IQVIA Health Flow

The key to effective capacity management

Predictive insights, combined with powerful simulations

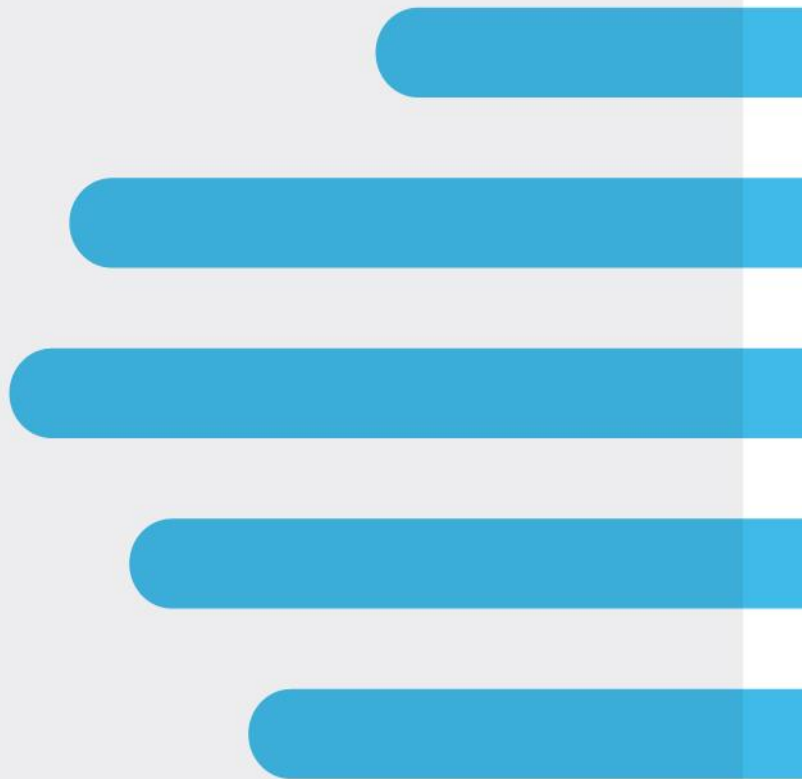March, 2023

IQVIA

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1. IQVIA HEALTH FLOW | CONTEXT

Introduction

In any hospital, patients come and go, they have different lengths of stay, different examinations are required, and complications can arise. There is also outpatient and surgical scheduling, and scheduling breaches. And on top of that there is the emergency flow.

The demand for care is high, but on the other hand hospitals are facing problems with staff shortages, absenteeism, job reorientation, budget etc. This imbalance creates an unsustainable strain on hospital capacity and staff.

So, the question is, how to win capacity? It's all about variability.

All patient flows cause variability. Peaks in variability create work pressure and stress and create a risk for patient safety (patient mortality, readmissions, infections, …). Valleys in variability cause inefficient use of your capacity. So, getting variability in bed and staff capacity under control is crucial to keep your hospital operating efficiently, keep workloads healthy and ensure quality of care.

Making optimal use of bed capacity, reducing workload peaks and aligning OR planning better are important goals for every hospital

The good thing is that the highest variability can be seen in the planned activity, which is controllable.
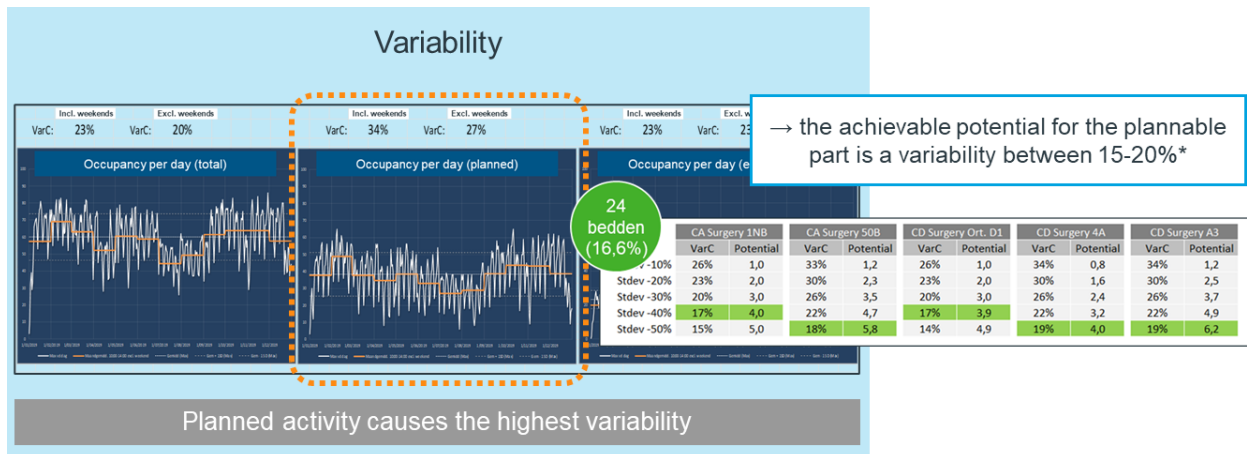
So, there is a need for more efficient and aligned planning to gain capacities. This is called "capacity management".

Value proposition

Although IQVIA Health Flow is developed from this need for more efficient and aligned planning to gain capacity, quality of care must remain central. Next to that, good capacity management brings value to patient satisfaction, employee satisfaction and budget satisfaction.

QUALITY OF CARE - Aligning the demand for care and the supply of care has a positive impact on the quality of care.

- Applicable for every process, but even more so for a care process, is the fact that a reduction of variability has a positive quality impact on the outcome.
- Ensuring an optimal patient to nurse ratio leads to better quality of care.
- Ensuring that the patient is admitted on the preferred ward leads to a better quality of care.

PATIENT SATISFACTION - Integrated capacity management leads to higher patient satisfaction thanks to:

- Reduction in waiting lists and waiting times
- Optimal Patientflow for planned and unplanned care
- Respect for patient preferences (e.g., Single room preferences)

EMPLOYEE SATISFACTION - Reduced variability in terms of capacity planning leads to increased well-being for the employees thanks to:

- More predictable planning and less (unexpected)overtime, leading to a better work life balance
- Reduced 'work peaks', leading to a reduction in stress
- Reduced operational overhead, leading to more productive time thanks to automated data capture
- Increased insight leads to less frustration. Most of the capacity peaks are planned peaks. By providing the right (predictive) information at the right time to the right person, IQVIA Health Flow provides insight on the impact of planning on the other entities within hospital.
- Increased insight leads to 'empowered' employees. Instead of choosing for a wall of screens in a 'command center', IQVIA Health Flow targets the individual stakeholder in the care process. The screens are designed to deliver personalized information that trigger decisions and actions. Feedback the from users indicate that by doing this they can more capitalize on their competences and have a more positive feeling of involvement.

BUDGET SATISFACTION - The focus on integrated capacity management by means of IQVIA Health Flow has a very positive budgetary impact thanks to:

- A digital twin of the hospital that allows for powerful capacity management simulations leads to identification of optimal capacity needs
- Reduction in variability leads to more optimal use of existing capacity. Studies show that a reduction of variability of 5% can lead to 15%-20% more activity within the same capacity boundaries.
- Reduction in waste leads to a reduction in cost. Examples:
    - o Meals delivered for patients already discharged
    - o Cleaning of rooms on the day that the patient will be discharged
    - o Overtime or extra resources due to unexpected capacity needs
    - o Sick leave due to stress factors
- Focus on expected/justified length of stay leads to a reduction in 'underfinanced' stays.

Capacity management process

Hospitals work very ad-hoc. The first goal is to get a better grip on what is happening and will happen, anticipating it by taking the right actions, not only looking at the now but also looking ahead. The second goal is to understand the variability and its impact, insights into the system through calculations and search for solutions through simulations.

IQVIA Health Flow is an innovative solution that supports the capacity management process from start to finish.
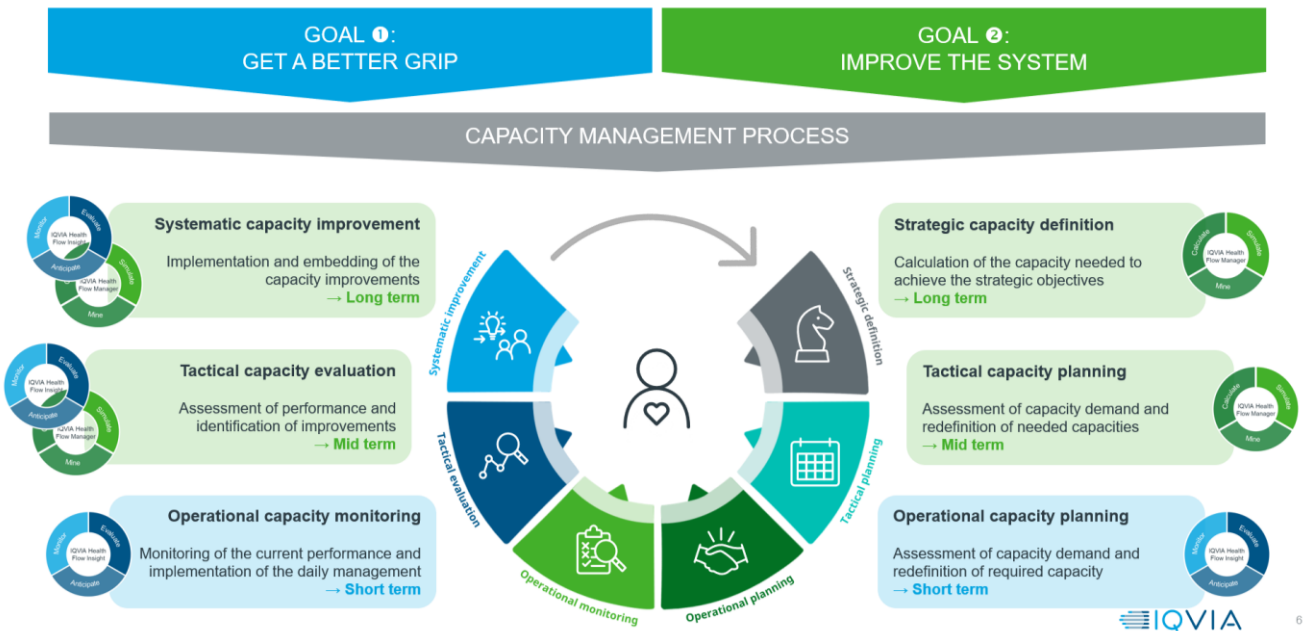
The capacity management process consists of the following steps

- Strategic capacity definition: simulation of the capacity needs for the coming 12 months, based on historical data and strategic initiatives.
- Tactical capacity planning: creation of a capacity calendar detailing daily capacity needs for the coming months.
- Operational capacity planning: use real-time and predictive insights to optimally align in- and outpatient activity with the planned capacity.
- Operational capacity monitoring: monitor performance and data quality.
- Operational capacity evaluation: take the necessary actions when variability increases, or capacity objectives are not met.
- Systematic capacity improvement: define and implement strategic capacity initiatives that will have an impact on the capacity needs for the coming months

The blue steps are supported by IQVIA Health Flow Insight, the green steps by IQVIA Health Flow Manager (3. IQVIA Health Flow | Solution)

2. IQVIA HEALTH FLOW | TECHNICAL SET-UP

Real time data processing

- The solution is able to extract, transform, load all types of structured data files (HL7, FHIR, CSV, direct DB access, …).

- The system enables the data linkage across multiple data sets from suppliers, and standardization of data into one common model.

- The data is (near) real-time processed and available

- Data from various peripheral systems and sources can be brought together in one common model. In this context, limited to:

  o Administrative: Patient activity, planning, expected discharge, …

  o Operation theatre planning

  o Staff planning

  o Patient characteristics, weight of care

- New data feeds can be established within the solution.
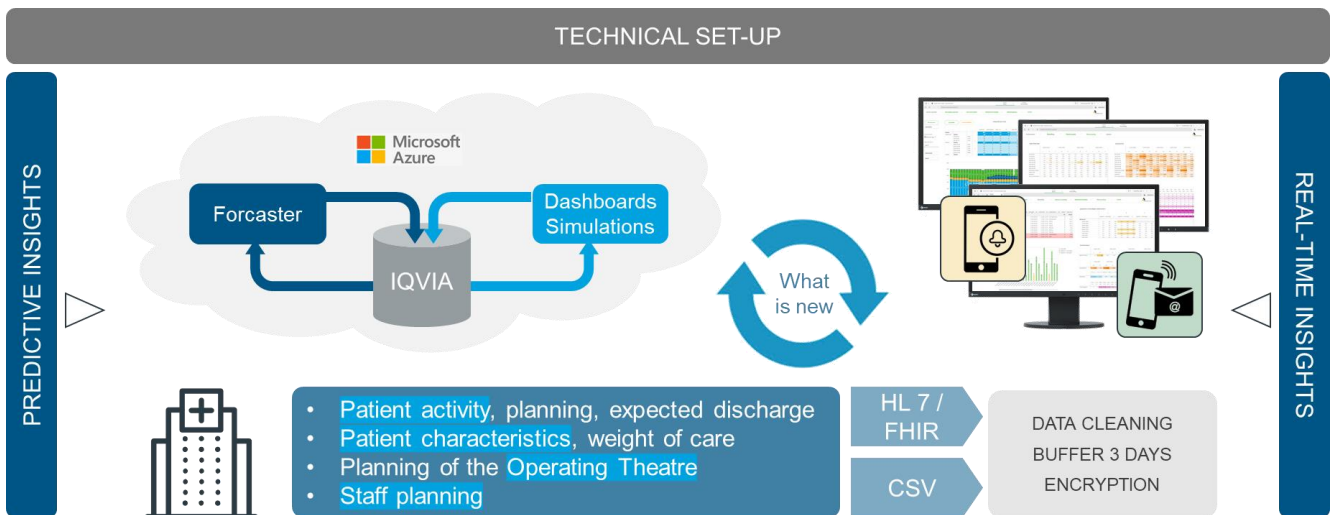
Forecasting algorithm

Next to real-time data and planned data, forecasted data is used to give insights into how the capacity will evolve in time.

The forecasting engine takes in account:

- the length of stay for a specific group of patients, for a specific doctor/specialism and projects this into the future

- the estimated discharge date and makes corrections into the future

- the emergency arrivals from the last year to predict the future

- the planned arrivals versus the effective arrivals in the past, to forecast the future

- the seasonal patterns and takes them into the future

- special events, which or entered by a user and which cannot be found in the historical data. For example, a new covid wave, changing holiday periods for surgeons, …
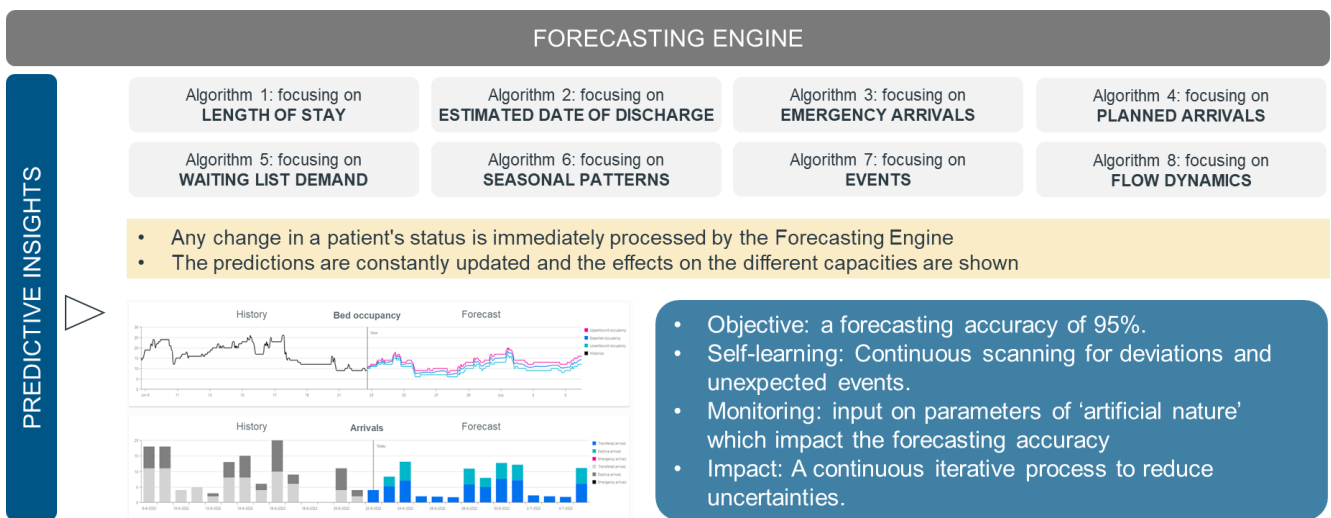

Alerting

- The system has the functionality to provide customizable live, real-time or near real-time user alerts. For example

  o For the OR planner if the status of the bed-house goes above a certain threshold

  o For the admission planner if a bed is freed earlier than expected

  o For the headnurse if many patients exceed their expected discharge date

3. IQVIA HEALTH FLOW | SOLUTION

IQVIA Health Flow is the result of a co-development effort by 4 parties:

- <u>IQVIA</u>: Solution lead with focus on system integration, industrialization, front-end development, implementation and change management.
- <u>Simbox</u>: Focus on the development of artificial intelligence in the context of Patient Flow Management
- <u>Ximius</u>: Focus on capacity management and real-time data capture and encryption
- *Ziekenhuis Geel*: Pilot hospital

IQVIA Health Flow is a SAAS solution running in Microsoft Azure that consists of 2 modules: IQVIA Health Flow Insight and IQVIA Health Flow Manager
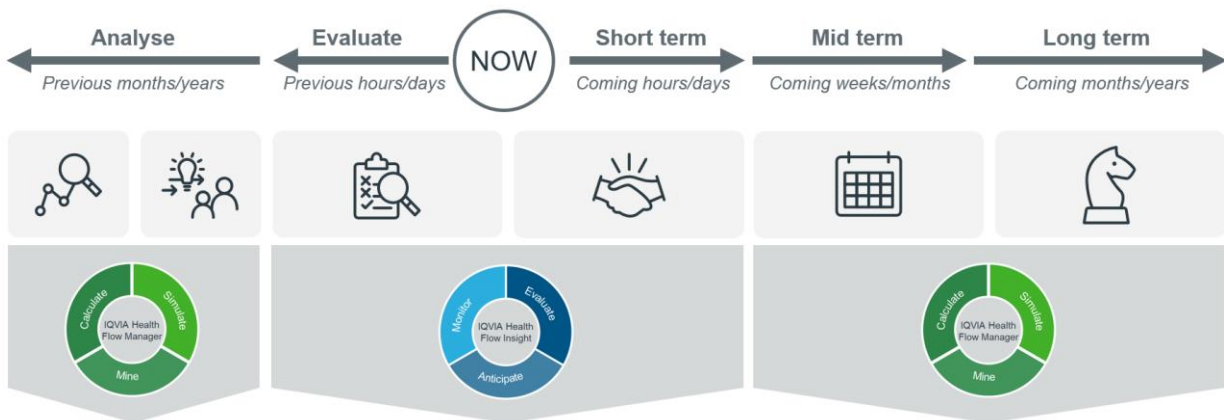
IQVIA Health Flow Insight

IQVIA Health Flow Insight provides insights in the current and future capacity needs in terms of beds and staffing, supported by data-driven notifications, send to the right person so that the right actions can be taken to solve or prevent capacity problems.

Real-time and predictive data

IQVIA Health Flow Insight monitors real-time all patient activity within the hospital (ambulatory, day, classical, emergency). Forecasting algorithms calculate how this activity (planned and unplanned) will evolve in the coming hours, days, or weeks.

Set-up can be done for an individual hospital or a network of hospitals.

Stakeholders

IQVIA Health Flow provides predictive insights to the different stakeholders to trigger the right actions at the right time and this with a minimal impact on the organization and the way of working. This is done by using role based (mobile) screens and the use of an intelligent alerting engine. The content of the screens can be highly customized and is defined by the combination of chapters, levels, and target groups.
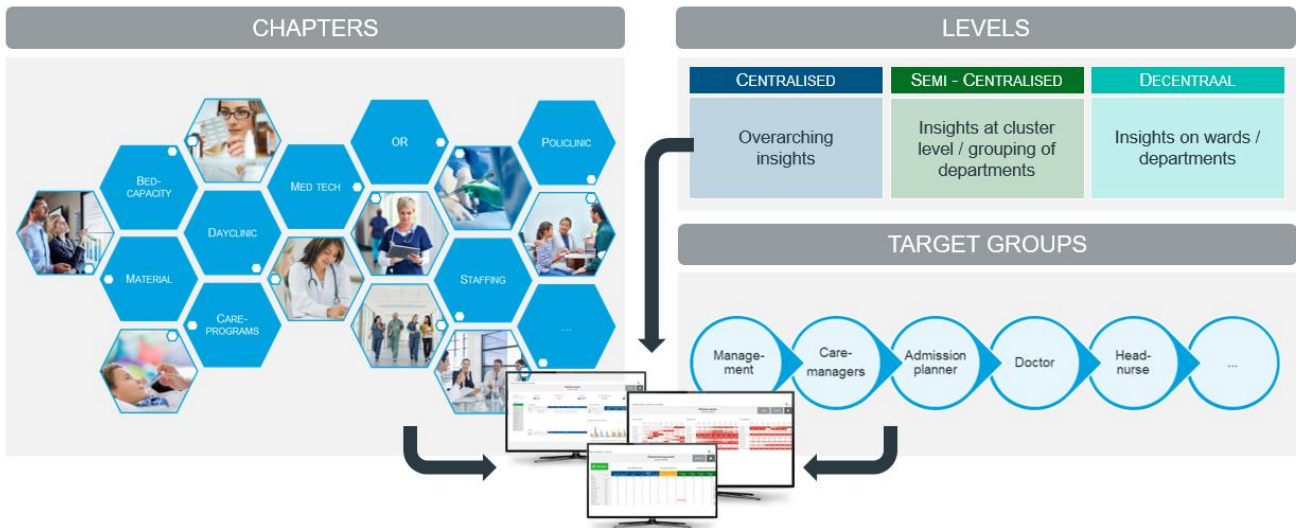
Objectives and outcomes

The final objective is to control variability, lower the peaks and make the valleys less deep. To achieve this goal there should be an optimal expected discharge date (EDD) registration, an efficient discharge management, anticipation to the predicted in- and outflow and a reduction of outliers.

As a result, there will be an overall reduction in length of stay, a lower delta patient-to-nurse ratio, an improvement capacity utilization, a lower workload perception. It will help to reduce overtime and sick leave and it will cause an overall gain of time.


Screens

To accomplish the different objectives and outcomes, different screens were set up for each target group. The screens are continuously optimized, updated and expanded and the target groups will be further expanded in the future.

Admission planner

As an admission planner, you should have a continuous view on the status of the bed house now and in the coming hours and days. And this across all departments so that the right capacity can be secured for planned and unplanned activity.

Therefore, the app designed for the admission planner provides these insights.
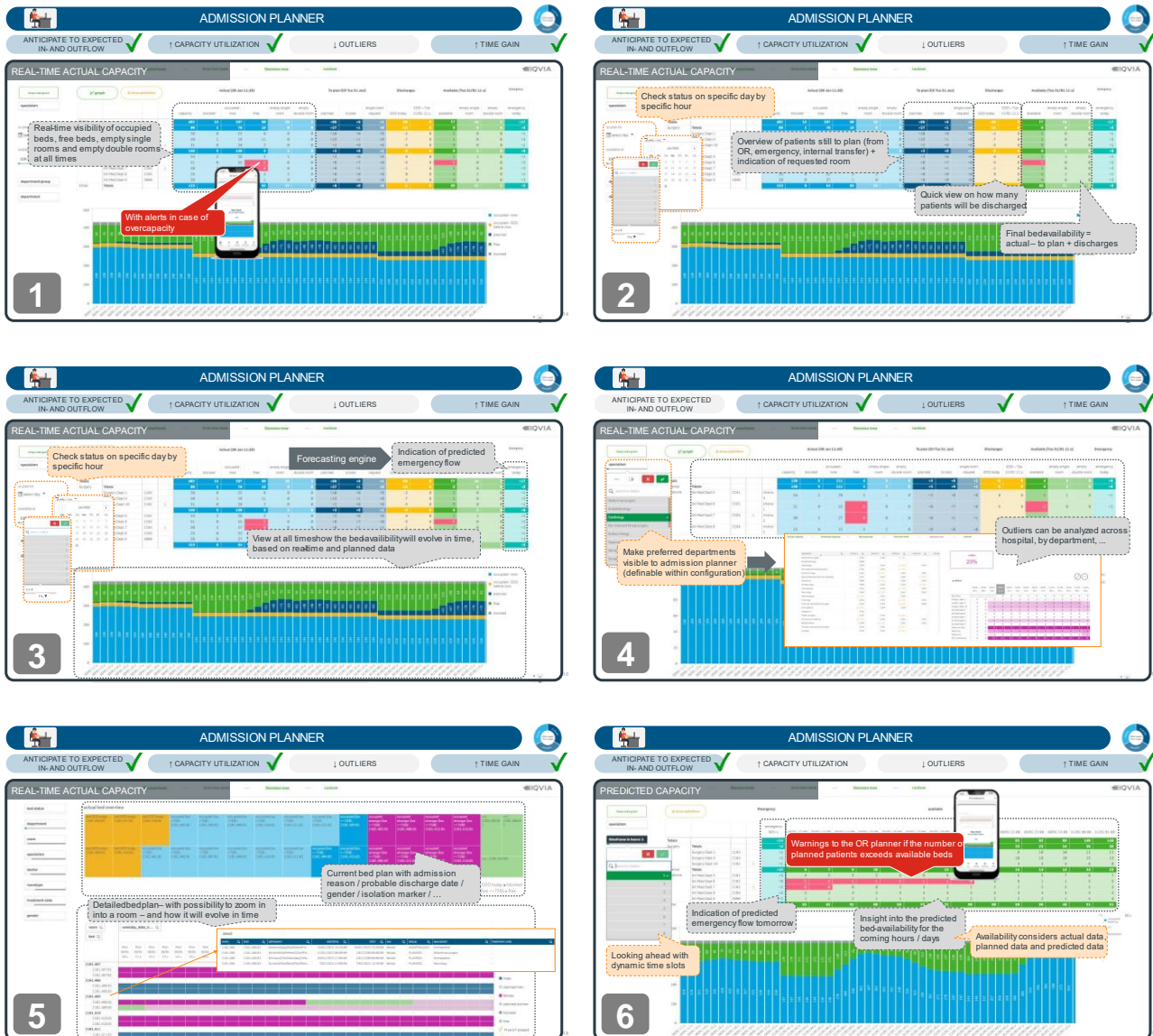
1	A continues real-time status of the beds (blocked, occupied, free), with the possibility of an alert in case of a capacity problem.
2	With an indication of beds to plan, discharges and final availability, now or on a specific time or day.
3	And with an indication of the predicted flow through emergency.
4	With guidance to plan patients on their most preferred ward, to prevent outliers.
5	A detailed bed-plan with the possibility to zoom in into a specific room or bed, and see all the necessary details, crucial for planning.
6	With insights into the predicted patient flow for the coming hours, days and weeks (calculated by the forecasting engine), considering real-time, planned and forecasted data.

Head of the flex team / Staff planner

As a staff planner you are responsible for efficiently scheduling the employees, with the objective of "the right care, at the right time, by the right person, in the best possible way, with as little waste as possible".

Therefore, the app designed for the staff planner should provide assistance for scheduling the staff in a well-considered way and it should quickly provide an insight into where there are shortages and where workload and weight of care are – or will become – high, in order to make the right decisions.
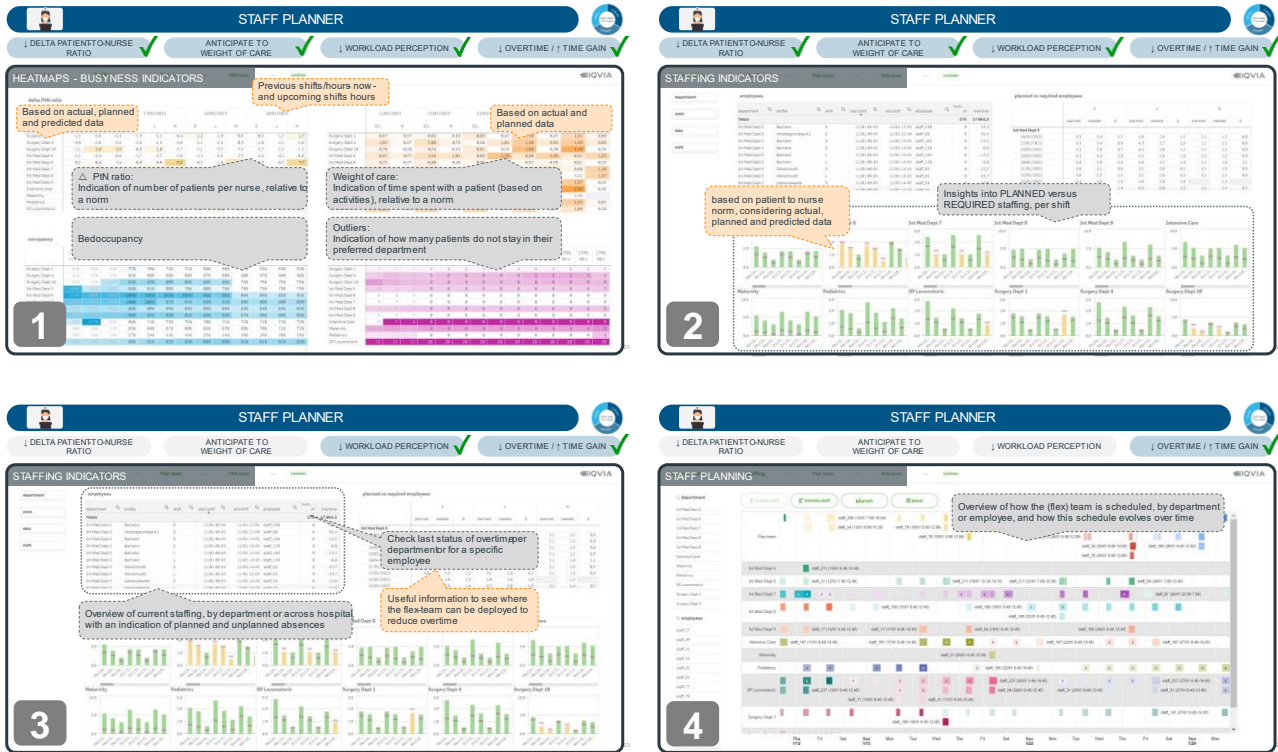

1	Busyness indicators in the form of heatmaps, regarding the delta patient-to-nurse ratio, the bed occupancy, the weight of care and the number of outliers. The darker the color, the busier this department. This for now and the coming hours, days, taking into account real-time, planned and predicted data.
2	Insights into the patient-to-nurse ratio across all departments, this for the current and upcoming shifts, with a visual view of where staff is over or under-scheduled, according to predicted patient presence, and with the possibility to check if flexibility between departments is possible.
3	Extra details about each staff member can be checked, with indication of planned or unplanned absence and overtime.
4	Clear overview of which employee is scheduled where at this moment and for the next few days.

Headnurse / Caremanager

As a head nurse you have two roles within capacity management: on the one hand, you can influence efficient bed planning by optimizing the registration of the expected discharge dates and discharge management, and on the other, they are responsible for efficient staff scheduling by aligning the planning with expected admission and discharge patterns.

The app designed for the head nurse shows a real-time and predictive view of the department's activity, with details on inflow and outflow and information about the staff and how they are planned.
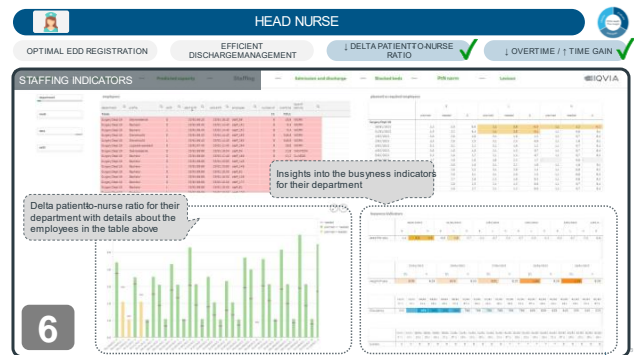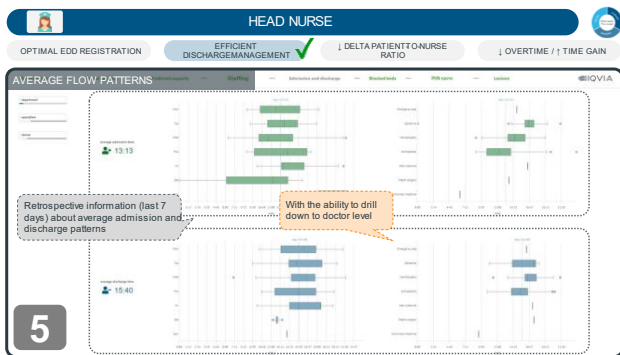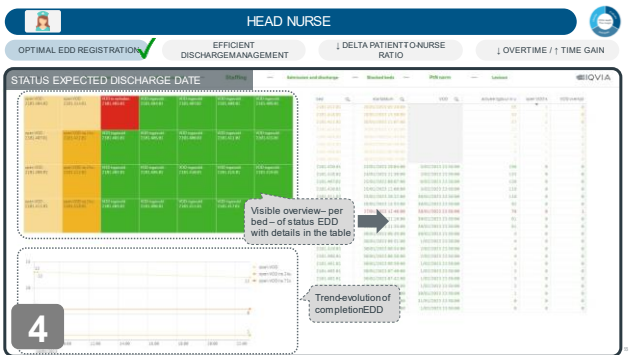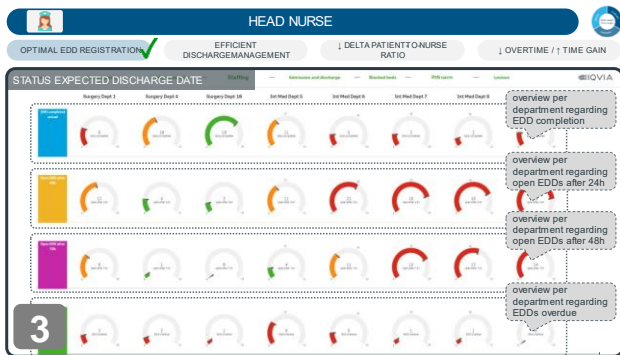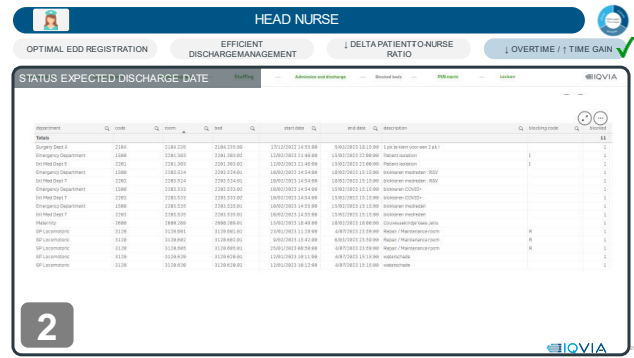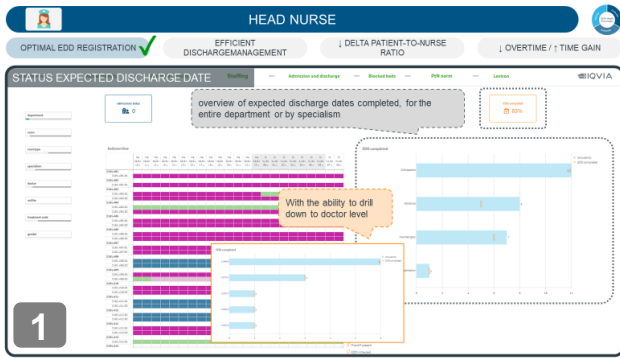
|	
1	Indication of how many patients still must be admitted and how many patients still have to be discharged, and this for today and tomorrow. And indication of EDD registration completed, across department, per specialism and per doctor.
2	Detailed overview of the blocked beds, with indication of start and end date and blocking reason.
3	Overview across departments of the EDD registration rate with an indication how many are not completed after 24-48 and 72 hours and with an indication of those who are overdue.
4	Detailed view of EDD registration per department with a trend to follow up the registration rate and with indication of the patients with the longest length of stay.
5	Retrospective information on admission and discharge patterns, and this for the last 7 days, in the form of boxplots. Per weekday and per specialism with the ability to drill down to doctor level.
6	Insights into the patient-to-nurse ratio within their department for the current and upcoming shifts, with the same details about the employees and an indication of the busyness within their department in the form of heatmaps.

IQVIA Health Flow Manager

Within the IQVIA Health Flow manager a copy is taken from your hospital and turned into a calculation and simulation environment. It helps to understand the variability and its impact, gives insights into the system through calculations and search for solutions through simulations.

The IQVIA Health Flow Manager provides an intuitive interface to create custom data models and powerful data science capabilities to map towards capacity and activity pathways.

It is fed with the information flowing from IQVIA Health Flow and additional datasets that can be loaded depending on the use case.

The IQVIA Health Flow Manager has two main purposes:

- it can be used to calculate the required beds and staffing (for the coming year(s), considering certain new situations and events,
- and it can be used to calculate the effect of the OR-schedule on the bed house and simulate how to minimize this effect (to reduce the variability)
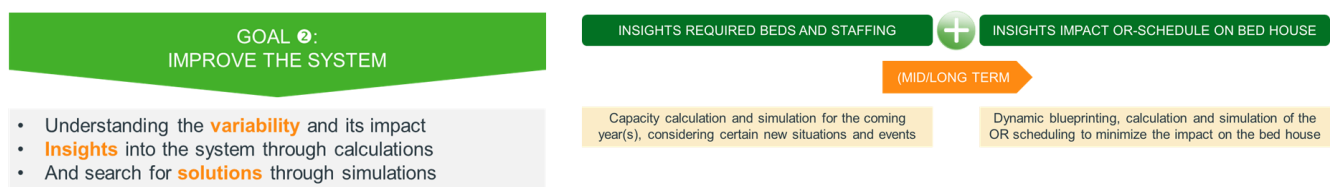
Digital Twin

As a capacity manager, you want to gain more insights into the hospital capacities and flows and look for opportunities and solutions. With the insights, calculations and simulations provided within the Digital Twin, a more precise and established plan can be set up and translated into a tactical and operational plan
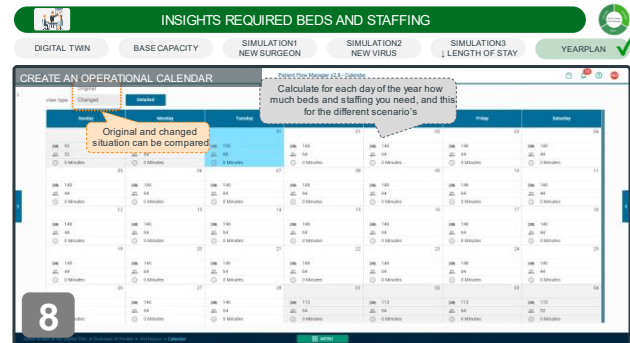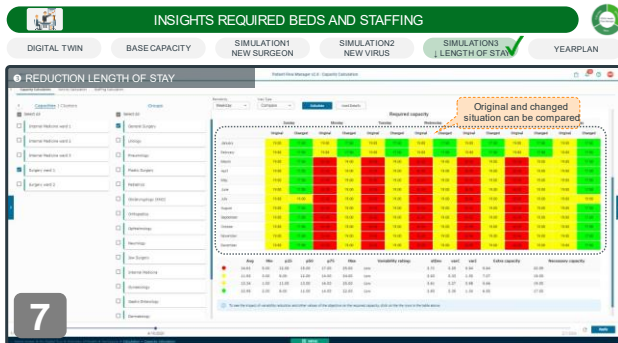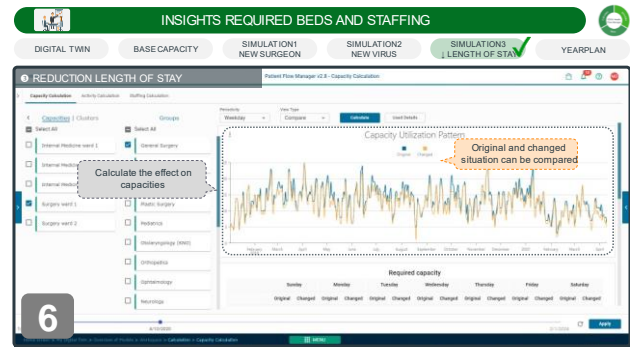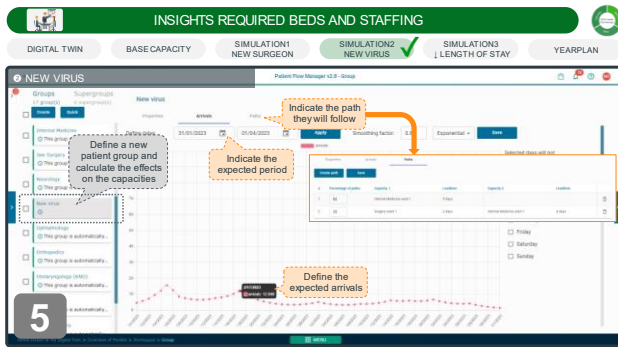
The required capacity, based on a reference period, can be calculated and specific new situations and events can be considered to calculate the required capacity for the coming year(s).

1	The copy of the hospital capacities and flows are visualized within "Paths". It groups patients who take the same steps, with details about each capacity used.
2	Calculate how many beds are needed for a specific department, a specialism, or your total hospital. The data is translated in a pattern of how many beds are needed. The same can be done to calculate the required staffing.
3	The graph is translated into a table that shows per month and per weekday how many beds are required, with an indication of the maximum and minimum beds required.
4	What if the hospital decides to hire an extra surgeon? → The effect on the capacities can be calculated by increasing the arrivals of a specific group of patients.
5	What if you want to simulate the effect of a new group of patients, which is not in your historical data? → The virus and the path patients will follow can be virtually simulated and the effect on the capacities can be calculated.
6	What will be the effect of a reduction of length of stay for a specific group of patients? → The gain in capacities (beds and staffing) can be simulated and compared with the original situation.
7	Table to compare different scenarios and the impact on the capacities.
8	The final strategy can be translated into a tactical and operational calendar with indication for every day of the year how many beds and staff are required, this for the original situation but also for the changed situation, and with a detailed plan below

Plannings Engine

The plannings engine within the IQVIA Health Flow Manager is designed to calculate the impact of the OR on the bed house. The OR scheduling is a major driver in causing a high variability within the departments. So, evaluate the OR schedule, calculate the impact on the departments and study possible optimizations is therefore crucial for a good and successful capacity management.

The tool can also be used to set up a virtual OR schedule (an OR that does not yet exist) in order to calculate and simulate how to set it up in the most optimal way, taking into account occupancy rates and impact on the bed house.
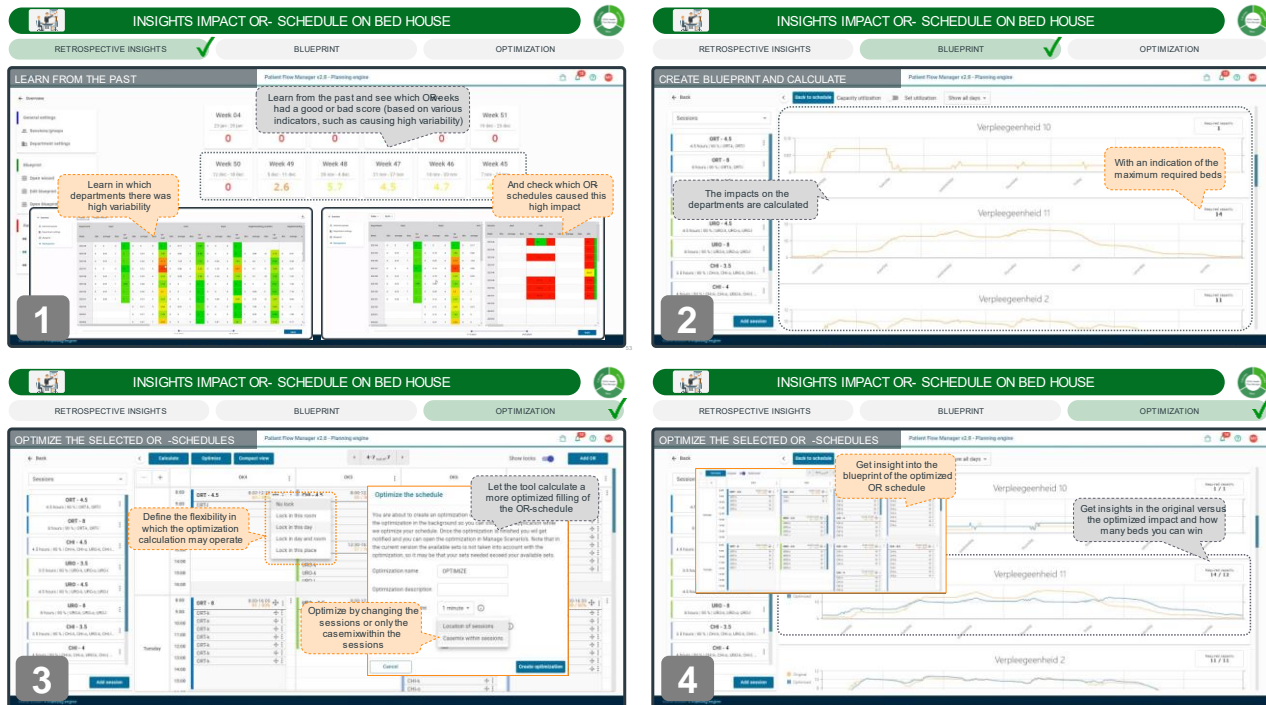
1	Insights into "how well" you planned, accordingly to some requirements and insights into the variability that specific OR schedules created within the bed house.
2	Based on a selected OR schedule you can than calculate what the impact was on the different departments.
3	Let the tool optimize the OR schedule, to lower the effect on the variability within the departments, and to gain capacity, considering certain restrictions (certain sessions or locations can be locked).
4	Differences between the optimized and original schedules can be checked, and the impact of the changes on the bed capacity for the different departments can be calculated (with an indication of how many beds you can win).