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# How to Choose an Automated Blood Pressure Monitor

## Recommendations for low- and middle-income country settings

The ideal blood pressure monitor should be validated as accurate, accompanied by multiple cuffs, durable and energy-efficient, have multiple options for power supply, and be available for a reasonable price. This document is mainly intended to help primary care providers in low and middle-income settings choose an automated blood pressure monitor for their office.

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### 1. How do I know if a blood pressure monitor is accurate?

There are two important device criteria to determine the accuracy of blood pressure monitors: validation and cuff size.

#### Validation<sup>1</sup>

Validation ensures that a device measures a patient's blood pressure within a certain level of accuracy. Unfortunately, most marketed devices are not validated. The three main validation protocols were developed by the US Association for the Advancement of Medical Instrumentation (AAMI)/International Standards Organization (ISO), the British Hypertension Society (BHS), and the European Society of Hypertension Working Group on Blood Pressure Monitoring (ESH-IP). It is critical that validation be independent, meaning it is conducted by an entity not affiliated with the manufacturer.

- **Highly Recommended:** Devices validated by an independent entity using the AAMI/ISO or the BHS protocol
- **Recommended:** Devices validated by an independent entity using the ESH-IP protocol
- **Not recommended:** Devices that have not been validated by an independent entity
- **Note:** A list of validated devices is available on the websites of [Hypertension Canada](#)<sup>2</sup> and the [British and Irish Hypertension Society](#)<sup>3</sup>

#### Multiple cuff sizes<sup>4</sup>

A common mistake in blood pressure measurement is using a cuff that is too small or too large relative to the arm size, which may lead to inaccurate blood pressure results. If a medium-sized cuff is used on a patient with a very thin arm, blood pressure results can be low by an average of 5.5 mm Hg systolic and 3.4 mm Hg diastolic, leading to the possibility of under-diagnosing patients with hypertension (over-cuffing).<sup>5</sup> If

a medium cuff is used on an obese patient who has a very large arm, blood pressure results can be high by an average of 6.9 mm Hg systolic and 4.0 mm Hg diastolic, leading to the possibility of over-diagnosing patients with hypertension (under-cuffing).<sup>6</sup>

- **Highly recommended:** Devices accompanied by a minimum of three cuffs (small, medium, and large) that cover a mid-arm circumference range of 17-44 cm; cuff sizes can differ depending on the manufacturer, but should follow recommendations based on independent validation protocols
- **Recommended:** Devices accompanied by one wide-range cuff
- **Note:** Wide range cuffs are designed to be used on patients whose arm circumference falls into the “small”, “medium” or “large” category, and are **only** recommended if it is the only validated cuff available with the device. <sup>1</sup>

In very low-resource settings, blood pressure measurement is often performed using a single cuff regardless of arm circumference. This is due to the lack of multiple cuff sizes or the operational challenges of switching cuffs in a busy clinical setting. Although best practice is to use a properly sized cuff, providers may consider using a medium size cuff for all patients in countries with low obesity rates where small and medium circumference arm sizes are more common. A small fraction of patients with small arm size may have undiagnosed hypertension, but generally, underweight individuals have a lower risk of hypertension and cardiovascular disease.<sup>7,8,9,10</sup>

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## 2. How do I know if a blood pressure monitor is durable?

You can determine if a blood pressure monitor is durable by learning the length of professional use it can accommodate. Most current devices are guaranteed for 2 to 5 years of use.

- **Recommended:** Professional devices that accommodate at least 2 years of use
- **Not recommended:** Home blood pressure monitors, as they have a much shorter lifespan under frequent use in a clinic environment than professional devices
- **Note:** Cuffs, cords and connections can deteriorate over time and compromise device accuracy. Therefore, these should be inspected annually and frayed cords, loose connections or aging cuffs (that fasten improperly) should be replaced.

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## 3. How do I know if a blood pressure monitor is energy efficient and has good charging options?

### Power use<sup>11</sup>

Fully automatic devices use more energy than semi-automatic devices because cuff inflation happens automatically. Semi-automatic devices save energy by allowing manual cuff inflation using a hand bulb.

- **Recommended:** Externally validated semi-automatic devices if electricity is unreliable and batteries are limited; these devices need less frequent battery changes than fully-automatic devices

## Power source

Blood pressure monitors can be charged by using an AC adapter, a USB port, rechargeable batteries, a solar panel, or single-use batteries.

- **Recommended:** Devices that can operate by using both AC and battery power; devices that also have a USB port charging option or solar option are preferable in settings where there is no or unreliable AC power
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## 4. How do I select an affordable blood pressure monitor?

The price of a blood pressure monitor depends on the manufacturer, model, add-on options (USB charge, wireless data transfer, etc.), country of purchase, and shipping/import costs. It is advisable to research and compare pricing across several manufacturers before purchasing a blood pressure monitor.

- **Recommended:** Buy devices in bulk to reduce the per unit cost. Externally validated devices from a local source may be available for a lower cost.
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## 5. Can a blood pressure device send measurement results directly to an electronic health record or smartphone?

Some blood pressure monitors can send results to an electronic health record or smartphone, providing rapid access to accurate information by eliminating transcription errors and enabling data uploading, storage and analysis.<sup>12</sup> This feature may facilitate blood pressure control by offering access to previous blood pressure results and supporting treatment decisions.

- **Recommended (Optional):** Devices that support direct data transfer to an electronic health record or smartphone. This is an optional recommendation and only relevant for areas with validated ability to upload blood pressure measurements into an electronic system that can use this information effectively. Although potentially useful, in practice data upload has often proven difficult and of limited benefit.
- **Note:** Devices that have this feature should be compliant with the internationally published interoperability standard IEEE 11073-20702s, which ensures that medical devices and medical IT systems are able to exchange data.<sup>13</sup>

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