

Creating and validating a Lateral Intercostal Artery Perforator And Other Local Chest Wall Flaps (LICAP) Stimulator

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Introduction

Background

- Chest wall perforator flaps (CWPF) are an important breast-conserving reconstructive option for patients with breast cancer as it enables safe resections while maintaining optimal aesthetic outcomes¹.
- The 2021 UK General Surgery Curriculum reflects the increasing importance of oncoplastic techniques, mandating trainees complete 25 local flap procedures to achieve a Certificate of Completion of Training (CCT) in breast and general surgery².

Problem

- However, current operative exposure is insufficient to ensure all trainees attain competence in CWPF surgery by the end of training³.
- Hence, there is a need for adjuncts to support training in CWPF procedures, to maximise the use of training times in operating theatre cases.

Aim

Develop a validated CWPF stimulator

Methodology

- 1 Design a de-novo CWPF surgical stimulator**
- Breast surgeons collaborated with designers to construct a CWPF simulator

- 2 Develop a competency assessment tool (CAT) to evaluate the competency of the stimulator developed**
- CAT is a qualitative assessment tool that assesses the technical skills of a surgeon performing an intervention⁴
 - Well validated in within international clinical trials⁴
 - Developed using a modified Delphi process⁵ (Figure 1)
 - Target of ≥70% agreement to reach final consensus

Hierarchical task analysis

- The task analysis of the CWPF procedure will be based upon prior clinical experience and anonymised patient videos from existing open-access video banks.

Interviews

- The outcome of the task analysis was used to create a semi-structured interview, which the questionnaire would be based on.

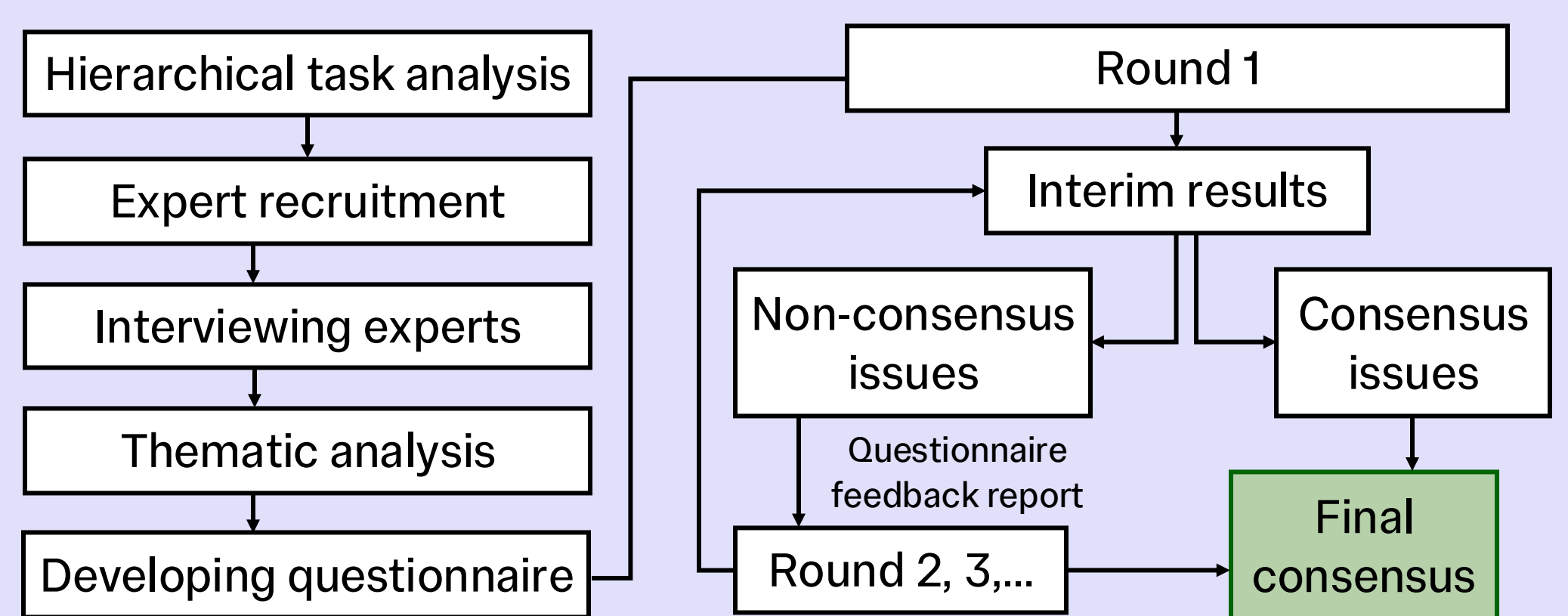


Figure 1: Modified Delphi process

3 Evaluation of the CWPF stimulator

- Surgeons with varying operative experience performed a stimulated CWPF using the stimulator developed.
- Procedures were videotaped (blinded, pseudo-anonymized), reviewed, and independently rated against CAT by three experts.

Results

Development of CAT

- 7 consultant breast surgeons** participated in the modified Delphi process
- 12 technical domains** were initially identified.
- The Delphi questionnaire is produced from this (Table 1).

The third phase of the study has yet to be done.

Instructions

For each statement, please rate your agreement with the scale: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree

Where applicable, provide optional comments.

Section A: Preoperative Cognition & Planning

Statement	1	2	3	4	5
Preoperative mental rehearsal is essential before patient marking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Precise patient selection is a critical determinant of operative success.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surgeons should integrate imaging, lesion location, and laxity when planning markings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anticipating intraoperative positioning during pre-op marking is important.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expert planning includes anticipating closure strategy at the time of marking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open question: How do you structure your preoperative mental planning?					

Table 1: Example part of the Delphi questionnaire

Section B: Anatomical Mapping & Visual-Spatial Awareness

Statement	1	2	3	4	5
Expert performance requires translating 3D anatomy into accurate 2D skin markings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Markings should be reassessed in multiple patient positions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volumetric estimation of tissue movement is a core pre-operative skill.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Novices struggle to account for contour, tension vectors, and closure direction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open question: Describe your technical approach to multi-position marking.					
Section C, D, E, F, G, H, I, J, K, L, ...					

Conclusions

- A novel CWPF surgical simulator and validated CAT were successfully developed, but the CAT has yet to be applied.
- This provides a structured training adjunct to support CWPF skill acquisition, addressing limited operative opportunities and enhancing trainee readiness for independent practice.

Future directions

- Complete phase 3 of the study
- Integration into national oncoplastic teaching programmes
- Multi-centre validation study with larger sample size
- VR/AR module development to simulate flap perfusion
- Benchmarking to establish performance standards for CCT readiness

Significance

- This stimulator offers a scalable solution to support trainees in meeting curriculum requirements for local flap competency.

Acknowledgements

- Consultant experts contributing to the Delphi panel
- Surgical skills lab staff and simulation technicians
- Imperial College Faculty of Medicine and partner NHS Trusts

References
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