

PROCESS  
MINER  
OF THE YEAR  
2018



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# Reducing Cancer diagnostic delay using Process Mining techniques



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**HOSPITAL UNIVERSITARIO LUCUS AUGUSTI**

**Process Mining Camp 2018**

# HOSPITAL UNIVERSITARIO LUCUS AUGUSTI

**900 BED  
PUBLIC  
UNIVERSITARY  
HOSPITAL**

- NW Spain 300.000 inhabitants
- 2.000 healthcare professionals
- 800.000 consultations + 19.000 surgeries a year



# Public Healthcare objective?

**BEST POSSIBLE CARE  
WITH A LIMITED BUDGET**

**Increasing costs (long living  
population, more expensive  
cancer treatments)**



# Public Healthcare objective?

## DIFFICULT BALANCE

- High citizen overall satisfaction (7 over 10)
- But long waiting time for a lot of activities



# Healthcare professional POV

## PATIENT CENTERED HEALTHCARE SYSTEM

### Strengths:

- Highly trained professionals
- Very good care

### Weaknesses:

- Slow organization, not enough professionals



# Patient POV

## PINBALL-LIKE ATTENTION

### Strengths:

- Very good professionals

### Weaknesses:

- Not enough investment to reduce waiting lists





# The great problem

NEVER  
ENOUGH  
MONEY

- Increasingly expensive treatments
- Reduce costs without limiting treatments?
- How to reduce delays to an optimum?





# Possible solutions???

R&D on new treatments?

Wearables and Big data?

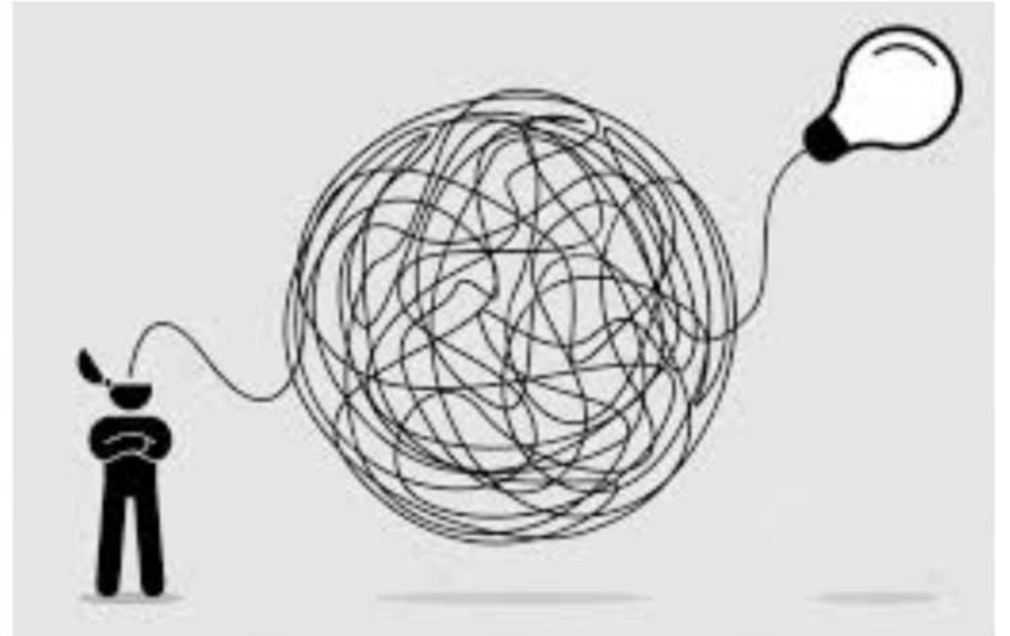
Personalized medicine, genomics?

Prevention plans?

**Yes, but LONG  
TERM, EXPENSIVE  
AND DIFFICULT...**

An immediate, cost-effective, solution for healthcare?

**It's Process Mining!!**



# Process Mining in Healthcare

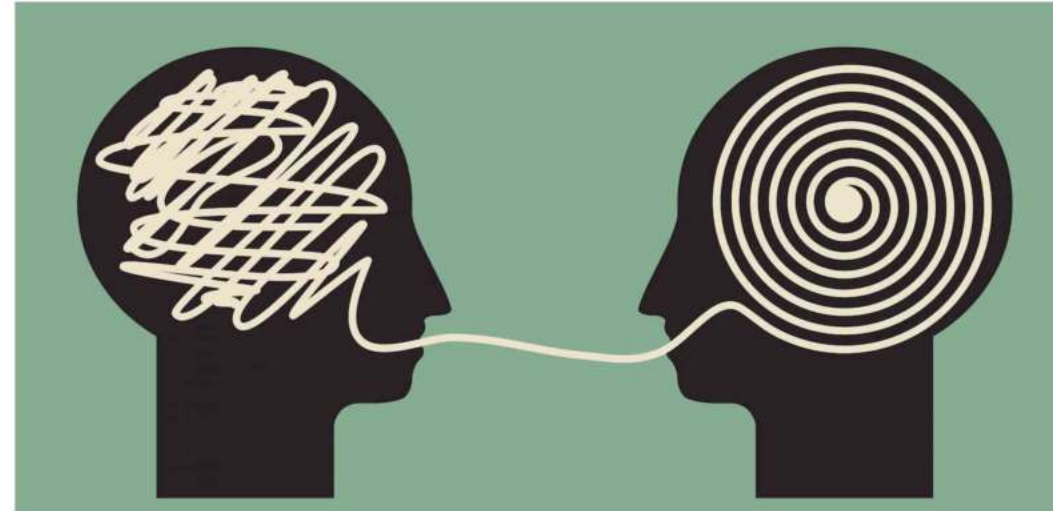
## USE CASES

Improve process

Identify patterns

Detect exceptions

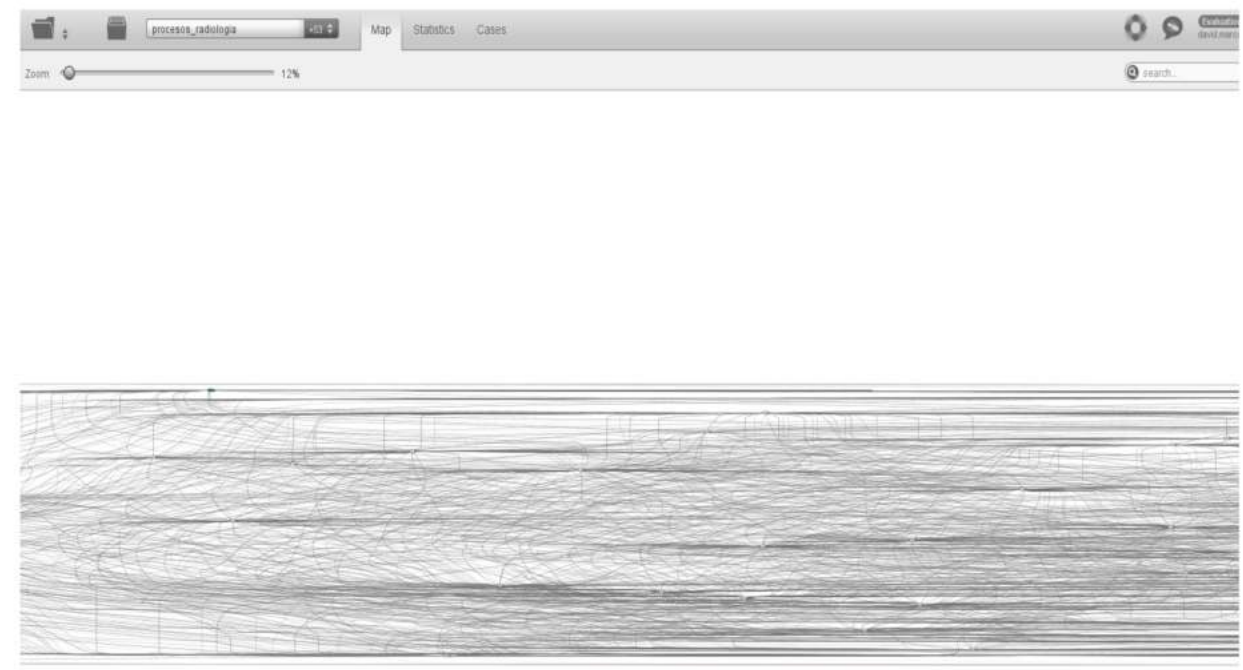
Identify networks



# Problems

## SPAGHETTI PROCESS

- Huge complexity of traces
- Data volume
- Lots of data sources
- Long time logs



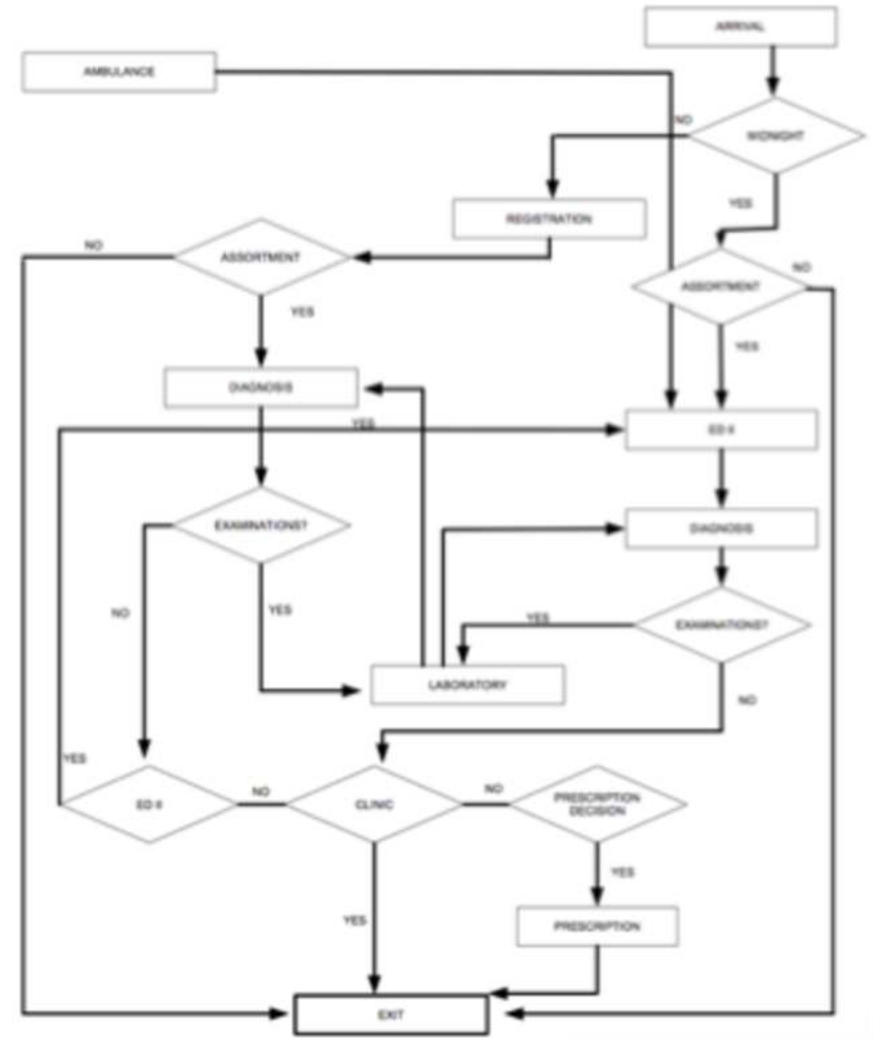
**ONE MONTH RADIOLOGY LOG!!!**

# More problems

Previous design and standardization?

No previous design (except fast pathways and Emergencies)

Almost every patient is unique!



# So how to do it ?

REDUCE  
THE  
SCOPE

- Problematic Department
- Study a group of patients





# National Research Project on mouth cancer patients

IT DEPT. AND OTORHINOLARINGOLOGY (ORL)

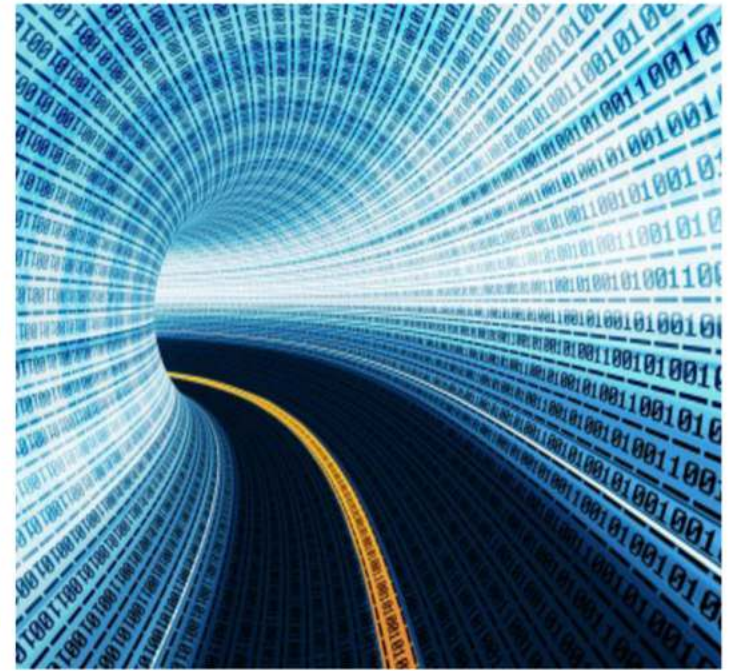
Difficult to detect without training

Great results when early treated

Increasing public healthcare problem



**FAST PATHWAYS**





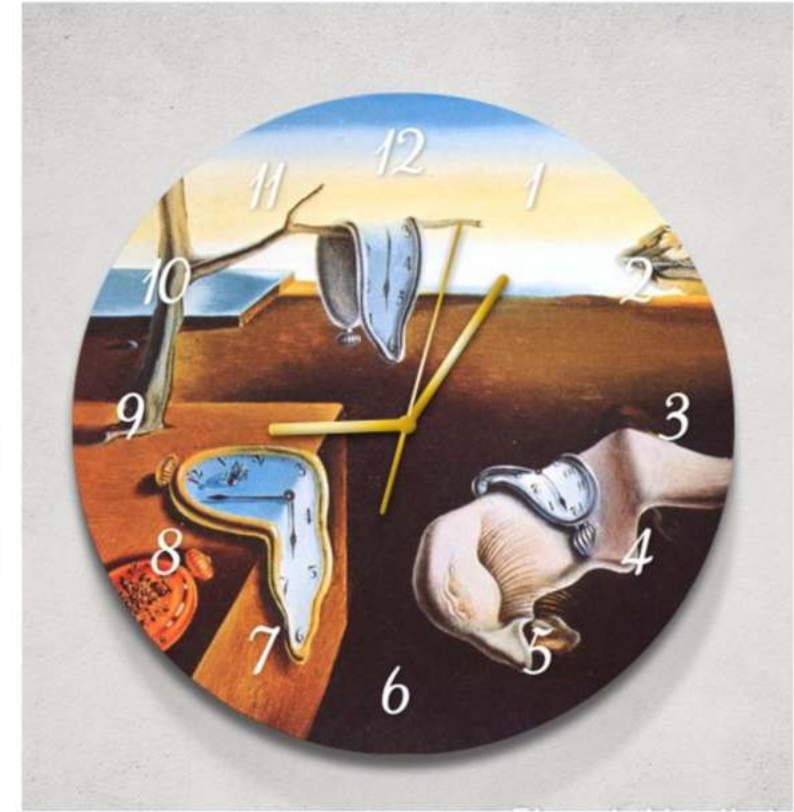
# So, what are we searching for?

DIAGNOSIS INTERVAL

First symptoms - the patient goes to the doctor

CANCER DETECTION – ORL DEPT.

ONCOLOGIC TREATMENT



# Process Mining on mouth cancer

patients?

**EARLY DIAGNOSE**

80% survival on early detection and fast treatment

1-2 years survival when late detection

**DIAGNOSE AND FAST PATHWAYS**



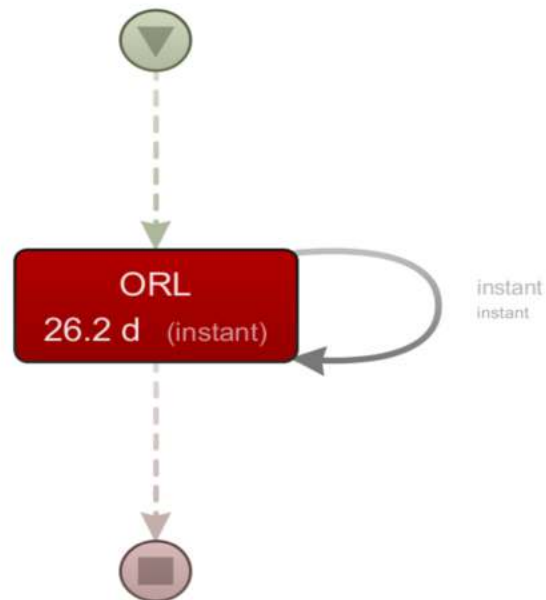
# Fast path = Ideal Path

**BEST CASE POSSIBLE**

Primary care detection, referral to  
OTORHINOLARINGOLOGY (ORL)

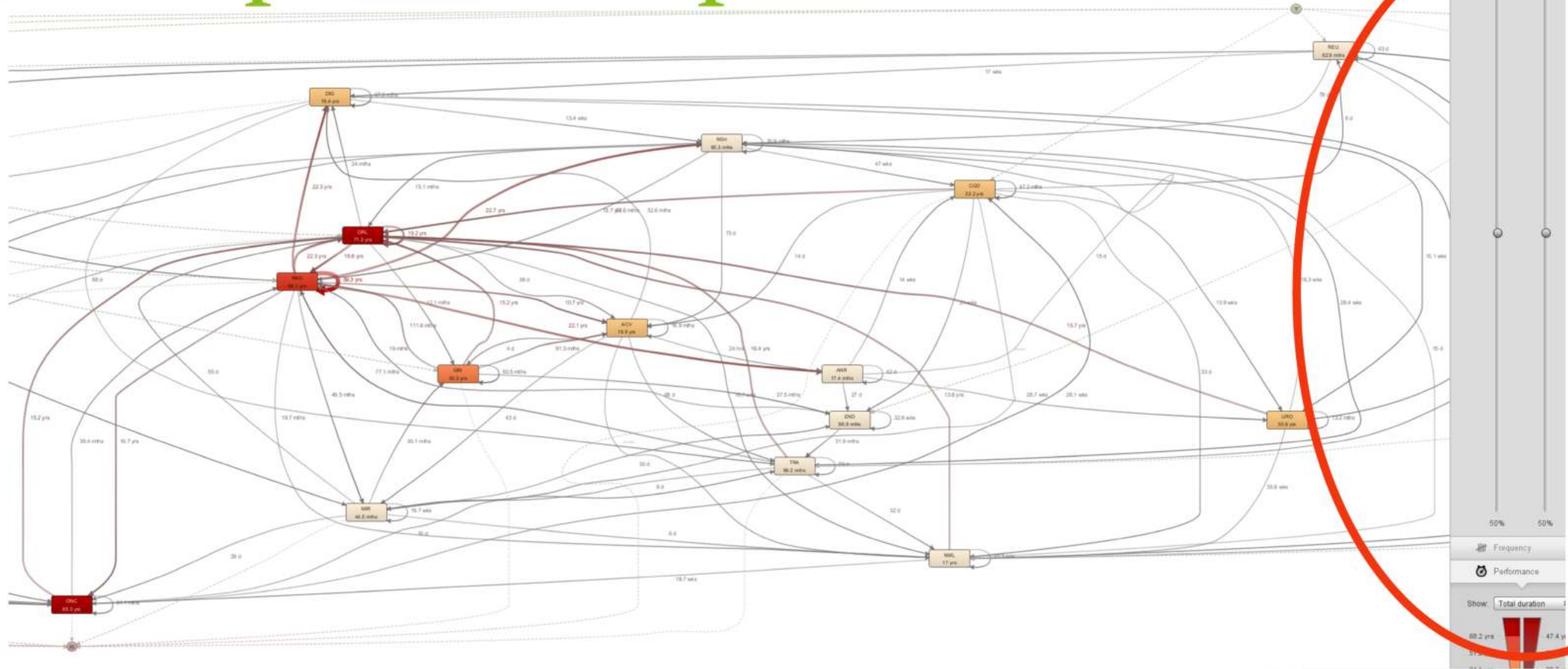


**SURGERY AND (SOMETIMES)  
ONCOLOGIC TREATMENT**





# Full paths - 21 patients



# Simplify process map

**DELETE TRACES AFTER DIAGNOSE**

**DELETE TRACES FROM UNRELATED  
DISEASES**

**DOCTOR'S EXPERTISE NEEDED**



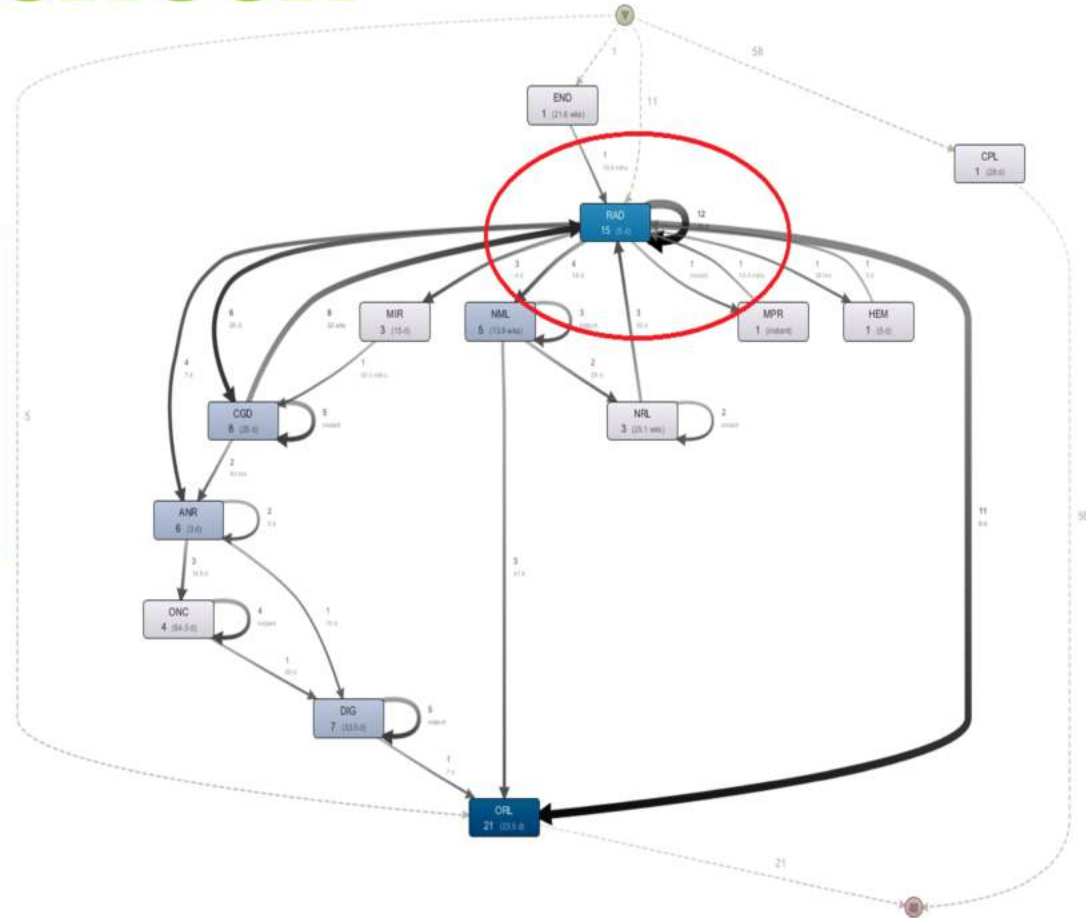


# Radiology bottleneck

Radiology is a central dept.  
40% total hospital's activity

More than 400.000 tests a year

Long delays - up to 10 months

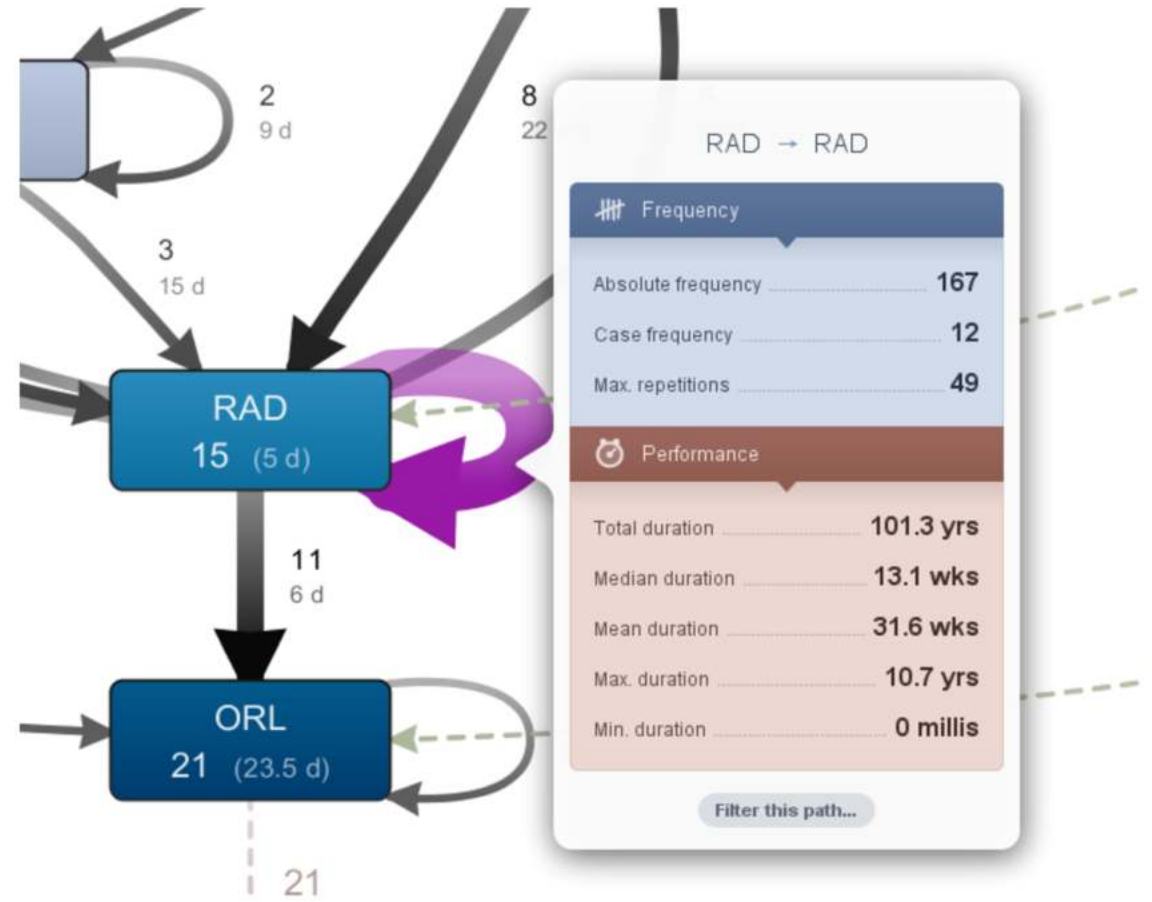




# Radiology loops

12 patients did this loop 4 times- mean waiting time of 31,6 weeks.

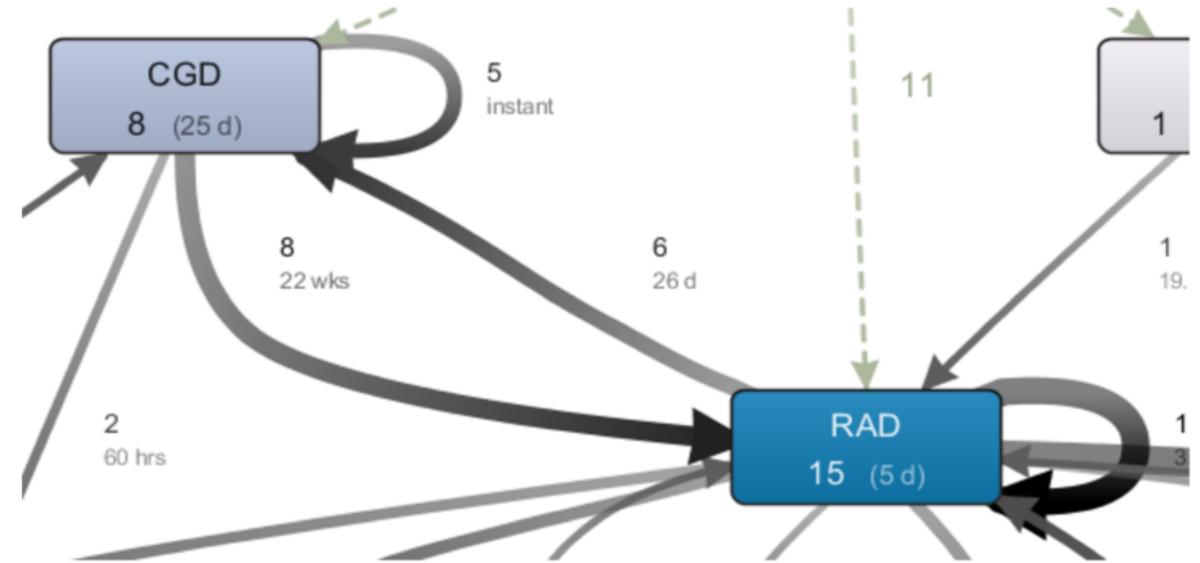
Patients are repeating tests - too long interval in between.



# Radiology out inefficiencies

Not possible to take a fast path from Radiology

Returning back to specialist is the only path



**IT PROBLEM – EHR DESIGN DOES NOT ALLOW DIRECT PATH**



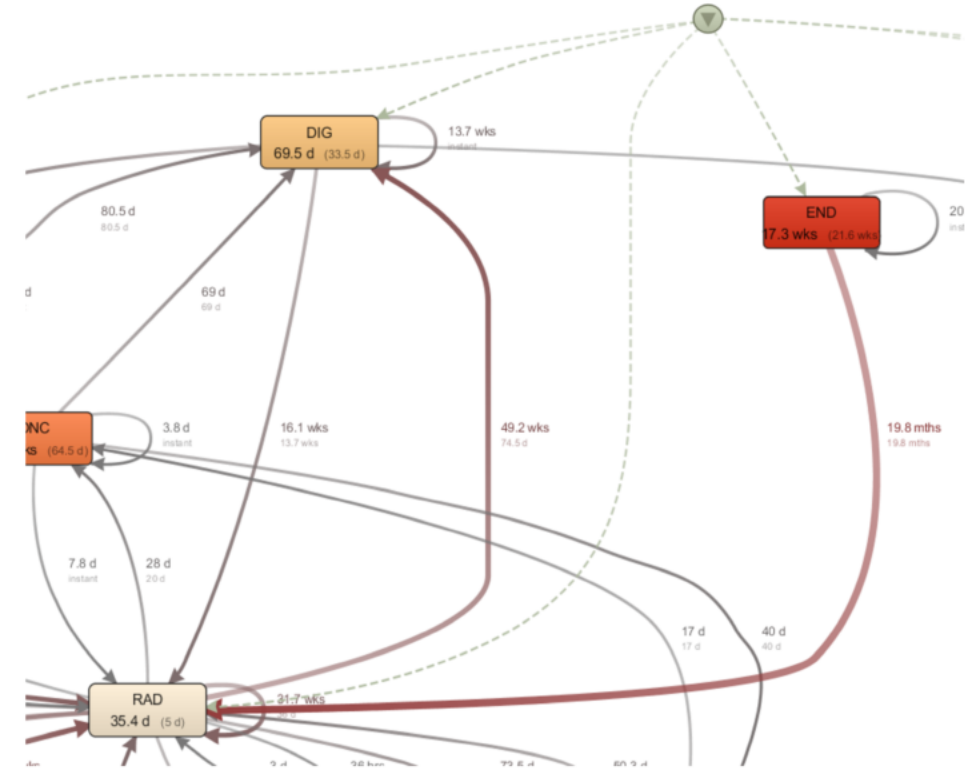
# Referral from general practitioner

Great delay variability on specialist (Dig., Endo., Pneum.)

Fast path only available from ORL



**ONLY 20% OF THE PATIENTS FOLLOW FAST PATH**



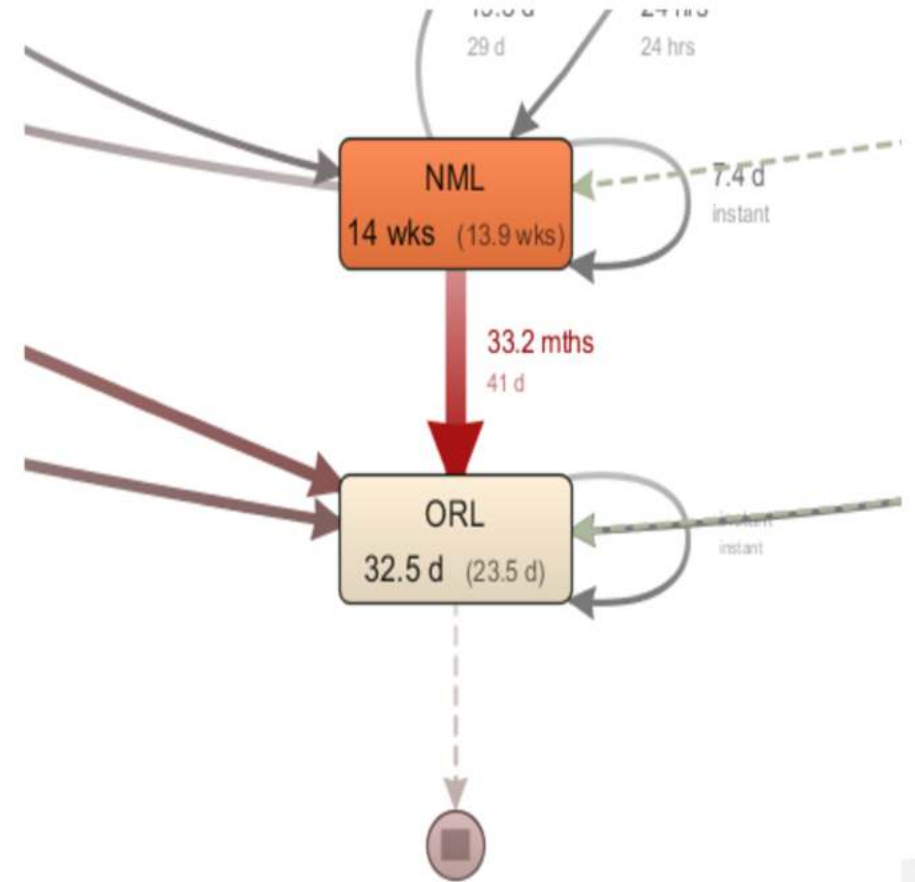
# Between specialists?

Great delay when referral between specialists

Returning back to Primary Care or long waiting time



IT PROBLEM – EHR DESIGN DOES NOT ALLOW FAST PATH BETWEEN SPECIALISTS



# Summary

## ORGANIZATIONAL PROBLEMS

- Fast paths to ORL not working
- Radiology bottlenecks

## CORRECT REFERAL FROM PRIMARY CARE

- EARLY DIAGNOSE  
TRAINING



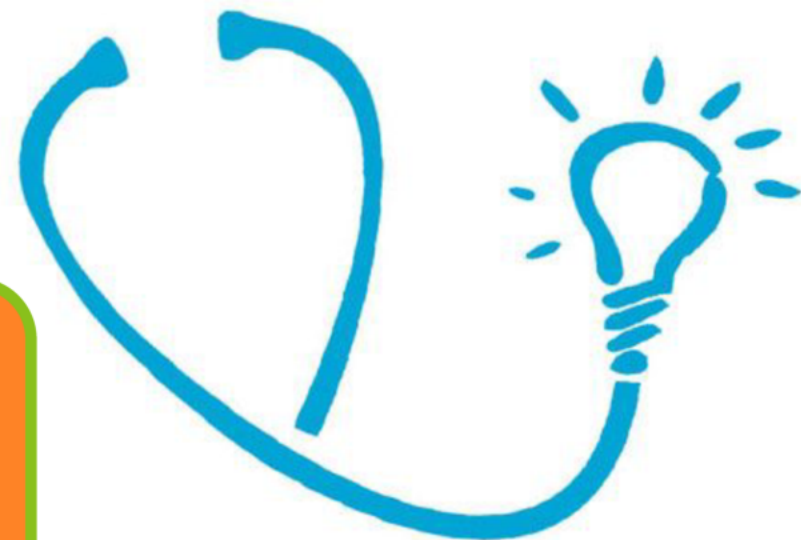
# NEXT STEPS

## ACTING ON

- Specific training on Primary Care and dentists
- Optimize processes in Radiology Dept.
- Fast paths analysis



# Expectations



SURVIVAL

- 1-2 year survival vs 20 years

REDUCING  
COSTS

- From 20.000 to 3.000 euro per patient



# Want more details?



Case Study



## CANCER DIAGNOSTIC DELAY REDUCTION

### Summary

IT Service of Hospital Universitario Lucus Augusti (HULA) takes part in a Spanish national research project to analyse reasons and consequences of delayed diagnosis in oropharyngeal cancer.

Oral and oropharyngeal cancer is a global public health problem, it is estimated that 405,000 new cases arise each year, increasing its incidence and mortality rate particularly in certain parts of Europe (France and Hungary), Southeast Asia, India and Brazil.

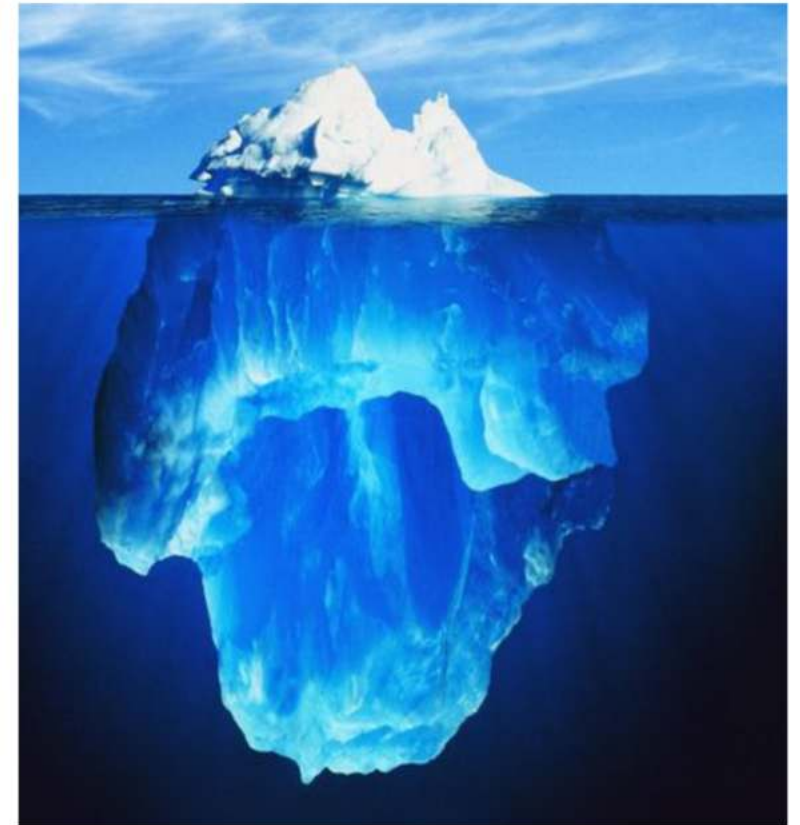
We have identified 250 patients and worked over 46 patients with this disease in our DB's and studied their paths into our hospital.

Using process mining software Disco, we have been able to find bottlenecks in our Hospital and identify the paths that patients with the worst prognosis follow.

This knowledge is allowing us to take actions that will improve processes and reduce diagnostic times, increasing patient survival.

At the same time, through data mining techniques like clustering, we expect that the analysis of the different paths and patients, allows us to determine what were the differences in the initial symptoms, so that we

- Process mining case study in Healthcare
- Revealed bottlenecks that can lead to faster cancer diagnosis



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Thanks for your attention



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