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# Impact of a Blood Pressure Practice Initiative on Attitude, Practice Behavior, and Knowledge Among Outpatient Rehabilitation Providers: An Observational Study

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Gift in Kind for Statistical Analysis from Henry Ford Community Care Services- Home Health Care.

*Human Subject Institutional Review Board Approval: Oakland University # 657553 and Henry Ford Health System #9146.*

**Purpose:** The purpose of this study is to describe the impact of a blood pressure (BP) educational initiative on the attitude, practice behaviors, and knowledge of outpatient (OP) physical therapists. **Methods:** An observational pre-test and post-test study design was initiated using a sample of convenience at 12 OP rehabilitation clinics. A 4-phase protocol included (1) evaluation of BP equipment, (2) pre-test questionnaire, (3) attendance at a 1-hour lecture on BP practice recommendations, and (4) performing BP measures on patient evaluations for 1 week followed by the post-test questionnaire. Descriptive statistics reported demographics, whereas a paired *t* test compared means of the presurvey and postsurvey responses with statistical significance set at  $P < .05$ . **Results:** Of the 55 therapists included, 70.9% were female and 29.1% male, whereas 41.8% and 58.2% reported having  $\leq 15$  and  $> 15$  years of experience, respectively. A significant improvement in BP attitudes ( $P = .02$ ), practice behaviors ( $P = .001$ ), and knowledge ( $P = .002$ ) was identified. **Conclusions:** An educational initiative that provided BP assessment tools, a 1-hour evidence-based BP lecture, a decision-making reference, and a directive to perform valid and reliable BP techniques and interventions resulted in positive changes to an OP therapists attitude, immediate practice behavior, and knowledge of BP. (*Cardiopulm Phys Ther J.* 2020;31:47–56) **Key Words:** blood pressure, physical therapy, education

## INTRODUCTION

Blood pressure (BP) assessment of patients and clients under the care of physical therapists (PTs) is instrumental to identify baseline cardiovascular risk, design an exercise

prescription, and monitor responses to exercise.<sup>1</sup> Furthermore, BP assessment is well established as an important aspect of care irrespective of a patient's pre-existing cardiovascular diagnosis.<sup>2,3</sup> Despite evidence supporting the need for routine BP assessment, previous studies report PTs practicing in an outpatient (OP) setting are measuring BP at low frequency.<sup>4,5</sup> Although it is conceivable, clinicians may perceive the use of clinical judgment and previous experience as plausible rationale to determine the need to measure a BP; a study by Feldman et al.<sup>6</sup> concluded clinicians made poor clinical decisions using these techniques in isolation. The study further established PTs were unable to predict a patient's hypertensive (HTN) status

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using a review of the individual's medical history or a visual inspection.<sup>6</sup> Furthermore, Vanzant et al.<sup>7</sup> have reported OP PTs to report significantly lower clinical practice behavior agreement when educating individuals on cardiovascular disease (CVD) risk factors, developing of CVD prevention programs, and monitoring patient with known CVD when compared with other areas of PT practice. This is of specific concern given evidence suggesting prevalence rates of elevated BP measures among individuals under the care of PTs, even in the OP practice setting, are in congruence and possibly in excess of rates reported in the general population.<sup>7-10</sup>

Although evidence for causation for BP omission specific to OP PTs is incomplete, time and inadequate equipment have been cited as a potential barrier to measuring BP.<sup>1,11</sup> Gaps in knowledge regarding the criterion for classifying a BP as suboptimal have also been reported.<sup>11</sup> This is additionally confounded by recent changes from the recommended BP classifications and criterion of normotensive, pre-HTN (P-HTN), or HTN (Table 1)<sup>12</sup> to the more recently recommended normal, elevated, stage 1 hypertension, and stage 2 hypertension classifications published in late 2017 (Table 2).<sup>13</sup> Variation among clinicians in regard to knowledge and standardized practice behaviors is not unique to PTs as reports from other health care professions suggest deficiency.<sup>11,14-17</sup> Furthermore, a study conducted within the discipline of nursing reported an individual's intention to take an accurate BP measurement increased the accuracy of the measures obtained.<sup>14</sup> It further suggests the constructs of the *Theory of Planned Behavior* support the prediction of a specific behavioral outcome when a behavior is intended, in this case accurately measuring a BP.<sup>14</sup>

Arena et al.<sup>11</sup> suggest that current attitudes, practice behaviors, and knowledge among OP PTs specific to BP examination and intervention are not in line with recommended practice. This is of critical concern given that direct consumer access to PT services is now available in all 50 states, whereby PTs may be the point of entry for an individual into the health care system. Educational strategies to enhance positive attitudes toward BP measurement, to augment evidence-based practice habits, and to bridge knowledge gaps are necessary to optimize the health and wellness of individuals under the care of OP PTs.<sup>11</sup> Therefore, the purpose of this study is to describe the impact of a BP educational initiative on the attitude,

practice behavior, and knowledge of OP PTs and occupational therapists (OTs).

## METHODS

### Research Design

After obtaining Henry Ford Health System and Oakland University Institutional Review Board approval to assure the rights of the participants were protected, a observational research design using a pre-test and post-test was initiated.

### Sampling Criteria

A sample of convenience from 12 OP clinics of one hospital-based health system was utilized. The clinics are not exclusive in regards to the nature of patient impairments and populations served. However, musculoskeletal conditions and adult residents of urban and suburban regions of Metropolitan Detroit in Southeast Michigan are most frequently encountered. Although all employees were invited to participate in the education experience, only PTs and OTs were offered an option for study inclusion because these disciplines were responsible for initial evaluations and care coordination of patients. One hundred and nine PTs and OTs were employed at the 12 clinics. However, given potential for varied work schedules, contingent and part time employment, medical leave and vacation schedules, and an employee's choice to not participate in the study, a robust retention and 20% attraction could provide 87 therapists for testing.

*Phase 1.* The investigator conducted an evaluation of available BP measurement equipment at each clinic in September of 2014 as a component of phase 1. The numbers, sizes, and functionality of available BP equipment was assessed. Sphygmomanometers and stethoscopes were each inspected for observable tears, cracks, or wear to the cuff, bulb, and tubing. In addition, gauge calibration was examined using a calibration protocol set forth by the European Society of hypertension.<sup>18</sup> Clinic supervisors were provided with recommendations for BP equipment purchasing and agreed to obtain before initiating phase 3 of the study. Equipment

**TABLE 1**

Joint National Committee of Prevention, Detection, Evaluation, and Treatment of High Blood Pressure Classifications

Blood Pressure Classifications <sup>a</sup>	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)
Normal	119 or lower	79 or lower
Prehypertension	120 to 139	80 to 89
Hypertension	140 or higher	90 or higher

<sup>a</sup>Modified from Seventh Report of the Joint National Committee of Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) Report.<sup>12</sup>

**TABLE 2**

Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guideline Classifications

Blood Pressure Classification <sup>a</sup>	Blood Pressure Criteria
Normal	Less than 120 mm Hg AND less than 80 mm Hg
Elevated	Systolic between 120 and 129 mm Hg AND diastolic less than 80 mm Hg
Stage I: hypertension	Systolic between 130 and 139 mm Hg OR diastolic between 80 and 89 mm Hg
Stage 2: hypertension	Systolic greater than or equal to 140 mm Hg OR diastolic greater than or equal to 90 mm Hg

<sup>a</sup>Modified from the 2017 Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines<sup>13</sup>.

recommendations were as follows; one stethoscope for each PT and OT, one standard aneroid BP cuff for every 2 therapists, and one small and one large BP cuff per clinic. In addition, if the clinic provided care to individuals under the age of 12 years, a child size cuff was recommended for purchase. Furthermore, it was recommended annual BP equipment checks be conducted moving forward by the health systems bioengineering department. Contact information for this department was provided to clinic supervisors.

**Phase 2.** Phase 2 was initiated in October of 2014. During this phase, the investigator met with employees at each clinic to explain the study, secure participant consent, and administer the pre-test questionnaire to consenting therapists. Questionnaires and all data collected from each therapist were blinded to the investigator using a therapist created unique identifier. The questionnaire, previously tested for validity and reliability and with precedence for use in a previous study,<sup>11,19</sup> was used with the addition of one question aimed at obtaining the discipline to which the respondent identified (PT or OT). Five attitude-focused questions used a Likert-type scale, and 9 practice behavior questions used ordinal responses that were converted to nominal responses to garner replies that were more positive or negative as self-reported by the responder. The questionnaire also included 6 knowledge questions; however, as only the questions requesting therapists indicate BP values defined as P-HTN or HTN would

ensure responses with definitive criterion established in the literature, only these 2 queries were used for statistical analysis of change. Responses to the additional knowledge question are descriptively reported. Blood pressure classification was defined using the *Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7)*<sup>12</sup> because these were the standard definitions available to therapists throughout the study data collection period. Although the investigators recognize new BP definitions have since emerged into mainstream health care (Table 2), the JNC7 criterion outlined in Table 1 was used to define normal BP, P-HTN, and HTN for the purpose of this study.

The questionnaire further captured therapist's demographics including sex, highest PT degree obtained, and years of experience working as a PT. Years of experiences were categorized as either having less than or equal to 15 or greater than 15. In choosing the 15 years of experience cut-point, the authors recognized the physical therapy profession underwent a transition to doctoral prepared entry level clinicians in the past 15-year period. Therefore, both experiential and academic background differences might contribute to difference in the groups. In addition, the JNC7 criteria were introduced approximately 15 years ago and therefore were considered when choosing the 15-year timeframe.

**Phase 3.** On October 28, 2014, and November 11, 2014, phase 3 was conducted. Therapists attended a 1-hour presentation either in person or remotely during a designated departmental in-service timeframe. The same presentation was offered on 2 different occasions to best accommodate work schedules and patient care obligations. Written handouts and an online version of the presentation were available to the learners for reference during and after the presentation. Learning objectives were as follows:

Upon Completion of this presentation, learners will be able to

1. Classify values for normal, pre-HTN, and HTN BP measures.
2. State the potential prevalence of suboptimal BPs in their practice setting.
3. Apply recommendations of the Eighth Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC8)<sup>20</sup> BP management algorithm to the delivery of rehabilitation services.
4. Choose correct tools, methodologies, and clinical techniques to obtain a valid and reliable BP reading including (1) use of pulse obliteration pressure to determine maximal cuff inflation level, (2) optimal body position for BP measurement attainment, and (3) best BP equipment choices.
5. Use evidenced-based strategies to progress patients/clients toward optimal BP measurements by (1) educating patients/clients on lifestyle modifications, (2) initiating communication and/or referrals to other health care providers when a suboptimal BPs is identified, and (3) identifying BP measures requiring prompt medical attention.

In addition, a rehabilitation provider BP decision-making algorithm was provided to each therapist (Appendix 1) for reference. The algorithm was created by the

studies' primary investigator using available evidence, review, and input by members of the Henry Ford Health System's *Measure Up Pressure Down (MUPD)—Self Management Task Force*, and Henry Ford Health System physicians from various specialty services. *Measure Up Pressure Down* is a national campaign of the American Medical Group Foundation with a mission to engage and empower patients to actively manage BP.<sup>21</sup> The campaign was kicked off in November of 2012 with participation of the United States Surgeon General. Its goal was to achieve HTN control for 80% of patients using the JNC7 standards by 2016. The Henry Ford Health System's *MUPD—Self Management Task Force* over saw 1 of 5 process planks as a means for the health system to achieve the *MUPD* goal.

**Phase 4.** Phase 4 requested therapists perform BP measures on each new patient evaluation for 1 week using the techniques and decision-making guidelines provided in the phase 3 educational content. Clinics choose to either conduct phase 4 during either the first or second week of December. Therapists were provided a BP measurement data collection sheet to record the BP readings obtained, side and site of BP measure, and any actions taken in response to the BP findings. The action choices included (1) no action taken, (2) informed patient of BP reading, (3) educated patient on lifestyle modification to optimize BP measurement, (4) engaged in discussion of medication compliance with patient, (5) called physician and informed of BP findings, (6) referred to emergency department for additional medical treatment, (7) modified the therapy visit on that date, (8) held the therapy visit on that date, and (9) an option to describe an action provided that did not meet the definition described in the other categories.

After performing the 1-week BP measurement task, each therapist was readministered a post-test questionnaire that was formatted identically to the pre-test questionnaire. Data collection sheets obtained from the week a therapist performed the BP measures and the pre-test and post-test questionnaires were matched using the therapist created unique identifiers. Questionnaires without a pre-test and post-test match were excluded from data analysis.

## Data Analysis

Therapist demographics are reported using descriptive statistics, whereas a paired *t* test compares the mean difference observed between the presurvey and postsurvey responses. As a secondary analysis, BP readings and associated actions identified during the week of measuring BP are reported. A 3-by-2 chi squared analysis reported the overall test, whereas a 2-by-2 chi-squared test reported each pairwise comparison. Survey responses that were omitted or missing from the survey were not included in analysis. Statistical analysis was performed using the Statistical Analysis Software version 9.4 (SAS Inc., Cary, NC) with statistical significance set at  $P < .05$ .

## RESULTS

### Respondent Demographics

A total of 68 PTs completed the prequestionnaire with 13 lost to attrition resulting in 55 PTs meeting the study inclusion criteria. Because of a low frequency of OT respondents ( $n = 4$ ), data from questionnaires submitted by OTs are not included in result reporting. Respondents were 70.9% ( $n = 39$ ) female, 29.1% ( $n = 16$ ) male, whereas 41.8% ( $n = 23$ ) and 58.2% ( $n = 32$ ) reported having less than or equal to 15 years and greater than 15 years of experience, respectively.

### Blood Pressure Equipment

A combined 23 aneroid sphygmomanometers were available at the 12 OP clinics for inspection. Of those 78.3% were found to be in calibration. No site reported having checked equipment for functionality and calibration in the previous year. It is further notable that 2 clinics did not have manual cuffs available within the clinic; however, did have automated BP cuffs accessible at adjacent physician clinics. An additional 36 standard, 10 small, 8 large, and 8 child size cuffs were recommended and purchased in line with the investigators suggested quantity outlined in the methods.

### Change in Blood Pressure Attitudes

The mean of responses to the preintervention and postintervention questions of attitude are reported in Table 3 with detail for all respondents, males, females, and respondents with greater than and less than or equal to 15 years of experience. A significant improvement in attitude was identified for all respondent ( $P = .02$ ) and also among respondents with less than or equal to 15 years of experience ( $P = .01$ ).

### Change in Blood Pressure Practice Behaviors

The mean of the responses to the preintervention and postintervention questions of BP practice behaviors is reported in Table 4 with detail for all respondents, males, females, and respondents with greater than and less than or equal to 15 years of experience. A significant improvement in practice behavior was identified for all respondents ( $P = .001$ ) and across all categories (males [ $P = .003$ ], females [ $P = .001$ ], respondents with greater than 15 years of experience [ $P = .001$ ], and less than or equal to 15 years of experience [ $P = .01$ ]). In addition, significant improvements among all subgroups were identified to choose the correct BP cuff size for each patient and most subgroups demonstrated positive change toward standardizing the patient position for BP measurement and in obtaining the BP measure at evaluations.

Respondent self-reported barriers to performing BP measure in the pre-test responses as lack of equipment ( $n = 13$ ), lack of knowledge ( $n = 3$ ), and dependent on the

TABLE 3

Mean of the Responses to the Preintervention and Postintervention Questions of BP Attitude

Question	Attitude Questions									
	All Respondents		Male		Female		>15 yr of Experience		≤15 yr of Experience	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
I feel it is important to take a blood pressure reading on every patient/client during an evaluation or re-evaluation.	2.96	3.11	3.00	3.38	2.95	3.00	2.91	2.84	3.04	3.48
I feel it is important to take a blood pressure reading on every patient/client PRIOR to physical therapy treatment.	2.80	2.85	2.69	3.00	2.85	2.79	2.75	2.63	2.87	3.17
I feel it is important to take a blood pressure reading on every patient/client AFTER physical therapy treatment.	2.67	2.62	2.63	2.81	2.69	2.54	2.56	2.50	2.83	2.78
I feel I am able to take an accurate blood pressure reading.	3.91	4.24	4.13	4.19	3.82	4.26 <sup>a</sup>	3.91	4.25	3.91	4.22
I feel confident in my ability to educate patients/clients about blood pressure-related findings.	3.22	3.84 <sup>a</sup>	3.56	3.81	3.08	3.85 <sup>a</sup>	3.16	3.81 <sup>a</sup>	3.30	3.87 <sup>a</sup>
All questions of attitude change	15.6	16.7 <sup>a</sup>	16.0	17.2	15.4	16.4	15.3	16.0	16.0	17.5 <sup>a</sup>

A higher mean number indicates a more positive response.

<sup>a</sup>Met significance level of  $P < .05$ .

BP, blood pressure.

patients presentation ( $n = 1$ ) were eliminated as perceived barriers on the post-test questionnaire. However, the reported barrier of time increased from the pre-test questionnaire ( $n = 18$ ) to the post-test questionnaire ( $n = 22$ ).

### Change in Blood Pressure Knowledge

The mean of the correct and partially correct responses to the preintervention and postintervention questions of BP knowledge are reported in Table 5 with detail for all respondents, males, females, and respondents with greater than and less than or equal to 15 years of experience. In addition, the combined change for questions of knowledge is reported. Overall, knowledge improvements ( $P = .002$ ) were observed and males and those with greater than 15 years of experience all demonstrated positive improvement that met the significance threshold ( $P = .01$  and  $P = .01$ , respectively).

### Blood Pressure Measures and Associated Actions

Blood pressure measures and associated actions for 259 new patient evaluations were recorded during phase 4. Of

these, 26.3% had a measure meeting the normal BP classification, 47.5% the P-HTN, and 26.3% HTN. It is notable that a pre-existing HTN diagnosis was not available to the investigators for analysis. Actions taken by the therapists were as follows: 46.7% ( $n = 121$ ) took no action, 80.4% ( $n = 208$ ) informed the patient of their BP reading, 17.8% ( $n = 46$ ) engaged in a discussion of medication compliance, 14.3% ( $n = 37$ ) provided education on lifestyle modification that may optimize BP measurement, 1.2% ( $n = 3$ ) called the physician, modified treatment, or held treatment. There were no patients referred to the emergency department.

Table 6 summarizes the resulting therapists' actions taken when patients' BP readings met the criteria of a normal, P-HTN, or HTN reading. In addition, Table 6 reports difference between BP classifications to each action. Significantly more actions were taken by therapists when a patient was identified as having higher BP readings.

### DISCUSSION

The purpose of this study is to describe the impact of a BP educational initiative on the attitude, practice behavior, and knowledge of OP PTs and OTs. It is notable, OT data is omitted from this study reporting due to low response frequencies.<sup>3</sup> Routine cardiovascular assessment by OP

TABLE 4

Mean of the Responses to the Preintervention and Postintervention Questions of BP Practice Behavior

Question	Practice Behavior Questions									
	All Respondents		Male		Female		>15 yr of Experience		≤15 yr of Experience	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
A physical therapy assistant, technician, or other health care provider obtains the blood pressure measurement in my practice setting.	1.76	1.80	1.63	2.00 <sup>a</sup>	1.82	1.72	1.75	1.78	1.78	1.83
I measure blood pressure during patient/client evaluation or re-evaluation.	1.95	2.35 <sup>a</sup>	2.00	2.38	1.92	2.33 <sup>a</sup>	1.88	2.38 <sup>a</sup>	2.04	2.30
I measure blood pressure on a patient/client PRIOR to physical therapy treatment	1.96	2.13 <sup>a</sup>	2.00	1.94	1.95	2.21 <sup>a</sup>	2.00	2.13	1.91	2.13
I measure blood pressure on a patient/client AFTER physical therapy treatment.	1.93	1.96	2.00	1.94	1.90	1.97	1.94	1.94	1.91	2.00
I inform a patient/client of their blood pressure reading after each measurement.	4.38	4.78 <sup>a</sup>	4.19	4.63	4.46	4.85 <sup>a</sup>	4.53	4.84	4.17	4.70 <sup>a</sup>
I standardize the patient/client position each time I perform a blood pressure measurement.	3.93	4.65 <sup>a</sup>	3.88	4.63 <sup>a</sup>	3.95	4.67 <sup>a</sup>	4.03	4.84 <sup>a</sup>	3.78	4.39
My clinical site performs yearly retraining of blood pressure measurement techniques	0.00	0.04	0.00	0.06	0.00	0.03	0.00	0.06	0.00	0.00
I use a different size blood pressure cuff depending on the measurement site used for each patient/client	0.49	0.81 <sup>a</sup>	0.63	0.88 <sup>a</sup>	0.44	0.79 <sup>a</sup>	0.56	0.84 <sup>a</sup>	0.39	0.77 <sup>a</sup>
I measure the maximal cuff inflation level prior to taking a blood pressure measurement	0.07	0.26	0.00	0.38 <sup>a</sup>	0.10	0.21	0.06	0.25 <sup>a</sup>	0.09	0.27 <sup>a</sup>
All questions of practice behavior change	16.4	18.7 <sup>a</sup>	16.3	18.8 <sup>a</sup>	16.5	18.7 <sup>a</sup>	16.8	19.1 <sup>a</sup>	16.1	18.2 <sup>a</sup>

A higher mean number indicates a more positive response.

<sup>a</sup>Met significance level of  $P < .05$ .

BP, blood pressure.

PTs is necessary for intervention safety, exercise prescription, and to identify patients in need of a physician referral.<sup>22</sup> Previous reports indicate OP PTs perform BP measures at low frequencies, have knowledge gaps regarding best BP practices, and report time constraints and equipment barriers.<sup>1,2,4,5,11,22</sup> Although the current practice culture among OP rehabilitation providers may benefit from educational initiatives addressing misinformed BP practice models,<sup>11</sup> there is paucity of evidence for an instructional design framework with this aim. This study provides a model for one such multimodal educational initiative that demonstrated significant improvements to the attitudes, practice behaviors, and knowledge of OP rehabilitation providers.

When comparing the demographics of the therapists participating in this study to those previously reported by Arena et al. which used the same questionnaire, the investigators note this population had a higher percentage of females (71.2% compared with 58.5%) and therapists with greater than 15 years of experience (57.6% compared with 41.2%).<sup>11</sup> However, this study identified those having greater than 15 years of clinical experience to report significantly more positive changes in BP knowledge, whereas those with less than or equal to 15 years of experience demonstrated significantly improved attitudes toward the BP measures after the study intervention. Although specific causation for these finding requires further examination, it is plausible that the release of the JNC7 criteria,<sup>12</sup> introduced approximately 15 years before

TABLE 5

Mean of Correct and Partially Correct Responses to the Preintervention and Postintervention Questions of BP Knowledge

Question	Knowledge Questions										
	All Respondents		Male		Female		>15 yr of Experience		≤15 yr of Experience		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Blood pressure value(s) considered to indicate prehypertension:											
Systolic	0.73	0.88 <sup>a</sup>	0.80	0.93	0.70	0.85	0.72	0.86 <sup>a</sup>	0.75	0.90	
Diastolic	0.57	0.82 <sup>a</sup>	0.50	1.00	0.61	0.74	0.58	0.79	0.57	0.86 <sup>a</sup>	
Blood pressure value(s) considered to indicate hypertension:											
Systolic	0.77	0.86	0.73	0.93	0.78	0.83	0.65	0.90 <sup>a</sup>	0.90	0.81	
Diastolic	0.60	0.84 <sup>a</sup>	0.56	0.93	0.61	0.80	0.67	0.83	0.57	0.85 <sup>a</sup>	
All questions of knowledge change	2.77	3.44 <sup>a</sup>	1.67	3.80 <sup>a</sup>	2.83	3.27	2.67	3.43 <sup>a</sup>	2.90	3.45	

A higher mean number indicates more correct and partially correct responses.

<sup>a</sup>Met significance level of  $P < .05$ .

BP, blood pressure.

the study, in combination with a statewide transition to doctoral academic preparation for entry level PTs during that same period may be contributors to knowledge gaps.

In addition, suggested changes to the recommended BP classification criteria that were enacted after this study concluded provides an additional conundrum in the effort to provide education in line with the current evidence. Specifically, evidence of baseline knowledge gaps in an OP therapist knowledge of the criteria and definition of P-HTN and HTN are evident despite the JNC7 being published nearly 15 years ago. Changes to these criteria present challenges toward imparting the contemporary knowledge required to make informed clinical decisions. The authors suggest the use of an algorithm, such as the rehabilitation provider BP decision-making algorithm proposed in this study, may be of future benefit because it is not inclusive of specific BP classifications rather a range of BP measures and associated clinically recommended actions.

The authors recognize this study design, inclusive of self-reported behavior change reporting within a few weeks after the required 1 week of BP measures, may not fully encompass sustained behavior change on the part of the therapist. However, as the study's findings suggest that when a workplace participated in an initiative that expected BP measures be performed, therapists report statistically significant improvements with the behavior change. Therefore, a directive to perform BP measures as a component of routine care from an authority figure may be an integral part of the behavior change process. This occurrence can be observed among PTs practicing in the home health care setting where BP measurement is an expected component of each encounter for Medicare reimbursement and has been reported to occur at a higher frequency than other areas of physical therapy practice.<sup>5</sup> Although future studies are warranted to examine the long-

term impact of this type of education model on behavior, enacting workplace policies toward routine BP measure may have an impact on the currently low frequency at which PTs are performing BP measures in the OP practice settings.<sup>4,5</sup>

The cost burden of HTN extends beyond individuals with this as the primary diagnosis. Hospitalization for HTN as a secondary diagnosis has been reported in excess of \$20,000 with 13% of the cost directly associated with HTN BP.<sup>23</sup> Wang et al. suggest a need for fiscally responsible programs that can prevent, manage, and control HTN. This study provides one such cost-effective model that can be incorporated into the daily practice of rehabilitation providers including PTs. Direct clinic costs for this type of program include obtaining adequate BP measurement equipment (\$35–\$47 for each standard aneroid cuff and stethoscope kit, ie, Moore Brand Blood Pressure Kit with Sprague Stethoscope-Moore Medical, LLC Farmington, CT and Pro's Combo II DH-American Diagnostic Corporation, Hauppauge, NY, respectively) as well as costs associated with clinicians time and associated patient care revenue lost while attending the 1-hour training. Performing a manual BP during an evaluation or intervention requires skill to (1) acquire the valid BP measurement, (2) formulate an evidence-based action plan, and then (3) act on the associated clinical decisions. Therefore, this sequence meets the definition of skilled and medically necessary, so is an essential element to include in each patient's medical record.

### Study Limitations

The investigators acknowledge this study only reports the immediate impact of the educational initiative and not the longitudinal changes to attitudes, behaviors, or knowledge. In addition, utilization of therapists from only



**TABLE 6**  
Patient BP Readings and Therapist Associated Actions

Therapist Action	BP Classification Based on Reading			Differences in Action by BP Classification (P)	Normal Compared With P-HTN (P)	Normal Compared With HTN (P)	P-HTN Compared With HTN (P = )
	Normal (n = 68)	P-HTN (n = 123)	HTN (n = 68)				
No action taken	37	69	15	0.001 <sup>a</sup>	0.82	0.001 <sup>a</sup>	0.001 <sup>a</sup>
Informed patient of BP reading	55	89	64	0.001 <sup>a</sup>	0.19	0.02 <sup>a</sup>	0.001 <sup>a</sup>
Educated patient on lifestyle modification to optimize BP measurement	2	9	26	0.001 <sup>a</sup>	0.21	0.001 <sup>a</sup>	0.001 <sup>a</sup>
Engaged in discussion of medication compliance with patient	2	9	39	0.001 <sup>a</sup>	0.21	0.001 <sup>a</sup>	0.001 <sup>a</sup>
Called physician and informed of BP findings call	0	0	3	0.01 <sup>a</sup>	—	0.08	0.02 <sup>a</sup>
Referred to emergency department for additional medical treatment	0	0	0	—	—	—	—
Modified the therapy visit on that date	1	0	2	0.18	.36	1.00	0.13
Held the therapy visit on that date held	0	1	2	0.24	1.00	0.50	0.29

<sup>a</sup>Met significance level of  $P < .05$ .

BP, blood pressure; HTN, hypertensive; P-HTN, prehypertensive.

one health system may have introduced bias and reduced generalizability of the study findings. Control for the number of BP measures a therapist obtained during phase 4 was not addressed, but would have been of benefit in determining if an optimal frequency exists to bring about change in a therapist's attitude, practice behavior, or knowledge. Finally, at the conclusion of this study, recommended change to the BP classification system were introduced, therefore modifications to the questionnaire used in this study before use in future investigations is warranted.

### Future Research

Future research inclusive of long-term impact studies of this educational initiative, outcomes of varied educational

and policy-related initiatives, and modification to the education provided to include the new BP classification recommendations are warranted. Inclusion of private practice OP clinics in future studies may improve generalizability. Attention to direct and indirect cost associated with this type of educational initiative would be of benefit in future studies. Finally, examination of the impact of prescribed BP-related policy and procedures is warranted to determine whether these variables would have a similar impact on a therapist's attitudes, practice behaviors, and/or knowledge.

### CONCLUSION

An educational initiative inclusive of (1) providing BP assessment tools, (2) attending a 1-hour evidence-based BP

lecture, (3) providing a decision-making reference, and (4) a directive to perform valid and reliable BP techniques and interventions for 1 week resulted in significantly positive changes to an OP therapists attitude, immediate practice behavior, and knowledge of BP.

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Rehabilitation provider blood pressure decision-making algorithm

