Addiction Research & Therapy

Bachur et al., J Addict Res Ther 2014, 5:3
http://dx.doi.org/10.4172/2155-6105.1000188

Review Article Open Access

Integrative Review: Teaching Strategies and Tools Used to Assess the Knowledge of Health Science Students Concerning Blood Pressure Measurement

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Received date: June 3, 2014;**Accepted date:**July 31, 2014;**Published date:**August 4, 2014

Abstract

Introduction and objectives: Eventhough indirect blood pressure measurement is a non-invasive procedure, it poses theoretical and practical challenges. This study's aim was to investigate what has already been published concerning Health Science students' knowledge of blood pressure measurement, to identify the tools used to estimate this knowledge and the teaching strategies adopted.

Methods: An integrative literature review was conducted. Research was carried out in four databases, using controlled and uncontrolled keywords.

Results: With regard to the level of evidence, 75% of the eight studies selected were classified as level 6, 12.5% was classified as level 4, and 12.5% as level 3. Nursing students were assessed in 62.5% of the studies; pharmacology students in 12.5%; chiropractic students in 12.5%, and both nursing and medical students were assessed in 12.5% of the studies. In regard to teaching strategies, 50% of the studies assessed traditional teaching methods; 12.5% also used role-playing as a teaching strategy; 12.5% used an arm simulator for blood pressure measurement; 12.5% designed pedagogical games; and 12.5% adopted an extracurricular program with lectures, video tutorials, and developed skills in the laboratory.

Conclusions: Most were observational studies assessing traditional teaching methods by means of non-validated questionnaires and checklists, following the recommendations of the American Heart Association. Pedagogical interventions were rare.

Keywords: Integrative review; Blood pressure measurement; Students; Knowledge

Introduction

The indirect measurement of blood pressure (BP) is an easy and non-invasive procedure [1], however, one with considerable theoretical and practical complexity. It is the basis for diagnosing, treating, managing and researching blood pressure. The patient'sanatomical-physiological aspects, the equipment used, and the observer him/herself are potential sources of error, possiblyinducingfalse diagnoses, which are preventable if the patient is properly prepared, the equipment is calibrated and a standardized technique is used [2].

The recommendations provided by international literature regarding the steps to indirectly measure BP are described by the American Heart Association (AHA), and the Cardiac Society ofGreat Britain and Ireland Standardization of Blood Pressure Readings since 1939 [3]. In Brazil, themostrecent and current recommendations at the time this paper was written were the VI Brazilian Guidelines of Hypertension (2010) [4].

Knowledge obtained in recent decades concerning BP measurement enabled important advancements that promote more precise diagnoses and more efficient treatment and follow-up;consequently, there are unquestionable benefits to patients. For successful results to be achieved, however, accurate measurements with error-free procedures are necessary [5].

BP measurement is largely used by health professionals to acquire information concerning a patient's basal cardiovascular status, which is essential for clinical decision-making. Nonetheless, health workers do not always comply with established guidelines [6], allowing for great variability of measurements and mistakes during its performance [7].

The examiner should know the basic concepts involved in BP physiology [8], equipment and the (right-side and left-side) methods of measurement available, in addition to the factors that may lead to errors, such as those related to patients, to the environment, technique, equipment and the observer [9,10].

Higher education should train professionals who are able to act globally, to commit to the problems presented by a population, producing and developing knowledge appropriate to its context,

preparing professionals for decision-making, leadership, teamwork, management and continuous education.

We opted to conduct this study because of our concern with the large number of studies addressing errors in BP reading [11-13], with gaps in the theoretical and practical knowledge of professionalsconcerning this topic [14,15], and with the lack of studies addressing educational interventions to be implemented among health sciences students.

tudies addressing the knowledge of health sciences students concerning the stages of the indirect measurement of BP were included in this review. The instruments used in these studies to measure such knowledge were also identified, as were the strategies used to teach this population. Scientific knowledge favors professional growth and performance and a methodological review can facilitate the access of students and professionals to knowledge produced in the field, which is necessary to promote safe and error-free care.

Method

This integrative review gathers the results of studies addressing a specific topic in a systematized and organized manner, with synthesized results, and enables the inclusion of experimental and non-experimentalstudies. Conclusions are drawn based on various studies addressing similar issues, analyzing data to reach a more comprehensive explanation for a specific phenomenon. Consequently, generating a consistent and comprehensive overview of complex concepts, theories or healthproblems [16].

We used the PICO strategy, in which P stands for patient or problem, I for intervention, C for control or comparison, and O for outcomes [17]. This strategy is composed of the following stages: identification of the topic and research problem; determining the study's object; search databases for relevant literature; selection of papers using inclusion and exclusion criteria; reading full-text papers; interpreting the results; and synthesizing knowledge.

The studies identified in the databases should address the following questions: What has been published on the knowledge of health sciences students concerning the indirect measurement of BP? What are the instruments used to measure such knowledge? What are the teaching strategies these studies describe?

The following databases were used to select the papers: Latin American and the Caribbean Health Sciences (LILACS), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis (Medline), and Cochrane Library. These databases were chosen to broaden the scope of research and minimize potential biases.

The search was conducted in October 2013 using the Health Science Descriptors (DECS) and Medical Subject Headings (MeSH) of "blood pressure determination", "students", and "knowledge," including the words "attitudes" OR "practice" OR "education" OR "methods". These vocabularies are used worldwide as a filter between the author's appropriate language and terminology of the field [18].

This review includes papers related to the indirect measurement of BP among health sciences students written either in Portuguese, English or Spanish; full-texts available on the Internet and published in the last 10 years (2003 to 2013). Exclusion criteriawere: unpublishedMaster'stheses and/or Doctoral dissertations.

To support the analysis of evidence in the papers selected for this review, we used the classification proposed by Melnyk and Fineout [19], which is composed of seven levels: level 1, evidence from systematic review or meta-analysis, including all relevant randomized controlled trials (RCTs) or evidence-based clinical practice guidelines that are themselves based on systematic reviews or RCTs; level 2, evidence from at least one relevant, well-designed RCT; level 3, evidence from well-designed clinical trials without randomization; level 4, evidence from well-designed cohort studies and case control studies; level 5, evidence from systematic review of descriptive and qualitative studies; level 6, evidence from a single descriptive or qualitative study; level 7, evidence from regulatory opinions, and/or reports of expert committees. Two researchers independently performed the methodological analyses and a third researcher resolved the differences in the event of disagreements.

The study was not submitted to the Institutional Review Board because it does not involve human subjects.

Results

This integrative review's objective was to determine what has been published in regard to the knowledge of health students concerning the stages of the indirect measurement of BP, and what tools and strategies have being used to measure such knowledge. The objective was to summarize knowledge concerning this topic and to contextualize the basis of clinical practice, in terms of technical/ scientific issues and their practical-theoretical basis.

We initially identified 79 papers, though six of these appeared twice. Of these, 44 were found in the Medline database, nine in CINAHL, seven in LILACS, and 13 in Cochrane. A total of 59 papers were excluded after analysis of the abstracts, either because they did not address the topic or did not present sufficient content to enable analysis. Another five papers were also excluded for not being available online or not having full-text online and one paper was excluded because of the language.

After applying the pre-established criteria, the elected papers were carefully read and all met the study's objectives. No study applied systematic reviews or meta-analysis found. The final sample was composed of eight papers.

In regard to the frequency of publications, two (25%) papers were published per year, with the exception of 2011, in which no papers were found. In terms of methodological characterization, five (62.5%) are descriptive, quantitative and observational studies, one (12.5%) is a descriptive, quantitative, methodological study, one (12.5%) is a cross-sectional, crossover study, and one (12.5%) is a before-after intervention study with a single group.

The following populations were addressed by the studies: nursing students were addressed in five (62.5%) studies, one (12.5%) study addressed pharmacology students, one (12.5%) addressed chiropractic students, and one (12.5%) study addressed nursing and medical students together.

In regard to the origin of publication, four (50%) studies originated from the European continent, three (37.5%) from North America, and one (12.5%) from South America.

In terms of classification of evidence, we observe that six (75%) papers presented level 6 evidence, one (12.5%) paper was level 4, and

one (12.5%) was level 3. Table 1 synthesizes the analysis of the papers included in this integrativereview (appendix 1).

Title	Authors	Journal	Year	Database	Methodological design	Population	University/Country	Teaching strategies	Data collection instruments	Evidence level
Modification of nursing students' performance in blood pressure measurement: an educational retraining programme [20]	Brokalaki H., et al	Inter Nursing Review	2008	CINAHL and Medline	Before-and-after intervention study with a single group.	Nursing students	University of Athens, Greece	Complementary program (tutorialvideo)	Checklist	3
Nursing student caring behaviors during blood pressure Measurement [21]	Minnesota baccalaureate Psychomotor skills Faculty Group	J Nursing Education	2008	CINAHL and Medline	Descriptive, quantitative, observational study.	Nursing students	University of Minnesota,USA	Complementary program (Dramatization)	Check list	6
Knowledge of correct blood pressure measurement procedures among medical and nursing students [22]	González-López JJ, et al.	RerEsp Cardiol	2009	Medline	Descriptive, quantitative, observational study.	Nursing and medical students	Universidad Autónoma de Madri, Spain	Conventional theoretical/ practical teaching	Questionnaire	6
A survey of first year student nurses' experiences of learning blood pressure measurement [23]	Baillie, L; Curzio, J.	Nurse Educ Practice	2009	CINAHL and Medline	Descriptive, quantitative, observational study.	Nursing students	London South Bank University, England	Conventional theoretical/ practical teaching	Questionnaire	6
Student Measurement of Blood Pressure Using a Arm Simulator Compared with a Live Subject'sArt [24]	Lee JJ, et al.	Am J Pharm Educ	2010	Medline	Cross-sectional, crossover	Pharmacy students	University of Connecticut School of Pharmacy, USA	Complementary program (Simulation)	Questionnaire	4
Development and validation of an educational game: blood pressure measurement [25]	Andrade, LZC; e cols.	Rev. Enferm. UERJ	2012	LILACS and CINAHL	Descriptive, quantitative, methodological study.	Nursing students	Federal University of Ceará, Brazil	Educational game (dominoes)	Questionnaire	6
Preparing students to competently measure blood pressure in the real-world environment: a comparison between New Zealand and the United Kingdom [26]	Bland M; Ousey K.	Nurse Educ Practice	2012	CINAHL and Medline	Descriptive, quantitative, observational study.	Nursing students	Universiy of Huddersfield, United Kingdom	Conventional theoretical/ practical teaching	Questionnaire	6

Knowledge of accurate blood pressure measurement procedures in chiropractic students [27]	Angela M.; et al.	J Chiropr Educ	2013	CINAHL and Medline	Descriptive, quantitative, observational study.	Chiropractic students	Palmer College of Chiropractic,USA	Conventional theoretical/ practical teaching	Questionnaire	6

Table 1: Description of papers (n=8) included in this integrative review according to title, authors, journal, year of publication, database, methodological design, population, university/country, teaching strategies, instruments of data collection, and level of evidence. RibeirãoPreto, Brazil 2013 (appendix 1).

On the equipment used, it is observed that 6 (70%) articles used electronic sphygmomanometers and only 2 articles (30%) cited the traditional aneroid sphygmomanometer. This review'sfindingseffectively respond to the guiding questions: "what has been published in regard to the knowledge of health sciences students concerning the indirect measurement of BP, as well as the instruments used to measure such knowledge and teaching strategies adopted."

Discussion

According to this review, what has been published so far is classified as containing a low level of evidence. For the most part, theoretical and practical educational programs in the conventional mode have been used with some complementary measures, such as tutorial videos and simulations/dramatizations, in addition to one educationalgame.

The indirect measurement of BP requires the professional to have cognitive competencies (knowledge), procedural competencies (technique performance), and appropriate behavior (approaching patients). Knowledge is important to the avoidance of errors related to the procedure and should be shared among universities so that professionals adhere to recommendations and guidelines are put into practice. It can certainly contribute to reliable and accurate readings of BP. The greatest benefit is undoubtedly for patients, since accurate measurements, in addition to reflecting homeostasis of one's cardiovascular system, also enables the correct identification of hypertensive individuals, the implementation of appropriate treatment, whether it is pharmacological or non-pharmacological, and verification treatment adherence. Four papersincluded in this review assessed the students' levels of knowledge concerning the stages of indirect BP measurement using quantitative questionnaires.

In regard to the theoreticalframework, three studiesfollowed the recommendations provided by AHA in regard to the indirect measurement of BP [20-28].

One of the studies applied a questionnaire to students fromtwo different programs [22]; medicalstudents in the 3rd and 6th years and nursing students in the 3rd year. The authors report thatthe knowledge of medical students increased from 28% to 61% as they acquired abilities over the course of the program, while nursing students already presented greater knowledge in regard to the steps to be followed. Early introduction of students to practical skills in laboratories can benefit pedagogical growth and improve the relationship of theory and practice, consolidating learning.

One of the studies [27] explored the knowledge of chiropractic students during the four years of the program using a questionnaire with 16 questions on a Likert scale. The scores obtained in the questionnaires progressively diminished from the first to the 4th year. The authors suggest that updating knowledge of these skills every six months after the first year of the program would certainly be efficient.

One study conducted in the University of London [23] followed the recommendations provided by the British Hypertension Society (2004) [29] for the measurement of BP. The sample was composed of 1st year nursing students, to which the professors applied a questionnaire composed of qualitative and quantitative questions. They verified how frequently manual and electronic sphygmomanometers were used; how frequently students were supervised during skill classes; whether the students had practiced the technique before the program; and how confident they were in performing the technique. The results suggest that experience with the technique varies according to the opportunities students have to practice it. These findings corroborate those of anotherreviewstudy [26] in which 1st year nursing students from different universities asked for more classes teaching skills so they would become more confident in measuring BP.

In addition to the application of questionnaires, four different instruments were found that are used to investigate knowledge of indirect BP measurement. One study conducted in Atenas20 used an educational program. This program included skill classes in the 1st semester and educational lectures, videos, laboratory practice, while students were supervised by a hospital's professors. In the 2nd semester, the professors identified the errors students committed in regard to the stages to be followed, provided recommendations suggested by AHA28 and then the studentshadtheirskillsreassessed. The students' performance after the basic program was deemed insufficient, though significant improvement was observed after a second intervention. The need to review these skills during the course of the program became evident.

A single study addressing nursing students assessed the effects of a teaching intervention using role-playing and analyzed the students' psychomotorskills [21]. Role-playing is a didactic technique that uses dramatization. The participants are involved in a problem situation, assume roles other than those experienced in their daily routine and are asked to make decisions and preview the consequences of thesedecisions [30]. It is a democratic and participatory teaching exercise that addresses content and learning, with learning occurringthroughpracticalexperience [31]. A performance test with 30 items was applied to students. Their behavior was assessed as either 1-present or 2-not present. The score was the sum of all the answers and ranged from 0 to 30. After two months, the same student sample had their psychomotor skills assessed through filming them role-playing BP measurements. The results showed significant improvement of the students' behavior and support the use of educational practices to promote the performance and skills of students in measuring BP.

With the same rationale, anotherreviewstudy [24]used an arm simulator for pharmacology students to take BP measurements. Life-size arm simulators enable students to practice the same skills and techniques required to measure BP in a humansubject [32]. The study does not report significant differences in the BP readings obtained from a human arm compared to those obtained from an arm simulator and students did not manifest preferences for learning the techniques with humans instead of simulators or vice-versa. Whether arm simulators can facilitate the learning of BP measurement or whether students are able to measure BP should be assessed in future studies.

Only one of the studies included in this review wasconducted in Brazil [25]. The paper describes the methodological steps to construct an educational strategy to consolidate the technique for indirect measurement of BP through a game applied to nursing students. The authors needed astrategy that was easy to transport and store and easy to be applied by a single mediator. Thus, theychose dominoes, which is a simple game, widely available, cheap and easy to learn, and specific rules could be established for the game. The game set has 28 domino pieces, 28 cards and one instruction card. Each domino has a pair of risk factors related to the physiopathology of cardiovascular diseases, therapeutic drug control and the prescription of exercise. The students' performance improved after the activity. The authors note that the use of educational games, such as dominoes, in learning arouses learners' motivation, curiosity and interest in learning in a fun and enjoyable way.

Studies report important gaps in the knowledge of students in regard to the stages of indirect BP measurement, namely, aspects regarding the instrumental technique and the anatomy- physiology involved. Currently, the education of health sciences students goes beyond pedagogical and didactic scientific updating; it is supposed to enable students to participate, reflect, and practice. We stress the need to develop new teaching models for the indirect measurement of BP directed to professionals and students in the health field.

It is worth noting that no population-based studies addressing either physical therapy or physical education students were found. These professionals constantly use the indirect measurement of BP in their clinical practice as a key parameter to assess exercise-induced cardiovascular output, especially in cardiovascular rehabilitation programs. Therefore, because there are few studies in these fields, these populations should be considered in future research addressing educational interventions concerning the measurement of BP.

This integrative review enabled the construction of a synthesis of scientific studies investigating the level of knowledge of health sciences students in regard to the indirect measurement of BP. There are gaps in the knowledge of students. The studies were classified as having a low level of evidence, thus, studies with greater methodological rigor are needed. Groups with interest in research should unite efforts with the encouragement of funding agencies to expand intervention studies and research involving students from various fields of health in order to play an important role in the expansion of knowledge in this field.

This paper's results reveal studies using conventional methods and some isolated educational interventions, such as an extra-curricular program including lectures, tutorial videos and skills classes in laboratories; simulations and games. There is also a need to train skills during the course of the undergraduate program so that students will commit the measurement process to memory. This study shows the link between the need for interventions and improved qualification and the theoretical and practical performance of students in the health field. Therefore, the indirect measurement of BP should be more deeply studied with the application of reliable and valid instruments to assess educational interventions designed to qualify and update the knowledge of students. Periodic updates are needed to ensure possession of the skills required error-free indirect BP measurement [33-36].

Conclusions

This review's results also suggest the need for educational interventions directed to other professions, such as physical therapists and physical educators, to complement and update their knowledge, thus favoring the performance of the stages concerning the measurement of BP and leading to improved clinical practice.

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