COVID19 has highlighted the need for local supply chains for PPE. Options were explored to provide a stockpile should current commercial supplies be depleted for face shields, respirator masks, and disposable gowns.

This study outlines the collaborative strategy for the design of a reusable N95 respirator mask, as part of a collaboration between Digital Metro North and the Herston Biofabrication Institute.

In-house fit testing and simulation allow for rapid iterative prototyping and for direct end-user engagement.

Methods

- Participatory design with health care workers, engineers and industrial designers
- 6 rounds of iterative prototyping
- Advanced manufacturing of rigid components
- Vacuum moulding of flexible components
- Cutouts N95 masks and heat moisture exchange filters

Evaluation:
- 26 Halyard qualitative fit tests
- 9 gas exchange tests
- 2 simulations sessions with survey
- 2 wear tests with survey
- RBWH HREC LNR/2020/QRBW/64373

Results – sustained iterative design

3 sizes, snap fit rigid body over flexible seal with:
- Port for either filter housing or HME filters
- 90% fit testing success rate + improved fit for staff who fail fit testing with all commercial masks
- 100% gas exchange and simulation success rate

Decision-making tool for hospitals wanting to introduce novel PPE

Abstract

COVID19 has highlighted the need for local supply chains for PPE. Options were explored to provide a stockpile should current commercial supplies be depleted for face shields, respirator masks, and disposable gowns.

This study outlines the collaborative strategy for the design of a reusable N95 respirator mask, as part of a collaboration between Digital Metro North and the Herston Biofabrication Institute.

In-house fit testing and simulation allow for rapid iterative prototyping and for direct end-user engagement.

Discussion

- Ensure diversity in participants when testing PPE
- Ready for testing to Australian Standards
- Need for repeat wear and cleaning tests if successful
- Injection moulding manufacturing in discussion
- Uncertainty around filter paper supply
- In-house fit testing and simulation capabilities can be activated to rapidly evaluate prototypes
- Participatory design leads to all users having say, mutual learnings and co-creation

Acknowledgments

In-house fit testing and simulation capabilities can be activated to rapidly evaluate prototypes

Participatory design leads to all users having say, mutual learnings and co-creation

Affiliations

1. Herston Biofabrication Institute, MNHHS
2. Design Lab, Queensland University of Technology
3. Faculty of Medicine, The University of Queensland
4. Digital Metro North, MNHHS
5. Department of Intensive Care Services, RBWH