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Location of Blood Pressure Measurement

Health care workers in a rural community hospital were queried about factors associated with blood pressure (BP) accuracy. Results suggest remedial education regarding cuff size, patient position, arm position, and location for accurate BP measurement is needed.

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Blood pressure measurement is one of the most common procedures performed by health care workers (Netea & Thien, 2004; Pickering et al., 2005; Schell et al., 2005). Blood pressure (BP) measurements are used to screen for hypertension; estimate cardiovascular risk; and diagnose, manage, and treat acute and chronic medical conditions (Schell et al., 2005). Accurate measurement is vital for appropriate diagnosis, management, and treatment of hypertension, as well as clinical decision-making in acute care settings.

Recommendations for BP measurement exist (O'Brien et al., 2003). Though BP measurement is relatively simple to perform, errors related to the observer, equipment, or failure to standardize the technique, and the circumstances of measurement can contribute to erroneous blood pressure readings (Netea, Lenders, Smits, & Thien, 2003a). Moreover, erroneous readings may result from physical factors, such as environment (Netea & Thien, 2004), malfunctioning equipment (Parati, Bilo, & Mancia, 2004), arm position (Mourand, Gillies, & Carney, 2005; Netea et al., 2003a; O'Brien et al., 2003; Pickering et al., 2005), body position (Netea et al., 2003a; 2003b), bladder size relative to arm size (Bur et al., 2003; Dobbin, 2002; Netea & Thien, 2004; O'Brien et al., 2003), and location of measurement (Mourad et al., 2005; Netea et al., 2003a; O'Brien et al., 2003; Pickering et al., 2005).

The location for BP measurement traditionally has been the upper arm (from shoulder to elbow). However, the upper arm may not be accessible due to medical devices. In addition, large cuffs may not be available for BP assessment for the obese patient. Thus, the forearm (from elbow to wrist) may be an alternative site (Schell et al., 2005).

Literature Review

The gold standard for blood pressure measurement is the direct intra-arterial method (Netea & Thien, 2004; Schell et al., 2005). However, this method is invasive and not practical. Historically, the most familiar indirect method of BP measurement is the use of the mercury or aneroid sphygmomanometer and a stethoscope using the upper arm (Genc, Altunkan, Kilinc, & Altunkan, 2008; Netea et al., 2003a; Netea & Thien, 2004; Pickering et al., 2005). This type of BP measurement relies on the auscultation (Aus) method based on the detection of Korotkoff sounds at the brachial artery with a stethoscope (Genc et al., 2008; Pickering et al., 2005). However, mercury and aneroid sphygmomanometers have lost favor due to environmental concerns about mercury contamination (Pickering et al., 2005) and lack of reliability over time (O'Brien et al., 2003; Pickering et al., 2005), respectively.

Development of electronic manometers has changed blood pressure measurement. In the hospital setting, health care workers rely more often on non-invasive, automated blood pressure machines to obtain readings than a sphygmomanometer and stethoscope. This method also is used commonly in the home setting and uses the oscillometric (Osc) method (Genc et al., 2008). These devices work on the principle of oscillometrics

Table 1.
Factors Associated with Blood Pressure Measurement Accuracy

Cuff Size	Accuracy dependent on correct size for UAC*	Pierin et al., 2004
	Most frequent error is miscuffing	Graves, Baliey, & Sheps, 2003
	97% of physicians do not use correct cuff size	Pierin et al., 2004
	Cuff too small for upper arm leads to falsely elevated reading	Dobbin, 2002
	Cuff too large for upper arm leads to falsely low reading	Dobbin, 2002
	Small adult cuff recommended for UAC, 22-26 cm^	Pickering et al., 2005
	Standard adult cuff recommended for UAC, 27-34 cm	Pickering et al., 2005
	Large adult cuff recommended for UAC, 35-44 cm	Pickering et al., 2005
	Adult thigh should be used for UAC, 45-52 cm	Pickering et al., 2005
Patient Position	Systolic generally lower and diastolic higher when sitting compared to supine position; differences as high as 10 mmHg	Mosenkis & Townsend, 2005
	Seated in chair with back supported; if not, diastolic may be increased by 6 mmHg	Pickering et al., 2005
	Reading may be elevated artificially while legs crossed at knee	Foster-Fitzpatrick, Ortiz, Sibilano, Marcantonio, & Braun, 1999
	Routine measurement, seated in chair, back supported, legs uncrossed on the floor	Mosenkis & Townsend, 2005
Arm Position	Reference level is level of right atrium/heart level	Netea et al., 2003b
	If upper arm below right atrium, falsely elevated	Pickering et al., 2005
	If upper arm above right atrium, falsely low	Pickering et al., 2005
	When sitting, support arm with antecubital fossa at level of the mid-sternum	Pickering et al., 2005
	When supine, support arm with a pillow	Pickering et al., 2005
Upper Arm vs. Lower Arm Comparisons	Correct cuff size used for upper arm and forearm; systolic, diastolic, and mean arterial pressures varied widely; measurement in these two sites is not interchangeable; measurement in forearm overestimates reading taken in upper arm	Palatini et al., 2004 Schell et al., 2005 Zweiker et al., 2000

* = upper arm circumference; ^ = centimeters

(Amoore & Murray, 2006; Cuckson, Moran, Seed, Reinders, & Shennan, 2004), in which oscillations created by arterial volume change with cuff deflation are detected by a transducer in the bladder cuff (Cuckson et al., 2004; Genc et al., 2008). Predetermined algorithms, usually based on mercury sphygmomanometry, are used to determine BP measurements from the oscillometric signal (Cuckson et al., 2004).

The forearm (elbow to wrist) has been suggested as an alternative location for BP measurement (Schell et al., 2005), particularly for the obese individual. While the upper arm continues to be the standard location for BP measurement, the wrist has become popular (Altunkan, Oztas, & Altunkan, 2006; Altunkan, Genc, & Altunkan, 2007; Altunkan, Ilman, & Altunkan, 2007; Pickering et al., 2005). However, wrist devices often are not available in the hospital setting.

Little research exists on the use of the forearm for blood pressure measurement. Findings from an early study indicated non-obese upper arm measurements were significantly greater than those obtained in the forearm (Tachovsky, 1985). Forearm BP measurements were comparable to upper arm measurements in ambulatory university emergency room patients (Singer, Kahn, Thode, & Hollander, 1999). The Omega 1400 automatic noninvasive BP monitor was used in that study, but the device was not designed for forearm BP measurement. In the emergency department of a large teaching hospital, BP measurements in the upper arm and forearm of seated patients were not interchangeable (Schell et al., 2005). Forearm BP measurement was not recommended in obese patients (Vinyoles et al., 2005). In a second study of obese patients, the forearm measurement overestimated or falsely elevated the values of upper arm BP measurement (Pierin, Alavarce, Gusmao, Halpern, & Mion, 2004).

Blood pressure measurement accuracy is dependent upon many factors, including correct cuff size for the patient's arm circumference, patient position, arm position, and the location on the body where the blood pressure is measured. For example, a BP cuff that is too small for the upper arm will lead to falsely elevated readings; a cuff that is too large will lead to falsely low readings (Dobbin, 2002). Errors in pressure measurement because of use of a wrong-sized cuff may contribute to misdiagnosis or inappropriate treatment. Substantial literature addresses factors associated with accuracy in BP measurement (see Table 1).

The upper arm is becoming less accessible for BP measurement due to placement of medical

devices, inability to cuff a large upper arm correctly, or patient request. Use of the forearm as an alternate site thus has been incorporated into clinical practice. However, current research suggests these two methods are not interchangeable (Palatini et al., 2004; Schell et al., 2005; Zweiker, Schumacher, Fruhwald, Watzinger, & Klein, 2000). The purposes of this study in a rural community hospital were to determine factors perceived by health care workers as influencing BP accuracy, the prevalence of using the forearm for BP measurement, and factors influencing health care workers' decisions to utilize the forearm as an alternate site.

Methods

In this study, health care workers in a rural community hospital were asked about factors associated with blood pressure accuracy, the use of the forearm for measurement, and clinical decision making about alternative sites. In the context of this study, health care workers included both unlicensed assistive personnel (UAP), such as nursing assistants, technicians, or medical assistants, and licensed personnel (LPNs, RNs).

Research design and sample. A quantitative, descriptive, non-experimental design was used. A convenience sample of health care workers (UAP and licensed staff) in a rural hospital was recruited. Inclusion criteria were the ability to read and write English, and full-time or part-time employment in direct patient care in an acute care setting. Persons employed in a casual or per diem status, in non-clinical roles, or as managers were excluded. Approximately 170 health care workers at the facility matched inclusion criteria for the study.

Research setting. The research setting was a non-profit hospital located in a rural community of 25,000. The facility is the only hospital in the vicinity and provides medical care to a four-county, two-state region in the Iowa/Illinois Mississippi Valley. With more than 50,000 patient visits annually, the facility is licensed for 147 acute care beds, 159 intermediate care beds, 23 dementia care beds, and 30 transitional care beds. Acute care services include inpatient medical and surgical units, behavioral medicine, critical care, progressive care, surgical services, pediatrics, obstetrics, and emergency services.

Instrument. A researcher-designed tool, the Blood Pressure Accuracy Form (BPAF), was developed for this study (see Table 2). The form's content was derived directly from literature regarding factors influencing the accuracy of BP determination. Clinical conditions and scenarios were developed by the first author. Content validity of the BPAF was established through a literature review and confirmation of content, use of terms, and ease of use by 10 registered nurses with at least 10 years of acute care nursing experience and an additional 10 registered nurses in graduate school. A pilot of the BPAF was performed with 15 nurses in pediatrics and obstetrics. The typical respondent in the pilot was female, age 40, and had worked in the respective department for 20 years. The pilot group did not recommend any changes to the BPAF. Cronbach's alpha for the first four items addressing the importance of various factors that can affect the accuracy of BP measurement was 0.68, and 0.80 for the remaining seven items addressing the frequency of each clinical condition that warranted the use of the forearm.

In the first portion of the tool (four items), respondents were asked to rate the importance they ascribed to correct cuff size, position of the patient, position of the patient's arm, and location of the BP measurement on a 1-5 scale (1 = least important; 5 = most important). Only respondents who had ever used the forearm as an alternate site for BP measurement were asked to proceed to the next section of the survey tool. Seven items addressed specific clinical conditions and frequency of conditions that necessitated the use of the forearm as an alternate site for BP measurement with a non-invasive device. Clinical conditions included limited access to upper arm due to medical device (intravenous catheter, dialysis graft/fistula/access device), inability to cuff the patient properly due to upper arm circumference, previous mastectomy with lymphedema, unavailability of upper arm due to procedure or patient positioning, or patient request. Other reasons for utilizing the forearm addressed equipment barriers, such as unavailability of correct cuff size in the worker's department or malfunctioning cuff/equipment. The frequency of obtaining BP using the forearm in the above cases was determined by asking respondents to indicate for each specific condition one of the following time determinants: at least daily, at least weekly, at least monthly, 6-11 times per year, 1-5 times per year, or never. Finally, respondents were asked about medical record documentation of the use of the forearm for blood pressure measurement. Response choices were "yes" or "no." The last portion of the tool addressed selected demographic characteristics. These included job classification, age, gender, highest educational level obtained, years in clinical practice, practice area, shift worked, and any certifications earned.

Ethical issues and approval. Permission to conduct this study was obtained from both the hospital and the University of Illinois at Chicago Institutional Review Board. No names were used; identification numbers were assigned to each BPAF to maintain employee anonymity. Completed BPAFs were kept in a locked file cabinet during data collection and were destroyed after data analysis was completed.

Data collection. The researcher met with nurse managers at a monthly professional leadership council to explain the study purpose. The researcher determined dates and times for upcoming departmental unit meetings and asked to be placed on the agenda to discuss the study. At the unit meetings, the researcher explained the study purpose and answered questions. Health care workers were reminded participation was completely voluntary; their participation or lack of participation would in no way influence their employment. Subjects also were informed they could withdraw from the study at any time. Potential participants were reassured names or other identifying data were not part of the survey, hospital administrators

Table 2.
Survey Tool: Blood Pressure Assessment Form

Directions for completion of survey:

1. Please do NOT put your name or any other identifying information on this survey. Complete all sections. Do not leave any sections blank.
2. This survey is being used to gather data for an educational research project. All data are collected in an anonymous format and your responses cannot be identified in any way.
3. You may notice small numbers in parenthesis following some of the responses. These numbers correspond with the research codebook, and are only there for ease of data input.
4. Once you've completed the survey, please place it in the envelope, seal it, and return it to the designated drop box.

Thank you for your participation – your help is greatly appreciated!

1. Rank (1=least; 5=most) how important you feel each of the following factors individually affect the accuracy of blood pressure measurement. Circle your responses.

	Least				Most
a. Correct cuff size for patient's arm	1	2	3	4	5
b. Position of the patient's body	1	2	3	4	5
c. Position of the patient's arm	1	2	3	4	5
d. Location on body where BP obtained	1	2	3	4	5

2. Have you ever utilized the forearm rather than the upper arm to measure blood pressure?
___ Yes. If yes, go to question 3. (1)
___ No. *If no, you are finished with this survey.* (2)

3. When blood pressure was measured in the forearm, indicate the frequency of each clinical condition that required the use of the forearm. Please answer all scenarios.

a. Limited access to upper arm due to medical device, such as PICC/ IV catheter, dialysis graft/fistula.

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

b. Cuff too small and larger blood pressure cuff (correct size) not available in department.

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

c. Malfunctioning cuff (Velcro on cuff will not hold on upper arm)

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

d. Largest and correctly sized BP cuff still too small due to patient's upper arm circumference.

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

e. Previous mastectomy with lymphedema

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

f. Patient request

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

g. Upper arm not accessible due to patient positioning/procedure.

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

CNAs, Technicians, and LPNs Only:

h. Nursing request or directive from supervisor

0	1	2	3	4	5
Never	1-5 times per year	6-11 times per year	at least once per month	at least once per week	at least daily

4. If the forearm was used for measurement of blood pressure, is it indicated as such in the medical record?
a. _____ Yes (1) b. _____ No (2)

Table 2. (continued)
Survey Tool: Blood Pressure Assessment Form

Directions: Please check the appropriate response under each category. Complete all fields.

1. **Age:** _____ years
2. **Gender:** _____ Female (1) _____ Male (2)
3. **Job Title:** _____ CNA (1) _____ Technician (2) _____ LPN (3) _____ RN (4)
4. **Total years you have worked in your current job title:** _____
5. **Current clinical practice area:**
   _____ Medical (1) _____ Surgical (2) _____ CCU (3)
   _____ Stepdown-PCU (4) _____ Emergency (5) _____ Dialysis (6)
   _____ OR/PACU/SDS (7) _____ Behavioral Med (8) _____ CathLab/COP (9)
6. **Number of years you have worked in your current clinical practice area:** _____
7. **Usual shift worked:**
   _____ Days (7-3) (1) _____ Evenings (3-11) (2) _____ Nights (11-7) (3)
   _____ 12 hour day (4) _____ 12 hour night (5) _____ 12 hour rotating (6)
   _____ Other (indicate hours) (7)
8. **Indicate your highest level of education completed:**
   _____ Less than High School Diploma (1) _____ High School/GED (2) _____ Some college (3)
   _____ Diploma - Nursing (4) _____ Technical School (5) _____ Associate's Degree (6)
   _____ BS Nursing (7) _____ BS/BA Non-Nursing (8) _____ Master's Degree Nursing (9)
   _____ Degree Non-Nursing (10) _____ Beyond Master's level (11)

RNs only for questions 9 and 10:

9. **Are you *currently certified* in your nursing specialty?** (CEN, CCRN, CNOR, or other)
   _____ Yes (1) Indicate name of certification _____ _____ No (2)
10. **Have you held certification in a nursing specialty in the past?**
    _____ Yes (1) Indicate name of certification _____ _____ No (2)

would not see their responses, and there was virtually no way the researcher could link survey responses to an individual participant.

The researcher delivered an appropriate number of survey packets to each department manager for distribution to employees via department mailboxes. Managers were instructed to distribute packets only to employees who met study inclusion criteria. Each survey packet consisted of the following: general instructions for completion of the instrument; a cover letter describing the study purpose, issues regarding participation and consent, steps taken by the researcher to protect the identity of the participant, and the two-page survey tool. A business envelope was secured to the packet. Closed collection boxes were placed in areas designated by the nurse manager.

Posters were placed in break rooms and lounges to recruit participants. Staff who consented to participate were asked to complete the instrument, seal it in the envelope provided, and place the envelope in the designated collection device on their units. Those who did not choose to participate were asked to seal the blank instrument in the envelope provided and place the envelope in the unit collection devices. Participants were given 2 weeks to complete the survey tool.

Data analysis. Data were entered into Microsoft Excel® and then imported into SPSS for Windows software (version 15.0; SPSS Inc, Chicago, IL). The data set was cleaned prior to analysis. Descriptive statistics (mean, median, standard deviation, frequency distributions) were used to characterize the sample, as well as summarize demographic and clinical data. Frequencies were determined for all variables. As the data did not meet the assumptions for parametric testing, nonparametric tests (Chi-square and the Mann-Whitney U) were performed. An alpha level of $p<0.5$ was considered statistically significant.

Results

Characteristics of the sample. Of the 170 survey packets distributed,

107 packets were returned (63% response rate). The typical respondent was age 43, had been a health care worker for 14 years, and had worked in the job area for 11 years (see Table 3). The majority of respondents were female (96.3%) and were employed as RNs (75.7%). Most nurse respondents held an associate's degree in nursing (53.3%). Of the 81 RNs, 96.3% (n = 78) reported no current certification in a nursing specialty.

Question 1: Which factors do health care workers in a rural community hospital perceive as having the most influence on BP accuracy? Cuff size was ranked highest followed by arm position, then location of measurement (see Table 4). Position of the patient was considered to affect BP accuracy the least. No significant difference existed between RNs and non-RNs (aides, technicians, and LPNs) regarding ranking of cuff size, body position, arm position, and body location of measurement.

Question 2: How prevalent is the practice of utilizing the forearm for BP measurement in a rural community hospital? Of the 107 respondents, 96 (89.7%) had taken a blood pressure in the forearm. No significant difference existed between RNs and non-RNs concerning use of the forearm for BP measurement. In departments such as ICU, ED, OR, and the cath lab, RNs generally were responsible for obtaining BP measurements. RNs in these areas were more likely to take the BP in the upper arm compared to RNs who worked in clinical areas where BP measurement is delegated to UAP (medical, surgical, PCU, behavioral medicine) (Fisher's exact test, p=0.026). Nursing experience in years was dichotomized at the median. Chi-square test suggested nursing experience of the RN was not associated significantly with taking the blood pressure in the forearm.

Question 3: What influences a health care worker's decision to utilize the forearm as an alternate site for measuring BP in a rural community hospital? The clinical scenarios and associated frequency of needing to use the forearm for blood pressure measurement are displayed in Table 5. RNs reported taking the BP in the forearm more frequently for cuff malfunctioning (p=0.037) and patient request (p=0.029) compared with the non-RN group. No significant differences existed between the groups with respect to responses concerning medical device, cuff not available, cuff too small, mastectomy, and patient position. The last item on the BPAF related to medical record documentation of the use of the forearm for BP measurement. Of those responding to this item, 83% (n=78) indicated use of the forearm for BP measurement was not documented.

Table 3.
Sample Characteristics (N = 107)

Variable	M (SD)
Age in years	43.5 (11.4)
Years in current job title	14.3 (10.4)
Experience in current area	11.5 (9.0)
	N (%)
Female	103 (96.3)
Registered nurse	81 (75.7)
Associate's degree	57 (53.3)
BSN/BA/BS degree	7 (6.6)
Master's degree	2 (1.8)
Day shift worked (7-3)	43 (40.2)
Certification in specialty	3 (3.7)

Discussion

The purposes of this study were to determine which factors health care workers perceive as having the most influence on blood pressure accuracy; the prevalence of forearm use for BP measurement; and influences on health care workers' decisions to utilize the forearm as an alternate site for BP measurement in a rural community hospital. Health care workers in this sample perceived cuff size as exerting the greatest amount of influence on BP accuracy, followed by arm position and location of measurement. Position of the patient was considered by respondents to have the least amount of influence on BP

Table 4.
Factors Affecting Accuracy of Blood Pressure Measurement (N = 107)

Variable	M (SD)	1*	2	3	4	5+
		n (%)	n (%)	n (%)	n (%)	n (%)
Cuff size	4.7 (.52)	0	0	4 (3.7)	20 (18.7)	83 (77.6)
Body position	3.9 (.99)	4 (3.7)	4 (3.7)	23 (21.5)	44 (41.1)	32 (29.9)
Arm position	4.1 (.84)	0	4 (3.7)	20 (18.7)	42 (39.3)	41 (38.3)
Body position	3.9 (.96)	1 (.9)	8 (7.5)	22 (20.6)	41 (38.3)	35 (32.7)

* 1 = least importance
+5 = greatest importance

Table 5.
Clinical Factors Leading to Use of Forearm for Blood Pressure Measurement and Frequency of Use of the Forearm (N = 96)

Variable	Never n (%)	1-5 Times per Year n (%)	6-11 Times per Year n (%)	At Least Once per Month n (%)	At Least Once per Week n (%)	At Least Daily n (%)
Medical device	14 (13.1)	30 (28.0)	17 (15.9)	21 (19.6)	12 (11.2)	2 (1.9)
Cuff not available	23 (21.5)	37 (34.6)	11 (10.3)	16 (15.0)	4 (3.7)	4 (3.7)
Cuff malfunction	23 (21.5)	24 (22.4)	18 (16.8)	15 (14.0)	10 (9.3)	5 (4.7)
Cuff too small	14 (13.1)	42 (39.3)	17 (15.9)	10 (9.3)	11 (10.3)	2 (1.9)
Mastectomy	31 (29.0)	19 (17.8)	17 (15.9)	20 (18.7)	8 (7.5)	0
Patient request	21 (19.6)	46 (43.0)	12 (11.2)	11 (10.3)	5 (4.7)	1 (0.9)
Patient position	26 (24.3)	37 (34.6)	19 (17.8)	8 (7.5)	4 (3.7)	1 (0.9)
Nursing request*	10 (9.3)	7 (6.5)	3 (2.8)	3 (2.8)	3 (2.8)	0

* n = 26, LPNs, CNAs, techs only

accuracy. All four factors (cuff size, patient position, arm position, and location of measurement) greatly influence accuracy of BP measurement, but the person taking the BP is the most critical component in the process (Pickering et al., 2005). Health care workers responsible for BP measurement must be trained appropriately to complete the task in a conscientious manner, with attention to cuff size, patient position, arm position, and location of measurement.

Data suggested nearly 90% of respondents have taken a blood pressure in the forearm and have incorporated the process into clinical practice. The practice of taking the BP in the forearm was universal and not dependent upon educational background or experience. However, in departments where the task of obtaining BP was not delegated to unlicensed personnel, such as ER and ICU, registered nurses were less likely to take the BP in the forearm when compared to RNs in other departments.

In this study of 107 health care workers, the majority recognized the importance of correct cuff size for BP accuracy but failed to recognize the importance of measurement location as equally influential. The inability of respondents to recognize the importance of the BP measurement location was not dependent on job title, years of experience, or department worked. Re-education for all employees is recommended regarding the physiology of BP determination, with all variables (cuff size, patient position, arm position, location of measurement) of equal importance in determining an accurate value.

Limited access to the upper arm due to the presence of medical devices, such as peripherally inserted central catheters (PICC), dialysis catheters, or intravenous catheters, was identified as one of the most common clinical reasons for needing to use the forearm. Thirty-five percent of the respondents identified this as occurring on a monthly, weekly, or daily basis. It is not clear from this study why the alternate upper arm was not used.

The inability to use an appropriate cuff size was identified as problematic. Of the respondents, 24% identified this as occurring on a monthly, weekly, or daily basis. A longer, wider cuff generally is required for adequate compression of the brachial artery in obese patients. However, many patients with large upper arm circumference (UAC) have a shortened arm length from the shoulder to the elbow, making the large cuff too wide. Also compounding the difficulty in cuffing the patient with a large UAC is the arm circumference at the elbow, which often is not the same as the arm circumference by the shoulder; this causes a cone-shaped arm. According to Pickering and colleagues (2005), the clinician in this situation may measure BP from a cuff placed on the forearm. All attempts should be made to keep the forearm at heart level. The practitioner must recognize this blood pressure may reflect an overestimation, but it will provide at least a general estimate of the systolic BP.

Patient request also was determined to be a reason for using the forearm. While BP measurement in the forearm may be faster and more comfortable for the obese patient, the readings obtained in the forearm are an overestimation of the actual blood pressure (Palatini et al., 2004; Schell et al., 2005; Zweiker et al., 2000). Staff and patient education should eliminate this reason for taking the BP in the forearm.

Site of BP measurement is presumed to be the upper arm. Data indicate use of the forearm is not documented as such in the medical record. Because current research indicates BP measurement in the forearm results in overestimation of the systolic pressure (Palatini et al., 2004; Schell et al., 2005; Zweiker et al., 2000), the location of the BP must be documented in the medical record.

In this study, equipment barriers were responsible for needing to use the forearm for BP measurement. Of the respondents, 22% reported the correct cuff size was not available in their departments on a monthly, weekly, or daily basis. Malfunctioning equipment also was identified by 28% as occurring on a monthly, weekly, or daily basis. Lack

of available varied cuff sizes and equipment in non-working order seemed to leave staff with no choice but to use the forearm for measurement.

Clinical Implications/ Recommendations

Policies and procedures relating to blood pressure measurement should reflect current standards of evidence-based practice. Procedures should be standardized and enforced throughout the organization. All persons who have responsibility for obtaining BP measurement should have appropriate training addressing cuff selection, patient position, arm position, and location of measurement with validation by a knowledgeable trainer. In addition, administrators should provide health care workers with remedial education regarding cuff size, patient position, arm position, and location of BP measurement, and how these factors influence accuracy of readings as well as ensure adequate numbers of functioning BP cuffs in a variety of sizes are available.

Limitations. The instrument utilized was designed specifically for this study, potentially resulting in lowered reliability and validity. In addition, the respondents knew the first author. Thus, possible response bias must be considered as another study limitation.

Recommendation for future research. Because this was a solitary study, performed in a rural setting, it could be replicated utilizing an urban institution. This replication would be necessary to determine if the findings can be generalized to other settings. In addition, a more diverse population would be beneficial for potential generalizability of study findings.

Conclusion

Some clinical conditions, such as a double mastectomy, necessitate the use of the forearm as the only means of blood pressure measurement; however, such conditions are limited and should be evaluated carefully. All efforts must be exhausted in locating proper cuff size prior to using the forearm; patient request is not an acceptable reason. If the blood pressure is obtained from a location other than the upper arm, it must be documented as such in the medical record. ■

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