



**TITLE:** Accuracy and Reliability of Automated Non-Invasive Blood Pressure Devices: Clinical Evidence and Guidelines

**DATE:** 25 November 2010

## RESEARCH QUESTIONS

1. What is the clinical effectiveness of automated non-invasive blood pressure devices in the pre-hospital setting?
2. What is the evidence for the safety of the use of automated non-invasive blood pressure devices in the pre-hospital setting?
3. What are the guidelines for the use of automated non-invasive blood pressure devices in the pre-hospital setting?

## KEY MESSAGE

The evidence on automated non-invasive blood pressure devices in the pre-hospital setting is limited, of relatively lower quality, and mixed in terms of its conclusions.

## METHODS

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 11, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between January 1, 2005 and November 12, 2010. No filters were applied to limit the retrieval by study type. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

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## RESULTS

Rapid response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

Four non-randomized studies were identified regarding automated non-invasive blood pressure devices in the pre-hospital setting. One clinical practice guideline was identified which included some material on the topic, while not its main focus. No health technology assessments, systematic reviews, meta-analyses, or randomized controlled trials were identified. Additional information that may be of interest has been included in the appendix.

## OVERALL SUMMARY OF FINDINGS

Overall, data from four non-randomized studies gave mixed results for the effectiveness and safety of automated non-invasive blood pressure devices in a pre-hospital setting.<sup>1-4</sup>

One of the included studies<sup>1</sup> examined the Oscar 2 model 222 non-invasive oscillometric ambulatory blood pressure measuring device by Suntech Medical of Morrisville USA. Twenty three critically ill patients had their blood pressure measured during ambulance transport with the objective to validate the Oscar 2 device. The study concluded the Oscar 2 appears to be an accurate out-of-hospital device. For measurements where the Oscar 2 did not indicate a measurement fault had occurred, the device fulfilled the Association for the Advancement of Medical Instrumentation (AAMI) protocol requirements.

Another study supportive of non-invasive blood pressure monitoring<sup>4</sup> assessed the correlation between non-invasive blood pressures calculated with radial artery tonometry and standard oscillometric cuff methods in near-continuous measurement every five minutes. Adult patients were transported either by helicopter (n=9 patients), fixed wing airplane (n=1), or ground vehicle (n=10). The study found the readings from the radial artery tonometry device and the oscillometric device were highly correlated, and there was no indication that its performance was adversely affected by the out-of-hospital setting.

Two other studies, however, were not as supportive of automated non-invasive blood pressure devices.<sup>2,3</sup> One of the studies<sup>2</sup> assessed the correlation between invasive and non-invasive arterial pressure measurements for 94 emergency out-of-hospital haemodynamically unstable patients. It found discrepancies between invasive and non-invasive measurements were common. Another study<sup>3</sup> assessed whether addition of diagnostic equipment (one option being automated non-invasive blood pressure measurement) improves the ability to predict the need for a life-saving intervention compared to physical examination for 381 non-head-injured trauma patients. The study concluded that similar results were obtained from manual measurements compared to automated medical instrumentation that may be unavailable or difficult to use in the field.

One clinical practice guideline was identified,<sup>5</sup> but its focus was on blood pressure measurement in the office or hospital setting. It did, however, make some comments on automated methods or pre-hospital measurement of blood pressure.

- Potential advantages of automated measurement include elimination of observer error, increasing the number of readings, and avoidance of expensive and repetitive training of health care professionals in auscultation, which is necessary to reduce observer error.
- The main disadvantages are the error inherent in the oscillometric method and the fact that epidemiologic data are mostly based on auscultated blood pressure measures.
- Many techniques for pre-hospital blood pressure techniques are available for use in the field and ambulance and helicopter transportation, including auscultatory, oscillometric, palpation and obliteration of the pulse wave on the pulse oximeter. All have a high degree of error that is worse with systolic blood pressure of  $<90$  mm Hg. In the pre-hospital setting, establishment of trends in blood pressure before arriving in the more controlled hospital environment is more important than the absolute value of the blood pressure.

## REFERENCES SUMMARIZED

### Health technology assessments

No literature identified

### Systematic reviews and meta-analyses

No literature identified

### Randomized controlled trials

No literature identified

### Non-randomized studies

1. Muecke S, Bersten A, Plummer J. The mean prehospital machine; accurate prehospital non-invasive blood pressure measurement in the critically ill patient. *J Clin Monit Comput.* 2010 Jun;24(3):191-202. [PubMed: PM20532593](#)
2. Sende J, Jabre P, Leroux B, Penet C, Lecarpentier E, Khalid M, et al. Invasive arterial blood pressure monitoring in an out-of-hospital setting: an observational study. *Emerg Med J.* 2009 Mar;26(3):210-2. [PubMed: PM19234017](#)
3. Holcomb JB, Salinas J, McManus JM, Miller CC, Cooke WH, Convertino VA. Manual vital signs reliably predict need for life-saving interventions in trauma patients. *J Trauma.* 2005 Oct;59(4):821-8. [PubMed: PM16374268](#)
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### Guidelines and recommendations

5. National Guideline Clearinghouse [Internet]. Rockville (MD): National Guideline Clearinghouse; c2010-. Recommendations for blood pressure measurement in humans and experimental animals: Part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research; 2005 [cited 2010 Nov 24]. Summary available from: <http://www.guideline.gov/content.aspx?id=6527>

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**APPENDIX – FURTHER INFORMATION:**

**Additional references**

6. Muecke S, Bersten A, Plummer J. Validation of arterial blood pressures observed from the patient monitor; a tool for prehospital research. J Clin Monit Comput. 2010 Apr;24(2):93-100. [PubMed: PM20020187](#)
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