A systematic review of variability and reliability of manual and automated blood pressure readings

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CRD summary
This review concluded that there were situations where the substitution of automated for manual blood pressure monitoring devices could have serious repercussions for the patients, such as when the patient was either hypertensive or hypotensive. The authors' conclusions did not follow directly from the results reported and limitations of the review mean that their conclusions are unlikely to be reliable.

Authors' objectives
To compare the accuracy and appropriateness of auscultatory (manual) and oscillometric (automated) devices for measuring blood pressure in clinical settings.

Searching
MEDLINE, CINAHL and The Cochrane Library were searched from January 1997 to May 2009 for studies published in English. Search terms were reported. Reference lists of retrieved papers were screened.

Study selection
Studies that compared manual and automated devices for measuring blood pressure in adults in any clinical setting in any country were eligible for inclusion. Studies of pregnant women (conducted under laboratory conditions) and studies related to home, ambulatory or self monitoring were excluded.

In included studies, manual blood pressure readings were taken using mercury or aneroid sphygmomanometers by trained observers, clinical nurses who did not receive any additional training, and by medical residents. Automated devices assessed included BPTru, Dinamap (8100, Pro-care 400), Omron (wrist blood pressure monitor, R3, HEM-907, 705CP), IVAC 4200, Spacelabs 90207, and TM-2564G. Included studies were conducted in emergency care, hypertension clinics, general wards, or outpatient clinics (where reported). Some studies used multiple measurements from the same patients alternating manual and automated readings; other studies took automated and manual readings simultaneously.

The authors did not state how papers were selected for inclusion.

Assessment of study quality
Studies were assessed for methodological quality using the criteria of Kmet et al (2004); exact details of the criteria assessed were not reported. Studies were assigned a score based on the percentage of items fulfilled.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
A narrative synthesis supported by tables of individual study details was presented.

Results of the review
Sixteen studies (4,456 patients, range 27 to 997) were included in the review. Details on sampling strategy were poorly reported but most appeared to use a convenience sample; one study used a randomised sample and two studies enrolled consecutive patients. The proportion of quality items fulfilled ranged from 45 to 95%.

Ten studies concluded that automated devices were less accurate than manual devices, particularly the mercury sphygmomanometer, but most concluded that the differences were insufficient to cause concern when used clinically.
One study found that automated devices consistently had lower readings than manual readings but after five readings the differences converged.

Two studies stated that there was sufficient agreement between automated and manual readings to warrant their use in clinical settings. However, based one of these studies, 70% of systolic measurements and 77% of diastolic measurements were within 5mmHg of the manual measurement, and 91% of systolic measurements and 95% of diastolic measurements were within 10mmHg.

Three studies showed that the Dinamap automated device was less accurate than manual readings.

Three studies reported that various types of automated devices overestimated systolic readings compared with manual readings.

Two studies found that automated devices performed less well when used to measure blood pressure in hypertensive patients.

One study reported that a wrist monitoring device was consistent with mercury sphygmomanometer readings, but this was not supported by a second study.

One study compared two automated devices with a mercury sphygmomanometer and reported differences between all three readings.

Authors' conclusions
There were situations where the substitution of automated for manual devices could have particularly serious repercussions for the patients, such as when the patient was either hypertensive or hypotenuse.

CRD commentary
The review addressed a clear question. Inclusion criteria were broadly defined, although they lacked clarity for study design and outcome. The literature search appeared appropriate for published studies, but restriction of the review to studies published in English raised the possibility of language and publication bias. It was unclear why the start date for the searches was 1997. Details on the review process were not reported, so it was not possible to determine whether appropriate steps were taken to minimise reviewer bias and errors.

A formal quality assessment was conducted, but the criteria used were for intervention rather than diagnostic studies. Details on the exact criteria assessed were not reported. The results were only reported as summary scores. Therefore, the quality of the included studies was unclear.

A narrative synthesis may have been appropriate, but lack of numerical and statistical data made the results difficult to interpret. It may also have been possible to conduct a meta-analysis if appropriate data were reported in and extracted from the primary studies. Data on the magnitude and clinical significance of the differences between automated and manual blood readings were lacking, which meant that it was not possible to draw firm conclusions from the data presented.

The authors' conclusions did not appear to follow directly from the results reported. Limitations of the review (the possibility of language and publication bias, inappropriate quality assessment, and lack of numerical and statistical data) mean that the authors' conclusions are unlikely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that practitioners should be made aware of the need to use auscultatory devices in specific circumstances, such as in management of hypertension, after a patient had experienced trauma, or where there was significant potential for deterioration in the patient's condition. Appropriate education was required for either type of device used, including audit and practice.

Research: The authors stated that further research was required on the use of aneroid sphygmomanometers as a replacement for mercury devices.
Funding
Not stated.

Bibliographic details

PubMedID
21320189

DOI
10.1111/j.1365-2702.2010.03528.x

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Automation; Blood Pressure; Humans; Reproducibility of Results

AccessionNumber
12011002695

Date bibliographic record published
21/09/2011

Date abstract record published
21/08/2012

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.