

# Comparison of Vein Selection of a Novel Ultrasound-Based Vein Visualization Device and Traditional Landmark Technique

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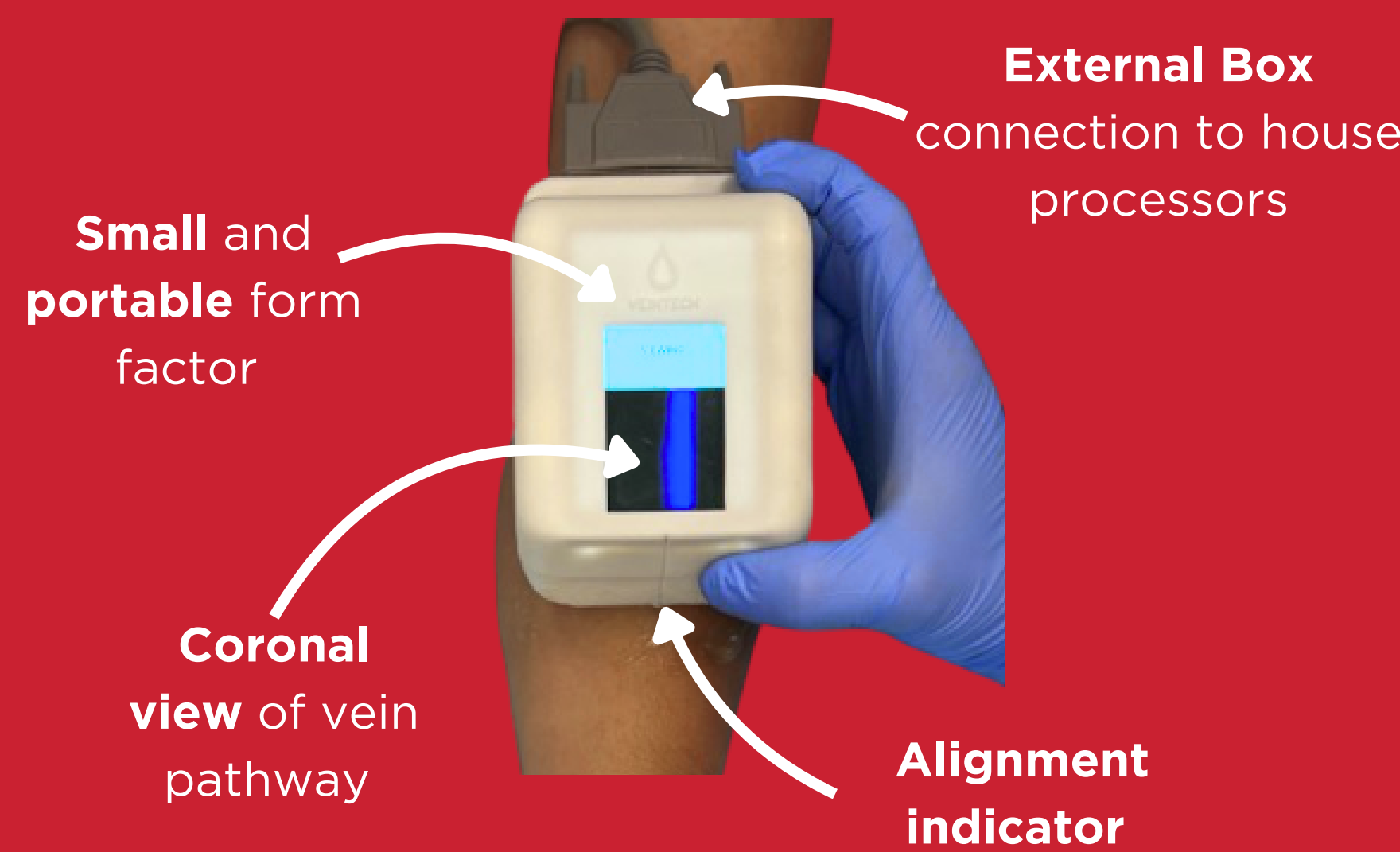
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## Introduction

Peripheral intravenous catheter (PIVC) failure prior to intravenous therapy completion is a major issue, occurring around 30-50% of the time.[1-2] Proper vessel selection is essential for successful insertion and improving post insertion outcomes. An inability to visualise or palpate veins is the single largest contributor to insertion failures.[3-4] Improved vessel characteristics leads to reduce complications like infection and infiltration, and associated costs.[5] We designed an observational study to compare the suitability of vein selected using an ultrasound-based vein visualization prototype versus the traditional landmark technique.

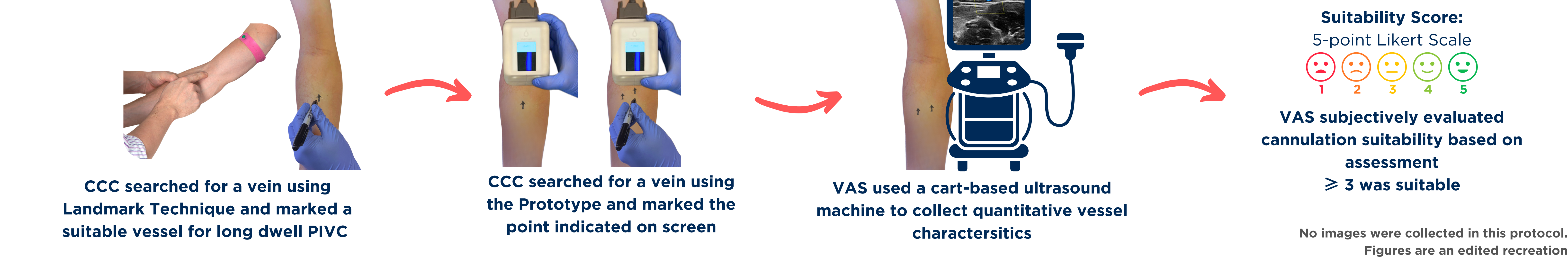
## Prototype of Ultrasound-Based Guidance Device



## Methods

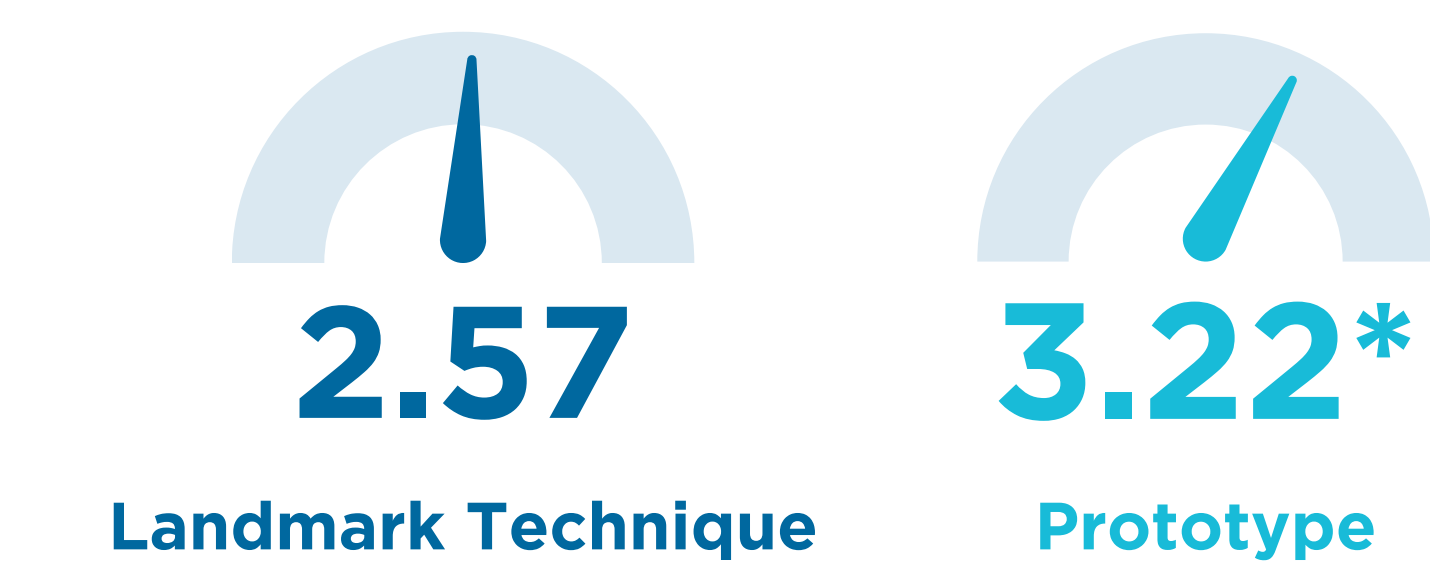
The study was conducted on 12 patients (24 arms) in a tertiary hospital in Western Australia. Recorded demographics included gender, age, height, weight, skin tone, and history of difficult intravenous access (DIVA). We developed a clinical prototype of a handheld ultrasound-based guidance device that displays the coronal view of well perfused veins at depth on a screen aligned with the transducers. Performance of this prototype has been previously demonstrated in bench and healthy humans.[6] Three Cannulating Competent Clinicians (CCC) (one per data collection session) used landmark technique (manual visualization and palpation with tourniquet) to select and mark a vein for cannulation. They then used the vein visualization prototype to assess, select and mark a vessel. CCCs assessed the vessel characteristics of palpability, visibility and location. A Vascular Access Specialist (VAS), blinded to both techniques used, evaluated marked vessels using ultrasound (GE Logiq S7). The VAS identified the anatomical vein, measured diameter, depth, and blood flow velocity. They then subjectively rated suitability, based on the data collected and their experience, on a 5-point Likert scale (5 = strongly agree). Vessels with a score  $\geq 3$  were considered suitable. The study was approved by South Metropolitan Health Service Human Research Ethics Committee (RGS0000006930).

## Methods



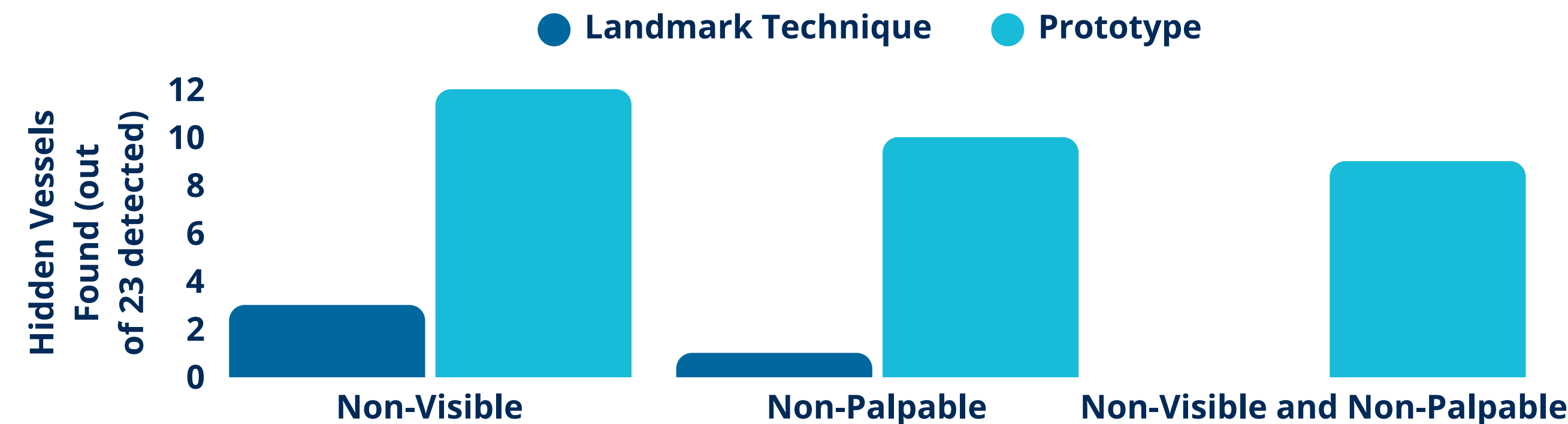
## Results

### Suitability Average Score

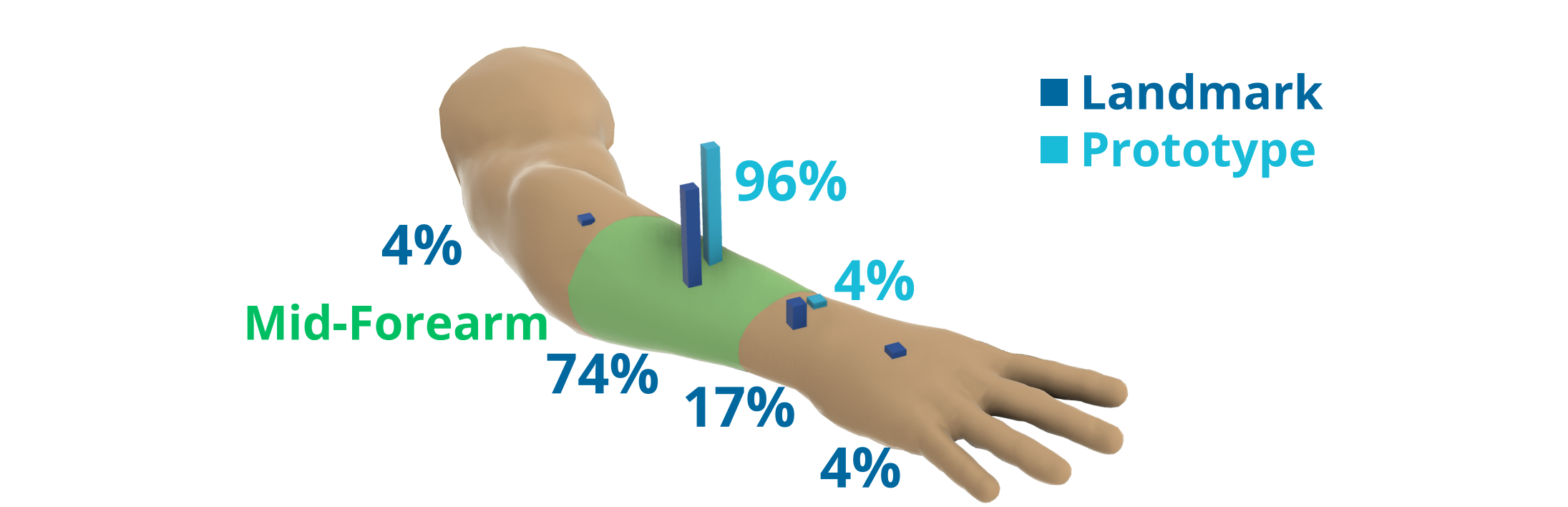


### Vessel Characteristics

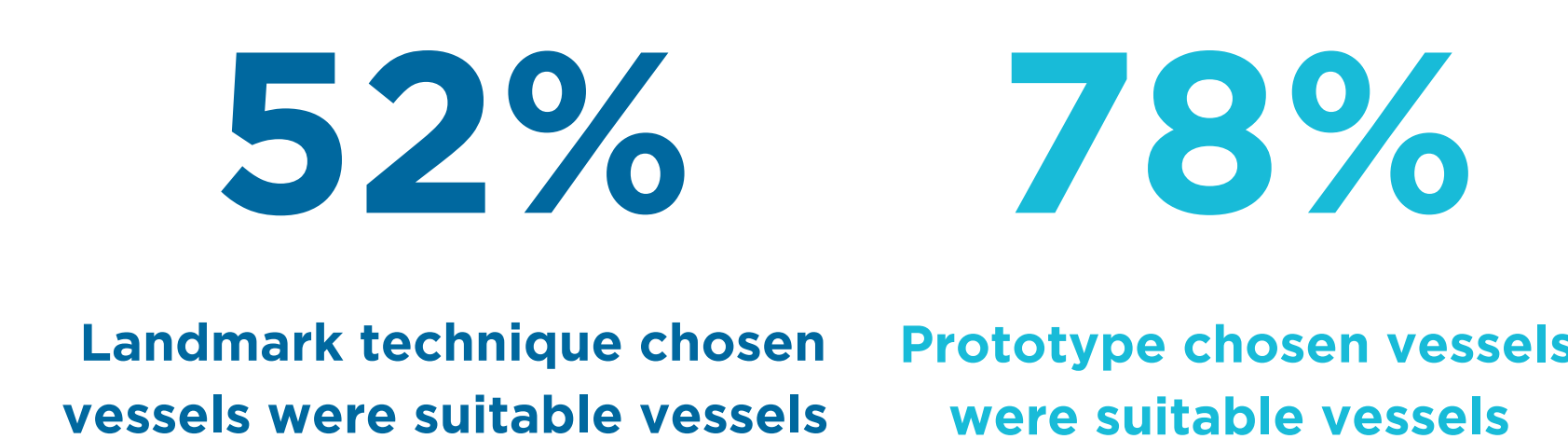
#### “Hidden” Vessels



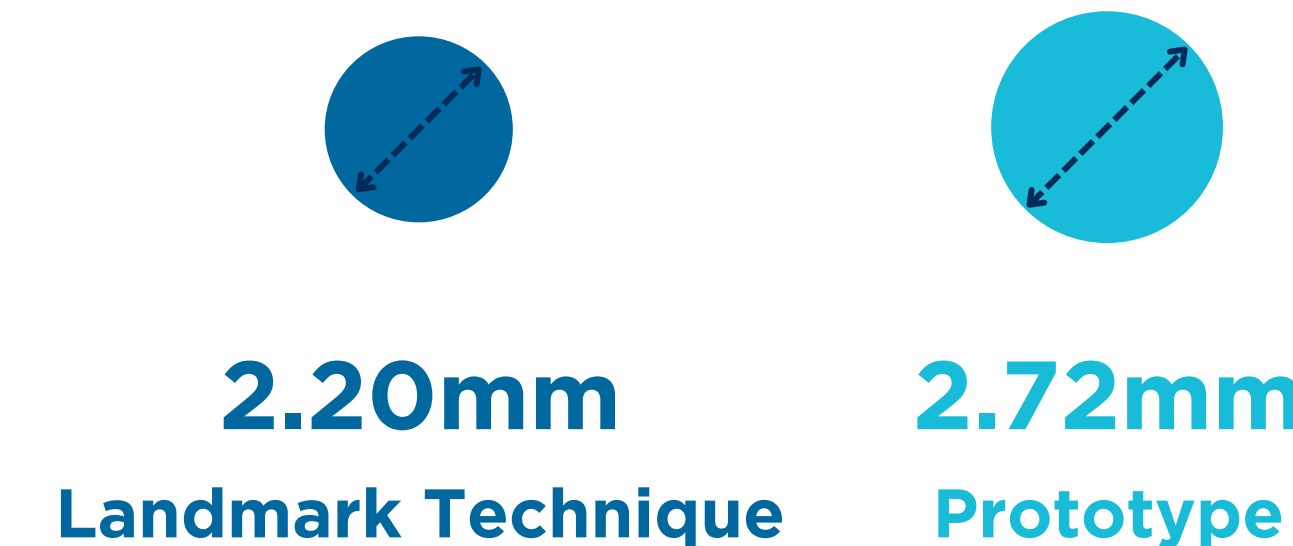
#### Location of Vessels Chosen



### Suitable Vessels Located



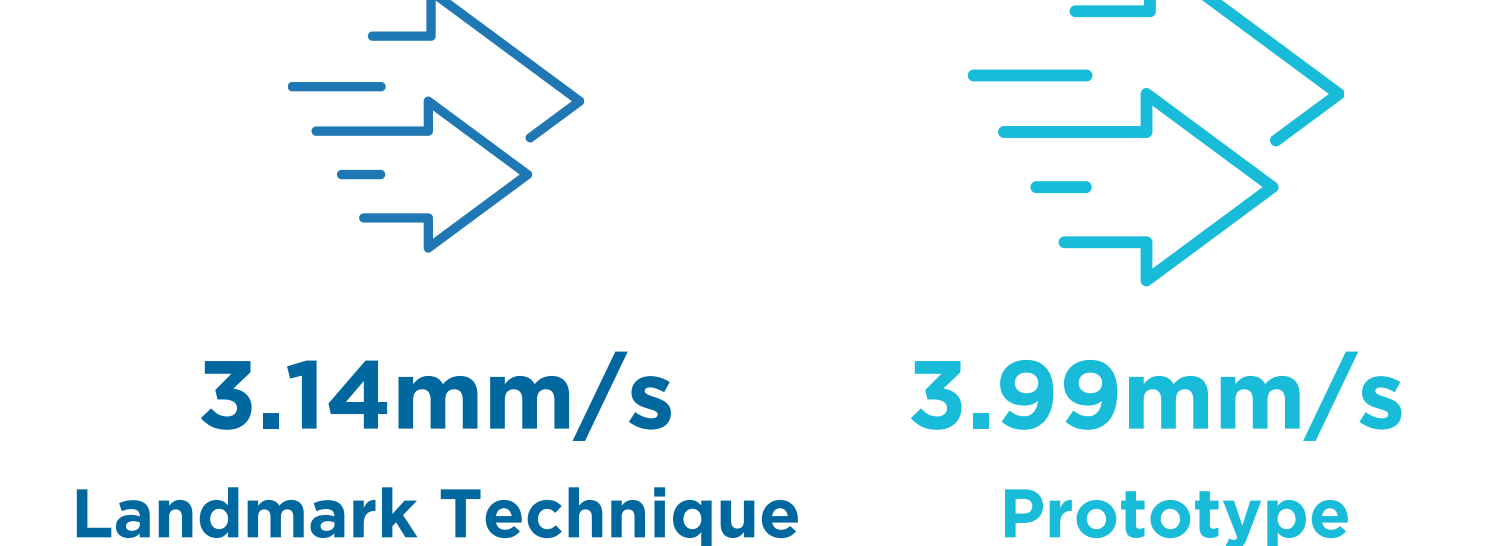
### Average Diameter



### Average Depth



### Average Velocity



\* Significant Difference ( $p < 0.05$ )

## Limitations

Suitability scores were assessed by only one VAS, future studies could use two or more VASs to confirm the score. Additionally, this is a prototype with unoptimized form factor which may have limited the selection of veins in other locations. Human factors data would have also been collected if the form factor was optimized. Suitability will eventually be assessed through in situ performance examination and whether rate of failure of cannulas change depending on the chosen site.

## Conclusion

This study showed a statistically significant 25.3% improvement in detecting suitable veins using the prototype. Findings highlight which vein characteristics affect suitability and technique performance, supporting future development of an objective cannulation suitability score. The prototype consistently identified larger, mid-forearm veins which are linked to fewer complications and improved first-time insertion success. It outperformed traditional landmark techniques by visualizing non-palpable, non-visible vessels often missed. Future prototype refinement will include ergonomic and use of clinical data to improve outcomes for DIVA and cancer patients requiring peripheral intravenous therapy.

## References

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