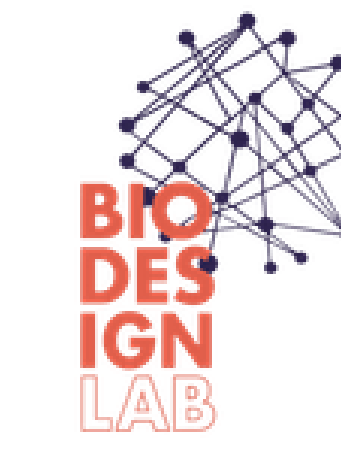


Design and Evaluation of Physical and Virtual 3D Models of the Fetal Heart for Medical Education and Prenatal Communication



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Objectives

This study aims to develop and evaluate physical and virtual three-dimensional (3D) models of the fetal heart as educational tools for medical training and as communication aids during prenatal counseling. The project investigates whether these models can enhance anatomical understanding of congenital heart diseases (CHDs), support spatial reasoning in medical education, and improve communication between healthcare professionals and pregnant women during prenatal care.



Methods

This is an ongoing mixed-methods study grounded in Design-Based Research (DBR). The research involves the development of anatomically accurate 3D models of the fetal heart generated from real fetal echocardiography datasets. Both physical models produced through 3D printing and interactive virtual models will be created. The models will be applied in educational and clinical simulation settings involving medical students, residents, physicians, and pregnant women. Data collection will include pre- and post-knowledge tests, structured questionnaires, semi-structured interviews, and participant observation to evaluate learning outcomes, spatial comprehension, communication clarity, and emotional response. Quantitative data will be analyzed statistically, while qualitative responses will undergo thematic content analysis.



Results

This study is currently in the development and implementation phase. Results are expected to evaluate whether the use of 3D fetal heart models improves anatomical comprehension of congenital heart conditions, enhances communication during prenatal counseling, and contributes to more empathetic and humanized clinical interactions. Data collection and analysis are ongoing.



Conclusions

This research proposes an interdisciplinary approach integrating biodesign, medical education, and prenatal care through the development of 3D fetal heart models. By translating complex echocardiographic information into tangible and interactive representations, the study aims to contribute to improved medical training and more effective doctor-patient communication. The findings may support the implementation of 3D educational tools in fetal cardiology and prenatal counseling.



Photos showcasing three-dimensional prints of fetal hearts as part of case studies