# **BRIEF COMMUNICATION**

# Self-Measured Blood Pressure Monitoring Among Adults With Self-Reported Hypertension in 20 US States and the District of Columbia, 2019

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#### **BACKGROUND**

Hypertension is a major risk factor for cardiovascular disease. Achieving hypertension control requires multiple supportive inventions, including self-measured blood pressure (SMBP) monitoring. The objective of this study is to report the use of SMBP among US adults.

#### **METHODS**

Behavioral Risk Factor Surveillance System data were used for this study. The 2019 survey included, for the first time, an optional SMBP module. Twenty states and the District of Columbia (N = 159,536) opted to include the module, which assessed whether participants were advised by a healthcare professional to use SMBP, and if they used SMBP monitoring. Among those using SMBP, additional guestions assessed the location of SMBP monitoring and whether SMBP readings were shared with a healthcare professional.

#### **RESULTS**

Among adults in the study population, 33.9% (95% confidence interval 33.4%–34.5%) reported having hypertension (N = 66,869). Among them, nearly 70% were recommended to use SMBP by their healthcare professional and approximately 61% reported SMBP use regardless of recommendation. The most common location of SMBP was the home (85.6%). Overall, >80% shared their SMBP reading with their healthcare professional, 74% and 7% were shared in person and via the internet or email, respectively. There were differences in healthcare professional recommendations, use of SMBP, and SMBP

doi:10.1093/ajh/hpab091

practices from healthcare professionals.8

sure; states; surveillance

**CONCLUSIONS** 

sion self-management and control.

**GRAPHICAL ABSTRACT** 

Among those with hypertension (N= 66,869)

Hypertension is a major preventable risk factor for heart disease and stroke.1 According to new guidelines, nearly 1 in 2 adults has hypertension in the United States.<sup>2</sup> Diverse interventions are needed to reach and sustain hypertension control. Self-measured blood pressure (SMBP) monitoring is a promising, evidence-based intervention to improve hypertension control. Significant evidence exists for SMBP use, with additional clinical support, to lower blood pressure (BP), increase BP control,<sup>3,4</sup> confirm new diagnoses of hypertension,<sup>5</sup> and rule out white-coat and masked hypertension.<sup>6</sup> However, limited data are available on the uptake of SMBP among individuals with hypertension<sup>7</sup> and recommendation

Keywords: blood pressure; hypertension; self-measured blood pres-

information sharing across demographic characteristics and state of

SMBP recommendation was common practice among healthcare

professionals, as reported by US adults with hypertension. Data from

this study can be used to guide interventions to promote hyperten-

re monitoring among hypertension in 20 US states and the District of Columbia 2019 Behavioral Risk Factor Surveillance System

pressure (BP) outside of the office (N= 31,929)

Shared BP readings with the healthcare professional via email/internet

In 2019, a new module to aid in assessing SMBP use was introduced into the Behavioral Risk Factor Surveillance System (BRFSS). Twenty states and the District of Columbia included the 4-item module in their surveys, alongside other core questions regularly included. The objective of this study is to assess SMBP recommendations from healthcare professionals and SMBP use among those with hypertension.

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Initially submitted March 31, 2021; accepted for publication June 2, 2021; online publication June 7, 2021.

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#### **METHODS**

BRFSS is an ongoing health-related surveillance system, conducted by telephone in 50 US states, the District of Columbia, Guam, and Puerto Rico. Participants are adults (≥18 years) in the civilian, noninstitutionalized population. The survey has been conducted annually since 1984 by state and territory health departments, with assistance from the Centers for Disease Control and Prevention. The survey includes core questions that are asked by all states and optional modules which are selected by states for inclusion. All questions used for this study are available on the BRFSS website (http://www.cdc.gov/brfss/questionnaires/), and additional survey information on the main BRFSS website (http://www.cdc.gov/brfss). The new SMBP optional module was first used in 2019 by 20 states (Alaska, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Kansas, Kentucky, Maryland, Maine, Mississippi, Montana, Nebraska, New Mexico, Ohio, South Dakota, Texas, Utah, and Wyoming) and the District of Columbia. The BRFSS response rates among those states and DC included in the current study ranged from 38.2% (Delaware) to 73.1% (South Dakota), with a median of 52.2% (New Mexico) (Survey response rates by states: Alaska [61.4%], Connecticut [44.5%], Delaware [38.2%], DC [40.6%], Florida [44.3%], Georgia [42.2%], Idaho [42.0%], Illinois [38.6%], Kansas [57.7%], Kentucky [60.3%], Maine [60.1%], Maryland [45.0%], Mississippi [57.4%], Montana [56.4%], Nebraska [57.3%], New Mexico [52.2%], Ohio [46.4%], South Dakota [73.1%], Texas [46.3%], Utah [54.8%], Wyoming [60.8%]).9

All BRFSS data are self-reported. Hypertension status was derived using the question, "Have you ever been told by a doctor, nurse, or other healthcare professional that you have high blood pressure?" Answers include "Yes," "Yes, but female told only during pregnancy," "Told borderline high or pre-hypertensive," and "No." Those who answered that they had borderline hypertension or pre-hypertension, and women who were told they had hypertension only during pregnancy, were not defined as having hypertension. Participants who answered "yes" were included in the current study. The SMBP module questions included: "1) Has your doctor, nurse or other healthcare professional recommended you check your blood pressure outside of the office or at home?; 2) Do you regularly check your blood pressure outside of your healthcare professional's office or at home?; 3) Do you take it mostly at home or on a machine at a pharmacy, grocery, or similar location?; and 4) How do you share your blood pressure numbers that you collected with your healthcare professional? Is it mostly by telephone, other methods such as email, internet portal or fax, or in person?" Descriptive characteristics included self-reported age, sex, race and Hispanic origin, level of education, antihypertensive medications use, and health insurance status.

## Statistical analysis

All participants with missing information on study characteristics were excluded (4%). Adjusted percentages and 95% confidence intervals for 4 outcomes: (1) received a recommendation from a healthcare professional to check BP outside of the office; (2) checked BP outside of the office and among those who checked BP outside of the office; (3) who checked it at home; and (4) who shared BP information with their healthcare professional via the internet or email were presented. Using logistic regression (PROC RLOGIST), each outcome was set as the dependent variable; the independent variables were modeled as categorical. The PREDMARG statement was used to request the predicted marginal proportions for each level of the variables (reference). The P value was obtained using the Wald F-test, controlling for age, sex, race/ethnicity, and education level. All outcomes were stratified by each independent variable. 10 The complex BRFSS survey design was accounted for using SAScallable SUDAAN. All statistical tests were 2-tailed, and we defined significance as a *P* value of less than 0.05.

#### RESULTS

Self-reported hypertension prevalence was 33.9%, which reflects 66,869 participants with hypertension. Among those with self-reported hypertension, 68.9% were recommended by a healthcare professional to check their BP outside the office. Regardless of healthcare professional recommendations, 60.9% reported checking their BP outside of the office (Table 1). Among those who checked BP outside the office, 85.6% checked it at home. More than 85% reported sharing their BP readings with their healthcare professionals. Most shared in person (73.5%) and 6.9% shared via internet or email. The remaining (5.4%) shared their BP readings by phone (Table 1).

Differences were found by demographic characteristics and state of residency. Adults aged ≥45 years of age, non-Hispanic Blacks, and persons taking antihypertensive medications were more likely to report receiving a recommendation to check their BP outside of the office. Men, adults ≥45 years of age, non-Hispanic Blacks, those with health insurance, and those taking antihypertensive medications were more likely to check their BP outside of the office than their counterparts. Those with health insurance and those taking antihypertensive medications were more likely to check their BP at home than their counterparts. Adults aged 18-44 years of age, those with higher levels of education, and those with health insurance were more likely to share their BP readings with a healthcare professional via the internet or email than their counterparts. By state, reported receipt of the recommendation to check BP outside of the office ranged from 55.8% (Connecticut) to 75.9% (Texas), and checking BP outside of the office ranged from 44.9% (Connecticut) to 69.0% (Florida) (Table 1). Among those who checked their BP outside the office, the percentage who reported checking at home ranged from 79.4% (Nebraska) to 90.2% (New Mexico), and the percentage who reported sharing their BP information with healthcare professionals via internet or email ranged from 3.1% (Mississippi) to 9.8% (Illinois) (Table 1).

## **DISCUSSION**

Overall, 68.9% of adults (≥18 years of age) with hypertension were recommended to use SMBP by their healthcare professional and 60.9% reported SMBP use, regardless of recommendation. Among those who used SMBP, 85.6% did

Table 1. Adjusted prevalence<sup>a</sup> and 95% confidence interval of self-measured blood pressure monitoring recommendations and use among adults with hypertension, 2019

		Among those with hypertension ( $N = 66,869$ )	insion (N = 66,869)	Among those with hy	Among those with hypertension who check blood pressure outside of the office $(N=31,929)$
		Recommended by healthcare			
		professional to use self-measured blood pressure monitoring	Checked blood pressure outside office	Checked blood pressure at home	Shared blood pressure readings with healthcare professional via email/internet
Total		68.9 (68.1–69.7)	60.9 (60.1–61.8)	85.6 (84.7–86.5)	6.9 (6.2–7.6)
Age (years)	18-44	63.4 (61.2–65.6)***	53.3 (51.0–55.6)***	77.1 (73.8–80.2)***	11.8 (9.0–15.3)***
	45–64	70.0 (68.7–71.3)	60.9 (59.5–62.3)	83.9 (82.3–85.3)	7.7 (6.7–8.8)
	≥65	70.5 (69.4–71.5)	64.7 (63.5–65.8)	90.5 (89.4–91.4)	4.5 (3.9–5.2)
Sex	Men	69.1 (68.0–70.3)	62.3 (61.1–63.5)***	85.0 (83.7–86.2)	6.8 (5.9–7.9)
	Women	68.7 (67.5–69.7)	59.4 (58.2–60.6)	86.3 (85.0–87.6)	7.0 (6.1–8.0)
Race/ethnicity	NH white	67.1 (66.2–68.0)***	57.9 (57.0–58.9)***	86.8 (85.8–87.8)*	7.2 (6.5–8.0)
	NH black	75.2 (73.1–77.1)	68.2 (66.0–70.3)	84.8 (82.4–86.9)	7.3 (5.6–9.6)
	Hispanic	70.2 (66.9–73.3)	66.3 (62.9–69.6)	82.0 (78.2–85.1)	5.1 (3.1–8.2)
	NH AI/AN	59.9 (52.3–67.0)	56.6 (49.4–63.7)	81.5 (75.1–86.5)	3.8 (2.4–6.2)
	NH API	67.7 (59.4–75.0)	61.1 (52.8–68.7)	84.9 (74.2–91.6)	6.4 (3.0–13.1)
	NH other	73.4 (66.6–79.3)	64.8 (57.3–71.6)	85.3 (78.8–90.0)	5.1 (2.8–9.3)
Education	<hs< td=""><td>66.7 (64.0–69.3)</td><td>62.2 (59.5–64.9)</td><td>86.7 (84.0–89.0)</td><td>3.5 (1.8–6.6)***</td></hs<>	66.7 (64.0–69.3)	62.2 (59.5–64.9)	86.7 (84.0–89.0)	3.5 (1.8–6.6)***
	HS graduate	68.5 (67.0–70.0)	61.4 (59.8–62.9)	85.0 (83.2–86.6)	5.5 (4.5–6.8)
	Some College	69.5 (68.0–70.9)	61.0 (59.5–62.6)	86.0 (84.3–87.6)	7.4 (6.2–8.8)
	≥College	70.0 (68.7–71.3)	59.4 (58.0–60.9)	85.3 (83.5–86.8)	10.3 (8.9–11.7)
Health insurance	Yes	69.2 (68.3–70.1)	61.5 (60.6–62.4)**	86.2 (85.2–87.1)**	7.2 (6.4–8.0)**
	No	66.1 (62.9–69.3)	55.6 (52.1–59.0)	80.5 (76.4–84.0)	4.0 (2.6–5.9)
Antihypertensive	Yes	73.7 (72.8–74.5)***	65.1 (64.1–66.1)***	87.0 (86.0–88.0***)	6.9 (6.2–7.6)
medication use	No	52.6 (50.4–54.8)	46.9 (44.7–49.2)	79.2 (76.1–82.0)	7.1 (5.1–9.7)
States	Alaska	66.3 (61.4–70.9)***	50.7 (45.7–55.6)***	89.6 (84.3–93.2)***	6.3 (3.6–10.6)***
	Connecticut	55.8 (53.5–58.0)	44.9 (42.7–47.1)	83.3 (80.6–85.7)	7.9 (6.3–9.7)
	Delaware	64.4 (60.8–67.7)	58.6 (55.0–62.2)	81.4 (76.4–85.5)	5.7 (3.7–8.6)
	DC	65.1 (60.7–69.3)	59.0 (54.6–63.2)	84.7 (79.4–88.8)	7.9 (5.4–11.5)
	Florida	73.9 (71.8–76.0)	69.0 (66.7–71.2)	82.8 (79.9–85.4)	5.4 (3.9–7.4)
	Georgia	75.5 (72.9–78.0)	68.9 (66.2–71.6)	83.7 (80.5–86.4)	6.9 (5.1–9.2)
	Idaho	65.6 (62.2–68.7)	58.7 (55.3–62.0)	83.6 (79.5–87.1)	9.7 (6.8–13.8)
	Illinois	63.1 (60.5–65.6)	54.2 (51.6–56.8)	84.0 (80.8–86.7)	9.8 (7.6–12.5)

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	Among those with hypertension (N = 66,869)	ension (N = 66,869)	Among those with hy	Among those with hypertension who check blood pressure outside of the office $(N=31,929)$
	Recommended by healthcare			
	professional to use self-measured blood pressure monitoring	Checked blood pressure outside office	Checked blood pressure at home	Shared blood pressure readings with healthcare professional via email/internet
Kansas	66.4 (6.88–68.8)	53.2 (50.6–55.7)	83.5 (80.3–86.3)	6.7 (5.0–9.0)
Kentucky	67.9 (65.4–70.2)	58.7 (56.1–61.3)	89.2 (86.3–91.6)	4.4 (3.2–6.1)
Maine	61.6 (59.3–63.9)	48.1 (45.8–50.4)	85.6 (82.6–88.3)	7.0 (5.1–9.7)
Maryland	62.1 (60.3–63.9)	50.5 (48.7–52.3)	86.0 (84.0–87.8)	9.3 (7.9–10.9)
Mississippi	62.6 (60.0–65.2)	58.8 (56.2–61.5)	88.0 (85.6–90.1)	3.1 (2.0–4.6)
Montana	64.0 (61.5–66.5)	53.9 (51.3–56.5)	89.5 (86.7–91.8)	8.3 (6.0–11.5)
Nebraska	59.8 (57.3–62.2)	50.0 (47.5–52.5)	79.4 (75.7–82.7)	6.5 (4.7–8.9)
New Mexico	64.5 (61.4–67.6)	54.6 (51.3–57.8)	90.2 (87.4–92.5)	6.1 (3.9–9.4)
Ohio	61.9 (59.5–64.3)	55.9 (53.4–58.3)	85.3 (82.4–87.8)	8.1 (6.2–10.4)
South Dakota	60.1 (56.1–64.0)	49.8 (45.8–53.9)	81.8 (76.4–86.2)	5.4 (3.5–8.4)
Texas	75.9 (73.6–78.1)	67.1 (64.6–69.4)	88.8 (86.3–90.8)	6.5 (4.8–8.9)
Utah	61.5 (59.4–63.6)	46.8 (44.7–49.0)	80.4 (77.5–83.0)	7.7 (6.0–9.7)
Wyoming	67.2 (63.9–70.4)	60.6 (57.2–63.9)	86.2 (82.2–89.5)	5.5 (3.7–8.1)

Table 1. Continued

<sup>a</sup>Adjusted by age, sex, race/ethnicity and level of education. Abbreviations: AI/AN, American Indian/Alaska Native; API, Asian Pacific Islander; DC, District of Columbia; HS, high school; NH, non-Hispanic. \*P < 0.05; \*\*P < 0.01; \*\*\*P < 0.001, statistical significance comparisons represent within group associations.

so at home. Of the 85.8% of SMBP users who shared their BP readings with healthcare professionals, only 6.9% did so via the internet or email. Variations in SMBP recommendations from healthcare professionals, use, location, and method of sharing BP readings varied by demographic characteristics and state of residency. While many of these findings are encouraging, there are ample areas for improvement. The observed difference of recommendation and use by age, race/ethnicity, level of education, and health insurance status could be due to lack of knowledge of hypertension management, access to devices, and ability to use technology. These findings highlight priority populations for public health education to improve SMBP monitoring.

This is the first state-level study from a population-based survey of SMBP monitoring recommendation and use, SMBP location, and the method of sharing BP information. While validated BP devices have been proven accurate and are recommended for BP measurement outside of clinical settings,13 data are limited for using BP kiosks that are often found in pharmacies, grocery stores, and worksites. Thus, taking one's BP using a validated BP device at home is preferred.4 In addition, while recording BP information manually can be useful in guiding clinical management, the secure electronic transfer of SMBP readings to healthcare professionals is preferred. Newer technology allows for BP values to be imported from BP devices into electronic health records, further integrating with clinical management.<sup>14</sup> The low percentage of electronic transmission of BP information via the internet or email, noted in this study suggests the need to advance interoperable, standards-based, and user-friendly solutions to transmit SMBP readings and record readings in electronic health records.<sup>15</sup> Additionally, while no difference was found in SMBP recommendation by insurance status, those without health insurance, compared to their counterparts, were less likely to report SMBP use outside of the office setting, less likely to report checking at home, and less likely to share with their healthcare professional. Cost-barriers to purchase SMBP devices may be preventing more widespread utilization. Increasing device coverage and reducing cost-sharing of devices by public and private insurers, especially during this era of rapidly expanding telemedicine use, can support broader uptake.<sup>16</sup>

During the COVID-19 pandemic, where many in-person visits have been eliminated or transitioned to virtual platforms, <sup>17</sup> vital signs, specifically BP and pulse rate, can be obtained using SMBP devices. The utilization of SMBP monitoring, in conjunction with regular clinical management, can serve as a vital link between patients and health-care professionals. Advancements in technology and clinical processes achieved during this unprecedented pandemic should continue to be leveraged to expand the implementation of SMBP monitoring. To improve hypertension management during the pandemic and beyond, both health-care professionals and patients need training in the use of validated devices and SMBP reading transmission. <sup>13,15</sup>

This study is subject to several limitations. First, all BRFSS data are self-reported and only capture those who are aware of a prior diagnosis of hypertension. Data from the National Health and Nutrition Examination Survey show that about 80% of people with hypertension are aware of their condition

therefore, results may not be generalizable to the full population with hypertension.<sup>18</sup> SMBP recommendations and use would likely be lower among those unaware of hypertensive status. Second, among those states that included the module in 2019 survey, the median response rate was 52.2% (range: 38.2%–73.1%), potentially impacting generalizability of the findings. However, BRFSS data are recognized as a data source of high quality, validity, and reliability, <sup>19</sup> and there is limited impact on validity from falling response rates, if the data collection process follows standard high quality.<sup>20</sup> Third, the SMBP questions included recommendations and use but did not assess other activities that support effectiveness, including proper training, selection of a validated device, appropriate arm cuff selection, positioning, and protocols to guide use and reporting of measurements. Fourth, less than half of all US states used SMBP modules in 2019 and the findings should not be viewed as generalizable to the US population. Nevertheless, the inclusion of SMBP questions on the BRFSS allows for a broad assessment of clinical recommendations and reported utilization of this evidence-based intervention.

In conclusion, this study provides an estimate of SMBP use in 2019 across a geographically diverse set of 20 US states and the District of Columbia. The COVID-19 pandemic provides an opportunity to leverage advances in effective community-based interventions. Interoperable, standards-based, user-friendly data exchange methods should be developed while simultaneously increasing access to validated SMBP devices that can also easily upload data to the electric health recorders. Due to the significant number of US adults with uncontrolled hypertension, and the recognized benefit of SMBP, policy, and programmatic interventions should be prioritized to support broader utilization.

#### **DISCLOSURE**

The findings and conclusions are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the American Medical Association. The authors declared no conflict of interest.

# **REFERENCES**

- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee. Seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. Hypertension 2003; 42:1206–1252.
- Ostchega Y, Fryar CD, Nwankwo T, Nguyen DT. Hypertension prevalence among adults aged 18 and over: United States, 2017–2018. NCHS Data Brief, no 364. Hyattsville, MD: National Center for Health Statistics, 2020.
- Uhlig K, Patel K, Ip S, Kitsios GD, Balk EM. Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Ann Intern Med* 2013; 159:185–194.
- Shimbo D, Artinian NT, Basile JN, Krakoff LR, Margolis KL, Rakotz MK, Wozniak G; American Heart Association and the American Medical

- Association. Self-measured blood pressure monitoring at home: a joint policy statement from the American Heart Association and American Medical Association. Circulation 2020; 142:e42-e63.
- 5. Nunan D, Thompson M, Heneghan CJ, Perera R, McManus RJ, Ward A. Accuracy of self-monitored blood pressure for diagnosing hypertension in primary care. J Hypertens 2015; 33:755-762; discussion 762.
- 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. Hypertension 2018; 71:e13-e115.
- Ostchega Y, Berman L, Hughes JP, Chen TC, Chiappa MM. Home blood pressure monitoring and hypertension status among US adults: the National Health and Nutrition Examination Survey (NHANES), 2009-2010. Am J Hypertens 2013; 26:1086-1092.
- Tirabassi J, Fang J, Ayala C. Attitudes of primary care providers in recommending home blood pressure monitor use. J Clinical Hyperten 2013;15:224-229.
- CDC. The Behavioral Risk Factor Surveillance System 2019 Summary Data Quality Report. July 16, 2020. <a href="https://www.cdc.gov/brfss/an-">https://www.cdc.gov/brfss/an-</a> nual\_data/2019/pdf/2019-sdqr-508.pdf>. Accessed 14 May 2021.
- 10. Research Triangle Institute. SUDAAN Language Manual, Volumes 1 and 2, Release 11. Research Triangle Park, NC: Research Triangle Institute, 2012.
- 11. Community Preventive Services Task Force. Self-measured blood pressure monitoring improves outcomes: recommendation of the Community Preventive Services Task Force. Am J Prev Med 2017; 53:e115-e118.
- 12. Ostchega Y, Zhang G, Kit BK, Nwankwo T. factors associated with home blood pressure monitoring among US adults: National Health

- and Nutrition Examination Survey, 2011-2014. Am J Hypertens 2017; 30:1126-1132.
- 13. Tucker KL, Sheppard JP, Stevens R, Bosworth HB, Bove A, Bray EP, Earle K, George J, Godwin M, Green BB, Hebert P, Hobbs FDR, Kantola I, Kerry SM, Leiva A, Magid DJ, Mant J, Margolis KL, McKinstry B, McLaughlin MA, Omboni S, Ogedegbe O, Parati G, Qamar N, Tabaei BP, Varis J, Verberk WJ, Wakefield BJ, McManus RJ. Self-monitoring of blood pressure in hypertension: a systematic review and individual patient data meta-analysis. PLoS Med 2017; 14:e1002389.
- 14. Centers for Disease Control and Prevention. Self-Measured Blood Pressure Monitoring: Actions Steps for Clinicians. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services: 2014. <a href="https://millionhearts.hhs.gov/files/MH\_SMBP\_">https://millionhearts.hhs.gov/files/MH\_SMBP\_</a> Clinicians.pdf>. Accessed 14 May 2021.
- Wagner S. Blood pressure self-measurement. Adv Exp Med Biol 2017; 956:97-107.
- 16. National Association of Chronic Disease Directors. A National Analysis of Self-Measured Blood Pressure Monitoring Coverage and Reimbursement. February 2020. <a href="https://chronicdisease.org/resource/">https://chronicdisease.org/resource/</a> resmgr/website-2020/consultants/cvh/smbp/synthesis\_of\_smbp\_ coverage\_f.pdf>. Accessed 14 May 2021.
- 17. Mann DM, Chen J, Chunara R, Testa PA, Nov O. COVID-19 transforms health care through telemedicine: evidence from the field. J Am Med Inform Assoc 2020; 27:1132-1135.
- 18. Yoon SS, Gu Q, Nwankwo T, Wright JD, Hong Y, Burt V. Trends in blood pressure among adults with hypertension: United States, 2003 to 2012. Hypertension 2015; 65:54-61.
- 19. Pierannunzi C, Hu SS, Balluz L. A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011. BMC Med Res Methodol 2013; 13:49.
- 20. Morton SM, Bandara DK, Robinson EM, Carr PE. In the 21st Century, what is an acceptable response rate? Aust N Z J Public Health 2012; 36:106-108.