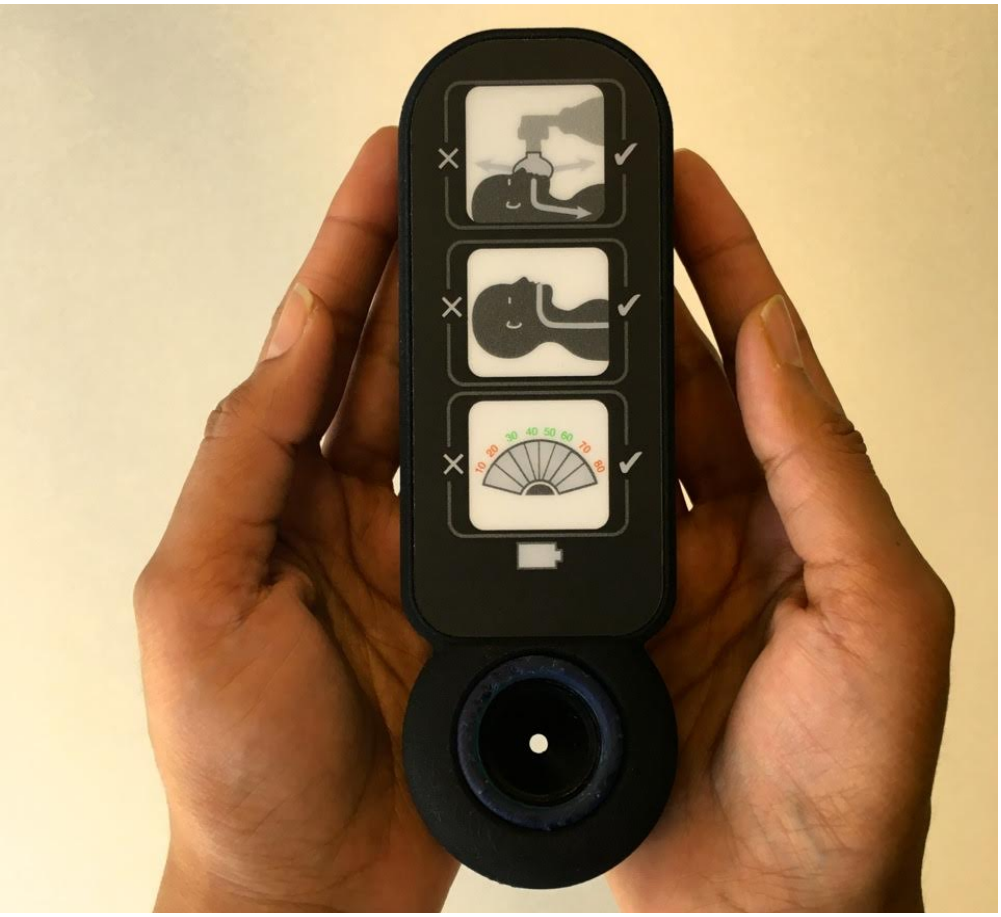
Training Manual

Augmented Infant Resuscitator (AIR)



A collaboration among:

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Massachusetts General Hospital (USA)
Harvard Medical School (USA)
Jawaharlal Nehru Medical College (India)
Moi University (Kenya)
Indiana University (USA)

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1. Background

Breathing problems at birth result in 1.9 million intrapartum stillbirths and neonatal deaths annually.[1] Effective bag-mask ventilation (BMV) is a life-saving newborn resuscitation skill and has the potential to significantly reduce these deaths.[2-9]

To be effective, BMV requires a good seal at the face-mask interface, an open airway, and gentle adequate chest rise at a correct rate.[10-12] However, achieving and maintaining effective provider-level ventilation skills after training has been a documented challenge in both resource-limited and resource-rich settings.[13-17] Inadequate BMV can have severely detrimental impact on perinatal outcomes; for every 30-second delay in effective ventilation, there has been an associated 16% increase in mortality.[19]

2. Introduction to the AIR device

The Augmented Infant Resuscitator (AIR) was designed to improve BMV training (Figure 1). The AIR device is an add-on device to existing bag-valve-mask devices and provides clinicians with real-time digital feedback on BMV to improve the acquisition and quality of clinicians' skills.[23]

*Figure SEQ Figure * ARABIC 1. AIR device connected to a bag-valve-mask device.*

The AIR device gives clinicians real-time digital feedback on:

- ventilation rate
- airway patency
- harshness of breaths
- presence of air leaks

3. AIR device visual feedback

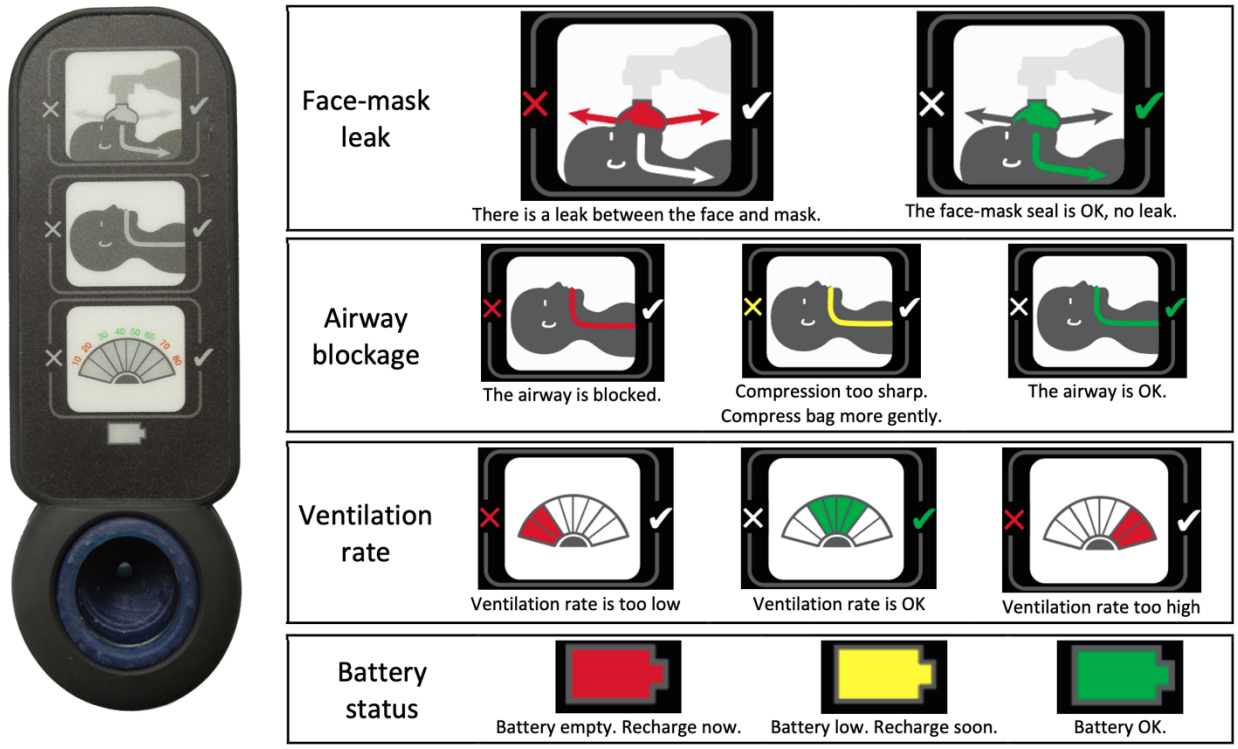
The AIR device is designed with several digital icons that give simple, clear visual feedback. The first icon provides information on face-mask leaks. If this leak icon is red, there is a leak between the face and the mask, and if the icon is green, there is a good seal between the face and mask.

The second icon provides information on airway blockage. If this airway icon is red, the airway is blocked. If the icon is yellow, compression of the bag is too sharp and the clinician should compress the bag more gently. If the icon is green, the airway is okay (i.e., patent).

The third icon provides information on ventilation rate. If the rate icon is red on the left side, the ventilation rate is too low. If the icon is red on the right side, the ventilation rate is too high. If the icon is green (in the middle), the ventilation rate is okay.

The goal of the clinician is to get all three of these icons to be green and to keep them green. This would signify good-quality bag-mask ventilation.

The small battery icon at the bottom of the AIR device shows whether the battery is empty (red), low (yellow), or okay (green).



4. Connecting the AIR device to its smartphone app

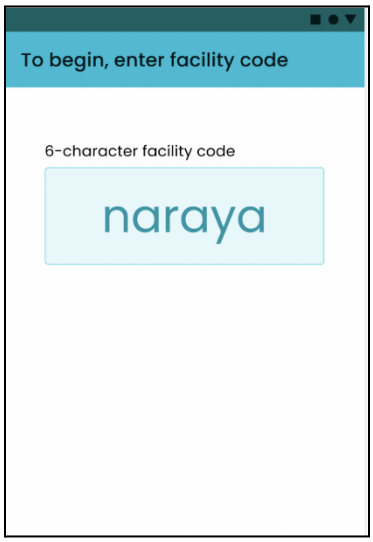
Connecting (or “pairing”) the AIR device to its smartphone app expands the functionality of the device. Specifically, the app allows the storage and analysis of the data being collected by the AIR device. The app can then give each clinician a detailed report on the quality of their ventilation, including giving a comparison of how one is doing in relation with the larger group.

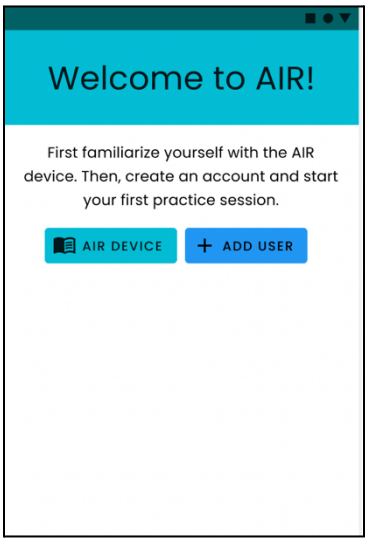
A smartphone will be provided to each healthcare facility as part of this study. Please keep it safe and secure, alongside the AIR device. This smartphone will need to be used by each clinician while they are regularly practicing with the AIR device.

5. Using the smartphone app

A. Registering your facility

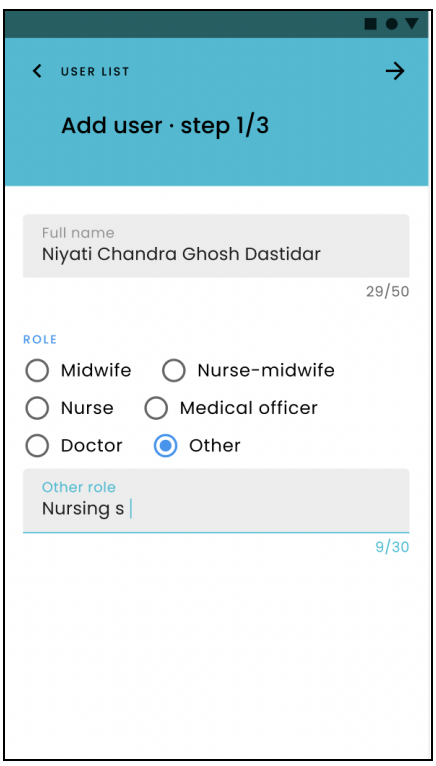
The first time the smartphone app is used at your facility, it needs to be registered or linked to your facility. This is a relatively simple process. Upon opening the app, you will be asked to provide a 6-character facility code. Please enter the code that you have been given for your facility. This will bring you to a Welcome screen that provides a button for the AIR device manual and a button to add a user.

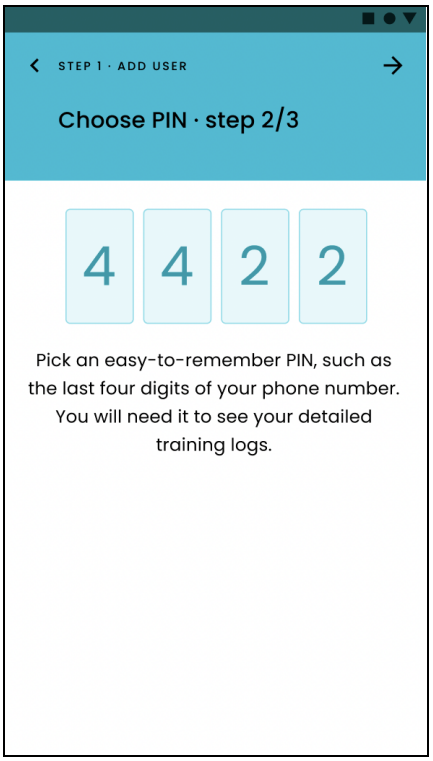


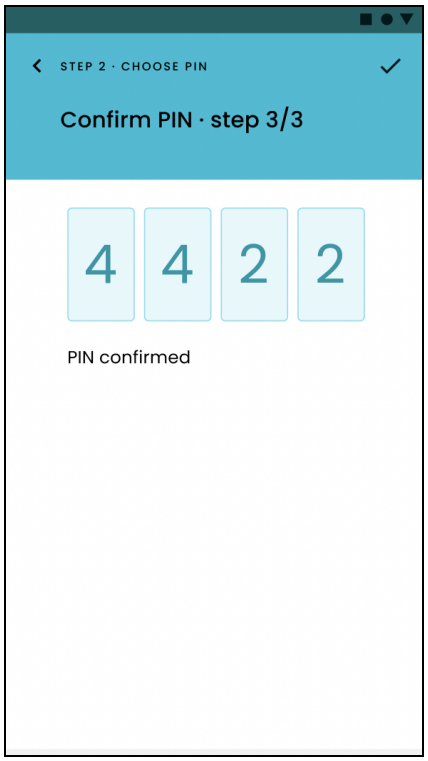


B. Adding a new user

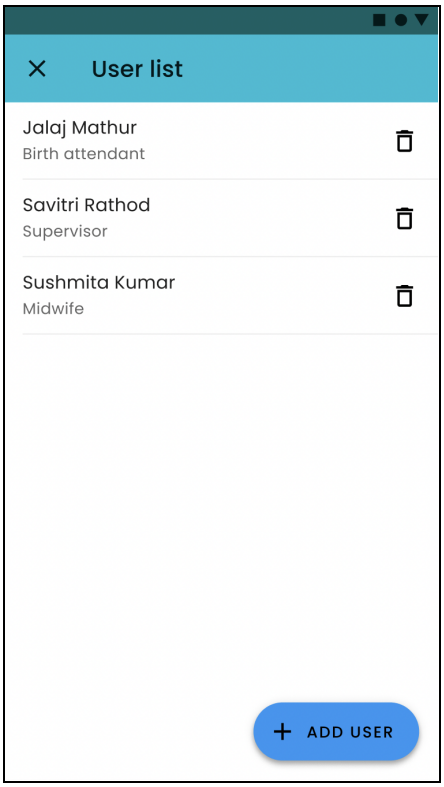
Adding a new user can be done from the Welcome screen or from the User List screen. From either of these, you will be asked to complete three simple steps, including entering name and role, choosing your personal four-digit PIN, and confirming your PIN. Pick an easy-to-remember PIN, such as the last four digits of your phone number. You will need this PIN to see your detailed training logs.





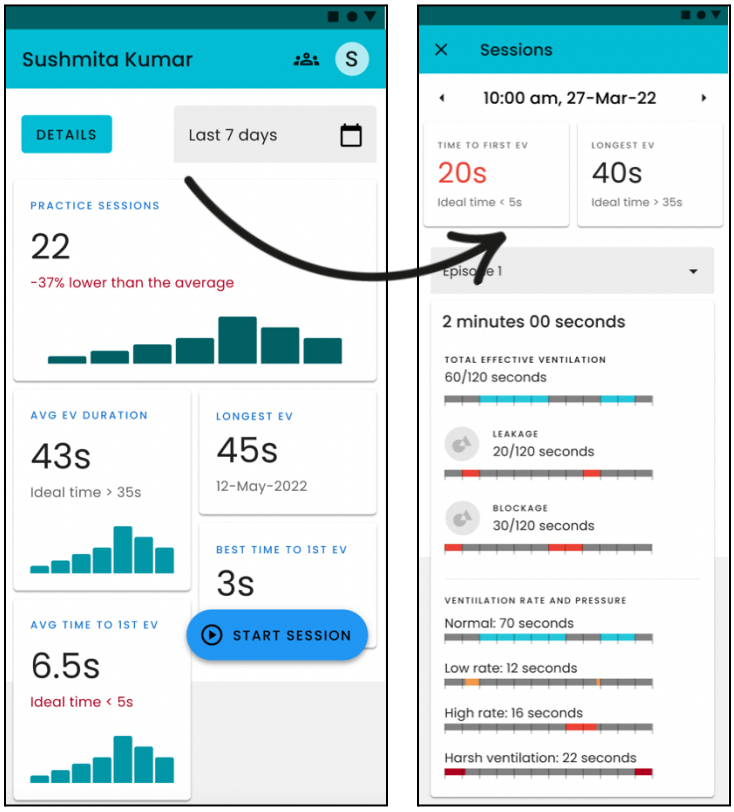


Once a user is added, the individual will be shown on the User List. If necessary, you can delete an incorrect profile by clicking on the trash can icon on the right side of the screen.



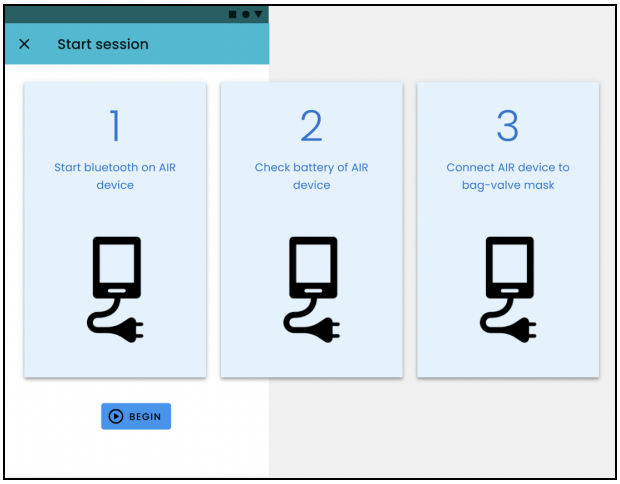
C. User home screen

When clicking on your username from the User List, the User Home screen will appear. This screen provides information on the user's practice sessions, average effective ventilation (EV) duration, longest EV, average time to first EV, and best time to first EV. To compare a user's results with the results of the group (all providers at that facility), you can click the individual/group icon (top right of screen) to toggle between an Individual-level view and a group-level view. By clicking on the calendar tab, a user can choose between seeing data from the past 7 days, past 14 days, past 30 days, past 60 days, or a custom date range. If you would like even more details on your performance, you can click on "Details," which will then show you the results for each practice session.



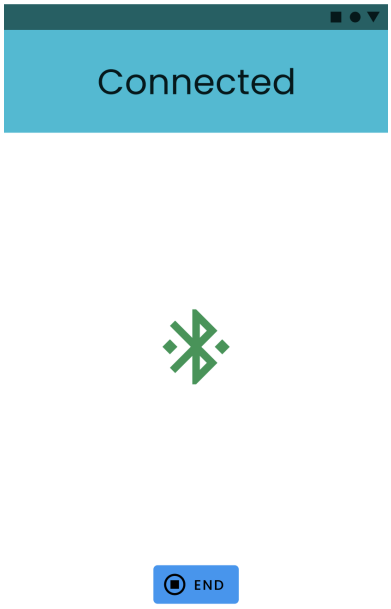
D. Starting a new practice session

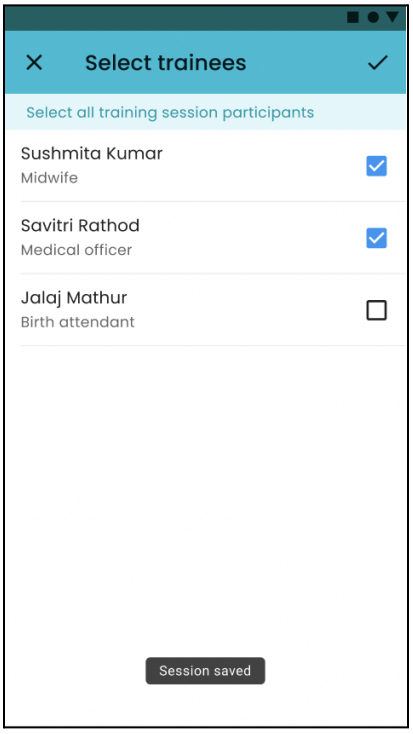
On the User Home screen is a "Start Session" button. Pressing this button starts a new practice session, and you will be guided to 1) start Bluetooth on the AIR device, 2) check the battery of the AIR device, and 3) connect the AIR device to the bag-valve mask.



E. Ending a practice session

At the end of your practice session, please click on “END”. This will end the session, and you will be asked to select all individuals who were involved in this training session.





6. Practicing with the AIR device

To retain and even improve the newborn ventilation skills you learned during your HBB training, it is important that every clinician practice bag-mask ventilation regularly. **We ask that each clinician please practice bag-mask ventilation at least twice a week (or more) with the AIR device attached and linked to the smartphone.** This should be done with the NeoNatalie manikin in your newborn resuscitation corner.

Practice can be individually or as a group. For each practice, imagine a scenario in which a newborn needs resuscitation and then practice how you would resuscitate that newborn, including with bag-mask ventilation. The frequency and quality of each practice session are collected by the AIR device and smartphone.

7. Device maintenance

So that the AIR device and its smartphone are always available to clinicians to use during the study, we ask that you:

- Keep the AIR device charged
- Keep the AIR device safe but accessible
- Keep the smartphone charged
- Keep the smartphone safe but accessible