



4.8 Reference Values for Submaximal Exercise Blood Pressure: the EXERCISE Stress Test Collaboration (EXERTION)

Schultz Martin¹, Ann-Marie Kovacevic¹, Philip Roberts-Thomson², Tony Stanton³, Christian Hamilton-Craig⁴, Sudir Wahi⁵, James Hare⁶, Joseph Selvanayagam⁷, Andrew Maiorana⁸, Alison Venn¹, James Sharman²

¹Menzies Institute for Medical Research, University of Tasmania

²Royal Hobart Hospital, Hobart, Australia

³Sunshine Coast University Hospital, Birtinya, Australia

⁴The Prince Charles Hospital, Brisbane, Australia

⁵Princess Alexandra Hospital, Brisbane, Australia

⁶The Alfred Hospital, Melbourne, Australia

⁷Flinders University, Adelaide, Australia

⁸Curtin University and Allied Health Department, Fiona Stanley Hospital, Perth, Australia

ABSTRACT

Background: Exaggerated blood pressure (BP) during submaximal exercise independently predicts cardiovascular mortality and identifies uncontrolled high BP not detected at rest. However, thresholds for submaximal exercise BP during clinical exercise testing have never been defined from a large representative sample, which was the aim of this study.

Methods: Records from 13,949 people referred for a clinical exercise stress test (aged 52 ± 13 years, 61% male) using the Bruce treadmill protocol (stages 1 to 4 plus peak) were extracted from 4 Australian hospitals over the years 2000–2018. Exercise records were linked to administrative health datasets (hospital admissions and emergency presentations) to define clinical characteristics, including cardiovascular disease history. Thresholds denoting exaggerated BP were defined as > 90th centile at each exercise stage.

Results: SBP and DBP thresholds across all stages were higher in males vs. females (stage-1: 180/90 vs 175/90 mmHg; stage-2: 196/94 vs 190/90 mmHg; stage-3: 204/97 vs 196/91 mmHg; stage-4: 210/100 vs 196/92 mmHg; peak: 215/100 vs 206/95 mmHg). SBP at all stages increased stepwise from the 1st to 4th age quartile ($p < 0.05$), whilst DBP remained similar (stage-1: 163/90 to 185/92 mmHg; stage-2: 180/90 to 204/95 mmHg; stage-3: 193/90 to 210/95 mmHg, stage-4: 200/91, to 210/96 mmHg; peak: 201/95 to 217/100 mmHg). Results were similar irrespective of cardiovascular disease history.

Conclusion: This is the first study to define submaximal exercise BP thresholds during clinical exercise testing. Thresholds were higher in males compared to females and increased with age. These thresholds may help clinicians to identify people at increased high BP-related risk.

© 2019 Association for Research into Arterial Structure and Physiology. Publishing services by Atlantis Press International B.V. This is an open access article distributed under the CC BY-NC 4.0 license (<http://creativecommons.org/licenses/by-nc/4.0/>).