Digitalisation in Emergency Medicine

26.04.2019

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Founding - President German Association of EM / DGINA

Past President EuSEM

EUSEM
EUROPEAN SOCIETY FOR EMERGENCY MEDICINE

Speaker: Barbara Hogan

Title: Digitalisation in Emergency Medicine

Member of a scientific committee	NO
Speaking or writing in exchange for remuneration	NO
Travel expenses and/or registration to congresses or other events covered	YES
If so: … as invited speaker	
Leader of research of clinical study	NO

Agenda

1	Web 4.0. and beyond...
2	Patient`s wish and need
3	Doctor`s wish and need
4	CEO`s wish and need
5	The future: Artificial Intelligence

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Web 4.0 beyond...
or digital revolution in health care economics?

Legal Compliance | Electronic patient file | Telemedicine | IT-Assisted Living | Remote surgery | Medical Data Flows | Knowledge Mgmt. | Disease-Web-Foren

Networked Care | Web-MOR-Services

Medical Documentation | ECR for Patients

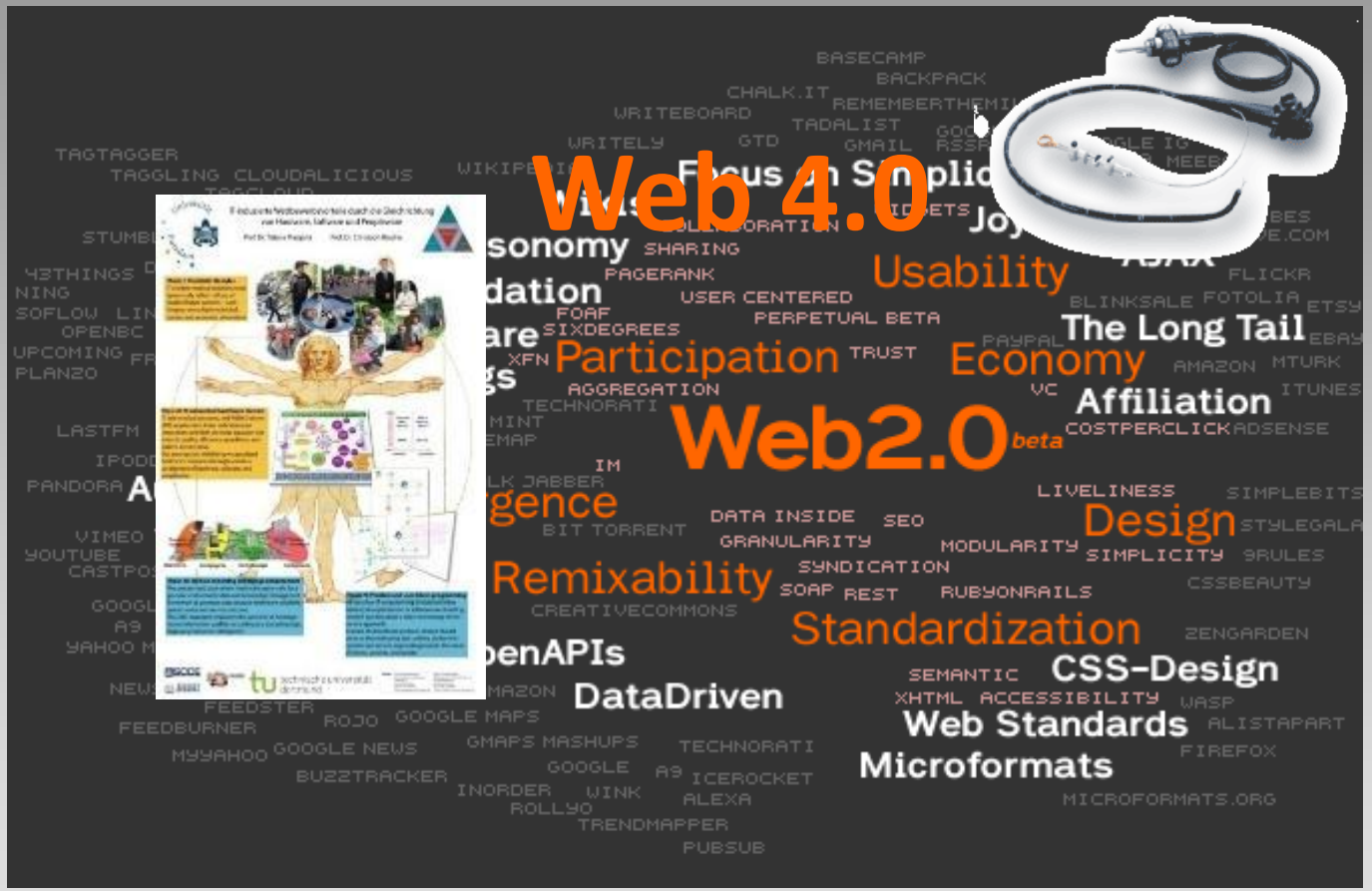
System-integration | Video Data Transfer

Lean Hospital | Treatment Data Bases

Seamless Workflows | Real Time Information

RFID-Solutions | Web-Based PatientCare

HL7-Solutions | Web-Based DMPs



Hospital-ERP-Syst. | One-Thing-Approach | Quality-Management | Peopleware Solutions | Hardware Solutions | Software Solutions | DRG-Controlling | Hospital-ERP-Syst.

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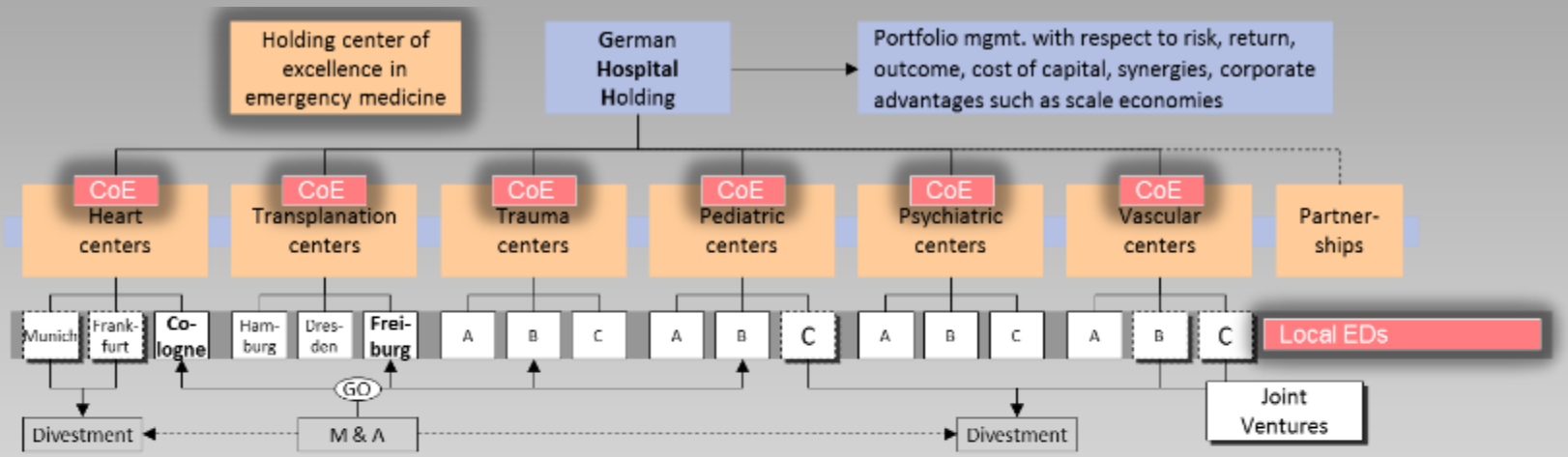
Some concepts of industrial Web 4.0 can be applied to medicine
Industry seeks to create a flowing process with Web 4.0

With a Medical 4.0 strategy new concepts
such as telemedicine and the digitalisation of work processes
for doctors, nurses and hospital administration
can take a central role



Corporate holding performance	Clinic/ department performance	Individual performance
▪ Portfolio management	▪ Structure and processes	▪ Qualification
▪ Mergers & acquisitions	▪ Interfaces and coordination	▪ Incentives and benefits
▪ Horizontal strategies	▪ Information policy	▪ Career options/ ladder
▪ Strategic positioning	▪ Cross-over competencies	▪ ED specialist status
▪ Clinic governance	▪ Quality of decision making	▪ ED employer branding
▪ Ownership & control rights	▪ Flat hierarchies	▪ Hard-, soft-, peopleware

According to a study by consultants Roland Berger, 90% of all hospitals in Germany have developed a digitalisation strategy.

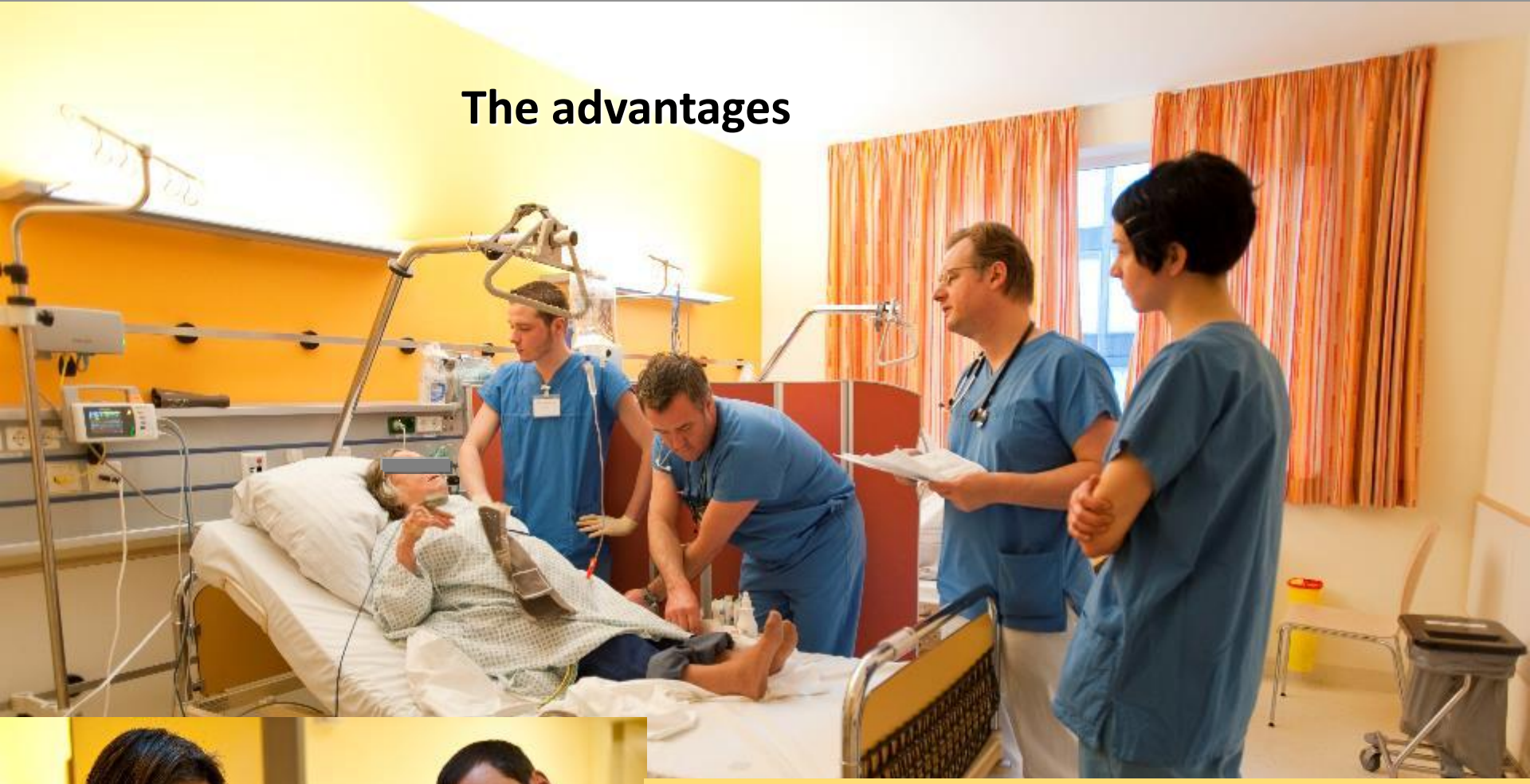
The areas of action for the transformation within the hospital are extensive.
Such areas include among others:

- Electronic patient records,
- Telemedicine,
- IT security and assistance and
- Nurse robots

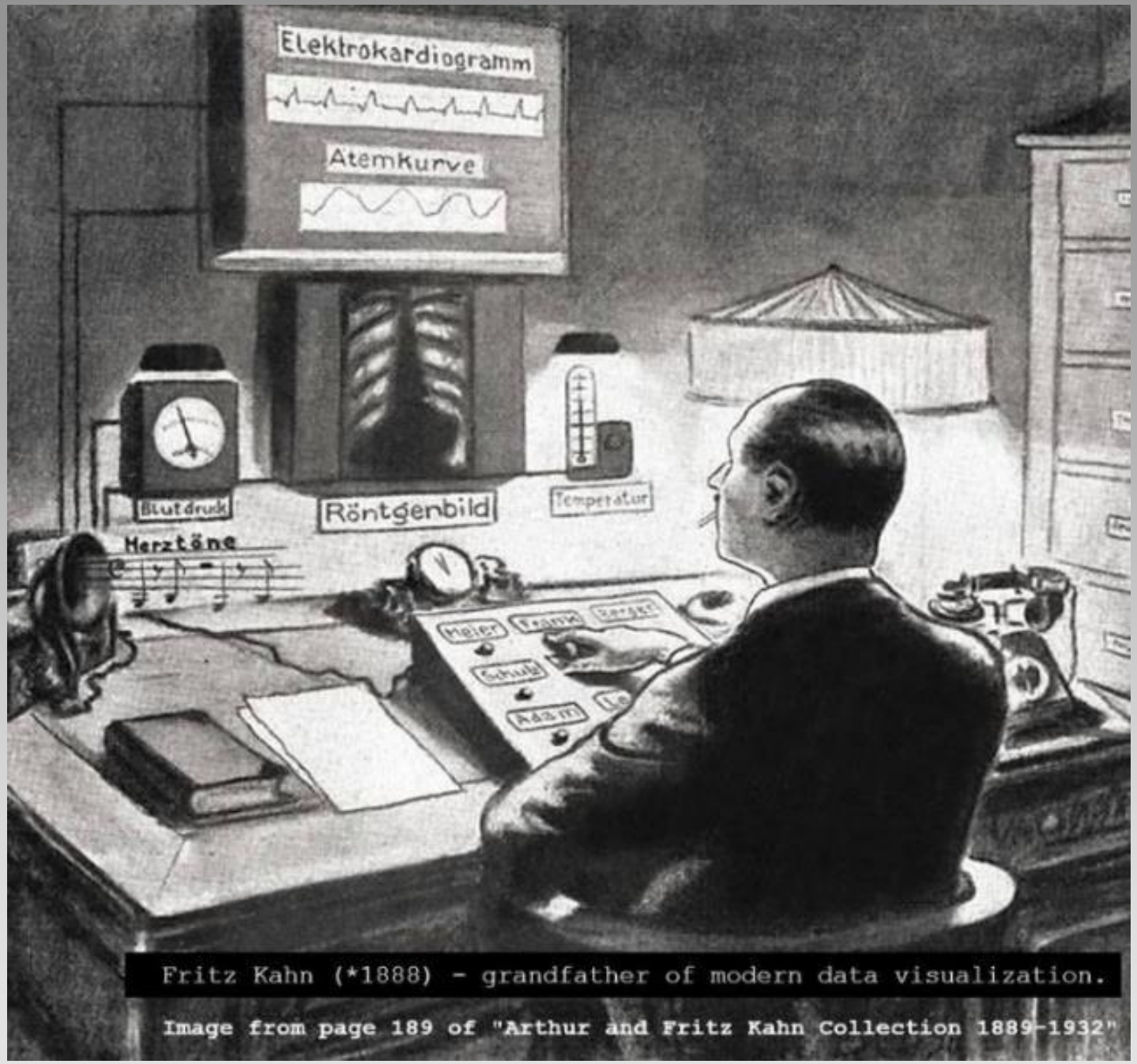
However, in order to successfully implement digital change, there must be more acceptance of new concepts such as telemedicine and nurse robots among patients.

Source: https://www.ergo.com/en/Wir-bei-ERGO/Wir-erzaehlen/Digitalisierung-und-Innovation/2018/Smart-Hospital-Die-Zukunft-der-Medizin

The advantages

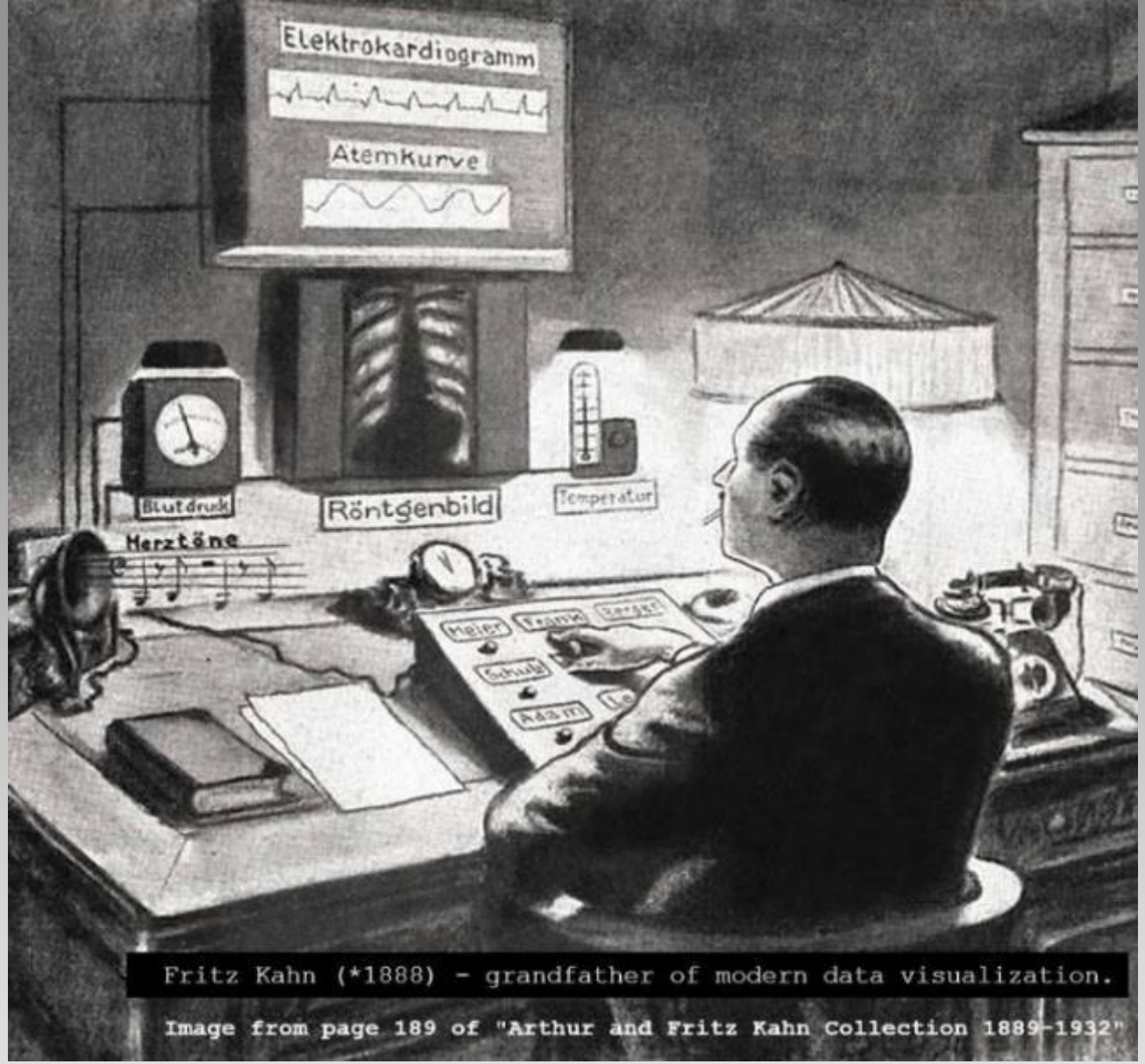


- Digitalisation can make the healthcare system much more effective
- Automatic medication distribution in hospitals reduces errors and gives nurses more time to spend with patients
- Changing to paperless work can cut administrative work for doctors and nurses, bring an increase in medical care quality and better economic performance



Fritz Kahn (*1888) - grandfather of modern data visualization.

Image from page 189 of "Arthur and Fritz Kahn Collection 1889-1932"



The vision showed digital processes presented in an analog form

What are the implications of digital convergence for hospitals and the healthcare sector?

Source: DER SPIEGEL, 48/2011, S.73

Modelling Digital Health & Fitness

Microsoft HealthVault

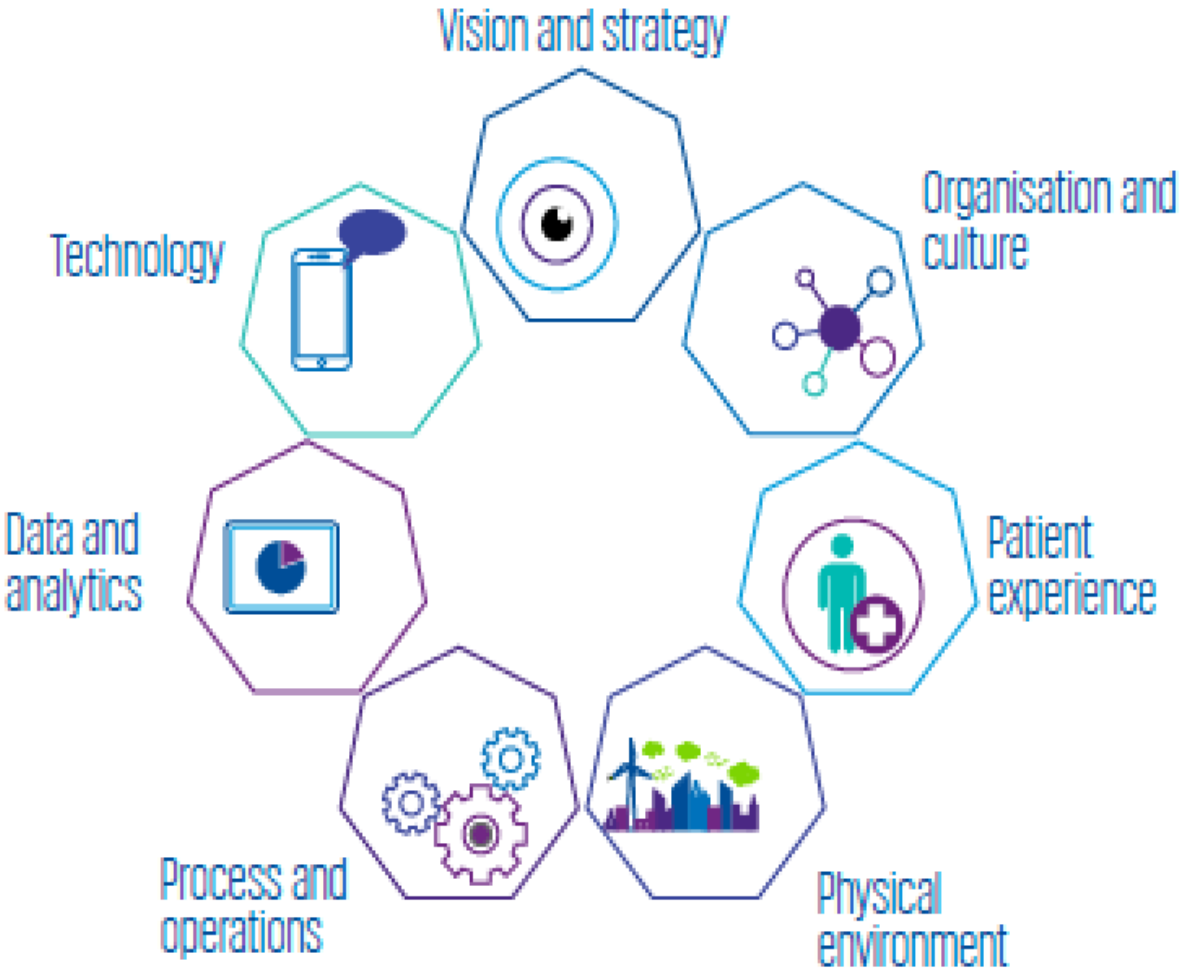
Google health

Source: MIT Technology Review, microsoft

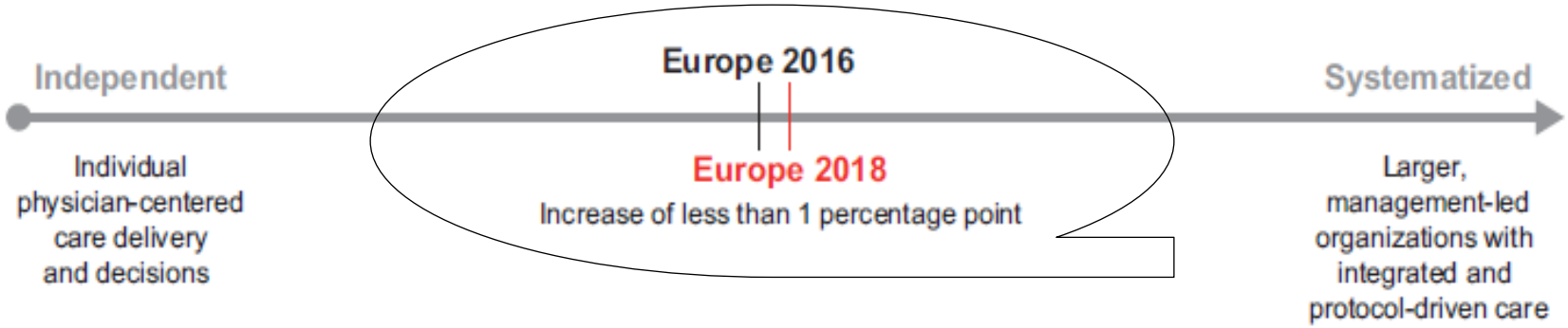
Some trend predictions (Deloitte)

1	**Health consumers in 2020** Informed and demanding patients are now partners in their own healthcare
2	**Healthcare delivery systems in 2020** The era of digital medicine – new business models
3	**Wearables and mHealth applications in 2020** Measuring quality of life not just clinical indicators
4	**Big Data in 2020** Health data is pervasive – requiring new tools and provider models
5	**Regulatory compliance and patient safety in 2020** Regulations reflect the convergence of technology and science

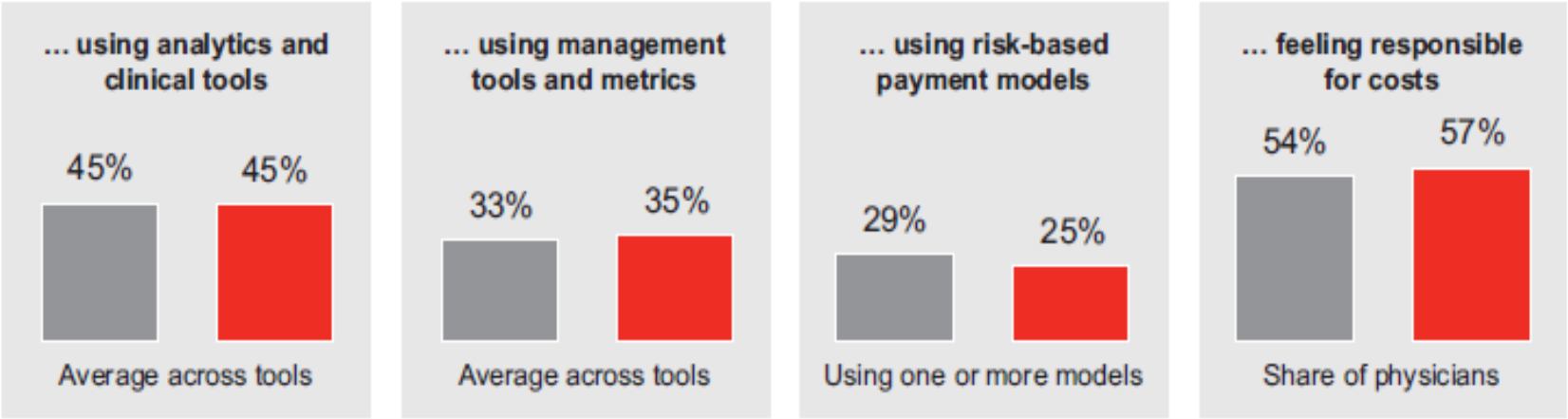
Framework for change



Change is slow in healthcare

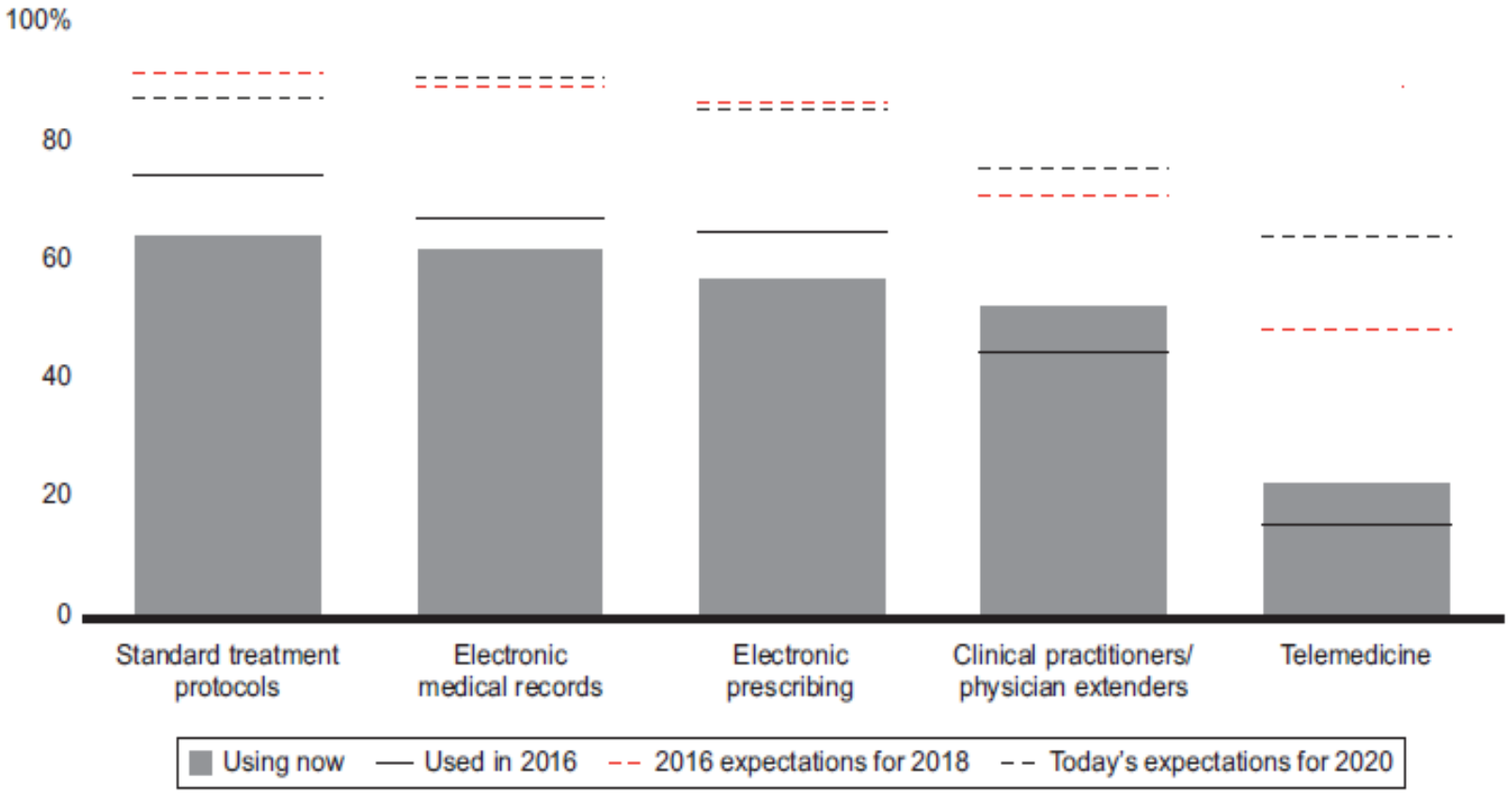


The level of systematization reflects the percentage of physicians who are …



Sources: Bain Europe Front Line of Healthcare Survey, 2018 and 2016

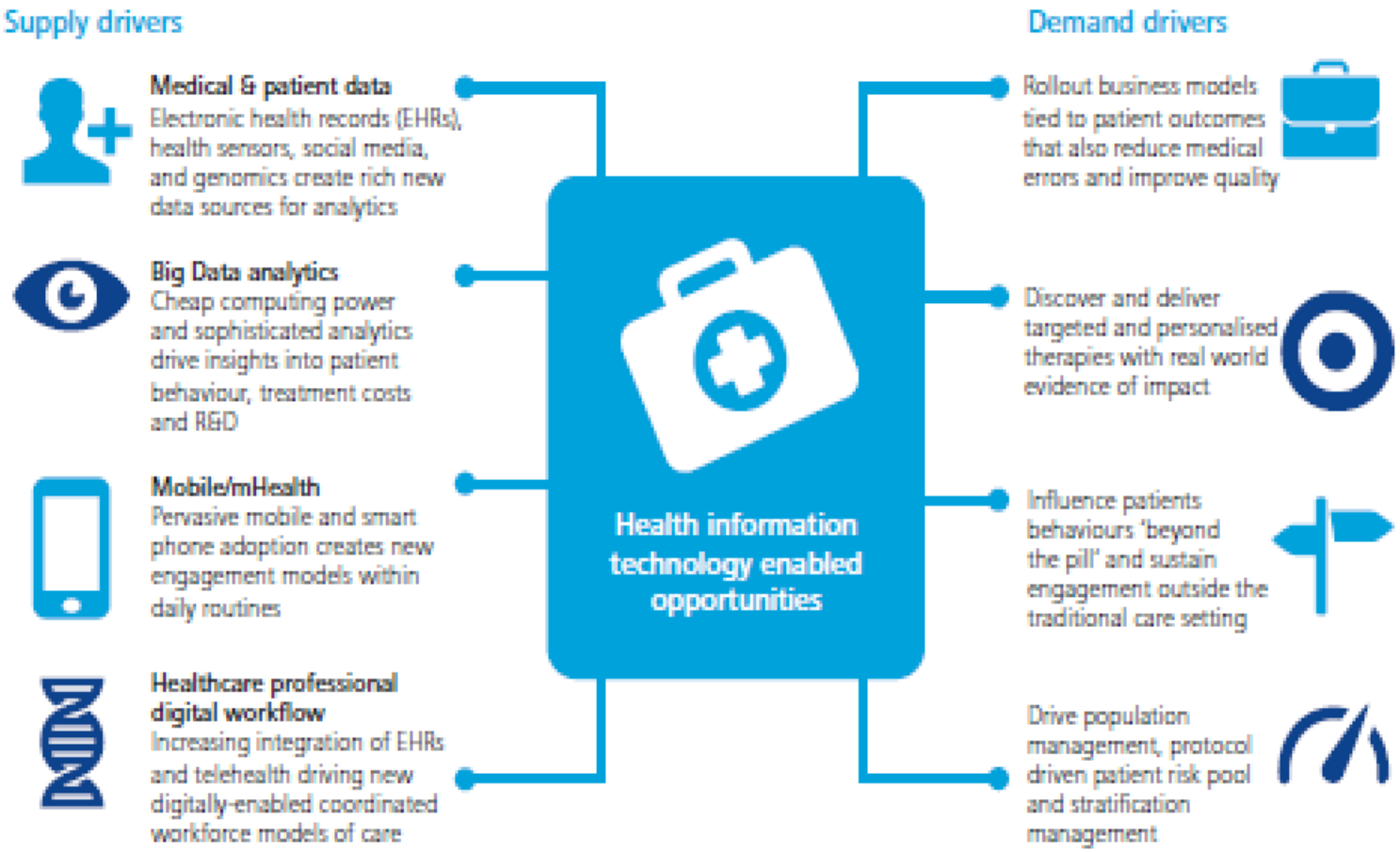
Telemedicine is still in its infancy



Sources: Bain Europe Front Line of Healthcare Survey, 2018 and 2016

Big data invasion in healthcare

New business models: 'Beyond the pill', outcomes and real world data are providing health data and transforming what is possible



Source: Monitor Deloitte

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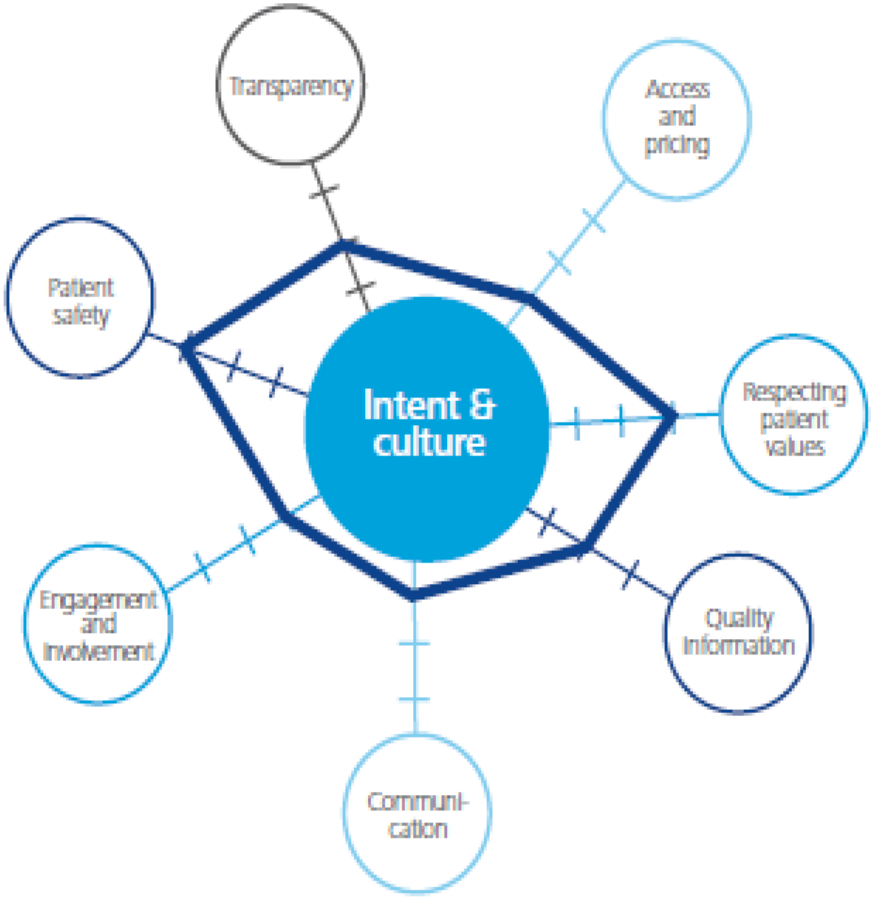
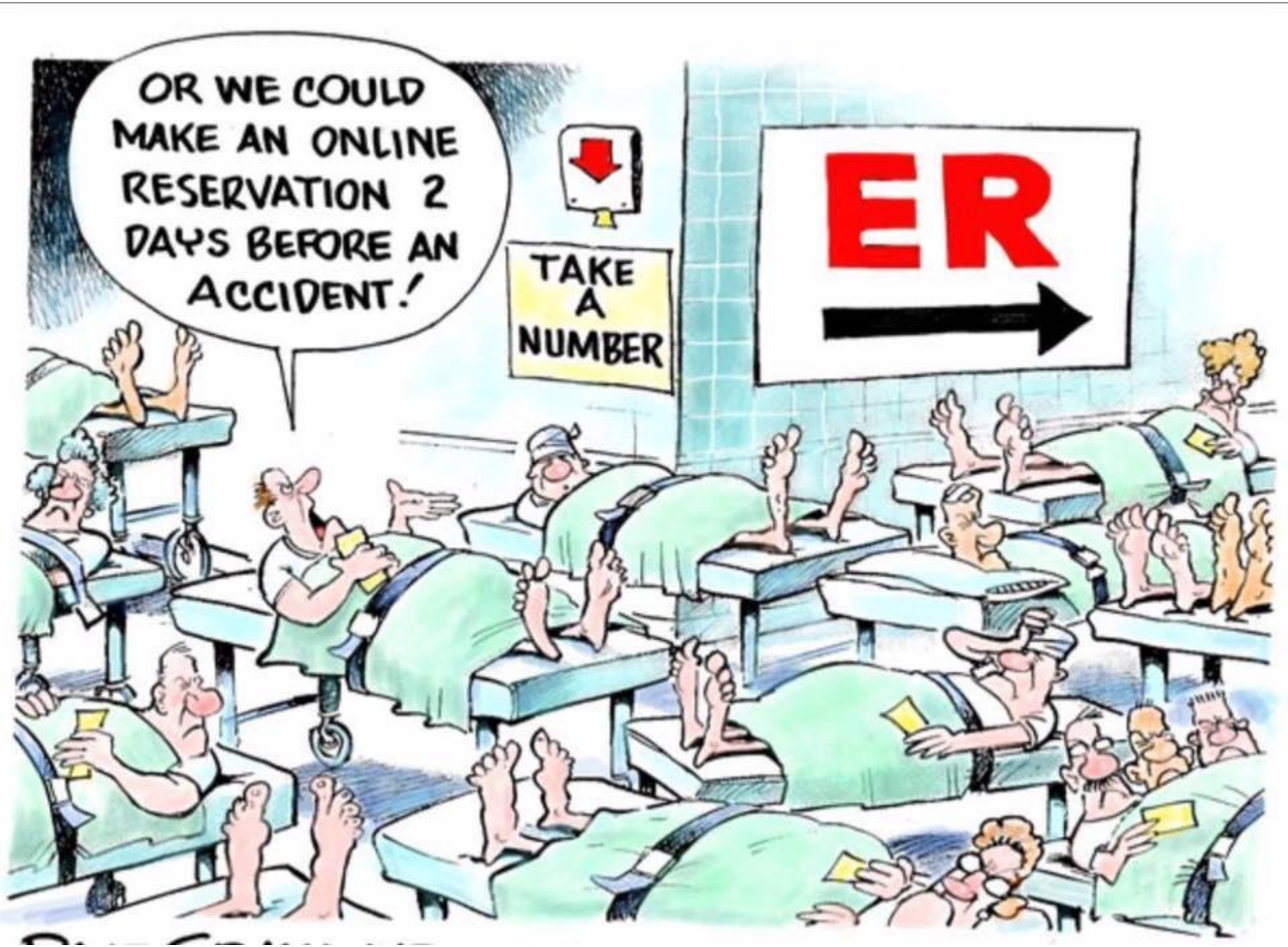
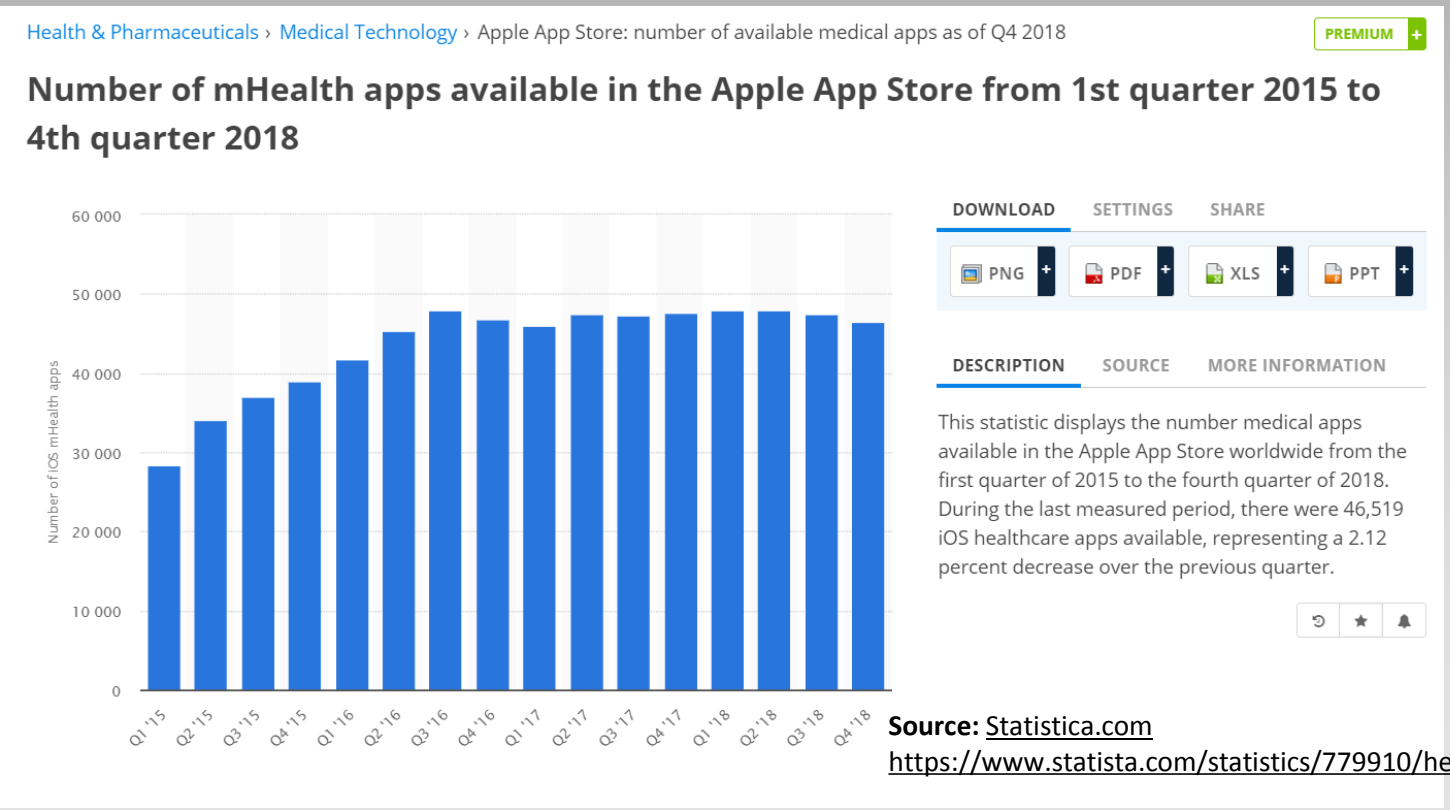
What patients expect to be done…



Source: Benchmarking Strategy for Corporate Patient Centricity, PatientView, 2013. see also: http://alexwyke.wordpress.com/2013/09/22/a-benchmarking-strategy-for-corporate-patient-centricity/


OR WE COULD MAKE AN ONLINE RESERVATION 2 DAYS BEFORE AN ACCIDENT!
TAKE A NUMBER
ER

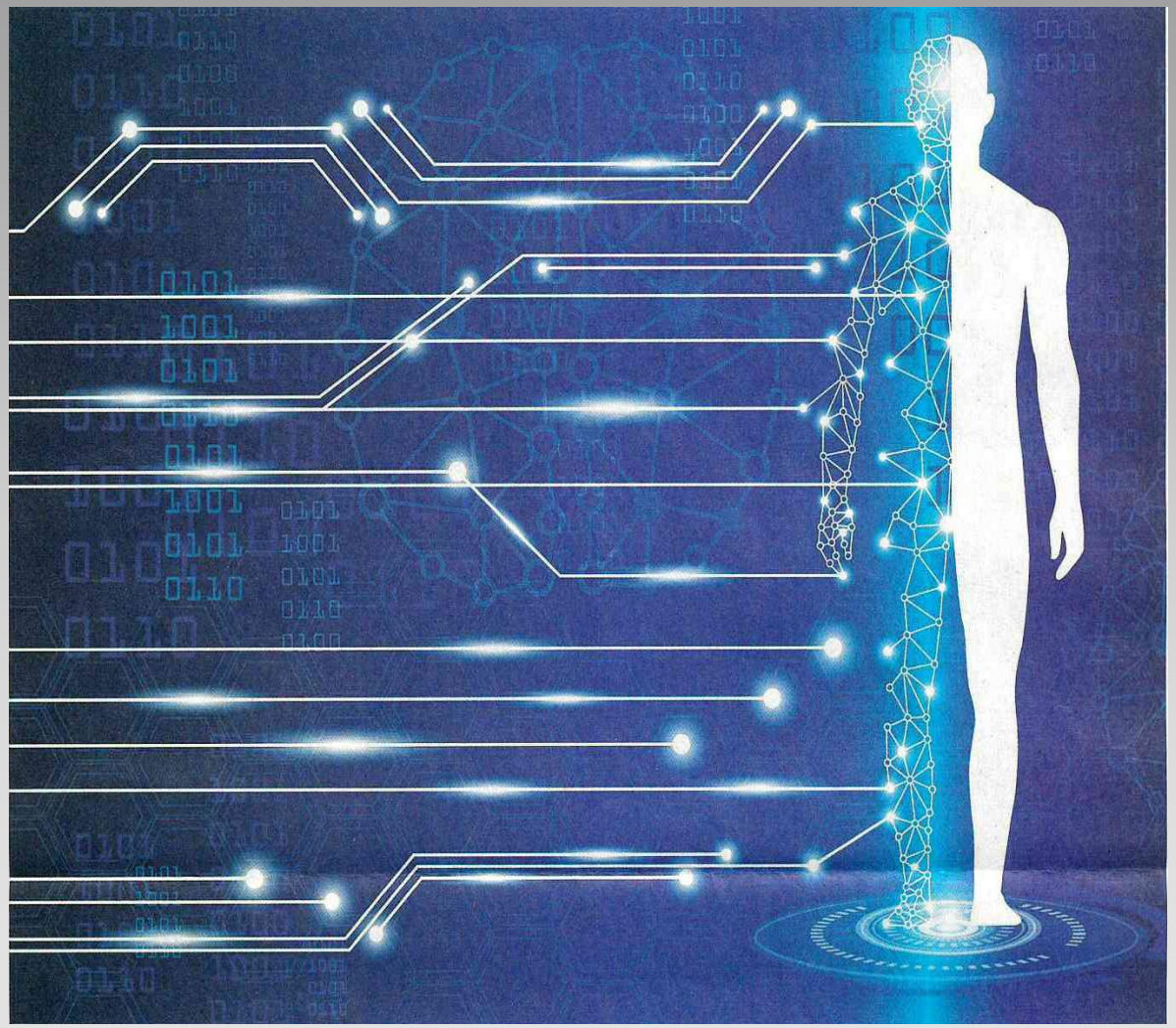
- Patients have an incredible amount of information available
- In December 2018 there were 46,000 health care apps available on iTunes just in the English language giving advice on the treatment of various illnesses
- Can patients cope with this flood of information?
- The number of apps is now falling

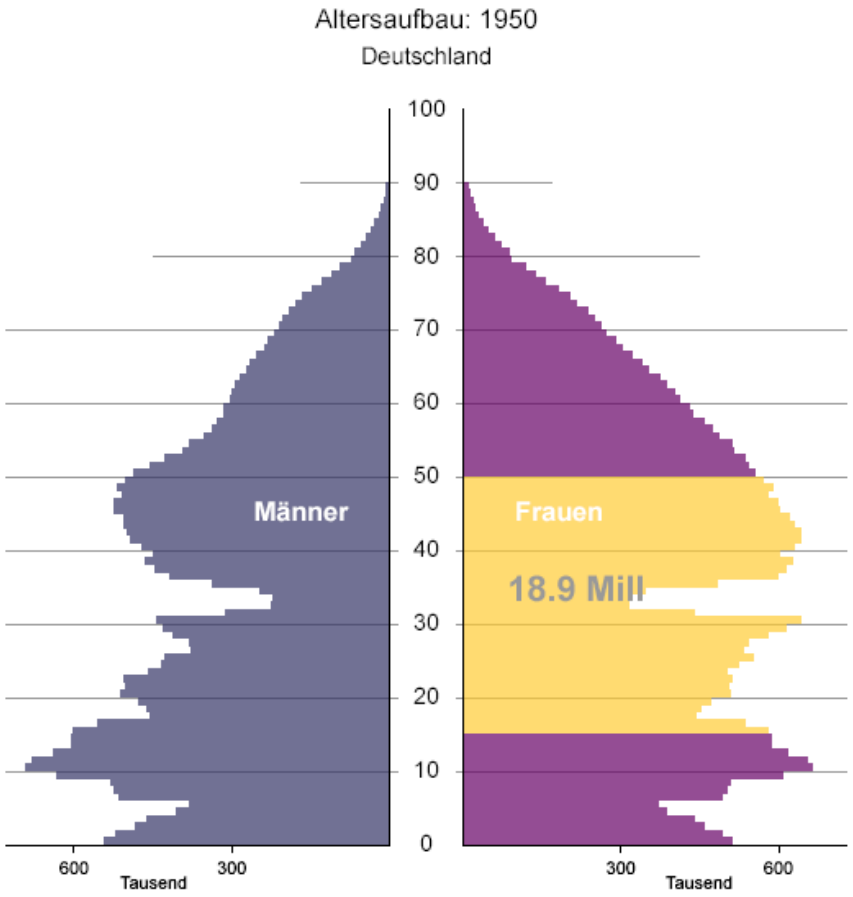


Source: Statistica.com
https://www.statista.com/statistics/779910/health-apps-available-ios-worldwide/

Is doctor patient knowledge already asymmetric?

Patients have access to huge volumes of information from “Dr Google”
Does it help them?





[1]CB Insights. (2019). 14 Trends Shaping Tech. https://www.cbinsights.com/reports/ CB-Insights-Tech-Trends-2019.pdf

Picture Source: Pixabay License

Times
8.1.2019 Doctor WHO?

The question is not if the patients can see their doctor via video consultation,
but if the doctors are ready to see/treat patient via video.

NO systematic or structured training yet at most medschools or during postgraduate training in medical video consultancy (MVC)

Times
8.1.2019 Doctor WHO?

Still " good old times" bed side teaching.
It is completely different to look, feel and sometimes smell – compared to a 2D video window.

- The Emergency Department Express Care program at New York-Presbyterian/Weill Cornell Medicine has established one of the first telemedicine programs in its academic hospital emergency department.

- The goal is to reduce the amount of time a patient with a non-urgent medical condition has to wait for care.

- The hope is to provide more efficient care for these patients without compromising the quality of care received.

- The initial results are promising since wait time has dropped from an average of 2 to 2.5 hours to only 35 to 40 minutes.

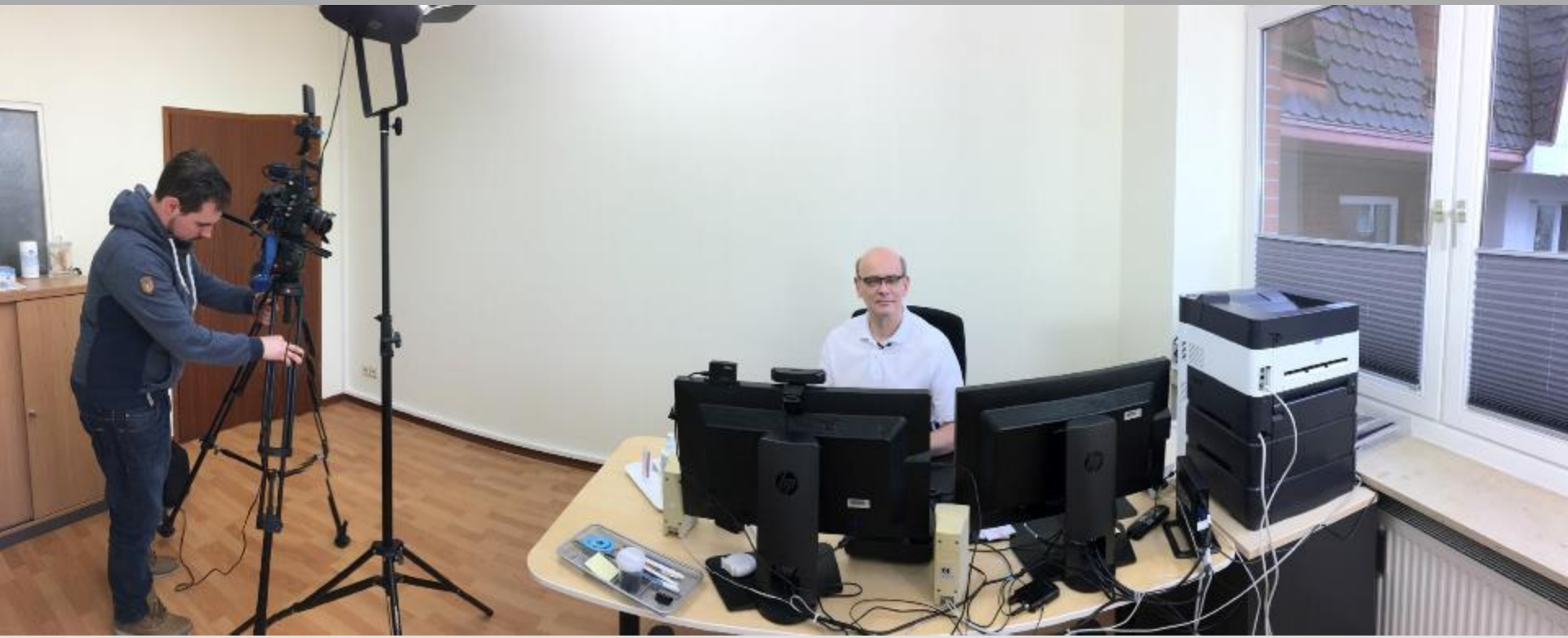
ED Express Care Patient Room

Source: John Abbott
NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society

Source: http://ridemedtrust.com/emergency-department-the-new-frontier-in-digital-health-care/

Telemedicine – introduction in my clinic

Emergency care in live stream with homes for the elderly



Big interest from media

The video live stream
gives a tool for a first assessment for the elderly patients in care homes.

A decision can be made: treatment at care home or in hospital

Digitalisation can help to solve a problem.
Video-infrastructure is easily available.

GEESTHACHTER ZEITUNG · SCHWARZENBEKER TAGEBLATT

Lauenburgische Landeszeitung

BEI STREIT MIT BEHÖRDEN

Bürgerbeauftragte berät ▶Seite 27

Wahlplakate

Ein Bad für Schwarzenbek?

Fährgäste sind spendabel

Leuchtendes Knöllchen

Emergency Care in Live Stream

Geesthachts Krankenhaus plant Übernahme

Lauenburg erhält 100 000 Euro

Bergedorfer Zeitung

ABSCHIED VON DER POLITIK

Emergency Care in Live Stream

Emergency Care in Live Stream

VIDEO-VISITE Pilotprojekt kommt bei Bewohnern im „Haus Elbsonne" gut an

Geesthacht (wjü). Plötzlich auftretendes Fieber, Schmerzen oder Orientierungslosigkeit – wenn die Bewohner des Alten- und Pflegeheims „Haus Elbsonne" solche Symptome zeigen, greift die stellvertretende Einrichtungsleiterin Kim Heuer ab sofort zum Tablet-PC. Denn seit Freitag ist die Video-Sprechstunde zum Medizinischen Versorgungszentrum (MVZ) am Buntenskamp für die Einrichtung an der Johannes-Ritter-Straße freigeschaltet und Dr. Henning Krämer (Arzt für Innere Medizin) schnell und unkompliziert per Bild und Ton erreichbar.

Konkret heißt das: Krämer sitzt zu festgelegten Zeiten in der Woche am Computer in einem Arbeitszimmer. Über ein durch die Kassenärztliche Vereinigung Schleswig-Holstein zertifiziertes und auf Datenschutz überprüftes PC-Programm, in das sich der Mediziner und sein Gesprächspartner nur über einen Sicherheitscode einwählen können, wird eine Verbindung zu seinem Patienten hergestellt. Auf seinem Bildschirm sieht der Arzt nun über den Tablet-PC, den eine Pflegerin hält, seine Patientin im Altenheim.

„Willkommen in der Video-Sprechstunde: Wie geht es ihr heute? Hat sie Schmerzen und was ist mit der nächtlichen Unruhe?", fragt der Arzt, dessen Stimme und Bild über Kamera und Mikrophon zu Pflegerin Sabrina Pahlke transportiert werden. Sie sitzt am Bett der zu behandelnden Bewohnerin, berichtet über den aktuellen Gesundheitszustand und stellt Fragen zur Medikation. Dr. Krämer kann parallel an einem Rechner auf die digitale Patientenakte der Frau zugreifen. „Man kann hören, wie der Patient atmet, und sehen, ob er blass oder die Haut bläulich verfärbt ist", erklärt Dr. Barbara Hogan, Ärztliche Leiterin und Geschäftsführerin des MVZ, welche Informationen in die Diagnose einfließen.

Kim Heuer testet mit einer Bewohnerin im „Haus Elbsonne" die neue Video-Visite. Foto: W. Jürgensen

„Außerdem können die Pfleger zum Beispiel den Puls fühlen oder die unteren Augenlider ein Stück herunterschieben, damit die Situation noch besser bewertet werden kann", sagt Hogan, die betont, dass der persönliche Kontakt zum Arzt nicht ersetzt werden solle, sondern es um schnelle fachliche Entscheidungen gehe, die dann wiederum Wartezimmer und Notaufnahmen entlasten könnten. Denn oft würden aus Unsicherheit unnötig Praxen und Krankenhäuser angefahren.

„Wir sind über die neue Möglichkeit sehr froh. Gerade in akuten Momenten können wir so schnell auf den Hausarzt zurückgreifen und müssen nicht wegen jeder Sache ins Krankenhaus fahren", sagt Kim Heuer, die den viel zitierten Ärzte-Mangel aus ihrer täglichen Arbeit in der Pflegeeinrichtung gut kennt. Während die Zahl der Pflegebedürftigen immer mehr zunimmt, kommen vor allem im ländlichen Raum immer weniger Hausärzte nach. „Die Hausärzte haben immer mehr zu tun. Es ist es sehr schwierig, einen Arzt für die Bewohner zu finden. Darum sind wir auch so froh, dass das MVZ sich kümmert", sagt Heuer, die gemeinsam mit ihrem Team am Freitag überraschende Erfahrungen machte. Anders als vermutet, kam die erste Video-Sprechstunde bei den zum Großteil an Demenz erkrankten Heimbewohnern sehr gut an. Heuer: „Es ist sehr positiv aufgenommen worden – gerade weil Dr. Krämer nicht nur wie am Telefon zu hören, sondern auch zu sehen war."

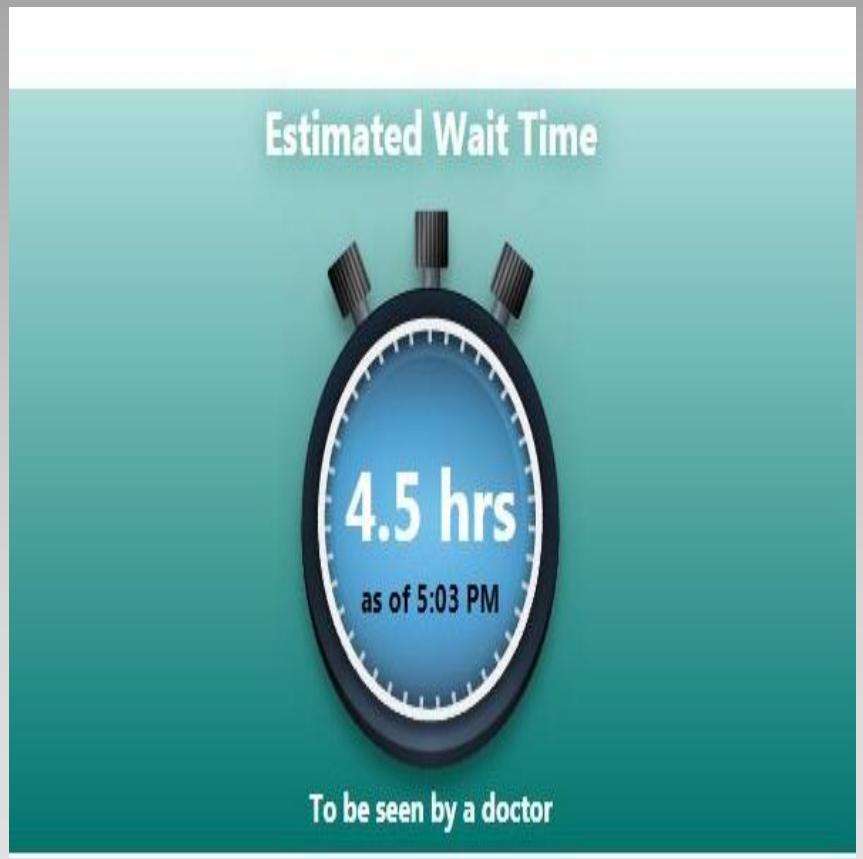
Dr. Henning Krämer wird trotz Video-Visite weiter zweimal im Quartal zum Hausbesuch ins „Haus Elbsonne" fahren, weil das Bild den persönlichen Kontakt nicht ersetze. Eine reine Ferndiagnose-Behandlung ist zudem verboten. Fotos: Jürgensen

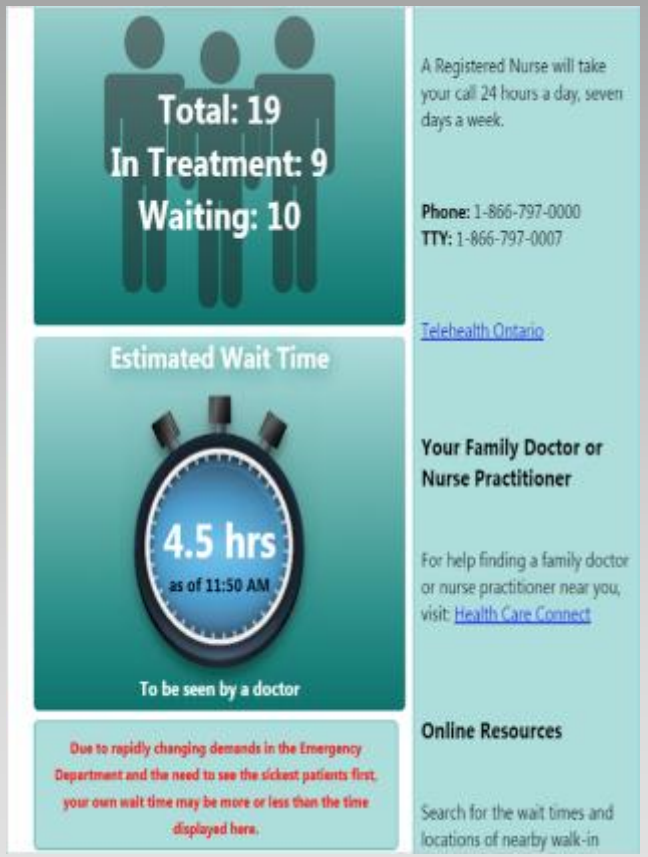
▶Das MVZ (Buntenskamp 5a) vereint Ärzte für Pädiatrie, Innere Medizin, Allgemeinmedizin, Gynäkologie sowie Ernährungsberatung. Mit 80 000 Patientenkontakten im Jahr – etwa 1000 davon sind Hausbesuche – ist das Ärztehaus einer der größten Gesundheitsversorger Geesthachts.

Digitalisation does not make all things better...

it can also show you how bad things are

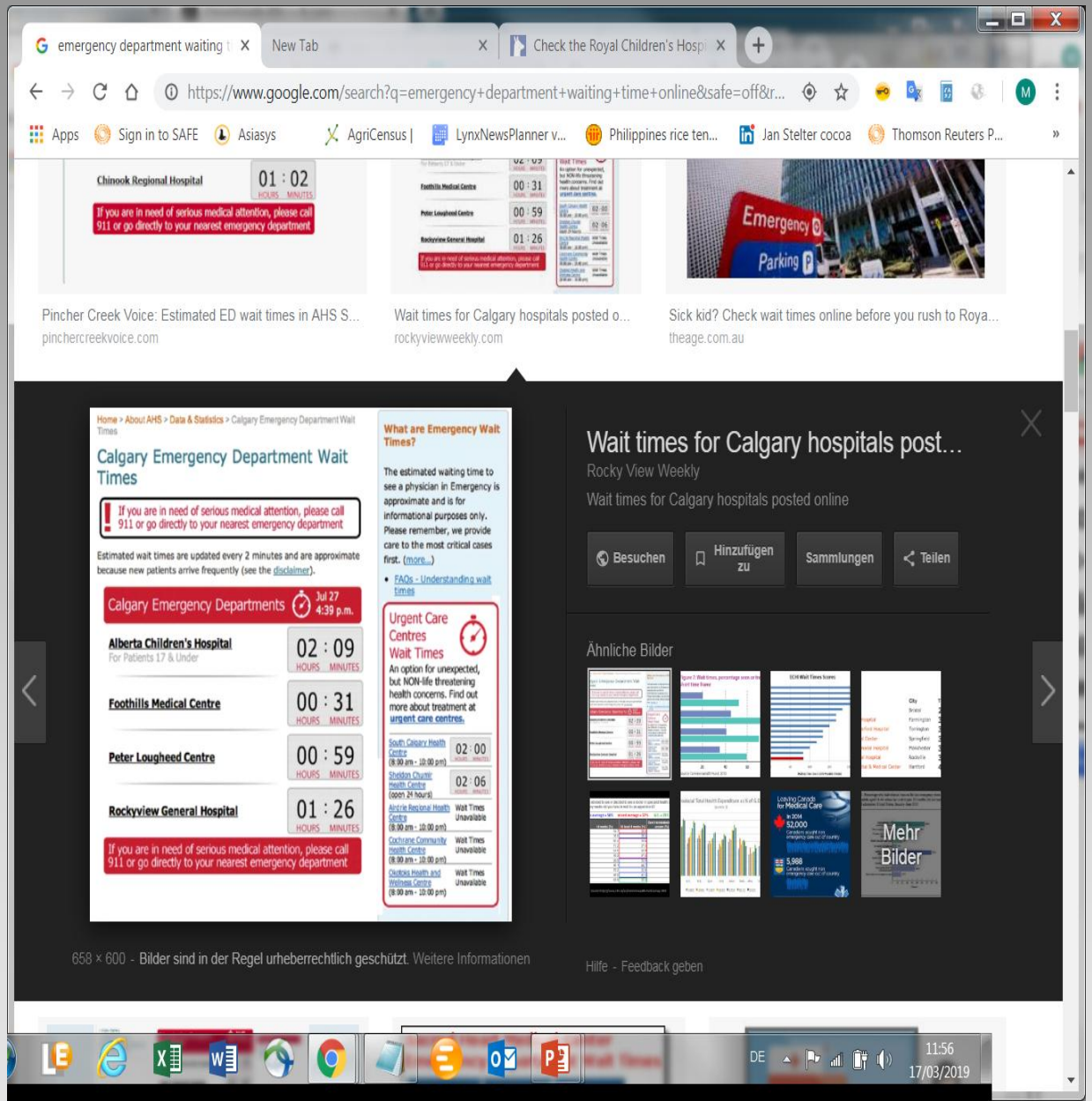
This hospital in Canada shows the current waiting time in its emergency department on the Internet





Source: www.wrh.on.ch/ waittimesmet

Elsewhere in Canada the waiting times in various hospital emergency departments are compared online



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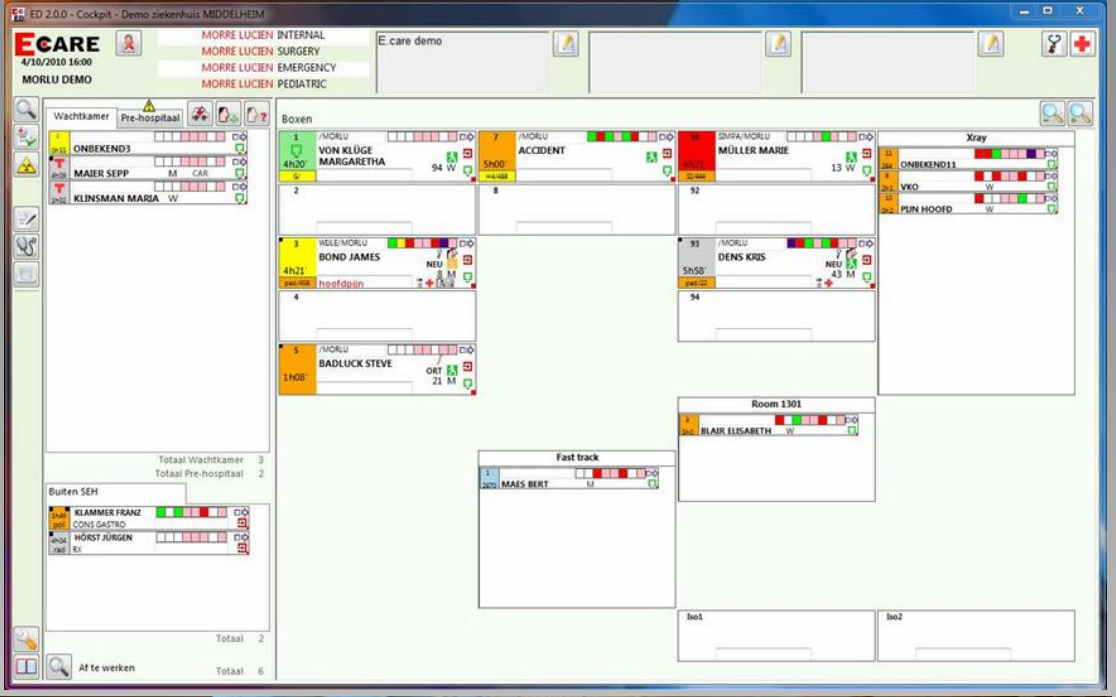


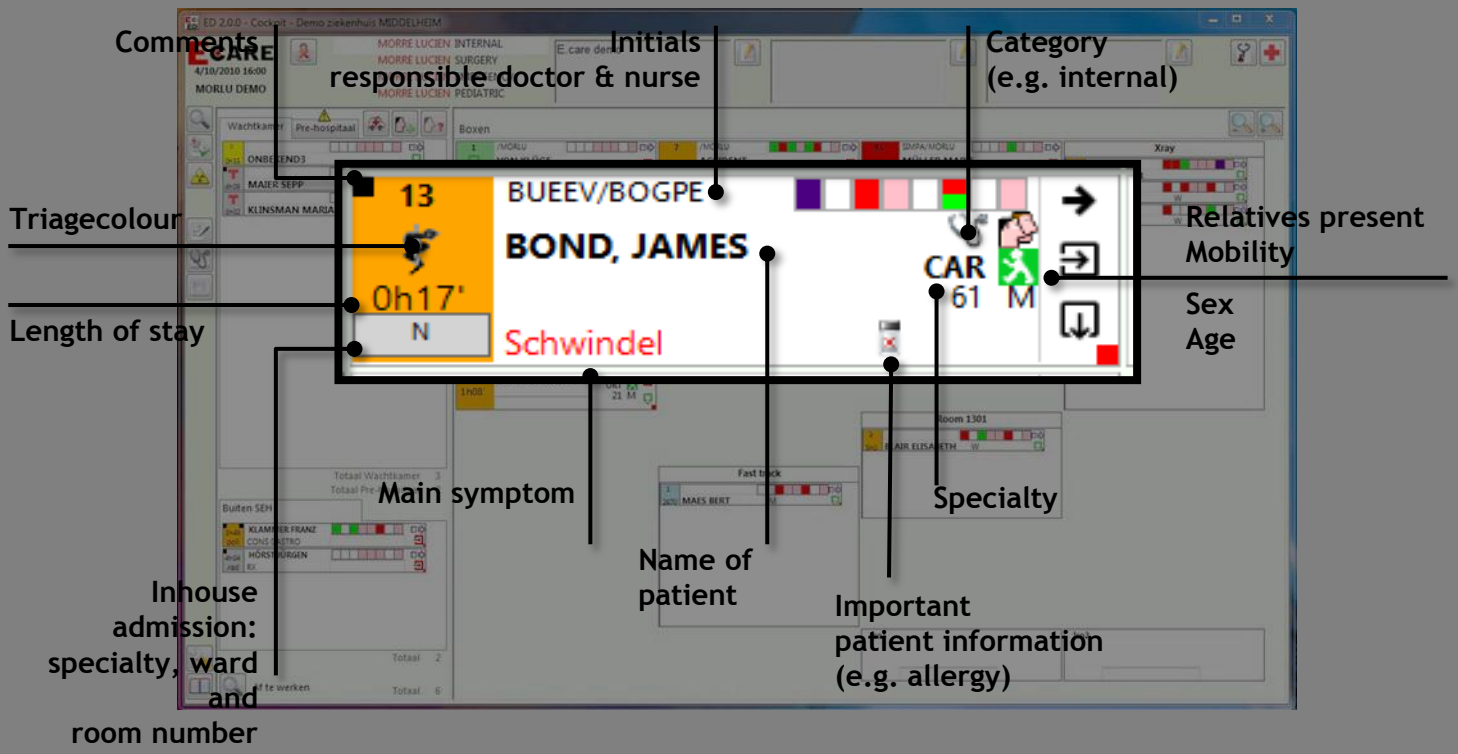
Improved communication – especially an overview:

- Communication with ambulance service
- Interprofessional, in Recusitation Area, during treatment
- Better communications with patients
- Transparent communications with in hospital wards which will receive patients
- Training, training, training: Personnel must get proper training in new systems

Continuous supervision of the workflow & patient flow

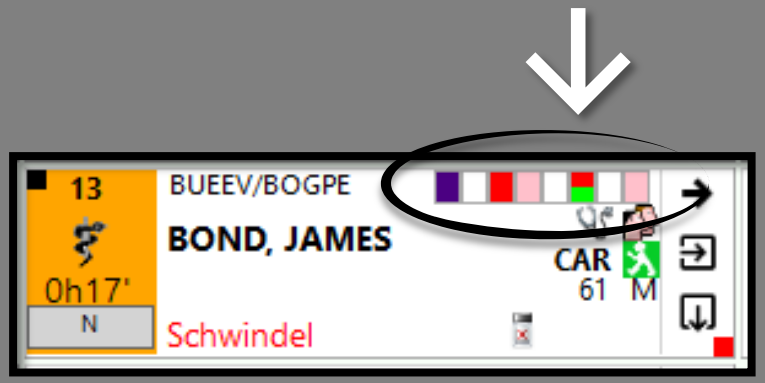
Clear cockpit screen

with the most important information about the patient



Clear cockpit screen

Including the most important treatment steps



This colour bar is the
E.care ED **STATUS BAR**

Time alarm if target times are exceeded (Triage,First View, first Lab result,…)

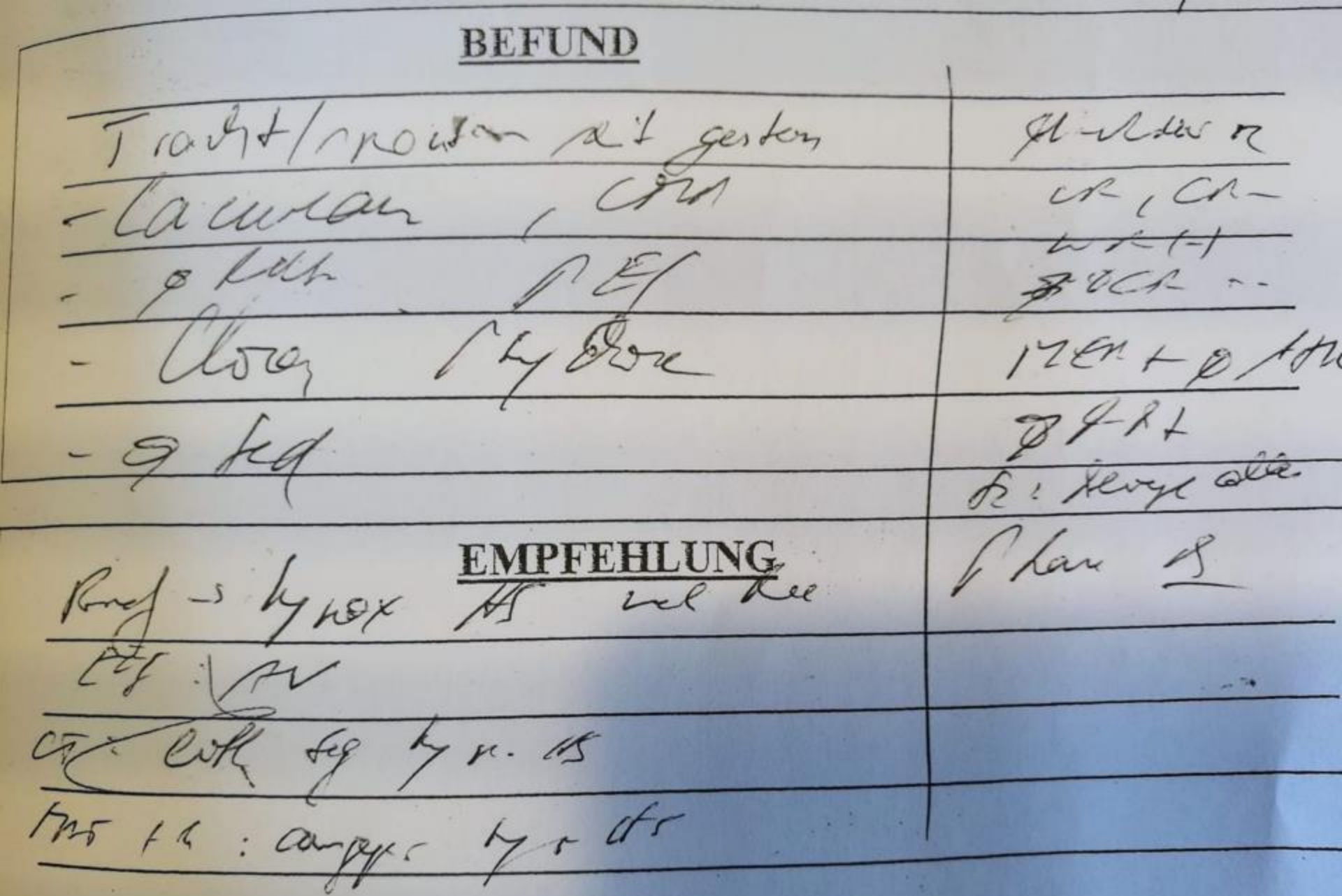
ICU
MANAGEMENT & PRACTICE

Man vs. machine in emergency medicine

With automation, "time to documentation" was reduced by 6.1 minutes
(0.6 min vs. 7.7 min $p < 0.05$)
and completeness increased (98% vs. 95%, $p < 0.05$)

Source: BMV Emergency Medicine, Dec 2018 https://healthmanagement.org/c/icu/news/man-vs-machine-in-emergency-medicine

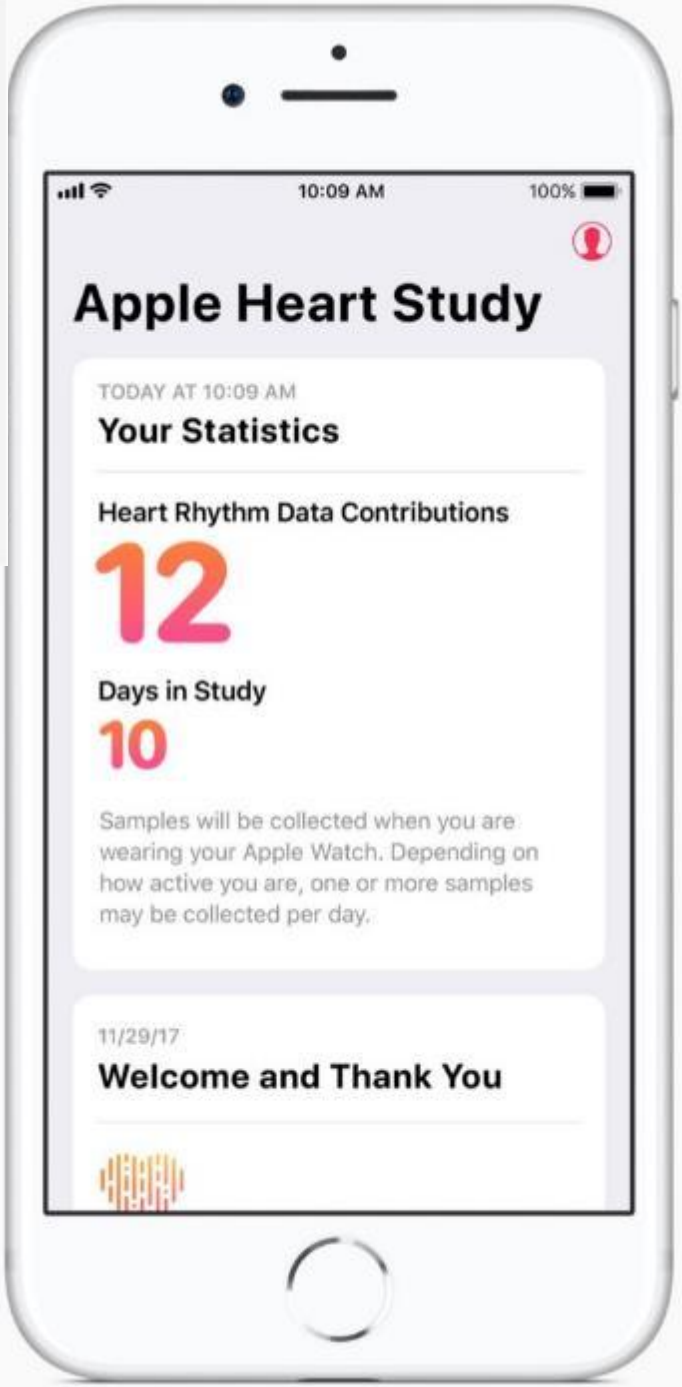
BEFUND



EMPFEHLUNG

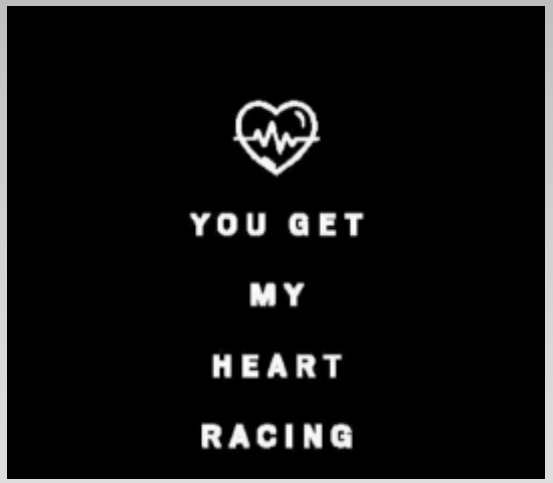
This kind of documentation is no longer of use in our time!

"The results of the Apple Heart Study highlight the potential role that innovative digital technology can play in creating more predictive and preventive health care," said Lloyd Minor, MD, dean of the Stanford School of Medicine. "Atrial fibrillation is just the beginning, as this study opens the door to further research into wearable technologies and how they might be used to prevent disease before it strikes — a key goal of precision health." Quelle: Stanford Medicine[1]



Smart Watch – Smart CPR

First study supports role of smart watches
as monitoring device
during cardio pulmonary resuscitation



BMJ Open

Can pulse check by the photoplethysmography sensor on a smart watch replace carotid artery palpation during cardiopulmonary resuscitation in cardiac arrest patients? a prospective observational diagnostic accuracy study

Yoonje Lee,[1] Hyungoo Shin,[1] Hyuk Joong Choi,[2] Changsun Kim[2]

To cite: Lee Y, Shin H, Choi HJ, *et al*. Can pulse check by the photoplethysmography sensor on a smart watch replace carotid artery palpation during cardiopulmonary resuscitation in cardiac arrest patients? a prospective observational diagnostic accuracy study. *BMJ Open* 2019;**9**:e023627. doi:10.1136/bmjopen-2018-023627

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2018-023627).

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ABSTRACT

Objective The purpose of this study was to assess whether a photoplethysmography (PPG) sensor in a smart watch can accurately recognise the return of spontaneous circulation (ROSC) in cardiac arrest patients compared with carotid artery palpation.

Methods This prospective observational study was conducted on 50 out-of-hospital cardiac arrest patients who visited the emergency department (ED) of one tertiary hospital. As soon as the patient arrived at the ED, advanced cardiac life support was carried out immediately. At this time, three smart watches were attached to the carotid artery, forehead and wrist and were checked for pulse measurements every 2 min. In the case of ROSC, blood pressure, heart rate and heart rate regularity were confirmed, and pulse was simultaneously measured at three sites with smart watches. In the case of no ROSC, only the pulse was measured at three sites with the smart watches.

Results There were 33 males (66%) and the mean age was 68±11.57 years. In 14 patients (28%), spontaneous circulation was recovered through cardiopulmonary resuscitation, and all survived. The sensitivity and specificity of manual palpation were 78.6% and 90.4%, respectively. False-positive and false-negative rates were 9.6% and 21.4%, respectively. Smart watches at all three sites had the same or higher sensitivity than manual palpation. The sensitivity of the smart watch was the highest, at 100%, in the carotid region and the lowest, at 78.6%, in the wrist region. The specificity of the smart watch was the highest, at 100%, in the wrist region and the lowest, at 78.7%, in the carotid region.

Conclusion Compared with manual pulse check, the PPG sensor embedded in the smart watch showed the same sensitivity and a higher specificity for recognising ROSC when measured at the wrist.

Strengths and limitations of this study

- We studied the feasibility of using smart watches for the recognition of cardiac arrest or return of spontaneous circulation during cardiopulmonary resuscitation.
- In this study, we attempted to investigate whether the limits of manual pulse checking can be overcome by using smart watches.
- Each investigator was blinded to the values measured to increase confidence in the results.
- One limitation of this study is the use of just one smart watch (Galaxy Fit).
- Another limitation is that we did not investigate other environments and situations in a prehospital setting.

INTRODUCTION

Carotid artery palpation of a cardiac arrest patient is key to allowing the rescuer to recognise the return of spontaneous circulation (ROSC) and determine the next action.[1] However, 'carotid artery palpation' is recommended only by the healthcare provider and does not exclude the possibility of error even if performed by an expert.[2 3] The recognition of ROSC using capnography, arterial blood pressure monitoring and ultrasound is highly reliable, but these techniques are not always available, especially in out-of-hospital settings.[4] Therefore, a more accurate and simple way to recognise ROSC than 'carotid artery palpation' would help less experienced rescuers make accurate decisions. In a recent animal study, photoplethysmography (PPG) was reported to be available in cardiac arrest situations.[5] Most current smart watches have PPG sensors for pulse measurement. PPG, the technology found in standard pulse oximeters, measures light reflectance in tissue to detect arterial pulsations. Therefore, the aim

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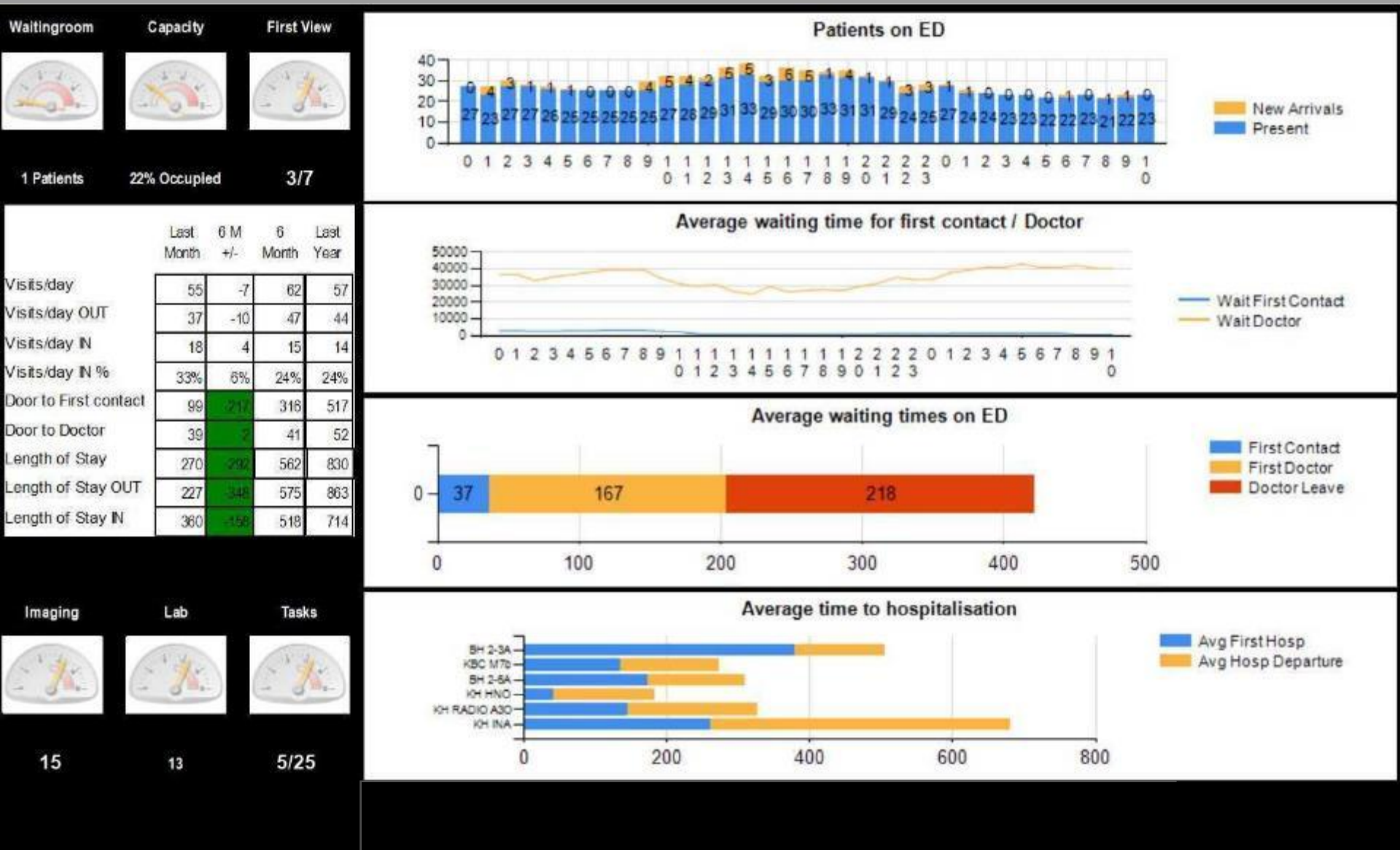
Agenda

1	Web 4.0. and beyond...
2	Patient`s wish and need
3	Doctor`s wish and need
4	CEO`s wish and need
5	The future: Artificial Intelligence

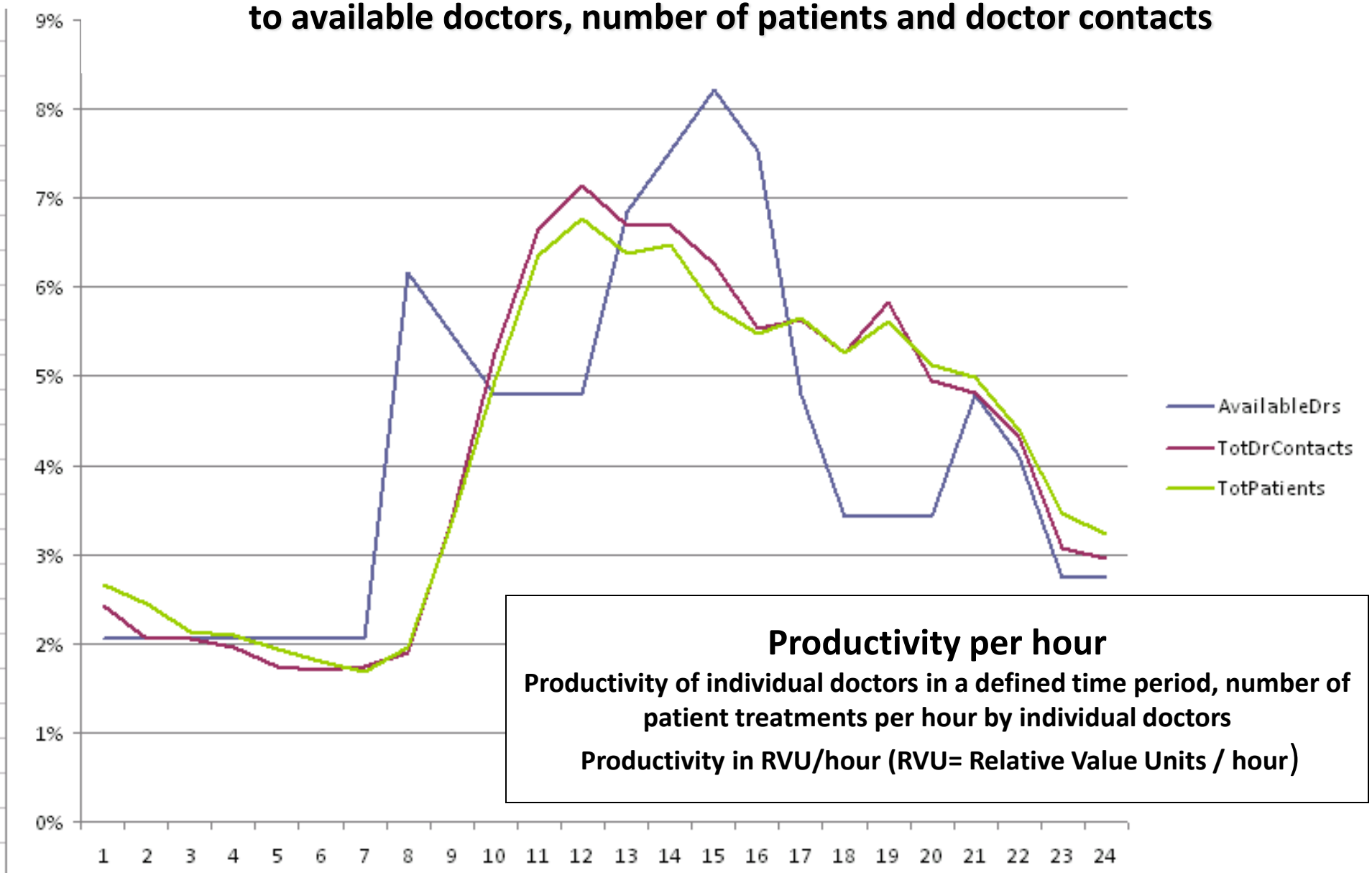
Illustrations of all processes / services / costs

Limited by data protection / employment laws regulating monitoring of personnel



	Last Month	6 M +/-	6 Month	Last Year
Visits/day	55	-7	62	57
Visits/day OUT	37	-10	47	44
Visits/day IN	18	4	15	14
Visits/day IN %	33%	6%	24%	24%
Door to First contact	99	-217	316	517
Door to Doctor	39	-2	41	52
Length of Stay	270	-292	562	830
Length of Stay OUT	227	-348	575	863
Length of Stay IN	360	-158	518	714

Distribution of doctors on duty
in relation to number of new patients arriving in the emergency department, to available doctors, number of patients and doctor contacts



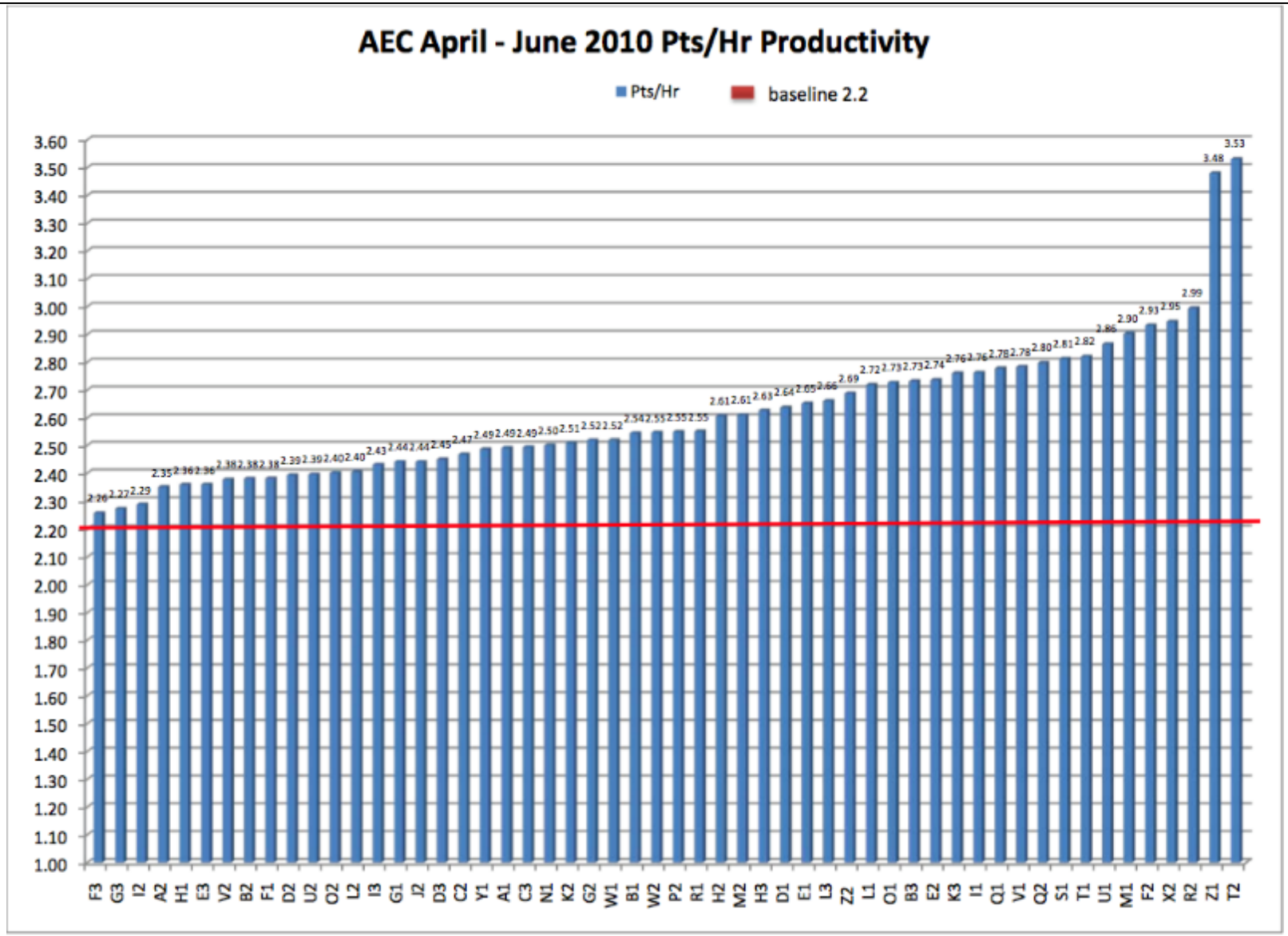
Productivity per hour

Productivity of individual doctors in a defined time period, number of patient treatments per hour by individual doctors

Productivity in RVU/hour (RVU= Relative Value Units / hour)

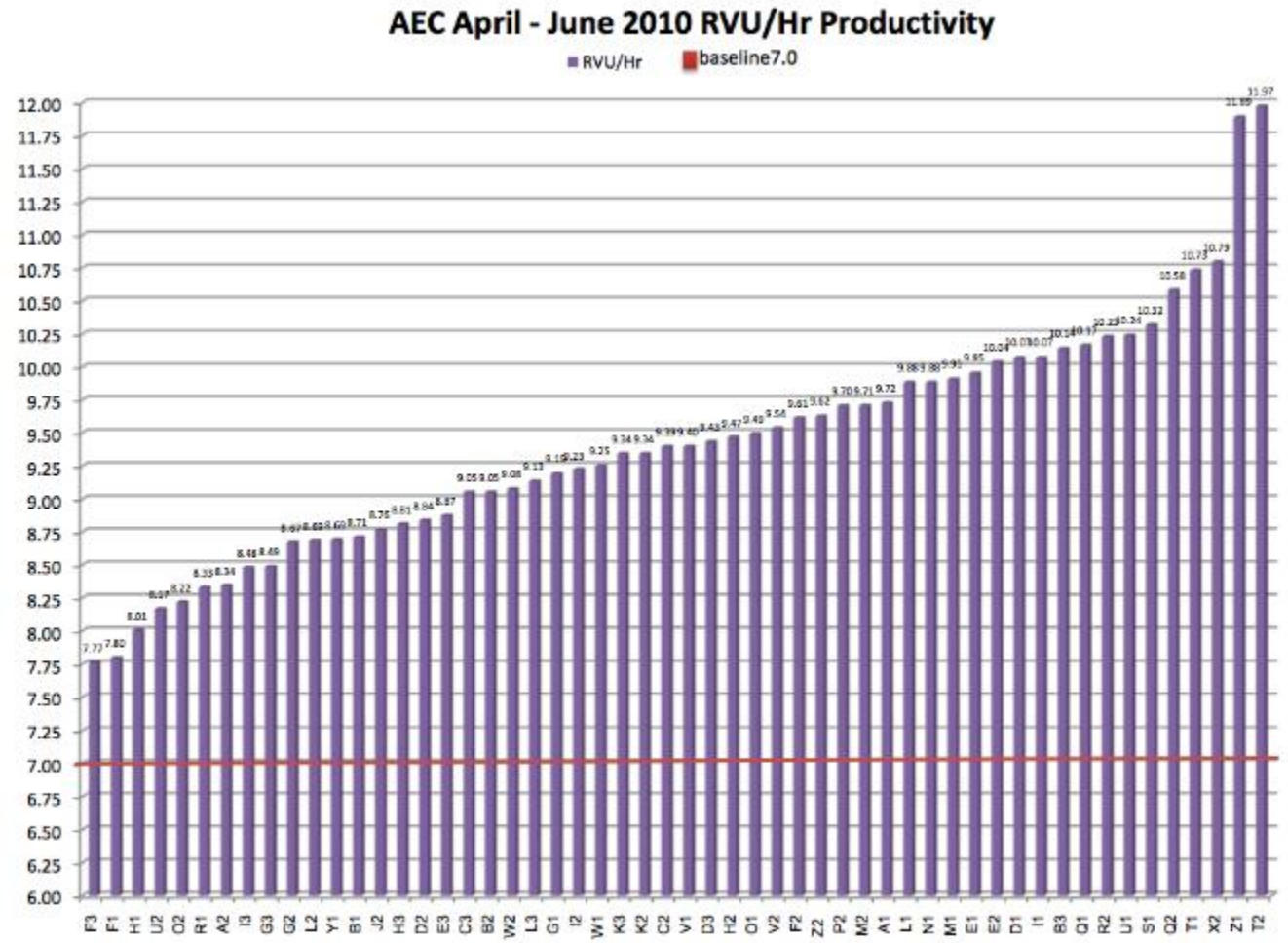
Productivity per hour

How productive were the individual doctors in this quarter year?
How many patients did the individual doctors treat per hour?

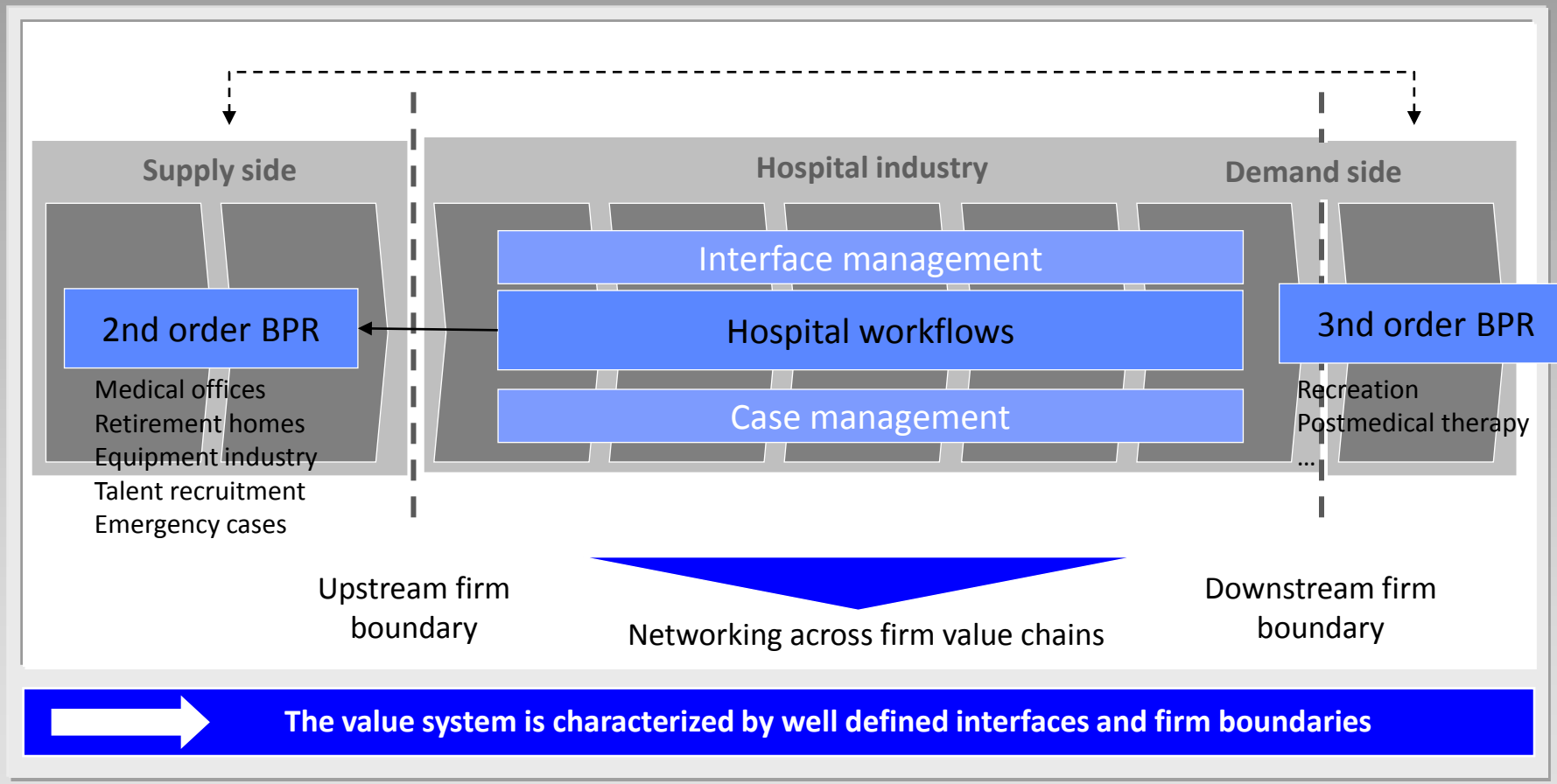


Productivity in RVU/hour

If the RVU is high – has this doctor treated more seriously ill patients or has he/she documented better than the others?



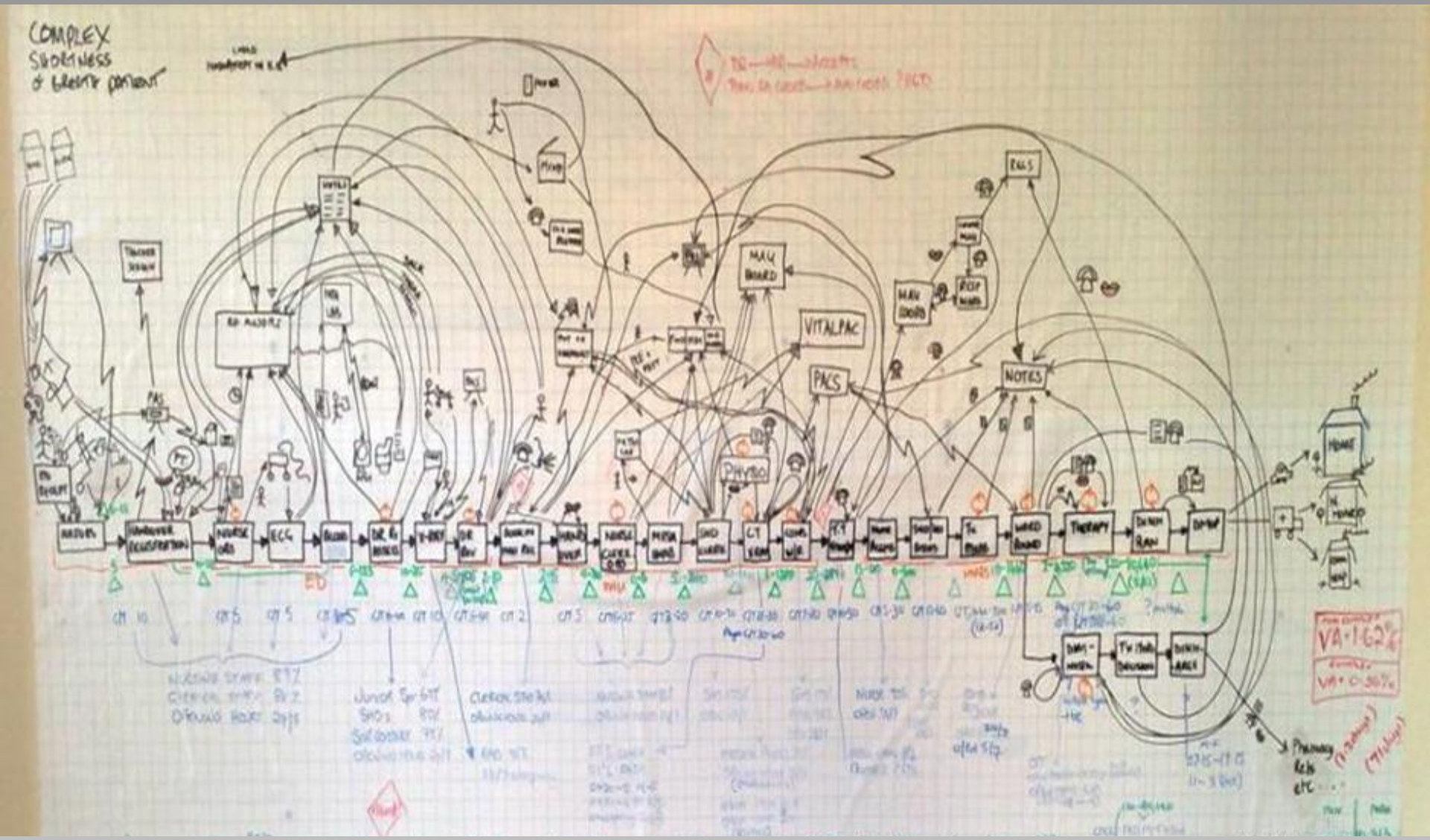
The process and work-flow driven organization:
Value creation
through harmonized interfaces, internal customer focus and automation



BPR: Business Process Re-Engineering

Koordinator 51073
Springer 51442
Internist I 51444
Internist II 51445
MTA 51446
N1
Ü21
U1
E1 E2
N2
Ü22
U2
Ü2
U3
N4
Ü24
U4
Schockraum I
Ü25
Wartebereich U
Diagnostik
ISO
U1
Arzt
Pflege
Diagnose
Koord.
Uhr
MTS
Uhr
Im Raum
Uhr
Stationssuche veranlasst! ja
Station:
Amb./E.:
Uhr
Verlegt:
Uhr
N2
Arzt
Pflege
Diagnose
Koord.
6:45
Uhr
MTS
7:15
Uhr
Uhr
Station:
19
Amb./E.:
Uhr
Verlegt:
Uhr

Every speciality department lives, preserves and defends its working processes



…with the result of unstructured working processes and high efficiency loss

Agenda

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TURING. DEEPART. IO

Style of van Gogh

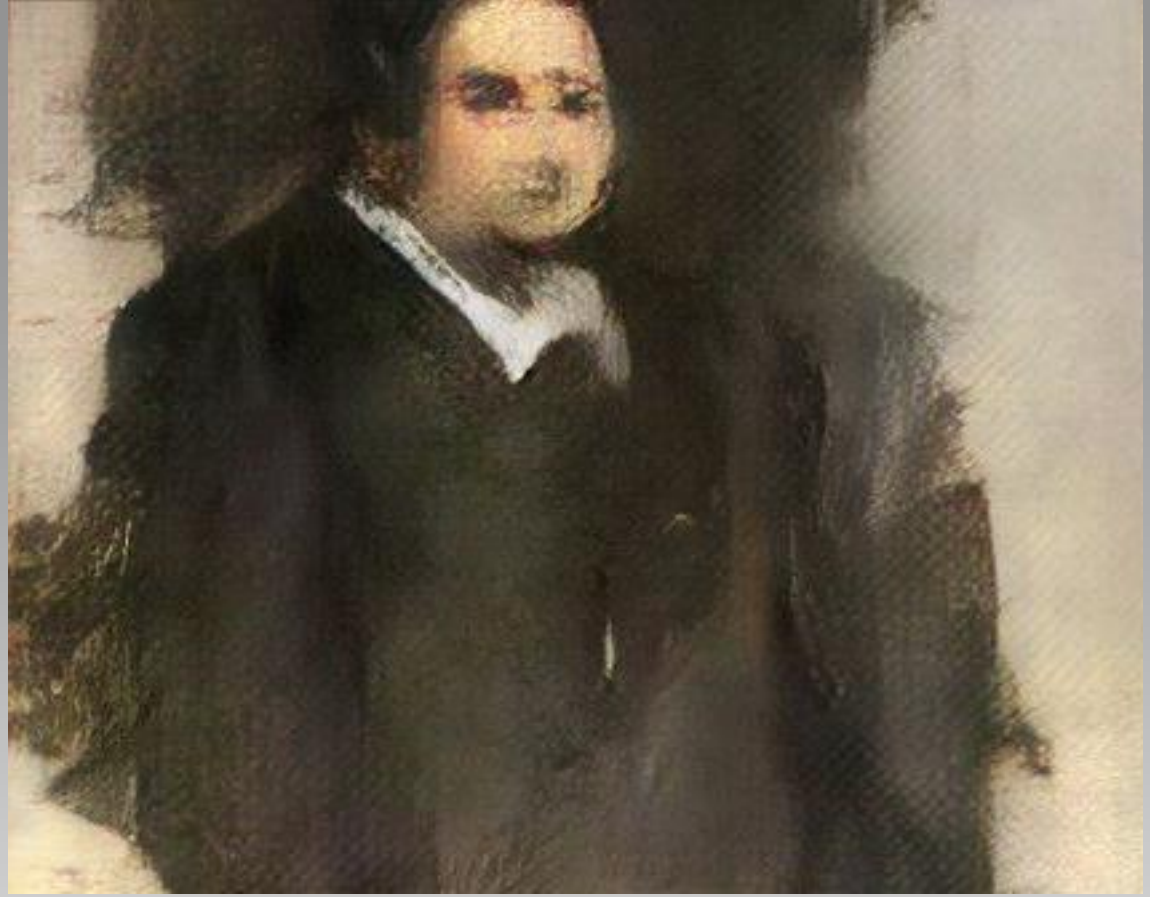
Bazille

Vincent van Gogh

TURING. DEEPART. IO

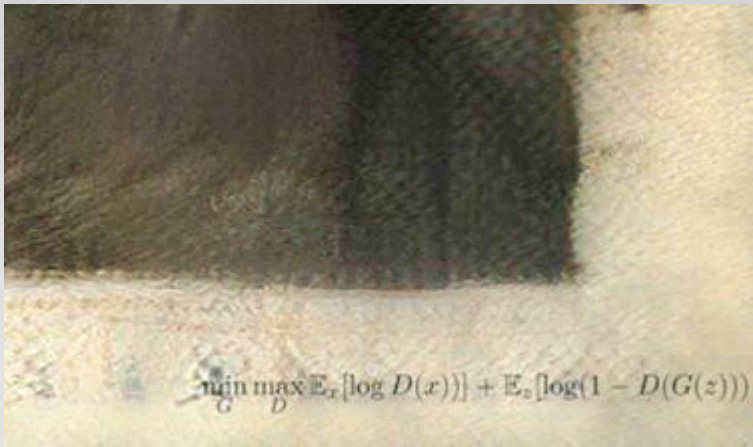
Artificial intelligence can learn to create pictures
in the style of the artist
in different periods of the artists life,

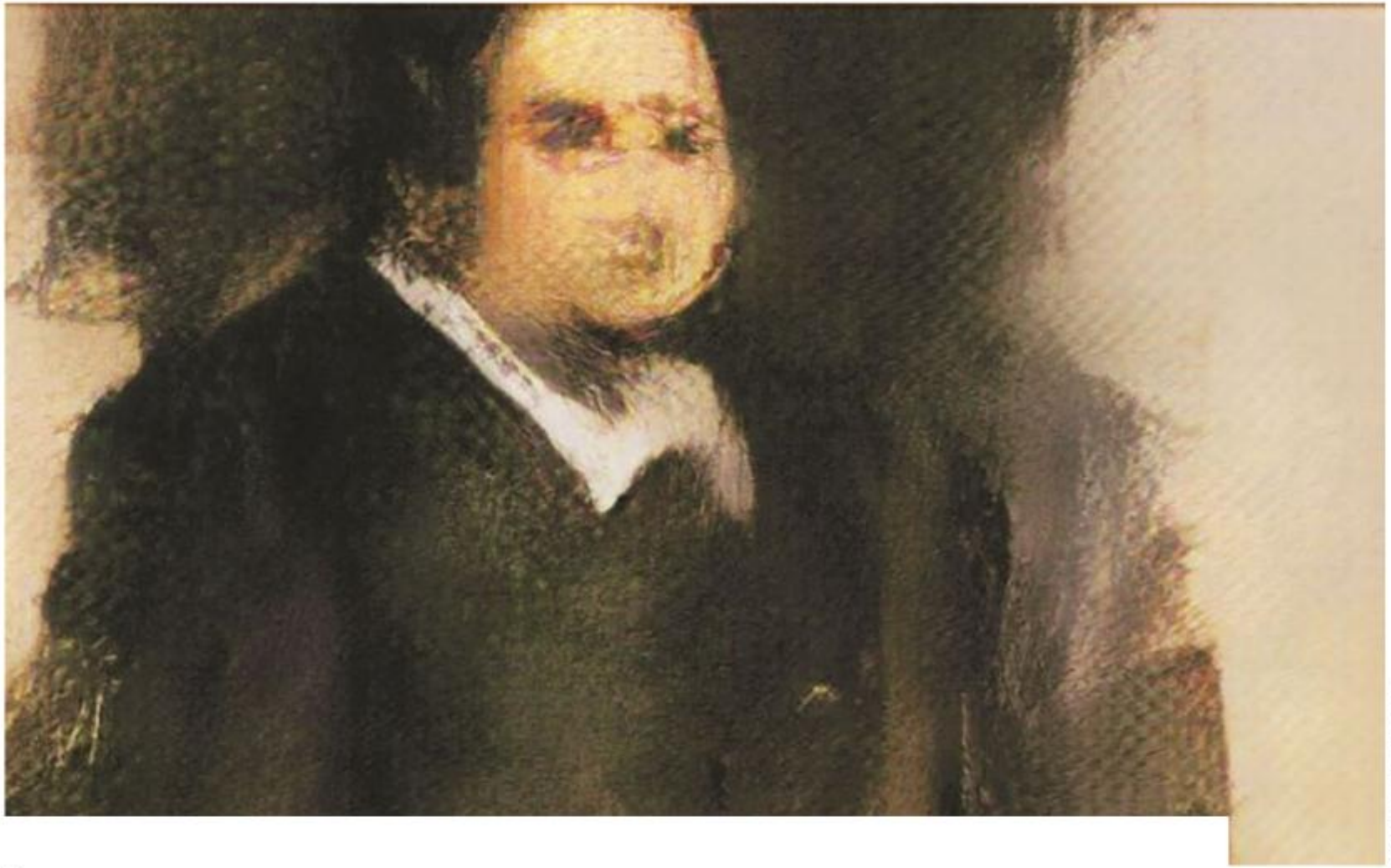
taking account of differing influences on the artist at that time



In October 2018 the first picture created using artificial intelligence, named Edmond de Belamy was auctioned in Christie`s in New York

The artist with this romantic name:
Gmax D Ex(logD(x)))+Ez(log(1-D(G(z))))
is rich:

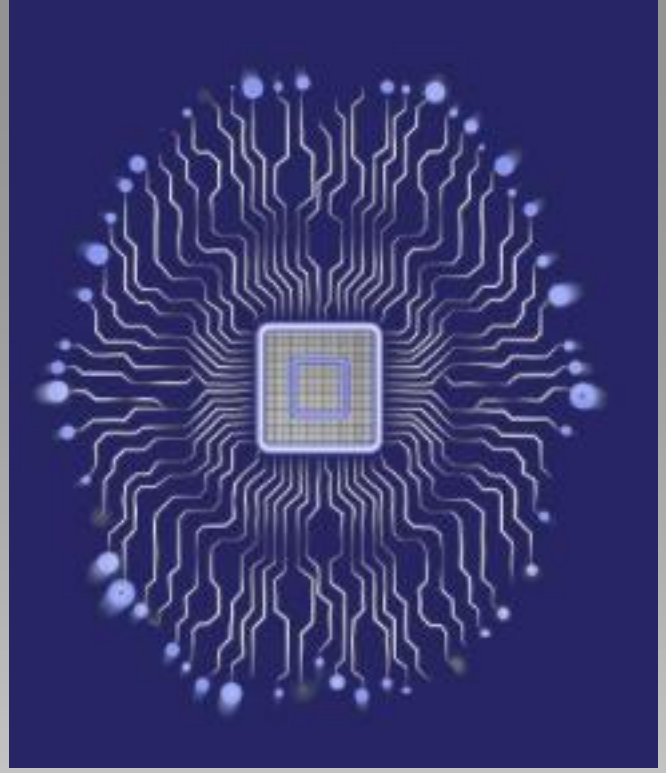




© Quelle: christies.com

Artificial Intelligence picture was auctioned in Christie`s in New York for 432.500,00 US-Dollar

von GQ
26. Oktober 2018



Flow Machines is an artificial intelligence

Which can compose and produce music –

like this album: **HELLO WORLD**

Source: https://www.helloworldalbum.net/listen/

A Japanese A.I. program just wrote a short novel and it almost won a literary prize

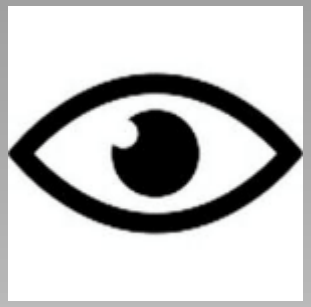
Artificial intelligence in digital medicine

1. Epidemiology: Recognising contexts in populations

2. Diagnostics: Sensitivity to early recognition

3. Therapy: Personalised medicine

Humans



Machine

Recognizing patterns
SKALENNIVEAU
WAHRNEHMUNG
SENSOR
MUSTER
VEKTOR
NEUROINFORMATIK
MERKMALSVEKTOR
DIGITALISIERUNG
LANGZEITGEDAECHTNIS
ERWARTUNGSWERT
KORRELATION
PHYSIK
MESSTECHNIK
KLASSIFIZIERUNG
SIGNALVERARBEITUNG
INTELLIGENZ
PERZEPT
MUSTER
WAHRNEHMUNG
DENKEN
BEGRIFFSBILDUNG
VEKTOR
WAHRSCHEINLICHKEITSRECHNUNG
SIGNAL
INTELLIGENZ
SIGNALMITTELUNG
BILDVERARBEITUNG
SPRACHERKENNUNG
ELEKTRONIK
SPEKTRALBEREICH
EMPIRISCH
INFORMATIK
BILDERKENNUNG
VERTEILUNGSFUNKTION
KORRELATIONSKOEFFIZIENT
MESSTECHNIK
PHYSIK
SENSOR
VEKTOR
MUSTER
KLASSIFIZIERUNG
WAHRNEHMUNGSPSYCHOLOGIE
MUSTERANALYSE
KLASSIFIKATIONSVERFAHREN
MERKMAL
DISKRIMINANZANALYSE
GESICHTSERKENNUNG
PHYSIK
KOGNITIONSWISSENSCHAFTEN
MUSTER
INFORMATIK
STOCHASTIK
MESSUNG
SIGNAL
VARIANZANALYSE
OBJEKTERKENNUNG
PERZEPT
KORRELATION
VEKTOR
SENSOR
TEXTERKENNUNG

Druirng teh rdeaing a text our bairn is wroikng exratrdionray hrad
To udernsatnd the wrods in the txet the dierffent leertts
of the iivinddual wdors can be in any oderr

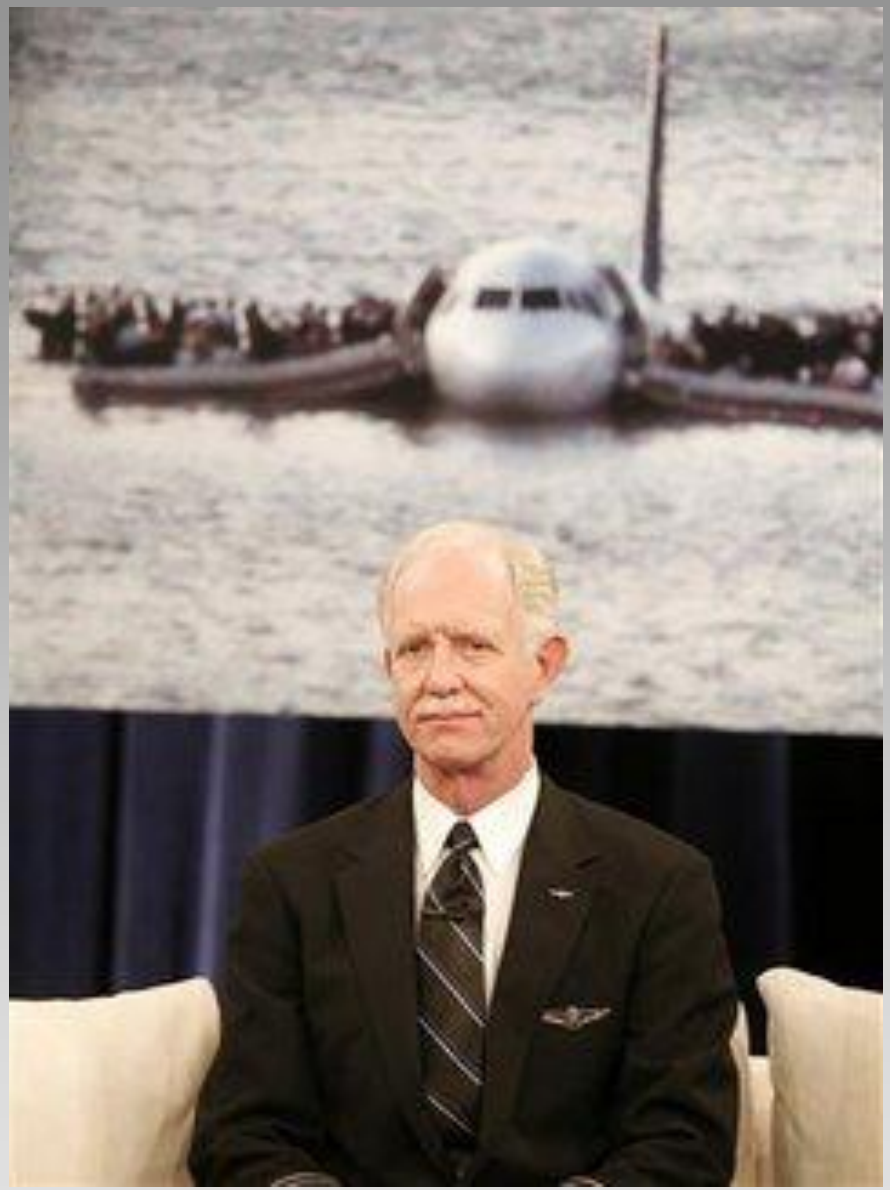
The msot imptronat fatcor is taht the fsrit and lsat lretets of the wrod are cocrert.
The rset can be miexd up in any oderr and we stlil undtserand.

We humans understand

CONTEXT

We humans remain

THE UNPREDICTABLE



This pilot switched off all automatic systems in his aircraft and saved everyone‘s life

106 STARTUPS TRANSFORMING HEALTHCARE WITH AI

We humans have Intuition

Intuition is analogue

Humans and machines

Colleagues not enemies
Addition not replacement
Help not competition

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