KRI Surgical Scheduling

User Guide

Contents

1 Overview

All residents must complete a certain amount of operations to successfully complete their training. Doctors have to assign residents to different types of operations in such a manner that allows residents to finish their training in the predefined timeframe. Finding an optimal schedule that takes into consideration multiple parameters and constraints is not a trivial job.

Using different scheduling methods we try to find the best schedule that meets all requirements, taking into consideration their entire training period as well as their interactions with other residents. Around this idea we developed an application that gives the user the flexibility to create his own setting for generating a schedule.

Along the generation of a monthly schedule, we also provide a short term decision support module that assists the doctor when taking the day to day decision of assigning the operations. Besides generation and schedule support our application also gives the opportunity to have a quick view of the progress of residents. With these we hope to help doctors schedule operations to residents in a more effective way, and residents to finish their training on time.

Minimal configurations 2

The functionality of the application can be used only with some minimal configurations, which are needed as input parameters for each functionality.

Residents and training progress

For more details see Chapter 7: Residents and Training Progress.

- catalogues have to be defined
- OPS codes have to be assigned to catalogues in order to update the residents' progress
- residents have to be added after catalogues have been defined

Generate schedule

For details about the generating of a monthly schedule see Chapter 5: Administration View.

- active residents must be defined
- monthly capacity for different catalogues has to be set
- monthly capacity of all residents has to be set
- resident training duration has to be set in Settings view, see Chapter 10 (this is recommended to be an average of the duration of residents)

Note: make sure that monthly resident capacity is set to a value larger than 0 for each resident. Only in this case the scheduler will assign operations to all residents.

Import operations

For a detailed explanation of this feature see Chapter 8: Import operations.

- OPS codes have to be assigned to catalogues in order to update the residents' progress
- the nickname in field Op1 should be the same as the nicknames in the application - only this way the application can determine the correct assignment

Decision support

For a detailed explanation of this feature see Chapter 6: Decision support.
A correct suggestion can be done only if the residents are correctly defined, as described above in this chapter. In addition:

- a residents' personal training duration should be correctly defined in the view "Residents and training progress"
- short term operations should be correctly defined (be assigned to a mapped catalogue and have an Op1)

IMPORTANT!

Adding new specialties and mapping of OPS codes to catalogues can only be done by developers.

Basics 3

The basics covered here are:

- Major navigation
- UI elements
- Validation behaviour

Major navigation

The navigation has two main parts: navigation between specializations and between views.

Specialization switch

One of the most important part of the navigation is switching between specializations. This allows the user to switch between any of the defined specializations while staying on the same view. When choosing one from the dropdown all the viewed residents, catalogues and schedules are shown only for that specialization.

IMPORTANT!

Switching between specializations is only supported when cookies are enabled in browser.
If cookies are disabled, only the default specialization is shown - “General surgery”.

Navigation bar

Another important part is the navigation bar. It shows the current view in the left part and the shortcut to the other view on the right side. This is especially useful for the administration part, as it will be shown below.

In schedule view(left side of the bar), the navigation bar also allows the user to switch to administration view(right side of the bar).

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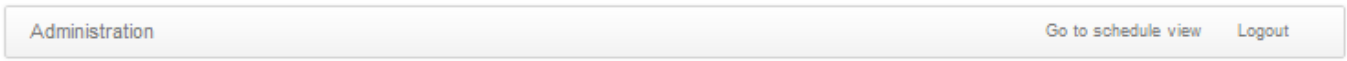
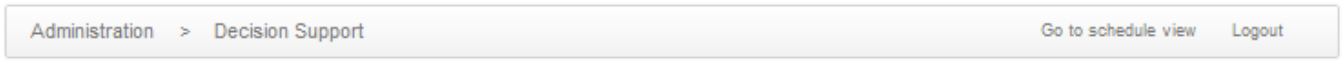


For any of the modules, for example Decision Support, this will be also shown in the navigation bar “Administration > Decision Support”- while allowing the possibility to click “Administration” in order to go directly to the administration home page.

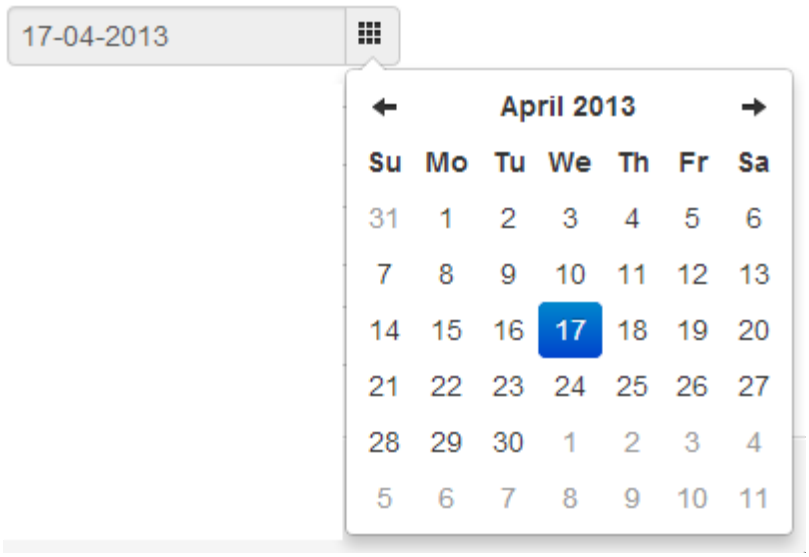


UI elements

Date picker

All places where a date must be entered have a datepicker. This is customized to show all the dates, or as we will se for vacation leave, only dates in the future.

The date picker that allows to choose any date is:

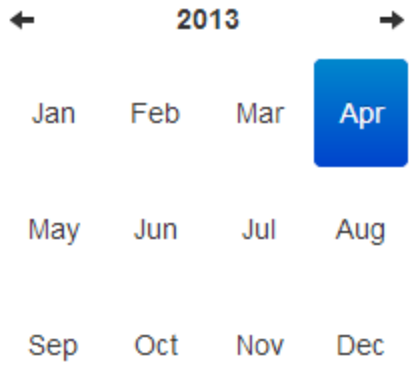


Here using the arrows we can navigate in any direction.

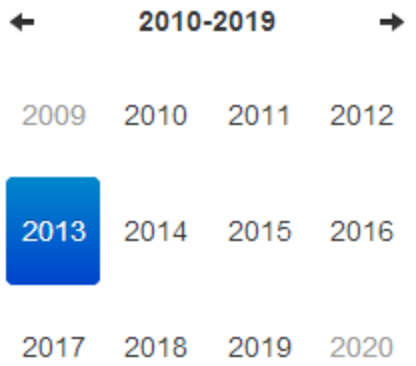
The date picker that allows the user to choose only future dates from has a different calendar, where the inactive, past dates are gray and cannot be clicked. There is also no arrow to allow navigation to past months.

The same principle will be used for months and years, the arrow will appear only for navigation to future dates.

The dropped down calendar can be shown for a larger timespan. In the above image, if the month “April 2013” is clicked, the calendar will change to show months:



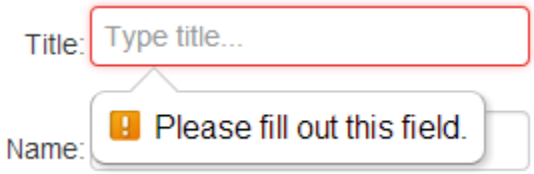
Nexr, if the year “2013” is clicked, the calendar will change once again, to show the years.



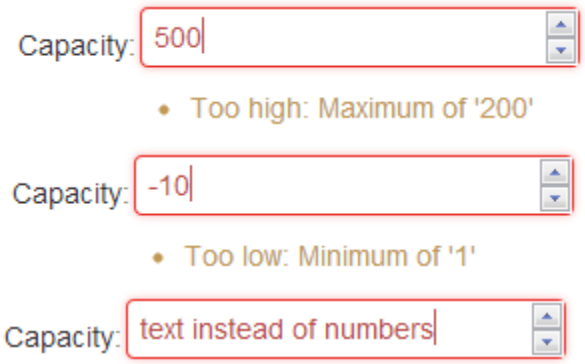
Using this method choosing any date is very easy and only a couple of clicks away.

Validation behaviour

For mandatory fields that were not filled in, the element will not be added/edited and a message will appear to fill in the respective field. Also, each field validates the input in real time making the borders red when there is a problem or green when the input is accepted.



The borders will be red when the expected value is an number but the entered value is text, or when the number is not between the expected bounds.

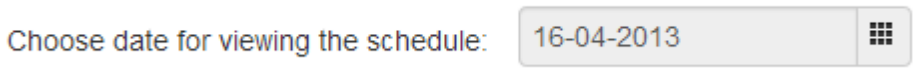


When the entered information has the right format and value, the input field will be green.

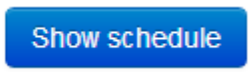
Scheduler View 4

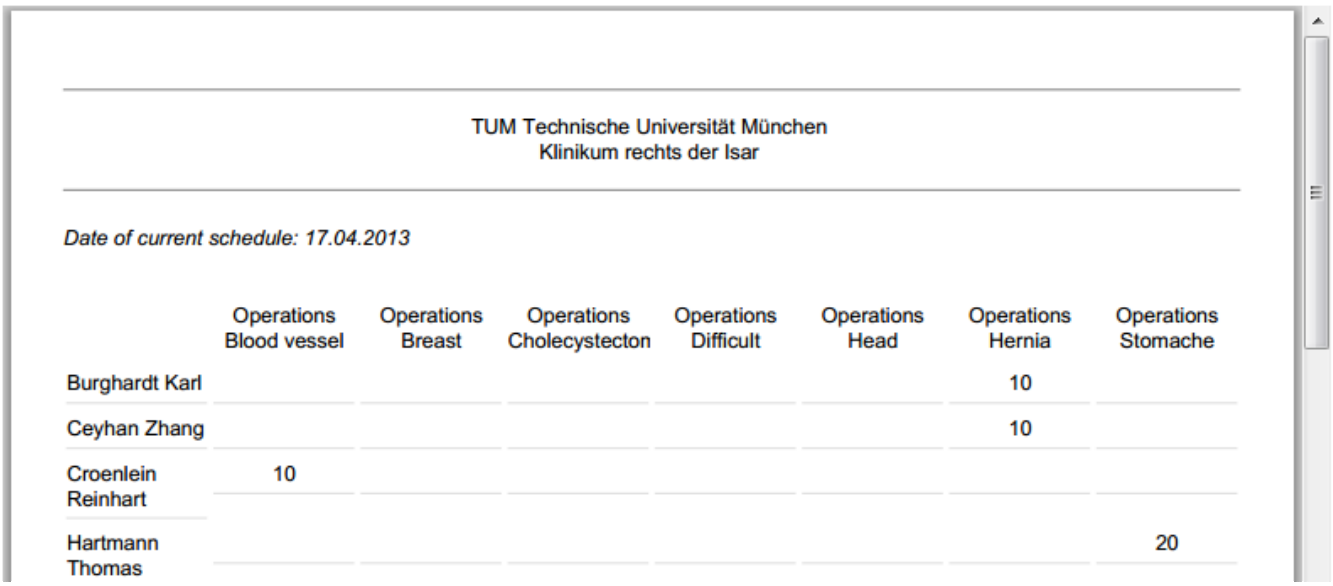
This view allows the user to see the generated schedule. The generated schedule is chosen after the generation date and displayed. This schedule can be downloaded as pdf or excel file.

The date that can be chosen is the date when the schedule was generated:



after choosing a date the monthly schedule is shown by clicking the button ”Show schedule”





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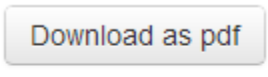
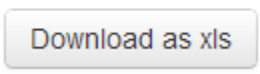
Date of current schedule: 17.04.2013

	Operations Blood vessel	Operations Breast	Operations Cholecystecton	Operations Difficult	Operations Head	Operations Hernia	Operations Stomache
Burghardt Karl						10	
Ceyhan Zhang						10	
Croenlein Reinhart	10						
Hartmann Thomas							20





The two donwload buttons will open a window that allows the user choose the save location or saves in the default location on the computer, depending on the browser settings.

Administration view 5

The topics covered here are:

- Organization
- Generate schedule

Organization

The Administration View offers a link to several functionalities of the application:

Generate schedule - using this icon monthly schedules can be generated for the selected specialty

Generate schedule

Decision support - using this icon you can easily decide which resident is in more need of operations, based on the current progress status

Decision support

Resident and training progress - using this icon the training progress of residents can be followed

Residents and training progress

Import - using this icon operations can be imported into the application so that the progress of the residents can be updated

Catalogues - using this icon catalogues can be managed

Settings - using this icon various global settings of the application can be set

Generate schedule

The generate schedule button can be found above. The schedule is always generated for the month in progress and for the selected specialty.

Example

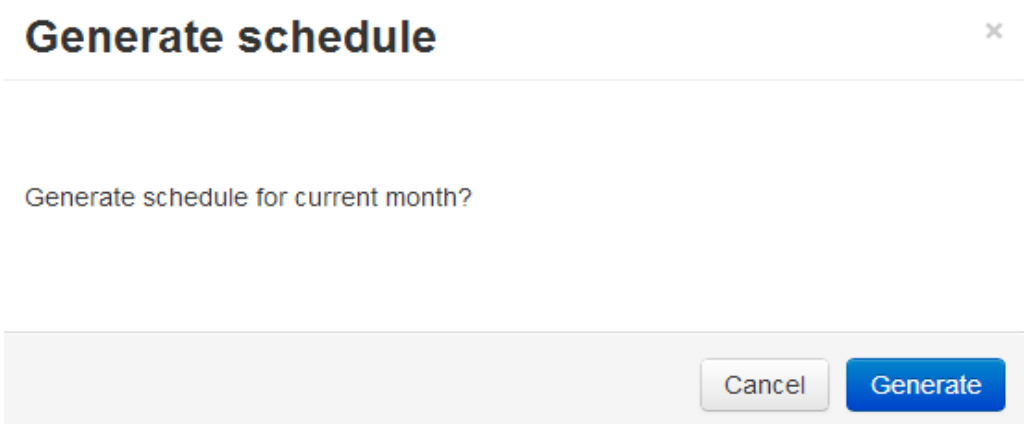
Scheduling the operations for current month, for specialty “General Surgery”

1) select the specialty from the dropdown to be “General Surgery”

2) make sure that all prerequisites[1] are set

3) click on the generate schedule button

4) the following dialog should appear:



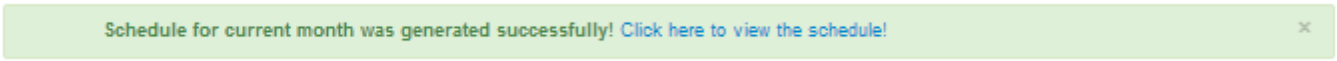
[1]for more details about the necessary parameters, see Chapter 2, Prerequisite section

5) click on generate - this will generate the schedule for the month in progress taking into account:

- capacity of residents for the current month
- availability of residents - if residents are on vacation, active, inactive
- availability of operations for the catalogues
- training period of residents

Note: if a resident is on vacation and he/she will be only available for half of the current month then the scheduler will take this into account, and the resident will get operations for half of the month

6) if everything is successful the following information should appear



7) go to schedule view to see the schedule

Decision Support 6

Decision Support Module provides the following:

- Decision support overview
- Planning the priority list of residents for each catalog
- Manage short term operations
- Accuracy refinements

Decision support overview

This module provides support for the doctor in assigning residents to operations. The module has two parts, first tab shows a list of system suggestions for assigning a resident to an operation and the second allows management of short term operations.

Prioritized list of residents

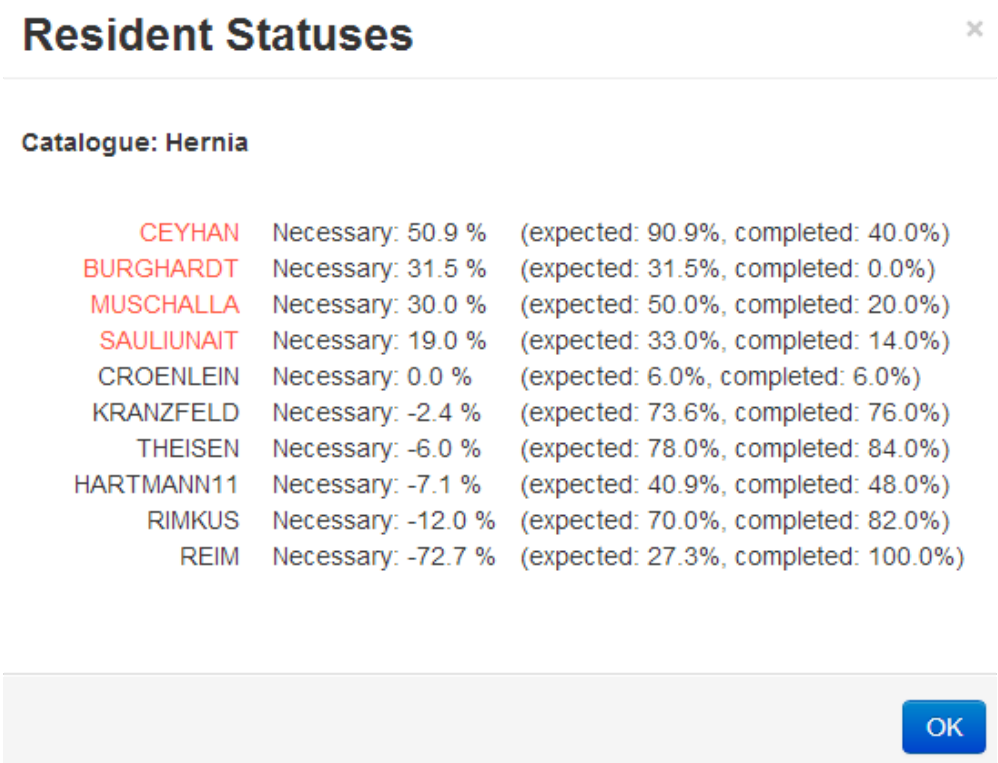
For each catalog, residents are ordered in a priority list based on their urgency to perform an operation in order to finish their training.

The residents that have fewer performed operations than estimated are colored in red. They are also ordered from the highest priority to the lowest. The residents that have enough performed operations are black.

Based on the priority, only the first seven residents are shown, the others are visible when clicking the “More” button.

	Catalogue	Residents	
1	Hernia	CEYHAN BURGHARDT MUSCHALLA SAULIUNAIT CROENLEIN KRANZFELD THEISEN	More >
2	Head	KRANZFELD CEYHAN RIMKUS MUSCHALLA HARTMANN11 BURGHARDT REIM	More >
3	Stomache	KRANZFELD MUSCHALLA BURGHARDT SAULIUNAIT HARTMANN11 RIMKUS CROENLEIN	More >
4	Difficult	BURGHARDT CROENLEIN CEYHAN THEISEN KRANZFELD RIMKUS MUSCHALLA	More >
5	Breast	CEYHAN KRANZFELD RIMKUS THEISEN MUSCHALLA HARTMANN11 SAULIUNAIT	More >
6	Cholecystectomy	MUSCHALLA BURGHARDT SAULIUNAIT CEYHAN CROENLEIN KRANZFELD RIMKUS	More >
7	Blood vessel	BURGHARDT CROENLEIN CEYHAN THEISEN KRANZFELD RIMKUS MUSCHALLA	More >

More information can be obtained with the button “More”. Here all the residents are visible also with the corresponding statuses shown using percentages:



A positive ‘necessary’ shows that the resident has performed too few operations and needs to speed up in order to finish on time. A greater percentage means the resident is in a higher need of that type of operations.
A negative ‘necessary’ means the resident has performed too many operations of this type and needs to slow down.

Short term operations

In order to make the decision support module more accurate between two imports, it is possible to have operations inserted manually.

	OpDate	OPSC01	OPSC01 Catalogue	OPSC02	Op1	Op2	Ass1
1	05.02.2013	5-744	Stomache		SAULIUNAIT	HARTMANN11	
2	05.02.2013	5-366	Not mapped		REIM		
3	20.02.2013	5-082	Head		SAULIUNAIT	MUSCHALLA	
4	02.03.2013	5-381	Blood vessel		SAULIUNAIT		
5	05.03.2013	5-511	Cholecystectomy		CROENLEIN	CEYHAN	REIM
6	06.03.2013	5-531	Hernia		CROENLEIN		

These short term operations will be automatically removed once the import takes place.

IMPORTANT!

For an accurate decision support, when adding a new operation in decision support module, all fields must be identical with the ones in the import file. Only this way the operations in the decision support module will be removed and residents' statuses correctly updated.

Planning the priority list of residents for each catalog

Each catalog will have a list with all active residents. The list is computed as follows: the status of each resident is computed for a catalogue, then we compute the expected progress based on resident's start date and training duration. Then using a priority rule we arrange all residents in an order that satisfy our requirements.

Priority rule for decision support

Our scheduler uses a rule that takes into consideration the difference between expected training progress and completed training progress.

For one resident, for one catalogue:

$$Completed = percent(\ count(Imported\ Operations) + count(Short\ Term\ Operations)\ )$$
$$Expected = percent(\ linear\ progression(Start\ Date, Duration)\ )$$
$$Necessary = Expected - Completed$$

This will provide us with a positive $Necessary$ when the resident has performed too few operations and needs to speed up in order to finish on time. A negative $Necessary$ means the resident has performed too many operations of this type and needs to slow down.

e.g. catalogue: Hernia, resident: MUSCHALLA, start date: 01.07.2010, duration: 66 months

$Completed = 20\%$ obtained from 10 imported operations + 0 short term operations

$Expected = 50\%$ operations from 25 operations

$Necessary = Expected - Completed = 30\ \%$

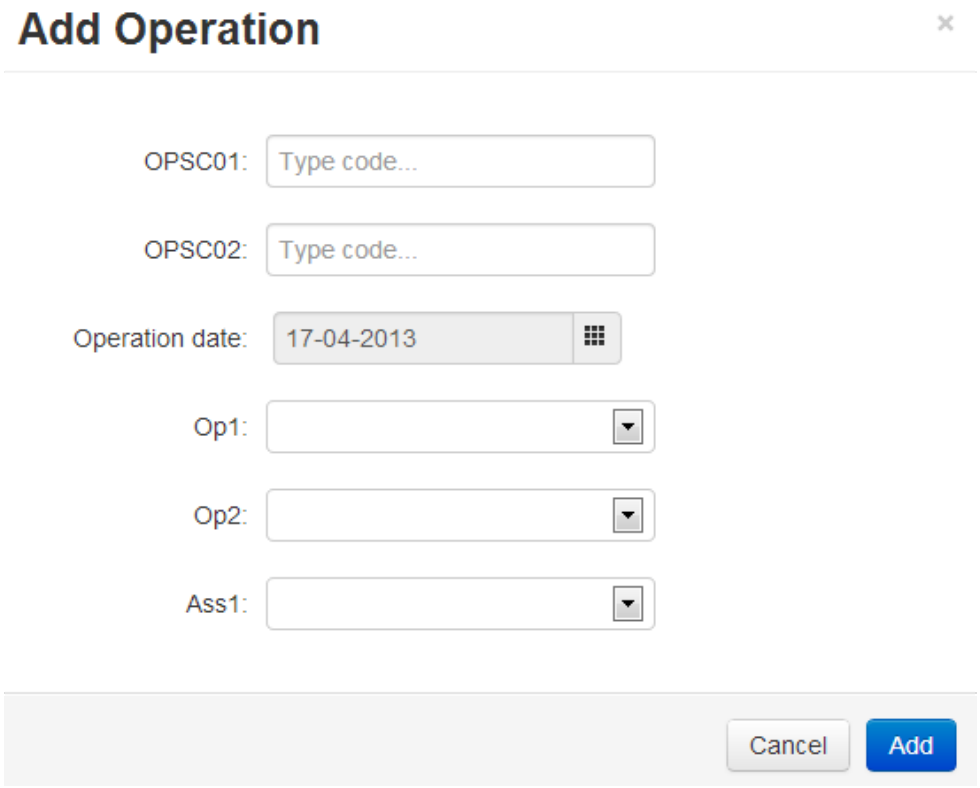
Manage short term operations

The short term operations can be added, edited and deleted.

Add short term operations

A new operation can be added using the button “Add Operation”.

This will open a new window where information about the operation will be filled in.

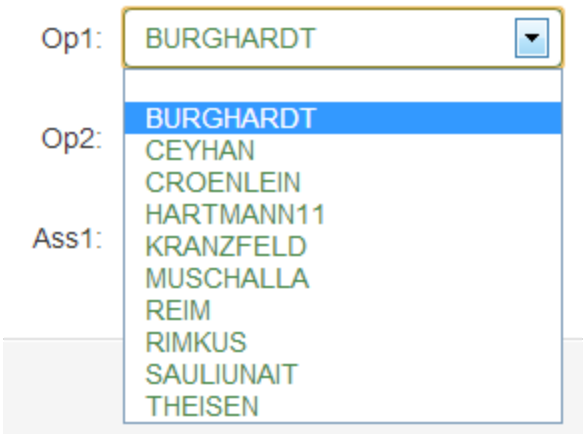


It is required that every operation has an OpDate, OPSC01 and Op1. The validation behaviour presented in chapter 3 applies.

OPSC01 can take any value, but only for mapped operation codes the catalog will be automatically found and filled in. For those that cannot be found, “Not mapped” will appear.

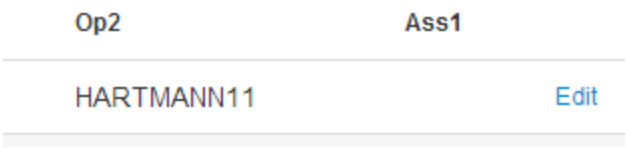
OPSC01	OPSC01 Catalogue
5-744	Stomache
5-366	Not mapped
5-082	Head
5-381	Blood vessel

Assigning a resident to an operation is done from a dropdown list that displays only the residents for the selected specialization.



Edit short term operations

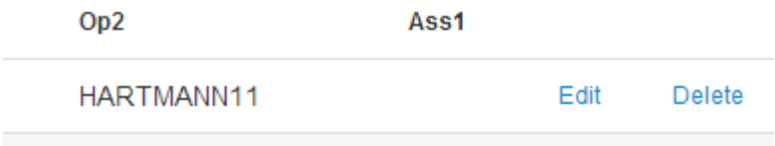
Any operation can be edited using the “Edit” button placed in Operations View.



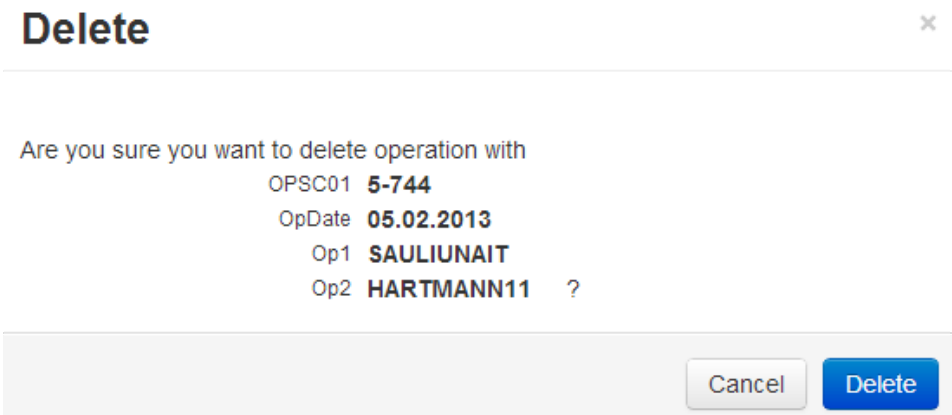
This will open a window similar to the one used for adding an operation, where information about the selected operation can be edited.

Delete short term operations

Any operation can be deleted using the “Delete” button placed in Operations View.



This will bring up a window where the deletion has to be confirmed.



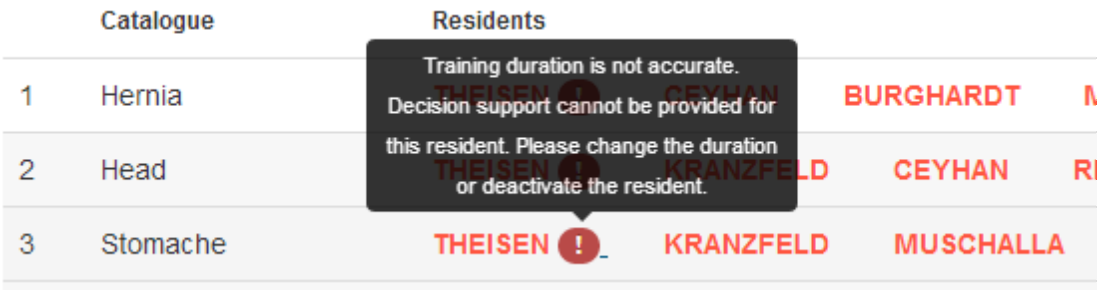
IMPORTANT!

After importing operations from a file, all short term operations that were also found in the imported file are automatically deleted. Operations that were not deleted have one or more fields that were different from the ones in the imported file.

Accuracy refinements

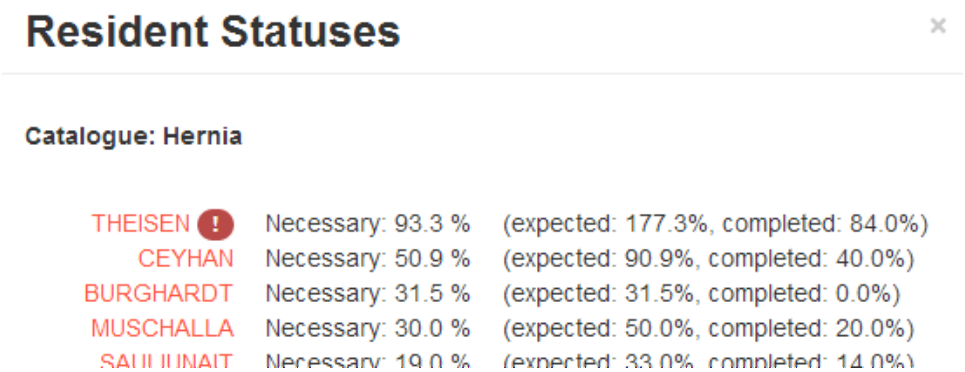
Operations that were not deleted after importing operations from a file, have one or more fields that were different from the ones in the imported file. These short term operations should be individually dealt with, as they will be taken into consideration for the decision support list of residents.

The decision support module will not be accurate in case there are residents that do not have a correct training duration. For these residents a warning symbol will appear.



The symbol appears when the entered training duration is exceeded. The warning can be fixed by going to “Residents and training progress” where the resident should be deactivated or the duration increased.

The same warning is visible in the window with more details about the resident statuses, where the expected progress has an incorrect value:



Residents and Training Progress 7

Residents and Training Progress provides the following:

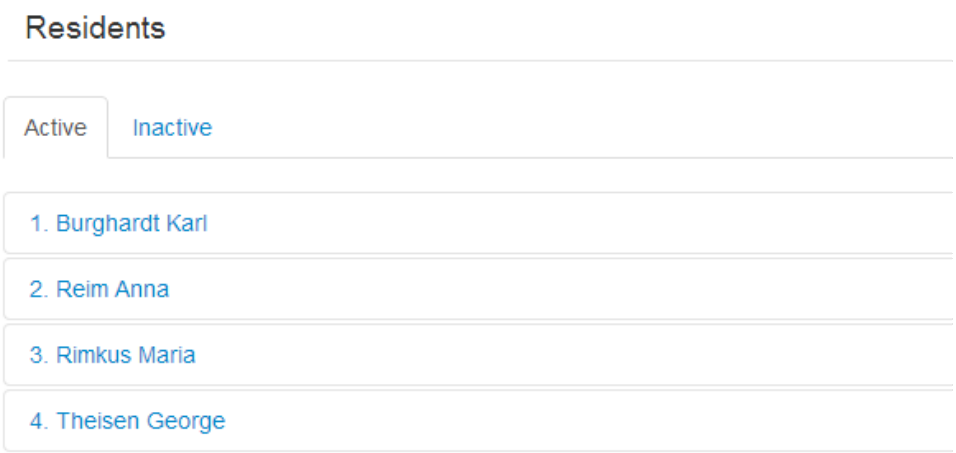
- Overview of the residents progress and status
- Adding new residents
- Management of existing residents

Resident Overview

This view provides personal information about residents and their training status. Residents are divided in two main categories based on their study status - Active residents and Inactive residents.

Active residents are the residents that will be taken into consideration for generating the schedule. These can be viewed in the first tab of the view.
Inactive residents are those that have finished their studies, are on vacation leave or have been deactivated. The details for these residents can be found in the second tab of this view.

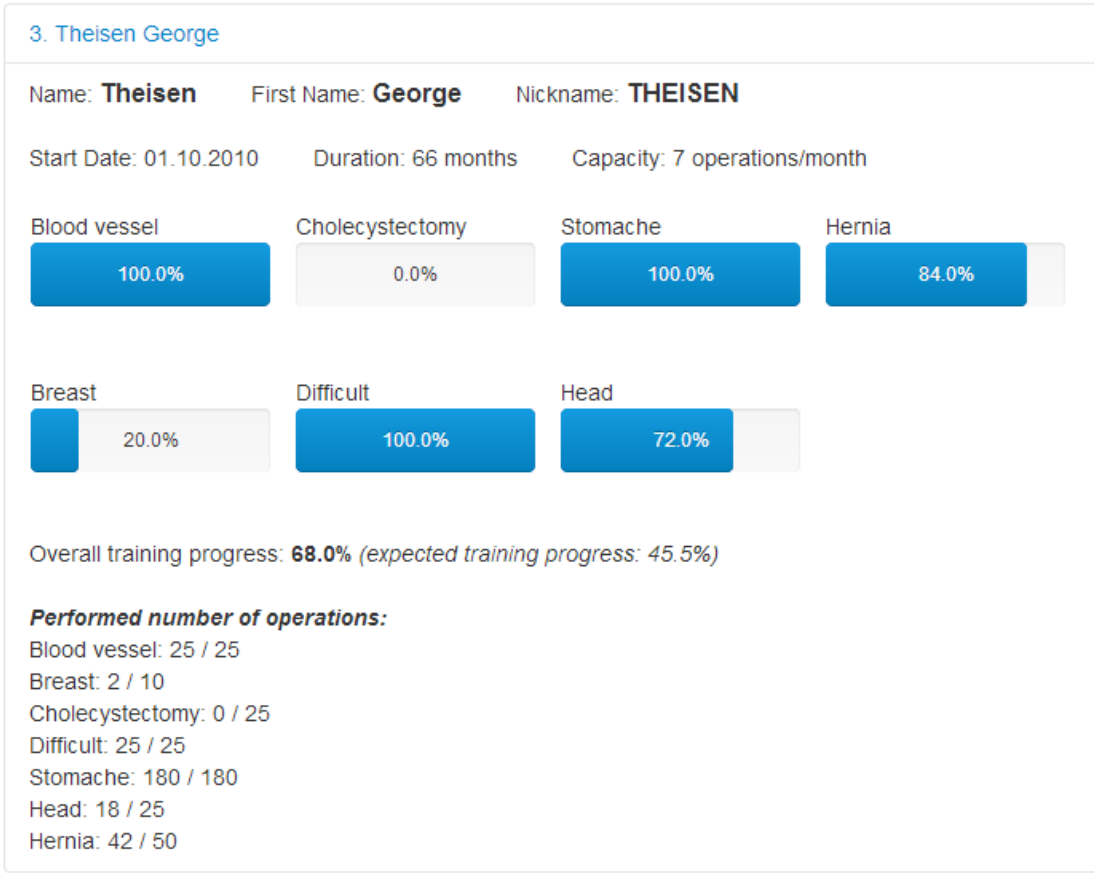
Active Residents Tab



A list with all the active residents is visible. When the name is clicked, an area with the details will be collapsed. Each resident has more information available.

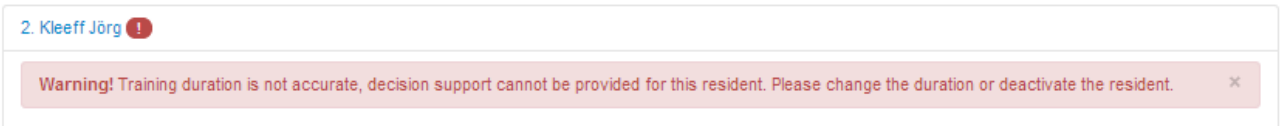
General information: name and nickname, the date when they started the training, the duration of their training and the maximum number of operations they can perform in one month (capacity).

Progress information: a general status for each catalog with the progress percentage, effective overall training progress percentage and expected training progress. The last part lists the exact number of performed operations that gave the percentages for the progress bars above.



Warnings: In case there are residents that do not have a correct training duration, a warning symbol will appear. This happens when the entered training duration is exceeded. In this case the decision support module will not be accurate until the resident is deactivated or the duration increased.

The reason for the warning is visible when the resident is clicked to see more details.



Inactive Residents Tab

A list with all the inactive residents is visible. When the name is clicked, an area with the details will be collapsed. The structure of the available information for each inactive user is similar with the one for active users.

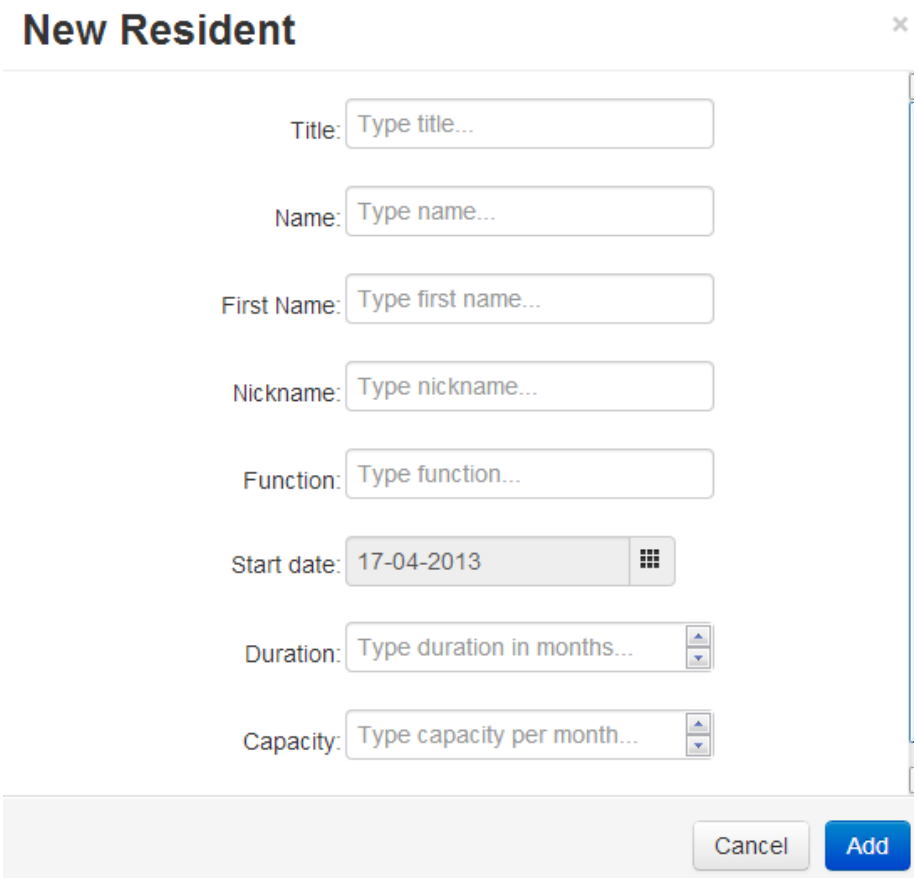
Add New Resident

Prerequisites

A resident will have assigned all correctly defined catalogues for the chosen specialty. A catalog is correctly defined if the block size is specified. For more details about the catalogues, refer to chapter 9. In case there are no catalogues found, the resident will not be added.

A new resident can be created by using the button “Add Resident”.

This will open a new window where personal information will be filled in.



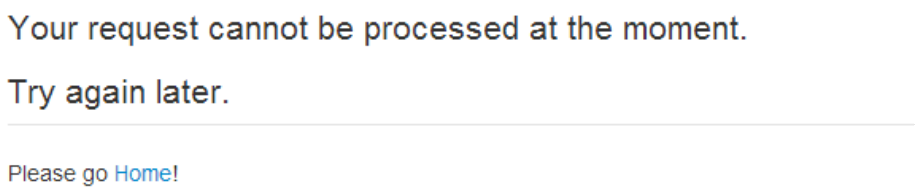
All fields are mandatory and the validation behaviour presented in chapter 3 applies. The following fields are very important:

- Nickname - a resident's nickname must be written exactly as it is used in the file with the performed operations that will be imported (maintain the same upper and lower letters, diacritics) .
  e.g. THESIEN, WILHELM2, FEUßNER, SÄCKL
  Please note that nicknames cannot be edited at a later point.
- Start date - the date of a residents' start. Please pay close attention when setting this field as it is used for computing the residents' progress and for the Decision Support module.
  Please note that the start date cannot be edited at a later point.
- Duration - the period of o residents' training. Please pay close attention when setting this field as it is used for computing the residents' progress and for the Decision Support module.
  Duration can be edited at a later point.
- Capacity - the number of operations the resident can perform in one month. This will be taken into consideration when generating the monthly schedule.
  Capacity can be edited at a later point.

A new resident is always created active, and immediately after creation it will be visible in the first tab "Active residents".

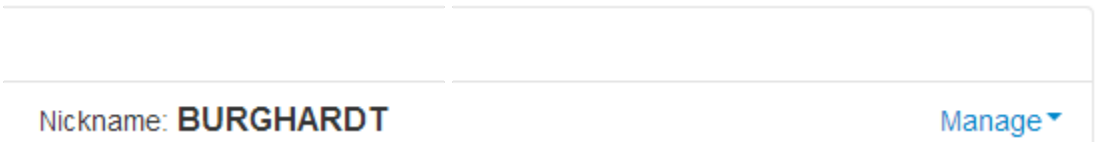
IMPORTANT!

Residents added for all specializations must have distinct nicknames. In case a nickname is not unique the resident will not be added. The user will be redirected to the error page.



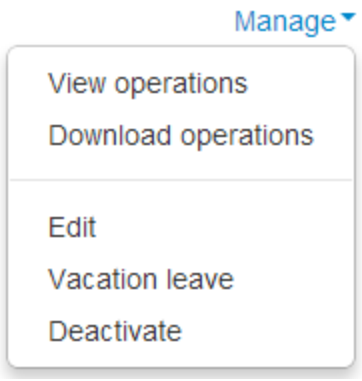
Manage Existing Residents

Each resident can be managed using the Manage button placed on the right side of the information area.



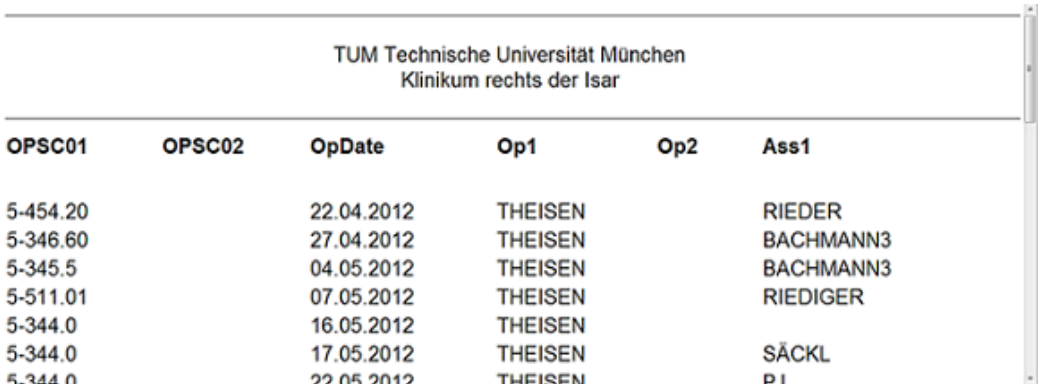
For the active residents the following manage options are available:

View operations - view a complete list with the performed operations
Download operations - download the complete list of performed operations in a .xls file
Edit - edit general information of the resident
Vacation leave - deactivates the resident for the specified period of time
Deactivate - deactivate resident for an indefinite period of time



View performed operations

Opens a new tab with all performed operations by that resident. This are the operations that are imported through the import module.



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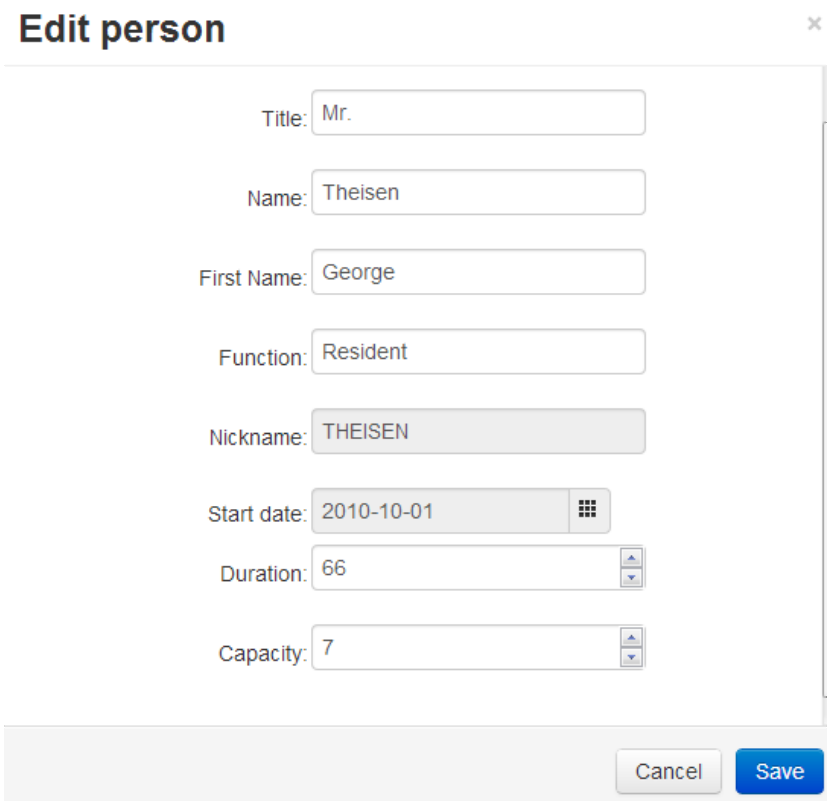
OPSC01	OPSC02	OpDate	Op1	Op2	Ass1
5-454.20		22.04.2012	THEISEN		RIEDER
5-346.60		27.04.2012	THEISEN		BACHMANN3
5-345.5		04.05.2012	THEISEN		BACHMANN3
5-511.01		07.05.2012	THEISEN		RIEDIGER
5-344.0		16.05.2012	THEISEN		
5-344.0		17.05.2012	THEISEN		SÄCKL

Editing a resident

From a resident the following information can be edited: title, name, first name, function, duration and capacity.

The start date and the nickname cannot be edited because they are already used for operations by the scheduler.



Vacation leave for a resident

Each resident can be deactivated for a specified period of time using this feature.

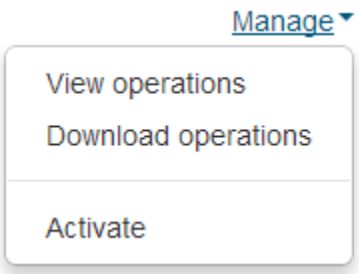
A resident's status will be changed into inactive and the resident will be automatically moved to "Inactive residents". The resident will be automatically reactivated when the vacation is over. (the day after the last day of vacation). There is also the possibility to manually reactivate a resident, which will take effect immediately, this will be shown in the following paragraphs.

Deactivating a resident

Each resident has a button "Deactivate" that will change a resident's status into inactive. That will immediately move the resident into the second tab, "Inactive residents".

For the inactive residents the following manage options are available:

View operations - view a complete list with the performed operations
Download operations - download the complete list of performed operations in a .xls file
Activate - activate resident



Activating a resident

Each inactive resident has an "Activate" button that will immediately change a resident's status into active and move the resident into the first tab, "Active residents".

Import operations 8

This module allows the user to update the performed operations for residents, using an excel file.

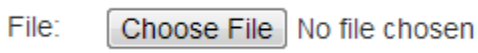
- Import module overview
- Excel file structure
- User feedback

Import module overview

The import of operations is done in two steps: choosing the file that will be imported and the actual import.

Choosing the file

A file has to be chosen using the “Choose file button”.



Clicking the button will open a new window that will allow the user to navigate in the file system of the local computer to the desired location. After choosing a file, its name will appear written near the button.

Import the chosen file

The import will be started only when clicking “Upload file” button.

The import might take several seconds, as the residents are also updated with the imported operations.

The import is comprised of several actions:

- copy the operations from the file to the system
- update residents’ statuses of performed operations
- delete identical operations from decision support module

Excel file structure

The imported file can be manually created or exported from other tools. For a successful import, the only requirement is that it has the following structure:

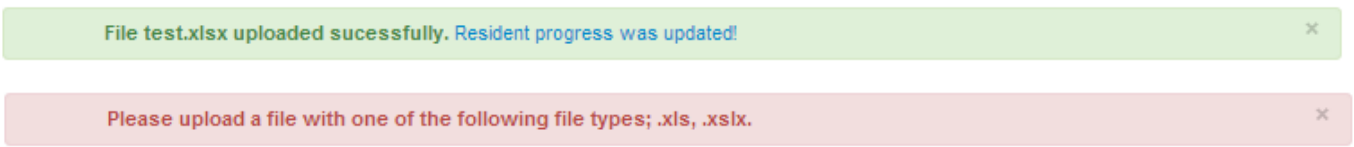
File Structure

OPSC01	OPSC02	OPDatum	OP1	OP2	ASS1
Text	Text	Date (dd/mm/yyyy)	Text	Text	Text

This structure is also shown in the view.

User feedback

There are two types of alerts, namely success alerts and error alerts. As shown below, the user is informed in each case what was performed or what is not correct.



Catalogues 9

This module provides the following:

- Catalogues overview
- Manage existing catalogues
- Add new catalogue

Catalogues overview

This view provides general information about catalogues in the chosen specialization. There is a list of catalogues as shown below:

Configure catalogues

	Name	Description	Trunk	easy / normal / hard	Block size	Monthly Capacity
1	Blood vessel	Operations done on any blood vessels. Codes that begin with 5-38, 5-39.	Special	25/0/0	5	35
2	Breast		Special	2/5/3	1	2
3	Cholecystectomy		Special	0/25/0	5	1

For each catalogues the following are shown:

- name - the name of the catalogue that will be used throughout the application when referring to a certain catalogue
- description - a short text explaining the catalogue
- trunk - to which trunk does the catalogue belongs to Special trunk or Common trunk
- easy / normal / hard - the number of operations that must be performed so that the catalogue is considered completed
- block size - defines how fine grained the scheduler will assign the number of operations to residents
- monthly capacity - defines how many operations for this block are available per month, also used by the scheduler when generating the monthly schedule

Manage existing catalogues

All catalogues can have the block size and capacity configured at any time. However, only for certain catalogues there is also the delete option. This will be covered in this chapter into more details.

	Name	Description	Trunk	easy / normal / hard	Block size	Monthly Capacity			
1	Blood vessel	Operations done on any blood vessels. Codes that begin with 5-38, 5-39.	Special	25/0/0	5	35	Configure blocks	Configure capacity	
2	Breast		Special	2/5/3	1	2	Configure blocks	Configure capacity	
3	Cholecystectomy		Special	0/25/0	5	1	Configure blocks	Configure capacity	
4	Difficult		Special	0/0/25	5	5	Configure blocks	Configure capacity	
5	Emergency		Special	10/10/10	0	0	Configure blocks	Configure capacity	Delete
6	Head		Special	0/25/0	5	2	Configure blocks	Configure capacity	
7	Hernia		Special	20/30/0	5	25	Configure blocks	Configure capacity	
8	Stomache		Special	100/50/30	10	160	Configure blocks	Configure capacity	

Configure block size

Configuration of block size is done using the “Configure blocks” button. This will open a new window that allows the user to enter the new value.

In case of entering a new value, there are several operations that will take place

- remove old configuration
- generate the new configuration
- update user status for all users

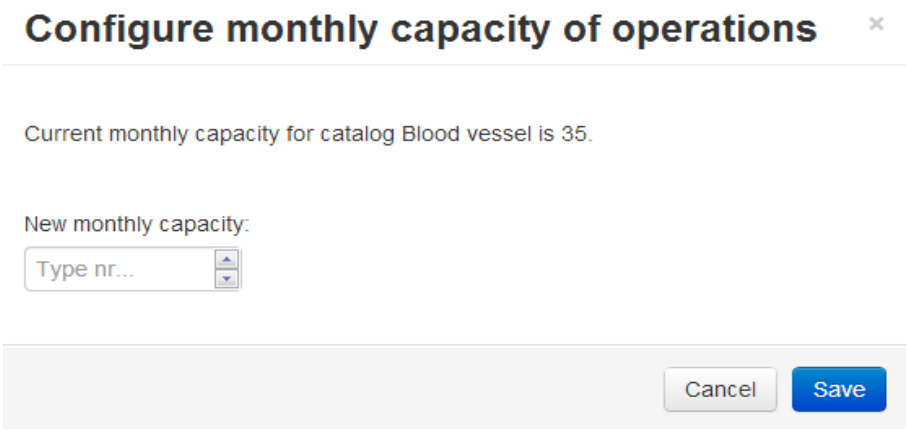
therefore this might take several seconds.

IMPORTANT!

When adding a new catalogue the default block size is 0. In order to have this catalogue assigned future resident, the block size must be set to a value larger than 0.

Configure capacity

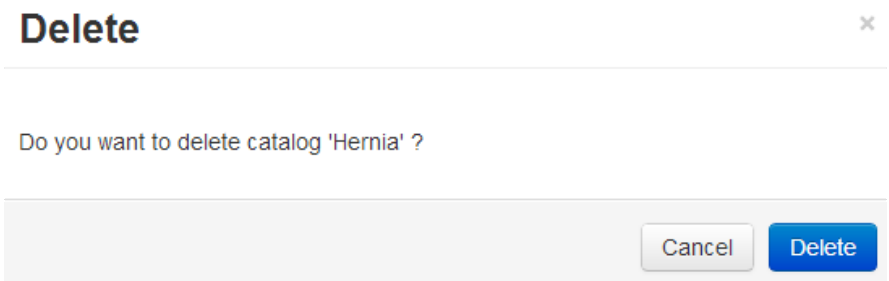
Configuring the capacity is done using the “Configure capacity” button. This will open a new window that allows the user to enter the new value.



Delete catalogue

Deleting a catalogue is possible only for certain catalogues. These are the catalogues that were not assigned to any resident. The moment one resident that must complete the operations for the respective catalogue exists, the catalogue cannot be deleted any more. This happens when adding a new resident, because for a new resident all correctly defined catalogues are assigned to be completed. See chapter 7 for more details on adding a new resident.

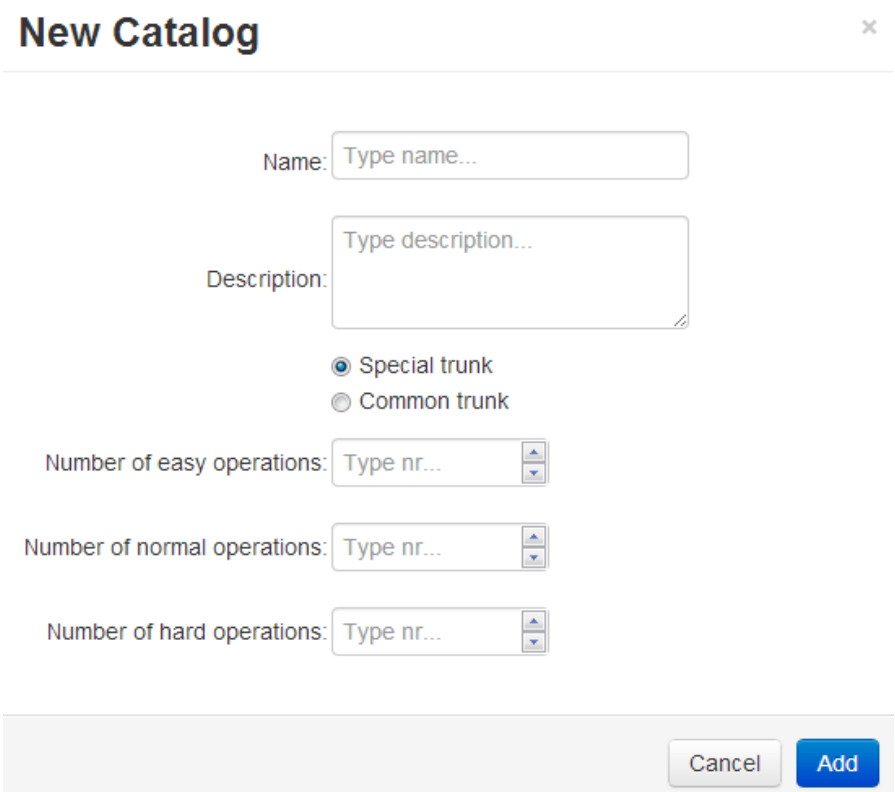
The button “Delete” will open a new window that asks for user confirmation:



Add new catalogue

A new catalogue can be created by using the button “Add Catalogue”.

This will open a new window where catalogue information will be filled in.



All fields except description are mandatory and the validation behaviour presented in chapter 3 applies. The number of easy, normal and hard operations in a chapter, each must have a value equal to 0 or larger.
Each catalogue can be either from special trunk or from common trunk. When operations are scheduled, first the common trunk operations will be scheduled and only when these are all completed, will the scheduling algorithm select also operations from special trunk.

Settings 10

This module allows the user to configure parameters that are common across all specializations.

The view is a part open for modification, currently the only available configuration is the training duration. This is mandatory and it is applied for all residents when generating a new monthly schedule.