

Knowledge and Skills About Measuring Blood Pressure Among Nursing Undergraduate Students

Conhecimento e Habilidades Sobre a Medida da Pressão Arterial Entre Graduandos de Enfermagem

Conocimientos y Habilidades en La Medición de La Presión Arterial Entre Los Estudiantes de Enfermeira

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How to quote this article:

Pereira BC, Nascimento MGG, Lima RS, *et al.* Knowledge and Skills About Measuring Blood Pressure Among Nursing Undergraduate Students. *Rev Fund Care Online*. 2018 Jul./Sep.; 10(3):729-736. DOI: <http://dx.doi.org/10.9789/2175-5361.2018.v10i3.729-736>

ABSTRACT

Objective: The study's main goal was to assess the theoretical and practical knowledge about measuring blood pressure among nursing undergraduate students. **Methods:** It was a mixed approach study, both descriptive and explanatory, and a cohort study; it was performed in 2015 with 40 nursing undergraduate students from a Public University in *Minas Gerais* State. The research was carried out in three phases, as follows: observational, theoretical knowledge survey and focus group. Data was organized by thematic analysis. **Results:** Following the data analysis, it was built the thematic map, the interrelationship faults between theory and practice as the central theme and their subthemes, the theoretical learning barriers, the practical learning barriers, the barriers of following and evaluation process, and also the strategies to improve the teaching-learning process. **Conclusion:** The theoretical and practical knowledge gaps about blood pressure measurement contribute to non-reliable values in daily practice, which may compromise the patient safety.

Descriptors: Nursing, Blood pressure, Knowledge, Nursing education.

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RESUMO

Objetivo: investigar os conhecimentos teórico e prático sobre a medida da pressão arterial entre graduandos de enfermagem. **Método:** estudo com abordagem mista, descritivo e exploratório, com corte transversal, realizado em 2015, com 40 graduandos de enfermagem de uma universidade pública de Minas Gerais, em três fases: observacional, levantamento do conhecimento teórico e grupo focal. Organização dos dados pela análise temática. **Resultados:** Da análise dos dados foi construído o mapa temático, As falhas na interrelação teoria-prática como tema central e seus subtemas, Barreiras para o aprendizado teórico, Barreiras para aprendizado prático, Barreiras no processo de acompanhamento e avaliação e Estratégias para melhoria do processo de ensino aprendizagem. **Conclusão:** As lacunas do conhecimento teórico e prático sobre a medida da pressão arterial contribuem para a obtenção de valores não fidedignos, o que compromete a segurança do paciente.

Descritores: Enfermagem, Pressão Arterial, Conhecimento, Educação em Enfermagem.

RESUMEN

Objetivo: investigar los conocimientos teórico y práctico sobre la medición de la presión arterial entre los estudiantes de enfermería. **Método:** estudio descriptivo con un enfoque mixto y exploratoria, con sección transversal en el año 2015, con 40 enfermería graduados de una pública Universidad de Minas Gerais, en tres fases: conocimiento teórico y observacional encuesta y grupos focales. Organización de datos para el análisis temático. **Resultados:** el análisis de los datos fue construido mapa temático, los defectos en la interrelación teoría-práctica como un tema central y sus subtemas, barreras para el aprendizaje teórico, las barreras al aprendizaje prácticas barreras en el proceso de monitoreo y evaluación y estrategias para mejorar el proceso de enseñanza-aprendizaje. **Conclusión:** Las lagunas de conocimientos teóricos y prácticos sobre la medición de la presión arterial contribuyen a obtener valores confiables, que apuesta por la seguridad del paciente.

Descriptores: Enfermería, Presión arterial, Conocimiento, La Educación de Enfermería.

INTRODUCTION

The technique learning process of measuring the blood pressure (BP) has deserved special attention because it is one of the most widespread procedures in clinical practice, especially in nursing. The professors have been taking into account that is critical to achieving a good professional performance, that they should base their knowledge on updated literature since science advancements require frequent review regarding the BP measurement.^{1,2}

In order to perform a correct BP measurement, the procedures recommended by the scientific literature³⁻⁴ should be respected, supported by theoretical and updated reasoning in order to obtain reliable values.⁴⁻⁵ It may avoid possible errors that can compromise the values obtained, the clinical evaluation, the Systemic Arterial Hypertension diagnosis (SAH), and can cause serious harm to patients when they are either imputed to inadequate treatments or

deprived of necessary treatments, consequently, impairing the patient safety.^{1,6}

The literature has reiterated that there are flaws in theoretical and practical knowledge of nurses regarding the BP measurement. Among the main flaws are the non-compliance of palpatory, auscultatory and oscillometric methods. In daily practice, professionals usually only perform the auscultatory method, which leads to errors in the BP measurement.⁷

A study developed by nursing professionals in the adult intensive care unit has found flaws in theoretical and practical knowledge, and they attributed these failures to a lack of update strategies development.⁵

Studies' results have shown similarity to what has been observed in the performance of nursing undergraduate students, and it has caused worries about the following questions: Why do students fail to comply with scientific principles and correct procedures for measuring BP? What factors have contributed to these knowledge gaps?

Aiming to answer such concerns, the main goal of this study was to investigate the gain of theoretical and practical knowledge about BP measurement among nursing undergraduate students, and also to identify the factors that lead to errors in the technique execution.

METHODS

The study had a mixed approach, both descriptive and explanatory, and being a cohort study; In the mixed approach, "qualitative thinking offers a foundation or a disposition for quantitative thinking".⁸

Sample were taken for convenience, with the participation of 40 undergraduate nursing students from a Public University, out of a total of 70, who met the inclusion criteria: to be regularly enrolled; have studied and approved in the disciplines of Semitechnique I and II; being either in practical activities or in the stage of clinical and surgical hospitalization during the period of data collection. Students who did not meet these criteria were excluded.

Data were collected by the principal investigator, after previous training, in three phases, as follows: The first phase, observational, was developed during the practical activities or students' internship stage, to evaluate the BP measurement by using brachial, popliteal and arterial dorsalis pedis techniques, by means of instruments elaborated by the authors in the form of a checklist, based on the Brazilian guidelines.³ The second phase was comprised by the theoretical knowledge about BP measurement, applied by the researcher, through a self-applied instrument, validated and authorized by the authors,⁴ consisting of the following three parts: previous self-assessment of theoretical knowledge, theoretical and practical knowledge, and self-quiz.

The third phase aimed to analyze the factors related to the error in measuring BP. This phase was conducted through a focus group, a moderator, a sub-moderator and a 90-minute

observer in a classroom at the University, in a space protected from noise and external interruptions and easily accessible, with resources of multimedia, portfolios, ceiling fan, coffee, water and snack. Participants gathered in chairs distributed in circular form. The triggering questions were based on the failures related to the calibration techniques, resulting from the observational phase. All participants were invited, but only nine agreed to participate in this study phase, so, only one focus group session was held. The testimonies were recorded in a digital device, with the participants' permission and also recorded in field diary. The data were transcribed immediately upon completion; corrections were made according to the Portuguese language, checked and analyzed by four researchers. To organize the data was used thematic analysis,⁹ operationalized in six phases, as follows: the data transcription; the organization of the initial codes according to the patterns of similarity; the themes search; the revision of the themes, for evaluation of its internal cohesion and referring to the data set; the definition and naming of themes and the production of the research report.

The analysis was based on the VI Brazilian Guidelines for Arterial Hypertension and on the Basic Attention Notebook number 37. It should be emphasized that the researcher knew the participants because they were students of the same course. The study was approved by the Research Ethics Committee, Process nº 869453. Participants signed the Term of Free and Informed Consent and their names were replaced by the letter 'P' followed by an Arabic numeral.

RESULTS

The sociodemographic characterization of the participants revealed that 87.5% (35) belonged to the female gender and 12.5% (5) to the male gender, with an average age of 24.22 years old, and a monthly family income of 1 to 5 minimum wages 70% (28), enrolled in the 6th and 8th periods of the course.

It was found that 77.5% (31) of the participants reported having obtained the theoretical and practical knowledge of the BP measurement procedure exclusively at undergraduate level.

The previous self-assessment related to theoretical knowledge revealed that 75% (30) of the participants classified their knowledge as good, and 72.5% (29) self-assessed the practical knowledge as good. Post-questionnaire self-assessment revealed that for theoretical knowledge, 32.5% (13) self-assessed as regular and 40% (16) poor. For the practical knowledge 25% (10) self-assessed as regular, 30% (12) as bad and 12.5% (5) as poor.

The results related to the theoretical knowledge of blood pressure are presented in the Table 1.

Table 1- Percentage distribution related to participants' theoretical knowledge about blood pressure, 2014.

Items (n = 40)	Right		Wrong	
	n	%	n	%
BP regulation mechanisms	29	72.5	11	27.5
What is BP	31	77.5	9	22.5
How should BP measurement be performed	22	55	18	45
Preferential position to perform a BP measurement	30	75	10	25
Stethoscope cuff inflation from the estimated level of BP	19	52.5	21	47.5
Stethoscope cuff placement on the arm	15	37.5	25	62.5
Basic procedure to be performed before a BP measurement	22	55	18	45
Factors that cause errors in the measurement	20	50	20	50
Interval to perform calibration	17	42.5	23	57.5
Importance of arm circumference measurement	12	30	28	70
Gold standard for BP measurement	9	22.5	31	77.5
The Korotkoff method	28	70	12	30
Equipment validation process	12	30	28	70
Korotkoff phases where the auscultatory gap occurs	11	27.5	29	72.5
Instrument considered gold standard for indirect BP measurement	6	15	34	85
The BP measurement	3	7.5	37	92.5
Definition of the stethoscope cuff width	29	72.5	11	27.5

Instrument elaborated by Almeida and Lamas (2013)

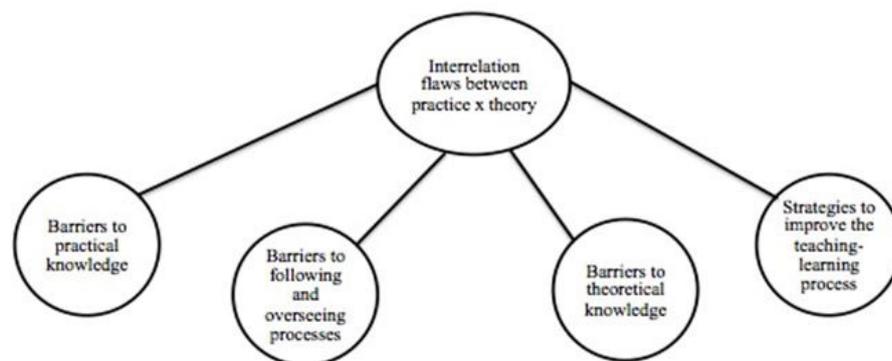
Regarding the evaluation of the brachial, popliteal and arterial dorsalis pedis BP measurements, it was verified that all the participants performed the brachial artery measurement, however, only 10% (4) were willing to perform BP measurement in the arterial dorsalis pedis region, and 7.5% (3) in the popliteal region. The other academics stated that they did not know how to carry out such measures.

It was found that 88% (35.2%) of the participants did not perform hand hygiene before and after the procedure, 97% (38,8) did not certify if the client had a full bladder, had coffee and food 30 minutes before the measurement, 93% (37.2) did not measure the arm circumference, and 100% (40) did not wait for 1 minute to perform the measurement on the other arm nor did they perform it; in their totality, they did not guide the patient about the procedure and the values obtained, and they did not perform the palpatory method to estimate the systolic pressure. On the other hand, 79% (31.6) certified the positioning of the patient for the measurement, 90% (36) kept the limbs at heart level during the measurement, and 93% (37,2) placed the stethoscope cuff adequately, nonetheless, the same ones could not be adequate for the circumference, since brachial measurement was not performed.

Six different brands of sphygmomanometers were used and none of them were validated either by the European Society of Hypertension or the Brazilian Society of Cardiology. From all the participants, 90% (36) stated that they did not know the need for validation of BP devices and the difference between validation and recommendation. Also, 80% (32) stated that the seal existence from the *Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO)* [National Institute of Metrology, Quality, and Technology] would indicate its validity. Additionally, all the participants affirmed that they did not obtain any

orientation from the University for the BP apparatuses acquisition.

Figure 1 - Thematic map of the participants' difficulties in measuring blood pressure. (n = 9), 2014



DISCUSSION

The knowledge about the BP measurement is obtained predominantly in the undergraduate course, through the contents related to anatomy, physiology of the BP, taught in the discipline of anatomy in the 2nd period, physiology in the 3rd period, and the theoretical and practical knowledge related to the measurement of BP are taught in the 4th period in the discipline of semiology during theoretical classes, laboratory practices and practical classes.¹⁰ This curricular organization leads to content fragmentation, which may contribute to the difficulty of gaining knowledge, and also might impair its application in clinical practice.

The fact that many students have the first contact with the BP measurement only in the academic environment places in perspective the importance of developing teaching methodologies favorable to the appropriation of knowledge about the matter.¹¹

Regarding the self-assessment post questionnaire, the knowledge gaps were verified, considering that the attribution of regular concept was preponderant among the participants under evaluation. They argued that certain contents were not taught over the course, which emphasizes the need to revise disciplines and contents, considering that the content competencies are used every time there is a need for clinical evaluation in the tree levels of health care, as follows: primary, secondary and tertiary care.

The results shown in the **Table 1** are in accordance with those obtained in the self-assessment, considering the high percentage of errors related mainly to the knowledge of physiology, device validation, BP measurement and brachial circumference measurement.

It was found that the results of this study with low knowledge on the topic are in agreement with those presented in other studies.¹²⁻¹⁴

The shortcomings in both theoretical and practical knowledge related to the BP measurement procedure among future professionals may imply inadequate nursing care, and also might lead to unnecessary risks during the hospitalization period and outpatient care. It can result in unreliable BP measurement data, errors in the diagnosis of hypertension, as well as generating inadequacy of the therapy, care quality and patient safety.

Therefore, it is essential to emphasize this theme both in relation to theoretical and practical knowledge during the nurses' training process, in order to provide skills and abilities for clinical performance with safety, since the BP measurement is performed routinely in the nursing practice, and the correct execution guarantees the reliability of the results.¹⁵

The results of the observational phase also coincide with those of the practical self-evaluation, since the majority considered the knowledge, after the application of the questionnaire, as regular, bad and very bad.

Similar results were also found in a study that pointed to incorrect interpretation of Korotkoff sounds, errors related to the technique of measuring BP, such as circumference measurement and non-estimation of systolic BP, as well as lack of mental concentration, decreased auditory acuity, incorrect positioning of the limb in which the measurement will be performed.¹⁶

It is worth highlighting that even in institutions that offer the different stethoscope cuff and tape measure for adequate BP measurement, all professionals did not bother measuring the arm circumference and ended up using a cuff with a standard size rubber bag 12 cm wide by 23 cm in length.^{15,17} The professionals presented as justification for such conduct the lack of training in the institutions that they work, and also because the institutions do not consider measuring BP as relevant, which is

contrary to the scientific literature on the topic and the nurse responsibility.¹⁷

As far as sphygmomanometers are concerned, there is a common tendency to use automatic and semi-automatic devices in clinical practice and, as long as they are validated, they have good efficacy as well as the aneroid devices. However, these devices do not replace the aneroid during the teaching of the BP measurement in the undergraduate course, in which the technique is recommended for the BP measurement in two times.^{3,13,18}

It was also evidenced the lack of knowledge of the academics for the procedures of measuring BP by popliteal and arterial dorsalis pedis regions. Although these measures are not standard, there has been evidenced an increase in the complexity of patients in the hospitalization sectors, imposing challenges in the daily work and the need for continual updating for safer practices.¹⁹

Those difficulties for the procedure of measuring BP correctly were justified in the statements obtained through the focal group.

It can be understood from the study analysis that the participants expressed the need for professional training on the matter. Furthermore, they awakened to the magnitude and relevance of the correct BP measurement for safe practice. Together these facts pointed out that it is imperative to include and search for further information regarding the content on the subject, and also have a systematic evaluation by the professors in order to integrate the theoretical contents to the practice, as presented in the statements.

The fragmentation between theory and practice appeared in the statements and qualifiers of the difficulties encountered by the students.

[...] You think you have a good knowledge, I think I can check the pressure, but linking this knowledge to theory I cannot. Knowing how to evaluate correctly the stethoscope cuff and also know the importance of this to be able to apply in practice I think this is missing (P5) [...]

In this regard, a study with nurses found the need for professional training in relation to the physiology of BP, measurement methods, indirect methods and all domains for a correct assessment of BP, and among the causal factors for the difficulties highlighted the lack of approach of the appropriate subject in the graduation and the importance of theoretical and practical improvement.⁵

The analysis of the gaps in theoretical and practical knowledge led us to call the central theme, as follows: Interrelationship flaws between theory x practice.

[...] Failure is everything, it is collective, it is as much of the student as of the teacher, like theory and practice;

Not only one factor that determines the error, it is the whole set (P2) [...]

The first sub-theme was entitled: Barriers to theoretical knowledge. Among the justifications related to the gaps in theoretical learning are the lack of content and the disarticulation between the disciplines of physiology and anatomy impacting on the measurement of BP, which makes the learning process difficult and clinical reasoning, as evidenced in the testimonies.

[...] It looks like it's not linking the materials, they're not interconnected, you know? So we go fishing one thing here and there it gets very fragmented and this reflects in practice and also in theory (P3) [...]

Regarding the curriculum, the classes' organization of the disciplines were criticized for contributing to the difficulty of articulating the various contents necessary in order to take care of either a situation or a problem. On the other hand, it has been defended the evocation of interdisciplinary work, considering that the professional doing demands different knowledge, given the complexity of the human being, mainly, in his process of becoming ill.²⁰⁻²¹

Content planning is fundamental because it cannot be done in a random way, it must have a sequence, so that the student can also have a sequence in the teaching-learning process.²² Also, it is necessary for professors to search for active teaching methodologies in order to make such content meaningful to the student.¹ These methodologies are based on the theoretical principle of autonomy, which has a purpose of stimulating the academic so that he can play his role in the teaching-learning process, which includes creative initiative, scientific curiosity, critical-reflective spirit, self-assessment, among others.²³

In this regard, a study has demonstrated the importance of instrumentalization through educational processes with active methodologies, so that nurses can become capable of performing the BP measurement correctly,²⁴ which includes the basis in scientific knowledge for the practice to be performed correctly and may reflect on the health care quality provided.²⁵

The second sub-theme was entitled: Barriers to practical knowledge. In this scope, the participants pointed to the shortage of adequate material resources, the lack of training for BP measurement in the popliteal and the arterial dorsalis pedis regions, and the work process, which have impaired the reflective practice, as evidenced in the testimonies.

[...] And the question of haste too, because we do not have time and are being charged at all times and if we do it in all patients does not give the times you do not even remember [...] And you think you are doing it right, you keep doing it (P9)[...]

[...] It would be good if the labs had more tools and even more appropriate training (P5)[...].

Among the failures observed for the BP measurement was the lack of palpatory estimation of systolic pressure and this was justified by the lack of time. Failure to perform this procedure may lead the observer to not correctly identify systolic pressure sound or to overestimate diastolic pressure in patients with auscultatory hiatus.¹³

Studies have demonstrated the importance of instrumentalization through educational processes, so that nurses can become capable of measuring BP,²² which reflects in the health care quality provided.²⁵

Undergraduate and post-graduate courses should direct their contents, discussions and reflections to transform reality and meet the real need for better performance in the BP measurement steps. It is necessary to develop teaching and learning strategies in order to insert a reliable and efficient knowledge in the execution of the technique to obtain reliable data and accurate diagnoses.²⁶

Another barrier related to practice was the lack of availability of adequate material resources.

[...] And another thing is also in practice not having the materials. We do not have a stethoscope cuff for obese how do you measure the pressure on the leg that is the popliteal, try to check the popliteal pressure and then? ... There is no material that does not have tapes on it, often it is not charged and they will get you to make the measurement if you do not have your own cuff (P4)[...]

In the practical classes developed in real scenarios, the students used for the BP measurement their own devices that were acquired without either criteria of validity or recommendation, and also the fact that the stethoscope cuff were only for brachial circumference of 32 cm.

This study argues that it is within the nursing laboratory that the approach to nursing care has to be approached, so a continuous evaluation of the human and material resources is necessary in order to favor the adequate initial formation of these students.²⁷

The American Heart Society recommends that the appropriate stethoscope cuff should have the ratio of the arm circumference around 0.40 and the length should range from 80 to 100% of this circumference, so different cuff sizes are required to fit different arm circumferences. Failure to use adequate cuffs can lead to either hyper or hypo estimation of the values obtained, and then generate inaccuracy in BP results.²⁷⁻²⁹

The third sub-theme was entitled: Barriers to following and overseeing processes. It refers to the lack of collection and monitoring by the professors in relation to the BP measurement. They point out that the discussion about the evaluative process is scarce, and also wonder about

the performance evaluation, emphasizing the student's role as the protagonist of the learning process:

*[...] This assessment they should talk to us like this: 'you are not doing this procedure correctly' and not only reflect this in your note, but justify what we are doing wrong. Because, how do we grow if we do not know where we are going wrong (P8)[...]
[...]Nobody stopped to teach, here you have to do it like that, there was no follow up (P7) [...]*

The professors' actions can provide the academic with the specific knowledge for the professional formation and a discovery of themselves, and also of the social and cultural world. Thus, the teaching-learning process only makes significant for the student when it stimulates their intellectual, social and cultural autonomy. It is necessary that the professionals are prepared pedagogically and hopefully in return, students interested and stimulated in the continuous search for learning.²²

Therefore, the nursing professional evaluation during the performance of the BP measurement should be performed in a non-punitive manner, considering methods available within each institution, in order to improve and update knowledge through lifelong education.

The fourth sub-theme was entitled: Strategies for improve the teaching-learning process. It was constructed from the suggestions presented by the participants, so that skills and abilities are acquired for the practice of clinical practice.

They emphasized the need to implement supervised learning spaces in laboratories and in real situations. The participants highlighted the need to carrying out theoretical and practical courses on the topic, to participate in an extension project that addresses the theme, integrated disciplines, lectures, events and mini courses. They also stated the need to equip laboratories with adequate material resources, as presented in the following statements:

[...] I learned to measure in both regions the popliteal and the arterial dorsalis pedis through the extension project (P4) [...]

[...] I think that on this question, it would be good if the laboratories had more instruments and even to have a more adequate training, and to have a specific class only of pressure. (P5) [...]

[...] I think I should have a mini-course of about 7 days on blood pressure, to learn everything, and then learn the pathophysiology and everything together (P7) [...].

In this perspective, strategies for the professional knowledge improvement are necessary, as well as investing in professional updating, in the equipment acquisition, in maintenance and storage, always aiming the execution of a safer practice.³¹ Proposing training and implementing

policies to acquire quality material resources can contribute greatly to patient safety.

They considered that the curricular restructuring with integrated disciplines and the use of active teaching methodologies that stimulate the active participation of the student are important conditions to improve the process of professional nursing training,¹¹ as explained in the testimony.

[...] I find interesting the way of studying some nursing courses, they have integrated subjects, so if it's going to talk about BP, it goes from the physiology, it encompasses all the pathologies that it can have and this all together in a single matter, already does the pharmacology of all medicines and already the semi-technical of this, so they can already encompass everything (P8) [...]

Knowledge is something that needs to be constructed and this occurs through the sharing of experiences, of learning, of interpersonal relationships, in order to reach their own conclusions within the correct method. Hence, initiatives and studies of the elaboration of educational products are of extreme importance for knowledge construction among the academics.¹¹

In this context, different approaches have been widely discussed as the guiding axis for the elaboration of pedagogical projects of graduation courses in health. Although there are recommendations for curricular integration, it seems that the multidisciplinary approach, which brings a group of disciplines working together on problems, topics or skills as a focus for learning, where learning is concerned not only with the mastery of tasks, but with learning during problem execution, has been flagged as one of the most viable. This form of approach is very close to the model of competence-based learning.³²

CONCLUSIONS

The study's results revealed that nurses' skills and abilities regarding the BP measurement are compromised, and it was corroborated by the following facts: the fragmentation between theory and practice; the failures in curricular structure related to the absent integration between the topics; the deficiency of approaching the content related to the issue; the flaws in the supervision process by the professors over their students, the lack of training in laboratory environments and the shortage of adequate material resources.

The nursing professional training process is complex. Therefore, it is necessary to master a set of knowledge that can make them able to follow the science development in order to ensure the performance of safe clinical practice.

Strategies were suggested by the participants aiming to improve the teaching-learning process related to measuring BP. Those strategies are relevant because they demonstrate

that self-assessment allowed the participants to become aware of the matter and, perhaps, of the need for constant searching for knowledge.

This study brings significant contributions to the nursing science field, considering that while it points out the weaknesses of theoretical and practical knowledge regarding the BP measurement, it also presents the suggestions for the improvement of the teaching-learning process for the first time in the literature.

As a limitation, it is worth mentioning that the observational phase was realized only in one day with each student, and the study locus was developed in an educational institution.

It is worth noticing that another research studies in another centers might be necessary in order to corroborate the findings of this investigation. Furthermore, it is proposed additional research that investigates the relationship between teaching methodologies for measuring BP and the knowledge gain among nursing undergraduate students.

ACKNOWLEDGEMENT

The authors acknowledge the professors that have collaborated in the research development. The authors are also grateful to the research participants and the Public University where the study was performed.

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Received on: 12/13/2016

Required Reviews: None

Approved on: 02/07/2017

Published on: 07/05/2018

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