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## Clinical Implementation of Self-Measured Blood Pressure Monitoring, 2015–2016

Sandra L Jackson, PhD, Carma Ayala, PhD, Xin Tong, MPH, and Hilary K. Wall, MPH

From the Division for Heart Disease and Stroke Prevention, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

### Abstract

**Introduction:** Self-measured blood pressure monitoring (SMBP) plus additional clinical support is an evidence-based strategy that improves blood pressure control. Despite national recommendations for SMBP use and potential cost savings, insurance coverage for implementation is limited in the U.S. and little is known regarding clinical implementation.

**Methods:** In 2017, using 2015 and 2016 DocStyles survey data from 1,590 primary care physicians and nurse practitioners in U.S. outpatient facilities, SMBP-related clinical practices and provider roles were assessed.

**Results:** Almost all (97%) respondents reported using SMBP. Among 1,539 who used SMBP, more than half (60%) used SMBP for a combination of diagnostic and treatment purposes, whereas 24% used SMBP for diagnosis only and 16% used SMBP for treatment only. The most common methods for patients to share SMBP results with clinical staff were paper log (68%), during appointments (66%), by telephone (37%), by secure website (22%), or by secure e-mail (19%). Nearly all (98%) respondents reported that medication adjustments were provided to patients based on SMBP readings. About 15% did not counsel patients regarding cuff size, and 8% did not validate patient devices. Only 13% of respondents reported having monitor loaner programs, and availability did not vary by the financial status of the patient population ( $p=0.59$ ).

**Conclusions:** SMBP is used widely in outpatient facilities as reported in the survey, although provider roles and SMBP-related practices vary, and gaps exist regarding patient counseling, device validation, and loaner program availability. As part of efforts to improve hypertension control, healthcare professionals can promote increased use of best practices for SMBP, whereas insurers can implement standardization and support of SMBP.

### INTRODUCTION

Hypertension affects approximately one third of U.S. adults, and is a leading risk factor for cardiovascular disease and stroke morbidity and mortality.<sup>1</sup> Among those with hypertension, uncontrolled hypertension is common, and is associated with increased long-term risk of stroke, heart attack, heart failure, kidney disease, and cognitive decline.<sup>1–3</sup> Self-measured blood pressure monitoring (SMBP) plus additional clinical support (such as one-on-one counseling, educational classes, and telehealth support tools) is an evidence-based strategy

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Address correspondence to: Sandra L. Jackson, PhD, 4770 Buford Highway NE, Chamblee GA 30341. icl1@cdc.gov.

that has been shown to reduce BP and improve hypertension control.<sup>4,5</sup> SMBP is defined as the regular measurement of BP by the patient outside the clinical setting, either at home or elsewhere. SMBP, with additional clinical support, has been shown to improve access to and quality of care for individuals with hypertension while making BP control more convenient and accessible across populations.<sup>4,6-9</sup>

Major U.S. and international clinical guidelines recommend SMBP for the diagnosis and management of hypertension.<sup>10-16</sup> In 2008, the American Heart Association, American Society for Hypertension, and the Preventive Cardiology Nurses Association released a Call to Action on use and reimbursement for SMBP.<sup>14</sup> These groups recommended advising patients to only use quality devices that have been validated, providing insurance coverage for devices, and reimbursing clinicians for their time to train patients regarding use, validate patient devices against office machines, interpret home BP measurement readings, and provide titration or lifestyle modification advice based on those readings. Yet, current insurance coverage for these devices is inconsistent, with Medicare providing coverage only when ruling out “white coat hypertension” using ambulatory BP monitoring devices but not home BP devices.<sup>17,18</sup> In addition, reimbursement for staff time is virtually non-existent.

Despite the lack of coverage, there are examples of SMBP implementation in clinical settings throughout the U.S.<sup>15,19-21</sup> SMBP with additional clinical support is cost effective and coupled with a shift in clinical payment in the U.S. from fee for service to pay for quality and increasing availability of telehealth for support, an uptick in SMBP implementation could be expected.<sup>4,6,8,9,17</sup> Approximately 39%–54% of patients with hypertension report using a home BP monitor,<sup>22-24</sup> yet data are scarce regarding SMBP-related resources in the clinical setting, such as clinician-directed hypertension management, use of evidence-based protocols, or provision of training regarding cuff selection or proper use of a monitor. This study aims to assess clinical implementation of SMBP including staff roles, purposes of SMBP (diagnosis, treatment, or both), and availability of BP monitor loaner programs.

## METHODS

### Study Population

DocStyles is a web-based survey conducted by Porter Novelli ([www.porternovelli.com](http://www.porternovelli.com)) that samples healthcare professionals (HCPs), including physicians (i.e., family and general, internal medicine/internists) and nurse practitioners (NPs). Each survey year, provider samples are drawn from SERMO’s Global Medical Panel2 ([www.sermo.com](http://www.sermo.com)) of >350,000 medical professionals in the U.S., with quotas set for 1,000 physicians and 250 NPs to participate. HCP participants were screened to include only those who practiced in the U.S.; actively saw patients; worked in an individual, group, or hospital practice; and had been practicing for >3 years. HCPs identified by SERMO as active members were invited to participate, followed by less active members, until annual quotas were met. During 2015 and 2016, a total of 3,643 physicians and NPs were invited to participate, and 2,507 completed the survey (69% response rate). Invitations were sent by e-mail. Reasons for noncompletion included terminating the survey prior to completion, not meeting screening questions, survey quotas being fulfilled, and nonresponse to the survey invitation. HCPs who completed the

survey were paid an honorarium between \$69 and \$76, depending on the number of questions asked. Demographics of the samples closely matched the American Medical Association's master file proportions for age, gender, and region. Sampling information and differences between the 2015 and 2016 surveys are described (Appendix Table 1).

The analytic cohort was limited to unique respondents (those who only responded in 2015 or 2016, or for the 24% that responded in both years, only the 2016 responses were included;  $n=1,907$ ). After excluding participants whose main work setting was inpatient practice ( $n=317$ ) and who did not report using SMBP ( $n=51$ ), the final analytic sample was 1,539. The Centers for Disease Control and Prevention licenses DocStyles data from Porter Novelli. Personal identifiers were not included; therefore, this research was determined to be exempt from the Centers for Disease Control and Prevention's IRB review.

## Measures

In 2015 and 2016, DocStyles contained 131 and 144 questions respectively, designed to provide insight into HCPs' attitudes and behaviors. For the SMBP component, questions assessed HCPs' opinions and counseling practices related to SMBP (Appendix Table 2). To examine ways in which providers use SMBP, HCPs were stratified by whether they ever recommend that patients monitor their BP at home for: (1) only diagnostic purposes, including suspected white coat hypertension or diagnostic confirmation; (2) only treatment purposes; or (3) both diagnostic and treatment purposes. HCPs were also asked about SMBP-related resources within their facilities.

The survey also collected information on HCPs' demographic characteristics, including age, sex, and race/ethnicity. Additional information about the HCP's clinical practice was included, such as type of HCP, number of practitioners in the practice, main work setting, years of practice, whether the respondent has privileges at a teaching hospital, and the perceived income of the majority of patients at the practice (poor: <\$25,000 and lower middle class: \$25,000–\$49,999, middle class: \$50,000–\$99,999, and upper middle class: \$100,000–\$249,000 and affluent: \$250,000).

## Statistical Analysis

Differences in HCPs' demographic, health, and facility characteristics, and responses to SMBP questions, were assessed using chi-square tests for categorical variables and *t*-tests of means for continuous numeric data. All analyses were conducted in 2017 using SAS software, version 9.3.

## RESULTS

Of 1,590 HCP respondents in outpatient facilities, 51 (3.2%) did not report using SMBP at all and were excluded from further analyses. Among 1,539 HCPs who reported that SMBP was ever used in their practices, 39% were women, 44% were family/general practitioners, 37% were internists, and 19% were NPs (Table 1). More than half (60%) of HCPs reported using SMBP for a combination of diagnostic and treatment purposes, whereas one quarter (24%) reported using SMBP for diagnosis only, and 16% reported using SMBP for treatment only. Compared with internists (55%) and family/general practitioners (61%), NPs

(66%) were most likely to report using SMBP for a combination of diagnosis and treatment. Of the three HCP types, internists (30%) were most likely to report using SMBP for diagnosis only.

Approximately half of HCPs reported that someone in their practice counsels patients regarding what size cuff to buy, one third reported that someone counsels patients on the importance of a properly sized cuff, and 15% reported no conversation with patients about cuff size (Table 2). Only 30% reported that their practice “always” validates the patient’s device for accuracy, whereas 62% reported that their practice validates devices “sometimes,” and 8% reported never validating devices. Nearly all HCPs reported that patients share SMBP results with clinical staff, with the most common methods including paper log (68%), in person during usual appointments (66%), by telephone (37%), by secure website or patient portal (22%), or by secure e-mail (19%; note: respondents could select multiple methods).

Nearly all HCPs reported that a team member of their practice instructed a patient to monitor their BP at home (100%), reviewed patients’ SMBP readings (99%), provided medication changes based on SMBP readings (98%), and recommended non-medication changes based on SMBP readings (98%; Figure 1). Of team members in the practice (i.e., physicians, NP/physician assistants, registered nurses [RNs], pharmacists, certified diabetes educators, or other providers) physicians (range, 78%–84%) and NP/physician assistants (range, 35%–39%) were the most frequently identified HCPs responsible for these activities (multiple provider types could be selected). Six percent of respondents reported that “no one” was responsible for training patients on proper positioning and technique for using a device, and 5% reported that “no one” was responsible for validating a patient’s device against an office monitor. In addition, of all SMBP-related activities assessed, validating devices (17%) and training patients on proper technique (14%) were the most likely to be ambiguously identified as the responsibility of “another care provider” (other than physicians, NP/physician assistants, RNs, pharmacists, or certified diabetes educators).

Only 13% of respondents reported having BP monitor loaner programs available (Table 3). There was no significant difference in availability of loaner programs ( $p=0.59$ ) based on the perceived income of the patient population served.

## DISCUSSION

Given recommendations for SMBP as a key strategy for diagnosis and management of hypertension,<sup>10–14</sup> it is encouraging that almost all (97%) respondents in this cross-sectional study reported using SMBP in some capacity within their practice. Of HCPs who reported using SMBP, nearly all reported that patients shared SMBP results with clinical staff, and that staff used them to provide medication and non-medication adjustments. However, purposes and procedures for implementing SMBP varied across providers. Potential gaps were identified, with about 15% of HCPs reporting that patients were not counseled regarding cuff size, and 8% reporting that patient devices were never validated.

Although nearly two thirds of respondents reported using SMBP for both diagnostic and treatment purposes, the relative frequency of these uses is unknown. SMBP is useful for diagnostic purposes in cases of suspected white coat hypertension (in which a patient has high BP readings in a clinical setting, but not elsewhere), which may affect 15% to 20% of people with elevated office BP.<sup>25</sup> SMBP is also beneficial for confirming a diagnosis of hypertension, as recommended by the U.S. Preventative Services Task Force in 2015 and the 2017 American College of Cardiology/American Heart Association Hypertension Guideline.<sup>26,27</sup> An initial high BP reading may be an anomaly, whereas frequent SMBP readings indicating hypertension, taken in a more relaxed setting at home, can give HCPs confidence to make the diagnosis.<sup>20</sup> For ongoing treatment purposes, SMBP may help HCPs overcome therapeutic inertia, tailor medical management for each patient more frequently, and better avoid over- or under-treatment, and may also improve patient engagement and encourage adherence.<sup>4,7,20</sup> Improved control of hypertension is a national priority, and is a key focus in national initiatives, such as Million Hearts<sup>®</sup> and *Healthy People 2020*. Increasing the use of appropriately implemented SMBP can facilitate these efforts, and promising examples of SMBP implementation exist.<sup>20</sup>

It is interesting to note that, of HCPs reporting use of SMBP, 98% reported that someone in their practice used SMBP results for medication changes, yet nearly one quarter of HCPs reported that they used SMBP for diagnostic purposes only. This may imply that different HCPs within teams use SMBP in complementary ways. Respondents most commonly identified physicians as being responsible for telling patients to monitor their BP at home, reviewing SMBP results, and providing medication changes based on SMBP results (range, 78%–84%), but more than one third of respondents also reported that NPs were responsible for these tasks (range, 35%–39%). The most common SMBP tasks under the responsibility of RNs were training patients on proper positioning and techniques for using monitors and validating devices against office monitors (40% each), although some respondents indicated that RNs made non-medication changes (17%) or medication changes (6%). It is possible that the roles of physicians, NPs, and RNs will evolve over time, with changes in technology, telehealth, state laws regarding practice authority, and continued emphasis on practicing to the top of the license.<sup>15</sup> It is recommended for HCPs to implement standardized hypertension treatment protocols in their practice to enable the full healthcare team to titrate medications.<sup>28</sup> Additionally, relevant team members should be identified and trained in taking BP and providing related clinical support for SMBP.<sup>15</sup> Training for BP measurement is necessary because technique can have a substantial impact on BP,<sup>19</sup> yet clinicians may not be well-trained in methods for accurate BP measurement.<sup>29,30</sup> The training of clinicians in accurate BP measurement, and in methods for conveying this training to patients, is especially important to ensure that BP is measured in a standard way both in and out of the office.

In addition to having a treatment protocol and training team members in SMBP-related activities, best practices for SMBP include taking the time to train patients to use their devices and validate patient devices with the office machines.<sup>16</sup> Given that some providers struggle with accurate BP measurement,<sup>29,30</sup> ability to accurately train patients to use SMBP cannot be assumed. When SMBP training is provided to patients, clinical competency checklists can be used to enhance the quality of training, and training can be performed in

conjunction with checking a patient's device for accuracy (here referred to as validation).<sup>16</sup> Validation in the clinic is necessary because even devices that meet standards for quality may not provide accurate measurements in all patients, and errors may be greater than 5 mmHg.<sup>16</sup> Having a patient bring his or her device into the clinic and measuring the patient's BP with the patient's home monitor provides an opportunity to train the patient in proper use of the device, as well as to validate the device against an office machine. Given the lack of reimbursement for these activities, it is not surprising that gaps were identified in these areas: 5%–6% of respondents reported that no one in the practice was responsible for these tasks, and 14%–17% ambiguously reported that these tasks were the responsibility of "another care provider." The response selection of "another care provider" could indicate that the respondents did not know who, if anyone, was responsible for the task, or it could indicate the responsibility of another person, such as a medical assistant, community health worker, or member of an external organization. In addition, only 30% of respondents said that patient monitors were always validated in the clinic before the patient's first use. External programs could play a role in addressing these gaps, such as community health workers, who could assist patients in their community.<sup>31–34</sup>

Despite nearly a decade elapsing since there were calls for insurance coverage of SMBP-related services, devices, and accessories, coverage is lacking.<sup>14,17,18</sup> Recommended devices can range in cost from \$80 to \$100; 14% of patients without monitors cited expense as the reason.<sup>14</sup> BP monitor loaner programs may be one strategy through which HCPs can help patients overcome this barrier.<sup>16</sup> Another benefit of loaner programs is that provided devices could be chosen from a list of certified devices and pre-validated with office devices,<sup>16</sup> which may help protect patients from purchasing unreliable monitors. However, there is a paucity of data regarding loaner programs in clinics. In the present study, only 13% of respondents reported offering a loaner program, and HCPs who served lower-income patients were no more likely to have a loaner program than HCPs with more affluent patients. One emerging strategy is for insurance companies to provide incentives to initiate loaner programs.<sup>23,35</sup> A solution with a broad potential reach could be insurance coverage of devices, as recommended in the 2008 Call to Action.<sup>14</sup> In addition to societal cost effectiveness,<sup>6</sup> from a payer perspective, coverage of SMBP may be cost saving.<sup>17</sup>

## Limitations

This study had at least five limitations. First, despite nearly all (97%) respondents reporting use of SMBP, the proportion of patients recommended to use SMBP by providers was not assessed. Only approximately 39%–54% of patients with hypertension report using a home BP monitor,<sup>22–24</sup> and using the nationally representative National Health and Nutrition Examination Survey during 2009–2010, it was estimated that only 24% of adults with hypertension were told by physicians to monitor their BP at home.<sup>17</sup> Therefore, the proportion of providers who report ever using SMBP should not be conflated with the proportion of eligible patients recommended to use SMBP, which is likely a much smaller percentage. In addition, DocStyles did not assess whether providers used SMBP systematically (i.e., whether it was always used to diagnose and manage patients with hypertension, or the extent of incorporation into the clinical and electronic workflow), which could also impact the proportion of eligible patients for whom SMBP was implemented.

Second, as with SMBP interventions,<sup>4</sup> SMBP implementation within clinical practices was likely to vary widely in terms of monitoring protocols, methods of review and use of data, and medication adjustment algorithms; it was not possible to examine these variations in detail. Third, self-reported data are based on respondent perceptions of SMBP use, and may be subject to inaccuracy or response bias. For example, best practices, such as validating monitors or training patients regarding cuff size, may be particularly vulnerable to social desirability bias, which may have resulted in over-reporting of SMBP practices. In addition, if clinicians are not well-trained in methods for accurate BP measurement,<sup>29,30</sup> the quality of training provided to patients may be suboptimal. Fourth, DocStyles is a web-based survey to which HCPs were invited to participate based on their positive engagement level, including history of survey completion, which may affect representativeness of the data. Although DocStyles participants approximated the American Medical Association's master file proportions according to age, gender, and region, other characteristics (such as race/ethnicity, or income distribution of the patient population served) may not reflect the overall population of HCPs in the U.S. Fifth, because of sample size constraints, this study combined data from 2015 and 2016, and was not able to examine changes over time.

## CONCLUSIONS

SMBP use was widely reported by outpatient primary care physicians and NPs in the DocStyles survey, although provider roles, uses of SMBP data, and SMBP-related practices varied. Incorporating SMBP into the system of care and identifying team members for patient instruction and education is vital to ensure proper SMBP use and follow-up. As part of efforts to improve hypertension control, HCPs can promote increased use of best practices for SMBP, whereas insurers can implement standardization and support of SMBP.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## ACKNOWLEDGMENTS

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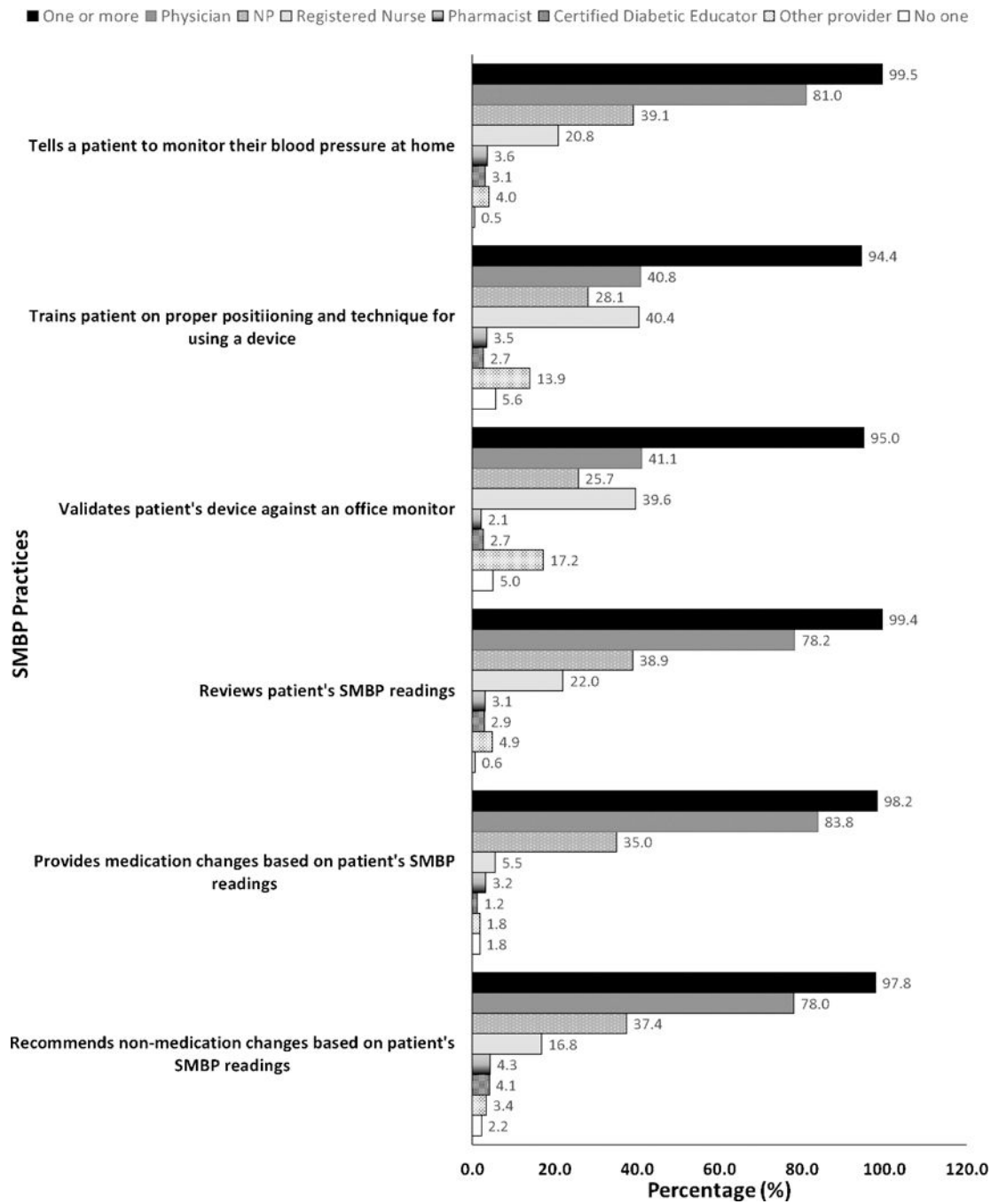
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**Figure 1.** Respondent perceptions of who is responsible for SMBP-related activities – DocStyles 2015 and 2016.

**Table 1.**Characteristics of Healthcare Professionals, by SMBP<sup>a</sup> Utilization Category, DocStyles 2015 and 2016

Descriptive characteristics	Overall N (%)	SMBP utilization categories			<i>p</i> -value <sup>b</sup>
		DX	TRT	Comb	
Total	1,539	371 (24.1)	246 (16.0)	922 (59.9)	
Healthcare professionals' personal characteristics					
Age groups, years					0.34
<44	676 (43.9)	171 (25.3)	114 (16.9)	391 (57.8)	
>45	863 (56.1)	200 (23.2)	132 (15.3)	531 (61.5)	
Gender					0.004
Male	935 (60.8)	<b>251 (26.8)</b>	<b>152 (16.3)</b>	<b>532 (56.9)</b>	
Female	604 (39.2)	<b>120 (19.9)</b>	<b>94 (15.6)</b>	<b>390 (64.6)</b>	
Race/ethnicity					0.01
Non-Hispanic whites	971 (63.1)	<b>216 (22.2)</b>	<b>150 (15.4)</b>	<b>605 (62.3)</b>	
Non-Hispanic blacks	49 (3.2)	<b>8 (16.3)</b>	<b>13 (26.5)</b>	<b>28 (57.1)</b>	
Asian	356 (23.1)	<b>109 (30.6)</b>	<b>50 (14.0)</b>	<b>197 (55.3)</b>	
Hispanic	57 (3.7)	<b>16 (28.1)</b>	<b>9 (15.8)</b>	<b>32 (56.1)</b>	
Other	106 (6.9)	<b>22 (20.8)</b>	<b>24 (22.6)</b>	<b>60 (56.6)</b>	
Provider types					<0.0001
Family/General practitioner	670 (43.5)	<b>159 (23.7)</b>	<b>100 (14.9)</b>	<b>411 (61.3)</b>	
Internist	576 (37.4)	<b>170 (29.5)</b>	<b>89 (15.5)</b>	<b>317 (55.0)</b>	
Nurse practitioner	293 (19.0)	<b>42 (14.3)</b>	<b>57 (19.5)</b>	<b>194 (66.2)</b>	
Healthcare professionals' practice characteristics					
Main practice setting					0.70
Individual outpatient practice	365 (23.7)	84 (23.0)	63 (17.3)	218 (59.7)	
Group outpatient practice	1174 (76.3)	287 (24.4)	183 (15.6)	704 (60.0)	
Number of years practicing medicine					0.10
<10 years	379 (24.6)	76 (20.1)	65 (17.2)	238 (62.8)	
>10 years	1160 (75.4)	295 (25.4)	181 (15.6)	684 (59.0)	
Number of patients seen weekly					<0.0001
<100	611 (39.7)	<b>93 (15.2)</b>	<b>110 (18.0)</b>	<b>408 (66.8)</b>	
>100	928 (60.3)	<b>278 (30.0)</b>	<b>136 (14.7)</b>	<b>514 (55.4)</b>	
Financial situation of majority of patients					0.01
Very poor-lower middle class	461 (30.0)	<b>92 (20.0)</b>	<b>83 (18.0)</b>	<b>286 (62.0)</b>	
Middle class	546 (35.5)	<b>128 (23.4)</b>	<b>77 (14.1)</b>	<b>341 (62.5)</b>	
Upper middle - affluent class	532 (34.6)	<b>151 (28.4)</b>	<b>86 (16.2)</b>	<b>295 (55.5)</b>	
Number of physicians in the practice					0.43
<5	666 (43.3)	166 (24.9)	107 (16.1)	393 (59.0)	
5-9	397 (25.8)	82 (20.7)	70 (17.6)	245 (61.7)	
10-19	247 (16.0)	58 (23.5)	37 (15.0)	152 (61.5)	
>20	229 (14.9)	65 (28.4)	32 (14.0)	132 (57.6)	
Privileges at teaching hospital					0.01

Descriptive characteristics	Overall N (%)	SMBP utilization categories			<i>p</i> -value <sup>b</sup>
		DX	TRT	Comb	
Yes	646 (42.0)	<b>177 (27.4)</b>	<b>110 (17.0)</b>	<b>359 (55.6)</b>	
No	893 (58.0)	<b>194 (21.7)</b>	<b>136 (15.2)</b>	<b>563 (63.0)</b>	

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Self-measured blood pressure monitoring categories included: DX: Ever recommend that your patients monitor their BP at home for diagnosis purposes, either: (a) yes, if patient has suspected white-coat HTN; (b) yes, to confirm a diagnosis of HTN, or both a+b; TRT: Ever recommend that your patients monitor their BP at home for treatment purposes, with the option (c) yes, as part of HTN treatment; COMB: Ever recommend that your patients monitor their BP at home for either diagnosis or treatment (combined) purposes (a+c, b+c, or a+b+c).

<sup>b</sup>Chi-square test for differences in distribution by SMBP utilization categories (by row).

SMBP, Self-measured blood pressure monitoring; DX, Diagnosis Only; TRT, Treatment Only; COMB, Combination of Diagnosis and Treatment; BP, Blood Pressure; HTN, Hypertension.

**Table 2.**

## Prevalence of Practices Related to SMBP, DocStyles 2015 and 2016

SMBP resources and practices	N (%)
Total	1,539
In your practice, do you or your staff help patients choose a properly sized cuff to use with their device?	
Yes, patients are told which size cuff to buy	796 (51.7)
Yes, patients are told that properly-sized cuff is important	512 (33.3)
No, there is no discussion	231 (15.0)
In your practice, how often do you or your staff validate the patient's device for accuracy before first use? <sup>a</sup>	
Always	458 (29.8)
Sometimes	960 (62.4)
Never	121 (7.9)
Ways patients share the results of their SMBP with clinical staff (can choose multiple options)	1,531 (99.5) <sup>b</sup>
By secure e-mail	285 (18.5)
By secure website or patient portal	335 (21.8)
By telephone	571 (37.1)
By written paper log	1,039 (67.5)
In person at a group or individual educational counseling	220 (14.3)
In person during their usual appointment	1,013 (65.8)
Other	13 (0.8)
Patients do not share their blood pressure readings	8 (0.5)

<sup>a</sup> A slight discrepancy in the data was that, while 7.9% of HCPs reported that they or their staff never “validate the patient’s home BP monitor for accuracy against an office BP monitor before the patient begins using it”, above, only 5% of HCPs reported that “no one” in the practice is typically responsible for validating “a patient’s home BP monitor against an office monitor” (Figure 1). This difference may be due to the wording of the two questions (the former specifies “before a patient begins using it”, while the latter does not, and the former specifies “you or your staff” while the latter asks “who in your practice”, which may have been interpreted more broadly to include affiliated certified diabetes educators or pharmacists that the respondent may not have initially included under “you or your staff”).

<sup>b</sup> Prevalence of using at least one strategy to share results.

SMBP, self-measured blood pressure monitoring; HCP, healthcare provider

**Table 3.**

Availability of Blood Pressure Monitor<sup>a</sup> Loaner Programs, by Provider Type and Practice Characteristic, DocStyles 2015 and 2016

Characteristics	Overall N	Loaner program, N (row %)		p-value
		Yes n (%)	No n (%)	
Total	1,452	193 (13.3)	1,259 (86.7)	
Provider types				<0.001
Family/General practitioner	636	73 ( <b>11.5</b> )	<b>563 (88.5)</b>	
Internist	539	96 ( <b>17.8</b> )	<b>443 (82.2)</b>	
Nurse practitioner	277	24 ( <b>8.7</b> )	<b>253 (91.3)</b>	
Number of patients seen weekly				0.01
<100	579	61 ( <b>10.5</b> )	<b>518 (89.5)</b>	
>100	873	132 ( <b>15.1</b> )	<b>741 (84.9)</b>	
Financial situation of majority of patients				0.59
Very poor-lower middle class	434	61 (14.1)	373 (85.9)	
Middle class	514	62 (12.1)	452 (87.9)	
Upper middle - affluent class	504	70 (13.9)	434 (86.1)	
Number of physicians in the practice				0.08
<5	638	71 (11.1)	567 (88.9)	
5-9	380	64 (16.8)	316 (83.2)	
10-19	225	31 (13.8)	194 (86.2)	
>20	209	27 (12.9)	182 (87.1)	

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Monitor- home blood pressure monitoring device.

**Appendix Table 1.**2015 and 2016 DocStyles' Healthcare Provider Panel<sup>a</sup>

Panel	2015	2016
	SERMO's Global Medical Panel <sup>b</sup>	SERMO's Global Medical Panel <sup>b</sup>
Primary care physicians <sup>c</sup>		
Sample released <sup>d</sup>	1,122	1,422
Quota	1,000	1,000
Number complete (response rate) <sup>e</sup>	1,000 (89.1%)	1,003 (70.5%)
Nurse practitioner		
Sample released <sup>d</sup>	487	612
Quota	250	250
Number complete (response rate) <sup>e</sup>	251 (51.5%)	253 (41.3%)
Combined healthcare providers		
Sample released	1,609	2,034
Quota	1,250	1,250
Number combined (response rate)	1,251 (77.7%)	1,256 (61.7%)
Excluded		
Removed repeated participants	600	0
Inpatient practice	116	201
Did not reporting using SMBP	15	36
Final sample	520	1,019

<sup>a</sup>Data provided by Porter Novelli (PN).

<sup>b</sup>During 2015 and 2016, includes over 330,000 and 350,000 medical professionals in the U.S., respectively. SERMO's continually attempts to remove primary care physicians who consistently failed to respond to previous surveys.

<sup>c</sup>Includes family/general practitioners and internists.

<sup>d</sup>The number of HCPs who received the survey. Surveys are sent on a rolling basis until quotas are reached. In 2015, the survey timeframe was increased to allow for more reminders and quotas were met while releasing fewer surveys.

<sup>e</sup>2015 response rates provided by PN. 2016 response rates calculated as [number complete/sample released].

HCP, healthcare provider; SMBP, self-measured blood pressure monitoring.



### Appendix Table 2.

#### List of Self-measured Blood Pressure Monitoring Questions, DocStyles 2015 and 2016

- 
1. The next few questions are about patient self-monitoring of blood pressure or home blood pressure monitoring. Please answer the following questions based on your experiences with your patients. Do you ever recommend that your patients monitor their blood pressure at home? Select all that apply. (*Yes, if a patient has suspected white-coat hypertension. Yes, to confirm a diagnosis of hypertension. Yes, as part of a hypertension treatment regimen. No, I never recommend that a patient take their blood pressure at home*)
  2. In your practice, do you or your staff help patients choose a properly sized cuff to use with their home blood pressure monitor? Select one only. (*Yes, patients are told which size cuff to purchase when buying a monitor; Yes, patients are told that a properly-sized cuff is important, but not told which size to use; No, there is no discussion with patients about properly-sized cuffs*)
  3. In your practice, how often do you or your staff validate the patient's home blood pressure monitor for accuracy against an office blood pressure monitor before the patient begins using it? Select one only. (*Always, Sometimes, Never*)
  4. Who in your practice is typically responsible for each of the following tasks? Select all (*Physician, Nurse Practitioner or Physician's Assistant, Registered Nurse, Pharmacist, Certified Diabetes Educator, Another Care Provider, or No One, if no one selected then others cannot be included*) that apply for each row:
    - a. Tells a patient to monitor their blood pressure at home
    - b. Trains patient on proper positioning and technique for using a home blood pressure monitor
    - c. Validates a patient's home blood pressure monitor against an office monitor
    - d. Reviews patient's home blood pressure readings
    - e. Provides medication changes based on patient's home blood pressure readings
    - f. Recommends non-medication changes based on patient's home blood pressure readings
  5. How do patients share the results of their blood pressure readings with clinical staff? Select all that apply. (*By secure email, By secure website or patient portal, By telephone, By written paper log, In person, at a group or individual educational/counseling session, In person, during their usual appointment, Other, Patients do not share their blood pressure readings, if last is selected, no other can be included*)
  6. Does your practice have a home blood pressure monitor loaning program for patients who do not own their own home blood pressure monitor? Select one only. (*Yes, No, or Don't know/Not applicable*)
-

**Appendix Table 3.**

Differences in Percentages of Team-based Care Members Who Interact With Patients for Lifestyle (Non-medication) Self-Measured Blood Pressure Monitoring (SMBP) Readings, by SMPB Utilization Category<sup>a</sup> – DocStyles 2015 and 2016

Variable	Overall n (%) or statistics (N=1,539)	DX (n=371)	TRT (n=246)	Comb (n=922)	p-value
Provides medication changes based on patient's SMBP readings					
Physician	1,289 (83.8)	<b>269 (72.5)</b>	<b>203 (82.5)</b>	<b>817 (88.6)</b>	<0.0001
NP/PA	538 (35.0)	<b>87 (23.5)</b>	<b>93 (37.8)</b>	<b>358 (38.8)</b>	<0.0001
RN	84 (5.5)	<b>43 (11.6)</b>	<b>9 (3.7)</b>	<b>32 (3.5)</b>	<0.0001
Pharmacist	50 (3.2)	<b>20 (5.4)</b>	<b>8 (3.3)</b>	<b>22 (2.4)</b>	0.02
Certified diabetes educator	18 (1.2)	6 (1.6)	1 (0.4)	11 (1.2)	0.39
Another care provider	28 (1.8)	11 (3.0)	3 (1.2)	14 (1.5)	0.16
No one	27 (1.8)	10 (2.7)	5 (2.0)	12 (1.3)	0.21
Recommends non-medication changes based on patient's SMBP readings					
Physician	1,201 (78.0)	<b>244 (65.8)</b>	<b>187 (76.0)</b>	<b>770 (83.5)</b>	<0.0001
NP/PA	576 (37.4)	<b>100 (27.0)</b>	<b>96 (39.0)</b>	<b>380 (41.2)</b>	<0.0001
RN	259 (16.8)	62 (16.7)	42 (17.1)	155 (16.8)	0.99
Pharmacist	66 (4.3)	19 (5.1)	7 (2.8)	40 (4.3)	0.39
Certified diabetes educator	63 (4.1)	15 (4.0)	6 (2.4)	42 (4.6)	0.33
Another care provider	52 (3.4)	9 (2.4)	7 (2.8)	36 (3.9)	0.36
No one	34 (2.2)	<b>13 (3.5)</b>	<b>8 (3.3)</b>	<b>13 (1.4)</b>	0.03

Notes: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>SMBP monitoring categories included: DX: Ever recommend that your patients monitor their BP at home for diagnosis purposes, either: (a) yes, if patient has suspected white-coat HTN; (b) yes, to confirm a diagnosis of HTN, or both a+b; TRT: Ever recommend that your patients monitor their BP at home for treatment purposes, with the option (c) yes, as part of HTN treatment; COMB: Ever recommend that your patients monitor their BP at home for either diagnosis or treatment (combined) purposes (a+c, b+c, or a+b+c).

DX, Diagnosis Only; TRT, Treatment Only; Comb, Combination of Diagnosis and Treatment; NP/PA, Nurse Practitioner or Physician's Assistant; RN, Registered Nurse; BP, blood pressure; HTN, hypertension

**Appendix Table 4.**

Respondent Perceptions of Who Is Responsible for SMBP-Related Activities – DocStyles 2015 and 2016  
(Corresponding Data for Figure 1)

Variable	N (%)
Tells a patient to monitor their BP at home	1,532 (99.5) <sup>a</sup>
Physician	1,246 (81.0)
NP/PA	602 (39.1)
RN	320 (20.8)
Pharmacist	56 (3.6)
Certified diabetes educator	48 (3.1)
Another care provider	62 (4.0)
No one	7 (0.5)
Trains patient on proper positioning and technique for using a device	1,453 (94.4) <sup>a</sup>
Physician	628 (40.8)
NP/PA	432 (28.1)
RN	622 (40.4)
Pharmacist	54 (3.5)
Certified diabetes educator	42 (2.7)
Another care provider	214 (13.9)
No one	86 (5.6)
Validates a patient's device against an office monitor	1,462 (95.0) <sup>a</sup>
Physician	633 (41.1)
NP/PA	396 (25.7)
RN	610 (39.6)
Pharmacist	33 (2.1)
Certified diabetes educator	42 (2.7)
Another care provider	265 (17.2)
No one	77 (5.0)
Reviews patient's SMBP readings	1,529 (99.4) <sup>a</sup>
Physician	1,204 (78.2)
NP/PA	598 (38.9)
RN	339 (22.0)
Pharmacist	48 (3.1)
Certified diabetes educator	44 (2.9)
Another care provider	75 (4.9)
No one	10 (0.6)
Provides medication changes based on patient's SMBP readings	1,512 (98.2) <sup>a</sup>
Physician	1,289 (83.8)
NP/PA	538 (35.0)
RN	84 (5.5)
Pharmacist	50 (3.2)

Variable	N (%)
Certified diabetes educator	18 (1.2)
Another care provider	28 (1.8)
No one	27 (1.8)
Recommends non-medication changes based on patient's SMBP readings	1,505 (97.8) <sup>a</sup>
Physician	1,201 (78.0)
NP/PA	576 (37.4)
RN	259 (16.8)
Pharmacist	66 (4.3)
Certified diabetes educator	63 (4.1)
Another care provider	52 (3.4)
No one	34 (2.2)

<sup>a</sup>Prevalence of at least one member selected.

SMBP, Self-measured blood pressure monitoring; NP/PA, Nurse Practitioner / Physician's Assistant; RN, Registered Nurse.

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