



Published in final edited form as:

Am J Hypertens. 2019 September 24; 32(10): 1030–1038. doi:10.1093/ajh/hpz101.

Association Between Medicaid Coverage and Income Status on Health Care Use and Costs Among Hypertensive Adults After Enactment of the Affordable Care Act

Donglan Zhang¹, Matthew R. Ritchey², Chanhyun Park², Jason Li³, John Chapel², Guijing Wang²

¹Department of Health Policy and Management, College of Public Health, University of Georgia, Athens, Georgia, USA;

²Division for Heart Disease and Stroke Prevention, Centers for Disease Control and Prevention, Atlanta, Georgia, USA;

³Department of Management, Terry College of Business, University of Georgia, Athens, Georgia, USA

Abstract

BACKGROUND—Hypertension is highly prevalent among the low-income population in the United States. This study assessed the association between Medicaid coverage and health care service use and costs among hypertensive adults following the enactment of the Patient Protection and Affordable Care Act (ACA), by income status level.

METHODS—A nationally representative sample of 2,866 nonpregnant hypertensive individuals aged 18–64 years with income up to 138% of the federal poverty level (FPL) were selected from the 2014 and 2015 Medical Expenditure Panel Survey. Regression analyses were performed to examine the association of Medicaid coverage with outpatient (outpatient visits and prescription medication fills), emergency, and acute health care service use and costs among those potentially eligible for Medicaid by income status—the very low-income (FPL = 100%) and the moderately low-income (100% > FPL = 138%).

RESULTS—Among the study population, 70.1% were very low-income and 29.9% were moderately low-income. Full-year Medicaid coverage was higher among the very low-income group (41.0%) compared with those moderately low-income (29.1%). For both income groups, having full-year Medicaid coverage was associated with increased health care service use and higher overall annual medical costs (\$13,085 compared with \$7,582 without Medicaid); costs were highest among moderately low-income patients (\$17,639).

CONCLUSION—Low-income individuals with hypertension, who were potentially newly eligible for Medicaid under the ACA may benefit from expanded Medicaid coverage by improving

For permissions, please e-mail: journals.permissions@oup.com

Correspondence: Donglan Zhang (dzhang@uga.edu).

DISCLOSURE

The authors declare no conflict of interest.

their access to outpatient services that can support chronic disease management. However, to realize decreases in medical expenditures, efforts to decrease their use of emergency and acute care services are likely needed.

Keywords

blood pressure; hypertension; hypertension control; Medicaid expansion; medical costs

The Patient Protection and Affordable Care Act (ACA), enacted in 2010, aims to increase health insurance coverage among the US population¹. As one way to achieve this goal, the ACA includes provisions expanding Medicaid to cover non-disabled adults—regardless of their parental status—who are aged 18–64 years and, at a minimum, have incomes equal to or less than 138% of the federal poverty level (FPL)^{2,3}. Between 1 January 2014 and 30 April 2015, a total of 29 states (including Washington, DC) expanded Medicaid; as of 27 July 2018, the total had increased to 32 states and another 2 states had adopted but not yet implemented Medicaid expansion^{2,4}. Since 2014, states that expanded their Medicaid programs have seen larger declines in their overall uninsured rates than states that have not expanded Medicaid^{2,5,6}. The total number of people covered by the Medicaid program increased from 55 million in 2013, prior to expansion, to approximated 67 million in 2018⁵, and its share of the total national health costs was 16.9% (\$543 billion) in 2015⁷.

Multiple studies have assessed the effect of Medicaid expansion on health care use, costs, quality of care, and health outcomes for the general Medicaid-eligible population^{8–10}. However, to the best of our knowledge, we are the first to assess how, following the period of rapid Medicaid expansion, health care use and spending differed significantly among individuals with specific chronic conditions, such as hypertension, as categorized based on their income and Medicaid coverage status. A recently-published review reported that hypertension prevalence among Medicaid-covered adults, aged 18–64 years ranged from 17.2% to 27.4%, was typically higher than that observed among similar aged comparison groups¹¹. Furthermore, they reported that while hypertension-related costs among this population were relatively low (i.e., \$687 per year) and were composed mainly of medication costs, the total costs of managing patients with hypertension were much higher (e.g., as high as \$19,821 per year). The number of Medicaid beneficiaries with hypertension has likely increased since the program's expansion¹¹. Optimal hypertension management typically requires routine health care professional visits and the use of prescription medication, both of which are facilitated by having sufficient health insurance coverage^{12,13}. Achieving blood pressure control can lead to considerable declines in the short- and long-term risk for heart disease and stroke, both of which are the leading causes of mortality, disability, and health care spending in the United States.¹⁴

States that have expanded Medicaid may consider how the newly eligible population with hypertension differs from those who were covered by traditional Medicaid. In addition, states that have yet to expand Medicaid might in part make decisions based on information about how health care use and costs among adults with prevalent conditions, such as hypertension, differ based on their Medicaid coverage status and level of income. Therefore, we assessed the association between having Medicaid coverage and health care use and

costs among hypertensive adults, by individual income level, categorized as either very low-income (< 100% FPL) or moderately low-income (>100%–138% FPL).

METHODS

Study population

We used data from the 2014 and 2015 Medical Expenditure Panel Survey (MEPS) for data analysis. MEPS, conducted annually by the Agency for Health care Research and Quality, is a nationally representative survey of noninstitutionalized civilians to understand health care use and costs in the United States¹⁵. For each year, full-year, household component files capture participants' responses regarding their sociodemographic characteristics, health status, and medical costs. In addition, data captured in household component event files can be used to assess the presence of medical conditions and associated medical events among participants.

The 2014 and 2015 MEPS were selected because we studied the changes in health care use after Medicaid expansion that began under the ACA. The study sample includes 2,866 nonpregnant hypertensive adults aged 18–64 years identified as low-income—defined as individual income no more than 138% of FPL—which is the target population for potential Medicaid expansion, regardless of their disability status. Pregnant women were excluded because they were already eligible with a family income at or below 138% FPL (or higher in some states) before the Medicaid expansion^{2,16}. Hypertension was defined as (i) self-reported having ever been diagnosed with hypertension or (ii) having had a medical billing claim for hypertension¹⁷. To identify the latter, we linked full-year consolidated data files with medical condition files and used the *International Classification of Diseases, Ninth Revision* codes 401–405 to identify the respondents who received medical services to treat one or more of the following: essential hypertension, hypertensive heart disease, hypertensive chronic kidney disease, hypertensive heart and chronic kidney disease, or secondary hypertension¹⁷. We compared population characteristics, health profiles, and health care use among hypertensive individuals who were categorized in the very low-income or moderately low-income group.

Variable measurement

We assessed the following dependent variables: (i) total annual medical costs and (ii) health care service use by service type. Total annual medical costs measured actual payments to medical care providers, inflated to the 2015 US dollar values by using the gross domestic product price index¹⁸, which included all payments to office-based services, outpatient facility expenditures, outpatient providers, inpatient stays, emergency room visits, prescription medications, and other relevant services. Health care service use included the number of outpatient visits, emergency room visits, inpatient discharges, and the total number of prescription drugs filled at pharmacies or hospitals within a year.

The primary independent variable was measured by the respondents' self-report for having been covered by either traditional or expanded Medicaid for 1–11 months or a full year. Demographic characteristics, socioeconomic status, and health profiles were

compared and controlled for in the analysis, based on previous literature¹⁷. Demographic characteristics included age group (18–34, 35–54, 55–64 years), sex (male, female), and race or ethnicity (Hispanic, non-Hispanic black, non-Hispanic other races, non-Hispanic white). Socioeconomic statuses included marital status (married, not married, including those who were never married, divorced, and widowed), educational attainment (having high-school degree, some college, having bachelor's or higher degrees, did not finish high school), residential region (Midwest, South, West, Northeast), ever being unemployed during the observation year (Yes, No), year (2014, 2015), and other insurance coverage during the year (Medicare or other public insurance, any private insurance, none).

Health profiles were constructed by using self-reported measures and included perceived health status (excellent/very good, good, fair/poor); weight status, measured by using body mass index (BMI) (underweight or normal weight [BMI < 25], overweight [BMI = 25–30], obese [BMI ≥ 30]¹⁹); current smoking status (Yes, No); history of being diagnosed with high cholesterol (Yes, No), diabetes (Yes, No), or any cardiovascular diseases, such as coronary heart disease, angina, heart attack, other heart disease or stroke (Yes, No); presence of two or more chronic conditions, including any cardiovascular diseases, cancer, diabetes, high cholesterol, arthritis, joint pain, chronic bronchitis, emphysema, asthma, or chronic depression (Yes, No); and having any physical, cognitive, or emotional limitations (Yes, No).

Statistical analysis

We first compared sample characteristics, health profiles, and health care use and spending between the two income groups and performed chi-square tests to show if there were significant differences. We then conducted survey weighted, negative binomial models to estimate the association between Medicaid coverage and number of health care services used, and generalized linear regressions with the log link and gamma distribution to assess the association between Medicaid and total medical costs, adjusting for all of the covariates listed above. We conducted the F test to assess if the associations between the full-year Medicaid coverage and health care service utilization were significantly different between the very low-income and the moderately low-income groups. All analyses used sampling weights, and standard errors accounted for the complex design of the survey as well as intracluster correlation by using Stata 14.2.

RESULTS

Table 1 shows the sample characteristics for the low-income, nonpregnant, US adults aged 18–64 years with or without disabilities who were diagnosed with hypertension. After adjusting for sampling weights, among all low-income individuals, 51% were male and more than 80% were aged 35–64 years, and approximately 51% were non-Hispanic white. Approximately 68% were not married, more than 40% lived in the South, 29% did not have a high-school degree, and 71% had been unemployed. Compared with those who were very low-income, those who were moderately low-income were significantly ($P < 0.05$) older and had a higher proportion of males (51% vs. 46%), Hispanics (23% vs. 17%), being married (39% vs. 29%), having attended some college (30% vs. 25%), and never being unemployed during the previous year (42% vs. 23%). Regarding health insurance coverage, 78% of all

participants had any type of coverage during the year, with similar rates occurring among the two low-income groups. Furthermore, 47% of all participants had no Medicaid coverage within the observation year, 16% were covered for 1–11 months, and 37% had full-year coverage. Medicaid coverage was higher in the very low-income population as compared to the moderately low-income population (full-year Medicaid coverage rates of 41% vs. 29%). Furthermore, excluding having Medicaid coverage, about 58% of all participants had no other health insurance plans during the study period, 20% had some form of private insurance, and 22% had some form of other public insurance, such as Medicare. The percentages of having private insurance or Medicare coverage were significantly higher among the moderately low-income group than the very low-income group (any private insurance: 28% vs. 16%; Medicare or other public: 27% vs. 20%).

Table 2 illustrates similar perceived health status that compares the very low-income participants with the moderately low-income participants with hypertension. Furthermore, they had similar weight status and prevalence of diabetes, cardiovascular disease, and two or more chronic conditions (all with $P = 0.05$). The moderately low-income population had lower prevalence of current smokers and less physical, cognitive, and emotional limitations, but higher prevalence of high cholesterol, as compared with those of very low-income. Outpatient visits, patient discharges, prescription refills, total health care costs, and total annual Medicaid expenditures per capita for those with Medicaid coverage among the very low-income participants were similar to that of the moderately low-income participants.

Table 3 shows the estimated annual total medical costs by income level and Medicaid coverage status, after controlling for all covariates. Among those with full-year Medicaid coverage, the mean total annual medical costs (95% confidence interval [CI]) were \$13,085 (\$11,831–\$15,944) for the entire low-income population, with \$5,770 (44%) of the total spending being incurred by Medicaid. Among those with no Medicaid coverage, mean total annual medical costs were \$7,582 (95% CI = 6,595–9,031). Among those with full-year coverage, the costs were higher among the moderately low-income population (\$17,639, 95% CI = \$8,117–\$27,611) than that of the very low-income population (\$11,652.10, 95% CI = \$10,309.20–\$13,219.40). Conversely, the total annual Medicaid costs among this group were slightly lower in the moderately low-income group (\$5,453, 95% CI = \$4,200–\$7,108; 31% of total annual medical costs were incurred by Medicaid) than that of the very low-income group (\$6,175, 95% CI = \$5,460–\$7,398; 53% of total annual medical costs were incurred by Medicaid).

Data presented in Table 4 show the incidence rate ratio (IRR) of health care service use by income level and Medicaid coverage status, after controlling for all covariates. Compared to not having any Medicaid coverage during the year, having full-year Medicaid coverage among the entire low-income population was associated with a substantial increase in the number of outpatient visits (IRR = 1.80, 95% CI = 1.47–2.22), emergency room visits (IRR = 1.36, 95% CI = 1.11–1.68), inpatient discharges (IRR = 1.82, 95% CI = 1.33–2.49), and prescription drugs filled (IRR = 1.81, 95% CI = 1.55–2.11). Among those with full-year Medicaid coverage, a significantly higher IRR was observed for the number of emergency room visits and number of prescription drugs filled among the moderately low-income group (1.57 and 2.14, respectively) compared to the very low-income group (1.29 and

1.73, respectively) (F test P -value <0.001). Conversely, the number of outpatient visits displayed an insignificantly higher IRR among those very low-income as compared to those moderately low-income (1.99 vs. 1.50, P -value = 0.083). The IRRs for inpatient discharges were similar across both income groups.

DISCUSSION

Medicaid expansion under the ACA increased the availability of health insurance for millions of newly eligible low-income adults. This study found, using a nationally representative sample of hypertensive adults during the first 2 years of expansion (2014 and 2015), that nonpregnant Medicaid enrollees ages 18–64 years with an income between 100% and 138% FPL had a similar health and health care service use profile as comparable individuals with an income 100% FPL. Furthermore, among both income groups, having full-year Medicaid coverage was associated with considerably greater use of outpatient visits, prescription medication fills, and emergency and acute health care services, as well as increased annual medical spending, compared to individuals with no Medicaid coverage. This was especially the case among the moderately low-income population. These later findings are supported by multiple studies that have described the impact of having Medicaid expansion on health care service use and costs including the randomized Oregon Medicaid Health Experiment²⁰. These studies, however, have either not focused on patients with specific chronic conditions and/or focused on a single state or a collection of states, rather than the entire nation. In contrast, our analysis was conducted among a nationally representative sample of hypertensive adults, and thus our study contributes a more comprehensive understanding about how Medicaid expansion might influence blood pressure management among individuals with hypertension.

National hypertension treatment guidelines recommend that blood pressure management include the ongoing use of outpatient services for activities such as the regular assessment of medication adherence and treatment effectiveness.²¹ Uninsured adults have historically been shown to be less likely than insured adults to receive this level of care, though, leading to lower rates of blood pressure control.²² Cole et al.²³ reported increases in Medicaid coverage and improved hypertension control among low-income patients treated in federally funded community health centers located in expansion states compared to those in nonexpansion states. Although our study was unable to describe differences in blood pressure control rates by Medicaid status, we did find that increased access to Medicaid coverage was associated with increased service use, which may support improved hypertension management. However, the degree of association being Medicaid access and the amount and types of services used varied by income status. Having full-year Medicaid coverage had a greater association with increased fills for prescription medications among the moderately low-income population compared with that of very low-income population, but less of an effect on outpatient service use. Moreover, compared with those of very low-income, we found that the moderately low-income population had an increased use of emergency department (ED) care.

Both extension of Medicaid coverage and patient-level factors are likely responsible for the differences observed in the types and amounts of services used by patients between the

two income groups. Although the overall health and health care use profiles were similar between the two income groups and we controlled for many other patient-level factors in our analysis, such as age, employment status, and other insurance coverage, factors we were unable to control for (e.g., newly gained access to health insurance through Medicaid expansion) may be partially responsible for the differences observed. For example, studies have reported that newly covered Medicaid beneficiaries are often unfamiliar with the new law or do not know the benefits offered by Medicaid expansion²⁴. This potential lack of understanding of the benefits may result in suboptimal use of needed preventive and chronic disease management services and over reliance on use of ED care^{25,26}. The population of moderately low-income enrollees with full-year Medicaid coverage assessed in this study were potentially more likely to be newly insured through Medicaid expansion than the very-low income group and, therefore, may be using a combination of ED and outpatient services as entry points into the health care system rather than just outpatient services. Although increased use of both of these service types could support improved access to prescription medications for hypertension management, ongoing medication management ideally should occur in the outpatient setting²¹. Sommers et al.²⁷ looked at the effects of Medicaid expansion after 2 years in Arkansas, Kentucky, and Texas and found that maturation of the program was associated with increases in preventive care use, improved quality of care, a decrease in the number of ED visits, and improve self-reported health. Allowing the Medicaid expansion to “mature” may result in gradual alteration of the health care seeking behaviors of those newly covered by the program and move them to adopt more optimal methods for chronic disease management, including use of outpatient services for ongoing assessment and medication therapy management and less use of ED services²⁸. Furthermore, because more than half of the Medicaid-eligible hypertensive adults have two or more chronic conditions, such as high cholesterol and diabetes, and approximately half of them are obese²⁹, improving the health care access and use patterns may benefit the management of other chronic conditions. These hypotheses should likely be assessed further.

Finally, we found that having full-year Medicaid coverage was associated with increased total annual medical costs among the moderately low-income population with hypertension (around \$17,600 per year), compared with the very low-income population with hypertension (around \$11,700 per year). According to a 2016 Actuarial Report on the Financial Outlook for Medicaid, the average cost per Medicaid enrollee for newly eligible adults was initially higher than that for previously Medicaid-eligible adults³⁰. However, this difference has gradually declined as the pent-up demand for services among newly enrolled adults has been addressed and, in states with managed care models, modifications have been made to capitation rates to better align with service utilization and risk corridors or minimum medical loss ratios have been used to control costs^{24,31}. Because of these efforts, it was projected that, in 2018, the average cost for newly eligible adults would be lower than that for previously eligible adults²⁴. Furthermore, a recent review, which summarized 153 studies, evaluated the effect of the Medicaid expansion program under the ACA on insurance coverage, access to health care, health care use, and health outcomes from January 2014 to June 2017 and found that Medicaid expansion may lower Medicaid expenditures and possibly benefit overall economic outcomes such as a reduction in uncompensated care costs for hospitals and increased employment rates within the expansion states⁸. As such,

the long-term economic effect of Medicaid expansion is yet to be seen. Furthermore, our study found that only a portion of the overall medical spending among individuals with full-year Medicaid coverage was incurred by the Medicaid program. This was especially the case for those of moderately low-income, as only around 1 in 3 of the dollars spent on their medical care was paid for by Medicaid. Given Medicaid is generally the last resort payer, other insurers such as group health plans or Medicare paid the first 2 of 3 dollars for costs incurred by potentially newly eligible individuals³². Therefore, increases in the FPL levels for Medicaid eligibility may lead to additional medical costs among those who receive the benefit, but these additional costs are dispersed among multiple payers, including the patients and are only partially borne by Medicaid.

This analysis has limitations. First, although we observed consistent positive relationships between Medicaid coverage and health care use among low-income adults with hypertension, we cannot deduce causal relationships by using the cross-sectional sample of the 2014 and 2015 MEPS. It is still possible that adverse selection may exist whereby healthier people are less likely to enroll in Medicaid even if they become eligible under the ACA³³. There is also a possibility that the health care use outcomes assessed in this study may have been influenced by a number of confounding factors, including differing health care use patterns among adults living in nonexpansion states compared to Medicaid expansion states or other health care reform efforts such as the community based prevention activities through the prevention and public health fund. We did not have state-specific information the publicly available MEPS datasets to control for these factors. To project future health care use and spending for hypertensive patients, states that have not yet expanded Medicaid should consider their current Medicaid uptake rate, as well as health profiles of the newly eligible patients in their specific state, if expansion were to be implemented. Second, measures of hypertension, prescription medication fills, health care uses, and costs were self-reported and, thus, were subject to recall bias, although the self-reported costs and related medical events were ascertained by their medical providers, and MEPS researchers have found there is a high agreement between the self-reported measures and actual medical claims³⁴. Also, we did not have the information on time in years of the diagnosis of hypertension, which may affect their health care use. In addition, prescription medications included all medications, which did not reflect blood pressure medications specifically. But as half of this population had at least two chronic conditions, more prescription medication refills may be related to better management of chronic conditions, including hypertension³⁵. Third, despite the 2015 MEPS being the most up-to-date and publically available data source that investigates the health care service use and spending for the entire nation, these data do not reflect the recent influence of Medicaid expansion on health care utilization. Continuous monitoring of the program and health care use is needed to understand the health and economic outcomes of the policy change in the future. Finally, despite assessing the health care use outcomes by the two FPL groups, we could not differentiate between hypertensive adults who were covered by traditional Medicaid and those who became eligible because of Medicaid expansion, as considerable heterogeneity existed in states' FPL-related Medicaid eligibility criteria prior to the ACA enactment². Furthermore, we could not identify adults who lived in states that did not expand coverage or hypertensive adults in expansion states who did not take advantage of their eligibility

because of personal choice, lack of awareness, or other reasons, and we are not able to take the variability in reimbursement models between federal and state governments or across states into consideration. In future studies, measures that are not captured by the present survey, such as patients' lifestyles, customs, cultural background, and access to psychosocial support groups, could be collected via primary data collection and integrated mixed methods with both qualitative and quantitative approaches used to explore other factors that may be contributing to how health care service are being used.

In conclusion, although low-income individuals with hypertension may benefit from expanded Medicaid coverage by increasing their access to outpatient services and prescription medications, we found having Medicaid coverage among both very and moderately low-income adults aged 18–64 years to be associated with increased use of emergency and acute care services and with increased total medical spending. On the basis of previous studies, as Medicaid expansion in each state matures and enrollees increase awareness of ACA's benefits and establish primary medical homes, use of outpatient services should likely continue with less reliance on more costly emergency and acute care services. This improved access, along with the adoption of comprehensive chronic disease management models in primary care settings that attempt to improve care coordination care and incorporate interventions aimed at improving Medicaid beneficiaries' lifestyle behaviors^{36,37}, could positively impact hypertension management, as well as the care received for other co-morbid chronic conditions. Furthermore, it could help prevent chronic disease progression and acute events, such as more costly and serious medical conditions including myocardial infarctions and strokes, in the short- and long-term.

ACKNOWLEDGMENTS

The findings and conclusions of this article are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention (CDC).

REFERENCES

- Centers for Medicare and Medicaid Services. Affordable Care Act (ACA): Definition and Goals. <https://www.healthcare.gov/glossary/affordable-care-act/>. Accessed 5, 2018.
- Herz EJ. Medicaid: A Primer. Congressional Research Service. CRS Report RL33202: Washington, DC. July 18, 2012.
- Greenhalgh M. The Affordable Care Act: Medicaid Expansion & Healthcare Exchanges. Government Relations Division: Washington, DC, 2014.
- Status of State Action on the Medicaid Expansion Decision. 2018; <https://www.kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>. Accessed 03 April 2018.
- Key Facts about the Uninsured Population. 2017; <https://www.kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/>. Accessed 03 April 2018.
- Hayes S, Collins S, Radley D, McCarthy D. What's at stake: states' progress on health coverage and access to care, 2013–2016. Issue brief (Commonwealth Fund). 2017; 2017:1–20.
- Centers for Medicare and Medicaid Services. 2015; <https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nationalhealthaccountshistorical.html>. Accessed 05 February 2019.
- Antonisse L, Garfield R, Rudowitz R, Artiga S. 2017 The Effects of Medicaid Expansion under the ACA: Updated Findings from a Literature

Review. <https://www.kff.org/medicaid/issue-brief/theeffects-of-medicaid-expansion-under-the-aca-updated-findings-from-a-literature-review-september-2017/>. Accessed 04 April 2017.

9. Medicaid Expansion Spending. 2015; <https://www.kff.org/medicaid/state-indicator/medicaid-expansion-spending/>. Accessed 03 April 2018.
10. Paradise J, Garfield R. What is Medicaid's Impact on Access to Care, Health Outcomes, and Quality of Care? Setting the Record Straight on the Evidence. Henry J. Kaiser Family Foundation: Menlo Park, CA, 2013.
11. Chapel JM, Ritchey MD, Zhang D, Wang G. Prevalence and medical costs of chronic diseases among adult Medicaid beneficiaries. *Am J Prev Med* 2017; 53:S143–S154. [PubMed: 29153115]
12. Fang J, Zhao G, Wang G, Ayala C, Loustalot F. Insurance status among adults with hypertension—the impact of underinsurance. *Journal of the American Heart Association*. 2016;5(12):e004313. [PubMed: 28003253]
13. Duru OK, Vargas RB, Kermah D, Pan D, Norris KC. Health insurance status and hypertension monitoring and control in the United States. *Am J Hypertens* 2007; 20:348–353. [PubMed: 17386339]
14. Li S, Bruen BK, Lantz PM, Mendez D. Impact of health insurance expansions on nonelderly adults with hypertension. *Prev Chronic Dis* 2015; 12:E105. [PubMed: 26133648]
15. Medical Expenditure Panel Survey. <https://meps.ahrq.gov/mepsweb/>. Accessed 03 April 2017.
16. Kaiser Family Foundation. Medicaid and CHIP Income Eligibility Limits for Pregnant Women, 2003–2018. <https://www.kff.org/medicaid/state-indicator/medicaid-and-chip-income-eligibility-limits-for-pregnant-women/?currentTimeframe=0&selectedDistributions=january-2014&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>. Accessed 10, 2018.
17. Zhang D, Wang G, Zhang P, Fang J, Ayala C. Medical expenditures associated with hypertension in the U.S., 2000–2013. *Am J Prev Med* 2017; 53:S164–S171. [PubMed: 29153117]
18. Using Appropriate Price Indices for Analyses of Health Care Expenditures or Income Across Multiple Years. https://meps.ahrq.gov/about_meps/Price_Index.shtml. Accessed 03 April 2018.
19. Wilson PW, D'Agostino RB, Sullivan L, Parise H, Kannel WB. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. *Arch Intern Med* 2002; 162:1867–1872. [PubMed: 12196085]
20. Freedman S, Nikpay S, Carroll A, Simon K. Changes in inpatient payer-mix and hospitalizations following Medicaid expansion: evidence from all-capture hospital discharge data. *PLoS One* 2017; 12:e0183616. [PubMed: 28957347]
21. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbiagele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2018; 71:e127–e248. [PubMed: 29146535]
22. Gillespie CD, Hurvitz KA, Centers for Disease Control and Prevention (CDC). Prevalence of hypertension and controlled hypertension—United States, 2007–2010. *MMWR Surveill Summ*. 2013;62(Suppl 3):144–148.
23. Cole MB, Galárraga O, Wilson IB, Wright B, Trivedi AN. At Federally Funded Health Centers, Medicaid expansion was associated with improved quality of care. *Health Aff (Millwood)* 2017; 36:40–48. [PubMed: 28069845]
24. Rhodes KV, Kenney GM, Friedman AB, Saloner B, Lawson CC, Chearo D, Wissoker D, Polsky D. Primary care access for new patients on the eve of health care reform. *JAMA Intern Med* 2014; 174:861–869. [PubMed: 24710808]
25. Askelson NM, Wright B, Bentler S, Momany ET, Damiano P. Iowa's Medicaid expansion promoted healthy behaviors but was challenging to implement and attracted few participants. *Health Aff (Millwood)* 2017; 36:799–807. [PubMed: 28461345]
26. Miller S, Wherry LR. Health and access to care during the first 2 years of the ACA Medicaid expansions. *N Engl J Med* 2017; 376:947–956. [PubMed: 28273021]

27. Sommers BD, Blendon RJ, Orav EJ, Epstein AM. Changes in utilization and health among low-income adults after Medicaid expansion or expanded private insurance. *JAMA Intern Med* 2016; 176:1501–1509. [PubMed: 27532694]
28. Irvin CV, Lipson D, Appold C, Colby M, Bradley K, Heeringa J, Libersky J, Byrd VLH, Baller J. Medicaid 1115 demonstration evaluation design plan. Final Report to the Centers for Medicare and Medicaid Services. Mathematica Policy Research: Cambridge, MA. 2015.
29. Wang TJ, Massaro JM, Levy D, Vasan RS, Wolf PA, D'Agostino RB, Larson MG, Kannel WB, Benjamin EJ. A risk score for predicting stroke or death in individuals with new-onset atrial fibrillation in the community: the Framingham Heart Study. *JAMA* 2003; 290:1049–1056. [PubMed: 12941677]
30. Truffer CJ, Wolfe CJ, Rennie KE. 2016 Actuarial Report on the Financial Outlook for Medicaid. Department of Health & Human Services: Washington, DC, 2016.
31. Lo N, Roby DH, Padilla J, Chen X, Salce EN, Pourat N, Kominski GF. Increased service use following Medicaid expansion is mostly temporary: evidence from California's low income health program. Policy Brief UCLA Cent Health Policy Res 2014.
32. Centers for Medicare and Medicaid Services. Medicaid Third Party Liability & Coordination of Benefits. <https://www.medicaid.gov/medicaid/eligibility/tpl-cob/index.html>. Accessed 10, 2018.
33. Marton J, Yelowitz A, Talbert JC. Medicaid program choice, inertia and adverse selection. *J Health Econ* 2017; 56:292–316. [PubMed: 29248057]
34. Zuvekas SH, Olin GL. Validating household reports of health care use in the Medical Expenditure Panel Survey. *Health Serv Res* 2009; 44:1679–1700. [PubMed: 19619249]
35. Ho PM, Bryson CL, Rumsfeld JS. Medication adherence: its importance in cardiovascular outcomes. *Circulation* 2009; 119:3028–3035. [PubMed: 19528344]
36. Billings J, Mijanovich T. Improving the management of care for high-cost Medicaid patients. *Health Aff (Millwood)* 2007; 26:1643–1654. [PubMed: 17978384]
37. Willard-Grace R, Chen EH, Hessler D, DeVore D, Prado C, Bodenheimer T, Thom DH. Health coaching by medical assistants to improve control of diabetes, hypertension, and hyperlipidemia in low-income patients: a randomized controlled trial. *Ann Fam Med* 2015; 13:130–138. [PubMed: 25755034]

Table 1.

Sample characteristics (weighted %) for low-income adults aged 18–64 years with hypertension, by income level, 2014 and 2015 Medical Expenditure Panel Survey

Variables	Total low-income population N = 2,866	Very low-income (< 100% FPL) n = 2,010	Moderately low-income (>100% –138% FPL) n = 856	P-value
Any health insurance during the year				0.6832
No	21.9	22.2	21.3	
Yes	78.1	77.8	78.7	
Medicaid coverage during the year				<0.0001
No	47.1	41.3	59.8	
Covered for 1–11 months	15.7	17.7	11.1	
Full-year coverage	37.3	41.0	29.1	
Other insurance during the year				<0.0001
None	58.3	64.3	44.9	
Any private	19.6	15.8	28.1	
Medicare or other public	22.1	19.9	27.1	
Year				0.3379
2014	53.1	53.9	51.2	
2015	46.9	46.1	48.8	
Sex				0.0321
Male	47.4	45.7	51.2	
Female	52.6	54.3	48.8	
Age				0.0367
18–34	15.0	16.3	12.3	
35–44	17.7	18.1	16.6	
45–54	30.0	30.4	28.9	
55–64	37.4	35.2	42.2	
Race/ethnicity				0.0385
Hispanic	18.5	16.8	22.5	
Non-Hispanic white	50.9	51.7	49.3	
Non-Hispanic black	23.4	24.6	20.6	

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Variables	Total low-income population N = 2,866	Very low-income (< 100% FPL) n = 2,010	Moderately low-income (>100% -138% FPL) n = 856	P-value
Non-Hispanic other races	7.2	7.0	7.8	
Marital status				0.0023
Married	31.9	28.9	38.6	
Not married (includes those who were never married, divorced, widowed)	68.1	71.1	61.4	
Region				0.0933
Northeast	14.8	15.3	13.5	
Midwest	21.6	23.3	17.8	
South	44.8	43.5	47.7	
West	19.0	18.0	21.2	
Education				0.0403
No HS degree	29.1	29.7	27.8	
HS degree or GED	37.0	38.7	33.2	
Beyond HS, some college	26.3	24.8	29.5	
Bachelor's degree or higher	7.7	6.9	9.6	
Ever unemployed during the year				<0.0001
Yes	71.0	76.7	58.4	
No	29.0	23.3	41.7	

Reported statistics were survey weighted. *P*-values were calculated by using chi-square test. Abbreviations: FPL, federal poverty level; HS, high school.

Table 2.

Health profiles and health care uses for low-income adults aged 18–64 years with hypertension, by income level, 2014 and 2015 Medical Expenditure Panel Survey

Variables	Total low-income population N = 2,866	Very low-income (< 100% FPL) n = 2,010	Moderately low-income (>100%–138% FPL) n = 856	P-value
Perceived health status (%)				0.5330
Excellent/very good	23.7	23.4	24.3	
Good	31.8	31.2	33.3	
Fair/poor	44.5	45.4	42.3	
Body mass index (%)				0.8890
Underweight/normal (<25)	22.1	22.2	21.9	
Overweight (25–30)	28.8	28.4	29.6	
Obese (30+)	49.1	49.4	48.5	
Current smoker (%)	33.5	35.8	28.5	0.0062
High cholesterol (%)	54.5	52.7	58.5	0.0227
Diabetes (%)	23.8	22.8	26.0	0.2035
Any cardiovascular disease (%) ^a	30.2	31.1	28.2	0.2668
Two or more chronic conditions (%) ^b	51.8	52.2	50.9	0.6461
Any limitations (physical, cognitive, emotional) (%)	59.4	61.4	55.1	0.0129
Total annual medical expenditure per capita				0.1130
Mean	\$10,142	\$9,199	\$12,234	
(SE)	(747)	(556)	(1,880)	
Total annual Medicaid expenditure per capita for those with any Medicaid coverage				0.5190
Mean	\$6,404	\$6,546	\$5,961	
(SE)	(414)	(477)	(786)	
No. of outpatient visits per year				0.8150
Mean	11.3	11.4	11.0	
(SE)	(0.8)	(1.0)	(1.1)	
No. of emergency room visits per year				0.005
Mean	0.5	0.6	0.4	
(SE)	(0.0)	(0.0)	(0.0)	

Variables	Total low-income population N = 2,866	Very low-income (100% FPL) n = 2,010	Moderately low-income (>100%– 138% FPL) n = 856	P-value
No. of inpatient discharges per year				0.5270
Mean	0.2	0.2	0.2	
(SE)	(0.0)	(0.0)	(0.0)	
No. of prescription drugs filled per year				0.2290
Mean	32.2	33.1	30.3	
(SE)	(1.3)	(1.8)	(1.6)	

Reported statistics were survey weighted. *P*-values were calculated by using chi-square test for categorical variables and *t*-test for continuous variables. Abbreviation: FPL, federal poverty level.

^aCardiovascular disease conditions include coronary heart disease, angina, heart attack (MI), other heart disease, and stroke.

^bChronic conditions included any cardiovascular diseases, cancer, diabetes, high cholesterol, arthritis, joint pain, chronic bronchitis, emphy-sema, asthma, and chronic depression.

Table 3.

Estimated annual total medical costs by income level and Medicaid coverage status for adults aged 18–64 years with hypertension, 2014 and 2015 Medical Expenditure Panel Survey

Medicaid coverage during the year	Total low-income population N = 2,866			Very low-income (< 100% FPL) n = 2,010			Moderately low-income (>100%–138% FPL) n = 856		
	\$	(95% CI)		\$	(95% CI)		\$	(95% CI)	
Total annual medical expenditure									
No	7,582	(6,595–9,031)	6,378	(5,492–7,369)	8,985	(5,128–13,715)			
1–11 months	10,645	(6,988–16,191)	9,829	(6,084–14,851)	8,501	(4,502–17,669)			
Full year	13,085	(11,831–15,944)	11,652	(10,309–13,219)	17,639	(8,117–27,611)			
Total annual Medicaid expenditure									
No	0	0	0	0	0	0			
1–11 months	2,166	(1,444–3,202)	2,146	(959–3,279)	1,824	(869–3,064)			
Full year	5,770	(5,037–6,508)	6,175	(5,496–7,397)	5,453	(4,200–7,108)			

Survey weight-adjusted generalized linear models were estimated with a log link and gamma distribution. Predicted mean and 95% confidence intervals (CIs) were presented. Models adjusted for age, sex, race/ethnicity, marital status, region, education, ever unemployed during the year, other insurance coverage, year, perceived health status, body mass index, current smoker, high cholesterol, diabetes, having any cardiovascular disease, and having any physical, cognitive, or emotional limitations. Abbreviation: FPL, federal poverty level.

Table 4.

Incidence rate ratio of health care uses by income level and Medicaid coverage status for adults aged 18–64 years with hypertension, 2014 and 2015 Medical Expenditure Panel Survey

Medicaid coverage during the year	Total low-income population <i>N</i> = 2,866			Very low-income (< 100% FPL) <i>n</i> = 2,010			Moderately low-income (>100%–138% FPL) <i>n</i> = 856			F test comparison of very vs. moderately low-income ^d
	IRR	(95% CI)	IRR	(95% CI)	IRR	(95% CI)	IRR	(95% CI)		
No. of outpatient visits										
No	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.	NA	
1–11 months	1.15	(0.83–1.60)	1.15	(0.81–1.65)	1.14	(0.64–2.01)	1.14	(0.64–2.01)	NA	
Full year	1.80 ^{***}	(1.47–2.22)	1.99 ^{***}	(1.60–2.47)	1.50 ^{**}	(1.14–1.98)	1.50 ^{**}	(1.14–1.98)	0.083	
No. of emergency room visits										
No	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.	NA	
1–11 months	1.43	(0.91–2.27)	1.15	(0.67–1.98)	2.51 [*]	(1.00–6.31)	2.51 [*]	(1.00–6.31)	NA	
Full year	1.36 ^{**}	(1.11–1.68)	1.29	(0.99–1.68)	1.57 ^{**}	(1.19–2.09)	1.57 ^{**}	(1.19–2.09)	<0.001	
No. of inpatient discharges										
No	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.	NA	
1–11 months	0.82	(0.39–1.74)	1.01	(0.42–2.43)	0.76	(0.14–4.17)	0.76	(0.14–4.17)	NA	
Full-year	1.82 ^{**}	(1.33–2.49)	1.83 ^{**}	(1.25–2.70)	1.98 ^{**}	(1.24–3.15)	1.98 ^{**}	(1.24–3.15)	0.432	
No. of prescription drugs filled										
No	1.00	Ref.	1.00	Ref.	1.00	Ref.	1.00	Ref.	NA	
1–11 months	1.06	(1.06–1.59)	0.96	(0.73–1.26)	1.45	(0.96–2.21)	1.45	(0.96–2.21)	NA	
Full year	1.81 ^{***}	(1.55–2.11)	1.73 ^{***}	(1.45–2.07)	2.14 ^{***}	(1.72–2.66)	2.14 ^{***}	(1.72–2.66)	<0.001	

Survey weight-adjusted negative binomial regression models were estimated. Incidence rate ratios (IRRs) and 95% confidence intervals (CIs) were presented. Models adjusted for age, sex, race/ethnicity, marital status, region, education, ever unemployed during the year, other insurance coverage, year, perceived health status, body mass index, current smoker, high cholesterol, diabetes, having any cardiovascular disease, and having any physical, cognitive, or emotional limitations. Abbreviations: FPL, federal poverty level; NA, not applicable.

^a Conducted only among the full-year Medicaid coverage subgroups.

* *P* < 0.05;

** *P* < 0.01;

*** *P* < 0.001.