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Precision and Reliability of Digital Blood Pressure Monitor When Monitoring the Blood Pressure of Patients in Critical Units of a Hospital in Peru

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ABSTRACT

The increasing integration of digital technologies in the healthcare field has raised questions about the accuracy of these devices. This study seeks to support its use in critical environments through scientific evidence. The main objective was to evaluate the accuracy and reliability of digital blood pressure monitors in monitoring blood pressure in critically ill patients, which was achieved with the help of the information provided in the articles. A qualitative approach was adopted that involved the review and analysis of ten previously published studies from reliable sources (PUBMED, SCIELO, RECIMUNDO, REPOSITORIO.WIENER). The methodology, measurement techniques, sample size, population studied and environmental conditions were evaluated. The results revealed that digital blood pressure monitors are generally accurate and reliable, but there are limitations and variations. Obesity of the patients, the position of the arm during measurement and the quality of the cuffs can affect the accuracy. Environmental conditions, such as temperature and humidity, also play a role. The use of high quality cuffs and standardization of arm position is recommended. In summary, digital blood pressure monitors are valuable in critical healthcare units, but their successful implementation requires careful evaluation of the circumstances and accurate calibration.

Keywords: Monitoring, Digital blood pressure monitor, Critical units, Health, Blood pressure

INTRODUCTION

The growing integration of digital technologies in the field of health has raised doubts about the accuracy of devices that measure blood pressure digitally, these are used to monitor blood pressure, they consist of a band that fits on the arm (cuff) and a device that records pressure (Arana C., 2022). Taking into account the aforementioned, it is evident that technological advances have led to various work processes in the healthcare environment

being carried out much more quickly, which is why the Pan American Health Organization (PAHO) considers that this new technology is a support in optimizing time in health care and in monitoring blood pressure by health personnel. This technological adaptation implies feasibility, but it has also generated a new learning challenge for some health professionals, who see this digitalization as a bit complicated, either because of the year in which they learned to measure blood pressure or because of the simple fact. of mechanized averse with the use of the manual tensiometer (Lizcano-Jaramillo, P. A., 2019).

On the other hand, there is evidence that the common use of automatic devices to measure blood pressure in critical health settings has raised concerns about their comparability compared to manual measurements with mercury sphygmomanometers, traditionally known as standard (Ostchega, et al., 2012). This is why Borneo (2020), in its study on the self-perception of digital skills in the Health personnel of Huánuco in Peru, found that most public workers had a basic level of digital skills, in addition, they excelled in the dimension technological, followed by digital participation, along with collaboration and communication, on the one hand, by mastering the four necessary aspects, only a small group felt digitally competent.

Additionally, it is understood that there are factors that affect the accuracy and reliability of these devices in a critical clinical environment, including the type of technologies used, the training of medical personnel, and the competence in the use of these devices to measure blood pressure in units reviews (MediPlus, 2023). Therefore, Padwal et al. (2020) points out that there are numerous problems, including the skills and abilities of health personnel working in these units, as they may be possible obstacles to ensuring accurate blood pressure measurement with monitors, this emphasizes that there is still health personnel who do not adapt to technological devices. However, the accuracy and reliability of digital blood pressure monitors in monitoring blood pressure in critical units is an essential aspect of modern healthcare that requires careful attention and a greater understanding of the competencies and technologies involved, thus leading to technological advance to a point of help for improving health (Cardona et al., 2018).

METHODOLOGICAL FRAMEWORK

Type of Investigation

The present literature review study was descriptive, because it is the most appropriate way to gather data that evidence the connections of the world in its natural state. This type of analysis is carried out as a first step before undertaking an experiment, allowing the precise identification of which variables influence and which elements they incorporate in the experimental study (Muguira, A., 2018). That is why the study has a qualitative approach, since the bibliographic works found are mostly qualitative, but we also found quantitative studies, so we proceed with descriptive and numerical data.

Methodology

A qualitative approach was adopted that involved the review and analysis of ten previously published studies from reliable sources (PUBMED, SCIELO, RECIMUNDO, REPOSITORIO.WIENER). In addition, an advanced investigation was carried out using various search tactics, where descriptors and keywords were combined. Considering language and age as filters (English and Spanish, 15 years, respectively). The sample was made up of 10 articles, of which 7 belong to qualitative studies and 3 to quantitative studies.

RESULTS AND DISCUSSION

Of the 100% of the articles selected, 70% were qualitative studies and 30% were quantitative studies (Table 1).

Table 1. Percentage of articles selected according to study methodology.

Study methodology	%
Qualitative studies	70%
Quantitative studies	30%
Total	100%

After a thorough analysis of the 10 original articles, the identified themes were classified into three different categories using a thematic analysis approach. These categories were named as follows: The first category refers to the comparison of digital devices in PA taking, compared to those that traditionally exist. For this context Ostchega et al. (2012) indicates that the differences between the devices (automatic oscillometric and mercury sphygmomanometers) were minimal or close to 2 mm Hg in all subgroups, whether by gender, age group, ethnicity, body mass index categories and variations in cuff size. However, exceptions were seen in the mean differences in systolic blood pressure, particularly in those using the extra-large blood pressure cuff (−3.1 mm Hg) and in individuals with obesity (−2.6 mm Hg), as well as in blood pressure.. diastolic blood pressure for the low weight group (−3.5 mm Hg). While Araujo et al. (2022) mentions that systolic BP measured by automatic blood pressure monitors is 1.17 mmHg on average in 95%; for diastolic BP, it produced −0.08 mmHg the average is 95% ranging between 0.69 and 0.54, compared to a mercury sphygmomanometer, so automatic blood pressure monitors have strong validity measurement compared to the column of mercury. Therefore, they can be safely used to measure blood pressure in children and adolescents in clinical and epidemiological studies. These findings, when compared with the study by Park, S.-H., & Park, Y.-S. (2019), found that automatic oscillometric devices recorded lower readings compared to mercury sphygmomanometers for both systolic blood pressure, with a mean difference of 1.75 mmHg (95% confidence interval: −3.05 to −0.45, I = 91.0%), as for diastolic blood pressure, with a mean difference of −1.20 mmHg (95% confidence interval: −2.16 to −0.24, I = 95.0%). When analyzed by manufacturer, the BpTRU device showed lower measurements

compared to the mercury sphygmomanometer, while the OMRON showed no significant differences in systolic and diastolic blood pressure measurements compared to the mercury sphygmomanometer, although the Results will vary depending on device used.

The second category refers to the accuracy of digital monitors in measuring the blood pressure of critically ill patients. Corresponding to this, Kamboj et al. (2021) states that the intervals of agreement in the population for systolic blood pressure were widely extended, varying from −36.13 mmHg to 28.28, in terms of the precision of diastolic blood pressure measurements, they showed a notable lack of consistency, which which resulted in unreliable estimates of population concordance intervals. Regarding non-invasive continuous blood pressure measurement based on tonometry, Saugel et al. (2013) point out that they examined and contrasted blood pressure values in a total of 4,502 records, each representing the average of 10 heartbeats. A positive bias of +0.72 mm Hg was detected in the Mean Blood Pressure (MAP), with a range of 95% agreement that varied between −9.37 mm Hg and +10.82 mm Hg, where mean differences were observed of −1.39 mm Hg and +4.36 mm Hg, respectively. Regarding automatic devices for selfmeasurement of blood pressure according to the International Protocol Asmar et al. (2010), tested three devices, successfully passing both the first and second stages of the validation process. The average discrepancies between the devices and mercury measurements were around 1.9±3.0 and −1.0±2.3 mmHg for systolic and diastolic blood pressure, respectively, for the Omron M3 device. Intellisense; 2.5±5.4 and −2.3±3.6 mmHg for the Omron M2 Compact device; and 1.4±4.5 and 0.8±4.6 mmHg for the Omron R3-I Plus device, thus, meeting the requirements of the International Protocol, they can be used to measure blood pressure.

The third category refers to the use of the digital monitor to take blood pressure. Regarding Asian hypertension management: current status, home blood pressure, and specific concerns in Indonesia, Turana et al. (2020) investigated that home blood pressure monitoring, known as LMWH, where they mention that it is a valuable tool since 70% of the diagnosis in the control of hypertension is more effective. However, in Indonesia, access to LMWH is restricted by factors such as the cost of the devices and a widespread perception that these devices lack reliability. Finally, with regard to the reliability of automated devices, Cardona et al. (2018) conducted a study in which 56 patients over 19 years of age were included, of which nineteen (38%) had high blood pressure. All of these patients had their blood pressure measured using both a traditional and a digital device. Aiming to evaluate the reliability of the automated device. The results indicated that the automated device proved to be a reliable tool for measuring blood pressure.

CONCLUSION

In the process of reliability of automated devices, studies compared blood pressure measurements obtained with an automated device and a mercury sphygmomanometer where it was found that there were no significant differences in systolic or diastolic blood pressure measurements between the two

methods. This suggests that automated devices, such as the OMRON HEM-7320-LA, can provide reliable measurements comparable to those obtained with traditional methods.

On the other hand, the articles read state that the use of automatic devices in critical emergency patients has a similar effectiveness to invasive measurement, which suggests that these devices can be a valid and less invasive alternative in emergency medical care settings.

Regarding the precision in measuring children and adolescents, the research revealed that automatic devices for measuring blood pressure are accurate and valid in different clinical and epidemiological studies. This is important as these devices can provide reliable measurements in a more efficient manner.

Differences between automatic devices and mercury sphygmomanometers are also presented, where several studies showed that blood pressure measurements between these devices, especially in certain age groups and with serious medical conditions, highlight the importance of considering the type of device used when interpreting measurements and control of hypertension.

Finally, this non-invasive monitoring in critical patients demonstrates how important it is to be constantly observed when measuring blood pressure in critical patients. Taking into account that this is a much more accessible alternative, thus avoiding invasive procedures, this is why advances in technology allow valuable information to be obtained in a less invasive way, which can improve patient care and optimization, critics.

RECOGNITION

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