member-years for 2016.

† Chronic condition count determined using the Charlson Comorbidity Index for a given year.

‡ Area-level income determined in relation to FPL for a family of 4 in 2015 in member's ZIP code. Data were missing for 34 726 members (0.3%) in 2008 and 20 940 members (0.2%) in 2016 in the 100% sample.

§ Geographic setting determined using metropolitan statistical area corresponding to member's ZIP code. Data were missing for 19 709 members (0.2%) in 2008 and 8728 members (0.1%) in 2016 in the 100% sample.

Table 2. Primary Care Visit Rates per 100 Member-Years, by Demographic and Area-Level Characteristics, 2008–2016*

Characteristic	Primary Care Visits per 100 Member-Years, n		Decline From 2008 to 2016 (95% CI), %†	P Value for Interaction‡
	2008	2016		
Overall	169.5	134.3	–24.2 (–24.5 to –24.0)	–
Age				
18–34 y	121.8	93.8	–27.6 (–28.2 to –27.1)	<0.001
35–44 y	160.3	124.3	–24.9 (–25.5 to –24.3)	<0.001
45–54 y	192.3	154.1	–22.3 (–22.8 to –21.7)	0.53
55–64 y	239.7	191.5	–22.5 (–23.0 to –21.9)	Reference
Sex				
Female	191.6	151.2	–24.3 (–24.7 to –24.0)	0.24
Male	145.6	116.0	–24.0 (–24.4 to –23.5)	Reference
Number of chronic conditions§				
≥1	351.8	312.1	–11.9 (–12.6 to –11.3)	Reference
0	146.1	113.2	–26.4 (–26.7 to –26.1)	<0.001
Area-level income 				
0%–200% FPL	174.4	127.7	–31.4 (–31.8 to –30.9)	<0.001
201%–300% FPL	173.9	140.4	–23.5 (–24.0 to –23.0)	<0.001
301%–400% FPL	166.1	134.6	–22.3 (–22.9 to –21.7)	<0.001
>400% FPL	156.8	132.2	–15.2 (–16.0 to –14.4)	Reference
Geographic setting¶				
Metropolitan	172.8	133.2	–26.8 (–27.1 to –26.4)	Reference
Nonmetropolitan	159.2	138.1	–15.1 (–15.7 to –14.4)	<0.001
Region				
Northeast	168.4	140.3	–20.8 (–21.4 to –20.2)	0.051
Midwest	171.7	152.3	–18.4 (–19.2 to –17.5)	0.010
South	179.5	132.0	–29.4 (–29.8 to –29.1)	<0.001
West	146.3	119.9	–19.8 (–20.6 to –19.1)	Reference
Area-level baseline PCP visit rate**				
Lowest quartile	125.9	97.5	–26.0 (–26.6 to –25.4)	<0.001
Second quartile	164.4	139.1	–20.3 (–20.8 to –19.7)	<0.001
Third quartile	182.9	143.6	–23.9 (–24.4 to –23.4)	0.124
Highest quartile	206.0	167.4	–23.3 (–23.9 to –22.6)	Reference

FPL = federal poverty level; PCP = primary care provider.

* 2008 and 2016 visit rates based on a 100% sample. Poisson analyses were performed using a 5% sample.

† Based on unadjusted member-year-level Poisson regression models accounting for member-time per year, presented as the percentage of change in visits across 9 y.

‡ Significance of the interaction term between a given variable and year.

§ Chronic condition count determined using the Charlson Comorbidity Index for a given year.

|| Area-level income determined in relation to FPL for a family of 4 in 2015 in the member's ZIP code. Data were missing for 16 984 member-years (0.3%) across the study period in the 5% sample.

¶ Geographic setting was determined using the metropolitan statistical area corresponding to member's ZIP code. Data were missing for 8707 member-years (0.1%) across the study period in the 5% sample.

** Based on subanalysis of the 97% of ZIP codes with at least 500 members residing there in every year of the study period; quartiles were determined based on 2008 ZIP code-level per capita PCP visit rates (lowest quartile, 10.8 to 127.3; second quartile, 127.4 to 145.0; third quartile, 145.1 to 160.7; highest quartile, 160.7 to 258.7).

[CI, –0.56% to 0.40%]). In contrast, visit rates to alternative settings increased by 9.1 visits (change, 46.9% [CI, 45.8% to 48.1%]) (Figure 3).

DISCUSSION

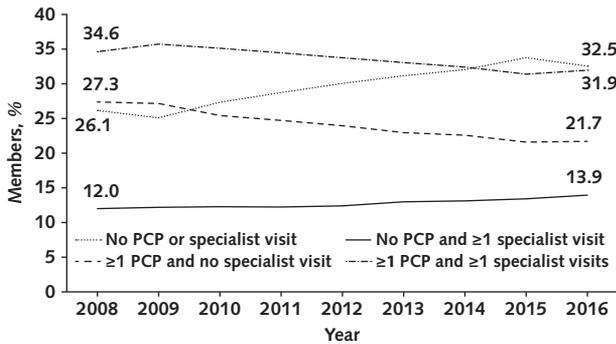
From 2008 to 2016, we found a 24.2% decline in PCP visit rates that was unexplained by sociodemographic shifts in plan membership. By 2016, nearly one half of commercially insured adults had no PCP visits in a given year. Our findings shed light on 3 potential factors underlying these trends.

First, patients and clinicians may be less likely to turn to in-person primary care visits in certain cases.

Declines were larger for younger, healthier adults, who may have fewer routine care needs and be increasingly comfortable with online self-care or a secure message with their clinician when acute needs arise (29, 30). In kind, visit rates decreased sharply for low-acuity conditions, such as conjunctivitis, that might be addressed more easily by calling a nurse or searching the Internet.

Second, adults may face greater financial barriers to seeking primary care, as deductibles increase and a larger proportion of adults are enrolled in plans including a deductible (12). In our data, we found that a growing proportion of primary care visits were subject to a deductible while out-of-pocket costs per visit in-

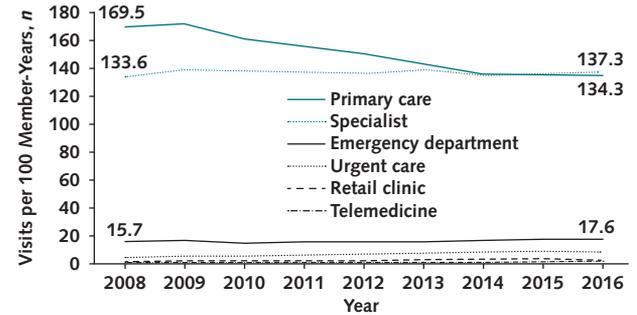
Figure 1. Trends in visit utilization patterns among commercially insured adults, 2008–2016.



The proportion of adults with continuous 12-mo plan enrollment in each year with 1) no PCP or specialist visits, 2) no PCP visit and 1 or more specialist visits, 3) 1 or more PCP visits and no specialist visit, and 4) 1 or more PCP visit and 1 or more specialist visit. Members contributing data varied from year to year. Analyses were performed using a 100% sample. PCP = primary care provider.

creased. The decline in PCP visits was largest in low-income communities, consistent with prior work showing that lower-income adults are particularly sensitive to increases in out-of-pocket costs (31). Using previous price elasticity estimates of -0.1 to -0.2 for ambulatory visits (32), we estimate that the 32% increase in out-of-pocket costs for problem-based visits we observed may explain approximately 3 to 6 percentage points of the 24-percentage point decline (that is, 12.5% to 25% of the decline). The increase in preventive visit rates may provide further evidence of financial barriers not captured in this estimate: PCPs may have billed more visits as preventive—perhaps at their patients' request—because this visit type became less

Figure 3. Trends in visit rates to primary care providers, specialists, and alternative venues, 2008–2016.

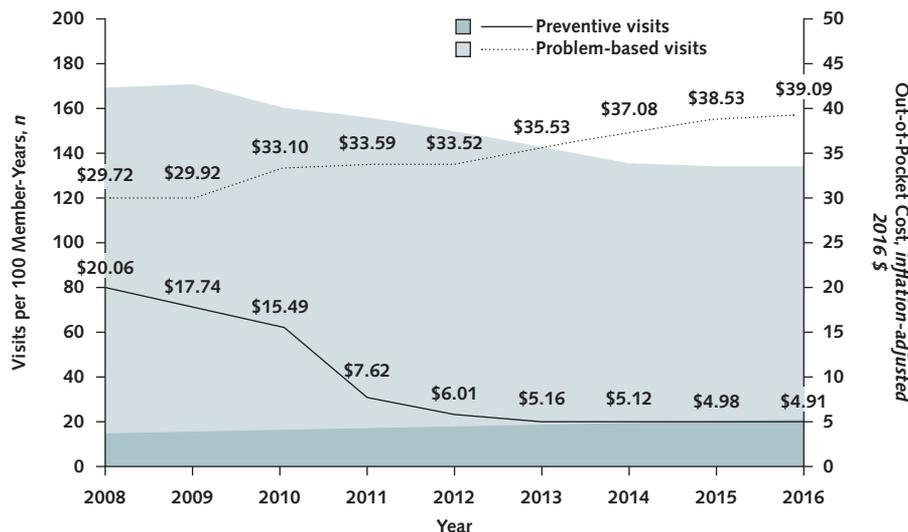


Urgent care visit rates rose from 4.4 visits per 100 member-years in 2008 to 8.0 in 2016. Retail clinic visit rates rose from 0.83 visits per 100 member-years in 2008 to 3.0 in 2016. Telemedicine visit rates rose from 0.003 visits per 100 member-years in 2008 to 1.6 in 2016. Analyses were performed using a 100% sample.

costly or free through the Patient Protection and Affordable Care Act (33). Our finding that only problem-based visits declined may also reflect nonfinancial access barriers, including limited primary care capacity and supply (3, 34–36): Clinicians and patients often schedule preventive visits many months in advance, whereas problem-based visits tend to have shorter lead times and may therefore be more sensitive to capacity constraints. Prior work suggests that although more NPs and PAs work in primary care, the number of primary care physicians per capita has remained flat while physicians increasingly work part-time (36–39).

Third, adults could be replacing PCP visits with visits to specialists or to alternative venues (8, 20, 40). Specialist visit rates remained steady, slightly surpassing

Figure 2. Trends in primary care visit types and out-of-pocket costs among commercially insured adults, 2008–2016.



Shaded areas represent visits per 100 member-years; lines represent mean visit out-of-pocket costs. Analyses were performed using a 100% sample.

primary care rates by 2016 (in parallel, by an outside estimate, the number of specialist jobs grew 3 to 6 times faster than those in primary care) (39). Although a decreasing proportion of adults saw any specialist in a given year, these individuals may have seen a larger number of specialists over time or have seen them with increasing frequency (10, 41, 42). Meanwhile, visits to alternative venues, such as urgent care clinics, retail clinics, emergency departments, and telemedicine, increased by 9 visits per 100 member-years, offsetting about one quarter of the PCP visit decline (35 visits per 100 member-years) (15, 20). The convenience of these alternatives may be particularly attractive compared with the often inefficient or inflexible scheduling practices in traditional primary care settings (43).

To the extent that the PCP visit rate decline reflects unmet need (for example, owing to increasing access barriers), more adults having no PCP at all, or a decline in primary care continuity (44, 45), this trend is concerning. Policymakers might focus on facilitating access to primary care, for example through lower cost-sharing for PCP visits and expanding primary care capacity (35, 46). There may also be a need to better educate Americans on the value of primary care. A substantial and increasing proportion of adults did not see a PCP at all in a given year, and some have argued that Americans increasingly undervalue longitudinal primary care relationships (29). Although conventional wisdom suggests that millennials are driving this shift, we observed similar increases across all age strata in the proportion of adults who did not see a PCP, suggesting the need for broader outreach. In addition, the growing use of alternative venues highlights the need for informational continuity and partnerships between these venues and primary care offices (10, 47).

More favorably, this trend may reflect a decrease in unneeded visits (for example, less frequent “routine” check-ups for otherwise healthy adults or follow-up visits to report test results) and a shift within primary care practices to promoting preventive care (to the extent that preventive visits accomplish this) (48). The decrease in primary care visits may also be driven by growing use of non-face-to-face interactions (such as secure messaging or virtual visits) or encounters with non-PCP team members (for example, nurse-led counseling) (49–53). Given the rise in both patient and health care complexity and in primary care visit length, PCPs may also be getting more done per visit (54, 55). This could be further promoted through patient education tools (56) and greater adoption of primary care payment and delivery models that encourage this approach, while guarding against clinician burnout due to increasing demands. To better understand the implications of these trends, future work might quantify how the decline in primary care visit rates has affected quality of care, clinical outcomes, and health care spending (7, 57, 58).

Our study has limitations. We used a national sample of commercially insured adults aged 18 to 64 years, so our conclusions may not extend to other populations, including those with Medicaid or Medicare (al-

though these groups have also experienced a visit decline) (8, 10). Our analyses of visit primary diagnosis and member chronic conditions relied on diagnosis codes, which are limited by the accuracy of physician billing (59). We did not have detailed data on health plan design and types of employers. Although we were able to identify NPs and PAs specifically practicing primary care, an advance from prior work, we may still underestimate visit rates by these clinicians when they bill under a physician. We were unable to capture non-billed interactions between patients and their primary care offices, such as telephone calls and secure messages, despite their growing use (60). Finally, we describe a series of factors that might drive the change in primary care visit rates, but the data do not allow us to quantify the relative contribution of these different factors in the decline in primary care visits.

In conclusion, despite robust evidence that high-functioning primary care is associated with mortality benefits at a population level (1–3), our results show a substantial decline in primary care visit rates that seems to be associated with decreased (real or perceived) need for some primary care visits, rising financial barriers, and increased use of alternative venues of care.

From Harvard Medical School, Boston, Massachusetts (I.G., Z.S., E.J.O., A.M.); Icahn School of Medicine at Mount Sinai, New York City, New York (A.R.); and University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania (K.N.R.).

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APPENDIX: MODEL SPECIFICATIONS AND REPEATED MEMBER ANALYSIS

Model Specifications

All Poisson models were performed using the SAS genmod procedure.

(1) Overall PCP visit rate

PCP visits = $\text{visityear}(\text{continuous}) + \text{member months enrolled offset}$

(2) Overall PCP visit rate, adjusted

PCP visits = $\text{visityear}(\text{continuous}) + \text{age}(\text{categorical}) + \text{gender} + \text{income}(\text{categorical}) + \text{MSA} + \text{region, member months enrolled offset}$

(3) Member subgroup analysis by characteristic (age, gender, income, MSA, region)

PCP visits = $\text{visityear}(\text{continuous}) + \text{characteristic} + \text{characteristic} * \text{visityear} + \text{member months enrolled offset}$

(4) Visit subtypes; visits with specialists, NPs, PAs; visits to alternative settings

Relevant visits = $\text{visityear}(\text{continuous}), \text{member months enrolled offset}$

Repeated Member Analysis

The number of members who contributed data in multiple years in our models was small (7.3% of member-years in the sample were from members contributing more than 1 year of data). To account for multiple observations across years, we attempted use of a simple robust variance estimator model, but the computational complexity with the Poisson model was such that the analysis could not be completed, even with the 5% random sample. Given that this was unsuccessful, we then conducted a sensitivity analysis to understand the degree to which multiple years of observations were contributing. We identified those members who contributed to multiple years of data within the 5% data set. For each of these members, we selected 1 year at random such that a member could only be in the data for a single calendar year. In this sensitivity analysis, we found a nearly identical decline in visit rates over time (24.5% [CI, 24.8% to 24.2%] adjusted decline in total visits versus 24.2% [CI, 24.5% to 23.9%]) adjusted decline in our main analysis).

Appendix Table 1. Low-Acuity Visit Diagnoses*

Diagnosis	ICD-9 Code	ICD-10 Code
Upper respiratory infection (including acute nasopharyngitis, laryngitis, tracheitis)	460.xx, 464.xx, 465.xx	J00.xx, J04.xx, J06.xx
Sinusitis	461.xx, 473.xx	J01.xx
Bronchitis	490.xx, 466.xx	J20
Pharyngitis	462.xx, 463.xx, 034.xx	J02.xx
Otitis media	381.xx, 382.xx	H65.xx
Otitis externa	380.xx	H60.xx
Conjunctivitis	372.xx	H10.xx
Urinary tract infection	599.xx, 595.xx	N39.0
Allergic rhinitis	477.xx	J30.xx
Influenza	487.xx	J09, J10, J11
Unspecified viral infection	079.99	B34.xx

ICD = International Classification of Diseases.

* Adapted from reference 22.

Appendix Table 2. Demographic Distribution of All Privately Insured U.S. Adults Aged 18 to 64 Years Compared With the Study Sample, 2008 and 2016*

Characteristic	2008†		2016‡	
	CPS, %	Study Sample, %	CPS, %	Study Sample, %
Age				
18-34 y	33	34	36	35
35-44 y	23	24	20	21
45-54 y	25	25	23	23
55-64 y	19	18	21	21
Sex				
Female	51	52	49	52
Male	49	48	51	48
Geographic setting				
Metropolitan	71	77	75	76
Nonmetropolitan	29	23	25	24
Region				
Northeast	19	25	19	24
Midwest	24	15	22	13
South	35	42	36	44
West	23	18	23	19

CPS = Current Population Survey.

* Demographic distributions were estimated from the U.S. Census Bureau CPS data for U.S. adults aged 18 to 64 years with private insurance and from the study sample of 100% claims from a large national insurer.

† Based on 133 034 538 persons in the CPS and 10 215 292 persons in the study sample.

‡ Based on 143 329 846 persons in the CPS and 10 468 634 persons in the study sample.

Appendix Table 3. Primary Care Visit Rates per 100 Member-Years, by Demographic and Area-Level Characteristics, 2008–2016 Adjusted Analyses*

Characteristic	Primary Care Visits per 100 Member-Years, <i>n</i>		Decline From 2008 to 2016 (95% CI), %†	P Value for Interaction‡
	2008	2016		
Overall	166.8	132.4	–24.2 (–24.5 to –23.9)	–
Age				
18–34 y	122.0	94.2	–27.4 (–27.9 to –26.8)	<0.001
35–44 y	160.0	125.5	–25.0 (–25.6 to –24.4)	<0.001
45–54 y	190.5	153.8	–22.3 (–22.8 to –21.8)	0.67
55–64 y	236.3	191.1	–22.5 (–23.0 to –21.9)	Reference
Sex				
Female	188.0	148.9	–24.7 (–25.0 to –24.3)	<0.001§
Male	143.7	114.6	–23.5 (–23.9 to –23.1)	Reference
Number of chronic conditions 				
≥1	314.8	276.5	–12.7 (–13.3 to –12.1)	Reference
0	145.9	113.7	–26.2 (–26.5 to –25.9)	<0.001
Area-level income¶				
0%–200% FPL	168.8	124.5	–30.8 (–31.3 to –30.3)	<0.001
201%–300% FPL	171.9	138.1	–23.4 (–23.8 to –22.8)	<0.001
301%–400% FPL	165.1	134.8	–22.4 (–23.0 to –21.8)	<0.001
>400% FPL	154.8	131.2	–16.2 (–17.0 to –15.4)	Reference
Geographic setting**				
Metropolitan	166.4	128.7	–26.6 (–26.9 to –26.3)	Reference
Nonmetropolitan	168.1	146.0	–15.3 (–16.0 to –14.6)	<0.001
Region				
Northeast	168.5	139.3	–21.2 (–21.8 to –20.6)	0.019§
Midwest	169.1	150.1	–17.9 (–18.7 to –17.1)	<0.001
South	176.1	130.2	–29.1 (–29.5 to –28.6)	<0.001
West	142.5	116.8	–20.1 (–20.8 to –19.4)	Reference
Area-level baseline PCP visit rate††				
Lowest quartile	127.6	100.1	–26.2 (–26.8 to –25.5)	<0.001
Second quartile	161.0	135.2	–20.5 (–21.0 to –19.9)	<0.001
Third quartile	181.2	142.9	–23.9 (–24.4 to –23.4)	0.0064§
Highest quartile	199.7	160.4	–22.8 (–23.4 to –22.1)	Reference

FPL = federal poverty level; PCP = primary care provider.

* 2008 and 2016 visit rates based on a 100% sample. Poisson analyses were performed using a 5% sample.

† Based on adjusted member-year-level Poisson regression models accounting for age, sex, income, setting, and region (unless a given covariate is used instead as an interaction term), and member-time per year, presented as the percentage of change in visits across 9 y.

‡ Significance of the interaction term between a given variable and year.

§ Decline that became newly statistically significant at $P < 0.05$.

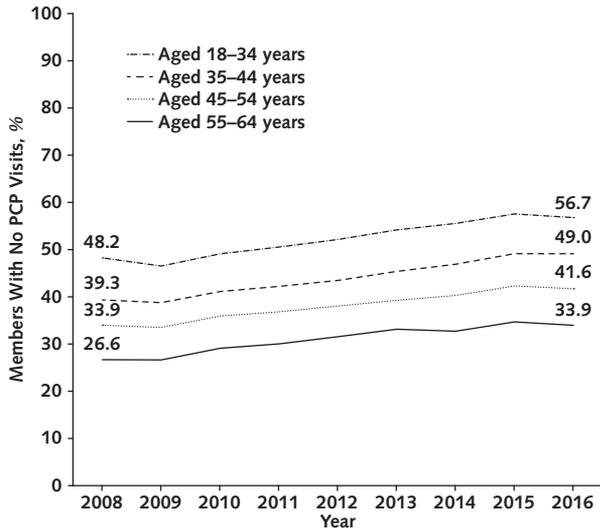
|| Chronic condition count determined by using the Charlson Comorbidity Index for a given year.

¶ Area-level income determined in relation to FPL for a family of 4 in 2015 in the member's ZIP code. Data were missing for 16 984 member-years (0.3%) across the study period in the 5% sample.

** Geographic setting was determined by using the metropolitan statistical area corresponding to member's ZIP code. Data were missing for 8707 member-years (0.1%) across the study period in the 5% sample.

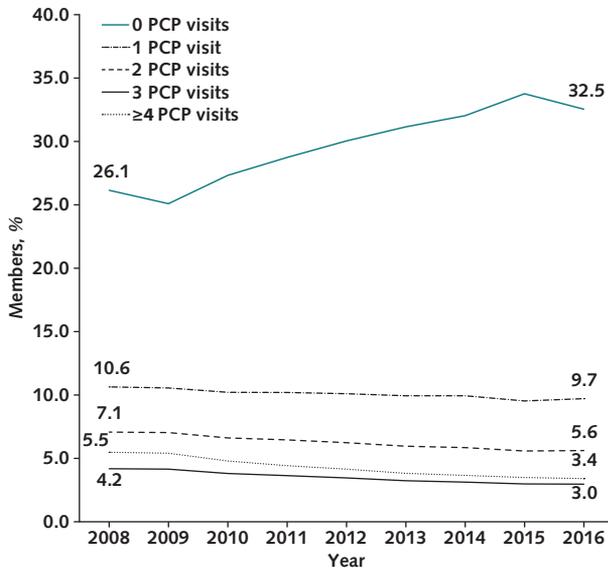
†† Based on subanalysis of the 97% of ZIP codes with at least 500 members residing there in every year of the study period; quartiles were determined by using 2008 ZIP code-level per capita PCP visit rates (lowest quartile, 10.8 to 127.3; second quartile, 127.4 to 145.0; third quartile, 145.1 to 160.7; highest quartile, 160.7 to 258.7).

Appendix Figure 1. Members with no PCP visit in 2008–2016, stratified by age.



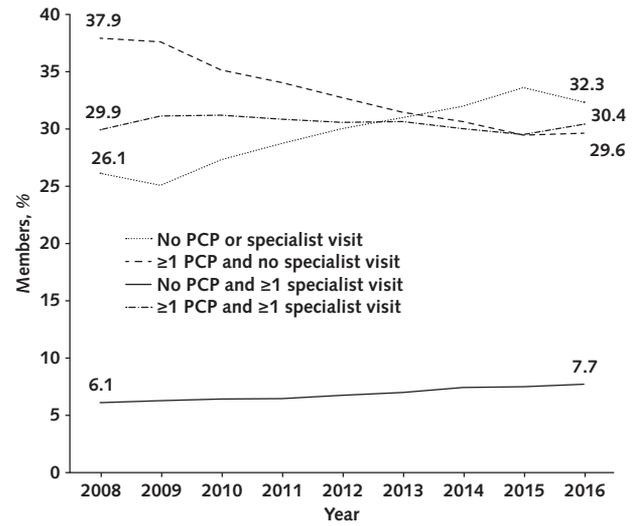
PCP = primary care provider.

Appendix Figure 2. Trends in PCP visit utilization patterns among commercially insured adults with no specialty visits who were continuously enrolled for 12 or more months, 2008–2016.



PCP = primary care provider.

Appendix Figure 3. Trends in visit utilization patterns among commercially insured adults, with gynecologists classified as PCPs, 2008–2016.



PCP = primary care provider.

Appendix Table 4. Sensitivity Analysis: Visit Decline Among Members Both With and Without Chronic Conditions*

Number of Chronic Conditions	Visits, <i>n</i>		Change in Visits From 2008 to 2016, <i>n</i>	Decline in Visits From 2008 to 2016 (95% CI), %	P Value for Interaction‡
	2008	2016			
≥1	351.8	312.1	-39.7	-11.9 (-11.3 to -12.6)	Reference
0	146.1	113.2	-32.9	-26.4 (-26.1 to -26.7)	<0.001
0†	186.8	154.8	-32.0	-19.1 (-18.8 to -19.5)	<0.001

* 2008 and 2016 visit rates based on a 100% sample. Poisson analyses were performed using a 5% sample.

† In a sensitivity analysis, we excluded members with no medical claims; this resulted in a diminished decline among members with no chronic conditions that remained statistically significantly larger than the decline among those with chronic conditions.

‡ Significance of the interaction term between a given variable and year.