Objective: Accurate measurement of blood pressure (BP) is crucial for hypertension management. Accuracy of brachial cuff (B\textsubscript{CUFF}) devices to measure invasive (intra-arterial) BP at the brachial artery (B\textsubscript{INV}) and aorta (A\textsubscript{INV}) has never been systematically assessed. This study aimed to determine the: 1) relationship between B\textsubscript{INV} and A\textsubscript{INV}; 2) accuracy of B\textsubscript{CUFF} devices to estimate invasive BP and; 3) accuracy of B\textsubscript{CUFF} devices to classify BP thresholds.

Design and method: Three individual patient meta-analyses (by search of online databases and systematic review supplemented by measurements in a tertiary hospital cardiac catheterization laboratory) were performed to determine: 1) B\textsubscript{INV} versus A\textsubscript{INV} BP; 2) B\textsubscript{CUFF} versus B\textsubscript{INV} BP and A\textsubscript{INV} BP and; 3) B\textsubscript{CUFF} for BP classification versus invasive BP.

Results: Most subjects (90%) were patients undergoing cardiac catheterization (total N = 3004; mean age 58.7 years, 95%CI [54.0, 63.4], 68% male). As shown in the table: 1) B\textsubscript{INV} systolic BP (SBP) was significantly higher than A\textsubscript{INV} SBP whilst A\textsubscript{INV} diastolic BP (DBP) was slightly higher than B\textsubscript{INV} DBP. 2) B\textsubscript{CUFF} underestimated B\textsubscript{INV} SBP and overestimated B\textsubscript{INV} DBP. The mean difference between B\textsubscript{CUFF} SBP and A\textsubscript{INV} SBP was small, whilst B\textsubscript{CUFF} DBP overestimated A\textsubscript{INV} DBP. However, according to mean absolute difference, B\textsubscript{CUFF} and A\textsubscript{INV} showed poor agreement. 3) B\textsubscript{CUFF} correctly classified 31.1/28.4% of high-normal (SBP 130–139 mmHg), 54.2/52.6% of grade I (SBP 140–159 mmHg) and 45.2/50.3% of grade II (SBP 160–179 mmHg) hypertension cases, using B\textsubscript{INV}/A\textsubscript{INV}, respectively, as the reference. Correct classification was more frequent for SBP B\textsubscript{CUFF} values <120 mmHg or ≥180 mmHg (both > 75%).

Conclusions: While recognizing the clinical importance of B\textsubscript{CUFF} devices, there is wide variability in device accuracy for measuring intra-arterial BP. Although B\textsubscript{CUFF} devices are reasonable for correctly classifying BP at low and very high BP thresholds, more accurate B\textsubscript{CUFF} devices in the high-normal BP to grade II hypertension range should improve hypertension management.