



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).

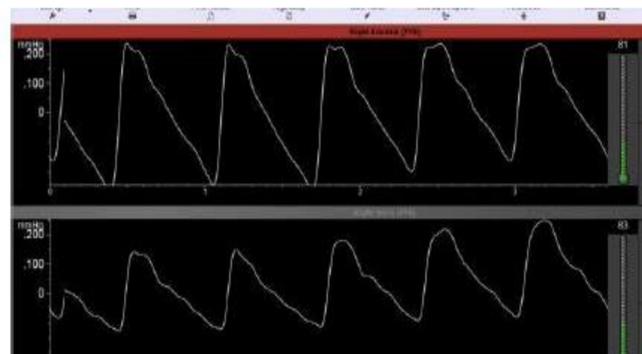


Figure 2. An example of the waveforms generated by VICORDER® (Skidmore Medical, UK) across the carotid site (top) and femoral site (bottom). Note that both sets of waveforms demonstrate strong foot-to-foot patterns and follow similar amplitude across the y-axis.

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
Cognitive			
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
Affective			
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 related to pulse-wave velocity.	3	3.5
10	I know where to find clarification, if needed, in the manual of operations.	4	5
Psychomotor			
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.

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