

SC1-PHE-CORONAVIRUS-2B

ENVISION

Intelligent plug-and-play digital tool for real-time surveillance of COVID-19 patients
and smart decision-making in Intensive Care Units

Project No. 101015930

Deliverable Number	D6.3
Deliverable Title	eLearning materials
Work Package Number	6
Work Package Title	Outreach and rollout
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Delivery date	30-11-2021 / 28.03.2022
Dissemination level	Public
Type	Report
Version	2



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Abstract

Within only six months, over 7.4 million people have been diagnosed with SARS-CoV-2. In the most severely hit countries, more than 10% of infected patients have received treatment in Intensive Care Units (ICUs). Insufficient data and limited knowledge on the disease as well as the lack of tools to support the intensivist in making accurate, timely and informed decisions have led to high mortality rates.

Continuous surveillance, the collection and intelligent analysis of data from many sources, including ventilators and electrical impedance tomography, would allow intensivists to decide on the best suitable treatment to accelerate the recovery of the often comorbid COVID-19 patients, while reducing the burden on clinical staff and healthcare costs. This information would also increase our understanding of the yet unknown course of disease, supporting other stakeholders in the quest for new therapies.

In ENVISION, our multidisciplinary public-private consortium will advance an innovative digital tool, Sandman.MD, a real-time and plug-and-play monitoring app, to an intelligent decision-support system for monitoring, prediction and treatment of COVID-19 patients in ICUs – the Sandman.IC – reaching Technology Readiness Level 9 and ready for CE marking by the end of the project. The app has been developed by our SME partner app@work (AAW) and was successfully introduced by several hospitals in Germany for use during the perioperative period. Sandman.IC will be integrated into an AI-driven data analytics suite with predictive modelling tools and enhanced with a smart alert functionality. The digital tool will be validated and demonstrated in 13 hospitals across Europe. Our Health Technology Assessment expert partner will demonstrate the economic and societal value of Sandman.IC, while an experienced SME will manage the innovation process in view of an immediate market uptake. The rollout will be supported by the European Society of Anaesthesiology and Intensive Care (ESAIC).



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Partner short names

AAW	app@work GmbH
accelCH	accelopment Schweiz AG
accelDE	accelopment Deutschland GmbH
CCHT	Spitalul Clinic Judetan De Urgenta Pius Brinzeu Timisoara
CHUC	Centro Hospitalar e Universitario de Coimbra E.P.E.
DPT	Central Hospital of Southern Pest National Institute of Hematology and Infectious Disease
ESAIC	European Society of Anaesthesiology and Intensive Care
GUF	Johann Wolfgang Goethe Universität Frankfurt am Main
ICS-HUB	Institut Catala de la Salut – Bellvitge University Hospital
iDA	Intelligent Data Analytics GmbH & Co. KG
KC	Lietuvos Sveikatos Mokslu Universiteto Ligonine Kauno Klinikos
LMI	Löwenstein Medical Innovation GmbH & Co. KG
SE	Semmelweis Egyetem
TAU	Tampereen Korkeakoulusaatio SR
UCL	University College London
UMCG	Universitair Medisch Centrum Groningen
UMCL	Univerzitetni Klinicni Center Ljubljana
UMCM	Univerzitetni Klinicni Center Maribor
UMFCD	Universitatea de Medicina si Farmacie Carol Davila din Bucuresti
UNIPG	Università degli Studi di Perugia
UNITO	Università degli Studi di Torino

Abbreviations

D	Deliverable
EC	European Commission
H2020	Horizon 2020
ICU	Intensive care unit
M	Month
MS	Milestone
SOP	Standard operating procedure
WP	Work package

Revision history

Date	Authors	Revision
15.11.2021	Cathy Weynants (ESAIC), Jennifer Rose (ESAIC), Julia Dowell (ESAIC)	Draft version
23.11.2021	Markus Ketomäki (GUF), Benjamin Ginski (GUF)	Revision 1
23.11.2021	Julia Dowell (ESAIC)	Revision 2
30.11.2021	Regina Minazhetdinova (GUF), Benjamin Ginski (GUF)	Final version
28.03.2022	Julia Dowell (ESAIC), Benjamin Ginski (GUF)	Final version 2



Executive Summary

This deliverable **D6.3 eLearning materials** is part of **Work Package 6 (WP6), Task 6.2: Cross-media communication and outreach** and it explains which of the training materials that were developed as part of an earlier deliverable (D4.2), are now available electronically and using what platforms.

Need for the Deliverable

In the ENVISION project, for artificial intelligence (AI) training purposes, all clinical partners across Europe collect vitals data from COVID-19 patients during their stay in the intensive care unit (ICU). The data recording is done using Sandman.IC which directly extracts the vitals data from the connected medical devices (in the current scenario vital sign monitors and ventilators), pseudo-anonymises it and then stores it in K-anonymised form on the big data hub (server) of the European Society of Anaesthesiology and Intensive Care (ESAIC). However, it must be ensured by the app@work (AAW) software experts together with the project coordinator (GUF) and ESAIC that the medical professionals can easily access the training materials needed to ensure data is recorded by Sandman.IC to a high-quality standard. Therefore, it is crucial that instructions and guidance that are easy to understand are available on the device itself and on the internet, in a secure way. As well as collecting data, Sandman.IC functions similarly to a typical patient data management system in the ICU. Sandman.IC, an innovative and at the same time a cost-effective tool, is intended to be used in intensive care throughout Europe. Therefore, it is imperative that clinical staff have easy access to training materials in order for meaningful further development of Sandman.IC. Finally, it needs to be ensured that the training materials that are available on each individual Sandman.IC, as well as the software itself, can be updated remotely and in real time.

Outcomes

The aim of this document is to create eLearning materials, specifically for healthcare professionals who will be using Sandman.IC. The eLearning materials need to be comprehensive enough to ensure data of high quality is collected and also that the full functionality of Sandman.IC can be utilised by the medical experts across Europe. If the tool is being used to its full functionality, then this will lead to better feedback of the tool due to the extensive use of Sandman.IC by many medical professionals in order to create more optimised functions. It is also crucial that both the eLearning materials and software can be updated remotely and quickly on each device.

Related documents:

- D4.1 Study protocol and standard operational procedures;
- D2.2 Unsupervised long-term documentation;
- D4.2 Sandman.IC user guide and trainings material;
- D4.3 Site initiation and installation report.



1 Introduction

Sandman.IC, the software to be developed in the ENVISION project, is intended to assist healthcare personnel in accurate and timely decision-making when treating COVID-19 patients in ICUs. In order to provide this help effectively, the planned predictive models have to be created using high-quality data. Thus, it is imperative to ensure the proper use of Sandman.IC during the data collection period. The smart app is also intended to be used as a patient management system in the future. Therefore, as well as overall training in the use of the app, information about the benefits offered by the app is also required. The Deliverable D6.3 eLearning Materials constitutes a part of Work Package 6, which aims to raise awareness of patient safety and achieve a wide outreach of the project results. However, in order to have high quality results, it is extremely important that healthcare professionals have the eLearning materials necessary to support them to acquire high quality, real-time data.

1.1 Purpose of this deliverable

The purpose of this deliverable is to:

- Describe the eLearning materials and their contents;
- Describe how the eLearning materials can be accessed and how they are updated;
- Explain the purpose of all training materials;
- Describe what is planned for the future and offer an assessment of the effectiveness of the training materials provided (outlook).

This deliverable is therefore structured as follows:

- What training materials have already been developed;
- How eLearning materials will be accessed (and which training materials will be available):
 - The ENVISION study 'Cloud' (which can be accessed from any device connected to the internet);
 - The Sandman.IC device;
- Summary;
- Outlook and assessment of the effectiveness of the training materials.

2 eLearning Training materials

2.1 Training materials that had previously been developed

The training materials were developed for deliverable 4.2 'Sandman.IC user guide and trainings material'. They were divided into two categories as follows (see also Figure 1):

- Data recording:
 - The aim was to ensure clinical partners could record data as soon as possible. This meant that clear, easy to use instructions were required;
 - It is crucial that high data quality is collected and so instructions needed to be detailed enough to minimise any human error;
 - Materials comprised of a pictogram and a short tutorial video.
- Patient management system:
 - The aim was to provide a clear explanation of the functionalities and benefits offered by Sandman.IC;



- o Materials comprised of a comprehensive user guide and a general training presentation. The presentation gave the clinical staff a chance to ask any specific questions and address any centre specific issues or problems.

The diagram below shows an overview of the training materials:

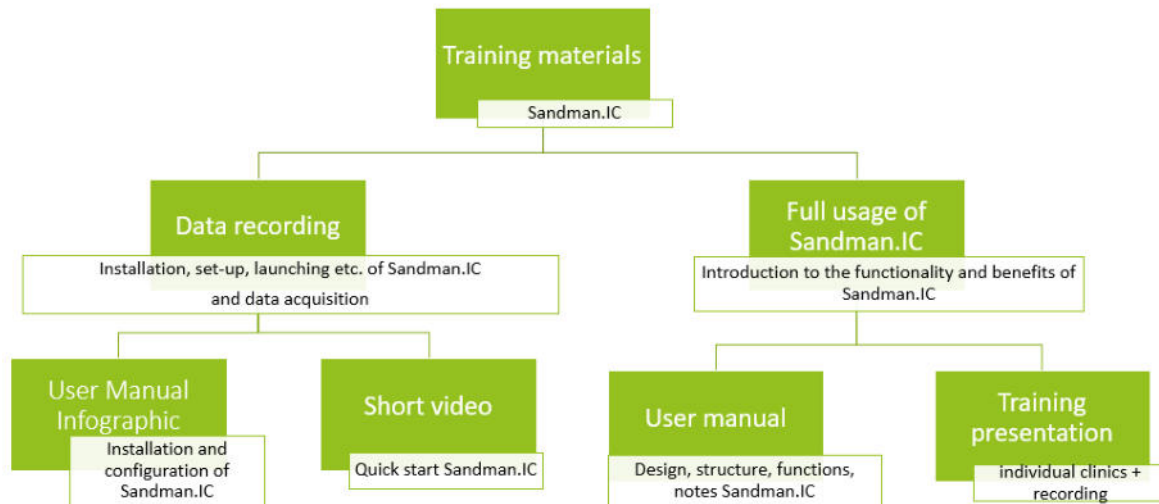


Figure 1: Overview of training materials.

2.2 Use of eLearning Materials

It was decided that in order for the training materials to be as widely available and easily accessible as possible, they would be made available electronically in two locations:

- The ENVISION study 'Cloud' (which can be accessed from any device connected to the internet);
- The Sandman.IC device.

The information below explains what training materials are available on which location.

2.2.1 The ENVISION study Cloud and eLearning materials

All ENVISION partners, including clinical staff working on the ENVISION project at hospitals will be given access to the ENVISION cloud (accelCLOUD). This website can be accessed only by authorised users. ENVISION partners are also allowed to upload the training materials to their respective hospital's internal website at any time (see Figure 2).

Once logged into the Cloud, there is the option to access short training videos (https://cloud.accelopment.com/index.php/apps/files/?dir=/ENVISION/09_Work%20Packages/Other/Trainingmaterial&fileid=78541)

The videos are about 2 minutes long and include text but no recorded speech to ensure that they are short and easy to understand, especially given that it will be used in 14 medical institutions in multiple countries.

Below is a description of the contents of the videos:

- How to connect the device;
- How to log in;

- How to search for a patient and start the data recording;
- How to disconnect the device when data recording is complete;
- Contact details in case of questions or feedback.

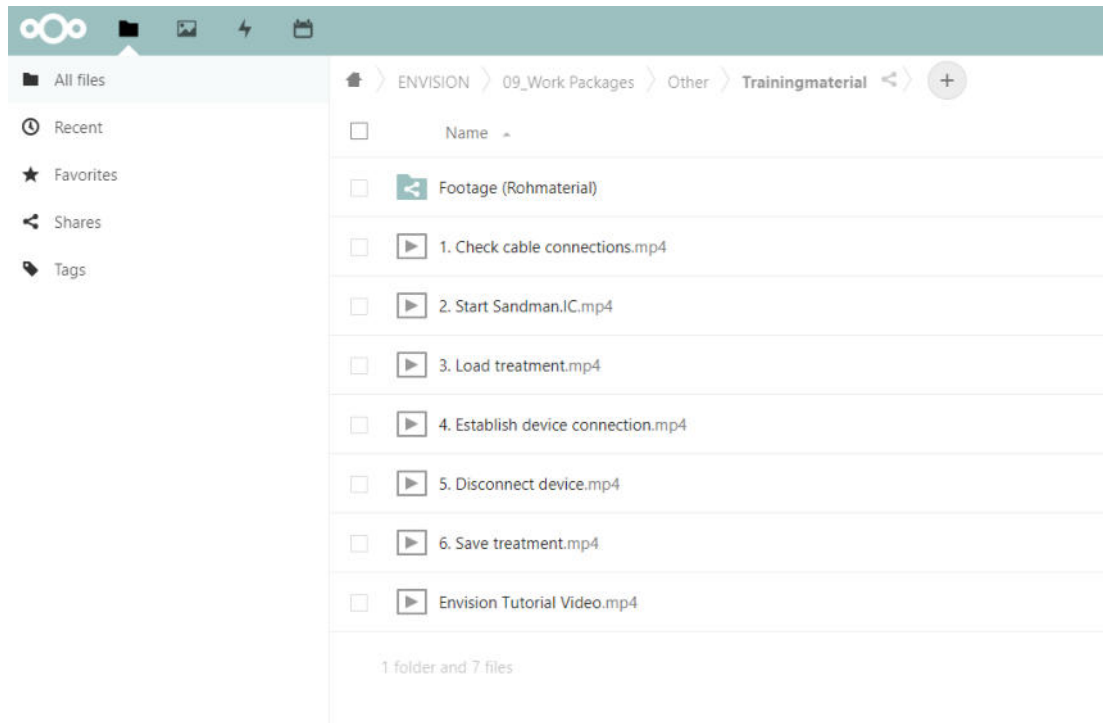


Figure 2: ENVISION cloud: List of training videos.

Below are several screenshots from the training videos, which show simple instructions with a 'live' demonstration (see Figure 3 and 4).

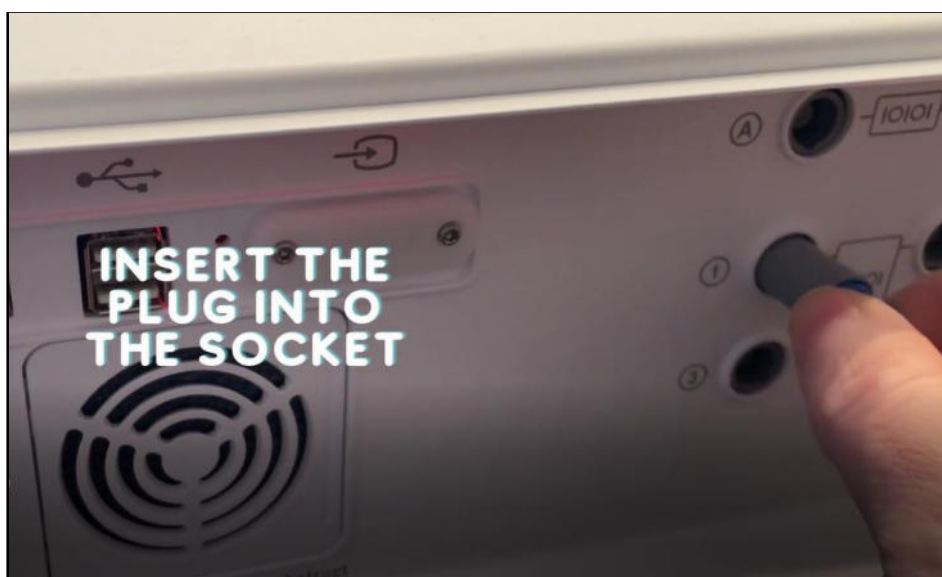


Figure 3: Connection between Sandman.IC and a medical device.

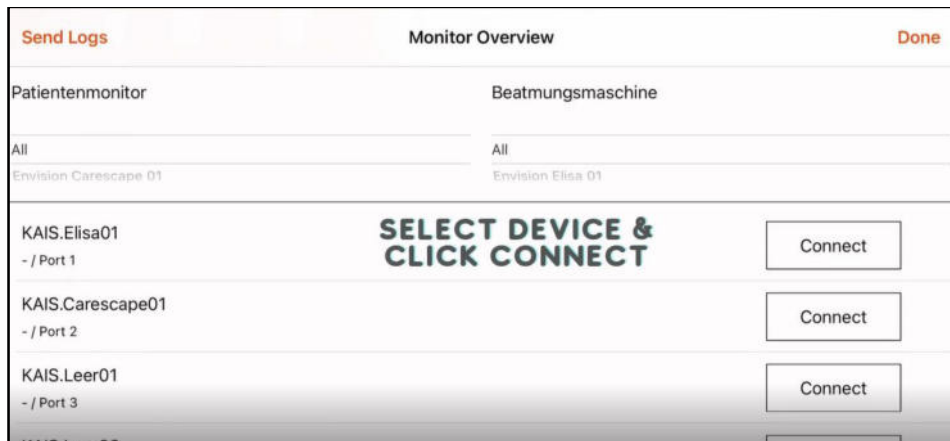


Figure 4: Overview of available medical devices for connection as shown in Sandman.IC.

2.2.2 The Sandman.IC device and eLearning materials

In addition to ensuring data capture, Sandman.IC has many useful features to help medical staff simplify their day-to-day work in the ICU. The functions of Sandman.IC are comparable to a comprehensive patient management system, where the recorded vital parameters of the patient are automatically documented and which at the same time enables a mobile and comprehensive planning of the treatment of the patient and allows continuous monitoring of the patient's health status.

It is therefore necessary to ensure that medical staff have all the information needed to ensure they can use the full functionality of Sandman.IC. On the device, staff will be able to access the following:

- User manual;
- FAQ list;
- Update version news.

2.2.2.1 User manual

The user manual describes the most important functions, structures and interfaces of Sandman.IC. It comprises of structured and illustrated information in an easy and quick to use guide and is divided into the following parts:

- Treatments;
- Course of treatment;
- Structure Sandman.IC;
- Patients;
- Medical History;
- Post ICU.

This document is attached as Appendix 1: User manual and is also available on the ENVISION cloud (accelCLOUD):

https://cloud.accelopment.com/index.php/apps/files/?dir=/ENVISION/03_Deliverables/Revision%20deliverables/D6.3&fileid=147720.

2.2.2.2 Frequently Asked Questions (FAQ) list

As clinical staff often have the same questions about using Sandman.IC, a FAQ list has been compiled and is available on the Sandman.IC device. This list will be updated as needed and will automatically update on each device. The list will probably grow vastly once all the clinics have worked with

Sandman.IC. The questions are grouped in categories to allow faster access. Below is an example of questions in the FAQs (see Figure 5).

Sandman.IC: Frequently Asked Questions

General questions about Sandman.IC

Why does the Sandman.IC only work on an iPad?

The Sandman.IC is only offered on iPads, since the Apple iOS operating system is one of the most secure operating systems. In contrary to other operating systems, the access to the data is restricted when using Apple iOS.

Furthermore, iOS is only offered by Apple and therefore can only run on Apple's own devices. Other operating systems available on the market, such as those offered by Android and Microsoft Windows, are not possible for iOS and iPads. Using only iOS reduces the error-rate of the overall system (operating system and hardware) and the required checks for the software to run safely on different systems.

Beyond the security features of iOS, the Sandman.IC is equipped with additional security features. In this regard, all Sandman data on the iPad is additionally encrypted separately.

Functionality of the Sandman

Can I log / monitor two ICU beds at the same time?

It is not possible to monitor the data of two ICU beds at the same time. This is because you can only load and edit one treatment in the Sandman.IC at a time and only a maximum of one patient monitor and one ventilator can be connected to the iPad.

Figure 5: Screenshot from the Sandman.IC FAQ.

2.2.2.3 Update version news

When a new app version is available, it will be distributed to all devices via the Mobile Device Management system. The Sandman.IC user simply has to confirm when the update should be installed. The release notes (which list the changes and describe the new functions) will also be loaded onto the iPad. Additionally, the release notes will be made available in the ENVISION cloud. This simple process to update Sandman.IC remotely ensures that the device is running with the latest version and therefore data is collected and transmitted as efficiently as possible.

3 Summary

As previously discussed, the purpose of this Deliverable is to ensure that the tools and materials needed to train and update clinical staff on using Sandman.IC are available electronically. These materials should allow the medical professionals to record data through Sandman.IC quickly and to a high standard. Furthermore, this should result in meaningful further development of Sandman.IC in intensive care. The eLearning materials are available on the ENVISION Cloud (the short training videos and the user manual) and the Sandman.IC device (the user manual, the FAQ list and information regarding updated version of the software). It was very important to have this information on the device so that it is easily accessed by the clinical staff and is updated as needed.



4 Outlook and assessment of the effectiveness of the training materials

As the Steering Committee meeting in June 2021 indicated that training materials for data acquisition (including the short training videos) were well accepted, and the virtual training presentations by AAW to the clinical experts went well, it was decided to ensure that these training tools are easily accessible on the device and online. The experts at AAW are available to answer questions about Sandman.IC via a dedicated e-mail account (AAW service hotline: envision@appatwork.com). There is also a Europe-wide standardised telephone number available for very urgent cases. AAW will be able to monitor any questions that are frequently asked and any reoccurring issues and therefore update the training manual and FAQ list appropriately. In this way the content of the learning materials is being constantly observed to see if updates are needed. As it is not always possible to quickly update materials such as the user manual, release notes of Sandman.IC updates will be published and sent to all the clinics. These will explain the changes made to Sandman.IC and summarise the information that users need to know. Finally, for future similarly structured EU research projects, the approach described in this deliverable can be adapted and implemented in a similar way.

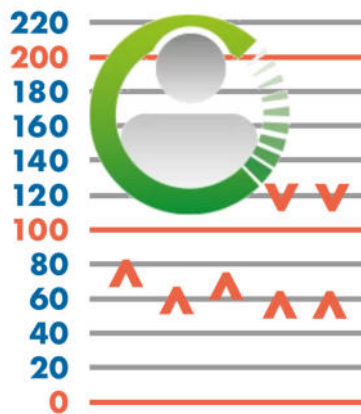
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Appendix 1: User manual



Sandman.MD

Sandman ICU User manual



Version 4

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II. Preliminary remarks

This user manual describes the everyday usage of the Sandman ICU app. It is structured in the same way as the process in the app and the patients stay in the Intensive Care Unit. It starts with the creating of a case, followed by the entering of personal and medical data of the patient. After that the patient can be admitted to the ICU and the treatment data, for example drug administration, is documented. The vital parameters from the patient monitor, as well as the respiratory data from the ventilator, are transferred automatically. In the end the discharge of the patient is documented.

In order to achieve a better understanding, screenshots of the app are incorporated into this manual. In some cases a hand pointer is added, to visualize the processes described in the text.

1. General

The main user interface is divided into four sections which are shown in the navigation bar at the bottom. These tabs are in chronological order of the patients stay in the ICU. First the patient data (height and weight) is documented and the anamnesis is conducted. The documentation of the treatment in the Intensive care unit is performed in the ICU tab. In the end the discharge of the patient is reported in the Post-ICU tab.

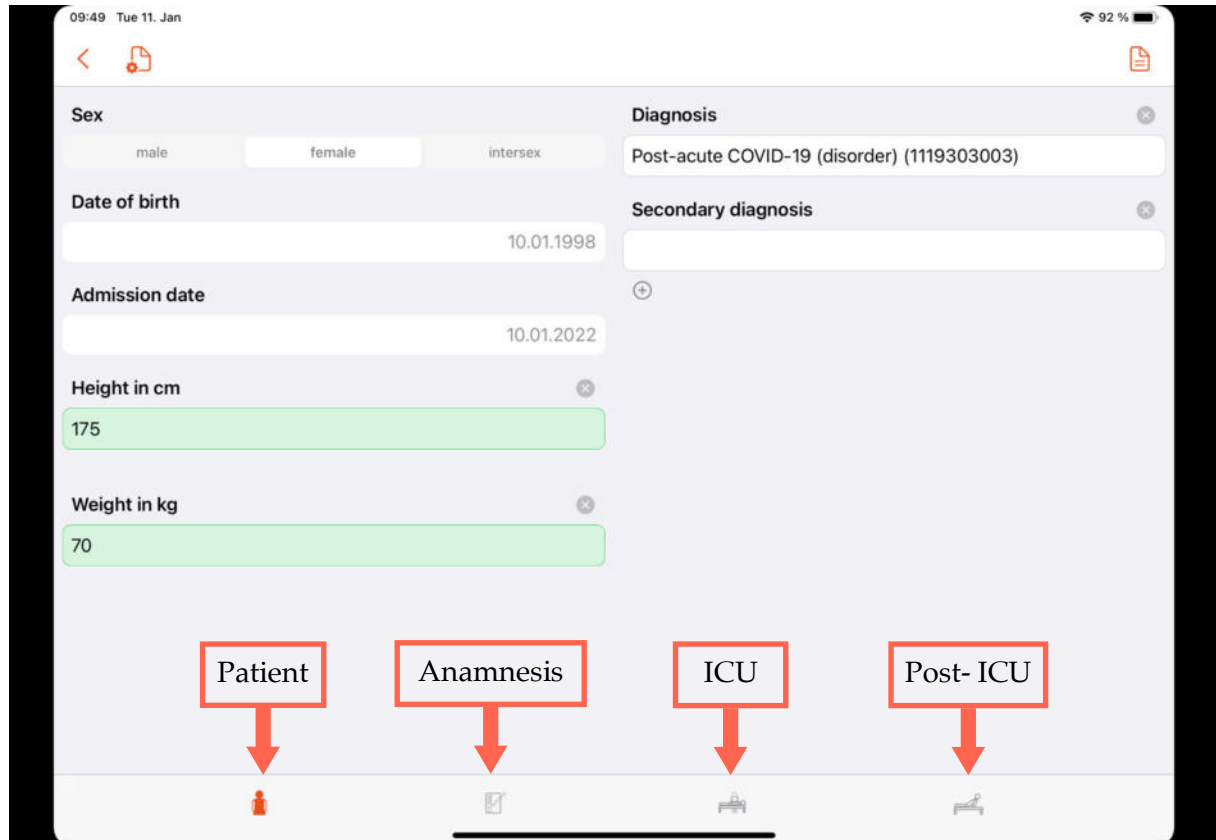


Figure 1: Main user interface

2. Open a case

Before you can start to document, you need to create a new case or reopen an existing one.

Please note:

The Case ID is given by the system and cannot be changed.

2.1. Create a new case

If you want to create a new case, click on the bed icon with the blue cross and fill in “Sex”, “Date of birth” and “Admission date”. Click on create. The treatment then appears on the screen in the category “Available”. To open it click on the red arrow pointing up on the right-hand side.

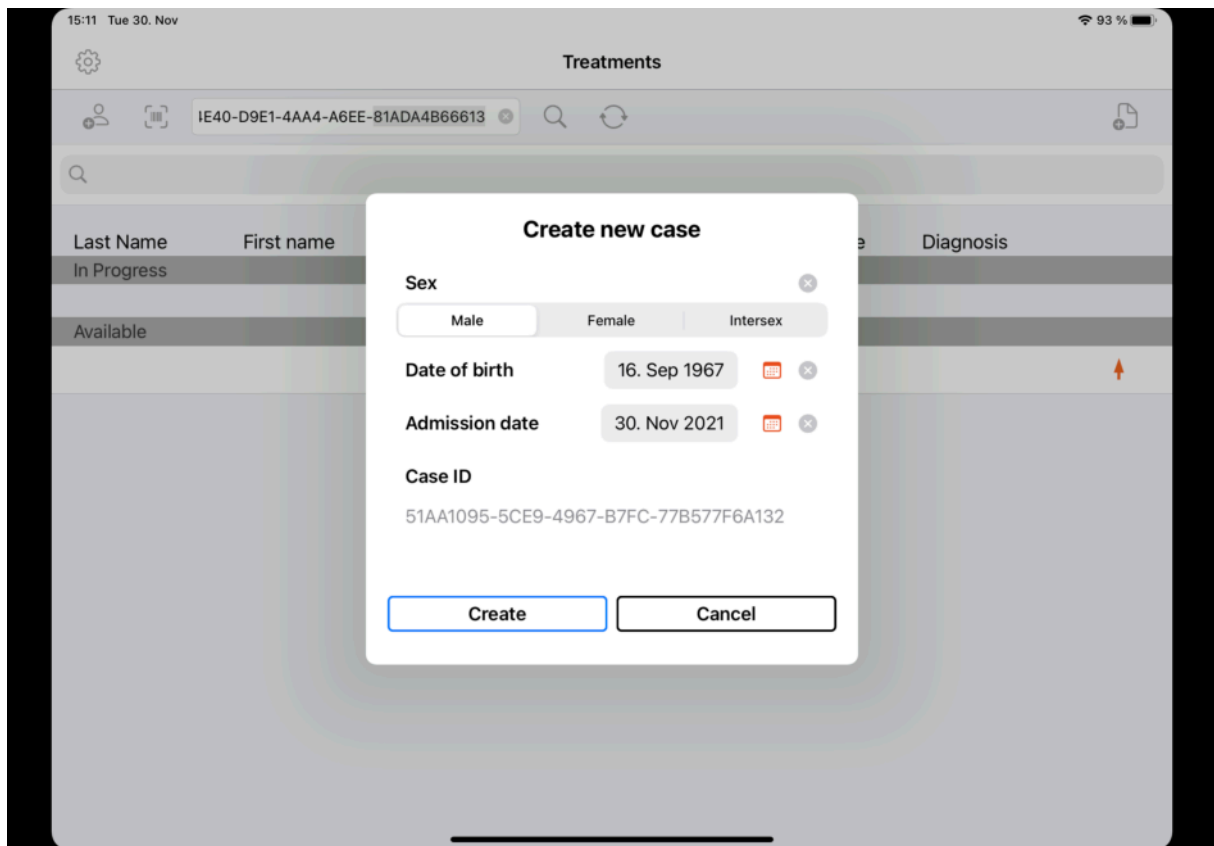


Figure 2: Creating a new case

2.2. Reopen an existing case

In order to search for an already existing case, you can click on the magnifying glass with an empty search bar. You will then see a list of the available cases. Load the requested case by clicking on the red arrow pointing up.

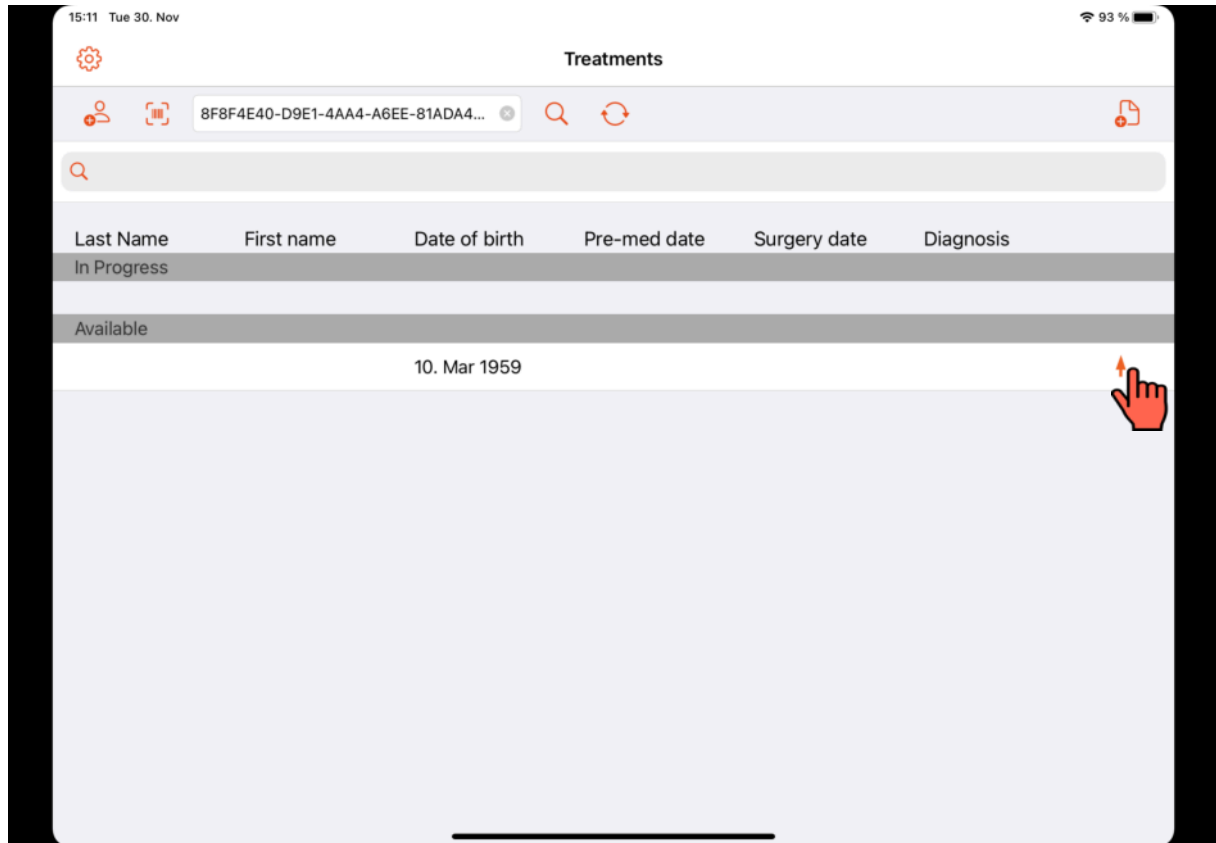
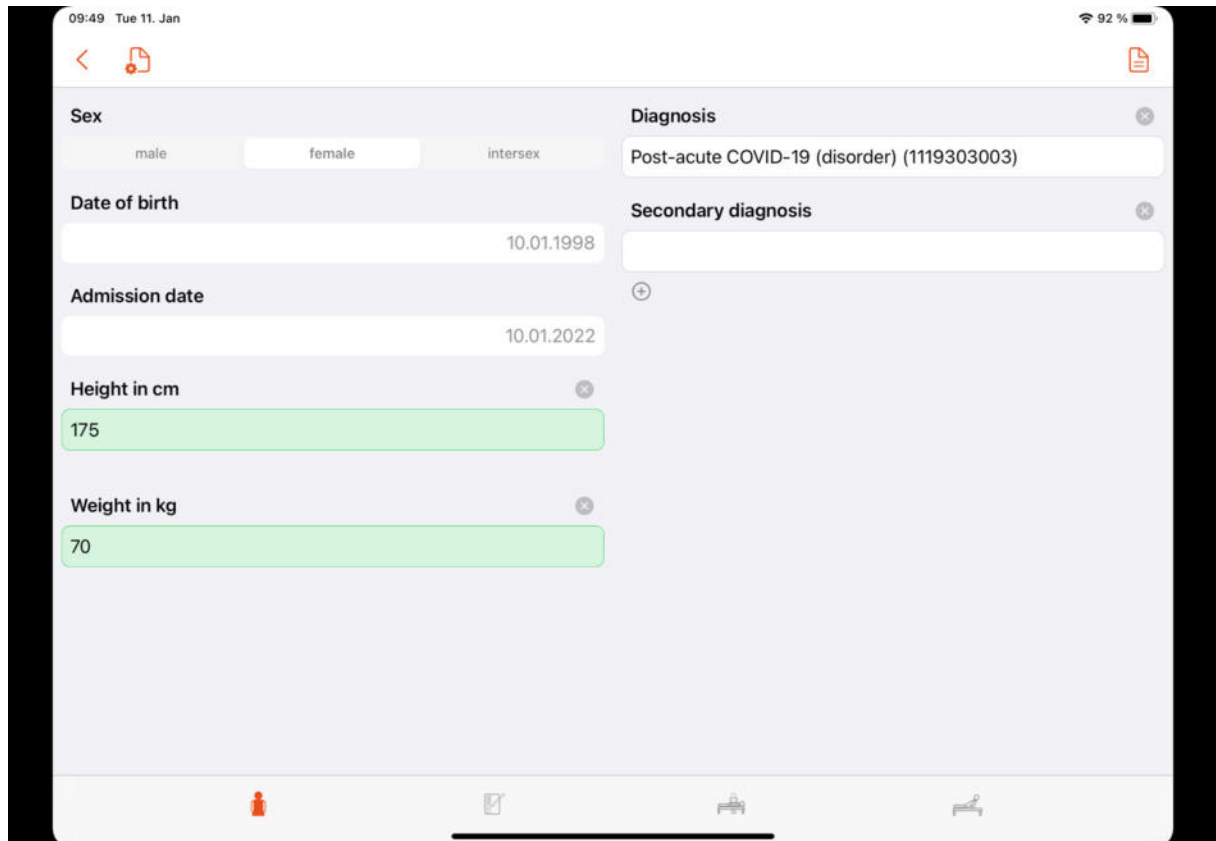


Figure 3: Loading an existing case

3. Document patient data

The first interface that is opened after a case is loaded is the patient tab. In this tab you can fill in the fields “Height in cm” and “Weight in kg”. If a numeric value is detected, the fields will be highlighted in green. If an invalid character is detected, the fields will be highlighted in red.

Additionally the main diagnosis can be documented. This can be done by typing in the field “Diagnosis”. Based on the inserted text (at least three characters) a list of diagnosis from the SNOMED terminology is shown. From this list you can choose the correct one. A secondary diagnosis can be filled in in the field below. Clicking on the little plus adds additional fields for further diagnosis.



The screenshot shows a mobile application interface for entering patient data. The top status bar displays the time 09:49, the date Tue 11. Jan, and a battery level of 92%. The interface is divided into two columns. The left column contains fields for Sex (radio buttons for male, female, intersex), Date of birth (10.01.1998), Admission date (10.01.2022), Height in cm (175), and Weight in kg (70). The right column contains fields for Diagnosis (Post-acute COVID-19 (disorder) (1119303003)) and Secondary diagnosis. The Height in cm and Weight in kg fields are highlighted in green, indicating valid numeric input. The bottom of the screen features a navigation bar with icons for a person, a document, a bed, and a chair.

Figure 4: Patient tab

4. Anamnesis documentation

4.1. Documentation of medical data

In the Anamnesis tab you can fill in medical information about the patient. Select one of the groups on the lefthand side. There you can mark the conditions which the patient suffers from and other medical data by clicking on the correct entries. They will then be marked with a little checkmark. There are also fields where you can fill in numeric values. If at least one of the submenus is filled in the exclamation mark is highlighted in yellow. You can click on a yellow exclamation mark in a group, to reset all entries in this group.

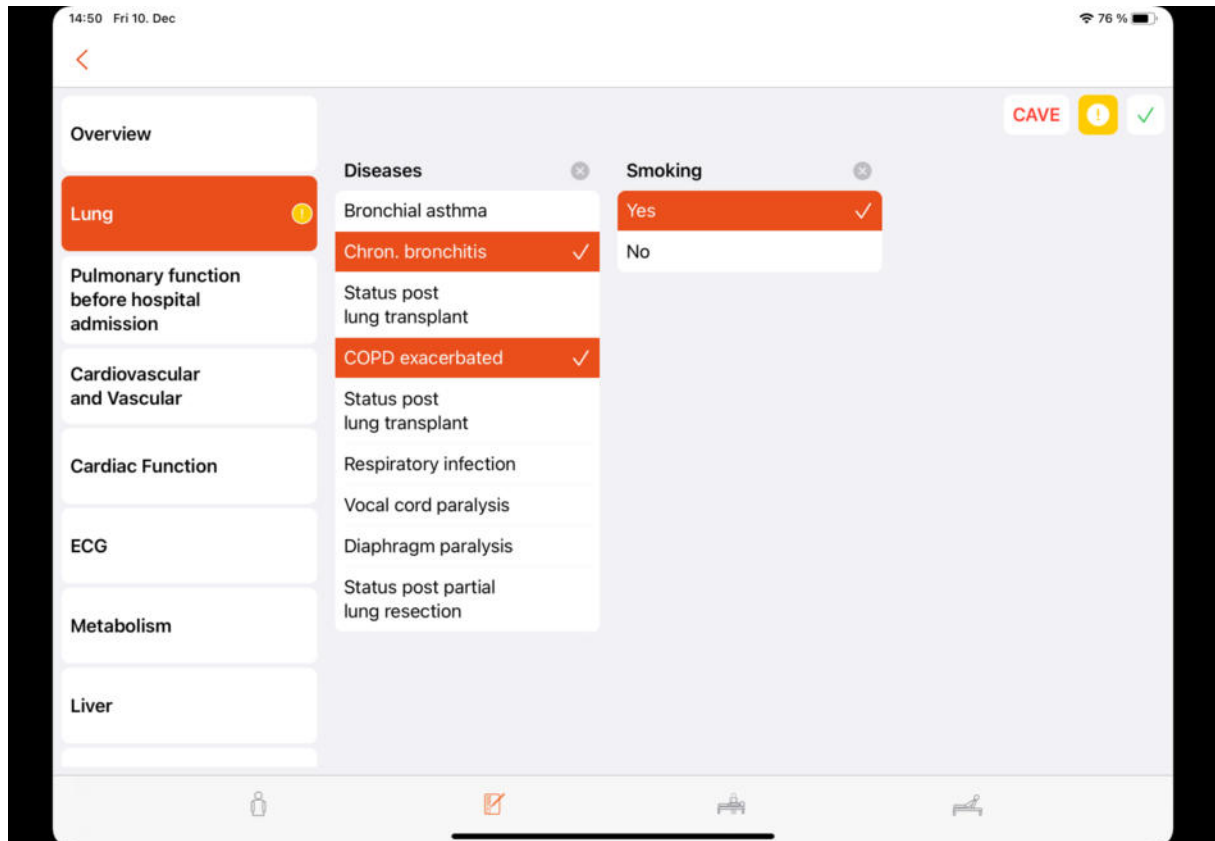


Figure 5: Anamnesis tab: Indicator edited

4.2. Green check mark as indicator: Completed

The group can be marked as completed, by clicking on the checkmark in the right upper corner. It will then turn green in the group menu and in the left column. The next group is opened automatically.

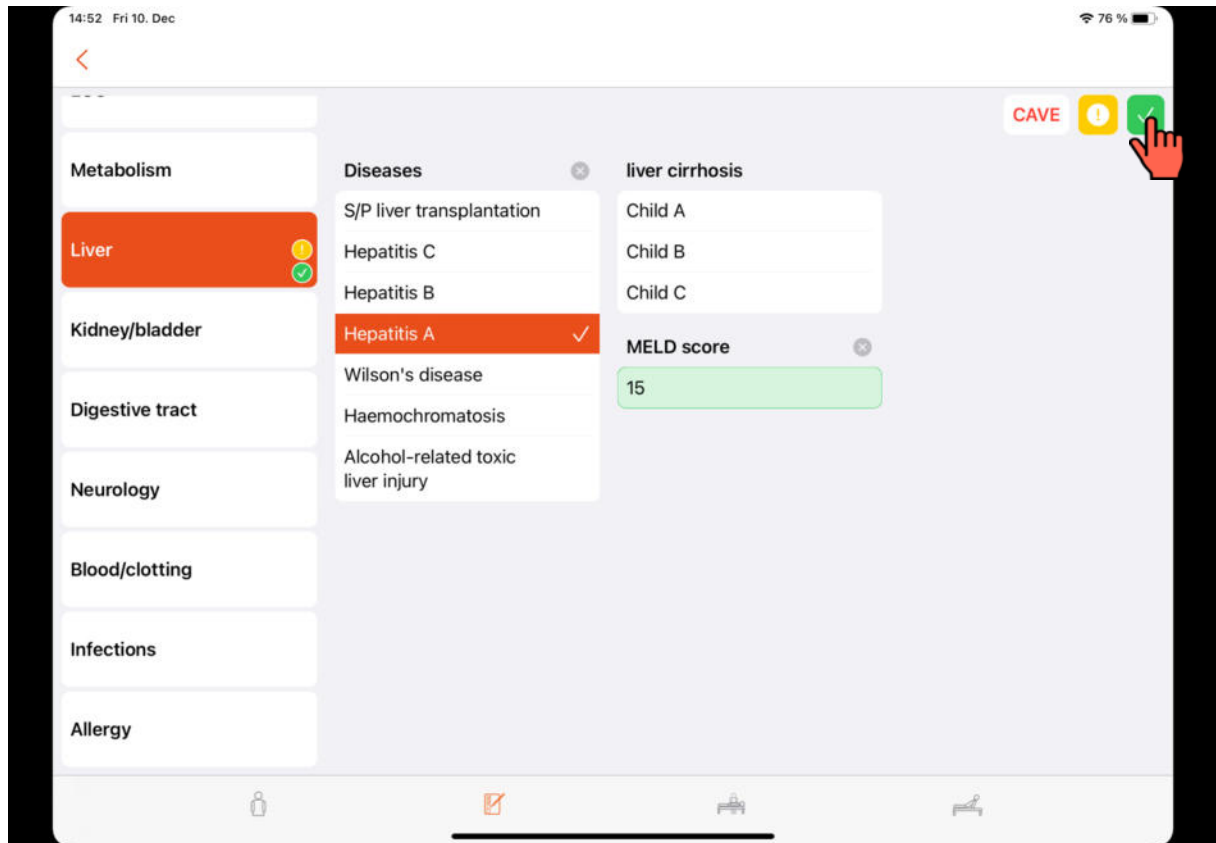


Figure 6: Anamnesis tab: Indication completed

4.3. CAVE as indicator: Critical entry

In case a condition may cause critical effects during the treatment and should be observed carefully, it is possible to set the flag CAVE. For this, click on CAVE in the right upper corner. The selected group will then be highlighted in red in the left column as well as the CAVE logo itself.

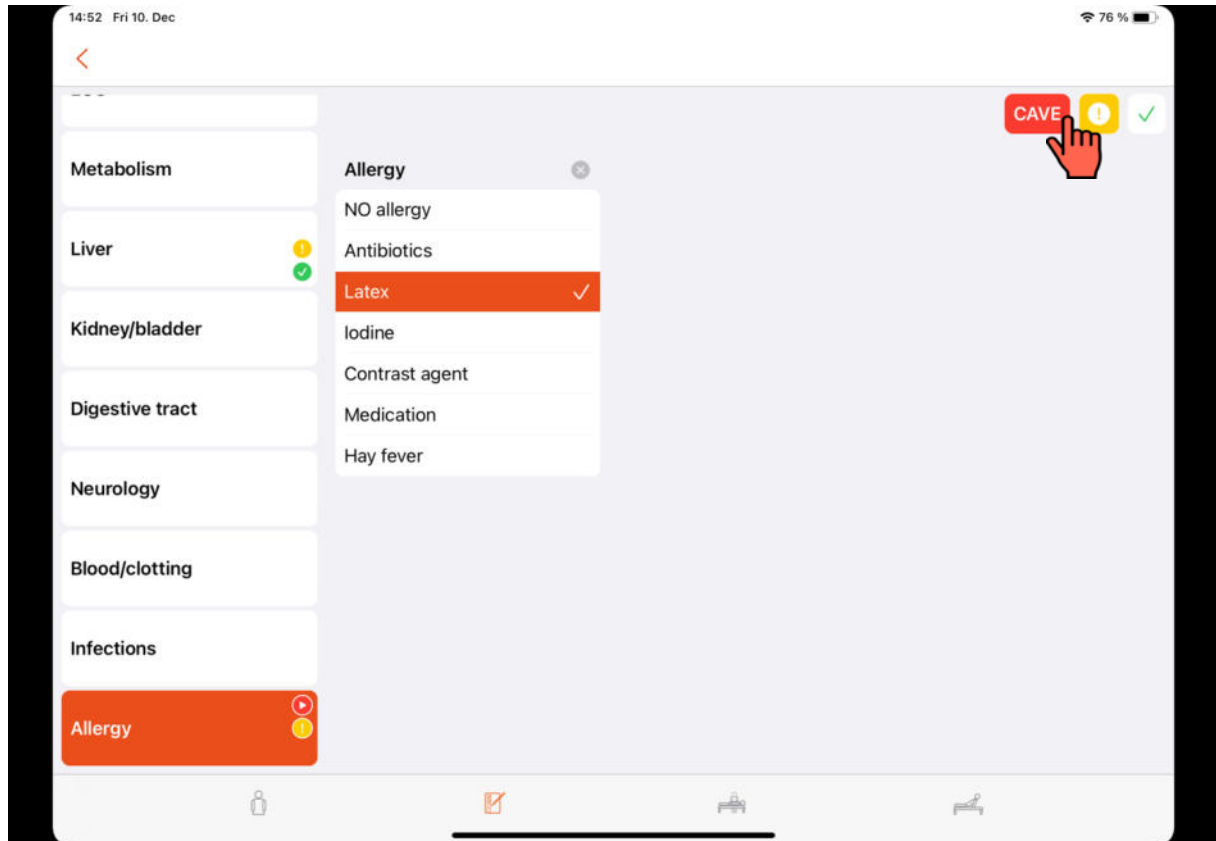


Figure 7: Anamnesis tab: Indication critical entry

4.4. Overview

All the filled in data is listed in the category “Overview”. In case CAVE was activated it is also shown here.

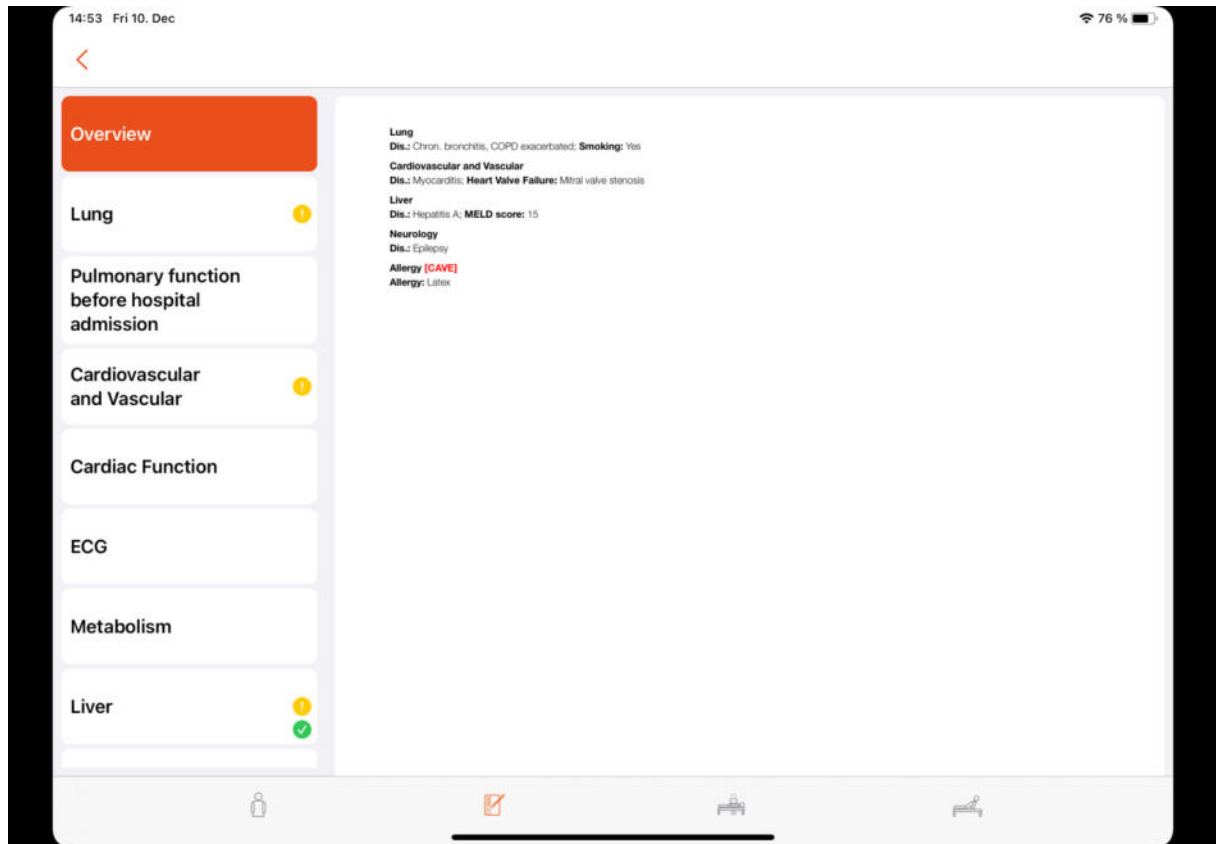


Figure 8: Anamnesis tab: Overview

5. Documenting the treatment in the ICU

At the top of the grid a timeline and the vertical red line represents the current point of time. The display in the ICU Tab is divided into two grids. In the upper half the given drugs and executed activities can be documented. In the lower half the data from the monitor and the ventilator is displayed and can be entered manually. The two sections can be enlarged by double-clicking in the desired section.

The list icon in the upper bar shows the overview of the anamnesis, as filled in before. If a group was marked with the CAVE flag, the icon is marked in red.

The timetable icon allows to jump to different positions on the timeline. Namely, the first entry, the last entry and the current point of time.

The monitor icon opens the window "Monitor overview". There you can connect the app to patient monitor and ventilator.

The page icon opens the "protocol selection" with the "Envision Form". This protocol can be printed and contains the case ID and other information about the case.

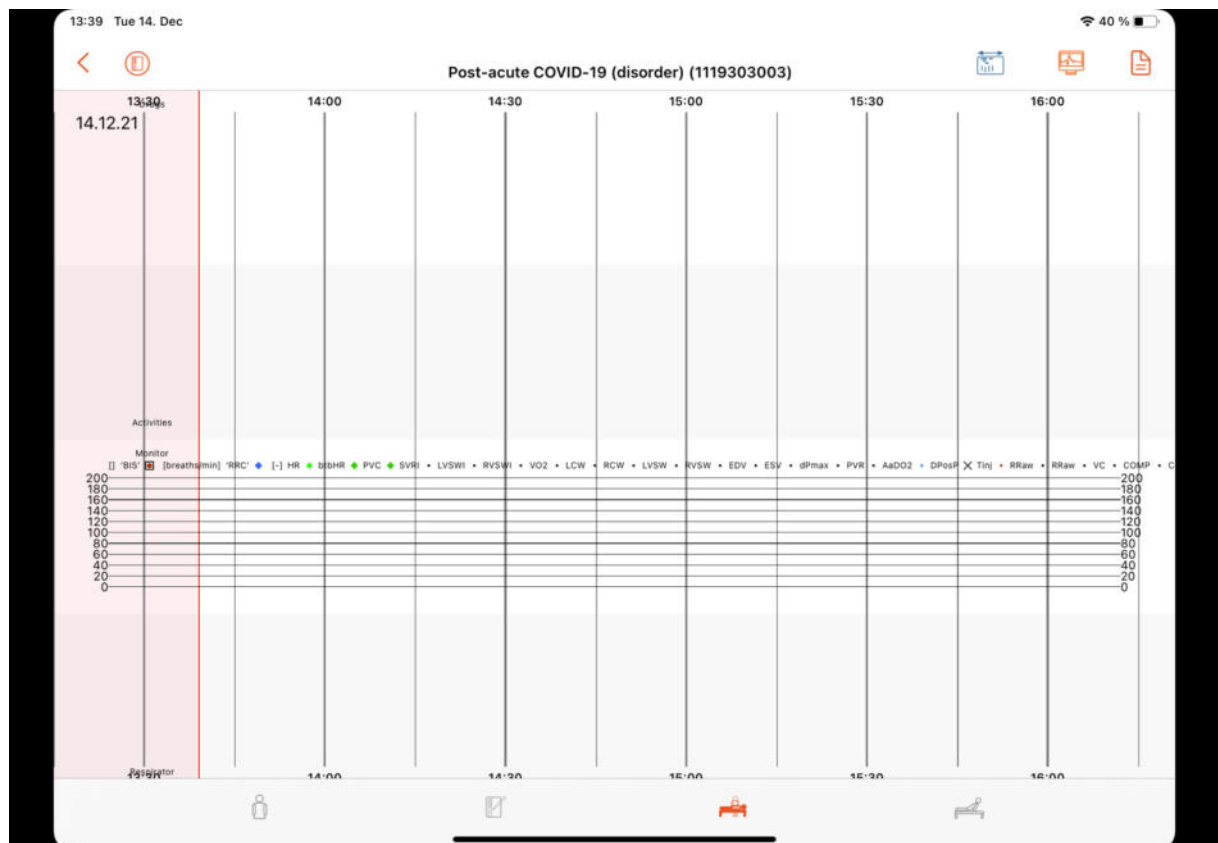


Figure 9: Overview ICU tab

5.1. Connect to medical devices

The medical devices can be connected with the App by clicking on the monitor icon in the upper bar. In the dialogue window the correct medical device can be chosen and selected by clicking on “Connect”. Please select the devices named with “envisionXXX Port 1” and “envisionXXX Port 2”. The number XXX can be found on the ComBox which the iPad is connected with.

Once the medical device is connected it is highlighted in green. After that you can click on “Done”. In the lower section you should then see parameters from the devices. The monitor icon in the upper bar is then coloured green.

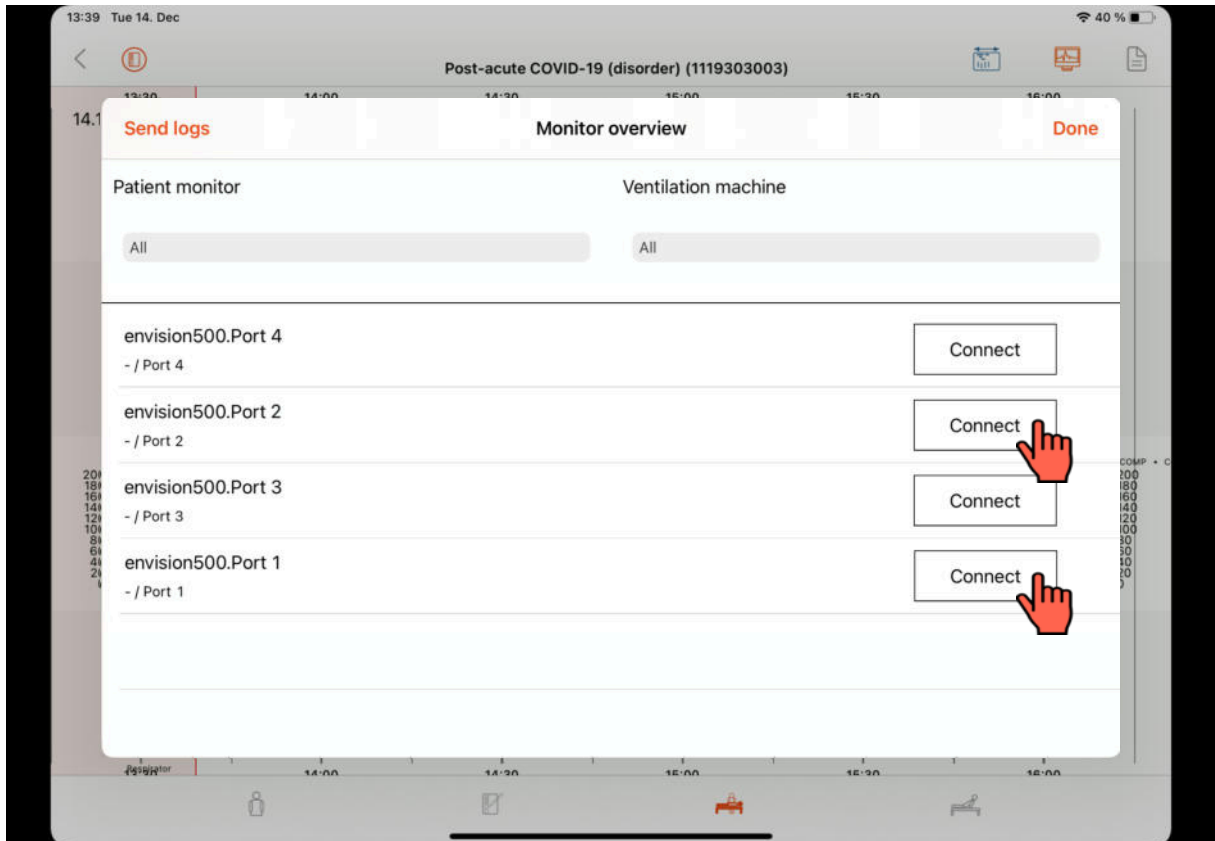


Figure 10: Connecting medical devices in the Monitor overview

5.2. Drug documentation

5.2.1. Documenting drug administration

Start the documentation by dragging the box “Drugs” into the grid. The left edge of the box represents the time of administration. After releasing the box a window is opened where you can first choose a type of drug, then select a certain drug and assign the amount.

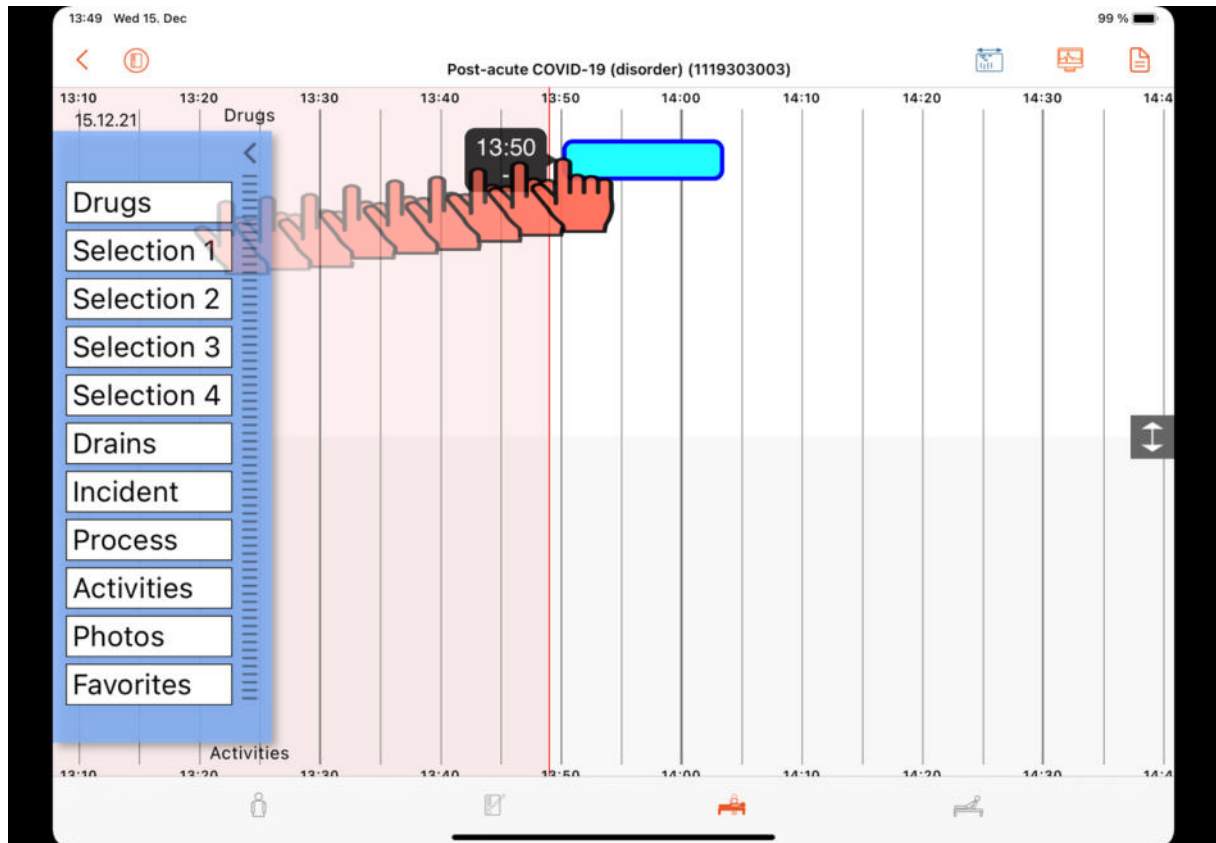


Figure 11: Documenting drug administration

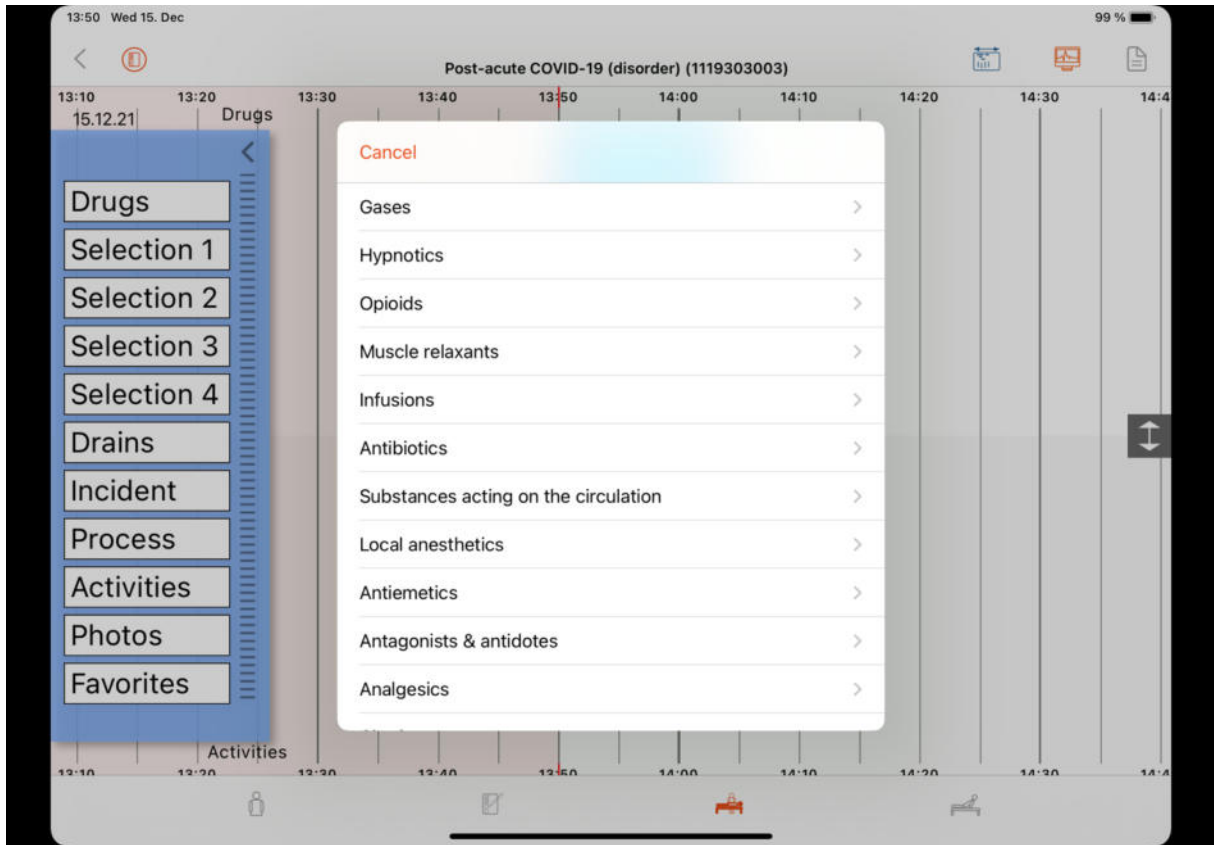


Figure 12: Types of drugs

5.2.2. Types of drug administration

You can also specify the way in which the drug is administered. Bolus, continuously or as infusion. Each drug has a default way of administration, but it can be changed by clicking on the correct type. Based on the way of administration the window has slightly different options.

“Bolus”: Assign the total amount administered to the patient

“Continuous”: Assign the amount administered to the patient per hour

“Infusion”: Assign the size of the infusion bag

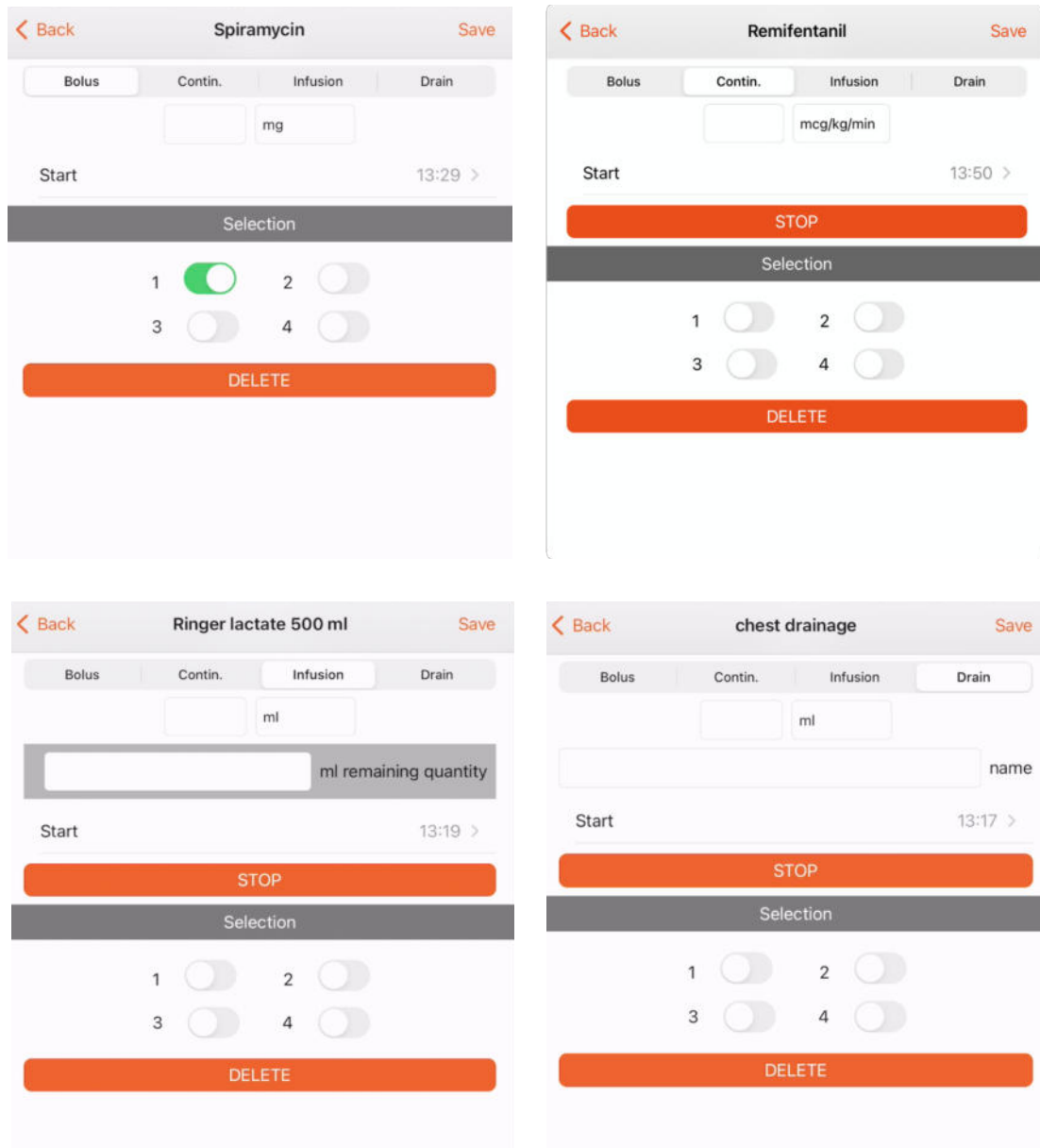


Figure 13: Types of drug administration and drain

Documenting a drain can be done analogously, by dragging the box “Drains” into the grid.

5.2.3. Grouping drugs and drains

Drugs and drains can be grouped in Selections to allow a faster access. This can be done by setting one or multiple selection flags. In order to access this selections drag the requested one into the grid. All the selected items will then appear in the grid. However, as their amount is set to 0, you need to open each drug administration and assign an amount.

5.2.4. Change settings in the drug detail window

You can click on an entry, hold it and then drag it to another point of time on the timescale. A drug administered as bolus is moved as a whole, whereas in case of continuously administered drugs, infusions or drains only the start time is changed. The end time is the current point of time.

Clicking on one of the entries opens its detail window. Based on the way of administration the window has slightly different options. In every case the entry can be deleted here. Additional options are described in the following:

“Continuous”: The flow can be changed and stopped.

“Infusion”: The exchange of the infusion bag can be documented with “Bottle change”. Then you need to fill in the remaining quantity in the old bag. The consumed amount will be calculated automatically. The infusion can also be stopped.

“Drain”: The exchange of the collection bag can be documented with “Container change”. You will be asked to state the withdrawn amount. The drain can also be stopped.

The change of flow, the exchange of an infusion bag or a collection container can also be done by placing two fingers next to each other on the entry and moving them to the time of change. In the appearing window you can then document the change.

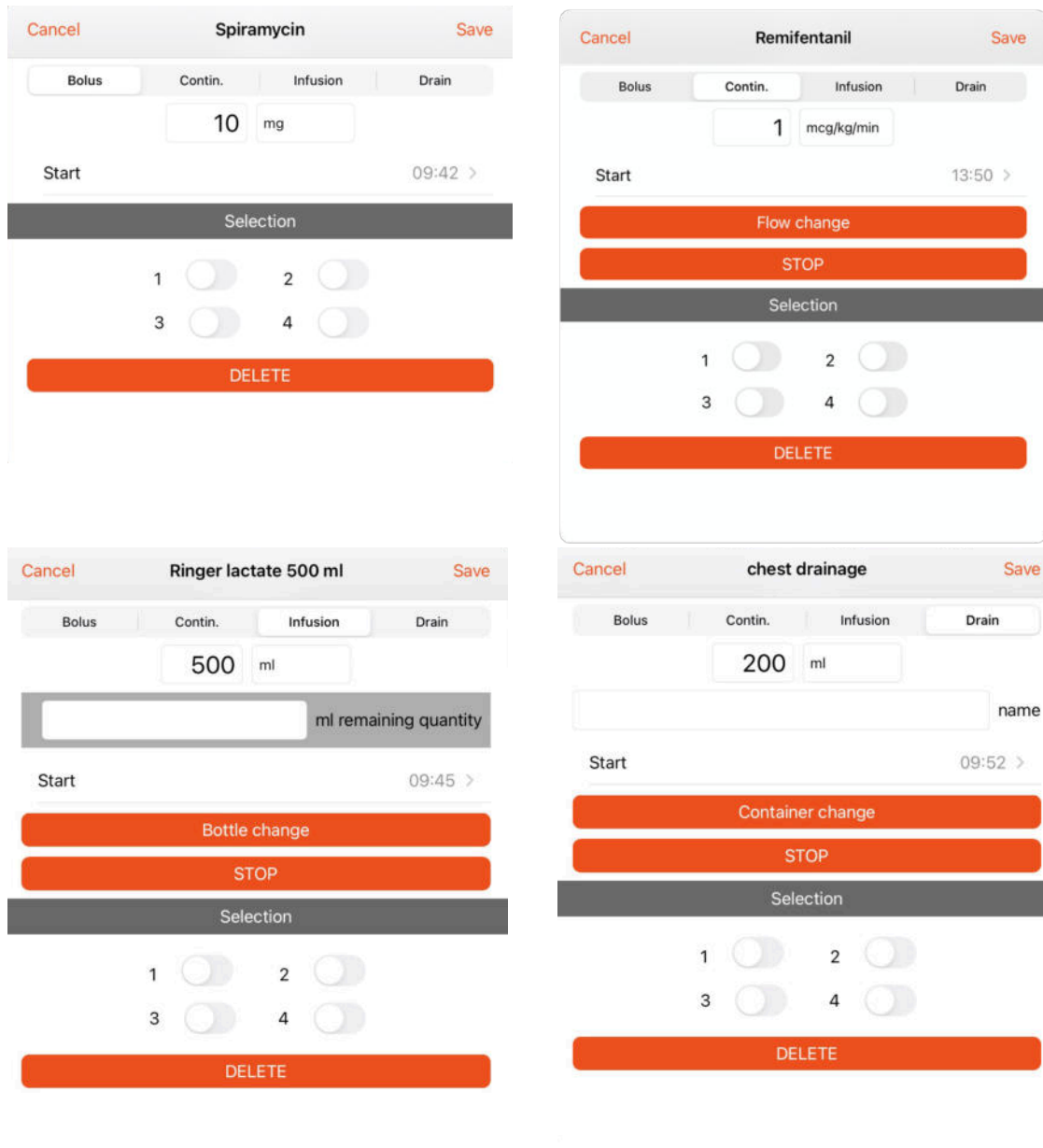


Figure 14: Detail windows for different types of drug administration and drains

5.3. Activity documentation

5.3.1. Documenting processes

Start the documentation by dragging one of the boxes (“Incident”, “Process”, “Activities”) into the grid. The left edge of the box represents the time of the activity.

Logistical events, such as transports are grouped in “Process”. There you can also document the discharge or the death of the patient. The processes “ICU admission” and “ICU discharge” are mandatory before closing the documentation. “ICU admission” should be documented as soon as the documentation has been started.

“BTM destruction” and “chief medical” are special in that regard, that an authentication is needed to document these two processes. It must be predefined who is allowed to authenticate these. The other processes do not require any further information.

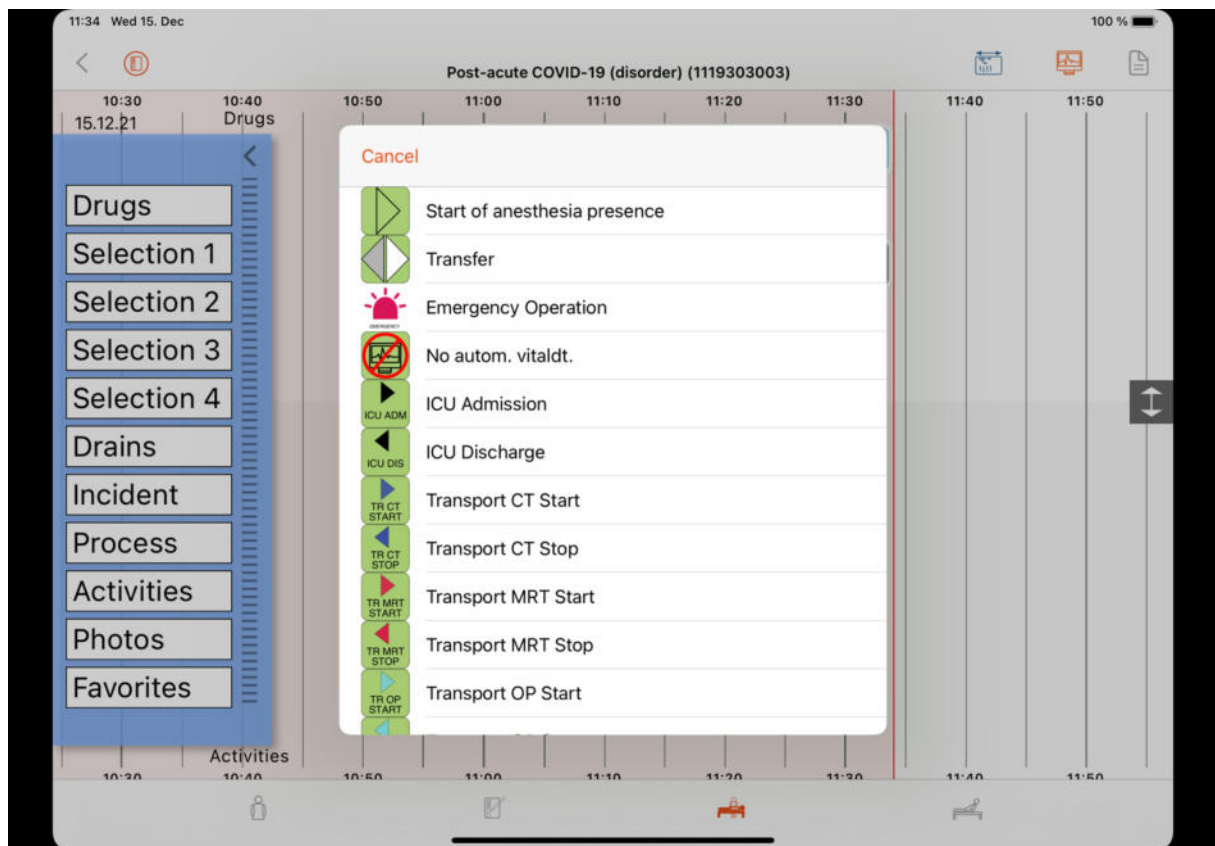


Figure 15: Category "Process"

5.3.2. Documenting activities

“Activities” comprise other events, like positioning the patient or monitoring. If the patient is ventilated and/or anesthetized, it can be documented here. Furthermore, diagnosis during the treatment can be documented in the subgroup “SNOMED CT”, analogously to the patient tab.

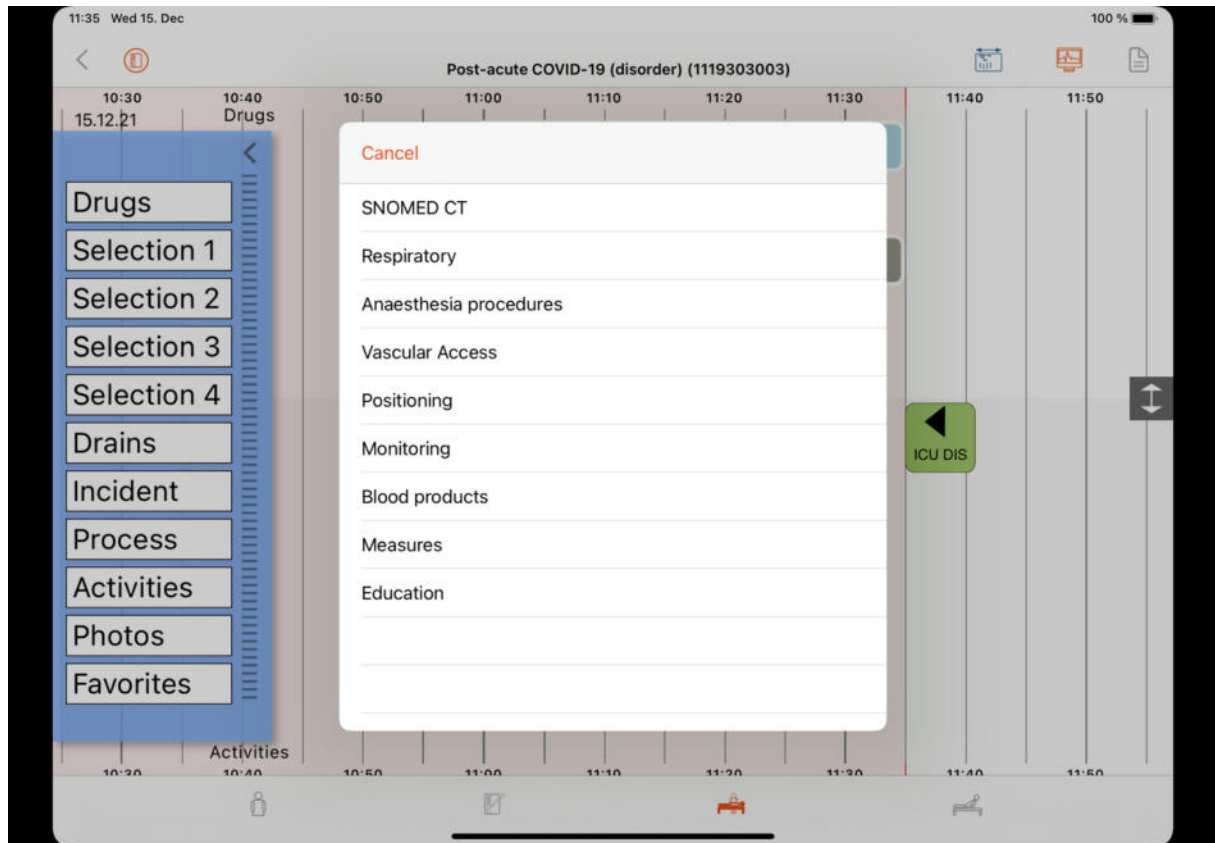


Figure 16: Category "Activities"

5.3.3. Documenting incidents

In the group "Incident" critical events during the ICU can be documented.

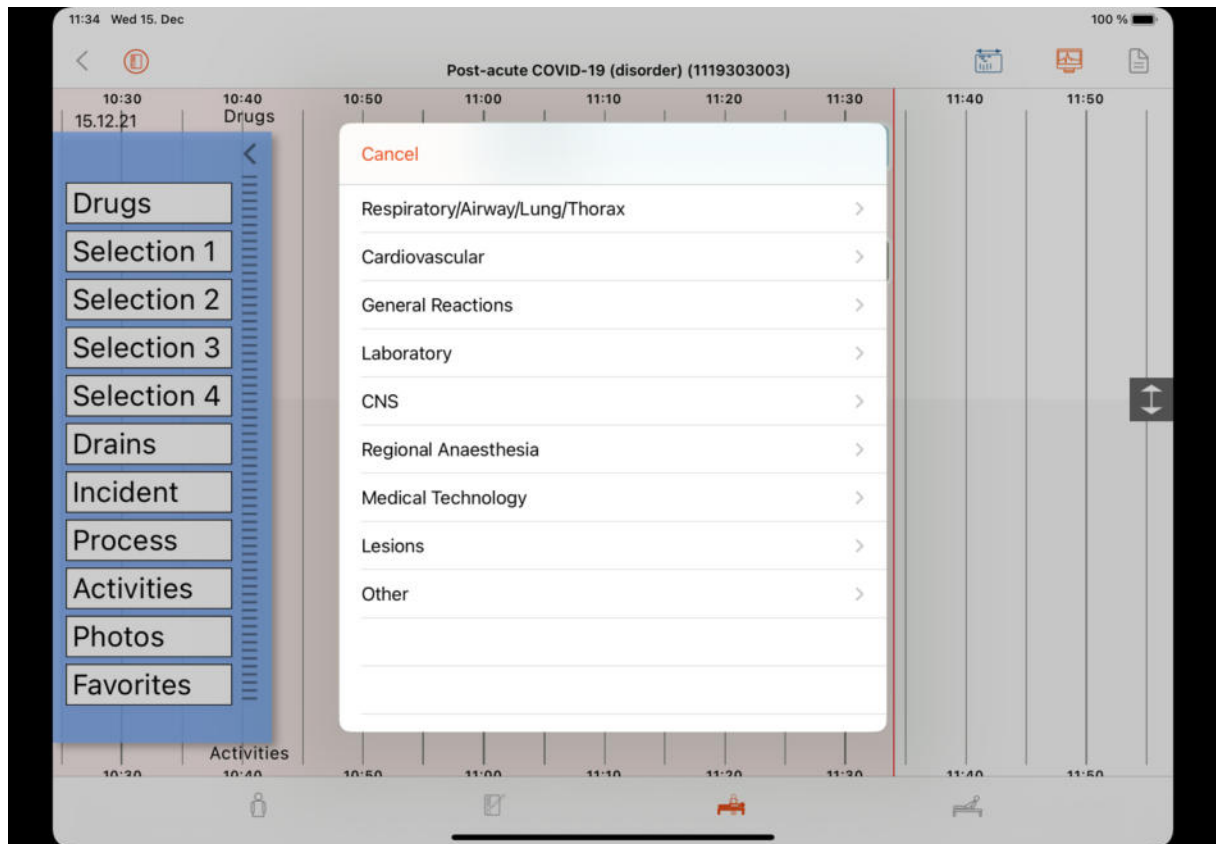


Figure 17: Category "Incident"

5.3.4. Setting Favorites

You can add entries to favorites. If you drag the group “Favorites” into the grid, a menu will be opened with all these entries.

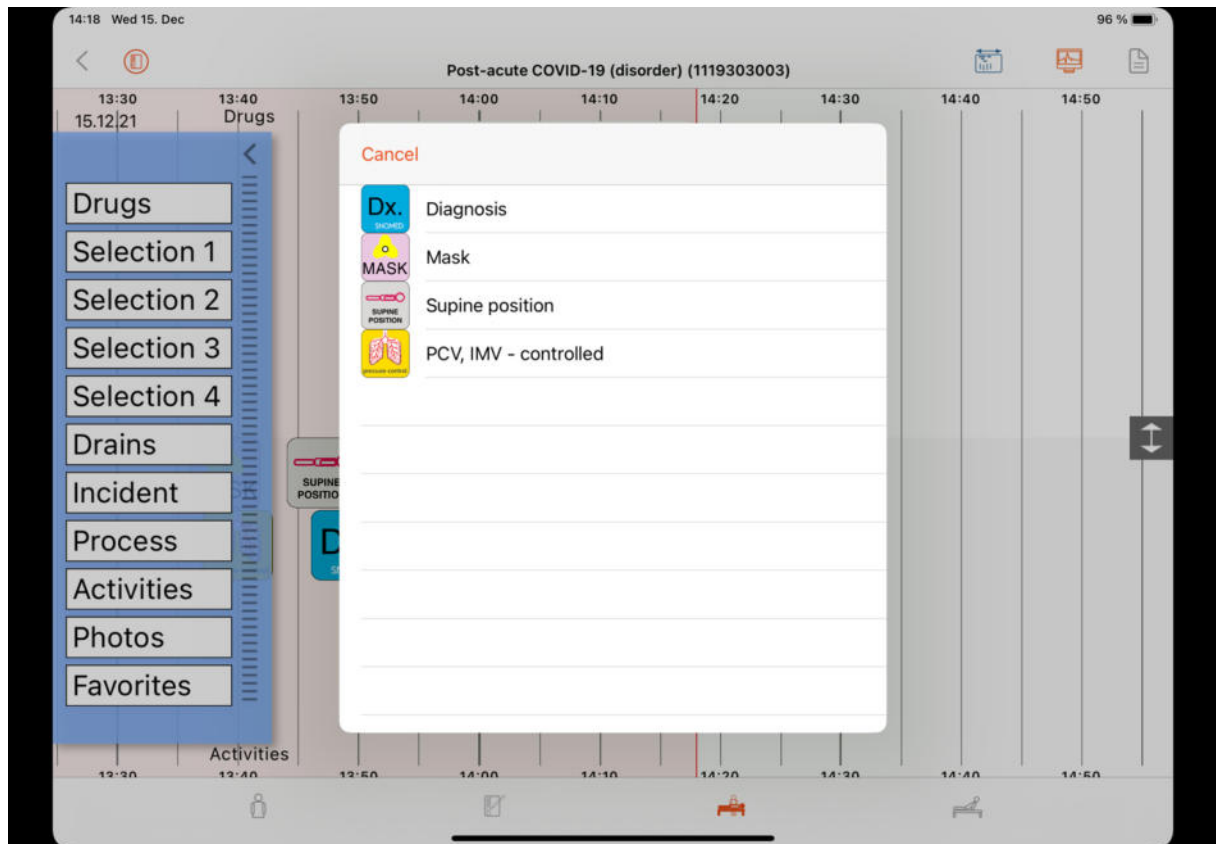


Figure 18: Category "Favorites"

5.4. Documentation of vital parameters and respiratory data

5.4.1. Automated data documentation

Once the medical devices are connected the data is displayed. In the upper half the data from the patient monitor is plotted and below that the respiratory data. Each value is saved every minute, but not necessarily displayed every minute. The time interval in which the values are displayed can be configured.

Patient monitor

The grid in the upper half shows the parameters of the monitor. The x-axis shows the time and the y-axis contains two scales. One of the scales is shown on the left hand side of the grid and the parameters are listed above. The other scale is plotted on the right hand side and the parameters of that scale are shown below. The value range of the scales, as well as the symbols and colours of each parameter can be configured. The time interval in which the data is displayed differs for different parameters.

Ventilator

The data from the ventilator is shown in the lower half. The data there is also displayed on the time axis. The rectangle with the values is located in such manner that the left edge represents the time of data collection. The vertical position of the entries has no further meaning. The data is displayed every ten minutes in the default setting.

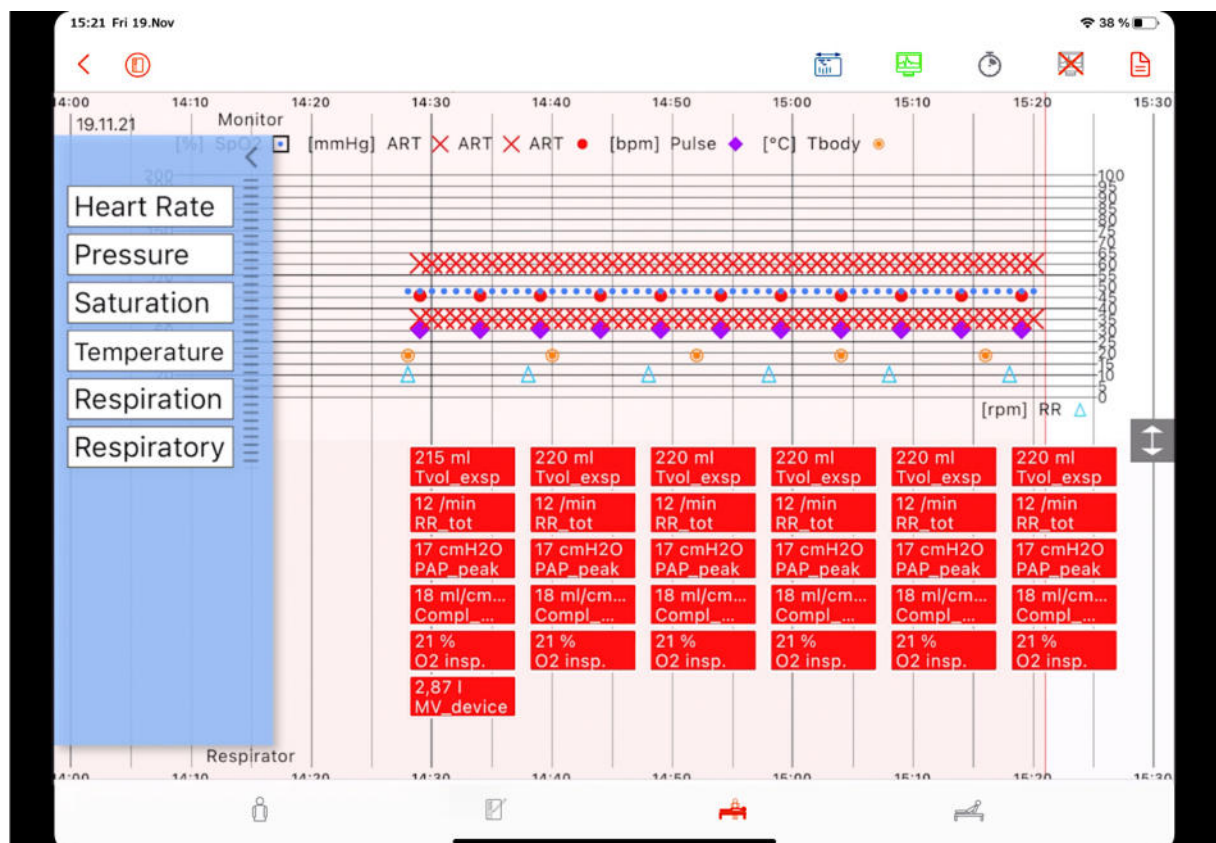


Figure 19: Automated data documentation

5.4.2. Manual data documentation

In addition to the automated documentation data can also be added manually. In order to do this drag the requested group into the grid and assign the value. Then click on save.

An already existing entry can be changed either in the detail window by clicking on it, or by moving it in the grid. The time can be changed by clicking on the entry and moving it horizontally to the correct point of time. The parameters of the patient monitor can also be moved vertically, to change their value according to the respective scale. This cannot be done with the respiration data. After releasing the entry at the desired place, a window will pop up. You have to confirm the moving, to prevent the unintended changing of entries.

An entry can be deleted in the detail window.

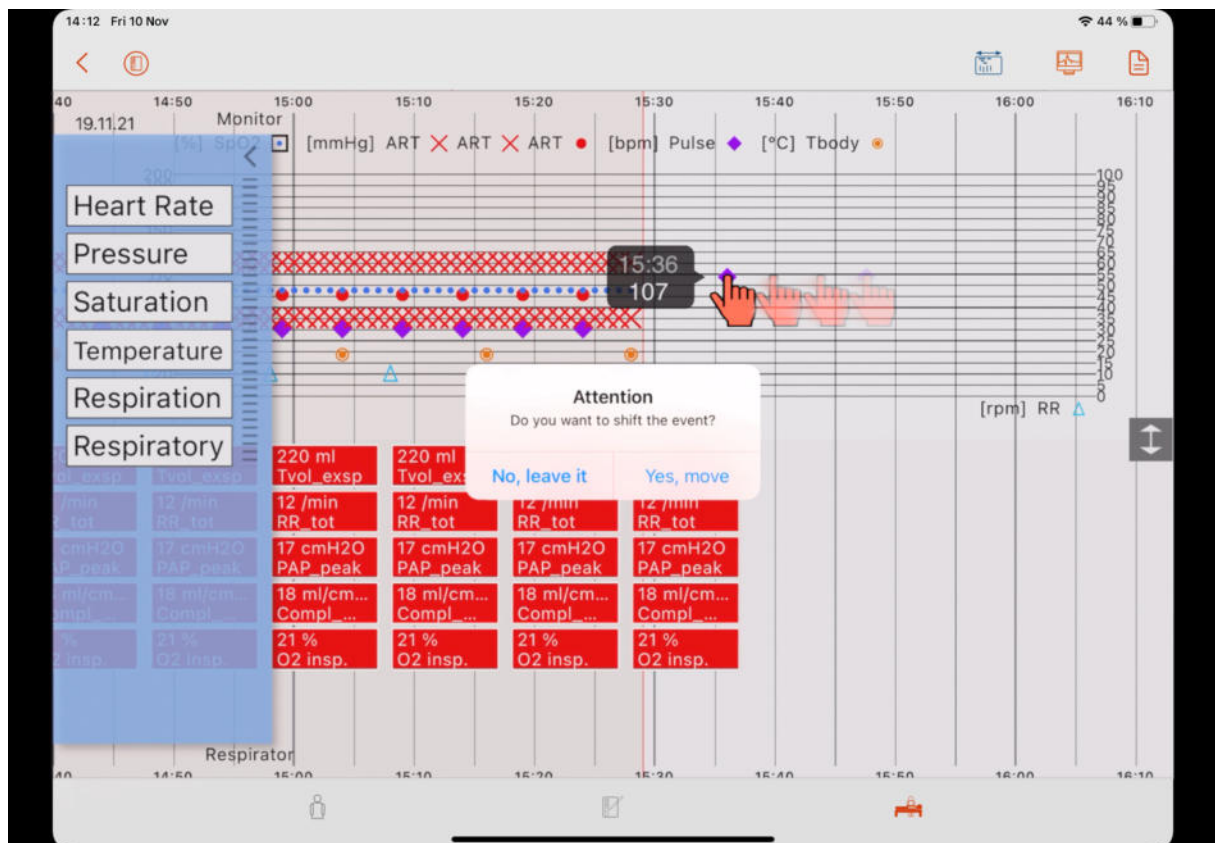


Figure 20: Moving of entries

5.5. Saving the treatment data

The treatment data shall be saved at least every 24 hours. For this the medical devices need to be disconnected. Then the treatment can be uploaded to the server and immediately afterwards downloaded again.

5.5.1. Disconnecting medical devices

Disconnecting the medical devices can be done in two ways. You can end the connection for every medical device individually. For this go to “Monitor Overview” by clicking on the green monitor icon in the upper bar of the ICU tab. You can then click “Stop” for every device. In order to disconnect all devices you can click on the crossed out monitor.

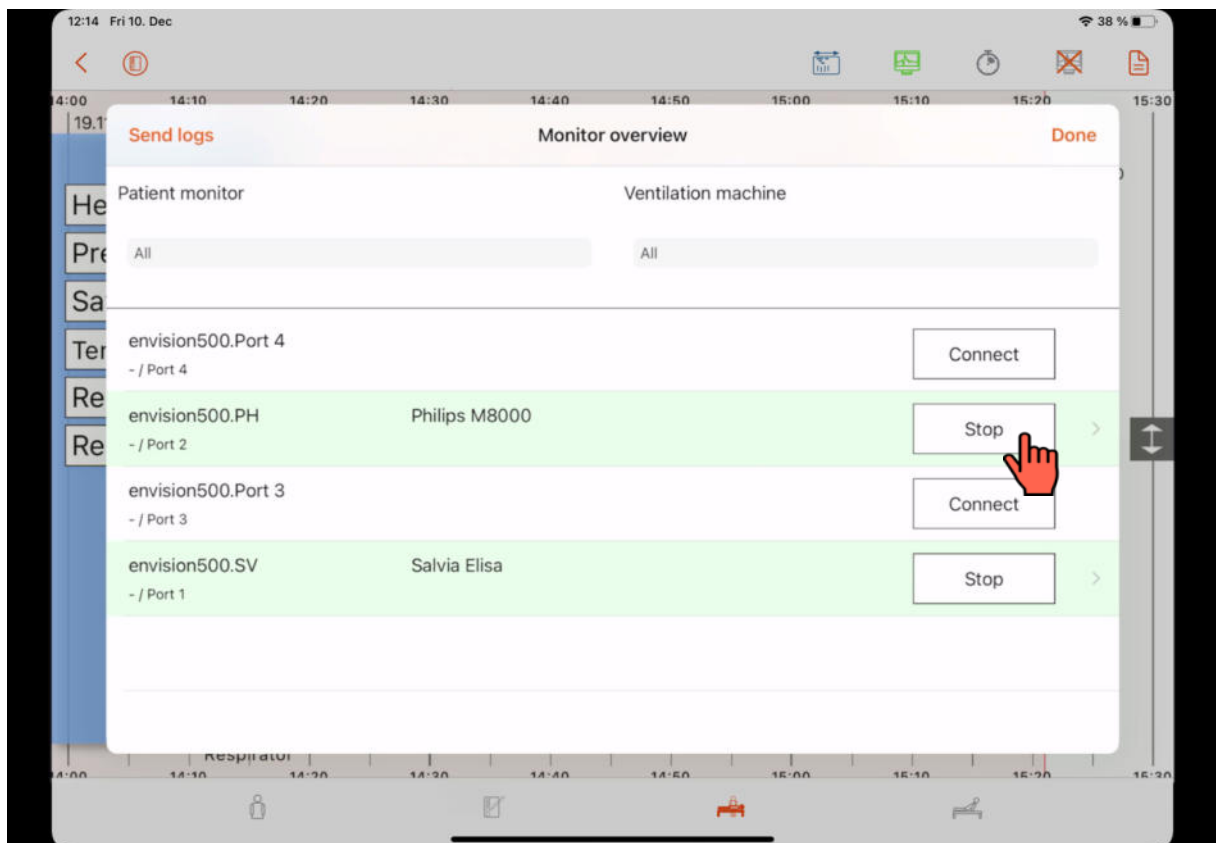


Figure 21: Disconnecting medical devices in the Monitor overview

5.5.2. Uploading treatment

After disconnecting the devices, go back to “Treatments” by clicking on the right arrow in the left upper corner. Load the treatment data onto the server by clicking the red arrow pointing down on the ride side. The treatment changes from “In Progress” to “Available”.

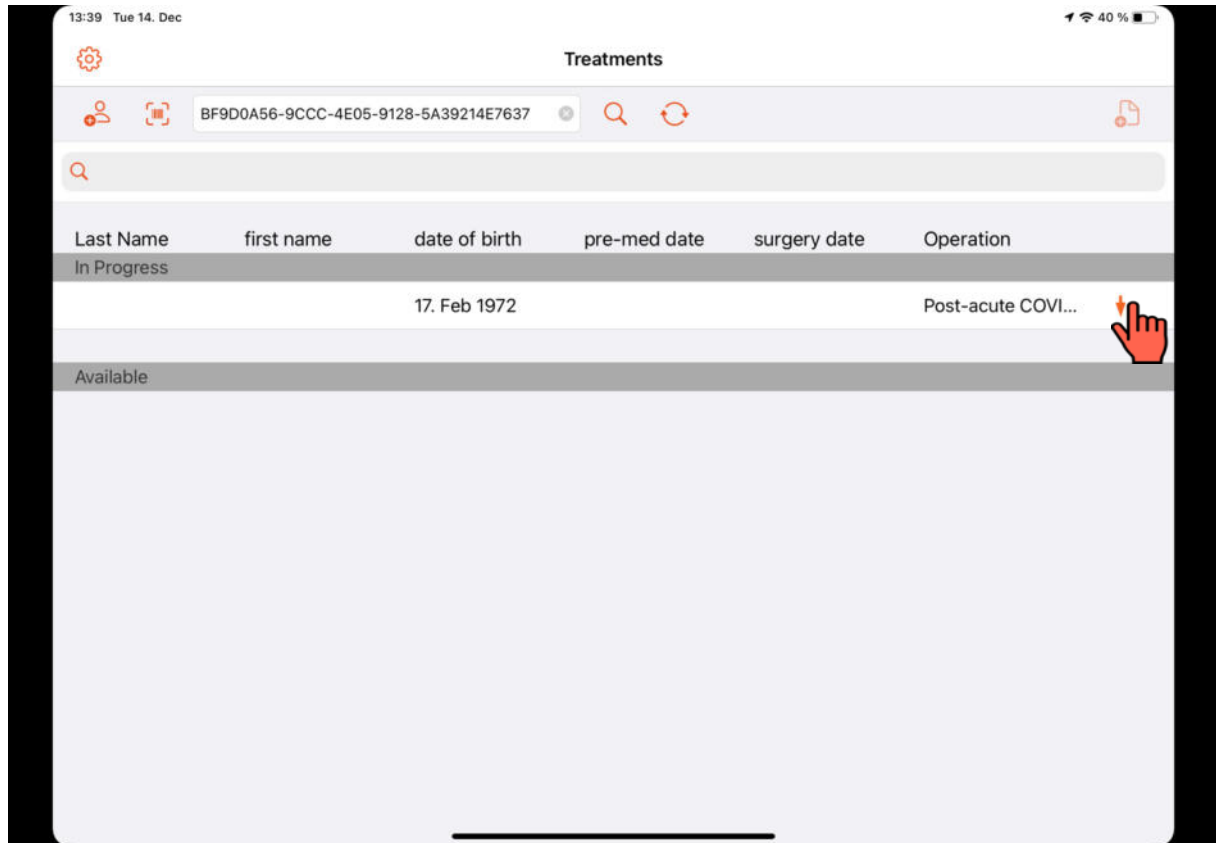


Figure 22: Uploading the treatment to the server

5.5.3. Reloading treatment

After saving the data on the server, you can immediately reload it. Select the red arrow pointing up at the right hand side to open the case again and get to the patient mask. You can then continue the documentation.

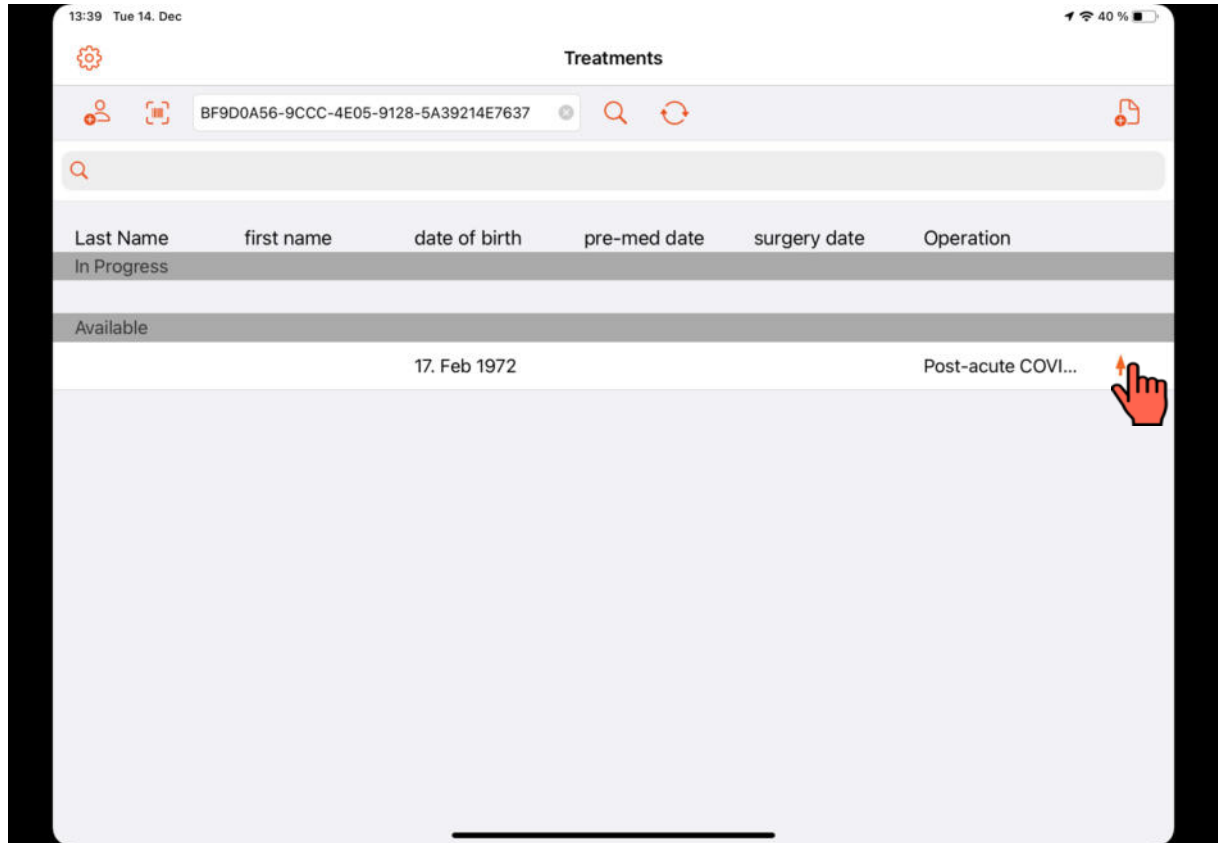


Figure 23: Reloading the current treatment after saving

6. Discharging the patient

Documenting the discharge of the patient requires the closing of the treatment documentation, additional information about the discharge and ends with the upload to the server.

6.1. Information about the discharge

In the fourth tab in the lower navigation bar you can specify the discharge of the patient. Insert the date of discharge. You can also fill in either the date of death or define where the patient is discharged to. In the second category you can note the pulmonary function at the hospital discharge, by documenting the vital capacity of the patient. In the group "Overview" you can see all the data you filled in in this tab.

The indicators in the right upper corner are analogous to the ones in the anamnesis.

If at least one of the submenus is filled in the exclamation mark is highlighted in yellow. A group can be marked as completed, by clicking on the checkmark in the right upper corner. It will then turn green in the group menu and in the left column. CAVE can be activated to mark a critical entry.

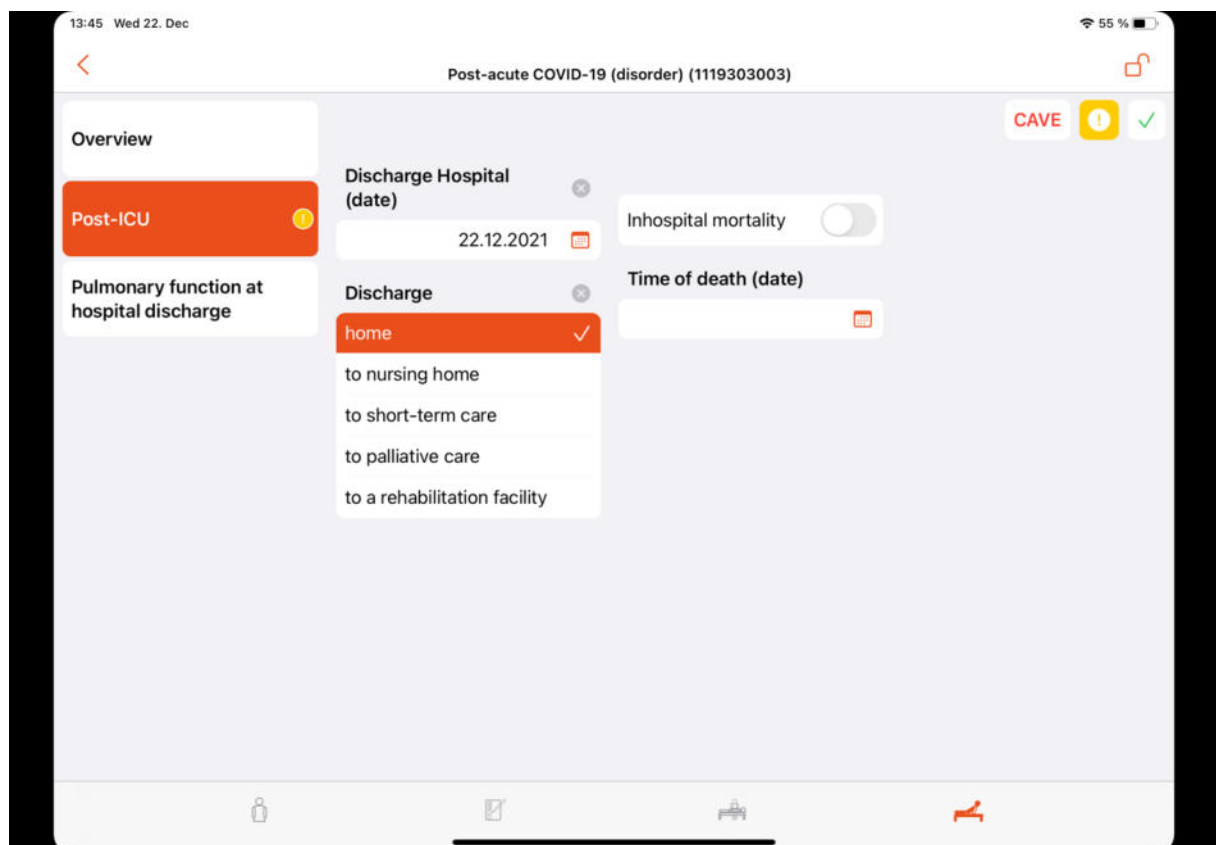


Figure 24: Post ICU tab

6.2. Closing the documentation

The documentation can be closed by clicking on the open lock in the upper bar of the Post-ICU tab. Before that, the process "ICU Discharge" needs to be dragged into the ICU grid. The process "ICU Admission" is mandatory, too. Without this the plausibility check would give a warning and will not allow you to close the documentation.

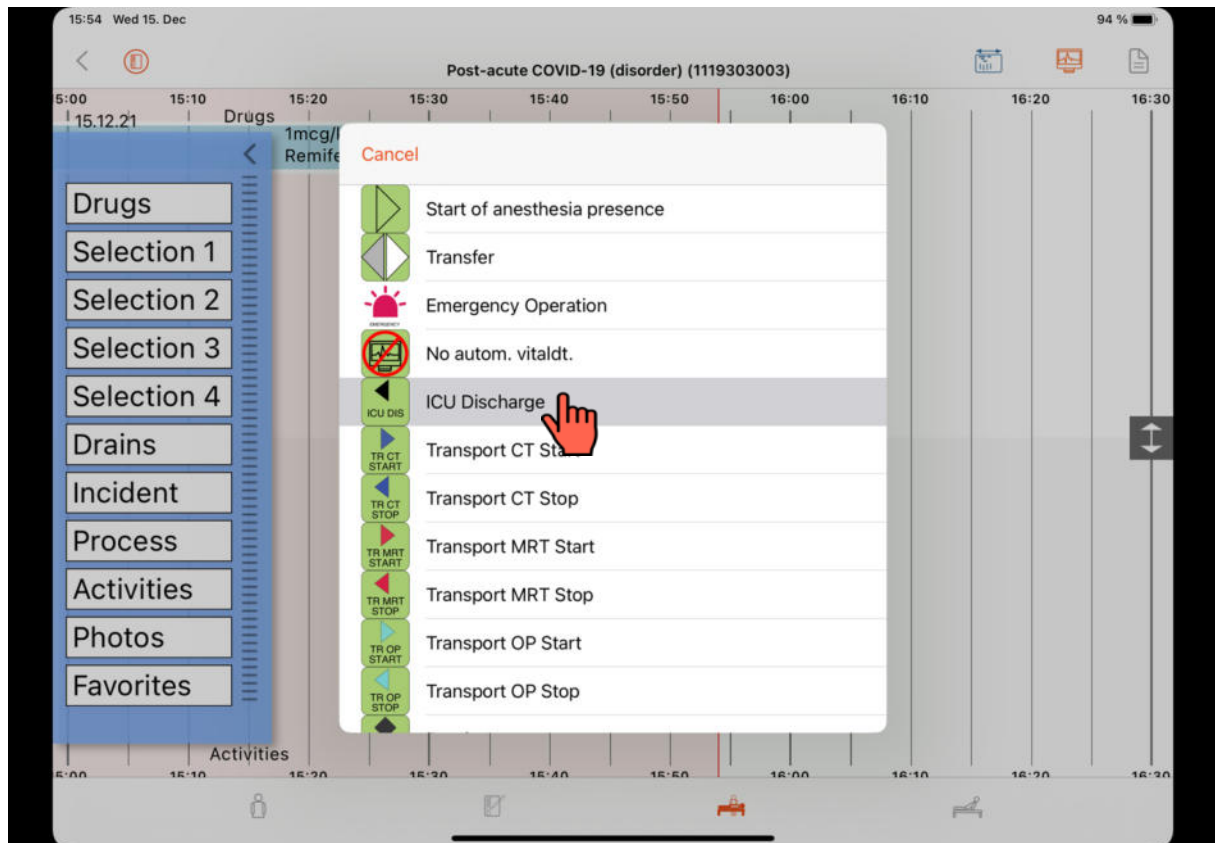


Figure 25: Documenting the process "ICU discharge"

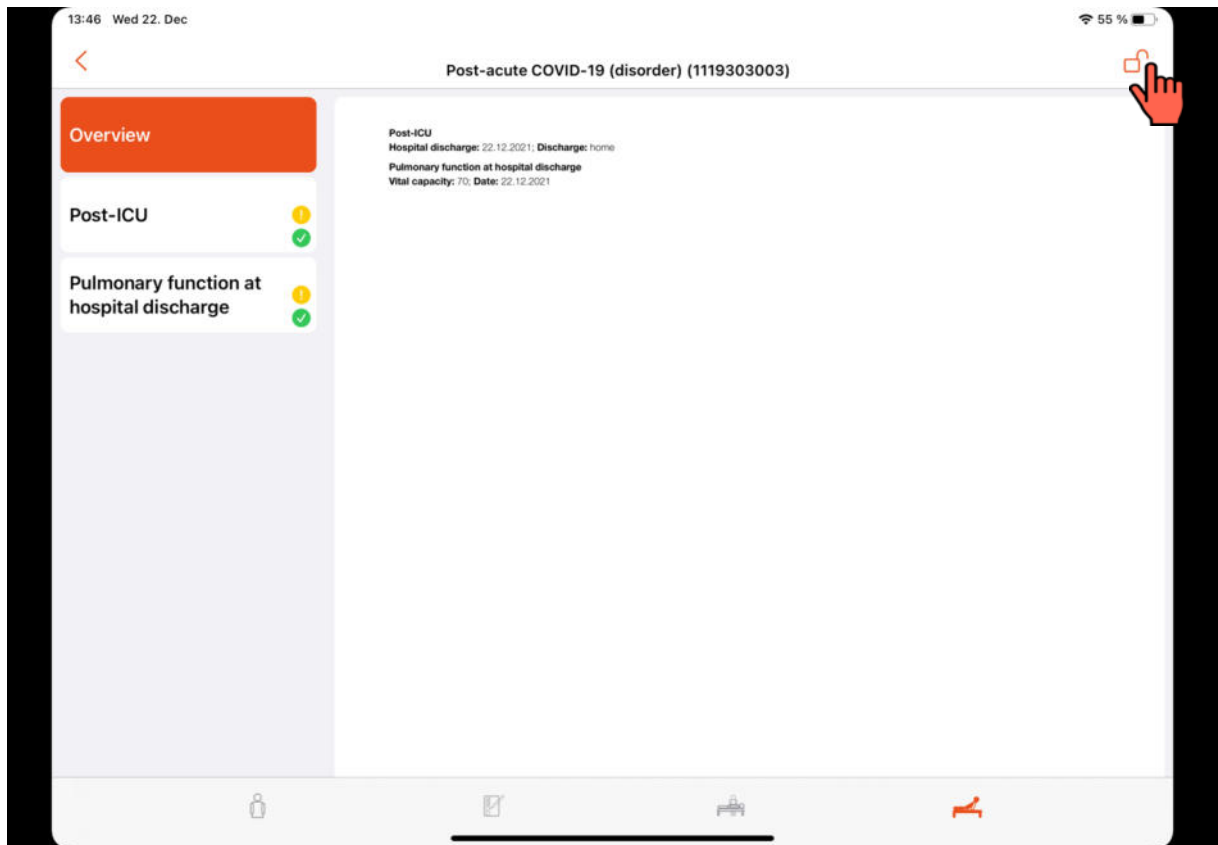


Figure 26: Closing the documentation

After a successful closing the grid will be shaded in gray and the lock icon will change from open to closed. The entries can then no longer be edited, but still be viewed. Should the necessity arise that the documentation needs to be edited it can be unlocked by clicking on the closed lock icon in the Post-ICU tab.

6.3. Uploading the treatment

After closing the treatment and documenting the discharge, the treatment must be stored in on the server. In order to do this, go back to “Treatments” and click on the orange arrow pointing down. The treatment will change from “In Progress” to “Available”. You can then create a new case, by clicking on the icon of the person with a plus.

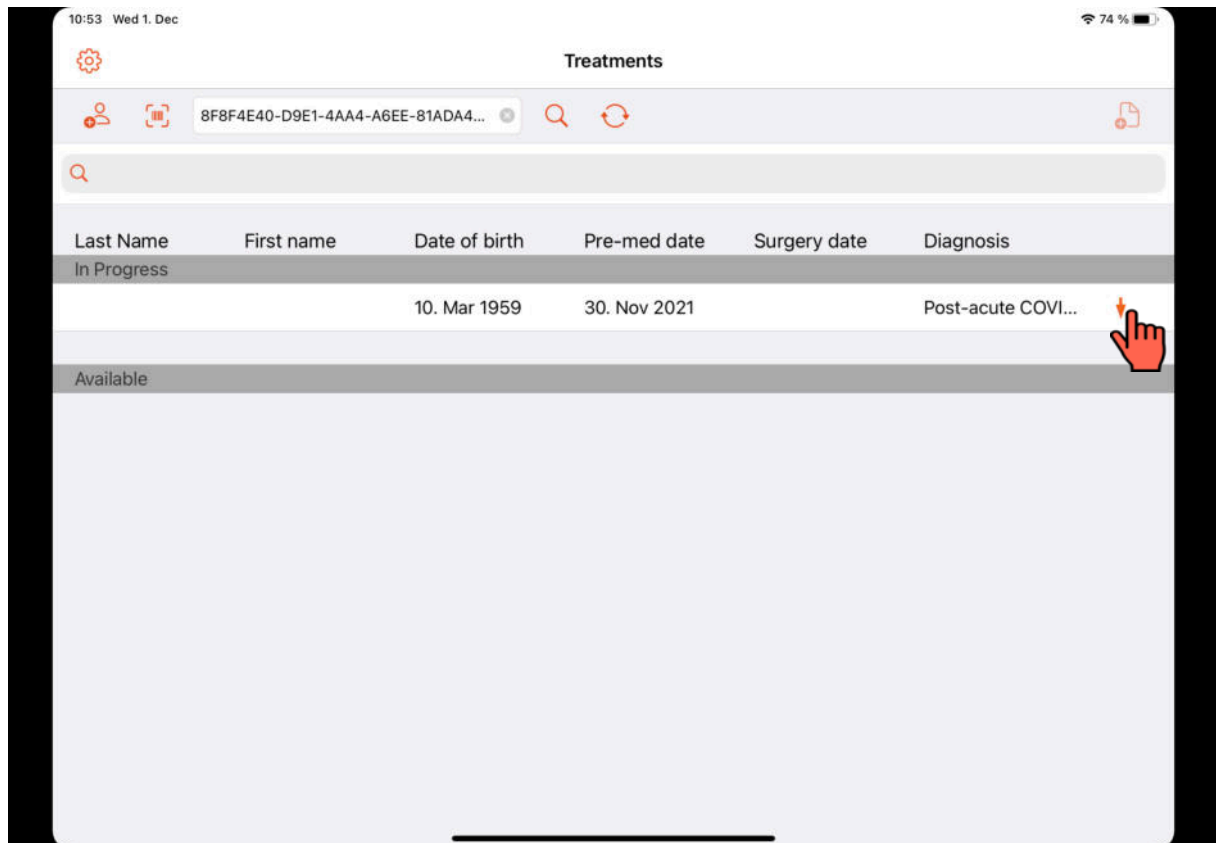
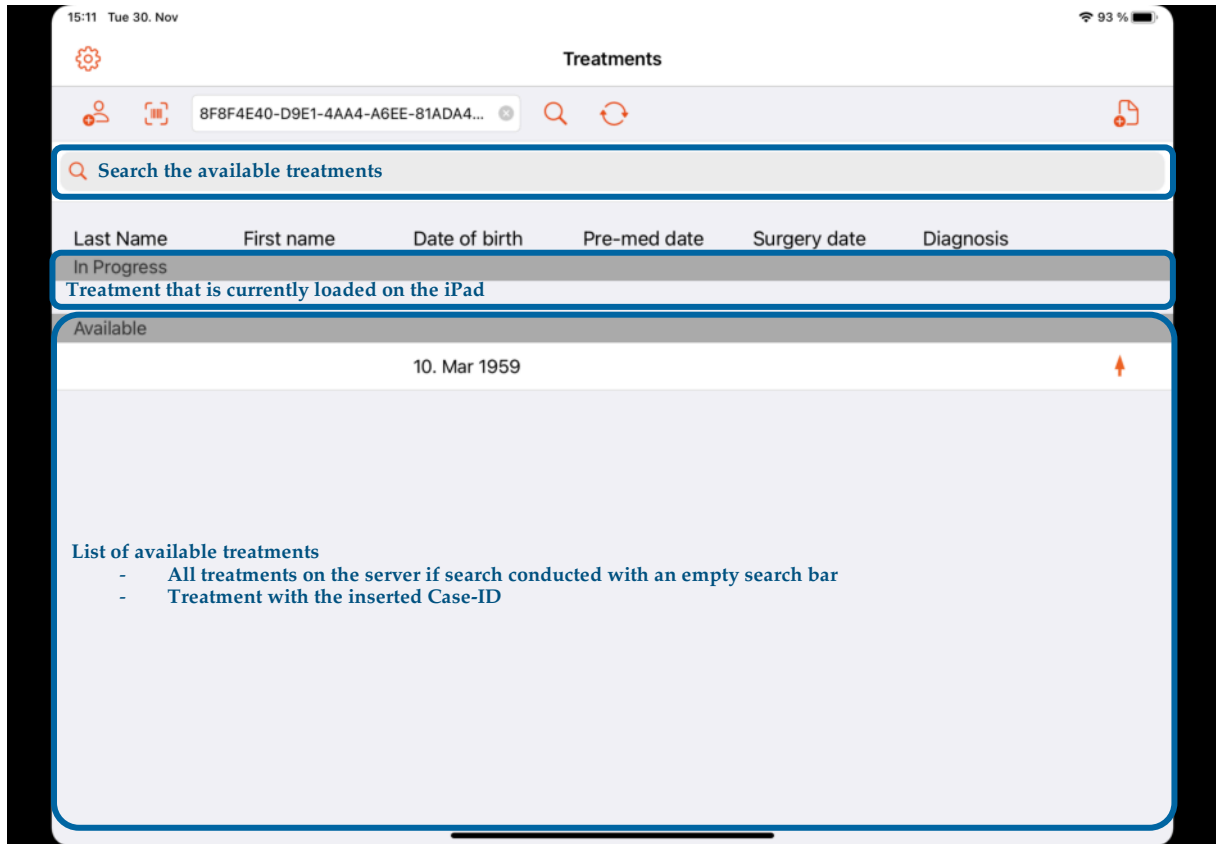









Figure 27: Uploading the treatment

Appendix: Screens and Icons

Treatment overview



Symbol	Name	Description
	Settings menu	Opens Settings: “Change password”, “Configuration”, “Administration”, “App configuration”, “Language selection”, “Send Logs”
	New case	Opens “Create new case” window: “Sex”, “Date of birth”, “Admission date”, “Case-ID”
	Scan Code	Opens camera to scan code of case ID
	Search/ Magnifier	Search for cases with a given case ID
	Reload	Reload the available cases
	Download	Download a treatment onto the iPad
	Upload	Upload a treatment onto the SAS server

Patient Tab

09:49 Tue 11. Jan 92%

< [document icon]

Sex Information filled in at the creation of the case

male female intersex

Date of birth

10.01.1998

Admission date

10.01.2022

Diagnosis

Post-acute COVID-19 (disorder) (1119303003)

SNOMED CT nomenclature of the diagnosis

Secondary diagnosis

+

Height in cm

175

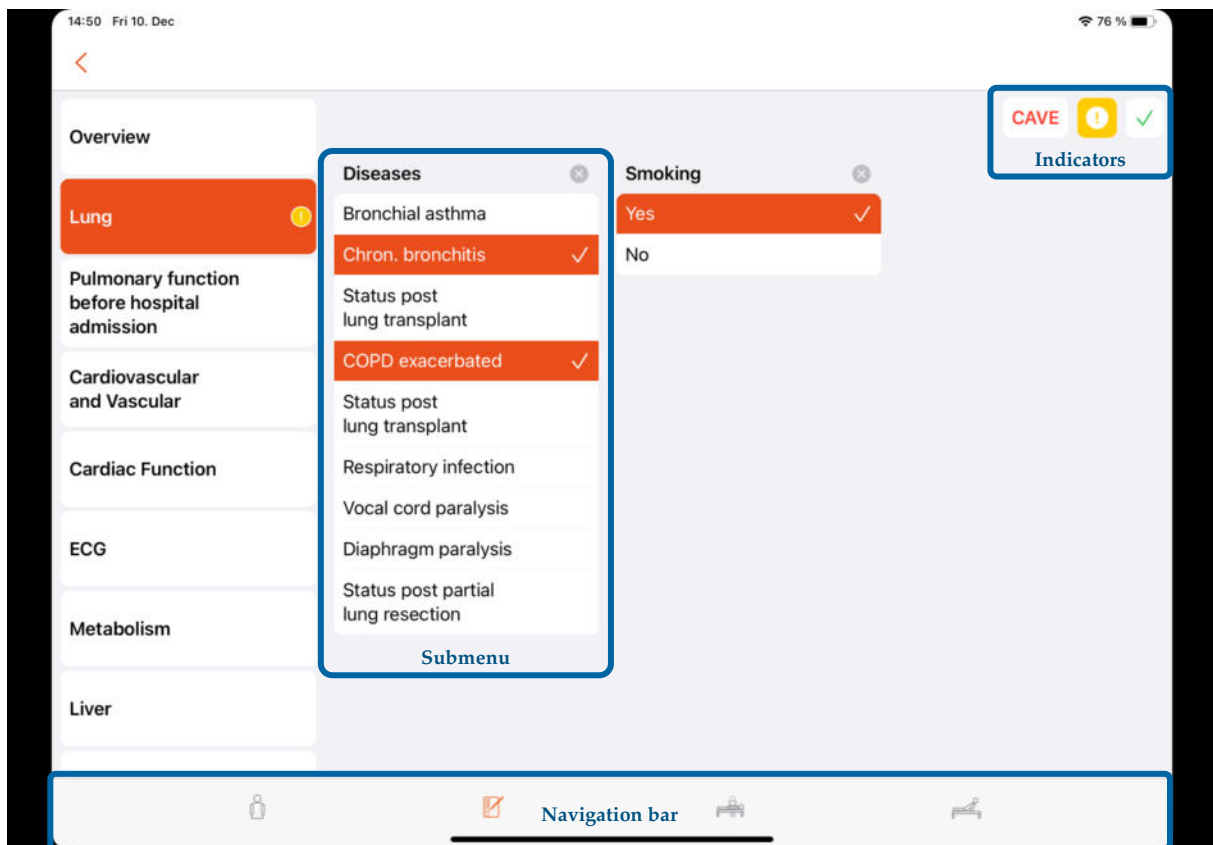
Information filled in in this patient mask



Weight in kg

70

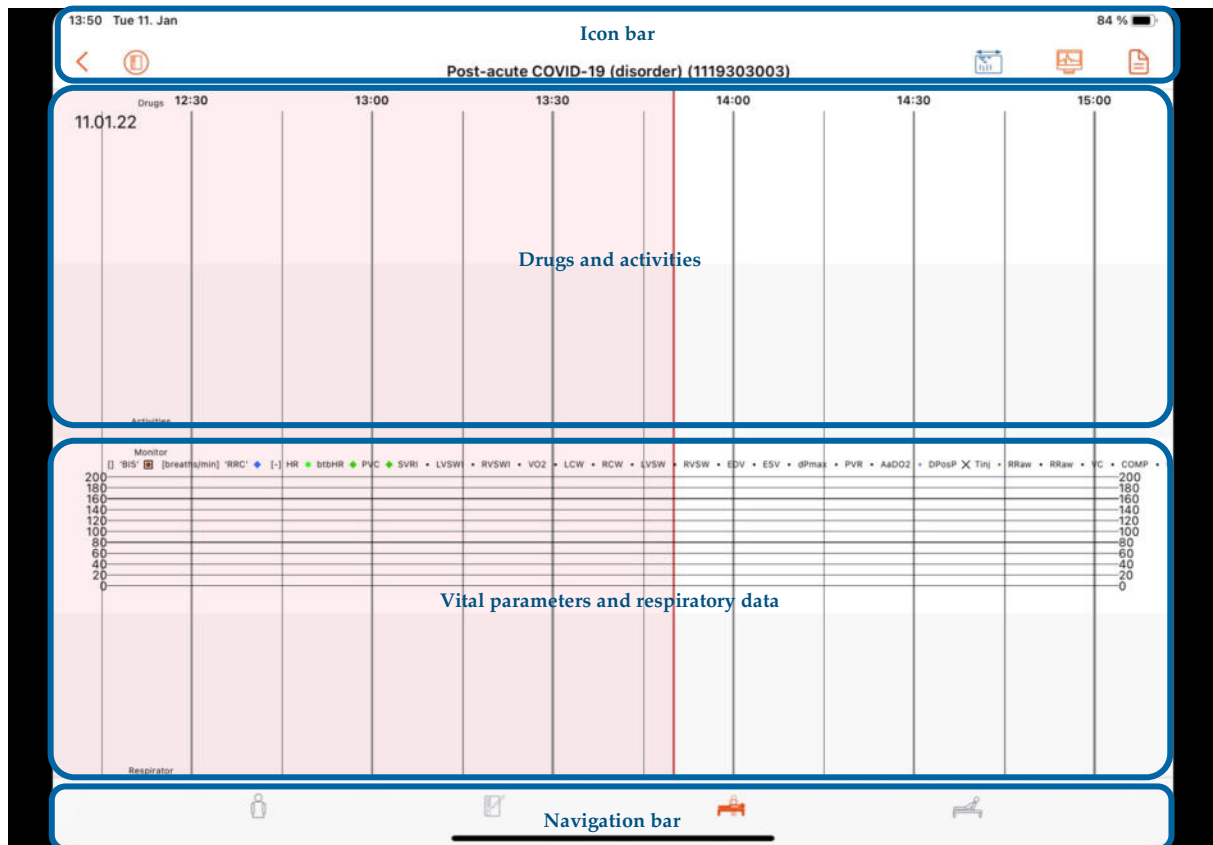
[person icon] [document icon] Navigation bar [bed icon] [stethoscope icon]

Anamnesis Tab

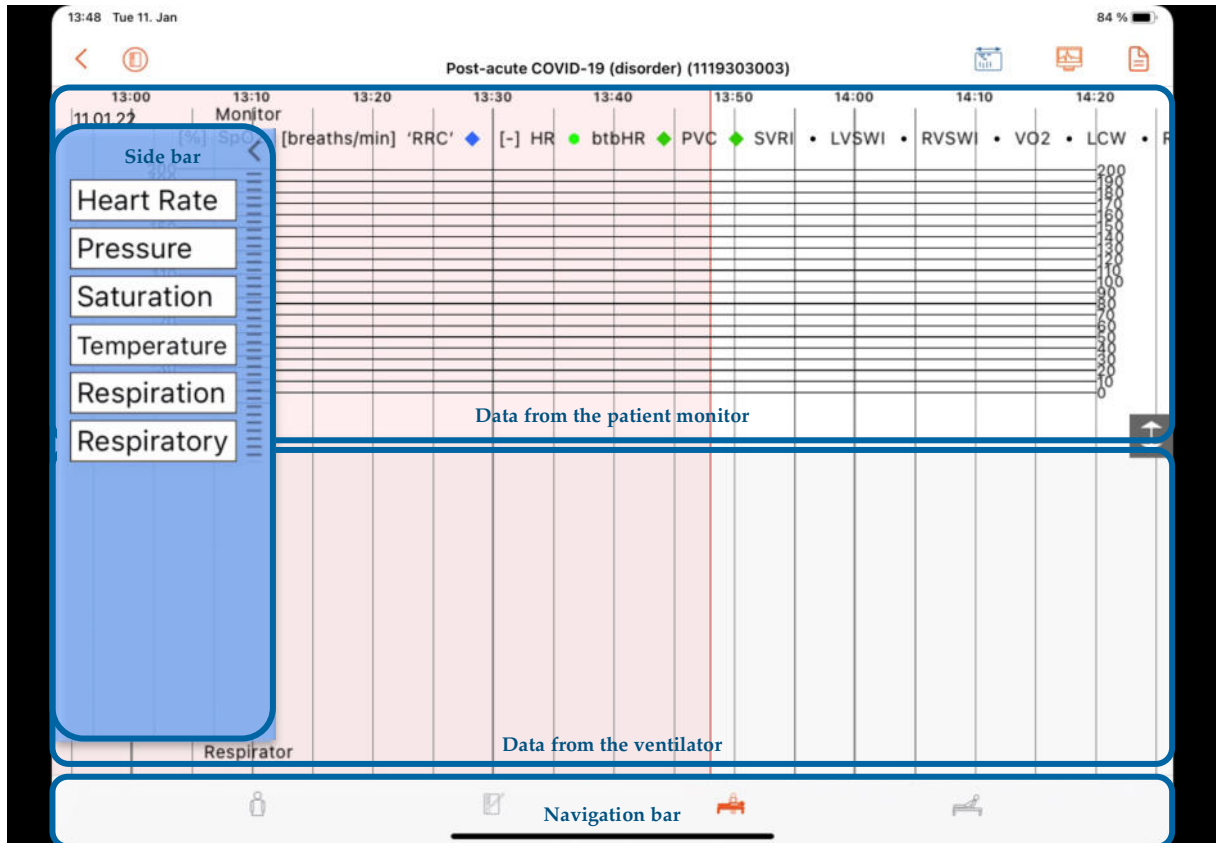
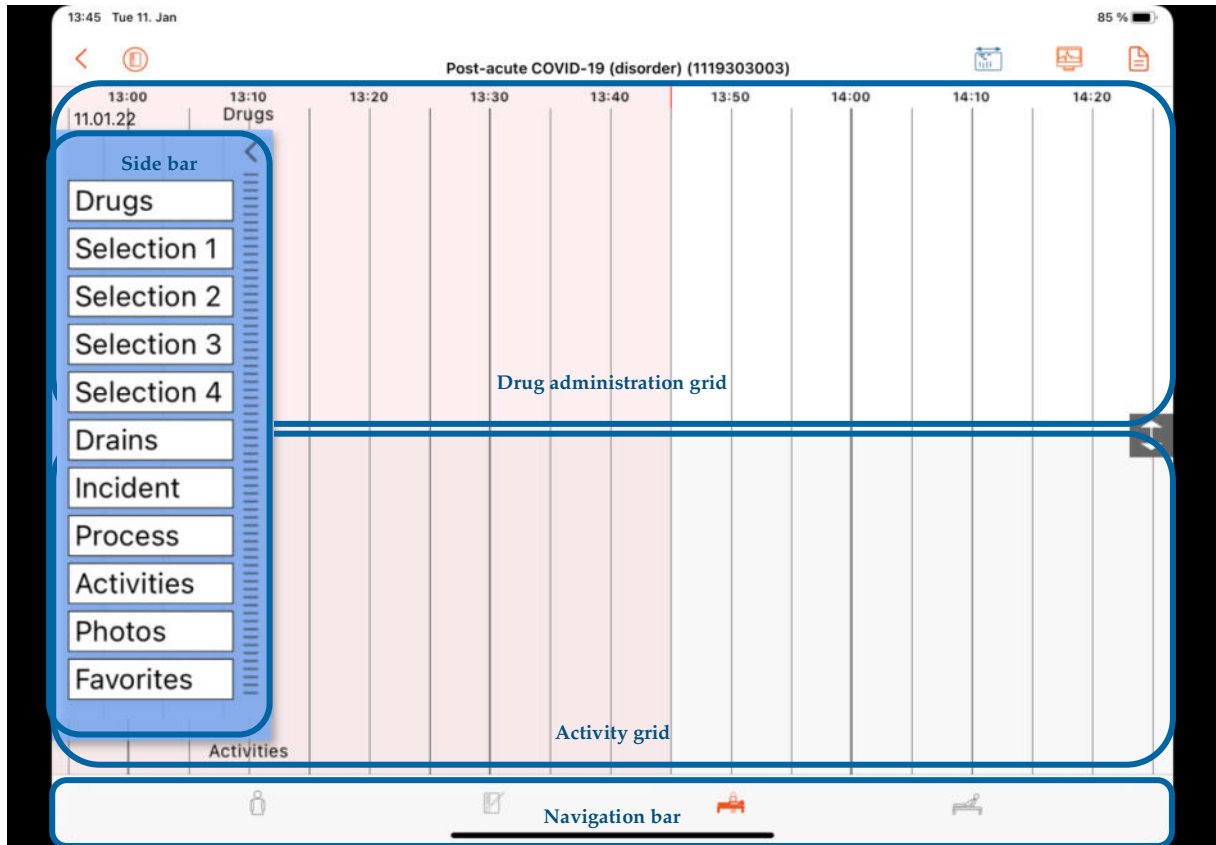


Symbol	Name	Description
CAVE	Indication Critical	Allows to mark a group as critical
	Indication Edited	Automatically highlighted when something is edited
	Indication Completed	Allows to mark a submenu as completed

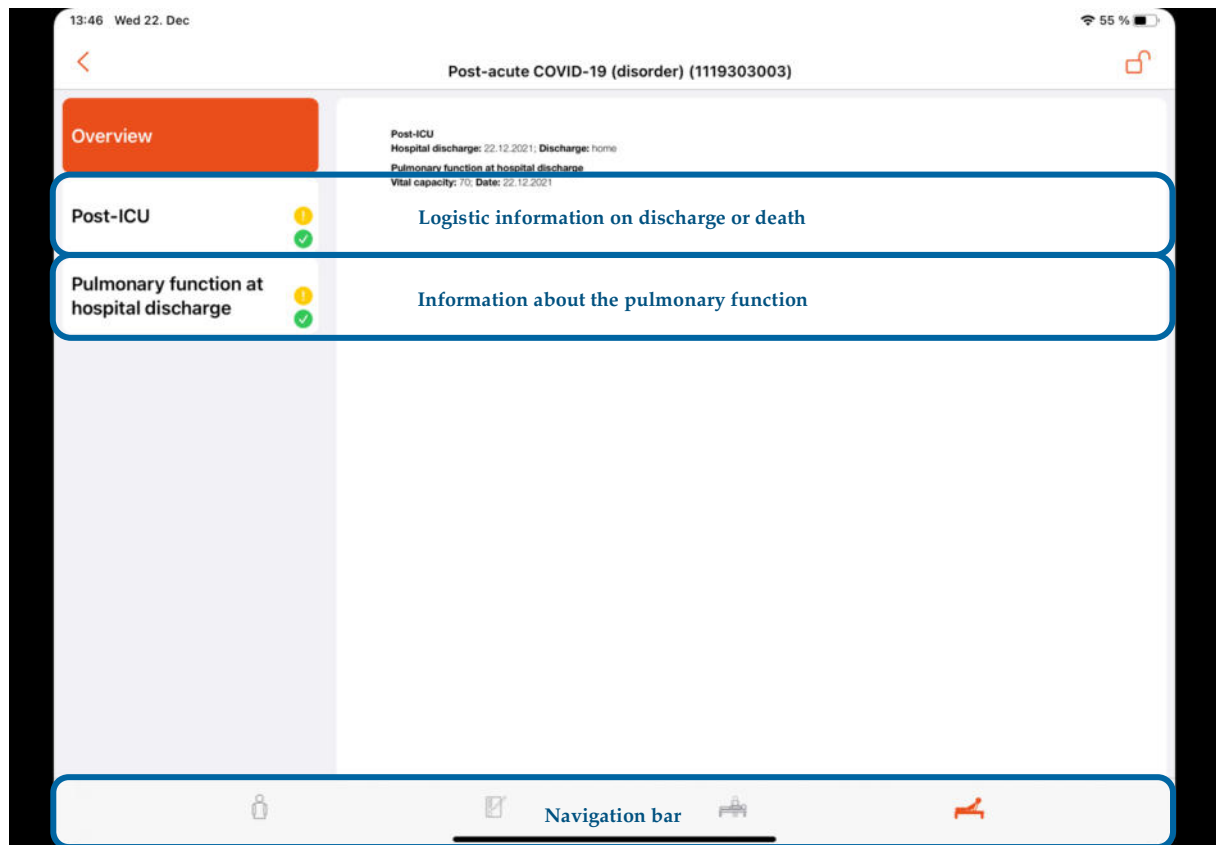
ICU Tab




Symbol	Name	Description
	Anamnesis	Shows anamnesis overview
	Time scale	Allows to jump to the first and last entry, as well as the current time
	Connecting medical devices	Opens "Monitor Overview"
	Monitor Overview	Opens "Monitor Overview" , disconnect individual medical devices
	Disconnect medical devices	Disconnect all medical devices
	Stop watch	Activates a mode in which every vital parameter is displayed every minute



Post- ICU Tab



Symbol	Name	Description
	Lock icon	Closes the documentation, the data can then no longer be edited and if the treatment is saved to the server it is marked as complete there

The Sandman ICU app is part of the EU project

ENVISION

For more information please visit the website:

<https://www.envision-icu.eu>

