



# Training and assessment of the reliability and reproducibility of aortic pulse wave velocity

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## INTRODUCTION

- Cardiovascular disease (CVD) remains the leading cause of death among women.
- One way to assess CVD risk is to measure subclinical markers such as arterial stiffness, a non-invasive validated and reliable marker of subclinical vascular remodeling and damage.

## BACKGROUND

- Doppler ultrasound technology such as the VICORDER® (Skidmore Medical, UK) vascular testing device measures arterial stiffness by capturing the aortic pulse wave velocity (aPWV), or the rate at which pressure waves move down the aorta.
- PWV can be expressed as the rate of propagation, or distance over time ( $\frac{\Delta x}{\Delta t}$ ).

## PURPOSE

- Implement and assess the learning efficacy of research staff following three training modules related to aPWV measurement and analysis.
- Determine the intra-rater reliability which reflects how consistently a technician measures aPWV.
- Determine the inter-rater reliability which reflects how consistently different technicians measure aPWV.

## METHODS & DATA ANALYSIS

### STUDY DESIGN

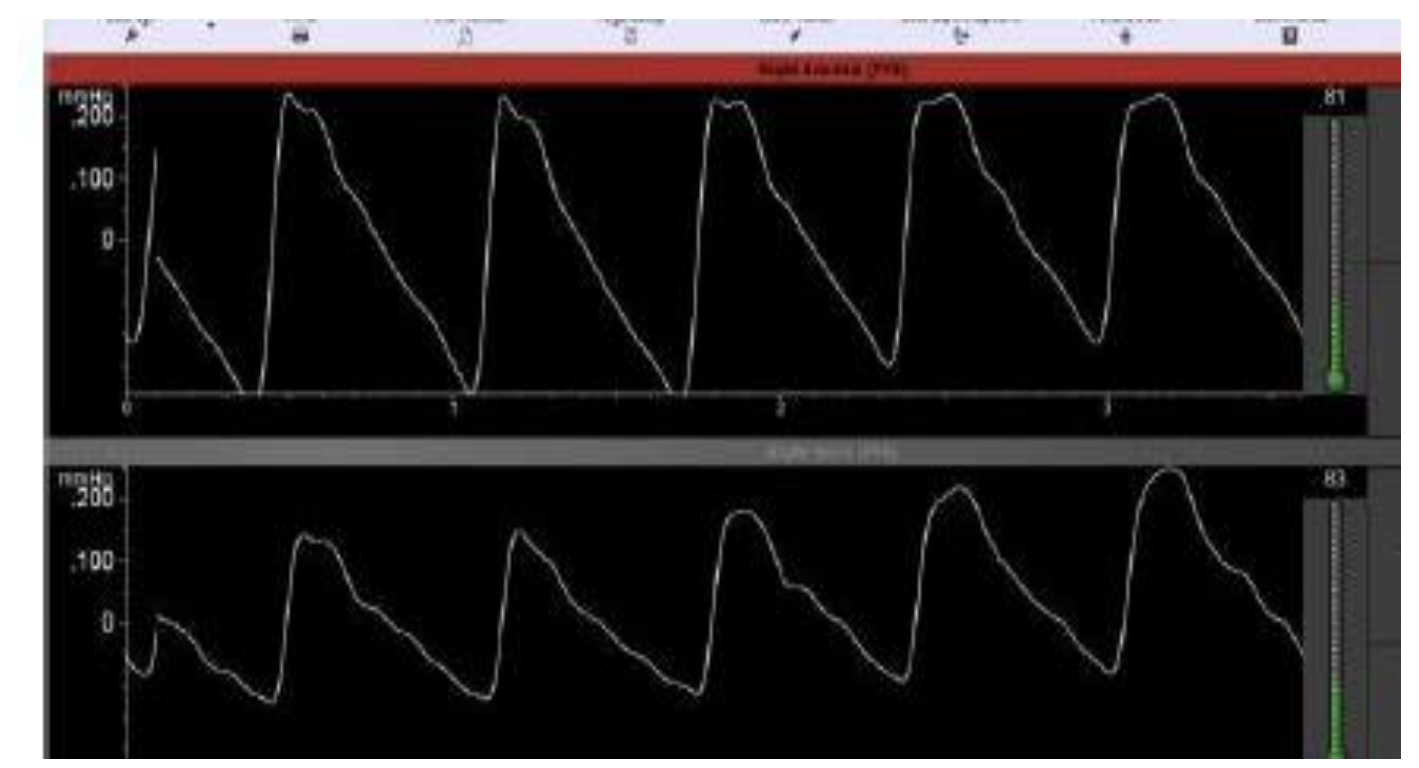
- Three training sessions were conducted to introduce, practice, and assess aPWV measurements across four research staff using the VICORDER® (Skidmore Medical, UK) vascular testing device.
- At the conclusion of the third training session, research staff completed a post-module training evaluation of their understanding related to aPWV.
- Inter-rater and intra-rater reliability were calculated using standard statistical packages.



**Figure 1.** Particular emphasis was given during the PWV training related to cuff placements so as to ensure that the appropriate arterial path was captured during VICORDER © (Skidmore Medical, UK ) measurement.

## RESULTS

- The inter-rater reliability correlation coefficient (ICC) range across the four examiner's was 0.75 (lowest) to 0.99 (highest).
- The average intra-rater reliability correlation coefficient across four technicians and sixteen trials was good (ICC=0.89).
- The intra-rater reliability correlation coefficient ranged from 0.75 (lowest) to 0.99 (highest) across the four examiners. The average inter-rater reliability correlation coefficient was strong (ICC=0.85).
- Research staff reported strong self-efficacy scores following the final training session (overall average=4.04/5).



**Figure 2.** An example of the waveforms generated by VICORDER® (Skidmore Medical, UK) across the carotid site (top) and femoral site (bottom). Note that both sets of waveforms demonstrate strong foot-to-foot patterns and follow similar amplitude across the y-axis.

**Table 1.** A modified self-efficacy scale for assessing aPWV clinical skills adapted from Kang, 2018 that is broken into three domains: cognitive, affective, and psychomotor.

Domain and number	Item	Analysis (1-5)	
		Mean	Median
<b>Cognitive</b>			
1	I can recall how to perform pulse-wave velocity measurements.	4.5	4.5
2	I understand the content of pulse-wave velocity and can teach it to others.	3.75	3.5
3	I understand the content of the manual of operations and can apply it to my role.	4.25	4
4	I can verbally explain the purpose and principle of operating pulse-wave velocity.	3.25	3.5
5	I can verbally explain the sequence and interrelationship between each step.	4	4
<b>Affective</b>			
6	I think I spend more time on pulse-wave velocity training modules than on others.	3.5	4
7	I think I gain more in pulse-wave velocity training modules than in others.	3.75	4
8	I tend to pay more attention to information related to pulse-wave velocity.	4	4
9	I tend to actively look for information relate to pulse-wave velocity.	3	3.5
10	I know where to find clarification, if needed, in the manual of operations.	4	5
<b>Psychomotor</b>			
11	I can precisely imitate the instructor's steps and actions of this clinical skill.	4.75	5
12	I can smoothly complete the operation steps of pulse-wave velocity assessments.	4.5	4.5
13	I try to monitor my pulse-wave velocity skill for improvements.	4.75	5
14	I try to monitor my pulse-wave velocity skill and make proper adjustments using the manual of operations.	4.5	4.5

## CONCLUSIONS

- Research staff reported moderate to high confidence in their ability to perform aPWV (Table 1) and demonstrated good intra- and inter-rater reliability (ICC=>0.8).
- The feasibility of replicating these training sessions are supported by:
  - Strong attendance records
  - The necessity of certifying research staff as set forth in the parent grant
  - The promising reliability and reproducibility of measures among research staff
- Several aPWV troubleshooting steps were trialed across the aforementioned training sessions which can be implemented during the parent study's clinical trial.

## IMPLICATIONS

- aPWV measurements are an assessment tool using a non-invasive vascular testing device.
- VICORDER® (Skidmore Medical, UK) vascular testing device is an accessible and real-time tool available to clinicians in rural healthcare areas, thereby enhancing timely care and prevention of CVD risk.
- This honor's study demonstrates that training clinicians such as registered nurses (RNs) to appropriately use this instrumentation is feasible.
- By training RNs, measuring aPWV can be used as a tool to target at-risk populations and administer timely preventative care; thereby, potentially lowering national CVD burden.

## REFERENCES

E.J. Benjamin, et al., Heart disease and stroke statistics-2017 update: a report from the American heart association, Circulation 135 (10) (Mar 07 2017) e146–e603.

Woodard GA, Brooks MM, Barinas-Mitchell E, Mackey RH, Matthews KA, Sutton-Tyrrell K. Lipids, menopause, and early atherosclerosis in Study of Women's Health Across the Nation Heart women. Menopause. 2011;18(4):376-384.

Cortés, Y. I., Catov, J. M., Brooks, M., Khoudary, S. R. E., Thurston, R. C., Matthews, K. A., Barinas-Mitchell, E. (2019). Pregnancy-related events associated with subclinical cardiovascular disease burden in late midlife: SWAN. Atherosclerosis, 289, 27–35. doi: 10.1016/j.atherosclerosis.2019.07.012

Kang Y-N, Chang C-H, Kao C-C, Chen CY, Wu C-C (2019) Development of a short and universal learning self-efficacy scale for clinical skills. PLoS ONE 14(1): e0209155. https://doi.org/10.1371/journal.pone.0209155

## ACKNOWLEDGEMENTS

The author would like to acknowledge and thank their advisor as well as the University of North Carolina at Chapel Hill's Honors committee.