ISRCTN43822066 https://doi.org/10.1186/ISRCTN43822066

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

Submission date
17/10/2025

Recruitment status
No longer recruiting

Registration date
17/10/2025

Overall study status
Completed

Last Edited
19/01/2026

Condition category
Other

[X] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] 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?
Principal Investigator: Hanna Rahimi, MD
Email: Hanna.Rahimi@regionh.dk

Contact information

Type(s)
Public, Scientific, Principal investigator

Contact name
Dr Hanna Rahimi

ORCID ID
https://orcid.org/0009-0002-3408-6159

Contact details
the Department of Pediatrics and Adolescent Medicine, Nordsjællands Hospital
Hillerød
Denmark
3400
+45 52441529
hanna.rahimi@regionh.dk

Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Protocol serial number
p-2025-19577

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, Horizonte Europa

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