



# Self-Measured Blood Pressure Monitoring During the COVID-19 Pandemic: Perspectives From Community Health Center Clinicians

Margaret Meador • Neha Sachdev • Eboni Anderson • Debosree Roy • R. Curtis Bay • Lauren H. Becker • Joy H. Lewis

## ABSTRACT

The early period of the COVID-19 pandemic necessitated a rapid increase in out-of-office care. To capture the impact from COVID-19 on care for patients with hypertension, a questionnaire was disseminated to community health center clinicians. The extent, types, and causes of care delays and disruptions were assessed along with adaptations and innovations used to address them. Clinician attitudinal changes and perspectives on future hypertension care were also assessed. Of the 65 respondents, most (90.8%) reported their patients with hypertension experienced care delays or disruptions, including lack of follow-up, lack of blood pressure assessment, and missed medication refills or orders. To address care delays and disruptions for patients with hypertension, respondents indicated that their health center increased the use of telehealth or other technology, made home blood pressure devices available to patients, expanded outreach and care coordination, provided medication refills for longer periods of time, and used new care delivery options. The use of self-measured blood pressure monitoring (58.5%) and telehealth (43.1%) was identified as the top adaptations that should be sustained to increase access to and patient engagement with hypertension care; however, barriers to both remain. Policy and system level changes are needed to support value-based care models that include self-measured blood pressure and telehealth.

**Keywords:** hypertension, community health centers, COVID-19, telehealth, self-measured blood pressure monitoring

## Introduction

The COVID-19 pandemic led to a rapid increase in telehealth encounters. A comparison of the second quarter of 2020 with the second quarters of 2018 and 2019 found that telehealth visits in the United States

increased from 1.4 million to 35 million, representing an increase from 1% to approximately 35% of visits.<sup>1</sup> Although this shift to virtual care created opportunities for innovation, challenges and barriers emerged.

One such challenge was the accurate assessment of blood pressure (BP) during telehealth encounters. Blood pressure measurements are used by providers and care teams to diagnose and manage hypertension. During the same period that use of telehealth increased, a substantial decrease in BP assessment was observed; nationally, <10% of telehealth encounters included BP assessment compared with 70% of office-based encounters.<sup>1</sup> Similarly, in a sample of community health center encounters from June to December 2020, BP measurements were documented in the electronic health record (EHR) in 100% of in-person compared with 10% of telehealth encounters.<sup>2</sup>

Lack of BP measurement inhibits clinical decision making around diagnosis and treatment of hypertension,<sup>2</sup> potentially leading to missed care opportunities for patients at risk for cardiovascular disease. In an analysis of 18,262 adults aged 18 years and older with hypertension (defined as  $\geq 140/90$  mm Hg), the estimated age-adjusted proportion with BP < 140/

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For more information on this article, contact M. Meador at [mmeador@nachc.org](mailto:mmeador@nachc.org).

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90 mm Hg increased from 31.8% in 2000 to 48.5% in 2008 and to 53.8% in 2014. However, this proportion declined to 43.7% in 2018. Simultaneously, from 2009 to 2019, the number of deaths attributable to high blood pressure rose 65%.<sup>3</sup> Improving BP outcomes nationally is a key priority of the Million Hearts initiative co-led by the Centers for Disease Control and the Centers for Medicare & Medicaid Services<sup>4</sup> and the American Medical Association (AMA).

Self-measured blood pressure (SMBP), sometimes referred to as home BP monitoring, is a method to obtain BP assessments for clinical decision making. SMBP is defined as BP measurements taken by a patient outside of the clinical setting. Most SMBP guidelines include the recommended monitoring schedule where BP is taken twice in the morning and evening for at least 3 days in a 7-day period (a minimum of 12 measurements) to generate an average blood pressure.<sup>15</sup> Self-measured blood pressure with clinical support has long been a recognized cost-effective, evidence-based strategy to improve BP control and has been recommended to be used as part of value-based care models to confirm a new diagnosis of hypertension before initiating treatment.<sup>5-15</sup> Self-measured blood pressure was highlighted in the 2020 U.S. Surgeon General's Call to Action to Control Hypertension as an important component of a national strategy to improve BP control.<sup>5</sup>

Before the COVID-19 pandemic, the National Association of Community Health Centers (NACHC) collaborated with the AMA and led a multiyear national Million Hearts quality improvement project to improve BP control rates in community health centers. The project promoted the use of SMBP and increased treatment intensification for adult Black/African American patients with uncontrolled hypertension. When the COVID-19 pandemic began, participating centers accelerated adoption of SMBP and other interventions. Project leads recognized the opportunity to capture frontline perspectives on changes related to hypertension management.

This article describes the results of a questionnaire distributed to health center clinicians in spring of 2021. We sought to understand perceptions on the extent, types, and causes of care delays and disruptions in relation to hypertension management and how clinicians and their organizations addressed delays and disruptions. We also aimed to learn clinician perceptions of what the greatest challenges were in managing hypertension during the pandemic. Recognizing that adverse situations can spawn innovation, reveal solutions, and help illuminate gaps, we aimed to hear from those on the frontlines

of healthcare what adaptations or innovations were used. We further wished to learn which changes clinicians felt should be sustained over the long-term and what supports would be needed to implement the changes and optimize care. This study was determined to be exempt by an Institutional Review Board under IRB Protocol 2019-092.

## Methods

### Settings and Participants

The NACHC Million Hearts quality improvement project involved seven HCCNs and 22 health centers from DC (4), FL (7), GA (1), IL (2), MI (2), PA (4), and NY (2). Most (16) centers were in the urban areas of Chicago, Detroit, the District of Columbia, Miami, and Philadelphia. The project team provided the questionnaire to the health centers participating in the Million Hearts project.

Health center patient populations ranged from 3,270 to 98,863; 30.0% were adults older than 18 years. The plurality of patients were Black/African American (44.5%), 57.4% reported an income of <100% of the federal poverty level, 27.4% reported being uninsured, and 22.1% were best served in a language other than English.<sup>16</sup>

Additional demographic characteristics of participating health centers are summarized in Table 1.

### Study Design

An online questionnaire<sup>17</sup> was developed to support a mixed methods design. The questionnaire included 16 multiple choice and four open-ended questions (see Appendix A: Hypertension COVID-19 Provider Questionnaire, Supplemental Digital Content 1, <http://links.lww.com/JHQ/A204>) organized into five sections: (1) demographics, (2) experience treating patients with hypertension during the pandemic, (3) telehealth and home blood pressure monitoring, (4) challenges and adaptations in treating patients with hypertension during the pandemic, and (5) future care delivery for patients with hypertension.

The telehealth and home blood pressure monitoring section included Likert scale type questions that asked clinicians to think back to prepandemic and assess their confidence in using SMBP data to make treatment decisions and any changes in this confidence after a year of providing care under pandemic conditions.

In April 2021, the questionnaire was disseminated electronically to health center controlled network

**Table 1. Characteristics of 22 Participating Health Centers and the Patients Served**

Health center characteristic	n (%)			
Location				
Urban	1 (68)			
Suburban	7 (32)			
Rural	0			
Region				
South	12 (55)			
Northeast	6 (27)			
Midwest	4 (18)			
West	0			
Clinical care team members (full time equivalents)	0 (%)	1–10 (%)	11–20 (%)	More than 20 (%)
Physicians	0	11 (50)	7 (32)	4 (18)
Physician assistants	8 (37)	14 (64)	0	0
Nurse practitioners	0	14 (64)	5 (23)	3 (14)
Patient population characteristics				
Total population, n	689,686			
Adult population (older than 18 years), n	482,481			
Race	n (%)			
Black/African American	307,078 (44.52)			
White	103,932 (15.07)			
Asian	10,252 (1.49)			
Native Hawaiian/other Pacific Islander	2,745 (0.40)			
American Indian/Alaska Native	3,076 (0.45)			
More than one race	16,495 (2.39)			
Unreported/refused to report or unknown	246,108 (35.68)			
Ethnicity	n (%)			
Hispanic/Latino	222,269 (32.23)			
Special populations	n (%)			
Agricultural worker	4,077 (0.59)			
Homeless	45,710 (6.63)			
Public housing	179,058 (25.96)			
Veteran	4,348 (0.63)			
Other	n (%)			

**Table 1. Characteristics of 22 Participating Health Centers and the Patients Served (Continued)**

Health center characteristic	n (%)
Uninsured	188,735 (27.37)
<100% of federal poverty level	395,509 (57.35)
Best served in a language other than English	152,623 (22.13)

(HCCN) leaders who distributed the questionnaire through health centers to clinicians caring for patients with hypertension. The number of clinical providers offered the questionnaire is estimated to be approximately 471 based on the number of full-time equivalent clinicians at each participating health center. The questionnaire was open until June 2021.

### Analysis

Quantitative data were analyzed, and frequency and percentage were used to summarize multiple choice question findings. For questions assessing perceived confidence in using SMBP prepandemic versus spring 2021, a Wilcoxon signed-rank test compared prepandemic and postpandemic responses.

Four open-ended qualitative questions were analyzed to determine high-frequency words and phrases.<sup>18</sup> From these results, three coders independently developed a set of response themes. The coders met to discuss and collate the themes into a codebook, used to identify and categorize response patterns.

## Results

### Demographics

Sixty-five responses were received (estimated response rate of 14%) with respondents representing 14 states and the District of Columbia (DC). Michigan and DC health center clinicians were the largest contributors with 20 and 10 respondents. All respondents were identified as prescribers; over half were physicians (55.4%), and about a third were nurse practitioners (29.2%). The remaining (15.4%) were physician assistants, pharmacists, or executive directors.

### Care Delays and Disruptions

The first seven questions on the survey were quantitative; these questions asked clinicians about their experience treating patients with hypertension during the pandemic, with a focus on care delays or

disruptions. Most respondents (90.8%) reported that their hypertensive patients experienced care delays or disruptions; 32.3% estimated that over half of their patients were affected. Multiple types of disruptions or delays were reported, with the majority related to lack of follow-up. Clinicians perceived pandemic-specific factors to be the most common reason (89%) for care delays and disruptions. These included fear of infection by COVID-19 at in-person encounters and pandemic-induced logistical challenges. Challenges with telehealth encounters, whether technology-related or for other reasons, were also perceived as common reasons (72%). Almost 70% of clinicians also attributed care delays/disruptions to health system factors, including staff shortages and fewer available appointments. Others reported a lack of continuity of care and missed or delayed medication orders or refills (Table 2).

When asked what their health centers did to prevent or reduce care delays or disruptions, the majority indicated that their organization increased appointment access through telehealth. Many also reported refilling medications for longer periods of time, and some proactively refilled prescriptions (Table 2).

### Telehealth and Home Blood Pressure Monitoring

The second section of the survey included six quantitative questions on telehealth and SMBP. A large number of respondents reported that their health center increased the use of SMBP and measurement of BP during telehealth visits. About a third indicated that their health center implemented a formal protocol to train patients on SMBP, with a process for patients to share several days' worth of readings with their care team. The methods used to expand the use of SMBP are presented in Table 3. In addition, approximately 75% of respondents said their patients asked about SMBP.

Clinicians reported higher levels of confidence using SMBP for treatment decisions compared with how they remembered feeling prepandemic (Table 3). A Wilcoxon test showed a significant improvement in perceived confidence in using

**Table 2. Types of Care Delays and Disruptions and How They Were Addressed**

What types of care delays or disruptions did your patients with hypertension experience? <sup>a</sup>	n (%)
Missed follow-up due to pandemic factors (e.g., fear of infection by COVID-19, increased risk for COVID-19, transportation or time limitations due to pandemic)	58 (89.23)
Unable to have their blood pressure measured within desired/recommended timeframe	48 (73.84)
Lack of or missed follow-up due to technology factors (e.g., lack of access to telephone, data, Wi-Fi, discomfort using telehealth modalities)	47 (72.31)
Lack of follow-up due to health system factors (e.g., lack of access to/availability of appointments, staff shortages)	45 (69.23)
Experienced a lack of continuity of care, i.e., saw providers other than their PCP	32 (49.23)
Missed or delayed medication refills	30 (46.15)
Missed or delayed medication orders	20 (30.77)
Other Missed annual laboratory monitoring of antihypertensive drugs Unable to get monitoring laboratory results performed They were not face-to-face with their provider Homelessness/housing insecurity affecting ability to obtain care	4 (6.15)
What did your health center do to address or prevent care delays/disruptions for your patients with hypertension? <sup>a</sup>	n (%)
Increased appointment access using telehealth (phone or video appointments)	61 (93.85)
Increased use of home blood pressure monitoring	48 (73.85)
Refilled medications for longer periods	39 (60.00)
Proactively sent medication refills	16 (24.62)
Increased hours for available in-person appointments	7 (10.77)
Increasing outreach	5 (7.69)
Other Referrals to FQHCs and education on lifestyle medication	1 (1.54)

<sup>a</sup> Respondents could pick multiple categories

SMBP to make hypertension treatment decisions from pre-pandemic (before March 2020) (median = 3, interquartile range: 2, 4) to during the pandemic (spring of 2021) (median = 4, interquartile range: 4, 5),  $p < .001$ . Furthermore, over half (51%) reported wanting to sustain an increased use of SMBP, and a fourth (25%) wanted to maintain or expand patient access to home BP devices.

### Challenges and Adaptations

When asked in an open-ended response format about the greatest challenges in diagnosing and managing patients with hypertension during the

pandemic, clinicians described a variety of issues, which were grouped into categories/themes. Reduced or lack of follow-up was mentioned most (41%); this included fewer in-person encounters, and patients sometimes not participating in telehealth options, even when available. Another indicated that their greatest challenge was “patients failing to show for in-person or telehealth appointments”; several respondents attributed the follow-up challenge to patient fears about contracting COVID-19; “patients are reluctant to come into the office,” or “patients fear coming into the health center.”

**Table 3. How Health Centers Initiated or Expanded the Use of Self-Measured Blood Pressure and Confidence in Using Those Measures in Making Treatment Decisions**

Please indicate how your health center initiated or expanded patients' use of home blood pressure monitoring <sup>a</sup>		n (%)
My health center began distributing home blood pressure monitors to patients		40 (61.54)
My health center began using home blood pressure measurements for vital signs during telehealth encounters		38 (58.46)
My health center started a formal protocol to train patients to take blood pressure measurements at home for hypertension management, including proper positioning and measurement technique, and a process for patients to share several days' worth of measurements back with the care team for clinical action		23 (35.38)
Other We expanded what we had already been doing with our home BP monitoring program Automated cuffs with observed patient self-management		2 (3.07)
Confidence in using home blood pressure measurements to make hypertension treatment decisions	Prepandemic	During pandemic
Answer	n (%)	n (%)
Very confident	7 (10.77)	19 (29.23)
Somewhat confident	30 (46.15)	33 (50.77)
Neither confident nor unconfident	14 (21.54)	8 (12.31)
Somewhat unconfident	9 (13.85)	4 (6.15)
Very unconfident	5 (7.69)	1 (1.54)
<sup>a</sup> Respondents could pick multiple categories		

About a third of clinicians (33%) expressed difficulty obtaining BP measurements from patients with hypertension, affecting their ability to make treatment decisions. About 1 in 4 (22%) indicated challenges related to home BP devices, including lack of patient access to devices or device coverage, difficulty getting devices to patients, challenges around ensuring patients had an appropriately sized cuff, or difficulty ensuring devices were validated for accuracy. Self-measured blood pressure implementation challenges were mentioned (17%), such as technical difficulties using devices and care teams' difficulty receiving accurate or sufficient numbers of BP measurements to make treatment decisions. Other challenges included delaying medication refills (11%) and the inability to have successful telehealth visits (6%). Unsuccessful telehealth visits occurred with poor cell phone or Wi-Fi service or difficulty with the telehealth software.

Clinicians were asked to share any staffing, workflow, system, or other kinds of adaptations their

organization made in caring for patients with hypertension. Responses were grouped by themes. Over half (51%) indicated that their health center increased the use of telehealth or other technology. About 1 in 3 (35%) indicated that their health center made home BP devices available to patients, with 22% sharing that they increased the use of SMBP. Other adaptations included expanding outreach and care coordination for patients with hypertension (24%) and using new care delivery options (22%). Respondents emphasized innovations to allow for care while social distancing, offering parking lot virtual visits with older rural residents, where the health center staff would bring a tablet to the patient's car, curbside BP measurement, walk-up or drive-through BP clinics, and quick nurse visits just to measure BP.

Over half (51%) identified the use of SMBP as an adaptation that was newly developed by their center which they felt should be sustained. "Home blood pressure monitoring, for certain—super successful.

[We were] able to make changes and monitor results without patients having to come back in.” Another adaptation prioritized by many (49%) was to keep using telehealth and related technology. Some specified the importance of telehealth in increasing access to care, and others clarified that having both tele video and telephone options should be continued. Several respondents noted that telehealth worked with SMBP. “I would like to continue telehealth options. Patients do check in more frequently regarding their blood pressure, especially if they have elevated readings.” Other adaptations to sustain were outreach to patients with hypertension for care coordination (24%), offering different care delivery models and expanded care team options (22%).

### Future Care Delivery

When asked in an open-ended response format what healthcare system changes could help support patients with hypertension better in the future, about half (47%) mentioned improved access to prescriptions, including 90-day prescriptions and home delivery of medications. Expanding access to or coverage for home BP devices was mentioned (33%), with specific note around the use of Bluetooth devices with multiple cuff sizes and improving transmission of data from devices to EHRs. About one-fourth expressed the need for expanded access to or use of telehealth and other technologies that facilitate virtual care (28%) and a need for improved virtual care reimbursement policies (23%). Figure 1 presents the most common response categories related to future healthcare system changes to support patients with hypertension.

### Limitations

With self-reported data from health center clinicians, the results may be subject to recall and/or social desirability bias.<sup>19</sup> Respondents may not have remembered all pertinent details and may have reported more favorable responses. The survey was distributed to a convenience sample of clinicians whose health centers participated in NACHC’s Million Hearts project. These providers may be more aware of and more comfortable with SMBP than those at nonparticipating health centers. The results lack geographic representation, with no participating centers from the West. The survey response rate is an estimation based on the maximum possible number of respondents; the actual number of clinicians who

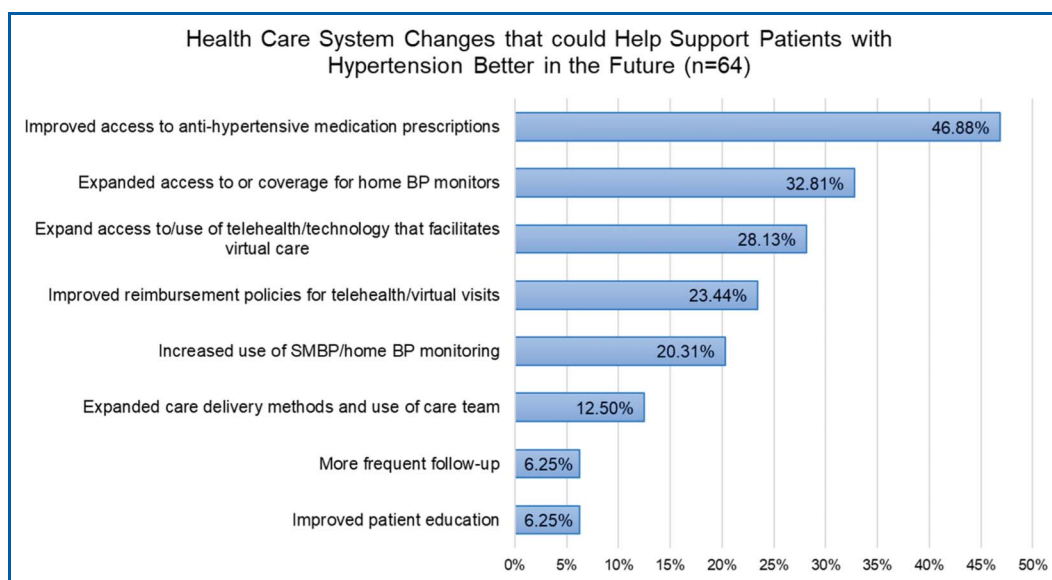
received the offer to complete the survey is unknown. The actual response rate may be higher. This survey was distributed in April 2021 and available until June 2021, before the widespread uptake of COVID-19 vaccines. Thus, remote care was potentially more of an imperative during this time. Although not a nationally representative sample, the survey findings do offer a glimpse into the behaviors and attitudes of health center providers during the pandemic.

### Discussion

This study captured the unique experiences of health center clinicians as they cared for patients with hypertension during the first year of the pandemic. Their responses revealed that care delays and disruptions were significant, whether from fears about contracting COVID-19, technology-related, or system-related. However, these challenges resulted in adaptations and new approaches to care; SMBP and telehealth were widely adopted innovations and support for/confidence in SMBP as a beneficial hypertension management strategy increased. The survey responses provide insight into clinicians’ perspectives about policies and system changes that could help sustain SMBP and telehealth and facilitate care for vulnerable patients with hypertension.

Reduced follow-up and difficulty obtaining BP measurements surfaced as the top two areas of care disruption. In response, clinicians reported a rapid acceleration in SMBP use. Clinicians also reported a significant increase in their comfort and confidence using SMBP for clinical decisions. Prepandemic uptake of SMBP had been slow,<sup>20</sup> and U.S. clinicians’ attitudes and beliefs toward SMBP have historically been a barrier to uptake.<sup>21,22</sup> The rapid improvement in clinicians’ attitudes and increased trust may have resulted from the necessity of using these measurements, without in-office encounters. Clinicians may have also been more open to innovation during this early period of the pandemic, allowing them to rapidly change their attitudes and beliefs toward SMBP. As “promoting shared management through self-measured blood pressure monitoring” is one of the evidence-based strategies prioritized in the U.S. Surgeon General’s Call to Action to achieve hypertension control nationally,<sup>5</sup> this pivot to SMBP as a hypertension management strategy during the pandemic may be a silver lining.

Many clinicians expressed an interest in continuing SMBP. However, significant challenges and barriers remain. These include the need for standards around



**Figure 1.** The most common response categories from surveyed community health center clinicians related to future healthcare system changes to support patients with hypertension.

data exchange for patient-generated data and data privacy and security issues. In addition, patients need access to clinically validated devices that accommodate larger arm circumferences. Device costs can be prohibitive with inconsistent or incomplete insurance coverage across states. Furthermore, variability in patient access to affordable broadband can impede data transfer.<sup>23</sup>

Despite these challenges, there is promise for SMBP's widespread adoption. Self-measured blood pressure with clinical support has been shown to be more predictive of cardiovascular disease events than office-based blood pressure measurement<sup>24-26</sup> and is an evidence-based strategy to improve BP outcomes.<sup>5-11</sup> With demonstrated improved outcomes and lower costs, SMBP and telehealth are part of value-based care models. Provider support, demonstrated in our study, could be leveraged to accelerate adoption. Another recent development supporting SMBP is the addition of average BP as a required data element in the U.S. Core Data and Information set version 4, which received final approval in July 2023.<sup>27</sup> Electronic health record vendors must include average blood pressure as a required data field in their products to receive certification in the future, a positive step toward interoperability for average blood pressure documentation.

Other pandemic initiated innovations in hypertension management included obtaining blood

pressure measurements at curbside stations, using nurse visits, and setting up drive-through hypertension clinics. Whether these initiatives have been sustained is an opportunity for future research.

Respondents suggested a variety of systemic changes that, if sustained, could improve care. A plurality recommended improving access to antihypertension medications, including policies such as 90-day prescriptions and home delivery of medications, which are known to be effective in improving medication adherence.<sup>5,28</sup> Surveyed clinicians also recommended increasing the use of SMBP as a way to improve hypertension management, emphasizing expanding access to and providing coverage for home BP monitors and strengthening health information technology infrastructure to enable data transfer from home BP devices to EHRs. These recommendations align with strategies outlined in the U.S. Surgeon General's Call to Action to Control Hypertension.<sup>5</sup> The input regarding SMBP reinforces recommendations outlined in the American Heart Association (AHA)/AMA SMBP joint policy statement on addressing barriers to SMBP implementation and equitable SMBP access.<sup>15</sup> The survey results further show clinician support for policies that would allow continued use of virtual care modalities (video and phone) and support for policies that include allowing originating site flexibilities, maintaining reimbursement for telehealth encounters,



and improving access to technology. With the end of the Public Health Emergency declaration, this study helps identify important policies to prioritize.

## Conclusions

This study highlighted the experiences of the health center clinicians who managed care for patients living with hypertension during the early phase of the COVID-19 pandemic. Pandemic-induced care delays and disruptions led to a rapid shift in adapting to patient needs by providing medication refills for longer periods of time and adopting new care strategies. Clinicians perceived SMBP to be an effective tool for improving hypertension management and control and expressed interest in continuing to use SMBP and telehealth. However, barriers to both remain. Clinicians recommended systemic and policy changes that would help sustain SMBP and telehealth use and which could improve the effectiveness and efficiency of care for vulnerable patients with hypertension.

## Implications

This study emphasizes the need to have SMBP programs that are patient-centered, with appropriate monitors and cuffs for each patient. Proper fitting validated devices can yield accurate and actionable BP measurements. These data can be input into EHR systems and can be used to make hypertension treatment decisions; strengthening the health IT infrastructure around electronic data transfer from home BP devices could make this process more efficient. In the near term, addressing the inconsistency and complexity of the insurance landscape around SMBP device and service coverage through policy intervention could remove obstacles to widespread SMBP adoption. Furthermore, rewarding clinicians and health centers that successfully meet or exceed standards for controlling patient hypertension could provide healthcare teams with the ability to continue clinical support for SMBP and telehealth options.<sup>5</sup> Traction for SMBP may depend on adoption of value-based care models that support outcomes-based payment. In the meantime, with the Public Health Emergency expiration, enacting permanent policy changes related to medication access, telehealth, and reimbursement for asynchronous, virtual care, would help advance sustainment of pandemic-induced innovations and increase health equity in hypertension management. Understanding

the perspectives of practicing clinicians can provide direction and support for needed policy changes.

## Authors' Biographies

**Margaret Meador, MPH, C-PHI, CPHQ** is Director of Clinical Integration and Education at the National Association of Community Health Centers, in Bethesda, Maryland, where she leads cardiovascular health-focused quality improvement initiatives with community health centers across the United States.

**Neha Sachdev, MD**, is the Director of Clinical Engagement and Equitable Care in Improving Health Outcomes at the American Medical Association. She collaborates with physicians, healthcare teams and organizations to implement evidence-based strategies and programs to prevent cardiovascular disease.

**Eboni Anderson, DEd, MA, MEd, MSW**, is the Director of Community Oriented Primary Care at A.T. Still University, School of Osteopathic Medicine in Arizona (ATSU SOMA). Dr. Anderson teaches public health rotations to dual-degree DO/MPH students and is committed to addressing health disparities and conducting community-based research.

**Debosree Roy, PhD**, is an assistant professor in public health at A.T. Still University, School of Osteopathic Medicine in Arizona (ATSU SOMA) and a research fellow at the National Center for Community Health Research.

**R. Curtis Bay, PhD**, is at A.T. Still University, School of Osteopathic Medicine in Arizona (ATSU SOMA). Dr. Bay is a biostatistics professor at A.T. Still University and Chair of the ATSU, Arizona IRB. He teaches evidence-based practice, statistics, and experimental methodology, and provides consultation with faculty on research design and analysis.

**Lauren H. Becker, MPH**, is a specialist at the National Association of Community Health Centers in Bethesda, Maryland, where she provides support to national cardiovascular health quality improvement efforts in community health centers.

**Joy H. Lewis, DO, PhD**, is a Professor of Public Health and Internal Medicine at A.T. Still University, School of Osteopathic Medicine in Arizona (ATSU SOMA) where she chairs the Department of Public Health and directs the National Center for Community Health Research. Dr. Lewis conducts community-based applied research related to social determinants of health, patient safety, value-based care, and preventive medicine.

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