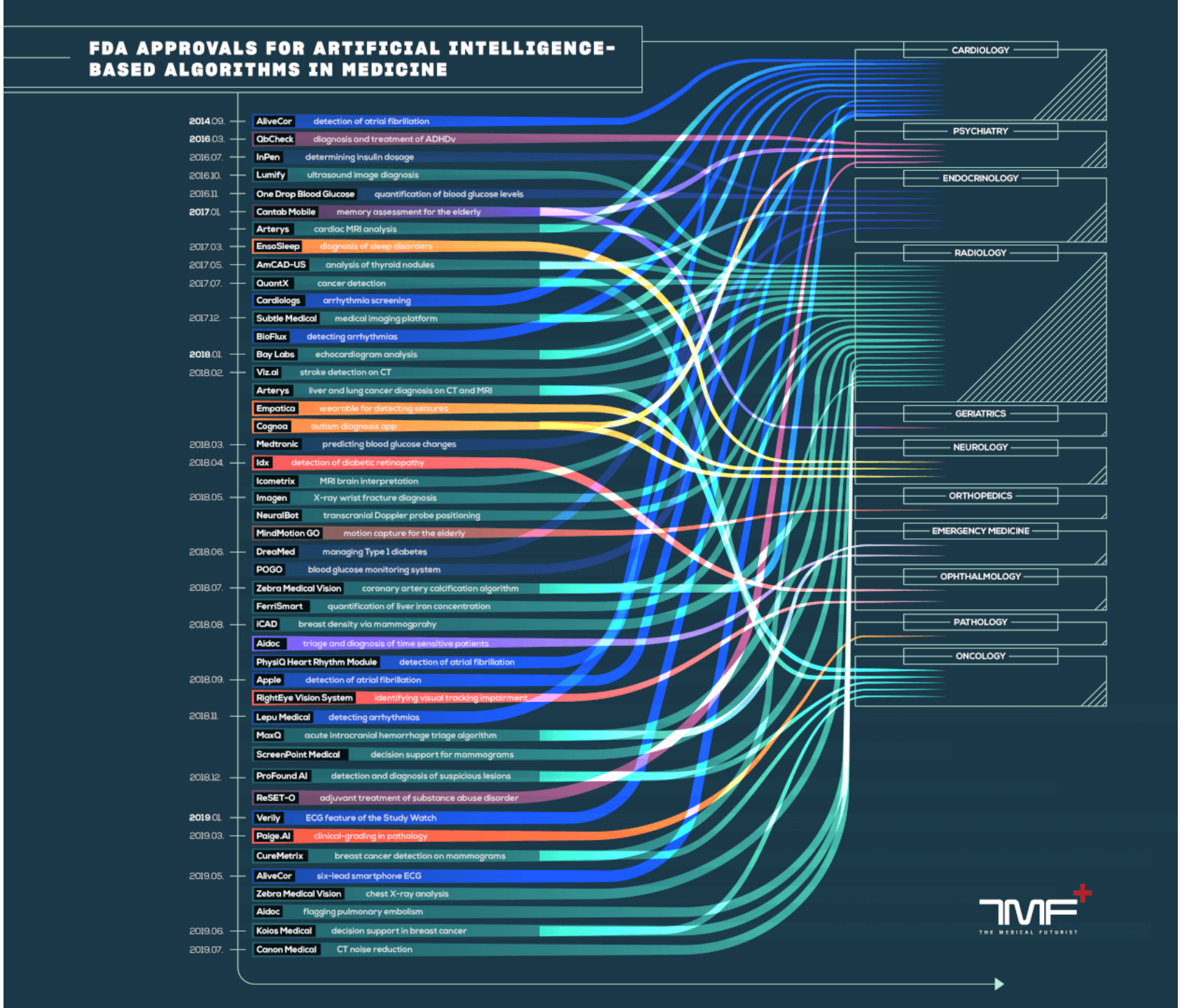
HEALTH PLUS.AI

Going from concept to clinical use with ML-based decision making

Conflicts of interest

- PI and anaesthetist at Amsterdam UMC
- Research and consulting grants from Edwards Lifesciences LLC
- Research grants from Philips NV
- Founder & CEO at Healthplus.ai
- Advisor to several VCs and accelerators


FDA APPROVALS FOR ARTIFICIAL INTELLIGENCE-BASED ALGORITHMS IN MEDICINE
2014.09. AliveCor detection of atrial fibrillation
2016.03. QbCheck diagnosis and treatment of ADHDv
2016.07. InPen determining insulin dosage
2016.10. Lumify ultrasound image diagnosis
2016.11. One Drop Blood Glucose quantification of blood glucose levels
2017.01. Cantab Mobile memory assessment for the elderly
Arterys cardiac MRI analysis
2017.03. EnsoSleep diagnosis of sleep disorders
2017.05. AmCAD-US analysis of thyroid nodules
2017.07. QuantX cancer detection
Cardiologs arrhythmia screening
2017.12. Subtle Medical medical imaging platform
BioFlux detecting arrhythmias
2018.01. Bay Labs echocardiogram analysis
2018.02. Viz.ai stroke detection on CT
Arterys liver and lung cancer diagnosis on CT and MRI
Empatica wearable for detecting seizures
Cognoa autism diagnosis app
2018.03. Medtronic predicting blood glucose changes
2018.04. Idx detection of diabetic retinopathy
Icometrix MRI brain interpretation
2018.05. Imagen X-ray wrist fracture diagnosis
NeuralBot transcranial Doppler probe positioning
MindMotion GO motion capture for the elderly
2018.06. DreaMed managing Type 1 diabetes
POGO blood glucose monitoring system
2018.07. Zebra Medical Vision coronary artery calcification algorithm
FerriSmart quantification of liver iron concentration
2018.08. iCAD breast density via mammogprahy
Aidoc triage and diagnosis of time sensitive patients
PhysiQ Heart Rhythm Module detection of atrial fibrillation
2018.09. Apple detection of atrial fibrillation
RightEye Vision System identifying visual tracking impairment
2018.11. Lepu Medical detecting arrhythmias
MaxQ acute intracranial hemorrhage triage algorithm
ScreenPoint Medical decision support for mammograms
2018.12. ProFound AI detection and diagnosis of suspicious lesions
ReSET-O adjuvant treatment of substance abuse disorder
2019.01. Verily ECG feature of the Study Watch
2019.03. Paige.AI clinical-grading in pathology
CureMetrix breast cancer detection on mammograms
2019.05. AliveCor six-lead smartphone ECG
Zebra Medical Vision chest X-ray analysis
Aidoc flagging pulmonary embolism
2019.06. Koios Medical decision support in breast cancer
2019.07. Canon Medical CT noise reduction
CARDIOLOGY
PSYCHIATRY
ENDOCRINOLOGY
RADIOLOGY
GERIATRICS
NEUROLOGY
ORTHOPEDICS
EMERGENCY MEDICINE
OPHTHALMOLOGY
PATHOLOGY
ONCOLOGY
TMF
THE MEDICAL FUTURIST

Eric Topol
@EricTopol

There's been a recent burst of peer-reviewed deep neural network #AI publications in medicine. Now there are 4 (*) prospective assessments. Progress. But algorithmic validation ≠ clinical effectiveness.

Specialty	Images	Publication
Radiology/Neurology	CT head, acute neuro events	Titano, Nature Medicine, 2018
	CT head for brain hemorrhage	Arbabshirani, NPJ (Nature) Digital Medicine, 2018
	CT head for trauma	Chilamkurthy, Lancet 2018
	CXR for metastatic lung nodules	Gang Nam, Radiology 2018
	CXR for multiple findings	Singh, PLOS One, 2018
Pathology	Breast cancer	Bejnordi, JAMA, 2017
	Lung cancer (+ driver mutation)	Coudray, Nature Medicine 2018
	Brain tumors (+ methylation)	Capper, Nature, 2018
	Breast cancer metastases*	Steiner, Am J Surgical Pathology, 2018
	Breast cancer metastases	Liu, Arch Path Lab Med, 2018

HEALTH PLUS.AI

Vision

From reactive to proactive health care

The Problem

It takes on average five days to spot infections in post-surgery patients. Current care is reactive and oftentimes too late to reduce the incidence and effect of these infections.

The Problem In Numbers

Diagnosis on Day 5
on average, and 50% failure to rescue

Infections
pneumonia, UTI, deep or superficial surgical site infections or even sepsis.

Postoperative infections
#1 cause of sepsis ICU admissions

40-60M of 324M people
who have surgery per year globally get an infection

Cost per hospital
+$11,5k per patient, +$35M per hospital

Post-surgical death
#4 cause of death in the world

17 to 25% of patients
get an infection with 30 days after surgery

The Problem In Numbers

Liabilities
for physicians & hospital

Hospital stay
+114-150%

Unclear personal risk
for patient & HCP decision-making

~15% of all patients
readmitted for infections

Biomarkers
expensive & unreliable, diagnostic and not predictive

A $0.46T global problem
without winners

Antibiotic use
and resistance

Surgical care
consumes 40% of health care budget

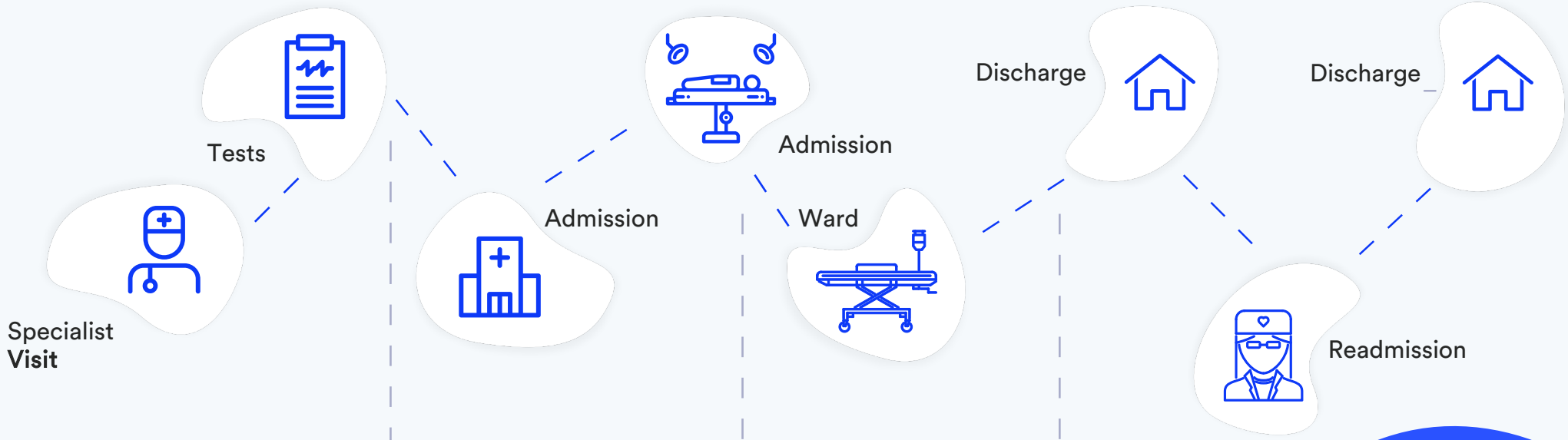
The Solution

A surgery risk management platform that predicts infections
& allows HCPs to reduce impact and incidence of infections.

No new measurements needed
Reusing existing data
Machine learning
Cloud based & work flow integrated

Changing the way we work?

STAGE	PRE-SURGERY	HOSPITALIZATION	POST-SURGERY



WHAT CHANGES

Optimization

Right post-op location

Early detection

Allocation of monitoring

Early treatment

Allocation of biomarkers & Antibiotics

Effect

Less readmissions
Less infections
Less sepsis
Earlier discharge

The Technology

EHR integration:

Either per hospital or via backend
of EHR partners like Cerner & Chipsoft

Machine Learning algorithms: (PERISCOPE)

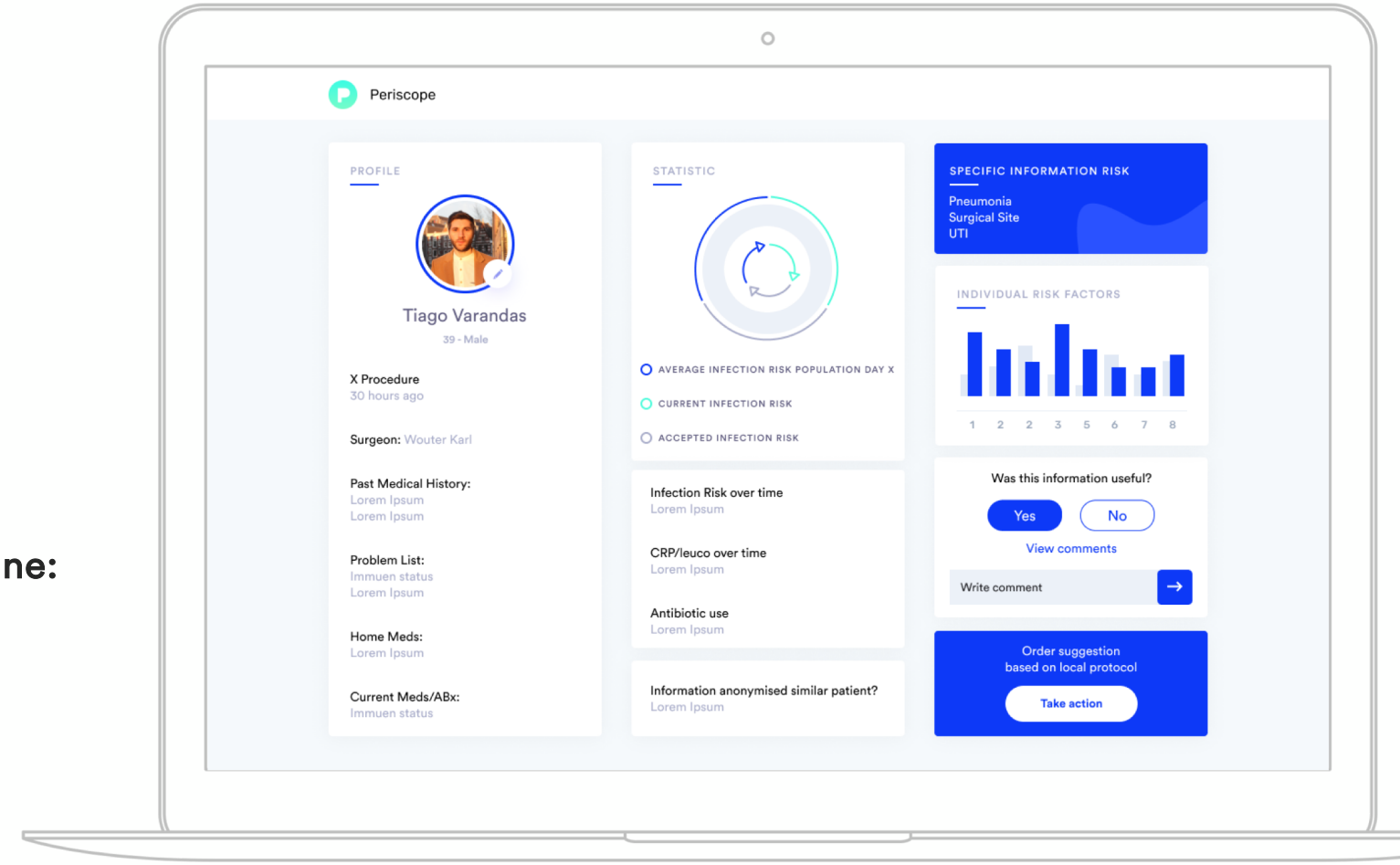
Cloud-based microservices pipeline:

Modern web stack that normalizes data
FHIR, SNOMED or other types of data,
automate data wrangling, QA/QC etc

Or

On-premise:

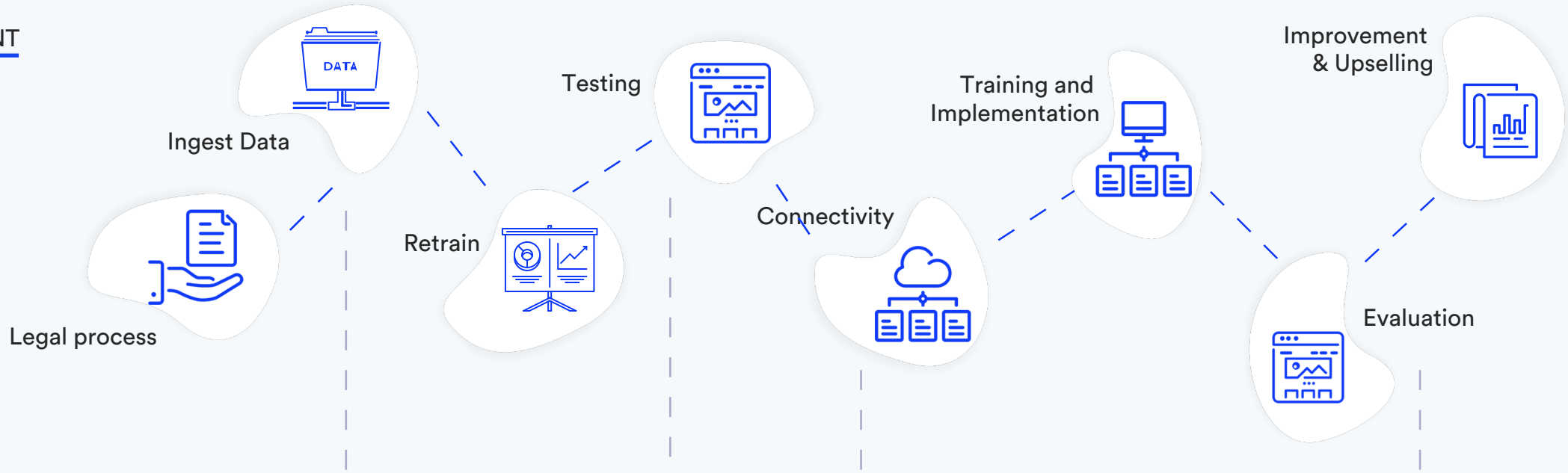
An on-site solution for cloud shy
hospitals. Meta-learnings go to our
cloud to continue central learning



Hospital Onboarding

STAGE	LEGAL PROCESS	CONNECTIVITY	INGEST DATA	RETRAIN	TEST	TRAIN	EVALUATE	IMPROVE

EVENT



DETAILS

Connectivity

On-premise or cloud-based and setting data sharing standards (with or without EHR vendor)

Retrain

Recalibrate central model to local practices and population

Testing

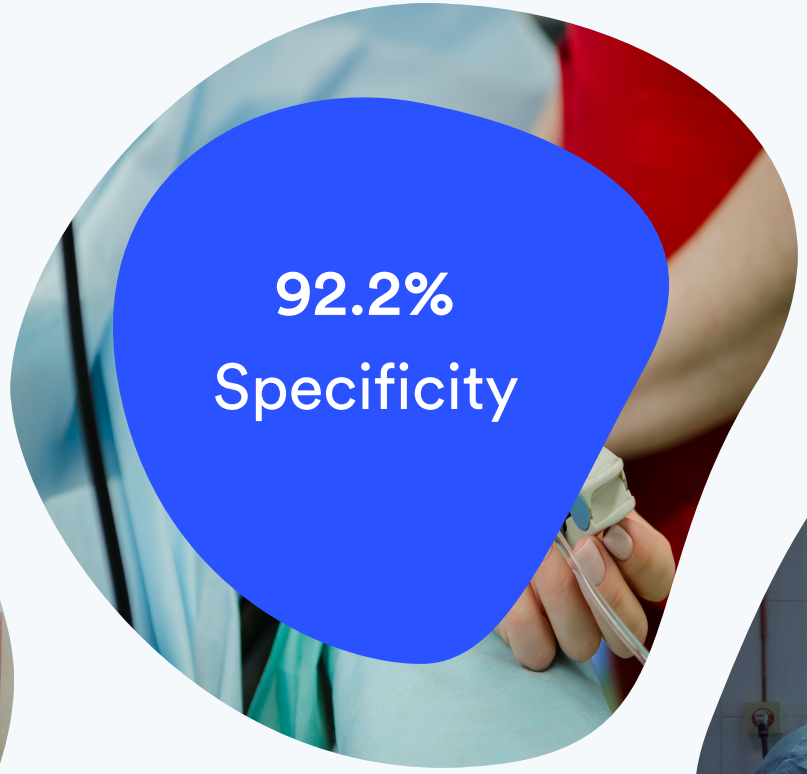
Underwater testing and defining action suggestions with clinical-leads of each pathway (what is acceptable risk? What actions should be taken for monitoring or intervention?)

Evaluation

Report on use and clinical effectiveness

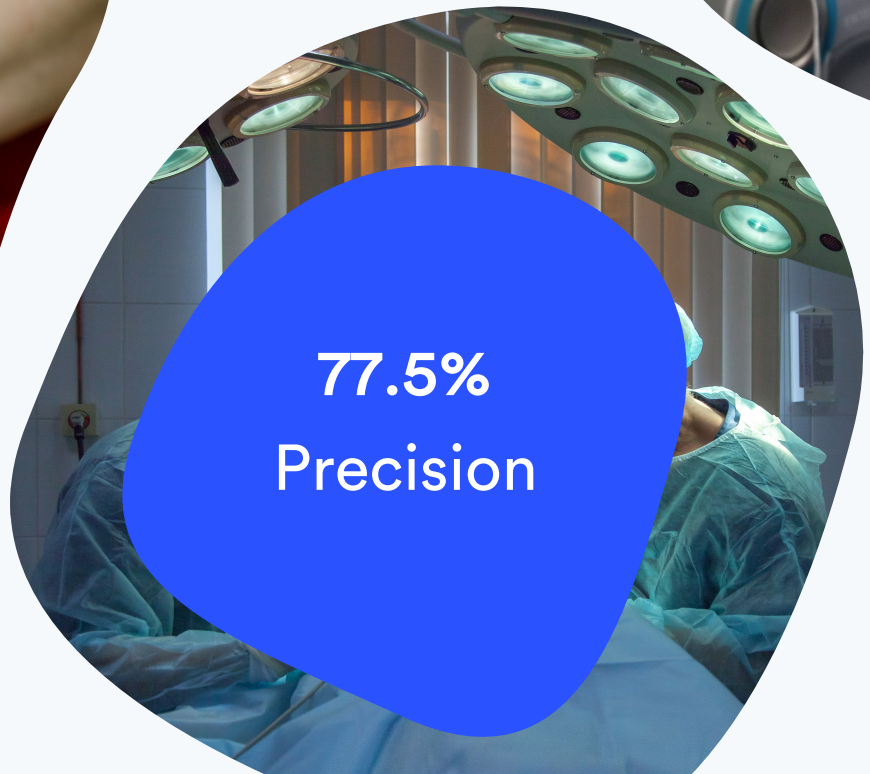
5 days prior to diagnosis

88.5%
Accuracy



92.2%
Specificity

88.5%
Recall



77.5%
Precision

Multicenter – Eurostars trial

- Three phases:
  - Local retraining - internal validation
  - ‘Underwater testing - external validation
  - Implementation - clinical validation

UNIVERSITETSSYKEHUSET NORD-NORGE
DAVVI-NORGGA UNIVERSITEHTABUOHCCEVIESSU

LUMC

ST. JAMES'S HOSPITAL
DUBLIN . IRELAND

Ospidéal Naomh Séamais
Seirbhís Dé agus A Phobail

REGION H

Rigshospitalet

Σ!

European Commission

The Team

25 years in ML, 15 years in dev ops, 15 years in clinic and research, and 10 years of leading major & award-winning IT projects

Bart Geerts | CEO

(MD PhD MSc MBA)

Ass. professor in anesthesia, intensive care, and clin. Pharmacology with extensive experience in clinical R&D, business and working with AI at/with LUMC, WHO, CHDR, Edwards Lifesciences, Philips, Scyfer, Amsterdam UMC.

Olivier Povel | COO

MSC

Hands-on experience in leading small and large teams (400+ people) with BI and AI projects since he studied AI at Utrecht University.

Adrian Lisko | CIO

MSC

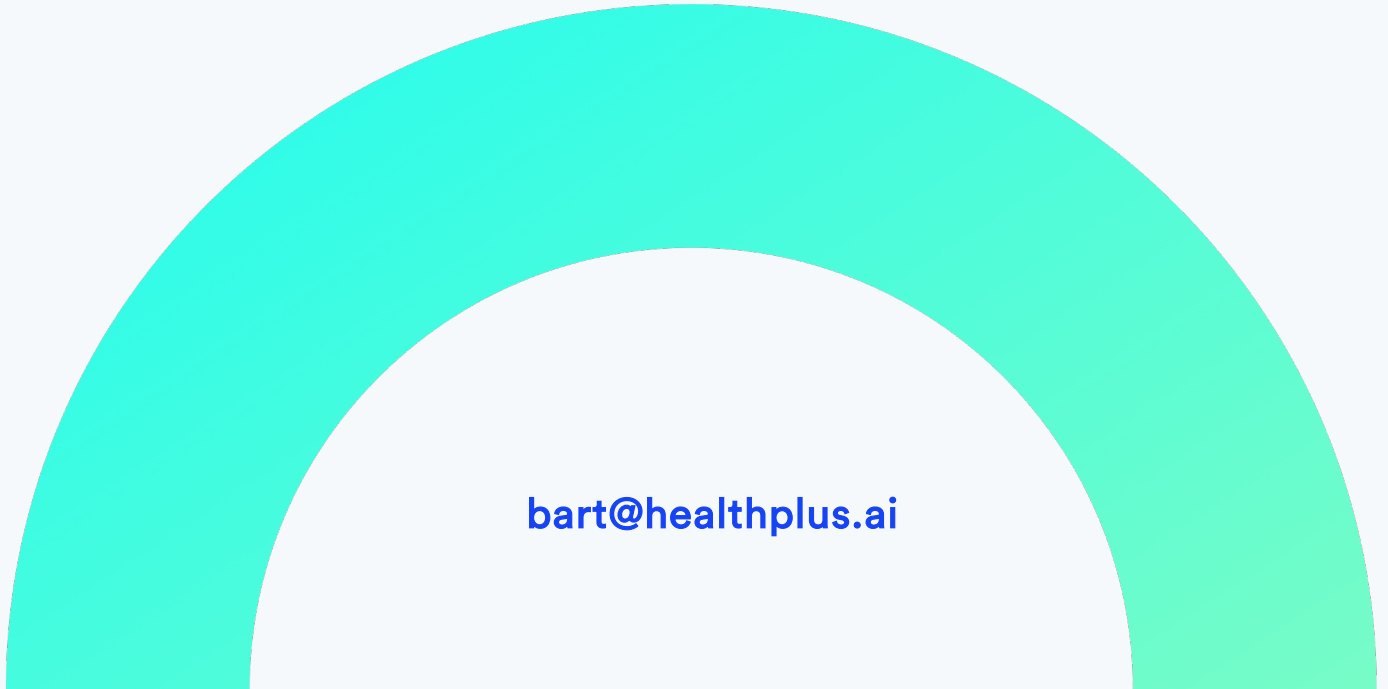
Machine learning expert: Build deep neural networks, time-series analysis, signal processing, state-space models and filtering and so on within ING, TomTom, Kempen & Co, Scyfer and Qualcomm

Lukas Chripko | CTO

BSC

Software architecture and design expert for complex structures, particularly API's, backend infrastructure and microservices. Build scalable solutions at alaTest.com Pingdom and 904Labs

Some of our learnings
-
QA



bart@healthplus.ai