

# 3D-printed cardiac models for patient evaluation for congenital heart disease

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<b>Registration date</b> 12/12/2024	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 12/12/2024	<b>Condition category</b> Circulatory System	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

Congenital heart defects that require surgical or interventional therapy are usually due to complex and individual anatomical conditions. In pediatric heart surgery or pediatric cardiology, information is typically provided in a physician-parent conversation using printed paper forms and handwritten additions, such as sketches. With the increasing availability of 3D printing, patient-specific 3D models have already been used for visualization in clinical practice. As an additional digital alternative, virtual reality technology offers the possibility of viewing a virtual three-dimensional model together with the physician and discussing interventions step by step. The aim of this study is to evaluate and establish alternative information methods for congenital heart defects. A comparison is made between paper-based information using information sheets, information with the aid of a 3D-printed model, and information using virtual reality, which displays a three-dimensional model in virtual space. The focus here is particularly on the increase in understanding as well as the impact of medical information on anxiety, restlessness, or nervousness.

### Who can participate?

Parents of children with Congenital Heart Disease (atrial and ventricular septal defect, Tetralogy of Fallot, Coarctation of the aorta)

### What does the study involve?

Randomization in the training group (paper-based information, 3D-printed models, or virtual reality). It begins with paper-based information, i.e., the first 35 patients receive this type of training, the next 35 patients will be trained with 3D-printed models, and then the following 35 patients will receive information through virtual reality.

Before the training, information is provided about the procedure and the purpose of the study, along with patient information and consent clarification. Consent is obtained after completing the first questionnaire. Data collection takes place immediately after the training using a second questionnaire. In the same session, patients receive an envelope with the third questionnaire, which should be filled out on the day of discharge and returned to the nursing station in a designated compartment. Instructions for this procedure are written on the envelope.

Since the training in this study does not constitute legally binding medical information, it is conducted separately from the attending physician at a time close to the discharge. The training in this study is conducted by the study leader or study assistant, who is obligated to confidentiality.

What are the possible benefits and risks of participating?

Risk: Since this is an observational study, there is no additional risk. Data are recorded in a pseudonymized manner, and anonymization occurs before data analysis. Thus, there are no data protection disadvantages for the patients.

Benefit: Participation in the study does not provide a direct benefit to the patients.

Where is the study run from?

LMU University Hospital in Munich, Germany and German Heart Center in Munich, Germany.

When is the study starting and how long is it expected to run for?

July 2021 to May 2024

Who is funding the study?

Investigator initiated and funded

Who is the main contact?

Linda Grefen, MD (Linda.Grefen@med.uni-muenchen.de)

## Contact information

### Type(s)

Public, Scientific, Principal Investigator

### Contact name

Dr Linda Grefen

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## Additional identifiers

### EudraCT/CTIS number

Nil known

### IRAS number

### ClinicalTrials.gov number

Nil known

## **Secondary identifying numbers**

3D-VR-2022

# **Study information**

## **Scientific Title**

Digitalization in patient education: 3D printing for congenital heart disease

## **Study objectives**

3D-printed models help to relieve parental anxiety in children with congenital heart disease and improve procedural understanding.

## **Ethics approval required**

Ethics approval required

## **Ethics approval(s)**

Approved 14/11/2022, LMU Ethics committee and ethical vote - Faculty of Medicine (LMU Munich Geschwister-Scholl-Platz 1, Munich, 80539, Germany; +49 89-4400 55191; ethikkommission@med.uni-muenchen.de), ref: 22-0281

## **Study design**

Interventional randomized controlled trial

## **Primary study design**

Interventional

## **Secondary study design**

Randomised controlled trial

## **Study setting(s)**

Medical and other records

## **Study type(s)**

Other

## **Participant information sheet**

See study outputs table

## **Health condition(s) or problem(s) studied**

Parents anxiety and procedural understanding with children suffering from CHD

## **Interventions**

This study focused on the use of 3D-printed cardiac models for the optimization of patient education for congenital heart disease. Parents of pediatric patients were included and either educated using the standardized paper-based method (control group) or the patient education was performed with the additional use of 3D-printed cardiac models for better visualization (3D model group). Participants were randomized using an online tool. Briefly, parents took questionnaires prior to the patient education for baseline testing regarding patient

characteristics, anxiety and procedural understanding. Custom-developed questionnaires were used for the evaluation of procedural understanding and satisfaction with the education. The mean duration of patient education for both groups was 25 minutes. The study concluded with the last questionnaire for the evaluation of the Trait-Anxiety Inventory (TAI) which was filled out upon discharge so there was no further follow-up after discharge of the patient.

### **Intervention Type**

Other

### **Primary outcome measure**

Parental preprocedural anxiety evaluated using the Visual Analog Scale (VAS, 1-10) and the State-Trait Anxiety Inventory, made up of the State-Anxiety Inventory (STAI) and the Trait-Anxiety Inventory (TAI). The German short version of the STAI was used with 10 statements regarding the state anxiety and trait anxiety for the patient, respectively. Scores for each short inventory ranged from 10 to 40, while higher scores were associated with higher anxiety levels. Collected before discharge and after the patient education.

### **Secondary outcome measures**

Parental procedural understanding and satisfaction with the patient education method measured using a questionnaire immediately after the patient education

### **Overall study start date**

01/07/2021

### **Completion date**

15/05/2024

## **Eligibility**

### **Key inclusion criteria**

Parents of patients with congenital heart disease

### **Participant type(s)**

Patient

### **Age group**

Adult

### **Lower age limit**

18 Years

### **Upper age limit**

60 Years

### **Sex**

Both

### **Target number of participants**

60

**Total final enrolment**

57

**Key exclusion criteria**

1. Language barrier
2. Previously educated by physician
3. Emergency intervention or surgery

**Date of first enrolment**

15/11/2022

**Date of final enrolment**

15/05/2024

**Locations****Countries of recruitment**

Germany

**Study participating centre****LMU University Hospital**

Marchioninistrasse 15

Munich

Germany

81377

**Study participating centre****German Heart Center Munich**

Lazarettstrasse 36

Munich

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80636

**Sponsor information****Organisation**

LMU Klinikum

**Sponsor details**

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### **Sponsor type**

Hospital/treatment centre

### **Website**

<https://www.lmu-klinikum.de/>

### **ROR**

<https://ror.org/02jet3w32>

## **Funder(s)**

### **Funder type**

Other

### **Funder Name**

Investigator initiated and funded

## **Results and Publications**

### **Publication and dissemination plan**

Planned publication in a peer-reviewed journal

### **Intention to publish date**

01/12/2024

### **Individual participant data (IPD) sharing plan**

The datasets generated during and/or analysed during the current study will be available upon request from Linda Grefen, MD ([Linda.Grefen@med.uni-muenchen.de](mailto:Linda.Grefen@med.uni-muenchen.de))

### **IPD sharing plan summary**

Available on request

### **Study outputs**

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Participant information sheet</a>			05/11/2024	No	Yes