A survey of validated automated home blood pressure monitors available for the Internet shopper

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Objective **Self-measurement of blood pressure using an automated home blood pressure monitoring (AHBPM) is increasingly used in hypertension management. Internet commerce increases dramatically each year. This study looked to identify the availability of validity of AHBPM and the correct cuff size to go with the AHBPM.**

Methods and results **Using the search engine 'Google.com', the author identified 124 consecutive unique sites offering at least one AHBPM. Validated AHBPM were those devices that had published studies showing that they had passed a recognized validation protocol. Each site was evaluated for all forms of sphygmomanometer, number of AHBPM, manual blood pressure devices, all cuff sizes available, additional cost of large adult cuff, number of validated AHBPM offered, and whether the site mentioned device validation. Of the 124 sites, 109 (81%) offered arm AHBPM and 66 (53%) offered one or more (range, 1–11) validated AHBPM. Only six of the 66 (9%) offering a validated AHBPM mentioned that fact; 58 of the 109 (53%) sites offering arm AHBPM offered more than one size of cuff; and 46 of the 58 (80%) charged extra for a large adult cuff (average $23.75, range, $4.80–98).**

Conclusions **Validated AHBPMs are readily available on the Internet. Currently, these sites do little to aid the consumer in purchasing a validated AHBPM. Large adult cuffs, commonly needed by hypertensive patients, are not always available for purchase. Charging extra for large adult cuffs is a potential hindrance to consumers purchasing the correct cuff size for accurate blood pressure measurement and should be eliminated. *Blood Press Monit* 10:103–107 © 2005 Lippincott Williams & Wilkins.**

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Introduction

Out of office self-measurement of blood pressure, recognized by all the current guidelines, is an increasingly important tool in hypertension management [1–3]. Home blood pressures are used to diagnose 'white-coat hypertension' [4] and 'masked hypertension' [5], improve hypertension control [6], and reduce the cost of hypertension care [7,8]. All of this depends on the availability of accurate home blood pressure measurement devices. For most patients, this involves the use of an automated home blood pressure monitor (AHBPM). Using the oscillometric technique and a proprietary algorithm to determine systolic and diastolic blood pressure, concern exists as to the accuracy of these AHBPMs [9]. Multiple protocols for device validation [10–12] have tried to identify which devices are accurate enough for diagnosis and treatment of hypertension. At the time of this study, the British Hypertension Society (BHS) website (www.hyp.ac.uk/bhs/home.htm) was the repository of validated blood pressure measurement devices. It has since been succeeded by www.dableducational.org, a not-for-profit site.

In addition to a validated blood pressure monitor, accurate blood pressure measurement requires the blood pressure cuff be appropriate to the arm of the user. Too small a cuff leads to overestimation of blood pressure while too large a cuff will underestimate blood pressure [13,14]. Recent studies have shown an increasing probability that hypertensives will require the large adult cuff for accurate blood pressure measurement [15,16].

Internet shopping is increasingly popular with consumers for many products, including medical devices. This study was a prospective survey of the Internet to determine the availability of validated AHBPM on the Internet, the availability of large adult cuffs to use with these devices, and whether there were cost disincentives to purchasing the large adult cuffs.

Methods

In December of 2002, the author searched the Internet using the search engine 'Google.com' and the search phrase 'home blood pressure monitor'. A list of validated automated blood pressure measurement devices was obtained from the BHS website (Table 1) and a review of the medical literature for devices which had published studies where they had passed a recognized validation protocol [10–12]. Included in this list are automated

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Table 1 Validated automated blood pressure measurement devices ($n=25$)

Omron
HEM 705C
HEM 722
HEM 735C
HEM 713C
HEM 712C
HEM 735C
HEM 737 (711AC, 773C, 739AC, 757)
HEM 907
RX
M4
A&D
UA 767
UA 631 (779)
UB 322
UB 401
Seinex 25M
Datascope Accutorr Plus
CAS Model 9010
Colin Pilot 9200
VSM Med Tech BpTRU
Welch-Allyn Vital Signs
Visomat OZ2
Braun Precision Sensor
Nissei WS 310

devices such as the Colin Pilot, BpTRU, and Visomat OZ2, which due to price, are more commonly used by clinicians rather than patients. However, since these validated devices were available for sale on the Internet and could be used for home blood pressure measurement, they are included in this study as AHBPMs. Each unique site was evaluated for its web address, number of all sphygmomanometers, number of AHBPM, type of AHBPM (wrist, finger, arm), number of manual devices (aneroid and mercury), number of validated devices, percentage of validated devices amongst all devices offered, and whether the site clearly identified AHBPMs that had passed a recognized protocol. Regarding blood pressure cuffs, the number of sites offering multiple blood pressure cuffs, the percent that charged extra for the large adult cuff, and the additional cost of the large adult cuff was identified.

Results

One hundred and twenty-four unique websites (Table 2) on 40 screens were identified. Of the 124 sites, 58 different brands of blood pressure measurement devices were found. The 10 most frequently found brand names were: (number of sites found) Omron (55); A&D (24); Mark of Fitness (12); Panasonic (11); Mabis (9); Welch/Allyn (Tycos) (9); Samsung (8); Lumiscope (8); Braun (8); and EXA-Med (5). The number of manufacturers per website was usually small; 98 of the 124 sites had only one or two manufacturers represented while 10 of the 124 sites had five or more different brands available for purchase. The number of devices available per site varied widely; 74 of the 124 sites offered five or more different blood pressure measurement devices for sale. The variety of the different blood pressure measurement devices offered at their sites is seen in Table 3. Sites offered both automated devices of all types as well as manual devices including mercury sphygmomanometers! Sites rarely differentiate devices for professional versus home use for either their automated or auscultatory blood pressure measurement devices. The most common AHBPMs offered are seen in Table 4. Omron brand devices were the most commonly available AHBPMs for arm, wrist, and finger devices. Of the 124 sites, 66 (53%) offered at least one validated AHBPM (range, 1–11 devices). On only six of the 66 sites did the website specifically identify which AHBPMs were recognized as passing a validation protocol.

Of the 109 of 124 websites offering AHBPMs, only 58 (53%) offered more than one cuff size for purchase with the AHBPM. Of the 58 sites, 46 (79%) charged extra for the large adult cuff with an average price of $23.75 (range, $4.80–98). Only eight sites did not charge extra for the large adult cuff and four sites did not specify whether extra charges for the large adult cuff would apply.

Discussion

Home self-measurement of blood pressure is an increasingly common tool for hypertension management [1–3]. Stergiou and colleagues [4] have shown home blood pressure measurement can be used to detect 'white-coat' hypertension, although they did not feel it was as valuable to detect this condition as 24-h ambulatory blood pressure monitoring. The adverse effect of 'masked hypertension' (normal office blood pressure with elevated out of office blood pressure) could also be predicted using home blood pressure measurement [5]. Canzanello *et al.* [6] have shown that rapid titration of blood pressure medication while following home blood pressure monitoring leads to high rates of blood pressure control at 1-year follow up. Soghikian [7] demonstrated that a 29% reduction in annualized cost of hypertension care could be realized using home blood pressure monitoring. Staesson and colleagues [8] in the THOP study have shown the feasibility of long-term hypertension management using home self-measurement of blood pressure and that this may reduce the cost of care with an outcome similar to standard therapy based on the office blood pressure measurement.

The improvements in care in these studies are predicated on the use of accurate home blood pressure measurement devices, using a cuff appropriate to the subject's arm circumference. Frequently neither medical professionals, nor the patients they serve are aware of which AHBPMs have passed a recognized validation protocol. They are also commonly unaware of the impact of too small or too large a blood pressure cuff on the accuracy of blood pressure measurement even when using a validated

Table 2 List of websites

A
- www.ababyoutlet.com
- www.amazon.com
- www.allheart.com
- www.allegromedical.com
- www.accessibilityworld.com
- www.appliancesource.com
- www.alco.co.za

B
- www.barrel-of-monkeys.com
- www.bodyclock.co.uk
- www.bloodpressuremonitor.com
- www.bombayelectronics.com
- www.bodytrends.com
- www.buyemp.com
- www.blood-pressure-n-blood-pressure-monitors.com

C
- www.comforthouse.com
- www.cardiac-oximeter.com
- www.clorders.com
- www.calorieking.com
- www.comparestoreprices.co.uk
- www.citizensafe.com
- www.choponline.com

D
- www.dillermedical.com
- www.drugstore.com
- www.dps-promatic.com
- www.dutech.com
- www.drleonards.com
- www.digimed.com
- www.dcaltime.com
- www.dasmedical.com

E
- www.epinions.com
- www.exa-med.com
- www.e-eldercare.com
- www.expresschemist.co.uk
- www.exmed.net
- www.e-sci.com

F
- www.firstlineindustries.com
- www.fitnessmonitors.com
- www.finerliving.com

G
- www.gadgetbargains.com
- www.getfit.com
- www.goodmans.net

H
- www.healthfitnessstore.com
- www.healthchecksystems.com
- www.healthtrade.com
- www.heartmonitors.com

H (continued)
- www.healthtrack.com
- www.homeindia.com
- www.healthpartners.com
- www.hammacher.com
- www.health-y.com
- www.hmint.com

I
- www.ivillage.co.uk
- www.itinscales.com

J
- www.just4teeth.com

K
- www.keysan.com

L
- www.life-assist.com
- www.lifeclinic.com
- www.lifesourceonline.com
- www.lifestylesports.com

M
- www.medicaltest.com
- www.majestic.com
- www.medexamtools.com
- www.medicalresources.com
- www.medical-supplies-equipment.net
- www.myhealthpro.net
- www.miami-med.com
- www.medprodukte.net (Germany)
- www.medicalmailorder.com
- www.monitorbp.com
- www.markoffitness.com
- www.microlife.com
- www.medical-scrubs.com
- www.medisave.co.uk
- www.mypharmacy.com
- www.milleniummedicalgroup.com
- http://monitoryourheart.com
- www.millenitech.co.za

N
- http://newfitness.com
- www.newsearching.com

O
- www.osim-usa.com
- www.outpost.com
- www.orthobionics.com
- www.omronhealthcare.com

P
- www.polarheartratemonitors.com
- www.portablenebs.com
- www.productwizard.com
- www.panasonic.com
- www.promolife.com
- www.parkside-healthcare.co.uk

P (continued)
- http://physicianequipment.com
- http://productsconsumerguide.com

Q
- www.quickmedical.com

R
- www.rtamedicalsupply.com
- www.rehaboutlet.com

S
- http://store.paraflexmed.com
- http://store.nurseweek.com
- http://shopglenmore.co.uk
- http://store.yahoo.com
- www.seniorshops.com
- www.samsunghealthcare.com
- www.safehomeproducts.com
- www.seniorshops.com
- www.scantechmedical.com
- www.sperlescales.com
- www.surgsupplies.com
- www.safetystore.com
- www.sjehealthandfitness.com
- www.self-test-kits.co.uk
- www.sports.bizrate.com
- www.sppbooks.com.au

T
- www.takegoodcare.com
- www.theessentials.com
- www.tens.co.uk
- www.take-care.com
- www.thstore.com
- www.tcmhospital.com

V
- www.valuemedicalsupplies.com

W
- www.welectronics.com

Table 3 Variety of monitors offered

Type of monitor offered	
Automated devices only	(n=81)
Arm and wrist/finger	56
Arm only	10
Wrist/finger only	15
Automated devices plus	(n=37)
Mercury and aneroid	4
Aneroid only	28
Mercury only	5
Non-automated only	(n=8)
Mercury and aneroid	4
Aneroid only	2
Mercury only	2

Table 4 Most commonly offered automated home blood pressure monitor (AHBPMs) devices

Most common AHBPM devices offered	
Arm (total 123 different devices)	
Omron HEM 705	28 sites
Omron HEM 739	28 sites
Omron HEM 712	28 sites
Highest non-Omron: A&D 767	17 sites
Wrist (total 99 devices)	
Omron HEM 609	26 sites
Highest non-Omron: A&D UB401	10 sites
Finger (total 7 devices)	
Omron HEM 406	10 sites
Highest non-Omron: Lumiscope 1083	6 sites

device. Most AHBPMs offered for sale in retail stores are sold with the standard adult cuff. The increasing prevalence of obesity has resulted in the standard cuff being too small for most hypertensives in a hypertension referral clinic [15] and for the ever-increasing number of all Americans, not just hypertensives [16].

With the Internet as an increasingly popular service for medical information, medications, and medical devices, this study looked at the Internet and the purchase of home blood pressure monitoring devices. A list of devices that had passed a recognized validation protocol, seen in Table 1, was used to determine how often validated AHBPMs were offered. There were 58 different manufacturers' brands identified at the 124 different sites, with Omron and A&D being the most dominant brand names. Most sites offered the consumers only a single manufacturer's product with only 10 sites having five or more manufacturers' devices for purchase. This would appear to reduce the likelihood of the consumer easily identifying a validated AHBPM. Even though the two dominant brands, Omron and A&D (Table 4), offer the most validated AHBPMs, when only 53% of sites in this study offered validated AHBPMs, the likelihood of a consumer finding a site with a validated AHBPM remained disturbingly low. Even more disturbing is that only six of the 66 (9%) sites that did offer validated AHBPMs clearly identified those devices that had passed a recognized validation protocol. It is extremely important that manufacturers provide this information to consumers in a clear and concise fashion. Too often sites of non-validated and validated AHBPMs used the nebulous phrase 'clinically proven' rather than specific information on validation studies. There is now the opportunity for manufacturers of validated AHBPM to provide a link from their sites to www.dableducational.org. This not-for-profit website provides a repository for validated devices that would aid consumers in selecting a validated, accurate AHBPM for home usage. The site is updated quarterly so as to review on-going publications on validated devices. In August 2004, the site received 160 000 visits from 2795 organizations in 84 countries, with 22 new papers on device validation added for a total of 352 papers relating to this topic available on this site.

Equally disappointing was the finding that barely half (58 of 109 sites, 53%) of the 109 sites that offered one or more arm AHBPMs offered a selection of cuff sizes for purchase beyond the standard adult cuff. Of the 58 sites that offered multiple cuff sizes, 46 (79%) demanded extra charges to supply the large adult cuff most commonly required by hypertensives. The average charge for the large adult cuff was $23.78 with a range from a nominal $4.80 to a high of $98! Shoppers have become increasingly price sensitive, and thus, these sites charging additional fees for the large adult cuff provide a financial disincentive for consumers to purchase the blood pressure cuff they need for accurate home measurement. As studies have shown an increasing need for the large adult cuff to accurately measure blood pressure [15,16], manufacturers should either offer the large adult cuff as 'standard' on their devices or do away with unreasonable extra charges for the large adult cuff.

Finally, Table 3 shows that mercury sphygmomanometers are still available for purchase on the Internet. Mercury's obvious toxicity [17,18] and the natural drive away from mercury-based medical devices [18] should cause these mercury devices to either be removed from sale or perhaps only be available for purchase by health professionals. A single mercury spill at home, with the high likelihood of an inappropriate cleanup and disposal of the mercury-contaminated materials, could be an environmental disaster. Clearly, mercury sphygmomanometers have no role in home self-measurement of blood pressure.

Conclusions

While validated AHBPMs are available on the Internet, barely half of the sites evaluated by this study had a validated AHBPM for sale. Manufacturers must aid consumers in the purchase of accurate AHBPM devices. First, they should clearly identify those AHBPMs that have passed a recognized validation study. Links to websites, such as www.dableducational.org, from the manufacturer's site will help further establish the importance of using a validated AHBPM for home self-measurement of blood pressure. Secondly, manufacturers must remove financial impediments to choosing the correct blood pressure cuff. Thirdly, consideration should be given to making the large adult cuff the standard cuff offered on all AHBPM devices. Finally, mercury sphygmomanometers must not be available for home use due to the risk of significant mercury environmental contamination should the device be broken. The importance of home self-measurement of blood pressure in the evaluation and treatment of hypertension is greatly diminished without the use of an accurate AHBPM with a cuff correctly sized to the patient's arm circumference.

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