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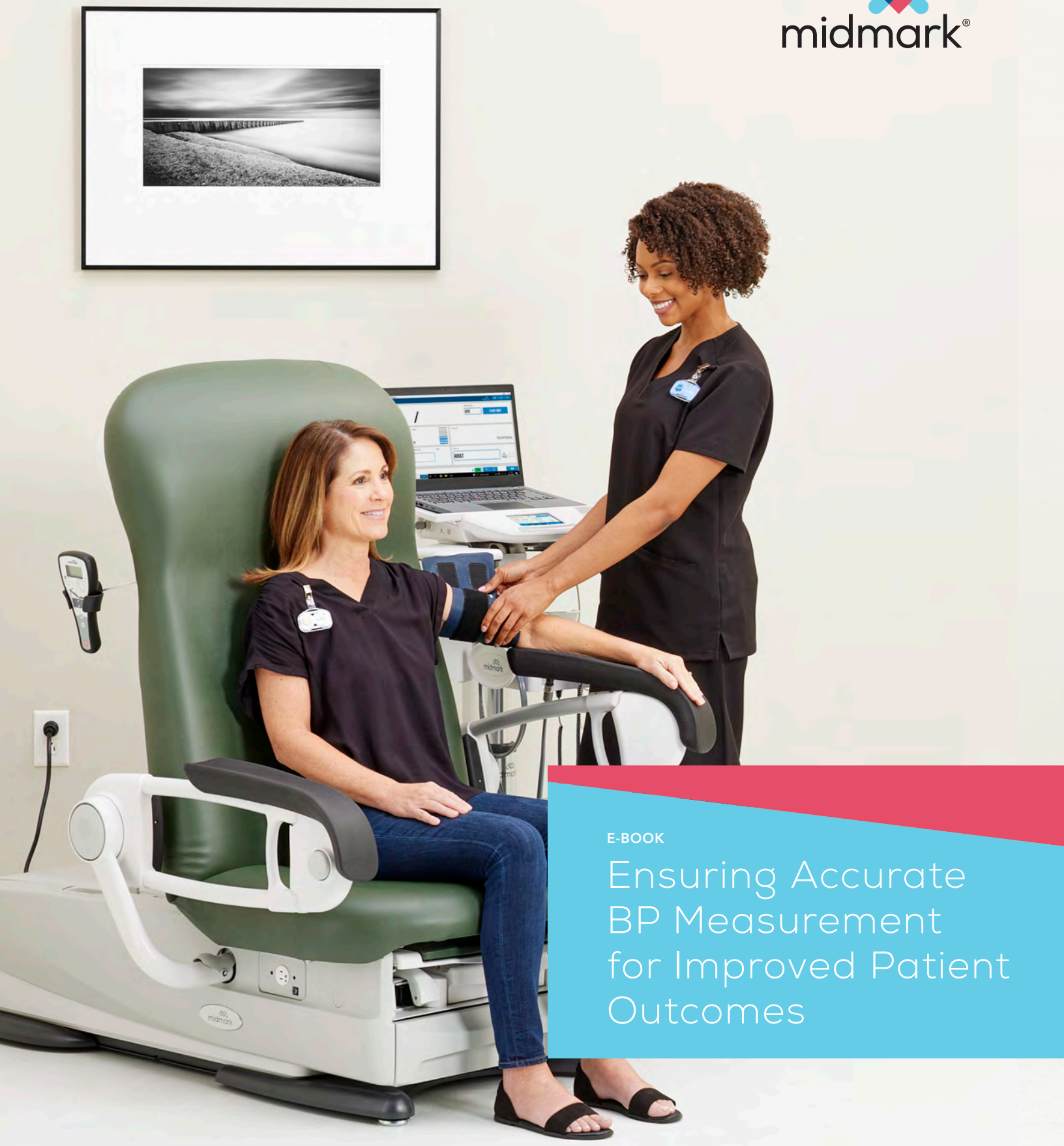


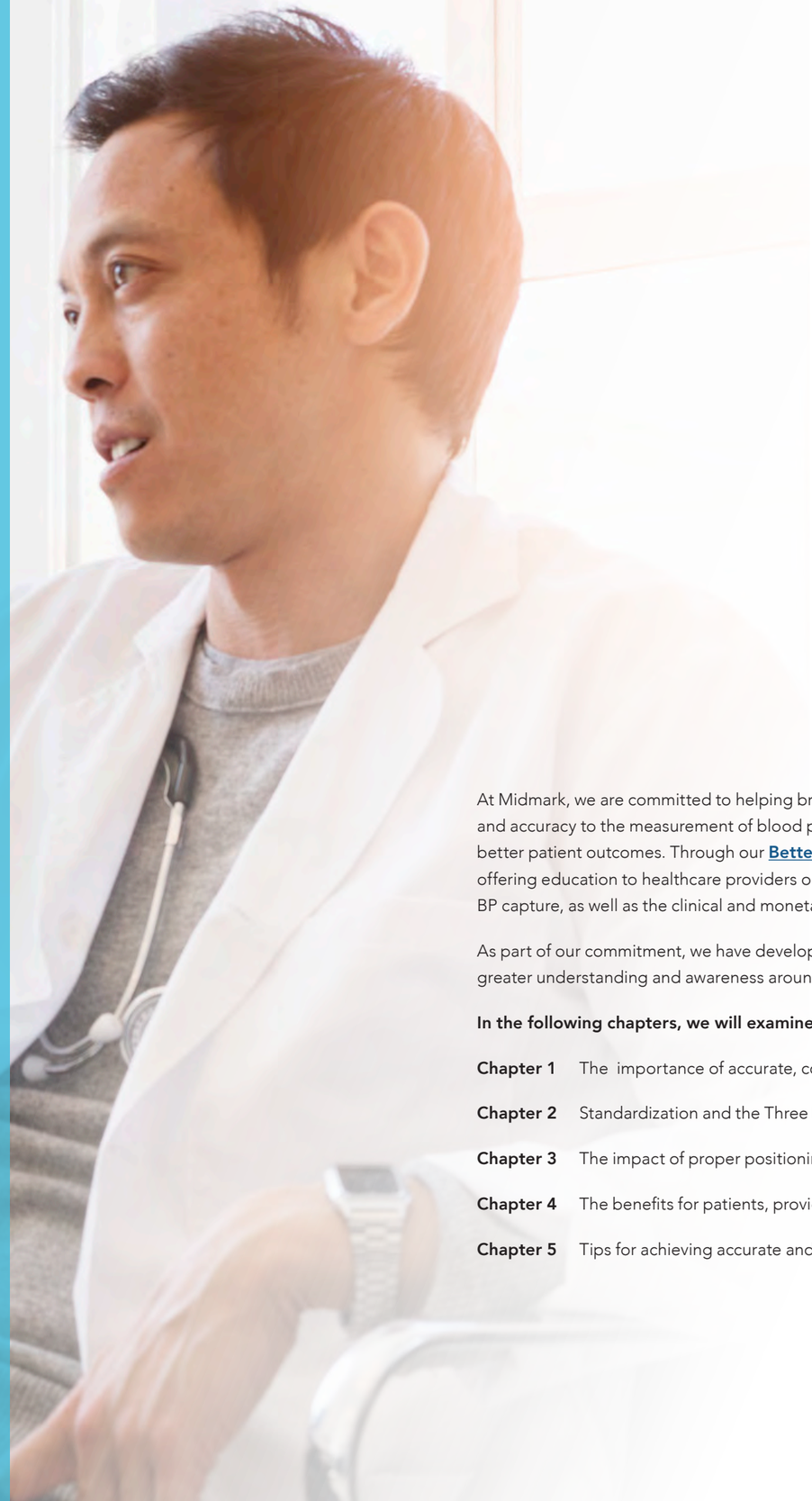
E-BOOK

Ensuring Accurate BP Measurement for Improved Patient Outcomes

The Importance of Correct BP Measurement

Of all the vital signs, blood pressure (BP) measurement has perhaps the strongest connection to point of care diagnosis, patient risk stratification and medication dosing. Consistent BP measurement is important in properly diagnosing and treating hypertension, in addition to treating patients with diabetes and renal disease.

Unfortunately, in today's increasingly demanding healthcare environment the vital signs acquisition process can be overlooked and undervalued. In fact, BP measurement continues to be the point of care test that is often suboptimally performed in the clinical environment.



At Midmark, we are committed to helping bring increased standardization and accuracy to the measurement of blood pressure (BP) that will help achieve better patient outcomes. Through our **Better BP initiative,** we have been offering education to healthcare providers on the importance of consistent BP capture, as well as the clinical and monetary impact of inaccurate BP.

As part of our commitment, we have developed this e-book to help foster greater understanding and awareness around the measurement of BP.

In the following chapters, we will examine:

Chapter 1 The importance of accurate, consistent BP measurement

Chapter 2 Standardization and the Three Pillars of Better BP

Chapter 3 The impact of proper positioning on BP readings

Chapter 4 The benefits for patients, providers and healthcare systems

Chapter 5 Tips for achieving accurate and consistent BP measurement

Chapter 1
The Importance of Accurate, Consistent BP Measurement

Clinical Significance of BP Measurement

Of all the vital signs, blood pressure (BP) measurement has perhaps the most clinically significant connection to point of care diagnosis, patient risk stratification and proper medication dosing. These important factors of care management are essential to proper diagnostic and therapeutic decision-making tied to better outcomes.

For instance, in order to properly diagnose and treat hypertension—a major risk factor for coronary heart disease, stroke and renal failure—caregivers need to obtain accurate BP information that includes both current BP measurements and trending data.

Inaccurate BP measurement can lead to either a missed diagnosis or misdiagnosis, both of which can cause harm to patients by either not appropriately treating hypertensive patients or medicating patients who are not hypertensive, respectively.

Accurate BP measurement can help identify patients with hypertension who may need treatment and also reduce instances where a patient might be overmedicated. As with any clinical disorder, there is risk to prescribing medication to a patient. This risk increases significantly when the person being treated does not actually suffer from the disorder, or the level of abnormality is over measured. In both cases, patients are at a high risk to incur avoidable medication side effects, which can lead to additional illness or injury.

To improve patient outcomes in general (and in particular for patients with chronic diseases, especially cardiovascular disease), the BP measurements guiding therapeutic management need to be accurate.

It is also important to detect small differences in BP readings to effectively manage patients with hypertension and other metabolic disorders, such as diabetes, renal disease and cardiovascular conditions. Careful BP management, including identifying and adjusting to small shifts over time, is essential to achieving best-in-class outcomes for each patient.

Because of its centrality in care and better outcomes, it is essential for BP measurement to be accurate and repeatable for all caregivers at all sites of care. Slight variations in technique and measurement can have a big impact on the effectiveness of the therapeutic management of many, if not most, chronic diseases.

To improve patient outcomes in general (and in particular for patients with chronic diseases, especially cardiovascular disease), the BP measurements guiding therapeutic management need to be accurate.

Occurrence of Inaccurate BP Measurement

Despite established protocols and efforts to raise awareness from groups like the American Heart Association (AHA) and companies like Midmark, BP measurement continues to be the point of care test that is often suboptimally performed in the clinical environment.

This is not a criticism of healthcare providers' current measurement processes. Rather, it is about the importance of having a standardized approach. It is also about ensuring the routine of conducting BP measurements at the beginning of every doctor's visit does not lead to straying away from the standardized approach over time.

Consider the act of driving a car. When we learn to drive, we are taught the optimal hand positions on the steering wheel are 10 o'clock and 2 o'clock. Most of us do that for the first few months. But as the act of driving becomes more routine for us, our hands begin to move and we develop our own way to hold the steering wheel. This does not mean we forgot how to drive or are now bad drivers; it just means that we have become comfortable enough with the task that we no longer do it the way we were taught.

When a standardized approach to BP measurement is not in place or followed the accuracy of the measurement can be impacted. This is often why BP readings can vary when obtained by different members of a care team. Two different caregivers independently acquiring BP measurements using manual methods on the same patient can often result in two different readings.

A lack of standardization is just one of the factors that can lead to inaccurate BP measurement. A 2019 **consensus document from the Lancet Commission on Hypertension Group** compiled the main causes of BP measurement inaccuracy into four categories:

Patient-Related

These causes stem from the actions and behaviors of the patients. Examples include eating a meal right before the visit, having a full bladder and experiencing a case of white coat syndrome.

Procedure-Related

This category primarily refers to the errors that can occur when not following best practices as defined by both the **AHA guidelines for in-clinic BP measurement** and the **Systolic BP Intervention Trial (SPRINT) study standardized protocol for measuring BP.** (Chapter 2 takes a closer look at these two protocols.)

Equipment-Related

These refer to issues that can arise when inadequate equipment is used as part of the process. This can include a chair that does not allow a patient to sit comfortably with feet flat on the floor or a BP cuff that is too large or too small for the patient.

Observer-Related

These are errors that can be potentially caused by the healthcare professional who is taking the BP measurement. Examples of these types of errors include transcription errors that occur when patient data is entered manually and the failure to allow a five-minute rest period before the measurement is taken.

The following chart shows the discrepancies some of the most common factors can cause with systolic and diastolic BP measurement.

Factor	Systolic BP Discrepancy (mmHg)*	Diastolic BP Discrepancy (mmHg)*
Patient talking or active listening	+10 - 15	+10
Arm is above heart level	-2 per inch	–
Arm is below heart level	+2 per inch	–
Patient's feet not flat on the floor	+5 – 15	–
Patient's back not supported	+5 – 15	+6 – 10
Patient's legs crossed	+2 – 8	+2 – 8
Unsupported arm	+6 – 10	+5 – 15
Patient doesn't rest 3-5 minutes	+10 – 20	–
White coat syndrome	+11 – 20	–

*Factor discrepancies are not cumulative.

This chapter should serve as an important reminder that even with something as seemingly simple and routine as BP measurement, there is the risk of human errors and inaccuracies occurring when proper protocols are not followed.

Chapter 2
Standardization + the Three Pillars of Better BP

Standardized Approach to BP Measurement

Increasing standardization within healthcare organizations is helping to allow good experiences and outcomes to be duplicated. The consolidation of medical practices has compelled many organizations to establish network-wide operational and clinical standards. This is making it possible for these organizations to develop clinical protocols that create efficiencies and cost savings, as well as drive better clinical outcomes. If something is proven to work, it can be easily replicated throughout the network by experienced healthcare workers and those who are just entering the field.

In fact, according to a **research report in the Annals of Family Medicine,** "Consistency across clinical sites offers advantages to an organization: it provides guidance during emerging health threats, facilitates the training and cross coverage of staff, allows for a more predictable patient experience, and can promote the wider adoption of efficient workflows."

Standardization can also help eliminate human variables that often increase the likelihood of errors and contribute to inaccurate diagnoses. One area at the point of care where this benefit is most evident is BP measurement. As mentioned in Chapter 1, proper protocols for BP measurement are defined by both the AHA guidelines for in-clinic BP measurement and the SPRINT study standardized protocol for measuring BP.

The **SPRINT study was published in the New England Journal of Medicine in 2015**. SPRINT researchers based the protocol on individual peer-reviewed clinical studies of varying size and quality that analyzed the known causes for BP measurement variation. Many of the known causes for avoidable variation were taken into account in the SPRINT protocol, except for the known impact of white coat hypertension. The study showed that lowering systolic BP (SBP) to less than 120 mmHg can reduce cardiovascular events by 25 percent for high-risk patients with hypertension.

In 2017, the AHA, partnering with the American College of Cardiology (ACC), published **new guidelines** for in-clinic BP measurement that largely mirrored the highly specific protocol for BP measurement defined in the SPRINT study. These guidelines for the detection, prevention, management and treatment of high BP lower the traditional definition of high BP to account for complications that can occur at lower numbers and to allow for earlier intervention.

Unfortunately, these protocols on their own are not enough. There needs to be greater education and awareness focused on the important role standardized protocols can play in achieving accurate, consistent BP measurement.

Better BP® Initiative

In an effort to help increase the level of education and awareness around proper BP measurement, Midmark established the **Better BP Initiative.** Through this initiative, we have been offering education to healthcare providers on the importance of consistent BP capture, as well as the clinical and monetary cost of inaccurate BP.

For instance, **our clinical education program** created a course focused on hypertension that provides continuing education units (CEUs) to a variety of healthcare professionals. This continuing education course highlights the importance of accurate and standardized BP measurement and is intended for registered nurses, surgical technologists or other healthcare professionals responsible for obtaining BP measurements.

We are also helping our healthcare customers understand that BP acquisition provides an ideal place to start the journey to better clinical outcomes through **the use of a Lean methodology approach.** First developed in the manufacturing industry, the Lean methodology for process improvement offers a systematic approach to implementing continuous improvements that minimize or remove waste and unnecessary steps without negatively impacting efficiency, productivity or quality.

The approach focuses on seven forms of waste: overproduction, waiting, defects, motion, overprocessing, inventory and transport. The first five can be directly applied to clinical work, including BP measurement. For example, in the area of overproduction, healthcare professionals can implement process improvements that help ensure they are only seeing BP patients that truly need to be seen and will benefit from the visit.

We are also embedding this initiative into many of the product solutions and technologies in development. Midmark has focused our fully integrated point of care ecosystem on three main areas. When combined, these **three pillars of Better BP** can help make it easier for caregivers to integrate BP measurement into clinical workflows to help ensure a more consistently accurate BP measurement process. The three pillars of Better BP are:

1. Proper Patient Positioning

Patient comfort level and position of their body, including arms and legs, can impact BP readings. Barrier-Free® power examination chairs, such as the **Midmark® 626 with Patient Support Rails+,** are designed to promote AHA-recommended patient positioning for BP capture.

The Midmark 626 is the only exam chair of its kind designed to promote proper patient positioning for a more accurate BP measurement. It offers multi-positioning options to ensure a patient's back is properly supported, while the arm is maintained at heart height by the accessory rails. The low chair height helps ensure a patient's feet are firmly placed on the floor while acquiring BP readings.

2. Accurate, Consistent BP Capture

Midmark is the first company to implement a SPRINT BP Protocol with patient positioning guidelines in a vital signs acquisition device. **IQvitals® Zone™** with the SPRINT BP Protocol introduces automation at the point of care that can help ensure a higher level of standardization, minimizing human variables while maximizing consistency and data accuracy.

The SPRINT BP Protocol features embedded positioning guidelines to help ensure **proper patient positioning techniques** are followed. The guidelines are displayed in a checklist format to help ensure accurate and repeatable BP capture every time. Healthcare providers can even leave the exam room during the measurement process, reducing the chance of white coat hypertension.

3. EMR Connectivity

Introducing connectivity to the BP measurement process helps protect the quality of data by reducing the risk of human errors occurring at the keyboard. Seamless connectivity from the IQvitals Zone device to the **electronic medical record (EMR)** allows access to patient information and facilitates automatic transfer of data to the patient chart. This minimizes the need for manual entry of patient data, improving workflow efficiency and reducing the likelihood of transcription errors.

While the AHA and SPRINT protocols do help bring greater standardization to BP measurement, what has been unknown—until recently—is the cumulative impact of proper positioning on BP readings. Chapter 3 looks at a recent study that determined the effect of poor positioning that occurs when BP is taken with the patient sitting on a typical clinical exam room table, where the feet are not flat on the floor, the back is not supported and the arm is not supported with the cuff at heart level.

Chapter 3 explores a recent study that looked at the impact proper positioning can have on blood pressure readings.

Chapter 3
The Impact of Proper Positioning on BP Measurement

A Commitment to Better BP

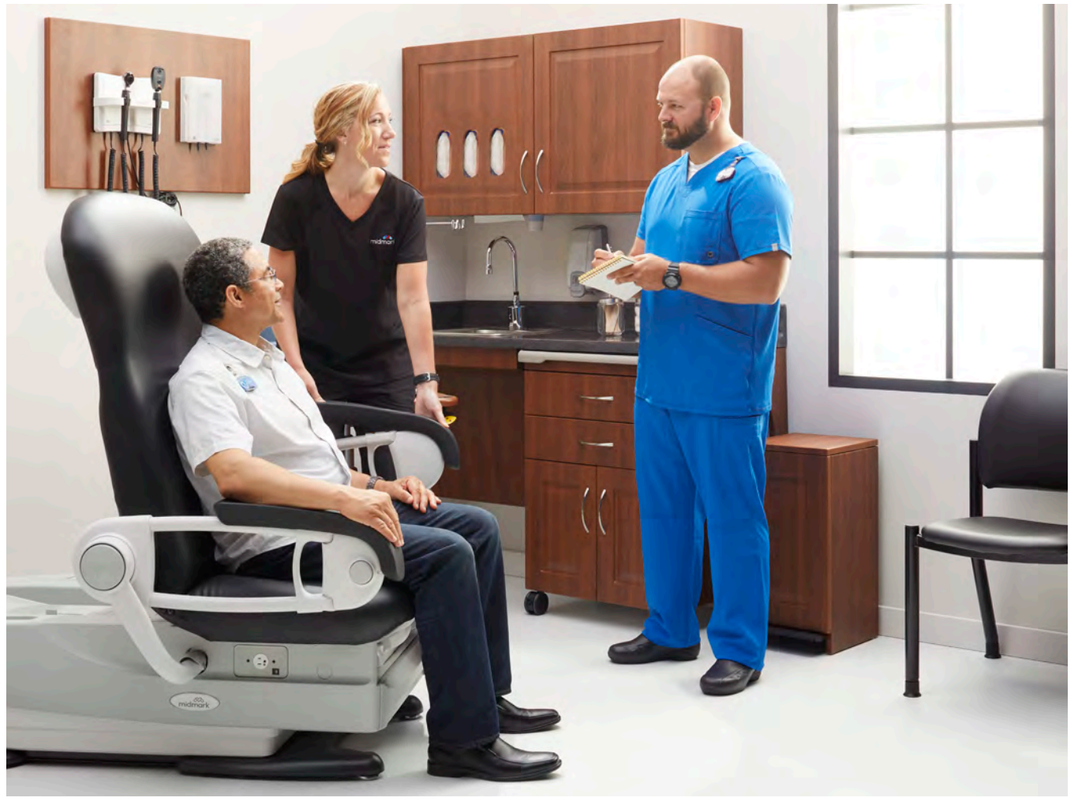
As mentioned previously in the introduction, Midmark is committed to helping bring increased standardization and accuracy to BP measurement. Through our **Better BP Initiative,** we have been offering education to healthcare providers on the importance of consistent BP capture, as well as the clinical and monetary impact of inaccurate BP.

As part of this initiative, Midmark funded the CORRECT BP study. The study was designed to affirm the guidelines for in-clinic BP measurement that the AHA published in 2017. It specifically looked at the impact proper positioning can have on BP readings.

Midmark was not directly involved with decisions related to the study design, data collection, analysis or interpretation of the data. The study was conducted by an independent clinical research organization in conjunction with a major public university to ensure that all "Good Clinical Practice Guidelines" were followed.

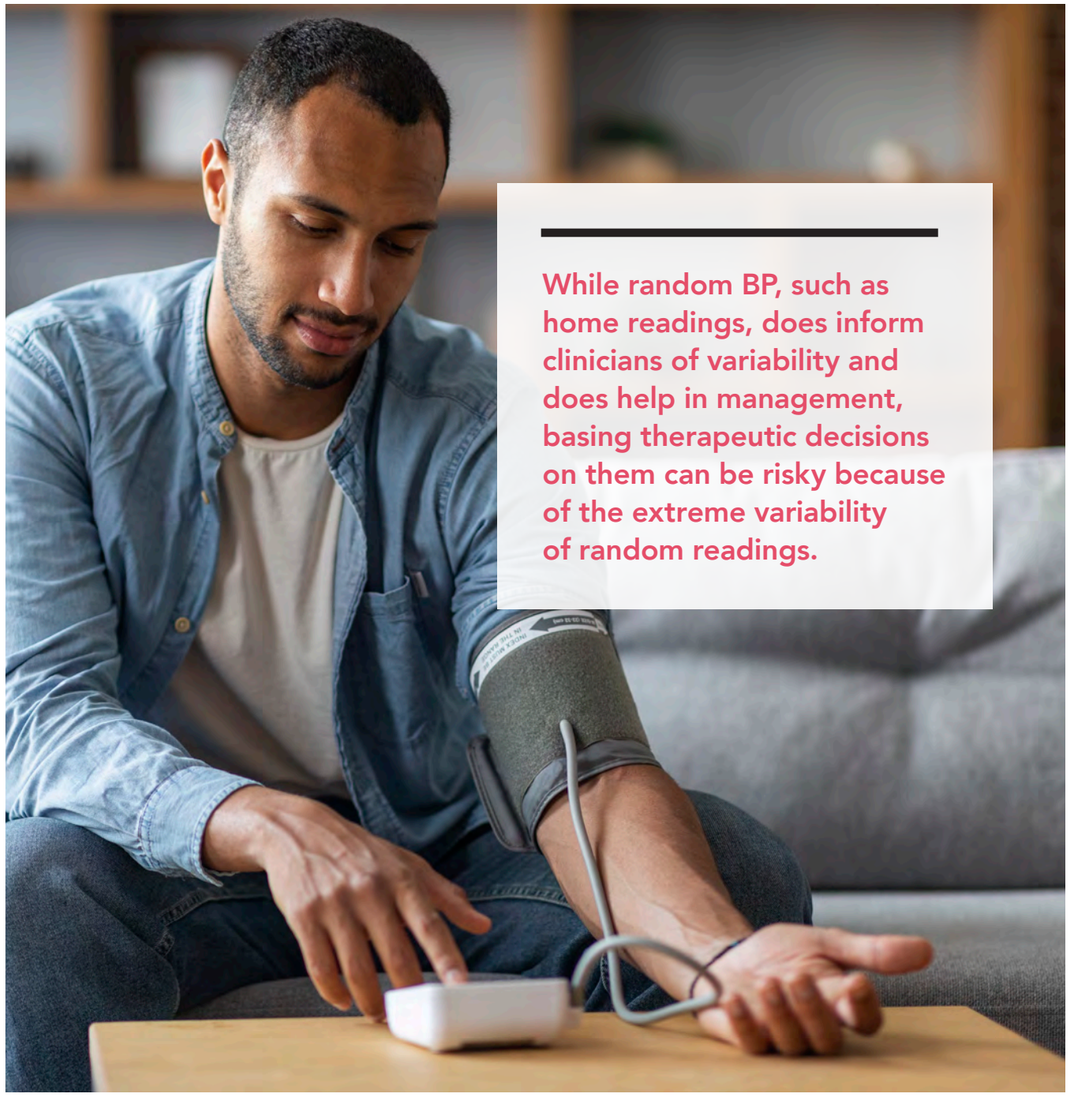
The authors of the study had full autonomy to design and administer the protocol they conceived to ensure all data was unbiased, factual and illustrative of actual clinical outcomes.

A peer-reviewed report of the study was published in eClinical Medicine, part of The Lancet Discovery Science.

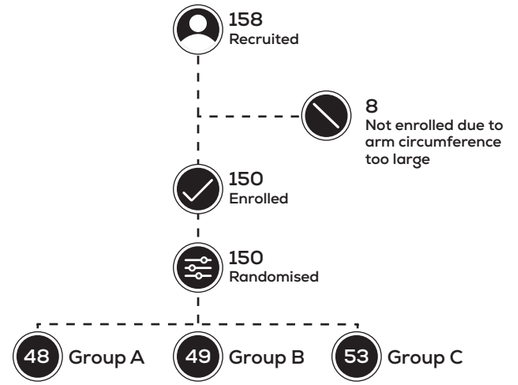


CORRECT BP Study Overview

The primary objective of the CORRECT BP study was to compare BP readings taken while adhering to AHA guidelines to those typical of routine clinical care. It was specifically designed to determine the effect of poor positioning that occurs when BP is taken with the patient sitting on a typical clinical exam room table, where the feet are not flat on the floor, the back is not supported and the arm is not supported with the BP cuff at heart level.



While random BP, such as home readings, does inform clinicians of variability and does help in management, basing therapeutic decisions on them can be risky because of the extreme variability of random readings.



The study focused on "resting BP" rather than "random BP" because the vast majority of clinical studies on the efficacy of BP management to goal targets have been done using resting BP as the foundation of management. Virtually all recommendations made on best practice for BP management, including those derived from the Systolic Blood Pressure Intervention Trial (SPRINT) study, are based on diagnosing and managing patients using best-case acquired resting BP.

While random BP, such as home readings, does inform clinicians of variability and does help in management, basing therapeutic decisions on them can be risky because of the extreme variability of random readings.

In fact, the **US Preventive Services Task Force (USPSTF) recommends** that the initial screening and primary diagnosis of hypertension should be performed with office blood pressure measurement (OBPM). Ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM) with validated and accurate devices should be used outside of a clinical setting to confirm a diagnosis of hypertension before starting treatment.

The CORRECT BP study was a three-group randomized clinical study with a cross-over design. Group A had three BP readings taken while seated on a fixed-height exam table followed by three readings taken in a position-adjustable exam chair. Group B had three BP readings taken in the chair followed by three readings taken on the table. The order in which the two types of readings were taken was randomized.

Group C had three BP readings taken in the exam chair followed by another three readings taken in the chair and was included for the purpose of obtaining an independent estimate of the order effect.

The study authors and designers chose to use the **Midmark 626 Barrier-Free® Examination Chair** to ensure proper participant positioning following AHA recommendations. It is the only exam chair of its kind designed to promote proper patient positioning for a more accurate BP measurement. Its low chair height allowed participants to place their feet flat on the floor, and powered movement of the back section helped ensure the participant's back was supported. The chair's **Patient Support Rails+** were used to support the arm with the BP cuff at heart level.

Proper Positioning is Critical

The CORRECT BP study validated that proper positioning has a clinically significant impact on BP readings. The results of the study demonstrated that following the AHA protocol (regarding positioning) for obtaining BP readings is critical for accurate BP measurement, and failure to do so can impact the validity of a diagnosis of hypertension, which is essential to establishing appropriate treatment and mitigating the complications and risks caused by many chronic conditions.

The study found that AHA and SPRINT recommended positioning resulted in substantially lower BP values when compared to improper positioning. BP readings taken on a fixed-height exam table where the proper AHA protocol could not be achieved were significantly higher than readings taken using the proper technique with the patient seated in an exam chair with adjustable positioning options.

Pooled systolic/diastolic BP readings taken on the exam table with incorrect positioning were significantly higher by 7.0/4.5 mmHg (both $p<0.0001$) than those taken in the exam chair.

1. Back Supported
2. Legs Uncrossed
3. Feet Flat on the Floor
4. Cuff Placed on Bare Arm
5. Arm Supported at Heart Height

The Clinical Significance of the Results

If improperly acquired higher BP readings are used, it could result in misclassifying a patient as having hypertension when they do not. Accurate BP measurement can help reduce instances where a patient might be overmedicated, which can increase the risk of side effects.

Additionally, as mentioned in Chapter 1, it is becoming increasingly important to accurately detect small differences in BP readings to effectively manage patients with hypertension and other metabolic disorders, such as diabetes, renal disease and cardiovascular conditions. Careful BP management, including identifying and adjusting to small shifts over time, is essential to management of metabolic disorders.

The observed benefit of proper positioning in the CORRECT BP study is sufficient to change the classification of BP disorders for millions of patients from hypertensive to normotensive. In fact, the study results support **estimates that as many as 30 million or more Americans may be incorrectly classified as having hypertension.**

It is important to stress that the study is not a criticism of healthcare providers' current measurement processes. It is a reminder that even with something as seemingly simple and routine as BP measurement, there is the risk of human errors and inaccuracies occurring when proper protocols are not followed. This study demonstrated that the effects of these errors are substantial and can directly impact clinical decision-making.

Providers should think about how they might **redesign their system's approaches** with respect to patient care to find ways to implement proper positioning and other recommendations into their BP acquisition process in a way that is still efficient without negatively impacting patients or workflow.

For patients, the study is a reminder of why they should pay attention to BP measurements and understand why accurate BP measurement is important. It also illustrates the importance of patients understanding the proper process to take an accurate BP measurement and taking steps to own their BP measurement process.

Chapter 4 takes a closer look at the benefits of more consistent and accurate BP measurement for patients and providers.

Chapter 4

Benefits of a More Consistent and Accurate BP Measurement

Value for Patients, Providers and Healthcare Systems

Chapter 1 of this e-book touched on the point that BP measurement has perhaps the most clinically significant connection to point of care diagnosis, patient risk stratification and proper medication dosing. These important factors of care management are essential to proper diagnostic and therapeutic decision-making tied to better outcomes.

When it comes to BP readings, slight variations in technique, measurement and documentation can have a big impact. For this reason, it's logical to presume that consistent and accurate BP measurements can provide benefits to patients, providers and healthcare systems. This chapter identifies some of the more important benefits.

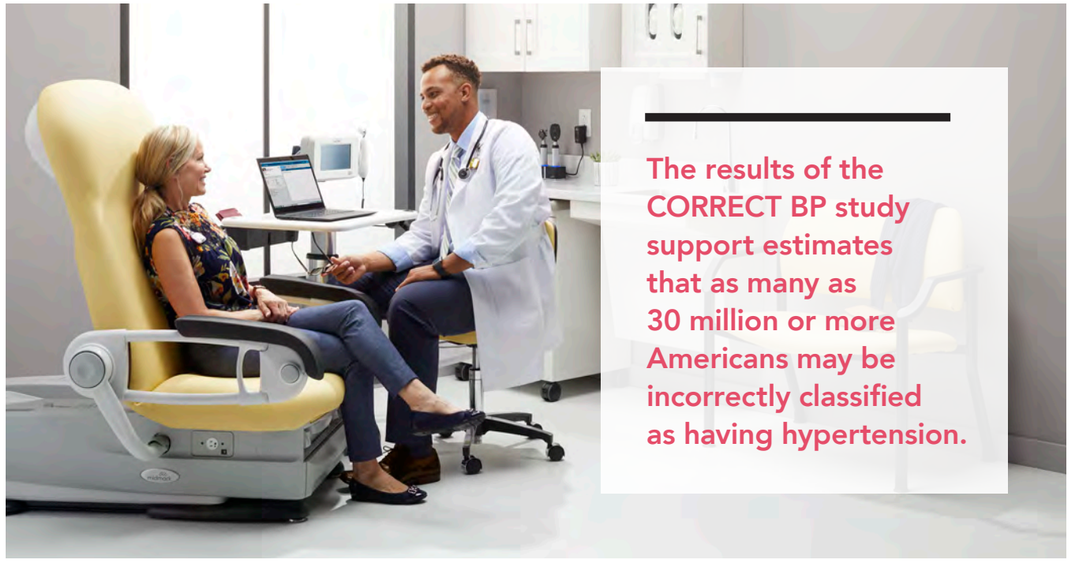
Patients

BP readings are perhaps the single most important physiologic metric to understanding a patient's individual risk for the development of some of the most common, costly and functional-impacting chronic diseases. If BP disorders are not correctly identified and properly managed, the impact can be extensive and far-reaching across numerous significant metrics of disease care performance.

For instance, in order to properly diagnose and treat hypertension—a modifiable risk factor for coronary heart disease, stroke and renal failure—providers need accurate BP information that includes both current BP measurements and trending data. It is also becoming increasingly important to detect small differences in BP readings to effectively treat patients with diabetes and renal diseases for optimal clinical outcomes.

If a diagnosis is made, in part, on improperly acquired higher BP readings, it could result in misclassifying a patient as having hypertension when they do not. Accurate BP measurement can help reduce instances where a patient might be overmedicated, which can increase the risk of side effects that can lead to additional illness or injury.

The observed benefit of proper positioning is sufficient to change the classification of BP disorders for millions of patients from hypertensive to normal. As mentioned in Chapter 3, the results of the CORRECT BP study support **estimates that as many as 30 million or more Americans may be incorrectly classified as having hypertension.**



The results of the CORRECT BP study support estimates that as many as 30 million or more Americans may be incorrectly classified as having hypertension.

Costs related to an improper BP measurement can add up quickly

1,900
Typical number of patients for one physician.

$135,000
Average annual cost of hypertension per practicing physician.

$733
Annual cost of over treatment for hypertension per patient

An accurate BP reading sets the stage for fully understanding the clinical picture of a patient. It is a foundation on which many of the most critical disease management protocols are built—and to be effective, it needs to be accurate, precise and repeatable.

And then there is the matter of trust. It is essential that patients have confidence in their care team as well as diagnostic and treatment conclusions. A misdiagnosis based on inaccurate BP readings could negatively impact that trust.

A **meta-analysis that looked at trust and health outcomes** found a small to moderate correlation between the two. From a clinical perspective, patients reported more beneficial health behaviors, less symptoms and a higher quality of life and were more satisfied with treatment when they had higher trust in their healthcare professional.

According to another study, "lack of patient trust is associated with less doctor–patient interaction, poor clinical relationships that exhibit less continuity, reduced adherence to recommendations, worse self-reported health, and reduced utilization of health care services." When patients lose trust in their medical provider, they are less likely to visit a physician and, if they do visit one, **they are less likely to comply with medical advice.** They are also **less likely to engage in maintaining their own health.**

Providers and Healthcare Systems

It is important to note that the CORRECT BP study mentioned in Chapter 3 was intentionally focused exclusively on the impact of patient positioning on BP accuracy. With the results being clinically significant, the authors of the study suggest that clinicians would also see improvement in their point of care BP accuracy that could positively impact clinical performance and outcomes for patients.

That said, it is easy to see how costs related to an improper BP measurement (monetary and reputational) could quickly add up for providers and healthcare systems. For instance, it is estimated that 9.8% of the US population is affected by overestimation of high BP errors[1]. When you consider the typical number of patients for one physician is 1,900[2] and the annual cost of over treatment per patient is estimated at $733[3], that can translate into an average annual cost of $135,000[4] for hypertension per practicing physician.

There is also the cost associated with repeating a diagnostic test to affirm the accuracy of the reading, which can be disruptive and impact the office in many ways. This can manifest in workflow interruptions from scheduling the repeat tests and rescheduling other appointments. It could also mean reallocating resources, such as rooms and staff, which can increase overall workload and decrease productivity.

Additionally, BP as a population health measure is only topped by patient experience as a mainstay in contract negotiations for payers when health systems and providers seek higher reimbursement for fee for service payments. Payors are more willing to pay providers that demonstrate excellence in BP management as they fully understand better BP control means lower overall costs of patient care.

A resulting misdiagnosis from potential inaccurate BP readings could lead to unnecessary tests and treatments, and necessary intensive medical interventions once the error is discovered, all of which increase healthcare costs. **It is estimated that misdiagnosis-related harms cost the US healthcare system more than $100 billion per year.**

The loss of trust can have further consequences than just a decrease in patient engagement. It can also result in lower patient satisfaction. **One study** looked at patients' perceived mistakes in their diagnostic and treatment care in the ambulatory setting. The study found that these perceptions had a concrete impact on the patient-physician relationship, often leading patients to seek another healthcare provider.

For some communities, once that trust has been broken, that patient-provider relationship can be permanently damaged, according to a **study that examined trust in healthcare** among individuals who identify as Black, Asian, Hispanic and Native American. Four out of five study participants said that after an experience where they lost trust, there was nothing the provider/health system could do to make them return to the same provider or health system.

As evident by these key examples, inconsistent and inaccurate BP measurements can result in direct and indirect consequences for patients, providers and healthcare systems.

Chapter 5 offers steps providers can take to help ensure more consistent and accurate BP measurement.

[1] 9.8% is percentage of population affected by overestimation of high blood pressure errors, calculated by 30,000,000 affected by overestimation* / 307,000,000 the 2009 U.S. population count**. Data from: *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2911816/ and **Census.gov

[2] Panel size sourced from Journal of the American Board of Family Medicine July - Aug 2016; Vol. 29, No. 4

[3] Cost data from Agency for Healthcare Research and Quality (AHRQ). Article: "Expenditures for Hypertension among adults aged 18 and Older, 2010: Estimates for the U.S. Civilian Noninstitutionalized Population"

[4] $733 x (9.8% of 1,900) = ~$135,000, where 1) $733 = cost of overtreatment per patient. Cost data from Agency for Healthcare Research and Quality (AHRQ). Article: "Expenditures for Hypertension Among Adults Aged 18 and Older, 2010: Estimates for the U.S. Civilian Noninstitutionalized Population". Includes cost of ambulatory visit and prescription (payer is either the patient, insurance company or ACO), 2) 9.8% = percentage of population affected by overestimation of high blood pressure errors, calculated by 30,000,000 affected by overestimation* / 307,000,000 the 2009 US population count**. Data from *https://www. ncbi.nlm.nih.gov/ pmc/articles/PMC2911816/ and **Census.gov, and 3) 1,900 = typical patient panel size per physician. Panel size sourced from Journal of the American Board of Family Medicine, July-August 2016; Vol. 29, No. 4.

Chapter 5
Steps to Help Ensure Consistent and Accurate BP Readings

A stronger BP measurement process

Healthcare providers are fortunate enough to experience blood pressure (BP) measurement from both sides: as the ones taking the measurement during patient visits and when they are patients receiving care. This unique perspective allows providers to see the benefits of standardizing BP capture to improve accuracy and consistency from the viewpoint of the patient as well as staff in the form of improved workflow.

The following are steps providers can take to help ensure consistent and accurate BP readings.

1. **Ensure staff are properly educated** on the BP measurement process and follow the **AHA guidelines for in-clinic BP measurement** to obtain accurate BP readings. They need to understand that even with something as seemingly simple and routine as BP measurement, there is the risk of human errors and inaccuracies occurring when proper protocols are not followed. These avoidable errors are significant enough to impact clinical decision-making and care management.

   When it comes to educating staff on proper BP measurement protocols, there are a variety of resources available. For instance, as part of its Better BP initiative, Midmark offers a course focused on hypertension through its **clinical education program.** This **continuing education course** is intended for registered nurses, surgical technologists or other healthcare professionals responsible for obtaining BP measurements. It is also designed for healthcare professionals who want to learn more about hypertension, the importance of accurate and standardized BP measurement, and integrating BP measurement into the clinical workflow.

2. **Partner with patients** to increase their level of engagement in the BP measurement process. Providers can use their unique perspective of the process to help patients understand why accurate BP measurement is important. Share the AHA guidelines and explain the importance of proper positioning, empowering patients to own the process and actively ensure it is accurate.

   This can be especially important for those patients who regularly capture their BP measurement at home or those who need to detect small differences in the readings to appropriately manage a chronic condition such as diabetes.

   At a minimum, during a visit it can be helpful for providers to share a few tips that patients should keep in mind as their BP reading is taken at home or in any other healthcare setting. Help patients understand the **seven simple steps they can take to help ensure accurate BP readings.**

3. **Revisit the BP measurement process** periodically with clinicians and staff involved in BP measurement to ensure improper habits and inconsistencies do not creep into the process and potentially impact the accuracy of the measurement. This is an ideal time to also revisit the AHA guidelines for in-clinic BP measurement and the **SPRINT study** standardized protocol for measuring BP.

   It can also provide an opportunity for providers to think about how they might redesign their system's approaches with respect to patient care to find ways to implement these recommendations into the process in a way that is still efficient without negatively impacting patients or workflow.

   Take the opportunity to identify any updates or modifications that need to be made to the process. For instance, one modification providers and health systems can make is to adopt a **Lean methodology approach** to BP measurement. In many cases, BP acquisition provides an ideal place to start the journey to better clinical outcomes through the use of the Lean methodology.

   (For more information on taking a Lean approach with clinical workflows, such as BP acquisition, read the Midmark white paper, **"Back to Basics: Using a Lean Approach to Help Create Better Outcomes and Lower Costs."**)

4. **Consider the role equipment plays** to help enhance BP measurement consistency and accuracy. Updating exam rooms can be disruptive and leadership teams often have competing operational and budget priorities. However, clinical and operational leaders should strongly consider proper-positioning equipment when designing future ambulatory clinics and environments.

   For instance, the **CORRECT BP study** authors and designers chose to use the **Midmark 626 Barrier-Free® Examination Chair** to ensure proper participant positioning following AHA recommendations. The 626 chair is the only exam chair of its kind clinically validated to promote proper patient positioning for a more accurate BP measurement. Its low chair height allowed study participants to place their feet flat on the floor, and powered movement of the back section helped ensure the participant's back was supported. **Patient Support Rails+** were used to support a participant's arm with the BP cuff at heart height.

5. **Create a fully connected ecosystem** that combines new technology and connectivity to improve clinical standardization, realize greater efficiencies and ultimately contribute to better clinical outcomes. A **fully connected ecosystem** helps eliminate human variables that increase the likelihood of errors that can contribute to inaccurate diagnoses by normalizing and automating the BP measurement process.

   It does this by introducing automation that facilitates the repeatable adherence to a health system's clinical guidelines for proper BP measurement techniques to achieve more accurate, consistent and reliable BP readings for all patients. This is especially evident when a connected diagnostic device is used in conjunction with a connected examination chair that can position the patient in accordance with AHA guidelines for proper BP measurement.

   A connected point of care ecosystem also protects the quality of the BP data by virtually eliminating the risk of human errors occurring at the keyboard. A connected diagnostic device, such as **Midmark IQvitals® Zone™** with the SPRINT BP Protocol, directly transfers patient data to electronic medical records (EMR), eliminating transcription errors and providing greater confidence in data accuracy. Studies have shown that manual transcription of vital signs data produces a 17% rate of error on average. Assuming you take six vital signs measurements on 20 patients a day, that equates to approximately 20 errors each day—and that's just relating to vital signs capture.[1]

By following these five steps, providers and healthcare systems can make noticeable improvements to the accuracy and consistency of BP readings at the point of care.

[1] Fieler, V. K., Jaglowski, T., & Richards, K. (2013). Eliminating errors in vital signs documentation. Comput Inform Nurs, 31(9), 422-427; quiz 428-429. doi:10.1097/01.NCN.0000432125.61526.27 PMID:24080751

While consistent and accurate BP measurement is important for providing patient care, the acquisition process can often be overlooked and undervalued. Fortunately, as this e-book has shown, there is increasing focus on fostering greater understanding and awareness around the measurement of BP. There are also a growing number of initiatives and new technologies designed to help bring improved standardization and accuracy to BP measurement, ultimately improving patient outcomes.

It is vital that you regularly revisit your BP measurement process to ensure consistency and accuracy are being maintained, as well as to identify opportunities to further strengthen the process. It is also important you read the Correct BP study to better understand how following the AHA protocol (regarding patient positioning) for obtaining BP readings is critical for accurate BP measurement.

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