

# Using virtual reality to improve how doctors and nurses learn to resuscitate newborns

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<b>Registration date</b> 17/10/2025	<b>Overall study status</b> Ongoing	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 19/01/2026	<b>Condition category</b> Other	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

The purpose of this study is to find out whether short, regular virtual reality (VR) training can help doctors and nurses improve their skills in newborn resuscitation. Newborn resuscitation is a life-saving procedure used when a baby has difficulty breathing or does not start to breathe at birth. The study compares VR training added to regular manikin-based training with the regular training alone. Researchers want to see if using VR can help healthcare workers perform resuscitation steps more effectively and confidently.

### Who can participate?

Only healthcare workers are taking part in this study. Participants include doctors in training and nurses who work in neonatal units where newborns are cared for. No babies or families are enrolled in the study. The study takes place at three hospitals in Denmark: Hillerød Hospital, Holbæk Hospital, and Rigshospitalet.

### What does the study involve?

Participants are randomly assigned to one of two groups.

1. VR group: continues their department's regular manikin-based training and also completes short weekly VR sessions for about eight weeks. Each VR session lasts less than one hour and can be done flexibly using a Meta Quest 3 headset.
2. Control group: continues with their regular manikin-based newborn resuscitation training only.

At the start and end of the study, all participants complete:

A skills test using a simulated newborn resuscitation scenario recorded on video and scored by two independent assessors who do not know which group the participant was in.

A knowledge test with multiple-choice questions about newborn resuscitation according to European guidelines.

Participants in the VR group also answer short questionnaires about their training experience, workload, and any VR-related symptoms. A smaller number of participants are invited to short interviews to share their experiences using VR.

### What are the possible benefits and risks of participating?

Participants may become more confident and consistent when performing newborn

resuscitation. The study may help hospitals find new ways to keep healthcare workers' skills sharp between formal training courses. While no babies take part, the results may contribute to better and safer care for newborns in the future. There are very few risks. Some people may experience mild eye strain, dizziness, or motion sickness during VR sessions. These symptoms are usually mild and go away quickly. Participants can stop a session or withdraw from the study at any time without giving a reason.

Where is the study run from?

The study will take place at the neonatal departments of Rigshospitalet, Nordsjælland Hospital Hillerød, and Holbæk Hospital (Denmark).

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

October 2025 to January 2026.

Who is funding the study?

The European Commission, supported through the European Union's Horizon Europe program through the XR2Learn Open Call #2 initiative.

Who is the main contact?

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## Contact information

### Type(s)

Public, Scientific, Principal investigator

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## Additional identifiers

### Clinical Trials Information System (CTIS)

Nil known

### ClinicalTrials.gov (NCT)

Nil known

### Protocol serial number

## Study information

### Scientific Title

Effectiveness of virtual reality-based simulation training as supplement to traditional simulation for improving neonatal resuscitation performance among doctors and nurses: a randomized controlled trial

### Acronym

NEONATAL

### Study objectives

The aim of NEONATAL is to study the feasibility, usability and effectiveness of VR-based simulation training in Neonatal Resuscitation (NR) in a European healthcare context, and to assess if it is an efficient supplement to traditional simulation training in a randomized controlled superiority study with parallel group pretest-posttest design.

The specific research objectives of NEONATAL are:

1. To investigate if VR simulation training in NR on clinical skills is an efficient supplement to traditional simulation training using mannequins in three hospitals in Denmark (primary outcome).
2. To investigate if VR simulation training in NR on clinical knowledge is an efficient supplement to traditional simulation training using mannequins in three hospitals in Denmark (secondary outcome).
3. To explore HCW's cognitive, emotional and motivational responses during the VR training, using validated questionnaires.
4. To determine the feasibility and usability of VR training in routine clinical training settings in Denmark (secondary outcome).

### Ethics approval required

Ethics approval not required

### Ethics approval(s)

### Study design

Multi-center randomized controlled trial with parallel-group pretest-posttest design

### Primary study design

Interventional

### Study type(s)

Efficacy, Prevention, Other

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

Simulation training in neonatal resuscitation

### Interventions

Intervention group: will receive virtual reality simulation training on supplementary to the traditional mannekin-based simulation training offered at the department.

The intervention consists of low-volume, high-frequency training using a virtual reality (VR) neonatal resuscitation module. The module was co-developed through an iterative process involving clinicians, educators, and Khora's XR developers to ensure clinical relevance and usability. The immersive scenarios include voice, sound (e.g., heartbeats), animation, and haptic feedback. Trainees can assess and treat a virtual newborn using equipment and medication within the virtual emergency room, with vital signs and patient condition changing in response to their actions. Movement is possible through teleportation. The scenarios are designed to strengthen key resuscitation steps, such as airway management and ventilation, while reinforcing the overall algorithm. Training is delivered via Meta Quest 3 headsets in short, weekly sessions (<1 hour) over the study period.

Control group: will only receive traditional mannekin-based simulation training offered at the department

Both groups will be assessed at baseline. Then, the intervention group (VR group) will take part of the intervention, which will be short sessions of VR training <1 hour during the follow-up period that is around 6-8 weeks (updated 19/01/2026, previously 2 months). Both groups will then be reassessed to see if they have improved their skills and if VR group has better results.

Randomisation directly in RedCap.

## **Intervention Type**

Other

## **Primary outcome(s)**

Clinical skills performance and adherence to the latest European Resuscitation Council Guidelines for Resuscitation (ERC) – Newborn Life Support (NLS), will be evaluated during scenario execution at baseline and endline using Laerdal dolls. The evaluation will be done by two assessors, using structured video observation checklists. The assessors are blinded for participant randomization. The NeoCheck, a validated 38-item checklist developed through a Delphi process, will be used to objectively assess participant performance during the NR simulation. Moreover, 4 additional global skills will be rated, as well as time to critical actions for both simulated scenarios. Measured at baseline and 2 months.

Removed 19/01/2026:

The assessment of participant performance during the NE simulation will be done through a 22-item skills checklist adapted from Hultin et al.

## **Key secondary outcome(s)**

Measured at baseline and 2 months unless noted:

1. Clinical knowledge acquisition will be evaluated through pre- and post-intervention tests with multiple-choice questions (MCQs) aligned with the latest NLS curriculum. The NEONATAL study group has developed the NR clinical knowledge test specifically for this project. The test consists of 23 MCQs, with four options and one correct answer.
2. Cognitive, emotional and motivational responses will be evaluated at baseline and endline through:
  - 2.1. NASA Task Load Index (NASA TLX), a validated scale measuring perceived workload related to the specific task. The workload score is based on 6 dimensions (mental, physical and temporal

demand, performance, effort and frustration), and each dimension is scored from 0 = Very Low to 100 = Very High, in increments of 5. This is subjective and based on the participants experience during the task. NASA TLX has previously been forward backward translated to Danish by two professional translators and tested in a Danish context.

2.2. Intrinsic Motivation Inventory (IMI), a validated questionnaire measuring intrinsic motivation related to a specific activity on a 7-point Likert scale ranging from 1 = not at all true to 7 = very true. A 7-item version of the scale will be used, including items from the subscale interest /enjoyment. It has been translated to Danish and tested in a Danish context.

3. Usability of VR will be evaluated at endline through System Usability Scale (SUS), a validated questionnaire measuring the subjective usability of a product on a 5-point Likert-scale ranging from 1= strongly disagree to 5 = strongly agree. The SUS item scores are subsequently converted into a single SUS score on a scale from 0-100. SUS has previously been translated professionally to Danish and validated in a Danish context.

4. Feasibility of VR will be evaluated at endline through:

4.1. Semi-structured end-user interviews with 15 participants, allowing NEONATAL to receive and consider feedback from participants to refine the content of the scenarios, ensuring that they meet user needs. The interview questions will be developed in collaboration between the Global Health Unit (GHU), Rigshospitalet, and Khora, ensuring both clinical and technical aspects being addressed. The final interview guide will consist of open-ended questions designed to elicit rich, detailed responses about participants' personal experiences, reflections, and suggestions for improvements.

4.2. Virtual Reality Sickness Questionnaire (VRSQ), a validated questionnaire measuring motion sickness in a virtual reality environment on a Likert-type scale ranging from 0 = none to 3 = severe. It includes 9 items covering symptoms of cyber sickness.

4.3. Recordings of training sessions and adherence, including number and duration of VR sessions.

### **Completion date**

28/02/2026

## **Eligibility**

### **Key inclusion criteria**

1. Resident doctors with clinical function in neonatology
2. Nurses with clinical function in neonatology

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

Health professional

### **Healthy volunteers allowed**

No

### **Age group**

Adult

### **Sex**

All

### **Total final enrolment**

0

### **Key exclusion criteria**

1. Unwilling to give informed consent
2. Change of workplace (to non-study site) before endline or unable to participate in the study until endline
3. Previously attended any formal training with VR
4. Not fully proficient in Danish

### **Date of first enrolment**

20/10/2025

### **Date of final enrolment**

31/12/2025

## **Locations**

### **Countries of recruitment**

Denmark

### **Study participating centre**

**Nordsjællands hospital Hillerød**

Hillerød: Dyrehavevej 29

Hillerød

Denmark

3400

### **Study participating centre**

**Rigshospitalet**

Blegdamsvej 9

Copenhagen

Denmark

2100

### **Study participating centre**

**Holbæk sygehus**

Smedelundsgade 60

Holbæk

Denmark

4300

## **Sponsor information**

**Organisation**

Nordsjællands Hospital Hillerød

**Funder(s)****Funder type**

Government

**Funder Name**

HORIZON EUROPE Framework Programme

**Alternative Name(s)**

Horizon Europe, Horizon Europe Programme, Framework Programme, Horizon Europe, EU Framework Programme, Horizon

**Funding Body Type**

Government organisation

**Funding Body Subtype**

National government

**Location****Results and Publications****Individual participant data (IPD) sharing plan****IPD sharing plan summary**

Data sharing statement to be made available at a later date