



## VPB-Round Table

# Process Mining (Artificial Intelligence) and Business Process Optimization: 2 case studies

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# Rapid growth | Current trends bring organizational challenges for tissue sparing surgery

Screening programs, aging populations and optimized diagnostics uncover lesions early



Increase in personalized surgical treatment pathways (BCS\* & TLND\*)



Demand to build sustainable care delivery with value-based solutions

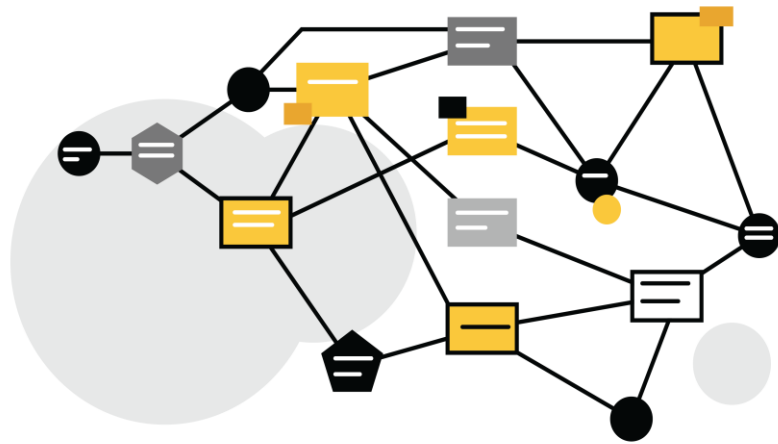


\*Breast Conserving Surgery  
\*Targeted Lymph Node Dissection

# How to measure and which tools can be used?

# What is process mining?

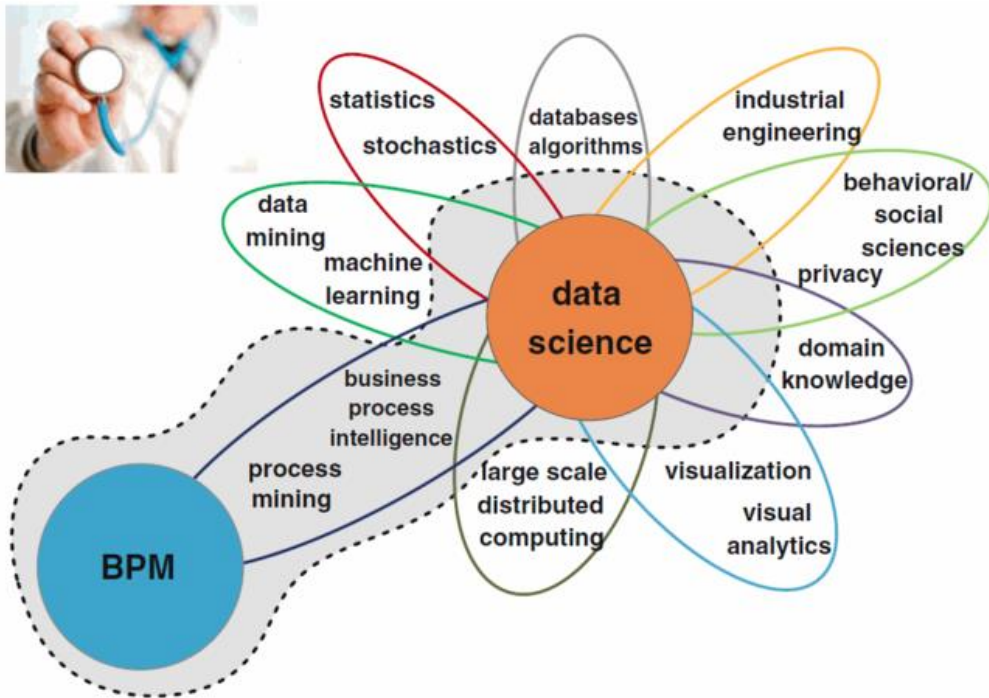
- A collection of techniques from **data science** and process management
- Allows for the analysis of **operational processes** based on **event logs**
- The goal is to turn event data into **insights** and **actions**



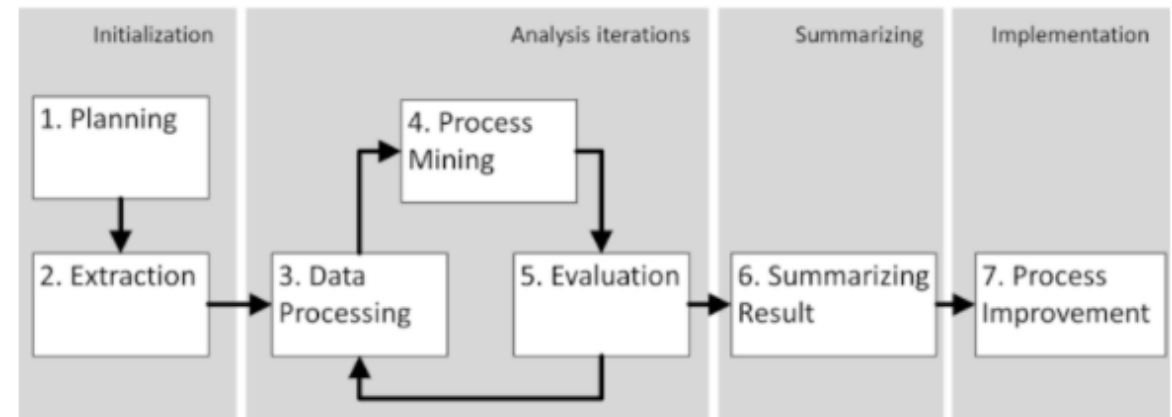
# Approach: Process Mining (data science) and Business Process Optimisation (BPM)



*The link to make it work?*

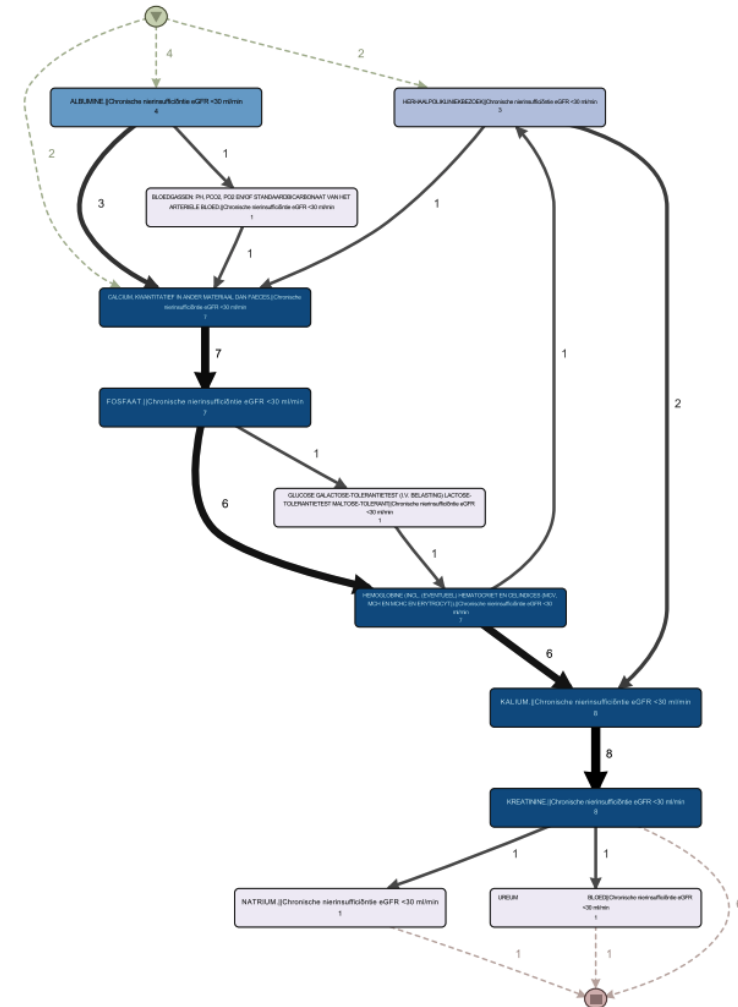


## Business Process Intelligence Program steps



# How does Process Mining work?

- **Phase 1 - Event collection**
  - Pull events from different administrative sources and create patient journeys
- **Phase 2 - Discovery**
  - Apply algorithms to the data and create visual representations of the underlying journeys
- **Phase 3 - Analytics**
  - Test the hypotheses and find answers to the main questions
- **Phase 4 – Application**
  - Turn the insights into actions



# Case study 1

## Hospital in the Netherlands

# Project preparations

## 1. Research Question:

- How much can the utilization of Sirius Pintuition improve the costs of care paths in a Dutch hospital?
- Expected outcome:
  - Process model with current care paths and associated costs based on data
  - Process model with envisioned care path(s) using Sirius Pintuition and associated costs

## 2. Definition project scope

1. Install Project Team
2. Visualization current care path
3. Definition patient scope
4. Legal requirements

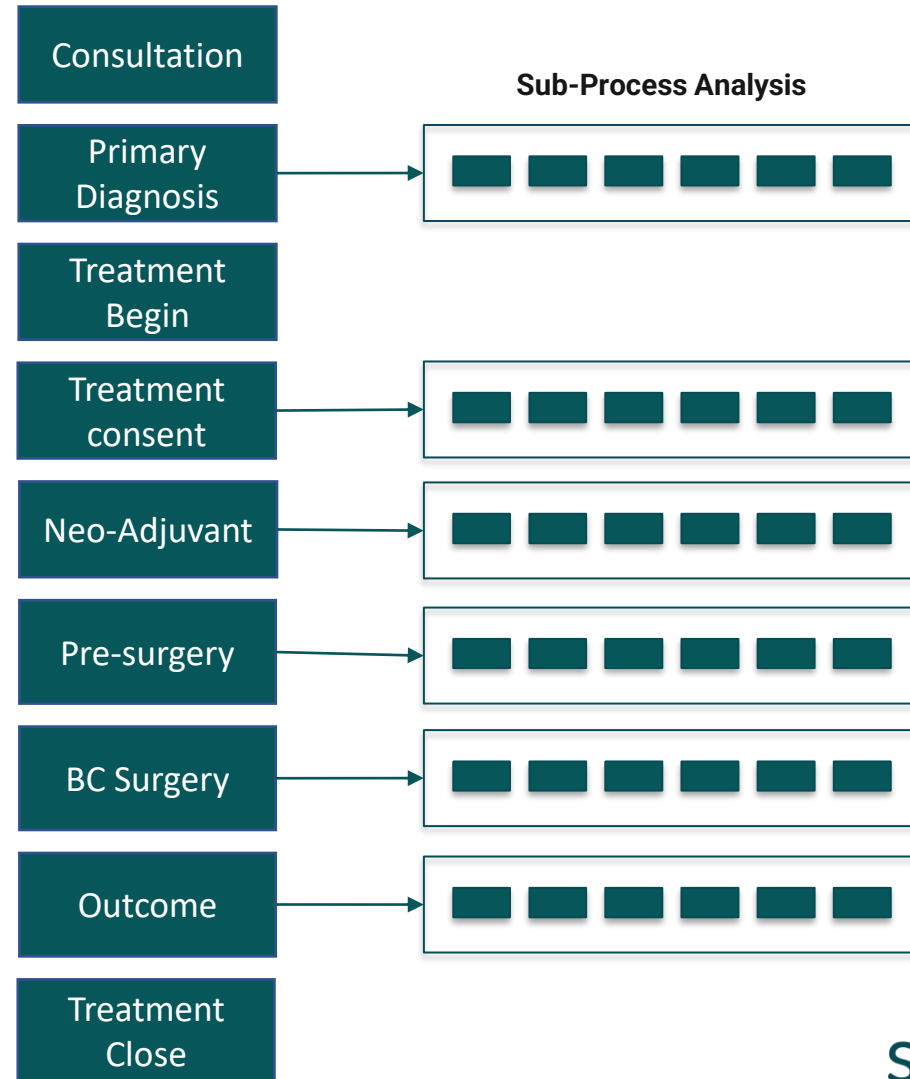


# Proposed Scope – Breast Cancer Surgery

Scope in:  
Primary and Targeted Lymph Surgery  
Diagnostic/breast Radiology

Tumors:  
DCIS  
Invasive  
Stage I-II  
N1 (including TAD)

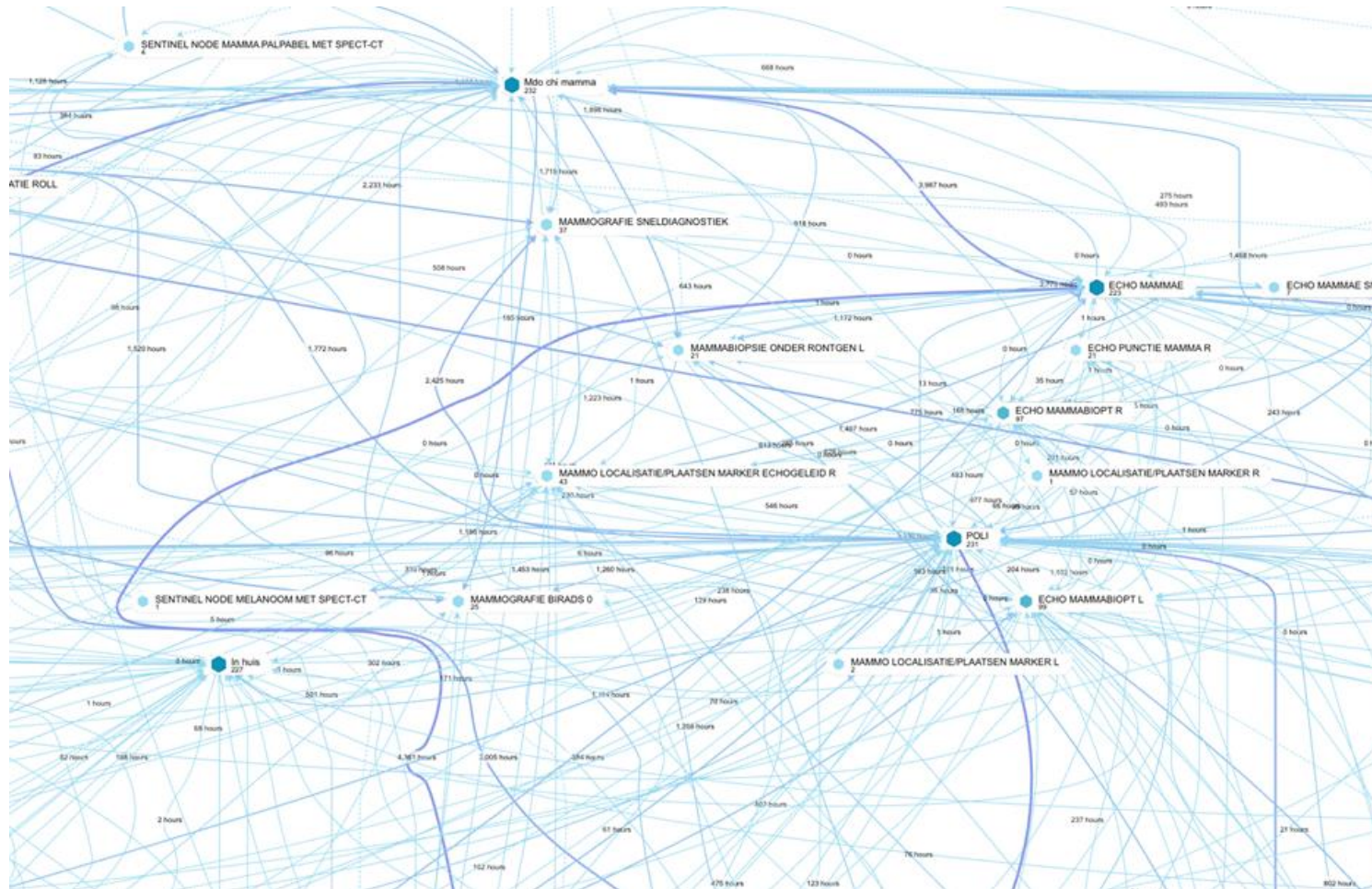
## Core Surgical Process Model Pathway



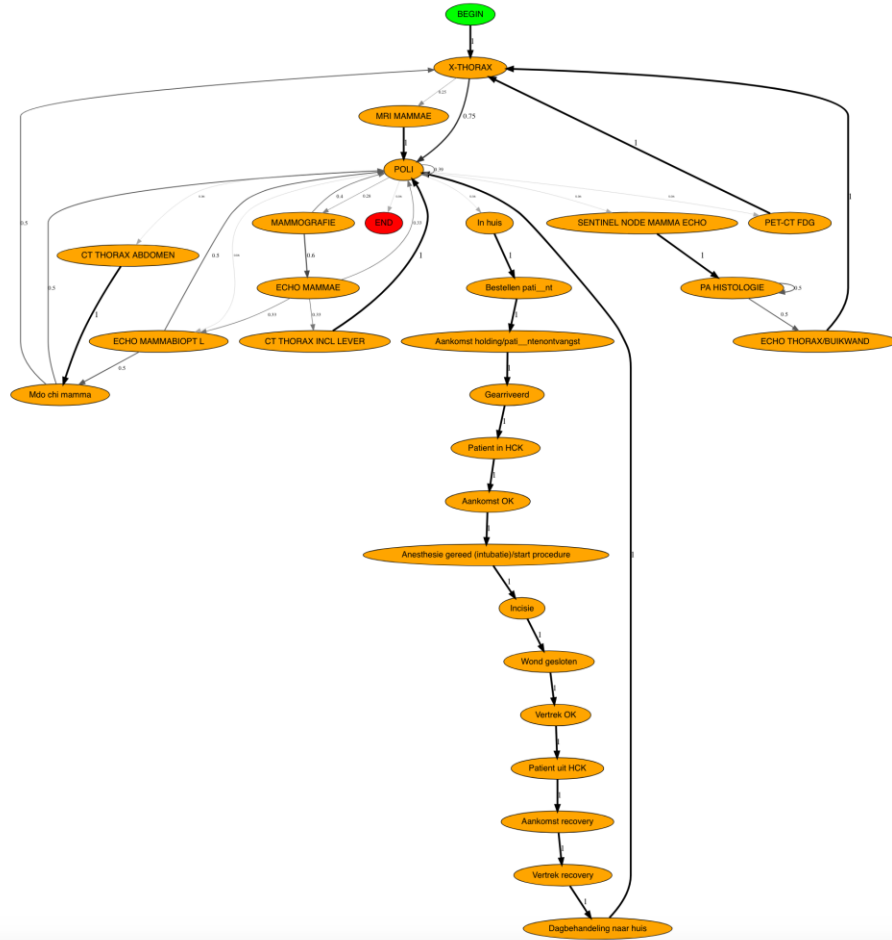
# Defined patient scope

- Group 1: Breast saving surgery
  - 232 patients --> 9.965 registered anonymous events in hospital information system
- Group 2: Breast saving surgery, with treatment of malignant lymph node in axilla
  - 65 patients --> 3.609 registered anonymous events in hospital information system

# Results after process mining Patient Group 2 (65 patients, 3609 events)



# Real patient and events (N=1)



step	patient	date	event
RADIOLOGIE	1	2017-03-22 20:35:00.000000000	X-THORAX
POLI	1	2017-07-12 08:50:00.000000000	POLI
RADIOLOGIE	1	2017-07-12 09:43:00.000000000	MAMMOGRAFIE
RADIOLOGIE	1	2017-07-12 09:59:00.000000000	ECHO MAMMAE
RADIOLOGIE	1	2017-07-12 10:33:00.000000000	ECHO MAMMABIOPT L
POLI	1	2017-11-12 13:20:00.000000000	POLI
POLI	1	2017-12-18 15:20:00.000000000	POLI
RADIOLOGIE	1	2017-12-19 15:22:00.000000000	ECHO MAMMABIOPT L
MDO	1	2017-12-21 00:00:00.000000000	Mdo chi mamma
POLI	1	2017-12-21 14:00:00.000000000	POLI
OPERATIE	1	2018-01-03 07:12:59.999999818	In huis
OPERATIE	1	2018-01-03 08:17:26.000000182	Bestellen patiënt
OPERATIE	1	2018-01-03 08:34:04.999999855	Aankomst holding/patiëntenontvangst
OPERATIE	1	2018-01-03 08:38:00.000000097	Gearriveerd
OPERATIE	1	2018-01-03 09:27:00.000000251	Patient in HCK
OPERATIE	1	2018-01-03 09:29:30.000000111	Aankomst OK
OPERATIE	1	2018-01-03 09:50:31.000000052	Anesthesie gereed (intubatie)/start procedure
OPERATIE	1	2018-01-03 09:58:28.999999891	Incisie
OPERATIE	1	2018-01-03 10:46:30.999999688	Wond gesloten
OPERATIE	1	2018-01-03 11:15:41.000000154	Vertrek OK
OPERATIE	1	2018-01-03 11:16:00.000000195	Patient uit HCK
OPERATIE	1	2018-01-03 11:25:01.999999908	Aankomst recovery
OPERATIE	1	2018-01-03 13:43:30.999999730	Vertrek recovery
OPERATIE	1	2018-01-03 17:13:59.000000199	Dagbehandeling naar huis
POLI	1	2018-01-15 13:40:00.000000000	POLI
NUCLEAIR	1	2018-02-01 00:00:00.000000000	SENTINEL NODE MAMMA ECHO
PATHOLOGIE	1	2018-03-01 10:15:00.000000000	PA HISTOLOGIE
PATHOLOGIE	1	2018-03-01 13:45:00.000000000	PA HISTOLOGIE
RADIOLOGIE	1	2018-03-16 10:23:00.000000000	ECHO THORAX/BUIKWAND
RADIOLOGIE	1	2018-04-17 08:13:00.000000000	X-THORAX
POLI	1	2018-05-14 13:40:00.000000000	POLI
RADIOLOGIE	1	2018-05-24 00:00:00.000000000	PET-CT FDG
RADIOLOGIE	1	2018-05-29 10:18:00.000000000	X-THORAX
POLI	1	2018-05-30 13:20:00.000000000	POLI
POLI	1	2018-09-04 11:40:00.000000000	POLI
POLI	1	2018-10-01 09:30:00.000000000	POLI
RADIOLOGIE	1	2018-10-09 11:53:00.000000000	MAMMOGRAFIE
POLI	1	2018-10-09 15:10:00.000000000	POLI
RADIOLOGIE	1	2018-10-30 08:55:00.000000000	CT THORAX ABDOMEN
MDO	1	2018-11-01 00:00:00.000000000	Mdo chi mamma
RADIOLOGIE	1	2018-12-12 11:23:00.000000000	X-THORAX
RADIOLOGIE	1	2019-04-17 10:12:00.000000000	MRI MAMMAE
POLI	1	2019-04-23 13:20:00.000000000	POLI
POLI	1	2019-07-10 15:20:00.000000000	POLI
POLI	1	2019-09-16 13:20:00.000000000	POLI
RADIOLOGIE	1	2019-09-30 15:39:00.000000000	MAMMOGRAFIE
RADIOLOGIE	1	2019-09-30 15:52:00.000000000	ECHO MAMMAE
RADIOLOGIE	1	2019-10-12 10:46:00.000000000	CT THORAX INCL LEVER
POLI	1	2020-04-05 09:50:00.000000000	POLI
RADIOLOGIE	1	2020-04-17 14:53:00.000000000	MAMMOGRAFIE
RADIOLOGIE	1	2020-04-17 15:01:00.000000000	ECHO MAMMAE
POLI	1	2020-04-20 11:10:00.000000000	POLI
POLI	1	2020-07-09 11:20:00.000000000	POLI
POLI	1	2020-11-05 15:40:00.000000000	POLI
RADIOLOGIE	1	2021-02-22 09:44:00.000000000	MAMMOGRAFIE
POLI	1	2021-02-22 14:40:00.000000000	POLI

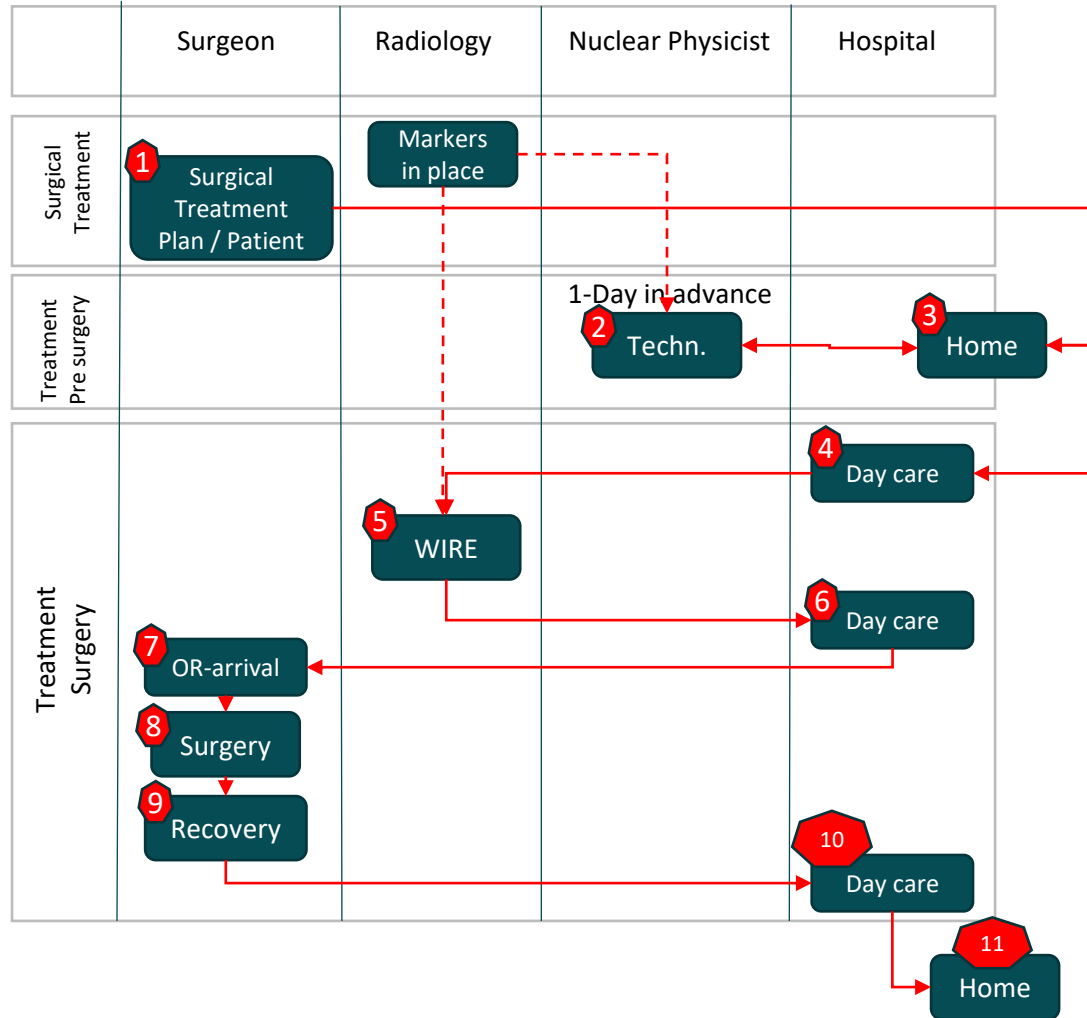
# Some findings

- Hospital has a documented and implemented care path for breast cancer treatment, but lot of patient-by-patient variation
- Eye-opener for involved health care professionals
  - Unawareness about “real life” care path
  - Unaware about unnecessary events in care path

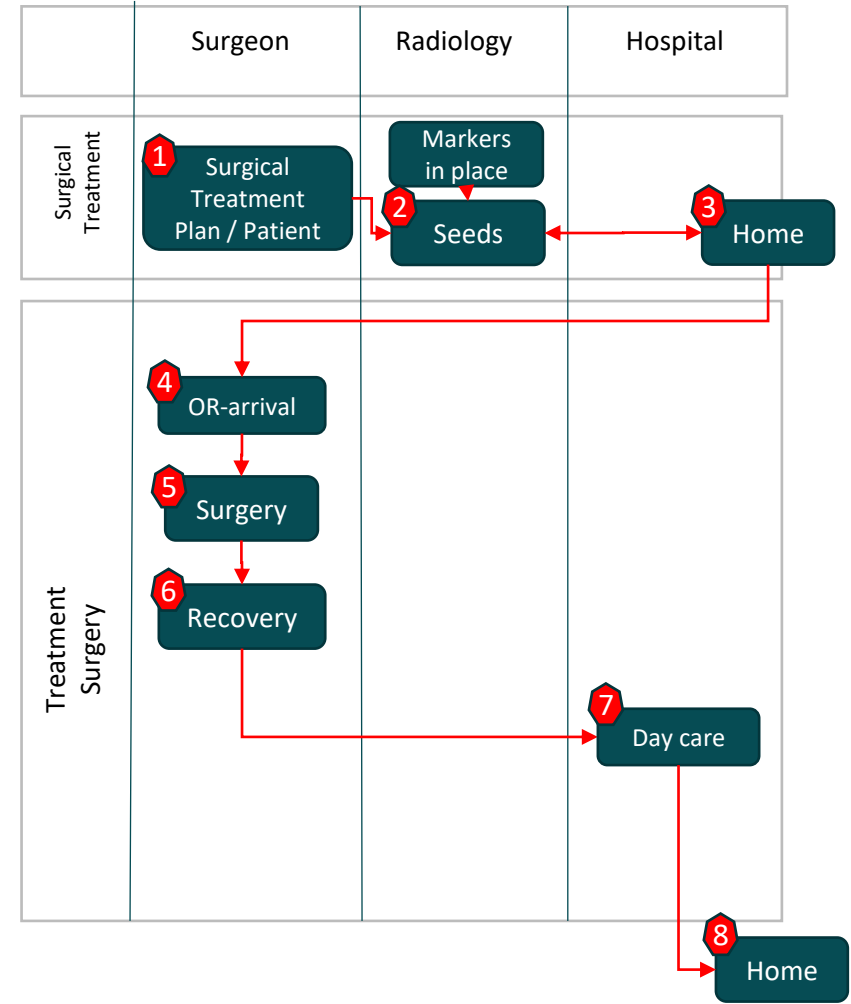
## Next steps:

- Adding Finance
- Adding prospective insights
- Discussion on procurement partnership

# Current flow



# Proposed flow



# Possible advantages

- No radiation/nuclear; no travel to separate location, no need to go day in advance and less resources
- Less events – no day-care/transportation and no technetium
- Less waiting on the day of surgery for patient – lower time in hospital
- Less potential bottleneck by radiology coupling causing delay of surgery
- Capacity planning – no special booking of radiology blocks pre-surgery
- Capacity constraint – no limit to start early on the day of surgery
- Lower risk of overnight stays in case of nuclear preparation or afternoon delays

Better process - Lower costs - Better patient experience

# Case study 2

## Hospital in the UK

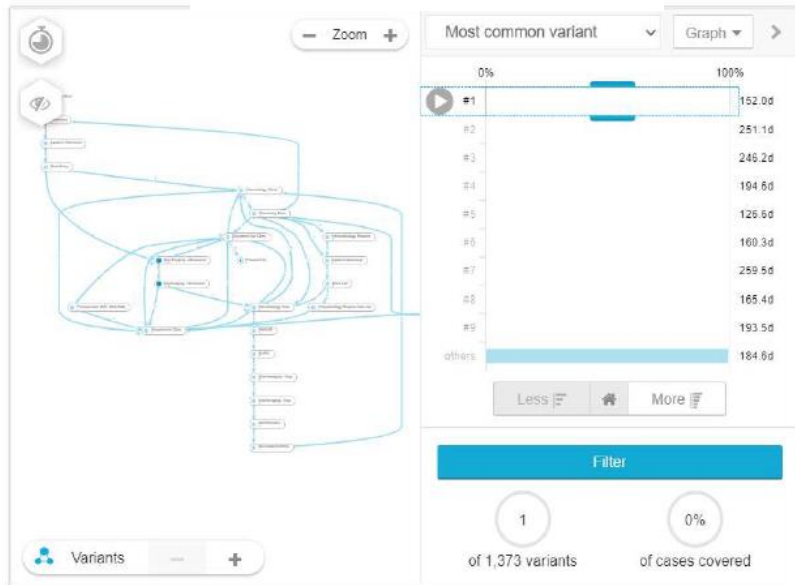


# Research question

1. Create a performance overview of the current patient pathway for the hook wires for non-palpable breast conserving tumor surgery for (to be identified) UK NHS hospitals. The pathway will be described in terms of both clinical outcomes, occupation of staff and other process resources.
2. Identify improvement opportunity when using Sirius Magnetic Localization related to the clinical and financial outcomes (based on the (involved) UK hospitals).
3. Formulation of hospital specific action plans for the improvement of the local pathway

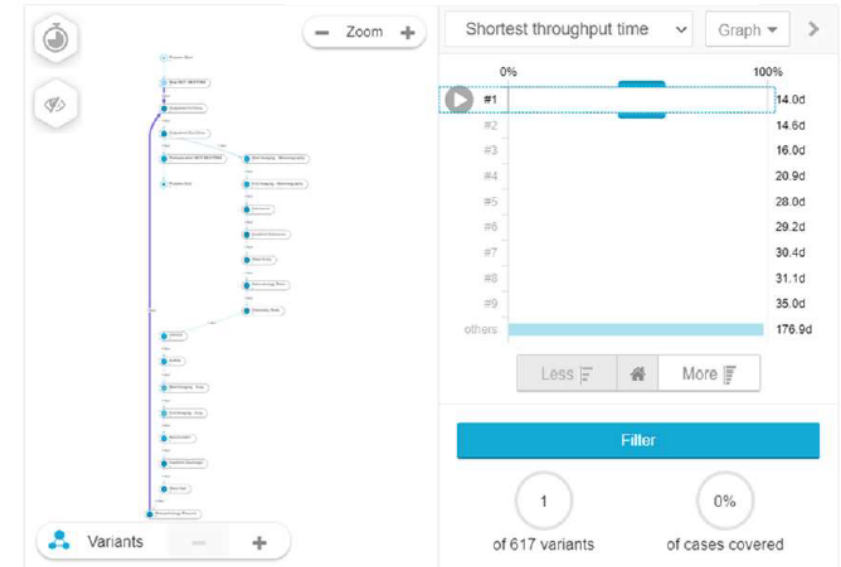
# Example SiriusLink™ – ProcesMining app

## Wire Guided



1367 cases  
Average time in hospital 10h  
140 patients spend over 14h (10.2%)

## Wire free



617 cases  
Average time in hospital 9h (pre-opp gain)  
48 patients spend over 14h (7.8%)



10% ↓  
24% ↓

Statistical difference

# Some findings

1. Every single case was a variant. All 1973 patients were treated using a different process
2. Wire free markers reduced pre-surgery preparation time by 1 hour
3. Patients with a magnetic marker are less likely to stay overnight, have shorter hospital stays and less variation between patients

## Next steps:

### Reduction of variation will bring:

- Significant process improvement
- Better patient experience
- Improved resource planning
- Improved patient scheduling
- Lower cost

# Conclusions

- VBHC is measuring patient value with patient relevant (medical outcomes) and costs over the full cycle of care (Porter)
- In presented cases, Process Mining has been an effective and objective tool to measure patient related events breast cancer treatment care path
- Stakeholder involvement is key, clinical stakeholders in the lead
- Pilot first, learn and adjust during the process --> create a learning cycle
- Procurement value is about cost savings in the total care path and not about lowest product prices

**Thanks for your  
attention**