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Racial and Ethnic Differences in Hypertension-Related Telehealth and In-Person Outpatient Visits Before and During the COVID-19 Pandemic Among Medicaid Beneficiaries

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Abstract

Background: Little is known about the trends and costs of hypertension management through telehealth among individuals enrolled in Medicaid.

Methods: Using MarketScan® Medicaid database, we examined outpatient visits among people with hypertension aged 18–64 years. We presented the numbers of hypertension-related telehealth and in-person outpatient visits per 100 individuals and the proportion of hypertension-related telehealth outpatient visits to total outpatient visits by month, overall, and by race and ethnicity. For the cost analysis, we presented total and patient out-of-pocket (OOP) costs per visit for telehealth and in-person visits in 2021.

Results: Of the 229,562 individuals, 114,445 (49.9%) were non-Hispanic White, 80,692 (35.2%) were non-Hispanic Black, 3,924 (1.71%) were Hispanic. From February to April 2020, the number

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Disclosure Statement

No competing financial interests exist.

of hypertension-related telehealth outpatient visits per 100 persons increased from 0.01 to 6.13, the number of hypertension-related in-person visits decreased from 61.88 to 52.63, and the proportion of hypertension-related telehealth outpatient visits increased from 0.01% to 10.44%. During that same time, the proportion increased from 0.02% to 13.9% for non-Hispanic White adults, from 0.00% to 7.58% for non-Hispanic Black adults, and from 0.12% to 19.82% for Hispanic adults. The average total and patient OOP costs per visit in 2021 were $83.82 (95% confidence interval [CI], 82.66–85.05) and $0.55 (95% CI, 0.42–0.68) for telehealth and $264.48 (95% CI, 258.87–269.51) and $0.72 (95% CI, 0.65–0.79) for in-person visits, respectively.

Conclusions: Hypertension management via telehealth increased among Medicaid recipients regardless of race and ethnicity, during the COVID-19 pandemic. These findings may inform telehealth policymakers and health care practitioners.

Keywords

hypertension-related telehealth; telehealth outpatient; in-person outpatient; telehealth outpatient cost; COVID-19; race; ethnicity; Medicaid

Introduction

Hypertension (blood pressure over 130/80 mm Hg) is the leading risk factor for cardiovascular disease–related morbidity and mortality in the United States.[1,2] From 2017 to 2020, an estimated 47% of adults (122.4 million) aged >20 years were diagnosed with hypertension.[1] In 2017–2018, hypertension cost the nation >$52 billion annually.[1] The prevalence of hypertension is disproportionately higher among racial and ethnic minorities.[1] In 2017–2020, 58% of non-Hispanic Black women and 58% of non-Hispanic Black men were diagnosed with hypertension compared with 43% and 49% among non-Hispanic White women and men, respectively. Among Hispanic individuals, 50% of men were diagnosed with hypertension, whereas 35% of Hispanic women were diagnosed with hypertension, the lowest among any group. Higher rates persist among Medicaid recipients, who have a demographic makeup of ~ 50% Black or Hispanic.[3,4] Among 19- to 64-year-olds, 28% of Medicaid recipients are diagnosed with hypertension, compared with 22% of privately insured persons.[3,5]

In addition to disparities in hypertension prevalence, disparities persist in management of high blood pressure.[1,6-8] Controlling hypertension is a priority for the nation's leading public health entities.[1,9] Adverse effects of hypertension can be reduced by preventing disease progression through consistent hypertension management[10] and ongoing patient–clinician communication to achieve hypertension control.[11,12] One such tool is telehealth, involving the exchange of medical information via remote electronic communication (e.g., remote monitoring or virtual follow-ups).[13] Prompted by state-mandated stay-at-home orders, telehealth use proliferated during the COVID-19 pandemic[14,15] to address delays in doctor visits[16,17] and interrupted continuity of care.[11,15,18] Telehealth use facilitated access to clinical care during the pandemic[11,16,19] and may reduce health disparities.[20,21]

The rise of telehealth during the COVID-19 pandemic and its potential to reduce barriers to care is well documented.[20-23] Yet, no study has analyzed the trends and costs of

telehealth for hypertension management by race and ethnicity. This study aims to examine the following outcomes by race and ethnicity among individuals with Medicaid (1) trends in hypertension-related outpatient visits (telehealth and in-person) before and during the COVID-19 pandemic (2019–2021) and (2) costs of outpatient visits in 2021.

Methods

DATA SOURCE

We used the Merative® MarketScan® Multi-States Medicaid Database from January 1, 2017 to December 31, 2021.[24] The MarketScan Medicaid Database contains administrative claims data from 5 to 13 states for each year and unique IDs to follow individuals over time. The Medicaid Database ranged from 9.0 million enrollees in 2017 to 9.4 million in 2021. We accessed the data through Merative Treatment Pathways, which allows researchers to extract data through online query-based tools. This project was not considered to be human subjects research and therefore did not require Institutional Review Board approval.

STUDY SAMPLE

The study sample included people aged 18–64 years with diagnosed hypertension in 2017–2018, 2 years of lookback periods, without including children or the dual Medicare-eligible population because their health care utilization patterns might be different from people aged 18–64 years.[25] Individuals were defined as having hypertension if they had at least one inpatient or emergency department visit or two outpatient visits 30 days apart with *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) diagnoses codes 110–I15 (Supplementary Table S1). In addition, these adults had to be continuously enrolled in Medicaid during 2017–2021. We excluded people who had pregnancy-related ICD-10-CM, diagnosis-related group (DRG), or ICD-10-PCS (procedure coding system) codes (Supplementary Table S1).[26]

HYPERTENSION-RELATED OUTPATIENT VISITS (TELEHEALTH AND IN-PERSON)

Telehealth outpatient visits were defined as an outpatient claim with a telehealth-related place of service code or procedure modifier and counted based on unique service date for the visit. In-person outpatient visits were defined as an outpatient claim without a telehealth-related place of service code or procedure modifier (Supplementary Table S2) and counted based on unique service date for the visit. Outpatient visits were considered hypertension-related if the claim contained at least one hypertension diagnosis (Supplementary Table S1).

HYPERTENSION-RELATED COSTS (PER VISIT)

We estimated the (1) average cost per outpatient visit (telehealth and in-person), (2) average out-of-pocket (OOP) cost for individuals per visit, and (3) share of patients' OOP costs to total costs. The cost analysis was restricted to persons with noncapitated insurance plans in 2021, because payment information from managed care and capitated insurance plans are unreliable. Year 2021 was selected to include the most recent cost data available in MarketScan. All cost estimates are presented per visit at 2021 price levels.

INDIVIDUAL CHARACTERISTICS

Racial and ethnic groups were classified by the MarketScan data team into three groups: non-Hispanic White, non-Hispanic Black, and Hispanic. Estimates for other race and ethnicity groups could not be reported owing to small sample size and data-user agreements; however, individuals from these groups were included in the overall results.

STATISTICAL ANALYSIS

From January 1, 2019 to December 31, 2021, we calculated (1) monthly numbers of hypertension-related telehealth and in-person outpatient visits per 100 individuals and (2) monthly proportions of hypertension-related telehealth outpatient visits (i.e., the total number of hypertension-related telehealth outpatient visits divided by the total number of hypertension-related outpatient visits).

We tested differences in monthly estimates by race and ethnicity using analysis of variance and differences for non-Hispanic White versus non-Hispanic Black, non-Hispanic White versus Hispanic, and non-Hispanic Black versus Hispanic using Welch's two-tailed *t*-test. The month-to-month changes from February 2020 (i.e., the month before the COVID-19 pandemic declaration) to June 2020 (i.e., the end of the stay-at-home order period in most states[17]) were tested with Welch's two-tailed *t*-test. A value of $p < 0.05$ indicated statistical significance.

We determined monthly averages of all months from January 2019 to February 2020 (pre-COVID-19 pandemic period), from March 2020 to December 2021 (during the pandemic), and from July 2020 to December 2021 (after stay-at-home order periods).[17] Hypertension-related outpatient visits were reported per patient per year, and hypertension-related costs were reported per visit for year 2021. We reported mean values and bias-corrected and accelerated bootstrap 95% confidence intervals (CIs) with 1,000 replications for outcomes. We used Stata SE statistical software version 17 (StataCorp, College Station, TX) for all analyses. Data analysis was performed in 2022–2023.

Results

From 2017 to 2021, we identified 229,562 adults aged 18–64 years with hypertension, continuously enrolled in Medicaid, and without a pregnancy diagnosis (Fig. 1). Of the sample, 114,445 (49.9%) were non-Hispanic White, 80,692 (35.2%) were non-Hispanic Black, 3,924 (1.71%) were Hispanic, and 30,501 (13.3%) were classified as other race and ethnicity (Table 1). The mean age (standard deviation [SD]) was 50.2 (10.6) years, and 58.9% of the sample were women.

HYPERTENSION-RELATED OUTPATIENT VISITS (TELEHEALTH AND IN-PERSON)

From January 2019 to February 2020 (pre-COVID-19 pandemic period), the monthly average of hypertension-related telehealth outpatient visits per 100 individuals was 0.01 (Fig. 2 and Supplementary Table S3). From February 2020 to April 2020 (i.e., the month after the COVID-19 pandemic declaration), the number of hypertension-related telehealth outpatient visits per 100 persons increased from 0.01 to 6.13, decreased thereafter to 3.41 in

June 2020, and the monthly average from July 2020 to December 2021 (after stay-at-home order periods) was 1.83. From January 2019 to February 2020, the monthly average of the number of hypertension-related in-person outpatient visits per 100 individuals was 62.66. The number decreased from 61.88 in February 2020 to 52.63 in April 2020 (14.95% decrease), and thereafter returned to a prepandemic level (61.97) in June 2020. The monthly average from July 2020 to December 2021 was 64.67.

Compared with non-Hispanic White and Hispanic adults, non-Hispanic Black adults had statistically significantly more hypertension-related in-person outpatient visits during pre-COVID-19 and COVID-19 pandemic periods (Fig. 3 A). The average number of in-person visits was more than twice as high for non-Hispanic Black adults as for non-Hispanic White and Hispanic adults (Supplementary Table S3B; $p < 0.001$). During the pre-COVID-19 period, the monthly average number of hypertension-related in-person visits per 100 adults was 44.89 for non-Hispanic White, 92.86 for non-Hispanic Black, and 42.49 for Hispanic individuals. The numbers were lowest in April 2020: 34.14 for non-Hispanic White, 84.39 for non-Hispanic Black, and 29.79 for Hispanic individuals.

The numbers of hypertension-related telehealth visits were statistically significantly different across racial and ethnic groups during the COVID-19 period (Fig. 3B and Supplementary Table S3A). Compared with non-Hispanic White adults (1.92), non-Hispanic Black adults (2.61) had a higher monthly average of hypertension-related telehealth visits per 100 individuals ($p < 0.001$). For non-Hispanic White adults, the number of telehealth visits per 100 individuals was 0.01 in February 2020, increased to 5.51 in April 2020, and the monthly average from July 2020 to December 2021 was 1.58 ($p < 0.001$; Fig. 3; Supplementary Table S3A). For non-Hispanic Black adults, the number was 0.00 in February 2020, increased to 6.92 in April 2020, and the monthly average from July 2020 to December 2021 was 2.17.

For Hispanic individuals, the number was 0.05 in February 2020, increased to 7.36 in April 2020, and the monthly average from July 2020 to December 2021 was 2.09. The differences in telehealth use by race and ethnicity were all statistically significantly different ($p < 0.001$) each month from March 2020 to December 2021 (Supplementary Table S3A).

Proportion of hypertension-related telehealth outpatient visits.—Figure 4 presents the proportion of hypertension-related telehealth outpatient visits out of all outpatient visits (both telehealth and in-person), overall, and by race and ethnicity. The monthly average proportion of telehealth visits from January 2019 to February 2020 was 0.01%. The proportion increased to 10.44% in April 2020, decreased to 5.22% in June 2020, and from July 2020 to December 2021 it was 2.76% ($p < 0.001$; Supplementary Table S3C).

The proportions of telehealth to total outpatient visits were statistically significantly different among the racial and ethnic groups during March 2020–September 2021 (except February 2021) (Fig. 4; Supplementary Table S3C; $p < 0.01$). During the peak of telehealth use in April 2020, the proportions reached 19.82% for Hispanic, 13.90% for non-Hispanic White, and 7.58% for non-Hispanic Black adults. The monthly averages of the proportions from

July 2020 to December 2021 were 4.79% for Hispanic, 3.42% for non-Hispanic White, and 2.20% for non-Hispanic Black adults.

Costs of telehealth and in-person outpatient visits.—In the subsample analysis of individuals with noncapitated insurance in 2021 (n = 87,862; Fig. 1), the average total costs for hypertension-related telehealth and in-person visits were $83.82 (95% CI, 82.66–85.05) and $264.48 (95% CI, 258.87–269.51) per visit, respectively (Table 2). The patient's OOP costs for telehealth and in-person visits were $0.55 (95% CI, 0.42–0.68) and $0.72 (95% CI, 0.65–0.79) per visit, respectively.

The average cost of telehealth per visit was lower for Hispanic ($69.47, 95% CI, 60.07–80.52) than for non-Hispanic Black ($84.35, 95% CI, 82.49–86.29) and non-Hispanic White adults ($82.65, 95% CI, 80.28–84.59).

The average cost of in-person visits was higher for non-Hispanic White ($290.12, 95% CI, 280.49–300.16) than for non-Hispanic Black ($246.63, 95% CI, 239.63–253.74) and Hispanic adults ($246.32, 95% CI, 208.85–293.86).

Discussion

Using the administrative MarketScan Medicaid claim database, we documented the trends and costs of hypertension-related telehealth and in-person outpatient visits among adults with hypertension before and during the COVID-19 pandemic by race and ethnicity. Hypertension-related telehealth use among those with hypertension grew during this period and remained elevated in 2021 compared with the pre-COVID-19 pandemic period. There is a breadth of research addressing the potential benefits of telehealth use in the reduction of health disparities; however, there are concerns regarding the digital divide or "the uneven distribution of information and communication technologies in society" based on access and usage.[27-29] Our own findings highlight how telehealth and in-person utilization increased among all racial and ethnic groups yet disparities remained.

Hispanic adults with hypertension had both the lowest cost per telehealth visit and the highest proportion of hypertension-related telehealth visits. Prior research has reported that Hispanic adults had the lowest self-reported telemedicine use[30] among all racial and ethnic groups. Furthermore, in a study of unique telehealth visits, Hispanic adults had the lowest likelihood of telehealth use[31] compared with non-Hispanic Black and non-Hispanic White adults. These prior studies did not specifically examine individuals using Medicaid, which may have contributed to the difference in our findings.

Another difference with prior studies is that our results found that Hispanic adults had a higher proportion of telehealth visits compared with other racial and ethnic groups even before the COVID-19 pandemic. This could explain the rapid rate of adoption of telehealth among Hispanic adults with hypertension when this option became widely available.

Expanding telehealth use could potentially reduce existing disparities related to hypertension. For example, Hispanic individuals have lower levels of hypertension awareness[32] and treatment[33] compared with non-Hispanic White and non-Hispanic Black

adults. Telehealth offers an opportunity to address this through evidence-based practices like self-measured blood pressure monitoring,[34] increased language concordance with a clinician,[32] and culturally adapted lifestyle interventions. Telehealth visits for routine and preventive care, health and lifestyle education, and patient monitoring are relatively low cost compared with in-person care.[33] Such visits, in turn, can lower cost of care, despite increased utilization. The concern regarding the digital divide remains, although increased access to device ownership and broadband access, and related education can support bridging of the digital divide by improving ease of use of evidence-based practices (e.g., patient monitoring and self-measured blood pressure).[29]

Non-Hispanic Black adults had the lowest proportion of hypertension-related telehealth outpatient visits (driven mainly by the higher number of in-person outpatient visits in the denominator). Previous results are mixed regarding use of telehealth services among non-Hispanic Black individuals. For example, Fischer et al.[35] found that Black individuals were less willing and less likely to use videoconferencing during February–April 2019. In contrast, White-Williams et al.[31] found that non-Hispanic Black individuals were significantly more likely to use telehealth visits compared with non-Hispanic White and Hispanic individuals. Roghani and Panahi[36] similarly found that Black respondents were more likely to use telemedicine compared with other racial and ethnic groups. The differences in the findings may be owing to (1) different time periods (e.g., Fischer et al.[35] focused on pre-COVID-19 pandemic periods), (2) different insurance types (e.g., White-Williams et al.[31] included persons with both commercial and public insurance, whereas we focused on Medicaid), and (3) different measures of telehealth (e.g., Roghani and Panahi[36] measured if providers offered telehealth before or during the COVID-19 pandemic and if participants scheduled telehealth appointments in a survey, whereas we identified the number of hypertension-related telehealth visits in administrative claims database). In addition, prior studies documented any telehealth use, whereas our study focused on hypertension-related telehealth outpatient visits. Our study demonstrated that, among those with hypertension, non-Hispanic Black adults increased their proportion of telehealth visits, but to a lesser extent than non-Hispanic White and Hispanic adults. Future research may explore the underlying mechanisms and reasons for the differences in costs per telehealth visit and telehealth utilization by racial and ethnic groups.

Non-Hispanic Black adults had the most hypertension-related in-person outpatient visits throughout our study periods. Black individuals, especially those of a lower socioeconomic status, may require complex hypertension management[33,37] for more aggressive forms of hypertension[33] compared with other racial and ethnic groups. Black persons have the lowest rates of hypertension control among any racial or ethnic group, despite higher rates of hypertension awareness and treatment compared with Hispanic adults.[1] Hypertension management can include complementary use of telehealth and in-person strategies,[38] which can improve access to complex specialty care[38-40] and multidisciplinary collaboration.[38]

Studies examining the U.S. Medicaid population provide valuable information on the role of telehealth and Medicaid in increasing access to care for low-income adults—because Medicaid-insured adults are more likely to be of lower Socioeconomic status (SES) compared with privately insured adults.[41] Medicaid populations have much lower OOP costs

compared with the privately insured,[22,42] and lower OOP costs are likely to be associated with higher utilization of care.[43] The combination of (1) Medicaid enabling low OOP costs and (2) telehealth reducing logistical barriers to care may facilitate improved hypertension management and reduce health disparities in hypertension awareness, treatment, and control.

This study is subject to limitations. First, the MarketScan Medicaid database contains data from only five to eight states in recent years—thus our results may not be generalizable to the entire U.S. Medicaid population and may suffer from regionalization. Second, this study included only individuals who were continuously enrolled in Medicaid and failed to capture those who dropped out of Medicaid or joined Medicaid during the pandemic. Third, the sample size of the Hispanic population was much smaller than that of non-Hispanic White and non-Hispanic Black populations, which could lead to a greater margin for error. Fourth, this study was focused only on Medicaid recipients, and the findings cannot be generalized to other publicly and privately insured adults with hypertension. Fifth, owing to the use of claims data, there is a potential risk for reporting errors because of telehealth coding discrepancies.[44]

Conclusions

Hypertension management via telehealth outpatient services increased during the COVID-19 pandemic among Medicaid recipients regardless of race and ethnicity compared with the pre-COVID-19 pandemic period. Hispanic adults had the highest proportion of hypertension-related telehealth visits of any racial and ethnic group, whereas non-Hispanic Black adults had the highest total number of telehealth and in-person outpatient visits. The growth and sustained elevated rates of telehealth use may indicate both increased availability and reimbursement as well as acceptance of telehealth for hypertension management. Research that further examines the factors fueling disparities in telehealth use and cost—while contextualizing the role of race and ethnicity—may help reduce disparities, improve access to care, and support hypertension management.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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REFERENCES

1. Tsao CW, Aday AW, Almarzooq ZI, et al. Heart disease and stroke statistics—2023 update: A report from the American Heart Association. Circulation 2023;147(8):e93–e621; doi: 10.1161/CIR.0000000000001123 [PubMed: 36695182]
2. Centers for Disease Control and Prevention. Know Your Risk for Heart Disease, 2023. Available from: https://www.cdc.gov/heartdisease/risk_factors.htm [Last accessed: August 9, 2023].
3. Centers for Medicare and Medicaid Services. Program History. Available from: https://www.medicaid.gov/about-us/program-history/index.html [Last accessed: June 5, 2023].

4. Michener JD. Politics, pandemic, and racial justice through the lens of Medicaid. Am J Public Health 2021;111(4):643–646; doi: 10.2105/ajph.2020.306126 [PubMed: 33507819]
5. Centers for Medicare and Medicaid Services. Medicaid Facts and Figures, 2020. Available from: https://www.cms.gov/newsroom/fact-sheets/medicaid-facts-and-figures [Last accessed: June 5, 2023].
6. Fryar CD, Ostchega Y, Hales CM, et al. Hypertension prevalence and control among adults: United States, 2015–2016. NCHS Data Brief 2017;289:1–8.
7. Wall HK, Ritchey MD, Gillespie C, et al. Vital signs: Prevalence of key cardiovascular disease risk factors for million hearts 2022—United States, 2011–2016. MMWR Morb Mortal Wkly Rep 2018;67(35):983–991; doi: 10.15585/mmwr.mm6735a4 [PubMed: 30188885]
8. Muntner P, Hardy ST, Fine LJ, et al. Trends in blood pressure control among US adults with hypertension, 1999–2000 to 2017–2018. JAMA 2020;324(12):1190–1200; doi: 10.1001/jama.2020.14545 [PubMed: 32902588]
9. Substance Abuse and Mental Health Services Administration Office of the Surgeon General. Publications and Reports of the Surgeon General. In: The Surgeon General's Call to Action to Control Hypertension. U.S. Department of Health and Human Services: Washington, DC; 2020.
10. Lee W-R, Yoo K-B, Jeong J, Koo JH. Chronic disease management for people with hypertension. Int J Public Health 2022;67:1604452. [PubMed: 35719730]
11. Khera A, Baum SJ, Gluckman TJ, et al. Continuity of care and outpatient management for patients with and at high risk for cardiovascular disease during the COVID-19 pandemic: A scientific statement from the American Society for Preventive Cardiology. Am J Prev Cardiol 2020;1:100009. [PubMed: 32835347]
12. Brigo E, Rintala A, Kossi O, et al. Using telehealth to guarantee the continuity of rehabilitation during the COVID-19 pandemic: A systematic review. Int J Environ Rese Public Health 2022;19(16):10325.
13. Drake C, Lewinski AA, Rader A, et al. Addressing hypertension outcomes using telehealth and population health managers: Adaptations and implementation considerations. Curr Hypertens Rep 2022;24(8):267–284. [PubMed: 35536464]
14. Wong MYZ, Gunasekeran DV, Nusinovici S, et al. Telehealth demand trends during the COVID-19 pandemic in the top 50 most affected countries: Infodemiological evaluation. JMIR Public Health Surveill 2021;7(2):e24445. [PubMed: 33605883]
15. Czeisler MÉ, Marynak K, Clarke KE, et al. Delay or avoidance of medical care because of COVID-19–related concerns—United States, June 2020. MMWR Morb Mortal Wkly Rep 2020;69(36):1250–1257. [PubMed: 32915166]
16. Abbas A, Hannan J, Stolp H, et al. Commitment to hypertension control during the COVID-19 pandemic: Million Hearts Initiative exemplars. Prev Chronic Dis 2022;19:E47. [PubMed: 35926561]
17. Moreland A, Herlihy C, Tynan MA, et al. Timing of state and territorial COVID-19 stay-at-home orders and changes in population movement—United States, March 1–May 31, 2020. MMWR Morb Mortal Wkly Rep 2020;69(35):1198–1203; doi: 10.15585/mmwr.mm6935a2 [PubMed: 32881851]
18. Riera R, Bagattini ÂM, Pacheco RL, et al. Delays and disruptions in cancer health care due to COVID-19 pandemic: Systematic review. JCO Glob Oncol 2021;7(1):311–323. [PubMed: 33617304]
19. Alshiyab DM, Al-Qarqaz FA, Muhaidat JM. Impact of COVID-19 pandemic on the continuity of care for dermatologic patients on systemic therapy during the period of strict lockdown. Ann Med Surg 2020;60:571–574.
20. Koonin LM, Hoots B, Tsang CA, et al. Trends in the use of telehealth during the emergence of the COVID-19 pandemic—United States, January–March 2020. MMWR Morb Mortal Wkly Rep 2020;69(43):1595–1599. [PubMed: 33119561]
21. Demeke HB, Merali S, Marks S, et al. Trends in use of telehealth among health centers during the COVID-19 pandemic—United States, June 26–November 6, 2020. MMWR Morb Mortal Wkly Rep. 2021;70(7):240–244. [PubMed: 33600385]

22. Lee JS, Lowe Beasley K, Schooley MW, et al. Trends and costs of US telehealth use among patients with cardiovascular disease before and during the COVID-19 Pandemic. J Am Heart Assoc 2023;12(4):e028713. [PubMed: 36789857]
23. Chao GF, Li KY, Zhu Z, et al. Use of telehealth by surgical specialties during the COVID-19 pandemic. JAMA Surg 2021;156(7):620–626. [PubMed: 33769434]
24. Truven Health MarketScan® Research Databases. Available from: https://marketscan.truvenhealth.com/marketscanportal [Last accessed: March 9, 2023].
25. Lee EC, Grigorescu V, Enogieru I, et al. Updated National Survey Trends in Telehealth Utilization and Modality (2021–2022). U.S. Department of Health and Human Services, 2023.
26. Kuklina E, Tong X, Bansil P, et al. Trends in pregnancy hospitalizations that included a stroke in the United States From 1994 to 2007: Reasons for Concern? Stroke 2011;42:2564–2570; doi: 10.1161/STROKEAHA.110.610592 [PubMed: 21799174]
27. Haynes N, Ezekwesili A, Nunes K, et al. "Can you see my screen?" Addressing racial and ethnic disparities in telehealth. Curr Cardiovasc Risk Rep 2021;15(12):23. [PubMed: 34900074]
28. Weber E, Miller SJ, Astha V, et al. Characteristics of telehealth users in NYC for COVID-related care during the coronavirus pandemic. J Am Med Inform Assoc 2020;27(12):1949–1954. [PubMed: 32866249]
29. Gonzalez S B Bhatt A, Pagliaro JA. Optimizing telehealth for special populations and closing the digital divide: Addressing social determinants of health in virtual care. In: Healthcare Information Technology for Cardiovascular Medicine: Telemedicine & Digital Health; 2021; pp. 101–110.
30. Lucas JW, Villarroel MA. Telemedicine use among adults: United States, 2021. NCHS Data Brief 2022;445:1–8.
31. White-Williams C, Liu X, et al. Use of telehealth among racial and ethnic minority groups in the United States before and during the COVID-19 pandemic. Public Health Rep 2023;138(1):149–156; doi: 10.1177/00333549221123575 [PubMed: 36113138]
32. Aggarwal R, Chiu N, Wadhera RK, et al. Racial/ethnic disparities in hypertension prevalence, awareness, treatment, and control in the United States, 2013 to 2018. Hypertension 2021;78(6):1719–1726; doi: 10.1161/HYPERTENSIONAHA.121.17570 [PubMed: 34365809]
33. Gu A, Yue Y, Desai RP, et al. Racial and ethnic differences in antihypertensive medication use and blood pressure control among US adults with hypertension. Circ Cardiovasc Qual Outcomes 2017;10(1):e003166; doi: 10.1161/CIRCOUTCOMES.116.003166 [PubMed: 28096206]
34. Parati G, Lombardi C, Pengo M, et al. Current challenges for hypertension management: From better hypertension diagnosis to improved patients' adherence and blood pressure control. International J Cardiol 2021;331:262–269, doi: 10.1016/j.ijcard.2021.01.070
35. Fischer SH, Ray KN, Mehrotra A, et al. Prevalence and characteristics of telehealth utilization in the United States. JAMA Netw Open 2020;3(10):e2022302. [PubMed: 33104208]
36. Roghani A, Panahi S. Does telemedicine reduce health disparities? Longitudinal Evidence during the COVID-19 Pandemic in the US. medRxiv 2021.
37. Konrad TR, Howard DL, Edwards LJ, et al. Physician-patient racial concordance, continuity of care, and patterns of care for hypertension. Am J Public Health 2005;95(12):2186–2190; doi: 10.2105/ajph.2004.046177 [PubMed: 16257949]
38. Tiara N, Jackson MS, Bostic M, et al. Telehealth use to address cardiovascular disease and hypertension in the United States: A systematic review and meta-analysis, 2011–2021. Telemed Rep 2023;4(1):67–86; doi: 10.1089/tmr.2023.0011 [PubMed: 37283852]
39. Garfan S, Alamoodi A, Zaidan B, et al. Telehealth utilization during the Covid-19 pandemic: A systematic review. Comput Biol Med 2021;138:104878. [PubMed: 34592585]
40. Guide to Community Preventive Services. Heart Disease and Stroke Prevention: Team-based Care to Improve Blood Pressure Control. The Community Guide, 2021. Available from: https://thecommunityguide.org/findings/heart-disease-stroke-prevention-team-based-care-improve-blood-pressure-control.html [Last accessed: February 10, 2023].
41. Becker G, Newsom E. Socioeconomic status and dissatisfaction with health care among chronically ill African Americans. Am J Public Health 2003;93(5):742–748. [PubMed: 12721135]

42. Sommers BD, Long SK, Baicker K. Changes in mortality after Massachusetts health care reform: A quasi-experimental study. Ann Intern Med 2014;160(9):585–593; doi: 10.7326/m13-2275 [PubMed: 24798521]

43. Baker-Goering MM, Roy K, Howard DH. Relationship between adherence to antihypertensive medication regimen and out-of-pocket costs among people aged 35 to 64 with employer-sponsored health insurance. Prev Chronic Dis 2019;16:E32; doi: 10.5888/pcd16.180381 [PubMed: 30900546]

44. Strom BL. Data validity issues in using claims data. Pharmacoepidemiol Drug Safety 2001;10(5):389–392.

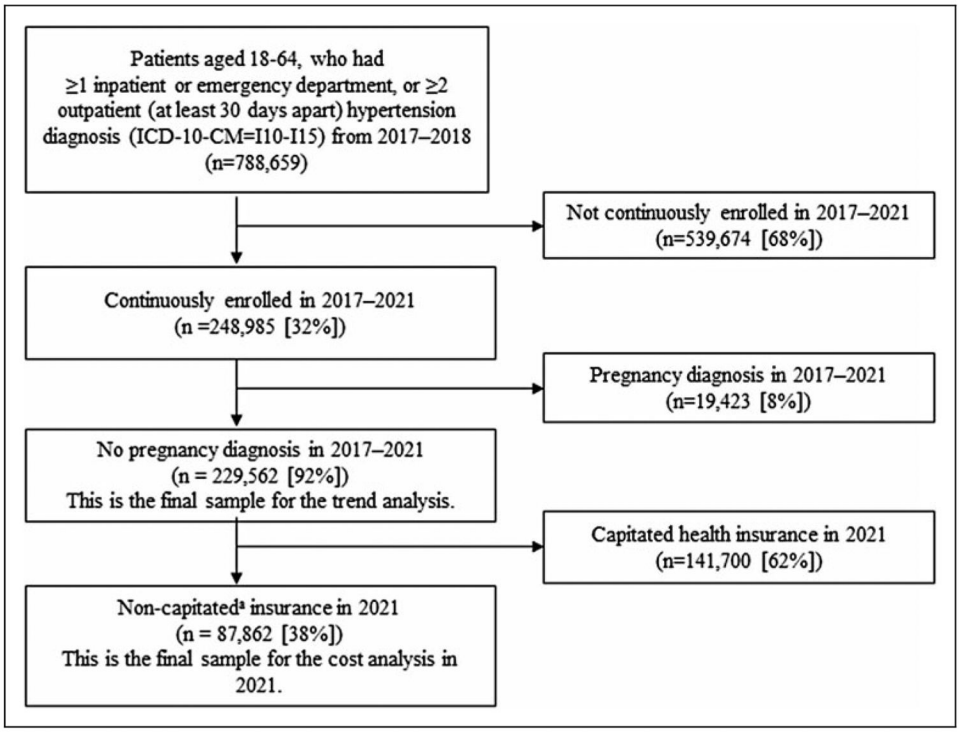

Fig. 1.

Study sample selection of individuals diagnosed with hypertension, MarketScan® Medicaid Database, 2017–2021. For the cost analysis, we restricted our population to those with noncapitated insurance because costs based on capitated plans are unreliable. ICD-10-CM; International Classification of Diseases, Tenth Revision, Clinical Modification.

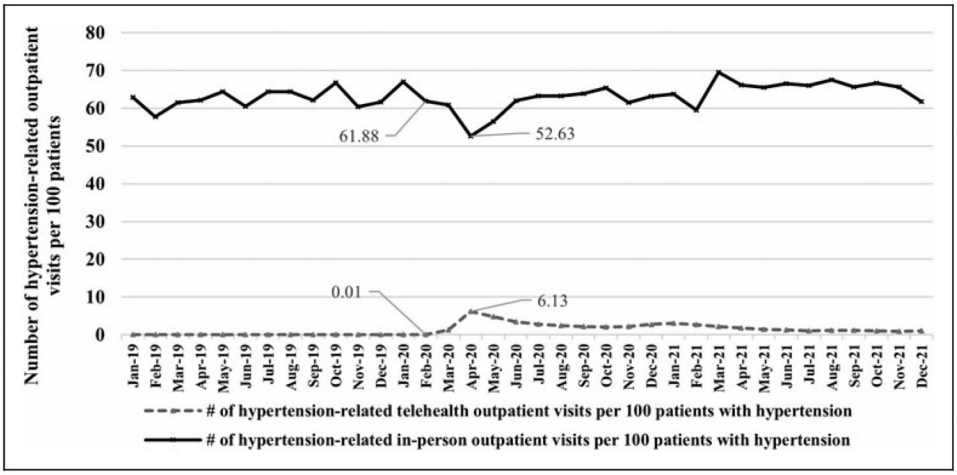

Fig. 2.

The numbers of hypertension-related telehealth and in-person outpatient visits per 100 persons, MarketScan Medicaid Database, 2019–2021

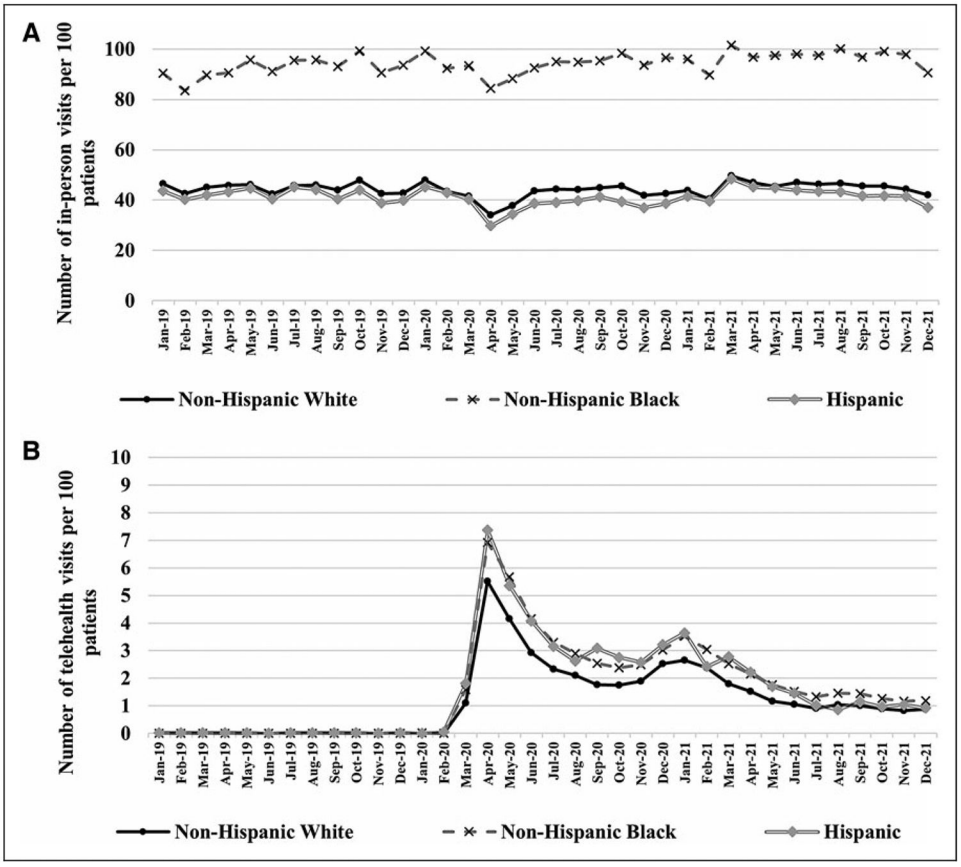

Fig. 3.

The numbers of hypertension-related telehealth and in-person outpatient visits per 100 persons by race and ethnicity, MarketScan Medicaid Database, 2019–2021.[a] **(A)** Number of in-person outpatient visits per 100 persons. **(B)** Number of telehealth visits per 100 persons.

[a]114,445 non-Hispanic White, 80,692 non-Hispanic Black, and 3,924 Hispanic adults.

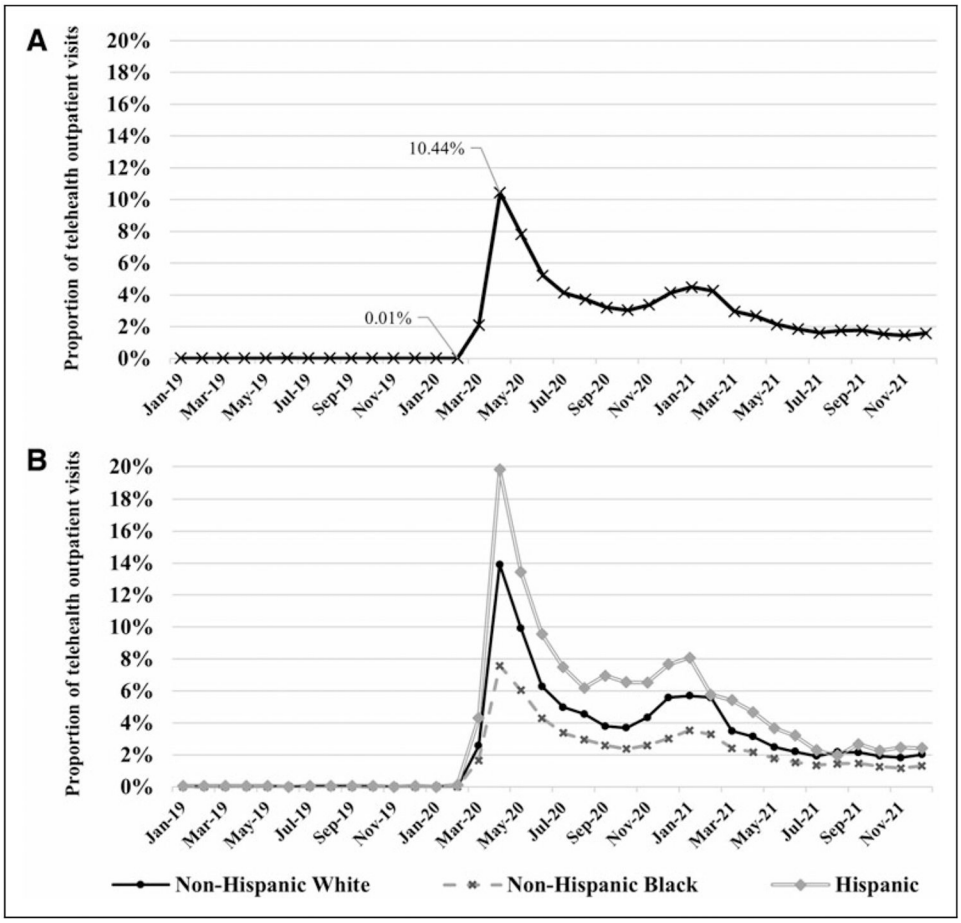

Fig. 4.

Proportion of hypertension-related telehealth outpatient visits overall **(A)** and by race and ethnicity **(B)**, MarketScan Medicaid Database, 2019–2021.[a] **(A)** Overall. **(B)** By race and ethnicity. [a]On the Y-axis, we report the percentage of hypertension-related telehealth outpatient visits with a claim diagnosis of hypertension among people with established hypertension (i.e., the total number of telehealth outpatient visits with a claim diagnosis of hypertension divided by the total number of outpatient visits with a claim diagnosis of hypertension, then multiplied by 100 among persons with established hypertension). The numerators (total number of telehealth outpatient visits with a claim diagnosis of hypertension) and denominators (total number of outpatient visits with a claim diagnosis of hypertension) are reported in Supplementary Table S1. Hypertension-related outpatient visits mean that the visits include a claim diagnosis of hypertension (ICD-10-CM = I10–I15). Of the 229,562 adults with established hypertension (Fig. 1), there were 114,445 non-Hispanic White; 80,692 non-Hispanic Black; and 3,924 Hispanic adults.

Table 1.

Summary Statistics, MarketScan Medicaid Database 2016–2021[a]

	ALL SAMPLE FOR TREND ANALYSIS	ALL SAMPLE FOR COST ANALYSIS
	N = 229,562	**N = 87,862**
Age, mean (SD)	50.2 (10.6)	51.4 (10.9)
Age groups, *n* (%)		
18–34	20,865 (9.09)	8489 (9.66)
35–44	43,862 (19.11)	12,848 (14.62)
45–54	66,139 (28.81)	22,174 (25.24)
55–64	98,696 (42.99)	44,351 (50.48)
Female, *n* (%)	135,143 (58.87)	50,287 (57.23)
Race categories, *n* (%)		
Non-Hispanic White	114,445 (49.85)	36,299 (41.31)
Non-Hispanic Black	80,692 (35.15)	36,319 (41.34)
Hispanic	3,924 (1.71)	1,024 (1.17)
Other race and ethnicity groups	30,501 (13.29)	14,220 (16.18)

SD, standard deviation.

[a]Of the 229,562 people identified in the sample selection process, there were 87,862 with noncapitated insurance in 2021 for subsample analysis (Fig. 1).

Table 2.

Average Outpatient Visits and Costs for Hypertension-Related Telehealth and In-Person Outpatient Visits Among Individuals with Established Hypertension, MarketScan Medicaid Database, 2021[a]

	ALL, *N*= 87,862	**NON-HISPANIC-WHITE, *n* = 36,299**	**NON-HISPANIC-BLACK, *n* = 36,319**	**HISPANIC, *n* = 1,024**
Telehealth outpatient visits in 2021	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Number of telehealth visits per patient	2.1 (2.02–2.16)	1.8 (1.73–1.89)	2.2 (2.0–2.3)	1.3 (1.1–1.5)
Total costs per visit	$83.82 (82.66–85.05)	$82.65 (80.28–84.59)	$84.35 (82.49–86.29)	$69.47 (60.07–80.52)
Patient OOP payments per visit	$0.55 (0.42–0.68)	$0.45 (0.33–0.57)	$0.68 (0.48–0.88)	$0.60 (0.24–0.96)
Share of patient OOP costs to total costs per visit (%)	0.62	0.51	0.76	0.86
Sample size (*N*)	6,814	2,205	3,170	50
In-person outpatient visits in 2021				
Number of in-person visits per patient	21.5 (21.0–22.0)	15.4 (14.8–16.0)	30.0 (29.1–30.9)	20.8 (15.3–27.1)
Total costs per visit	$264.48 (258.87–269.51)	$290.12 (280.49–300.16)	$246.63 (239.63–253.74)	$246.32 (208.85–293.86)
Patient OOP costs per visit	$0.72 (0.65–0.79)	$0.80 (0.70–0.90)	$0.85 (0.70–1.00)	$1.30 (1.00–1.60)
Share of patient OOP costs to total costs per visit (%)	0.27	0.26	0.33	0.53
Sample size (*N*)	60,872	24,325	25,656	514

[a]Hypertension-related outpatient visits include visits with a claim diagnosis of hypertension (ICD-10-CM = I10–I15). The sample size indicates the number of individuals in the respective groups who had telehealth and in-person outpatient visits in 2021. Total costs for in-person and telehealth were defined by the average cost per outpatient visit for in-person and telehealth visits in 2021, respectively. The share of patient OOP costs to total costs per visit was a ratio of patient OOP costs per visit and total costs per visit. The 95% CIs are the bias-corrected and accelerated bootstrap 95% CIs with 1,000 replications.

CI, confidence interval; ICD-10-CM; International Classification of Diseases, Tenth Revision, Clinical Modification; OOP, out-of-pocket.