Impact of an educational intervention on ankle-brachial index performance among medical students and fidelity assessment at month-6

Loukman Omarjee, Céline Donnou, Ségolène Chaudru, Clara Locher, Eunice Paul, Marie Charasson, Chadi Mauger, Vincent Jaquinandi, Olivier Stivalet, Guillaume Mahé

▶ **To cite this version:**

Loukman Omarjee, Céline Donnou, Ségolène Chaudru, Clara Locher, Eunice Paul, et al.. Impact of an educational intervention on ankle-brachial index performance among medical students and fidelity assessment at month-6. Annals of Vascular Surgery, 2019, 56, pp.246-253. 10.1016/j.avsg.2018.07.044 . hal-01903061

HAL Id: hal-01903061

https://univ-rennes.hal.science/hal-01903061

Submitted on 9 Nov 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

ACCEPTED MANUSCRIPT

Impact of an educational intervention on ankle-brachial index performance among medical students and fidelity assessment at month-6

Loukman Omarjee, MD-MSc[1,2,3], Céline Donnou, MD[1,4], Ségolène Chaudru, MSc[2], Clara Locher, Pharmd-MSc[2], Eunice Paul, MD[5], Marie Charasson, MD[1,5], Chadi Mauger, MD[1], Vincent Jaquinandi, MD-PhD[1,2], Olivier Stivalet, MD[1,2,4], Guillaume Mahe, MD-PhD[1,2]

1: Vascular Medicine Department, CHU de Rennes, 35033 Rennes Cedex 9, France

2: Université de Rennes 1, INSERM CIC 1414, 35033 Rennes Cedex 9, France

3: Department of Vascular Medicine, Centre Hospitalier de Redon, 35600 Redon, France

4: Department of Vascular Medicine, Centre Hospitalier de Saint-Malo, 35403 Saint-Malo, France

5: Department of Vascular Medicine, Centre Hospitalier René Pleven, 22100 Dinan, France

Correspondence to:

Dr Loukman OMARJEE, MD-MSc

Vascular Medicine Department

Pôle imagerie médicale et explorations fonctionnelles.

Hôpital Pontchaillou, 2 rue Henri Le Guilloux. Rennes, F-35033. France.

Contact Phone Number: +33 (0) 2 99 28 43 21

Contact Mobile Number: +33 (0) 6 27 49 70 51

Contact Email: loukmano@yahoo.fr

Contact Fax Number: +33 (0) 2 99 28 43 64

Twitter: @LoukmanOmarjee

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

ABSTRACT

Background: The resting ankle-brachial index (ABI) is a clinical test to diagnose peripheral artery disease (PAD). The Wyatt's score has been proposed to assess the students' performance on ABI measurement on a healthy volunteer (HV). No study has shown that this score is sensitive to different teaching methods. In this randomized-controlled-trial, we wanted to determine whether didactic learning alone or didactic learning combined with experiential learning improve proficiency in the ABI procedure assessed by the Wyatt's score.

Methods: Medical students (n = 30) received a didactic learning, including i) a presentation of the ABI guidelines and ii) a video demonstration. Each student, was then randomized into two groups ("the no experiential learning group" and "the experiential learning group"). An initial evaluation was performed after the didactic learning and then the final evaluation at the end of the intervention. A student was considered to be proficient when he performed a correct ABI procedure on a HV. The correct procedure corresponds to: i) correctly answered Wyatt's score and ii) a difference of an ABI measurement between a professor in vascular medicine and a student ≤0.15.

Results: No student was proficient at the initial evaluation. At the final evaluation, there was a significant difference between the number of proficient students for the Wyatt's score depending on their learning group (didactic alone (1/10) or didactic + experiential training (15/20)) and also for the ABI procedure (didactic alone (0/10) or didactic + experiential training (16/20)). At month-6, among the twelve students who passed the final evaluation, four passed both the Wyatt's score and the ABI measurement.

Conclusions: Our study demonstrates that the Wyatt's score was sensitive to an educational intervention and no improvement was found in the case of no experiential learning. The Wyatt's score could be used to evaluate student on ABI measurement after an educational intervention.

Trial Registration: A randomized controlled trial (RCT) was conducted in the vascular medicine department of Rennes University Hospital (France). This was approved by the ethics review board of our institution (n° 16.150).

Keywords: peripheral artery disease, teaching, diagnosis, vascular medicine, medical students

Word Count: Abstract: 335; Main Body: 2582

List of abbreviations: PAD: Peripheral Arterial Disease; ABI: Ankle-Brachial Index; TASC: Trans-Atlantic Inter-Society Consensus; AHA: American Heart Association; CVD: Cardiovascular Diseases; RCT: randomized controlled trial; HV: Healthy Volunteer

ACCEPTED MANUSCRIPT

BACKGROUND

Peripheral Arterial Disease (PAD) is a highly debilitating disease that affects 202 million people around the world and about 7 million people in France[1]. Noninvasive physiologic vascular studies such as the ankle-brachial index (ABI; ratio of the highest systolic blood pressure measured at the ankle to that measured at the brachial artery) at rest play an important role in the diagnosis and characterization in PAD of the lower extremity[2]. ABI is a quick and cost-effective examination in primary care and should be used to screen patients meeting the Trans-Atlantic Inter-Society Consensus Document on Management of PAD (TASC) II criteria[3].

Recent guidelines from the American Heart Association (AHA) have proposed methods for measurement and interpretation of the ABI, as well as the ABI learning procedure[4]. ABI is measured and calculated as the ratio of the highest systolic blood pressure in each ankle from the right and left posterior tibial or dorsalis pedis arteries, divided by the highest brachial systolic blood pressure. A resting ABI value of 0.90 or less defines PAD diagnosis. Also, ABI is a measure of atherosclerosis severity in the legs and is associated with both atherosclerotic risk factors and prevalent cardiovascular diseases (CVD) in other vascular beds[4]. ABI may be used as a risk marker both in the general population with established or free of clinical CV diseases[4]. Given the importance of ABI in screening for PAD but also for CVD especially in asymptomatic patients, it is important for vascular physician to know ABI measurement and its interpretation, but above all it requires technical learning to obtain expertise from the beginning of medical studies and to optimize patient care. Previous study of our group has shown in a first randomized trial that didactic learning alone is insufficient to gain proficiency in the ABI procedure and combining didactic learning with experiential learning significantly improved the students' proficiency[5]. Moreover, *Wyatt et al.* have defined a scoring sheet (Wyatt's score) to assess the proficiency in performance of the ABI[6] (Figure 1). They have

shown that baseline knowledge of the ABI test was poor among a sample of internal medicine residents and requires action to improve ABI learning in medical school and residency programs[6]. The aims of this study are to determine i) whether didactic learning alone or didactic learning combined with experiential learning improve proficiency in the ABI procedure assessed by the Wyatt's score, ii) to assess the fidelity of ABI measurement at month-6.

METHODS

Study design

A randomized controlled trial (RCT) was conducted in the vascular medicine department of Rennes University Hospital (France). This was approved by the ethics review board of our institution (n° 16.150). All included medical students signed an informed consent form and healthy volunteer (HV) and patient cohorts were orally informed according to the approved study procedure.

Didactic Learning

For this study, 4th to 6th year undergraduate medical students (eighteen women and twelve men), with no prior experience in the evaluation of ABI received a specific one-hour didactic course provided by an experienced vascular specialist including i) a presentation of the AHA guidelines (50 min)[4] and ii) a video demonstration of the ABI procedure with a clear description of each step and emphasis on correct technique (10 min). In this video, a vascular specialist performs an ABI measurement on both lower extremities of a patient. The video was recorded to i) explain the utility of the measurement in clinical practice, ii) describe the appropriate care of the Doppler ABI, iii) demonstrate the location of the pulses on the arms

and lower legs, iv) listen to the quality of the pulse of arterial blood flow, v) list the tips for effectively using the Doppler probe, vi) calculate the ABI, and vii) state the significance of the ABI result.

Baseline assessment

Following this didactic course, the students were invited to complete the Wyatt's score and perform an ABI measurement. A technician supervised an initial ABI procedure evaluation. During this evaluation, each medical student attempted to i) perform an ABI measurement for the right or left lower limb extremity of a HV, and ii) select the appropriate numerator and denominator required to calculate the ABI of a hypothetical patient. One minute after the student finished, a vascular specialist blinded to the students' ABI measures came into the examination room and repeated the ABI measurement.

Randomization

Then, they were randomized into two groups as illustrated in Figure 2 ("no experiential learning group", "experiential learning group"). This latter group was randomly divided into two groups: "experiential learning on HV group" and "experiential learning on patients group".

Educational Intervention

The HV cohort had no medical risk factor and normal ABIs, whereas the patient cohort consisted of consecutive patients referred for PAD diagnosis. We excluded patients with recent below the knee lower extremity arterial bypass, the presence of open wounds, ulcers, or fistulae contraindicating cuff placement, or who were unable to provide oral informed consent.

For experiential learning on HV, students came three times in pairs for a one-hour session during which students trained on one another. For experiential learning on patients, students came three times individually when a vascular ultrasound exam was programmed. For each experiential learning session, students performed an ABI measurement on both lower extremities (right and left lower extremities) of the volunteer under the vascular specialist's supervision (i.e., seven pressures recorded: right brachial artery, right posterior tibial artery, right dorsalis pedis artery, left posterior tibial artery, left dorsalis pedis artery, left brachial artery and right brachial artery). The equipment provided to the student included adult medium and large sized blood pressure cuffs, an 8 MHz Doppler ultrasound probe, ultrasound gel, a stethoscope, and an automatic blood pressure monitor, as previously reported by *Wyatt et al*[6]. Students were then instructed to calculate and interpret the ABI, according to the AHA recommendations (i.e., the ABI of each leg should be calculated by dividing the higher of the posterior tibial artery or dorsalis pedis artery pressure by the higher of the right or left arm systolic blood pressure).

During each experiential learning session, the vascular specialist identified all problems of the measuring process that may affect the accuracy of the ABI to provide pertinent and personalized feedback to the students. For example, the vascular specialist was careful with the choice or attachment of the cuff, the position and angle of the Doppler probe, or of insufficient contact via the transmission gel for the Doppler probe, which may dislocate during the measurement and deflation of the cuff.

Immediately after completion of the ABI measurement, the vascular specialist provided i) feedback to the students on their individual errors in performing the ABI measurement and its calculation and interpretation and ii) a demonstration of the ABI measurement on both lower extremities of the same volunteer.

Final assessment

The final assessment was performed following the same procedure as the baseline assessment.

Outcome measures

A student was considered to be proficient in performing the ABI measurement if he correctly answered the 15-items of the Wyatt's score and performed the following procedure during the evaluation on a HV: i) installed the volunteer in a supine position with the head and heels supported, ii) used the appropriate device among the equipment provided for each participant (i.e., sphygmomanometer cuff with a width of a least 40% of the limb circumference placed just above the malleoli, 8 MHz Doppler probe with Doppler gel applied over the probe and placed in the area of the pulse at a 45° to 60° angle to the surface of the skin), iii) inflated the cuff progressively up to 20 mmHg above the level of flow signal disappearance and then deflated slowly to detect the pressure level of flow signal reappearance, iv) performed the pressure measurements in the accurate order (i.e. for the right ABI measurement: right brachial artery, right posterior tibial artery, right dorsalis pedis artery, left brachial artery, and right brachial artery again), v) recorded each pressure, vi) selected the appropriate numerator and denominator to calculate the ABI, and vii) obtained an accurate ABI. Even if the ABI of the student was accurate, but the pressure measurements were not performed in the correct order, or the sphygmomanometer cuff was not correctly placed, the student was not considered to be proficient.

An ABI was considered to be accurate if the difference between the ABIs measured by the vascular specialist and the student was ≤ 0.15, as previously reported[7,8]. Furthermore, this cut-off was chosen since a decrease of the ABI > 0.15 over time is effective for detecting significant PAD progression, as stated in the AHA recommendations[4]. The intra-observer

coefficient of variation for the ABI in our vascular laboratory is 8% (Typical error of the estimate is 0.06).

Fidelity assessment at month-6

Between the beginning of the study and the evaluation at day-28, only the students of the group "experiential learning group" received the 3 sessions of practical training. Between the end of the evaluation and the follow-up at month-6, no student received practical training.

Students considered proficient having passed all the theoretical and practical tests at the final assessment were invited to perform another evaluation at month-6 in order to verify the acquisition of knowledge and skills of measuring the ABI.

Statistical analysis

Statistical analysis was performed using the computing environment R (R Development Core Team, 2005). A Fischer test was used to compare the number of students proficient in performing the Wyatt's score and ABI procedure in each group between the initial and final evaluations. At month-6, the percentage of success was calculated for the Wyatt's score and the ABI procedure according to the randomization group of each student.

Between-group comparisons were also performed at the initial and final evaluations. A two-tailed p value < 0.05 was considered to be statistically significant.

RESULTS

Thirty medical students were included in this RCT (Figure 2) where they are completed the baseline Wyatt's score and performed ABI assessment. Of the initial cohort of 30 students, 20 (67%) were randomized in two groups of 10 and received the educational intervention. One

group performed the three times repeat assessment on HV while another one performed it on patients.

At the initial evaluation, after the didactic learning alone, no student was proficient in performing the ABI procedure while 2 (6.7%) passed the Wyatt's score.

At the final evaluation, the number of proficient students for the Wyatt's score in the no training group was not significantly improved compared with the initial evaluation (1/10 vs 1/10; p=ns; Figure 3, panel A). The same results were observed for the ABI procedure in this group (1/10 vs 2/10; p=ns; Figure 3, panel B). In the experiential learning group (training on HV), the number of proficient students for the Wyatt's score significantly increased (0/10 vs 9/10; $p < 0.001$; Figure 3, panel A) and also for the ABI procedure (0/10 vs 8/10; $p < 0.001$; Figure 3, panel B) after three experiential ABI measurements on both lower extremities (right and left). In the experiential learning group (training on patient), the number of proficient students for the Wyatt's score was not significantly improved (1/10 vs 6/10; p=0.07; Figure 3, panel A) while for the ABI procedure, it was significantly improved (0/10 vs 8/10; $p < 0.001$; Figure 3, panel B) after three experiential ABI measurements on both lower extremities (right and left).

At the final evaluation, there was a significant difference between the number of proficient students for the Wyatt's score depending on their learning group (didactic alone (1/10) or didactic + experiential training (15/20)) and also for the ABI procedure (didactic alone (0/10) or didactic + experiential training (16/20)). There was no significant difference in the proficiency of the students according to their experiential learning group affiliation (HV *vs* patients).

Fidelity at month-6

At the final evaluation, only 1 student in the no training group was successful, while in the experiential learning group, 6 students from the training on HV group and 5 from the training on patient group were successful. At month-6, the student of the no training group failed. In the group receiving the interventional education, 3/5 (60%) passed the Wyatt's score and 1/5 (20%) the ABI procedure in the training on patient group. 5/6 (83%) passed the Wyatt's score and 3/5 (60%) the ABI procedure in the training on HV group. (Figure 4)

DISCUSSION

ABI is an important and widely non-invasive used tool for the diagnosis of PAD and is part of the medical curriculum. In this we showed that i) didactic learning alone (no training), even with a video demonstration, is insufficient to ensure proficiency of medical students in performing the Wyatt's score and the ABI procedure; ii) didactic learning associated with an intervention that combined three experiential training sessions with direct feedback to participants significantly improved the students' proficiency relative to didactic learning alone for both Wyatt's score and ABI procedure; iii) at month-6, there is no fidelity for the only one student who passed the final evaluation while in the experiential group, the fidelity decreased more for the ABI procedure than the Wyatt's score leading the need for continuous training.

Our study demonstrates that the Wyatt's score was sensitive to an educational intervention and no improvement was found in case of no experiential learning. Therefore, the Wyatt's score could be used for the assessment of vascular medicine students. It should be of interest to validate it among PAD patients.

Teaching of the ABI procedure in major medical schools consists of only a didactic session, evaluated by questionnaire[9–11], that is insufficient to ensure competence with the theoretical procedure. Our study supports dropping didactic learning alone or combining it with

experiential training. Training should include practical instruction on how to perform an ABI but also a didactical teaching following the international recommendation[4].

There was no difference in student proficiency between the two experiential learning modalities (HV vs patients). Thus, experiential learning on HV may be preferable from a practical point of view (*i.e.* organization, feasibility) as a first step of teaching the ABI procedure.

The strength of this study is that we used the ABI measurement value of our vascular specialists as a "gold standard" for comparison with the measurements performed by the students.

Limitations

This study had some limitations. First, students in the no training group received only one hour of didactic learning. It cannot be excluded that repeat didactic learning might have improved the final proficiency of the students in completing the Wyatt's score and measuring the ABI. However, following only one didactic course corresponds to a current practice in most French medical schools[12]. The present study confirms that such learning is insufficient and experiential training should be performed, as suggested by other studies[13,14].

CONCLUSION

Didactic learning alone is insufficient for proficiency in performing the Wyatt's score and ABI procedure on HV; it should be combined with experiential learning.

The Wyatt's score could be used to evaluate student on ABI measurement after an educational intervention. In case of success of the Wyatt's score, an ABI done by an expert is not required. Nevertheless, without continuous practice, we note that at month-6, the theoretical knowledge on the Wyatt's score as well as the skills for the measurement of the ABI do not

297 persist Further studies are needed to i) determine the minimal amount of experiential learning
298 required to be proficient; ii) assess the effect of experiential learning modalities (HV vs
299 patient) on a larger population; and iii) evaluate the students' proficiency in a follow-up
300 study.

301 **Acknowledgments**

302 The authors thank Awenig Carel, Marielle Delalande, Virginie Jégou, Philippe Landreau, and
303 Mathilde Ouvrard for their technical help. Ségolene Chaudru, a PhD student of our team, has
304 received a grant from the region "Bretagne" (Bourse ARED).

305

306 **Competing Interests**

307 The authors declared no potential conflicts of interest with respect to the research, authorship,
308 and/or publication of this article.

309

310 **Funding**

311 The authors received no financial support for the research, authorship, and/or publication of
312 this article.

313

314 **Availability of data and materials**

315 The datasets used and/or analysed during the current study available from the corresponding
316 author on reasonable request.

317

318 **Permission Information**

319 The authors do hereby declare that all illustrations and Figures in the manuscript are entirely
320 original and do not require reprint permission.

321

ACCEPTED MANUSCRIPT

Contributors

Dr Loukman OMARJEE contributed to literature search, data collection, data analysis, data interpretation, writing the report and final approval of the version to be published.

Dr Céline DONNOU contributed to literature search, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Ms Ségolène CHAUDRU contributed to study management, literature search, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Dr Clara LOCHER contributed to literature search, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Dr Marie CHARASSON contributed to literature search, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Dr Chadi MAUGER contributed to literature search, data collection, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Dr Vincent JAQUINANDI contributed to literature search, data collection, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Dr Olivier STIVALET contributed to literature search, data collection, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

Pr Guillaume MAHE contributed to study design, literature search, data collection, data analysis, data interpretation, revising the intellectual content and final approval of the version to be published.

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

Ethics approval and consent to participate

Ethical approval of the study was obtained from the Ethic Committee of the Rennes University Hospital (France) and approved by the institutional review board (IRB) (n° 16.150). All included medical students signed an informed consent form and HV and patient cohorts were orally informed according to the approved study procedure.

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The objectives of the study were explained to the participants who were informed that their participation was voluntary, and anonymity was assured.

ACCEPTED MANUSCRIPT

REFERENCES

1. Fowkes FGR, Rudan D, Rudan I, Aboyans V, Denenberg JO, McDermott MM, et al. Comparison of global estimates of prevalence and risk factors for peripheral artery disease in 2000 and 2010: a systematic review and analysis. Lancet Lond Engl. 2013 Oct 19;382(9901):1329–40.

2. Sibley RC, Reis SP, MacFarlane JJ, Reddick MA, Kalva SP, Sutphin PD. Noninvasive Physiologic Vascular Studies: A Guide to Diagnosing Peripheral Arterial Disease. Radiogr Rev Publ Radiol Soc N Am Inc. 2017 Feb;37(1):346–57.

3. Lau JF, Weinberg MD, Olin JW. Peripheral artery disease. Part 1: clinical evaluation and noninvasive diagnosis. Nat Rev Cardiol. 2011 May 31;8(7):405–18.

4. Aboyans V, Criqui MH, Abraham P, Allison MA, Creager MA, Diehm C, et al. Measurement and Interpretation of the Ankle-Brachial Index: A Scientific Statement From the American Heart Association. Circulation. 2012 Dec 11;126(24):2890–909.

5. Donnou C, Chaudru S, Stivalet O, Paul E, Charasson M, Selli J-M, et al. How to become proficient in performance of the resting ankle-brachial index: Results of the first randomized controlled trial. Vasc Med Lond Engl. 2017 Nov 1;1358863X17740993.

6. Wyatt MF, Stickrath C, Shah A, Smart A, Hunt J, Casserly IP. Ankle-brachial index performance among internal medicine residents. Vasc Med Lond Engl. 2010 Apr;15(2):99–105.

7. Monti M, Calanca L, Alatri A, Mazzolai L. Accuracy of in-patients ankle-brachial index measurement by medical students. Vasa. 2016 Feb;45(1):43–8.

8. Ray SA, Srodon PD, Taylor RS, Dormandy JA. Reliability of ankle:brachial pressure index measurement by junior doctors. Br J Surg. 1994 Feb;81(2):188–90.

9. Chaudru S, de Müllenheim P-Y, Le Faucheur A, Kaladji A, Jaquinandi V, Mahé G. Training to Perform Ankle-Brachial Index: Systematic Review and Perspectives to Improve Teaching and Learning. Eur J Vasc Endovasc Surg Off J Eur Soc Vasc Surg. 2015 Oct 23;

10. Chaudru S, de Müllenheim P-Y, Le Faucheur A, Jaquinandi V, Kaladji A, Mahe G. Knowledge about ankle-brachial index procedure among residents: being experienced is beneficial but is not enough. VASA Z Gefasskrankheiten. 2016 Jan;45(1):37–41.

11. Chaudru S, de Müllenheim P-Y, Le Faucheur A, Jaquinandi V, Mahé G. Ankle brachial index teaching: A call for an international action. Int J Cardiol. 2015 Apr 1;184:489–91.

12. Mahé G. [Ankle-brachial index measurement: Methods of teaching in French medical schools and review of literature]. J Mal Vasc. 2015 May;40(3):165–72.

13. Wyatt MF, Stickrath C, Shah A, Smart A, Hunt J, Casserly IP. Ankle brachial index

performance among internal medicine residents. Vasc Med. 2010 Apr 1;15(2):99–105.

14. Georgakarakos E, Papadaki E, Vamvakerou V, Lytras D, Tsiokani A, Tsolakaki O, et al. Training to Measure Ankle-Brachial Index at the Undergraduate Level: Can It Be Successful? Int J Low Extrem Wounds. 2013 Jun 1;12(2):167–71.

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

Figure titles:

Figure 1: Wyatt's Score

Figure 2: Study design flow chart

Figure 3, panel A: Wyatt's score evaluation

Figure 3, panel B: ABI measurement on healthy volunteers

Figure 4: Fidelity assessment at month-6

Figure legends:

Figure 1: Wyatt's Score for Ankle-brachial index measurement

Figure 2: Study design flow chart. ABI: Ankle-brachial index X: number of students proficient at the final assessment (T0+28 days on average)

Figure 3: Comparison of the number of medical students proficient in performing the Wyatt's score (Panel A) and resting ABI (Panel B) procedure on healthy volunteers at the initial and final evaluation between the the 'no training group', the 'experiential learning group training on healthy volunteer' and the 'experiential learning group training on patients'

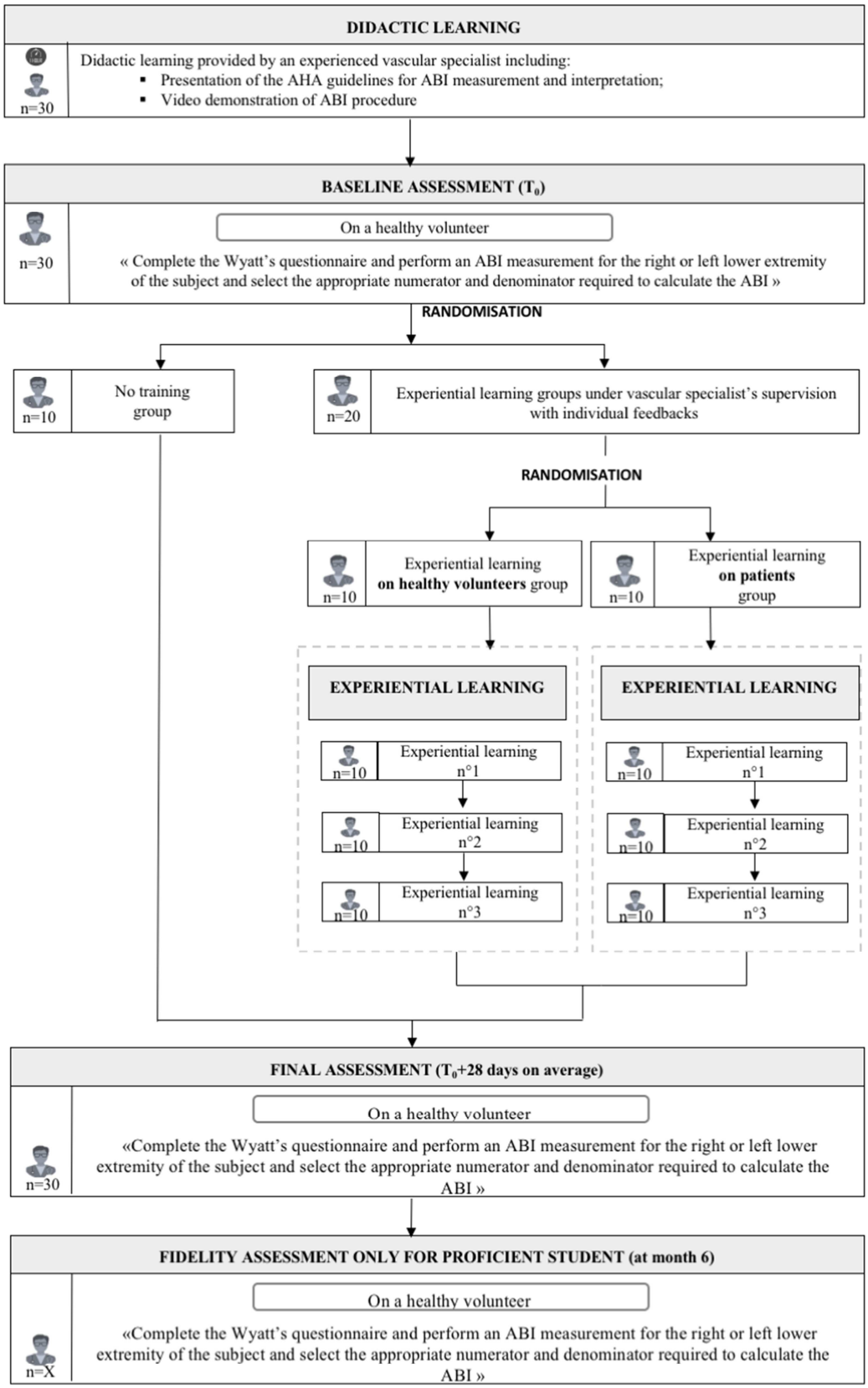
Figure 4: Percentage of success of medical students proficient at the final evaluation in performing the Wyatt's score and resting ABI procedure on healthy volunteers at month-6 between the 'no training group', the 'experiential learning group training on healthy volunteer' and the 'experiential learning group training on patients'.

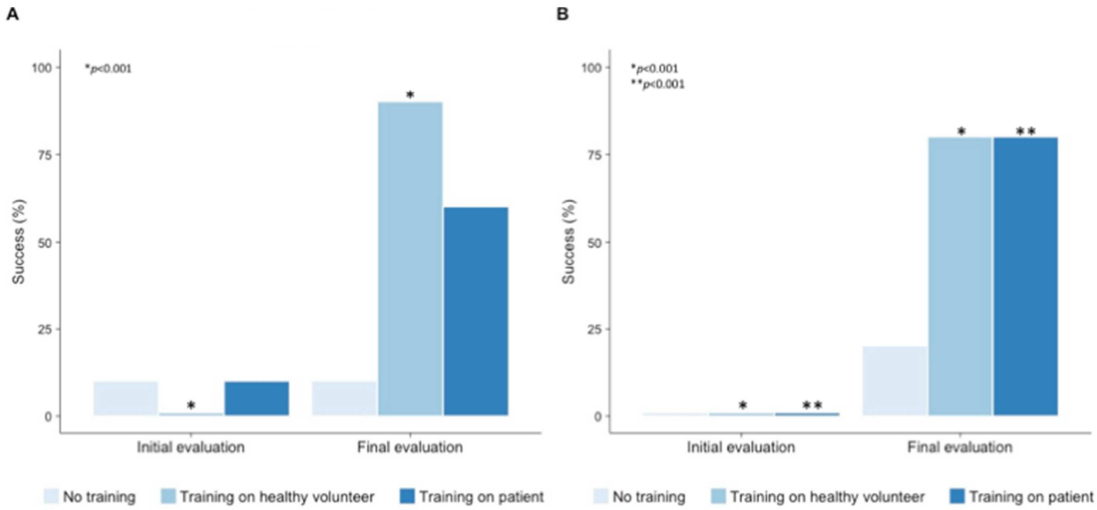
ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

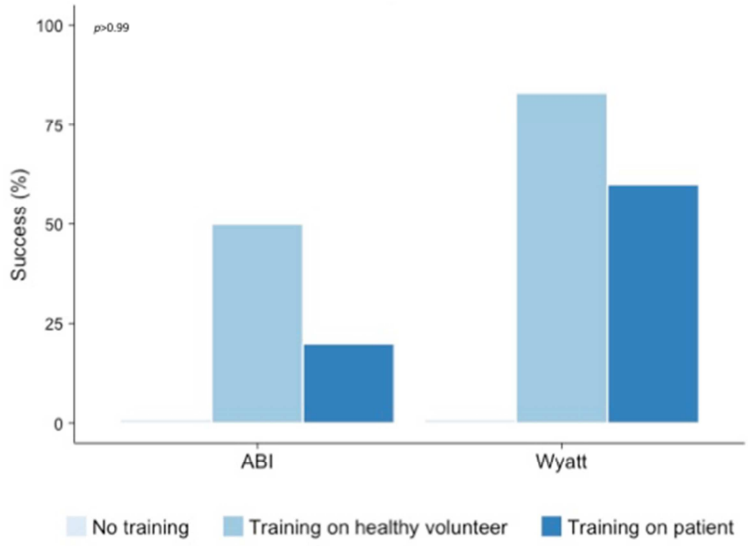
Wyatt's Score	
Element of ABI measurement	**Score**
Arm	
A. Use of arm cuff	1
B. Use of Doppler probe to acquire systolic pressure from brachial vessels	1
(i) Right brachial artery	
(a)Doppler signal obtained from right brachial artery	1
(b)Systolic pressure recorded within 5 mmHg of onset of Doppler signal	1
(ii) Left brachial artery	
(a)Doppler signal obtained from left brachial artery	1
(b)Systolic pressure recorded within 5 mmHg of onset of Doppler signal	1
C. Systolic pressure acquired from both brachial arteries	1
Right leg	
A. Use of leg cuff	1
B. Correct placement of cuff over lower leg	1
C. Use of Doppler probe to acquire systolic pressure from tibial vessels	1
(i) Dorsalis pedis artery	
(a)Doppler signal obtained from right dorsalis pedis artery	1
(b)Systolic pressure recorded within 5 mmHg of onset of Doppler signal	1
(ii) Posterior tibial artery	
(a)Doppler signal obtained from right posterior tibial artery	1
(b)Systolic pressure recorded within 5 mmHg of onset of Doppler signal	1
D. Systolic pressure acquired from both pedal arteries	1
Total score	15

ACCEPTED MANUSCRIPT


DIDACTIC LEARNING
n=30
Didactic learning provided by an experienced vascular specialist including:
Presentation of the AHA guidelines for ABI measurement and interpretation;
Video demonstration of ABI procedure
BASELINE ASSESSMENT (T0)
n=30
On a healthy volunteer
« Complete the Wyatt's questionnaire and perform an ABI measurement for the right or left lower extremity of the subject and select the appropriate numerator and denominator required to calculate the ABI »
RANDOMISATION
n=10
No training group
n=20
Experiential learning groups under vascular specialist's supervision with individual feedbacks
RANDOMISATION
n=10
Experiential learning on healthy volunteers group
n=10
Experiential learning on patients group
EXPERIENTIAL LEARNING
EXPERIENTIAL LEARNING
n=10
Experiential learning n°1
n=10
Experiential learning n°2
n=10
Experiential learning n°3
n=10
Experiential learning n°1
n=10
Experiential learning n°2
n=10
Experiential learning n°3
FINAL ASSESSMENT (T0+28 days on average)
n=30
On a healthy volunteer
«Complete the Wyatt's questionnaire and perform an ABI measurement for the right or left lower extremity of the subject and select the appropriate numerator and denominator required to calculate the ABI »
FIDELITY ASSESSMENT ONLY FOR PROFICIENT STUDENT (at month 6)
n=X
On a healthy volunteer
«Complete the Wyatt's questionnaire and perform an ABI measurement for the right or left lower extremity of the subject and select the appropriate numerator and denominator required to calculate the ABI »



ACCEPTED MANUSCRIPT



ACCEPTED MANUSCRIPT