HHS Public Access

Author manuscript

Am J Hypertens. Author manuscript; available in PMC 2025 January 16.

Published in final edited form as:

Am J Hypertens. 2024 January 16; 37(2): 107–111. doi:10.1093/ajh/hpad093.

Rural and Urban Differences in Hypertension Management Through Telehealth Before and During the COVID-19 Pandemic Among Commercially Insured Patients

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Abstract

BACKGROUND: The COVID-19 pandemic prompted a rapid increase in telehealth use. However, limited evidence exists on how rural and urban residents used telehealth and in-person outpatient services to manage hypertension during the pandemic.

METHODS: This longitudinal study analyzed 701,410 US adults (18–64 years) in the MarketScan Commercial Claims Database, who were continuously enrolled from January 2017 through March 2022. We documented monthly numbers of hypertension-related telehealth and in-person outpatient visits (per 100 individuals), and the proportion of telehealth visits among all hypertension-related outpatient visits, from January 2019 through March 2022. We used Welch's two-tail t-test to differentiate monthly estimates by rural–urban status and month-to-month changes.

RESULTS: From February through April 2020, the monthly number of hypertension-related telehealth visits per 100 individuals increased from 0.01 to 6.05 ($P < 0.001$) for urban residents and from 0.01 to 4.56 ($P < 0.001$) for rural residents. Hypertension-related in-person visits decreased from 20.12 to 8.30 ($P < 0.001$) for urban residents and from 20.48 to 10.15 ($P < 0.001$) for rural residents. The proportion of hypertension-related telehealth visits increased from 0.04% to 42.15% ($P < 0.001$) for urban residents and from 0.06% to 30.98% ($P < 0.001$)

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Disclosure

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. Use of trade names and commercial sources is for identification only and does not imply endorsement by the US Department of Health and Human Services.

Conflict of Interest

There is no potential conflict of interest related to any part of this article.

for rural residents. From March 2020 to March 2022, the monthly average of the proportions of hypertension-related telehealth visits was higher for urban residents than for rural residents (10.19% vs. 6.96%; $P < 0.001$).

CONCLUSIONS: Data show that rural residents were less likely to use telehealth for hypertension management. Understanding trends in hypertension-related telehealth utilization can highlight disparities in the sustained use of telehealth to advance accessible health care.

Keywords

blood pressure; commercial insurance; hypertension; hypertension management; in-person outpatient; telehealth

Hypertension (blood pressure consistently over 130/80 mm Hg) is the leading risk factor for cardiovascular disease (CVD) in the United States.[1] The Centers for Disease Control and Prevention has made hypertension control a national priority, with a focus on optimizing patient care and addressing social determinants of health to support hypertension management and control.[2] Adverse effects of hypertension can be reduced via consistent hypertension management[3] and ongoing patient–clinician communication to achieve hypertension control.[4,5] Telehealth, the delivery of health services through digital means including audio, video, or monitoring devices, which proliferated during the COVID-19 pandemic,[6] can reduce delays in doctor visits and interruptions in continuity of care.[5]

There are documented disparities in prevalence of self-reported hypertension in rural areas (40%) vs. urban (29%).[7] In addition, the stagnation in CVD mortality declines since 2010 contributed to a reversal in life expectancy gains in rural areas and to a stalling of life expectancy gains in urban areas.[8] Compared to urban residents, rural residents were less likely to use telehealth during the pandemic.[9,10] It was unclear to what extent telehealth was used during the pandemic to manage hypertension by rural and urban individuals.

To address this gap in literature, our study documents the trends in hypertension-related telehealth and in-person outpatient visits by rural-urban status, by following adults with hypertension before (January 2019-February 2020) and during (March 2020-March 2022) the COVID-19 pandemic.

METHODS

Data source

We used the Merative MarketScan Commercial Claims Database from January 1, 2017, to March 31, 2022.[11] The MarketScan database contains administrative claims data for enrollees and their dependents in employer-sponsored insurance (ESI) plans from primarily large employers. The database includes approximately 18–25 million US enrollees with ESI plans during 2017–2021. We extracted individual- and claim-level information, including diagnoses and procedure codes, in addition to place of service, type of insurance, service date, and patients' rural–urban status of residence. The data underlying this article cannot be

shared publicly due to the data use agreement. The program codes used for the study will be available upon request to the corresponding author.

Study sample

We restricted the study sample to adults aged 18–64 years in 2017–2018 who had commercial insurance and were continuously enrolled from January 1, 2017, to March 31, 2022. We excluded those with a pregnancy diagnosis: the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM), Diagnosis Related Group (DRG), and ICD-10-Procedure Coding System (ICD-10-PCS); the respective codes for pregnancy can be found in prior studies.[12,13] We identified people as having diagnosed hypertension if they had at least one inpatient or emergency department or two outpatient claims (30 days apart) with a hypertension diagnosis—the ICD-10-CM codes I10–I15 in 2017–2018.

Study measures

Telehealth outpatient visits were identified using place of service (= 2) and procedure modifiers (= 93, 95, GO, GQ, and GT) (for details of descriptions, see Lee *et al.*[10] and MarketScan database[11]). All other outpatient visits were defined as in-person visits. We defined telehealth and in-person outpatient visits as hypertension-related if the outpatient visit claims contained at least one hypertension diagnosis.

Statistical analysis

The monthly numbers of hypertension-related telehealth and in-person outpatient visits per 100 individuals and the proportion of hypertension-related telehealth visits among all hypertension-related outpatient visits (sum of telehealth and in-person visits) were reported by rural–urban status (urban vs. rural) from January 2019 through March 2022. The definition of rurality relied on the National Center for Health Statistics urban-rural classification scheme for counties; metropolitan counties are urban and nonmetropolitan counties are rural.[11]

We tested the differences in monthly estimates of hypertension-related telehealth and in-person outpatient visits, and the proportions of telehealth visits by rural–urban status. The month-to-month changes from February 2020 (the month before the pandemic) to June 2020 (the last month of COVID-19 stay-at-home order periods[6]) were tested using Welch's two-tail *t*-test. We provided the monthly average of the estimates in pre-COVID-19 pandemic (January 2019–February 2020), during the COVID-19 pandemic ("COVID-19," March 2020–March 2022), and after the stay-at-home order period[6] (July 2020–March 2022). A P value <0.05 indicates statistical significance. We used Stata SE statistical software version 17.0 (StataCorp, College Station, Texas) for the analyses. Data analysis was performed in 2023.

RESULTS

We identified 701,410 individuals who satisfied the sample inclusion criteria. Of those, 585,539 (83%) lived in urban areas and 115,871 (17%) in rural areas. From February to

April 2020, the monthly number of hypertension-related telehealth visits per 100 persons increased from 0.01 to 6.05 ($P < 0.001$) for urban areas and from 0.01 to 4.56 ($P < 0.001$) for rural areas, whereas the monthly number of hypertension-related in-person visits per 100 individuals decreased from 20.12 to 8.30 ($P < 0.001$) for urban areas and from 20.48 to 10.15 ($P < 0.001$) for rural areas (Figure 1). During the same period, the proportion of hypertension-related telehealth visits increased from 0.04% to 42.15% ($P < 0.001$) for urban areas and from 0.06% to 30.98% ($P < 0.001$) for rural areas.

The average monthly numbers of hypertension-related telehealth visits per 100 persons were 0.00 (pre-COVID-19), 1.94 (COVID-19), and 1.59 (after stay-at-home order period) for urban areas and 0.01, 1.38, and 1.14, respectively, for rural areas. The average monthly numbers of hypertension-related in-person visits per 100 persons during the same periods were 22.00 (pre-COVID-19), 18.08 (COVID-19), and 18.93 (after stay-at-home order period) for urban areas and 23.17, 19.61, and 20.37, respectively, for rural areas. The average monthly proportions of hypertension-related telehealth visits during the same periods were 0.02% (pre-COVID-19), 10.19% (COVID-19), and 7.76% (after stay-at-home order period) for urban areas and 0.03%, 6.96%, and 5.30%, respectively, for rural areas.

During the COVID-19 period, urban residents had a higher monthly average number of telehealth visits per 100 persons than rural residents (1.94 vs. 1.38; $P < 0.001$) (Figure 1). On the other hand, during both the pre-COVID-19 and COVID-19 periods, the monthly average number of hypertension-related in-person visits per 100 individuals was lower for urban residents than rural residents: pre-COVID-19: 22.00 vs. 23.17, $P < 0.001$; during COVID-19: 18.08 vs. 19.61, $P < 0.001$. During the COVID-19 period, the monthly average proportion of hypertension-related telehealth visits was higher for urban residents than rural residents (10.19% vs. 6.96%; $P < 0.001$). In addition, all the urban-rural differences in the numbers of telehealth and in-person visits, and the proportions of telehealth visits for each month, were statistically significant in their respective periods.

Compared to pre-COVID-19 periods, after stay-at-home order periods the average number of hypertension-related in-person visits decreased (22.00 vs. 18.93 for urban areas and 23.17 vs. 20.37 for rural areas) (Figure 1a). The average number of hypertension-related telehealth visits after stay-at-home order periods increased compared with pre-COVID-19 periods: 1.59 vs. 0.00 for urban areas and 1.14 vs. 0.01 for rural areas.

DISCUSSION

Using the administrative MarketScan database, we observed statistically significant differences, by rural–urban status, in hypertension-related telehealth and in-person outpatient visits before and during the COVID-19 pandemic. The number and proportion of telehealth visits during the COVID-19 pandemic were significantly higher for urban residents compared to rural residents. Meanwhile, the number of hypertension-related in-person visits before and during the COVID-19 pandemic was significantly lower for urban residents compared to rural residents.

Our findings of increased telehealth use for both urban and rural residents are consistent with prior studies revealing increased reliance on outpatient telehealth for chronic disease during and after the pandemic.[9,10] Urban residents saw a more rapid rise, a higher peak in the number of telehealth visits, and a sustained choice for telehealth care vs. in-person care during the COVID-19 pandemic compared to their rural counterparts. Rural residents had higher numbers of hypertension-related in-person visits before and during the COVID-19 pandemic compared to their urban counterparts. This is consistent with studies among users of safety-net clinics and Medicaid beneficiaries, in which rural residents used more in-person care than their urban counterparts and had significantly lower odds of using telehealth.[9,14] This may be related to rural areas' higher prevalence of hypertension as well as higher CVD mortality,[9,15] potentially indicating need for more intensive treatment that usually requires in-person care.[14] Yet given the ability of telehealth to reduce onsite resource use and improve staffing efficiency and training,[16] while providing similar reductions in blood pressure as in-person care,[17] further expansion of telehealth in rural areas may be beneficial.

The rural–urban disparity of telehealth use is often attributed to the "digital divide,"[18,19] which refers to the exacerbation of existing disparities due to differential access to technological resources. The digital divide can be caused by lack of broadband connectivity, mistrust of technology, negative cultural expectations regarding use of digital health, varying degrees of digital literacy, inability to buy or upgrade needed equipment, and issues related to reimbursement and coverage. The complexities of the digital divide imply that simply expanding telehealth services may not address the urban-rural disparities in either telehealth use or hypertension management and outcomes.

Among rural residents, the increased, consistent use of in-person care, even during the COVID-19 pandemic, was notable. This implies a need for continued in-person services during broad health care disruption, especially in rural populations. Further, the greater reliance on in-person services may amplify concerns about closing hospitals in rural settings.

Telehealth offers the opportunity for increased implementation of evidence-based strategies for hypertension management, including self-measured blood pressure (SMBP) monitoring. SMBP, which is measurement of blood pressure by a person outside a clinical setting, has been noted as a primary intervention in the *2020 Surgeon General's Call to Action to Control Hypertension*.[2] The person remotely shares their BP value with their clinical team, who then use the data to manage the person's care plan and remotely share guidance for the patient. Health care policies look to (i) minimize the digital divide to increase broadband access, (ii) relax policies related to telehealth appointments, and (iii) expand opportunities for reimbursement. As a result, we may enhance to (i) implementing SMBP interventions and (ii) integrating SMBP into routine care and reimbursement practices with the goal to improve hypertension control and collect more data on hypertension prevalence.[20]

Future research on (i) strategies supporting the adoption of telehealth and the sustained substitution of telehealth (vs. in-person care), and (ii) their effects on hypertension- and CVD-related health outcomes, can provide valuable insights that could help address rural health disparities. Further, future research can explore the role of policy in the digital

divide, namely reimbursement, equitable access to digital infrastructure, and increasing digital literacy.[14] Future research could also examine the strategies and policies that drive the adoption of telehealth in rural settings, while also evaluating its effectiveness in managing hypertension.

This study has several limitations. First, we included people who were continuously enrolled in ESI plans before and during the COVID-19 pandemic. Thus, these results are not generalizable to people who may have lost insurance coverage during the pandemic due to unemployment. Second, because we focused only on persons covered by commercial insurance, our results are not generalizable to people with public insurance, such as Medicaid and Medicare. Third, as a dataset relying on a convenience sample, MarketScan does not represent the entire privately insured population.

CONCLUSIONS

The use of hypertension-related telehealth outpatient services–among commercially insured adults in the United States significantly increased during the COVID-19 pandemic, yet geographic disparities persist based on rural–urban status. Rural residents, who face disproportionately high CVD rates and are more likely to be medically underserved, had significantly lower numbers of telehealth visits. The trends in hypertension-related telehealth use can track rural–urban disparities, and thereby identify populations needing additional support to increase utilization.

Acknowledgments

The authors are genuinely grateful to Fatima Coronado, MD, MPH, Michael Schooley, MPH, Janet Wright, MD, and Adam Vaughan, PhD, MPH, MS (Centers for Disease Control and Prevention) for their guidance, suggestions, and article review. We sincerely appreciate Moira Urich (Centers for Disease Control and Prevention) for her edits to the manuscript.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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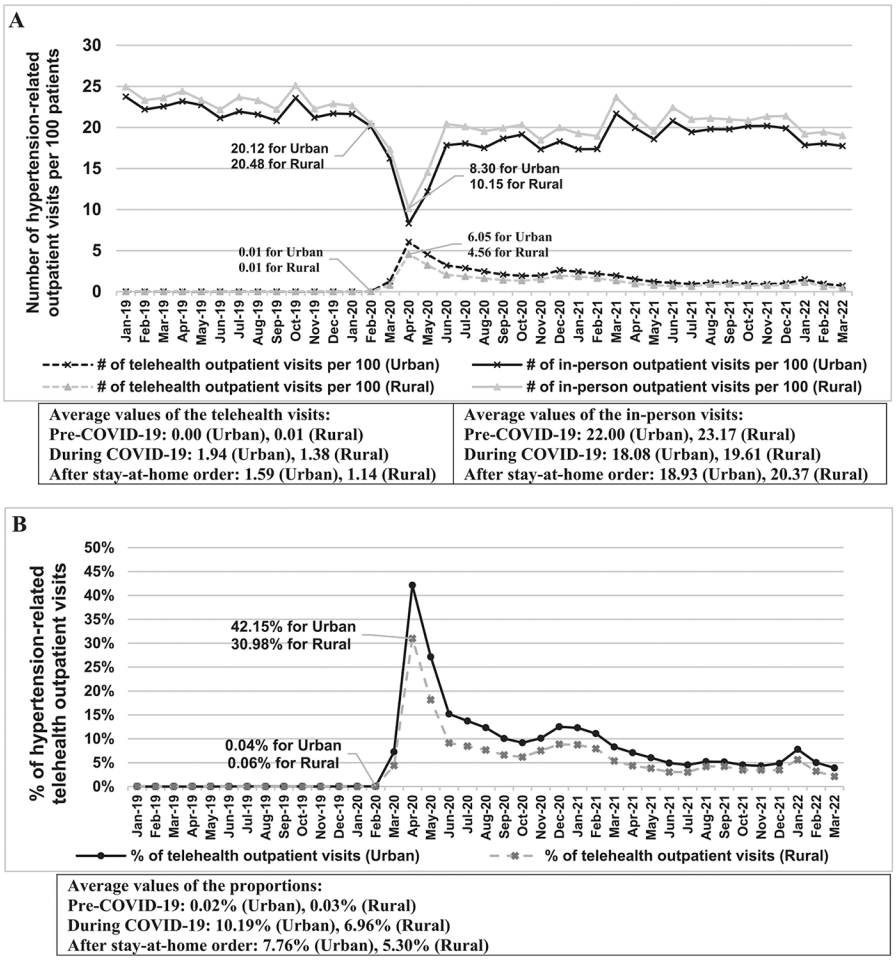

Figure 1.

Numbers of hypertension-related telehealth and in-person outpatient visits per 100 patients, and the proportion of hypertension-related telehealth visits by rural–urban status, MarketScan Commercial Database, January 2019–March 2022. (**a**) Monthly numbers of hypertension-related telehealth and in-person outpatient visits per 100 individuals. (**b**) Proportions of hypertension-related telehealth visits among all hypertension-related outpatient visits. We defined pre-pandemic (January 2019–February 2020), during pandemic (March 2020–March 2022), and after stay-at-home order periods (July 2020–March 2022). All estimates were reported by rural–urban status (urban vs. rural) from January 2019 to March 2022. The definition of rurality relied on the National Center for Health Statistics urban-rural classification scheme for counties; metropolitan counties are urban and nonmetropolitan counties are rural. There were 585,539 participants living in urban and 115,871 living in rural areas. Hypertension-related indicates that outpatient visits contained hypertension diagnoses (ICD-10-CM = I10–I15). The differences in the number of telehealth outpatient visits and proportions of telehealth visits are statistically different from March 2020 to March 2022 ($P < 0.001$). The differences in the number of in-person outpatient visits were statistically significant from January 2019 to March 2022 ($P < 0.001$). All

month-to-month changes from February 2020 to June 2020 were statistically significant ($P < 0.001$).