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## Global Perspective - Role of Technology in the Patient Centric Healthcare Delivery

Olaf Göing  
Head of Cardiology Department  
Sana Klinikum Lichtenberg, Berlin



**30 Ekim - 1 Kasım 2019**  
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# From Star Wars to Bedside - New Project Course at Stanford

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Image: Courtesy of Interactive Commons of CWRU



**NEW PROJECT COURSE**

- Learn and develop latest AR/VR tech
- Create solutions to real medical problems

**RAD 206: MIXED-REALITY IN MEDICINE**

Starts Sept 24, 2018.  
Meets M,W 1:30-2:50. 3 units  
Max Enrollment 15. Sign up early!  
[www.stanford.edu/class/rad206](http://www.stanford.edu/class/rad206)

From the Incubator for Medical Mixed and Extended Reality at Stanford. IMMERS.Stanford.edu



RAD206 (Mixed-Reality in Medicine) is a new project course in Autumn 2018, primarily targeted to engineering students who wish to learn about mixed-reality technology and apply it to real-world medical problems. Students will be given hands-on experience learning to develop for the Microsoft HoloLens, and guided through medical application projects with mentorship from practicing medical faculty and fellows.

This course is offered by the Department of Radiology to all Stanford Students. The IMMERS facilities, personnel and sponsors will all contribute to the course. In particular, we are grateful to Microsoft for providing Mixed-Reality headsets, and the VPTL for a small funding grant.

Please see the course website [rad206.stanford.edu](http://rad206.stanford.edu) for complete details!

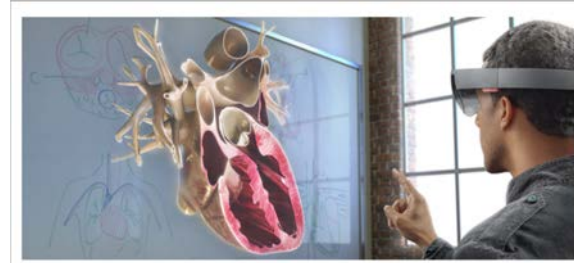


Image: Courtesy of Microsoft



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# Fei-Fei Li, Head of 2 Vision Labs at Stanford



**FEI-FEI LI: IF WE WANT MACHINES TO THINK, WE NEED TO TEACH THEM TO SEE**



COMPANIES > GOOGLE (ALPHABET)

## Google's AI Cloud Star Leaves After Pentagon Deal Protests

Fei-Fei Li, chief scientist at Google's cloud-computing division, is leaving after controversy over the use of the company's AI technology and a deal with the Pentagon • Andrew Moore, dean of the school of computer science at Carnegie Mellon University in Pittsburgh will become head of AI at Google Cloud at the end of 2018 • In early June, Google retreated from a Pentagon cloud contract following employee protests • In internal emails, Li praised the contract but cautioned colleagues to avoid mentioning the AI component of the deal for fear that the public would latch onto concern about "weaponized" AI, The New York Times reported

Fei-Fei Li, former chief scientist at Google Cloud, speaks onstage during The 2018 MAKERS Conference at NeueHouse Hollywood on February 6, 2018 in Los Angeles

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Provide help, where staff cannot perceive everything...



Pilot Partnerships

Intermountain Healthcare

Lucile Packard Children's Hospital Stanford

We have partnered with Intermountain's Healthcare Transformation Lab where we have deployed 3D depth sensors in several patient rooms. With the help of Intermountain, we are using live data streams to teach our computer vision algorithms to discern events of clinical relevance such as hand hygiene events and patient interaction.

In collaboration with Lucile Packard Children's Hospital, we have installed state-of-the-art sensors in over 10 patient rooms and multiple corridors for hand hygiene activities. Our machine learning algorithms learn routine movement patterns by staff and individual hand hygiene behaviors by guests.

Our Computer Vision Approach

Dispenser Usage Detection

Physical Space Analytics

Privacy Safe Assessment

With the help of artificial neural networks, our method uses deep learning to automatically detect usage of an alcohol-based sanitizer dispenser from challenging ceiling-mounted top views.

Intuitive, qualitative results analyze human movement patterns and conduct spatial analytics which convey our method's interpretability. Red regions denote high traffic areas while blue denotes low traffic regions.

To comply with privacy regulations, we use deidentified depth images instead of color photos to track and analyze hand hygiene compliance. Our method can track multiple clinicians throughout a hospital ward.

## Bedside Computer Vision

- a

THE NEW ENGLAND JOURNAL of MEDICINE

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Image Challenge: What's the diagnosis?

PERSPECTIVE: What We Can Do about Maternal Mortality — And How to Do It Quickly

SPECIAL REPORT: Health Care in the 2018 Election

Perspective

Bedside Computer Vision — Moving Artificial Intelligence from Driver Assistance to Patient Safety

Serena Young, M.S., N. Lance Downing, M.D., Li-Fai-Fai, Ph.D., and Arnold Milstein, M.D., M.P.H.

Article Figures/Media Metrics

April 5, 2018

N Engl J Med 2018; 378:1271-1273

DOI: 10.1056/NEJp1716891

3 References

We may be approaching the limits of what is achievable through improvements in clinical processes, culture, and narrowly focused technological assistance. Expectations that fatigued clinicians will reliably execute each behavioral step of complex hospital treatments ignore evidence from cognitive science that humans usually operate in error-prone "fast thinking" mode. <sup>1</sup> Even remotely located hospital staff watching intensive care beds by video feed cannot immediately detect and correct bedside behavioral errors such as failing to reset bedrails, restraints, or inflatable calf boots.



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# Machines **see** Diabetes...

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**Verily and Nikon to collaborate on machine learning in diabetes**



Marco Ricci

January 3, 2017



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# The link between disturbed sleep and cardiovascular diseases - but it's hard to get an appointment for the sleep lab...

These goals may best be addressed  
through strengthening collaboration among the cardiology,  
sleep medicine, and clinical trial communities.

## Circulation

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**Sleep Apnea and Cardiovascular Disease**  
**Lessons From Recent Trials and Need for Team Science**  
Luciano F. Dräger , R. Doug McEvoy, Ferran Barbé,  
Gerardo Lorenzi-Filho, and Susan Redline   
and On behalf of the INCOGACT initiative (International Collaboration of  
Sleep Apnea Cardiovascular Trials)  
Originally published 7 Nov 2017 | Circulation. 2017;136:1840–1850



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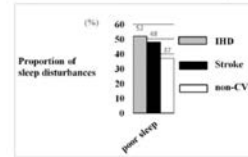
ESC Press Office

**Poor sleep is associated with ischaemic heart disease and stroke**

29 Aug 2017

Figure A: Poor sleep

Proportion of poor sleep in ischaemic heart disease (IHD), stroke, and non-cardiovascular disease (CVD) populations. Poor sleep was defined as a global Pittsburgh Sleep Quality Index score of 6 or more.



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## Artificial Intelligence for Healthcare

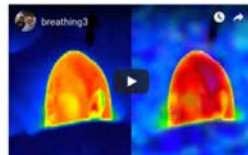
### SLEEP MONITORING

Sleep is something that every person needs. Without sleep a normal days task seem never ending. Your body suffers and you suffer even people who come in contact with you suffer too. Without sleep you can't function normally. Your moods change changing your personality, changing how you perceive the world. A sleep disorder is a condition that prevents a person from getting restorative sleep causing daytime sleepiness and dysfunction. There are over 80 different types of sleep disorders but there are only four that are the most common. These disorders are Insomnia, Sleep Apnea, Restless Leg Syndrome, and Narcolepsy. Two immediate consequences of bad sleeping are fatigue (see link1, link2) and pain [1].

[1] <http://www.ncbi.nlm.nih.gov/pubmed/21873265>

### RESPIRATORY RATE

We are developing new techniques to diagnose and triage common respiratory conditions. In particular we will extract respiratory rate, chest excursion, and time trends from thermal imaging videos. The videos 1 and 2, were taken with a thermal camera and show how respiratory frequency could be extracted. The footages were recorded in home settings and total darkness.



1. This video shows a baby. On the left, the original footage. On the right the result of applying a de-noising and eulerian magnification [1] filters. Now, recovering the numerical breathing rate is straight forward by tracking the accumulation of heat in the whole magnified video.

[1] <http://people.csail.mit.edu/mrub/vidmag/>



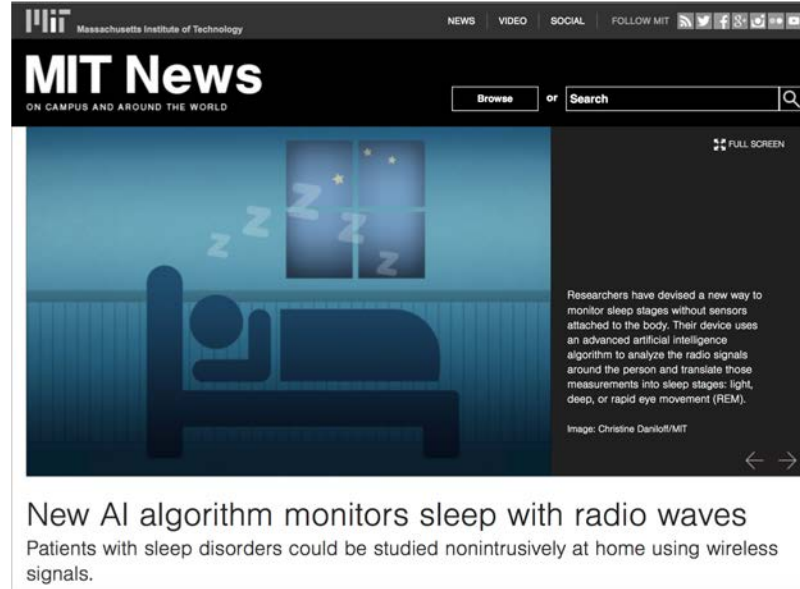
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# From the West Coast to the East Coast

## - Clinical Value?



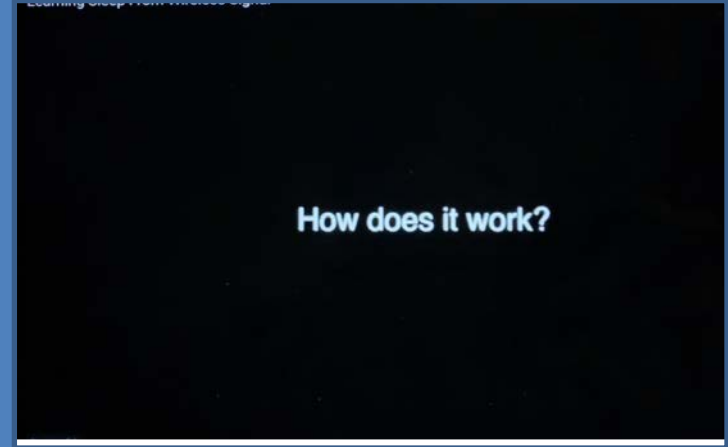
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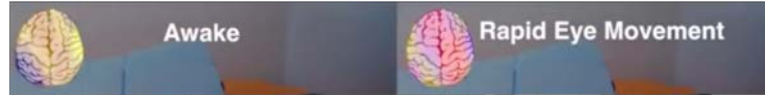
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# SLEEP Laboratory Wireless



We are also working on that...



## Understanding Diseases with Sleep Stages



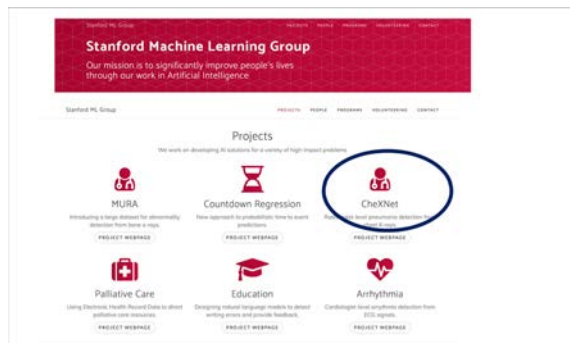
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# Andrew Ng, Co-Founder Google Brain, Former AI Leader of Baidu - Leading ML Group at Stanford



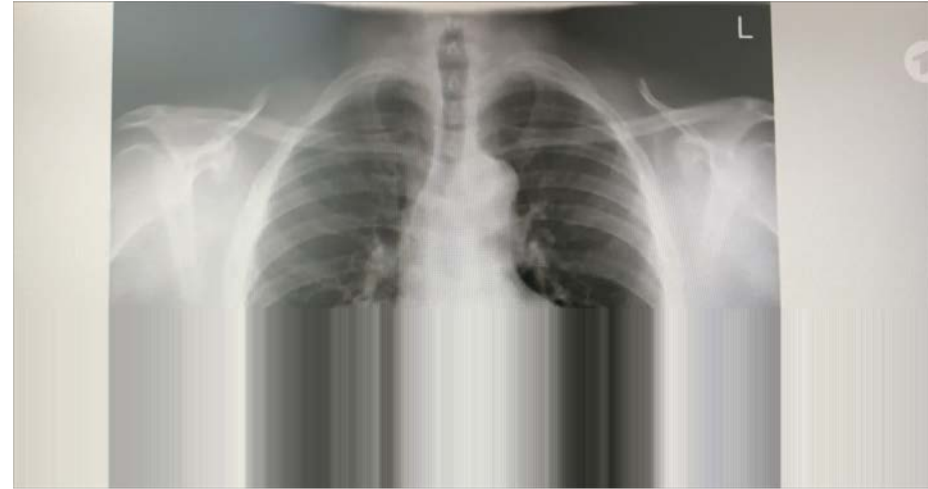
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# X- Ray: What is the diagnosis? - your Cell Phone will tell you!



Copy: German Television (ARD)



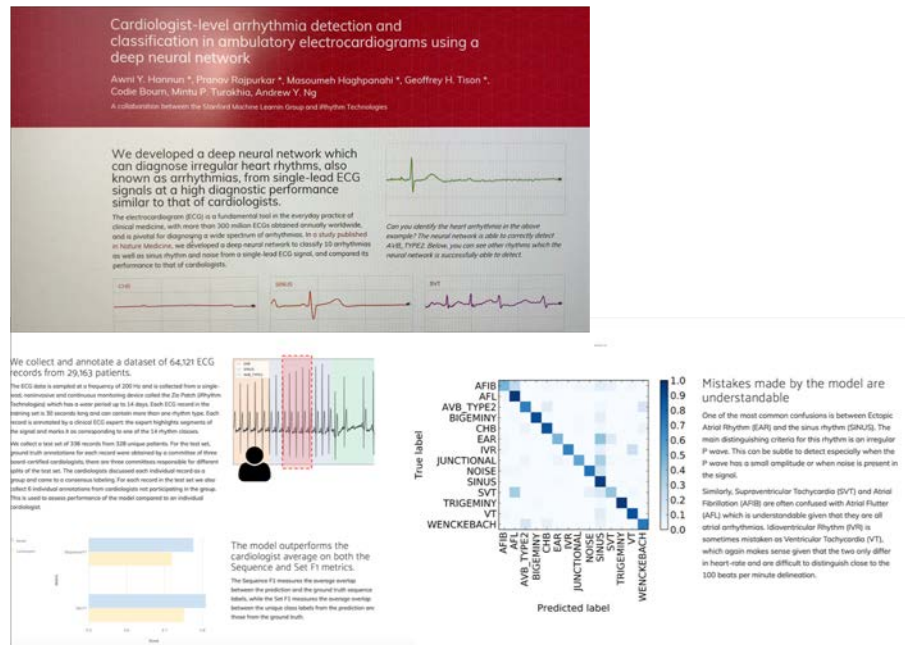
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# Cardiologist-level arrhythmia detection with AI



MENU

nature  
medicine

Letter | Published: 07 January 2019

## Cardiologist-level arrhythmia detection and classification in ambulatory electrocardiograms using a deep neural network

Awni Y. Hannun\*, Pranav Rajpurkar, Masoumeh Haghighpanahi, Geoffrey H. Tison, Codie Bourn, Mintu P. Turakhia & Andrew Y. Ng

Nature Medicine **25**, 65–69 (2019) | Download Citation

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# From Science to Bedside Approach...



**Apple Heart Study**  
In partnership with **Stanford MEDICINE**



**Apple Heart Study**  
In partnership with **Stanford MEDICINE**



Early diagnosis and treatment may prevent serious heart complications, including strokes.




To accelerate discovery in heart science, we've created an innovative research study.




It uses an app designed to notify participants if an irregular heart rhythm is observed.

**Detecting Atrial Fibrillation (AF)**



Gesellschaft zur integrierten Versorgung von Patienten mit Herz-Kreislauf-Erkrankungen e.V.



**Watch Your AF! - Trial**

Aim: The Apple Watch for AF detection in patients with an implanted loops recorder after catheter ablation.

O. Göing, J. Brachmann, W. Haverkamp, A. Schirdewan†



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# Testing AI Algorithm and ECG Quality vs. ILR



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# Is there any Value for AI in the Area of Heart Failure?

**JAHA**  
Journal of the American Heart Association

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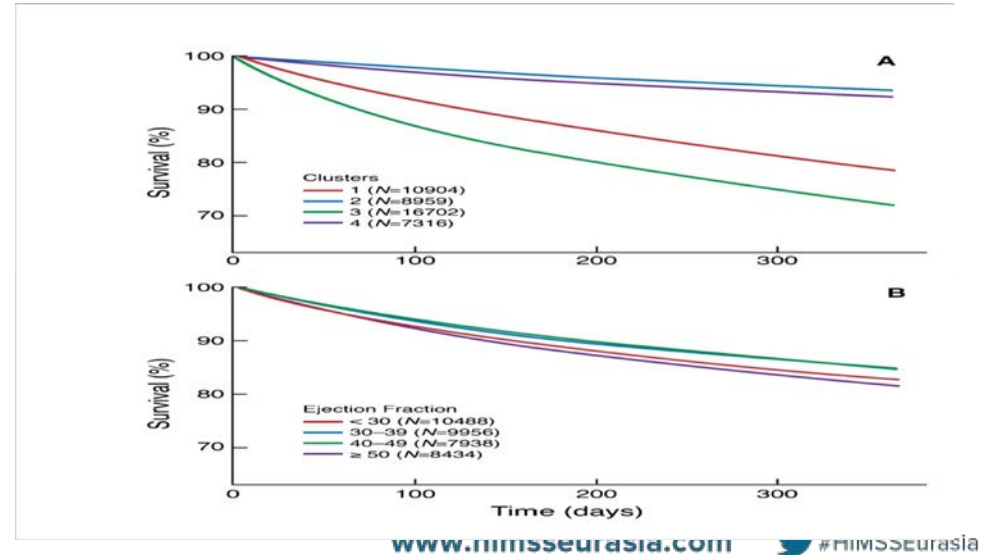
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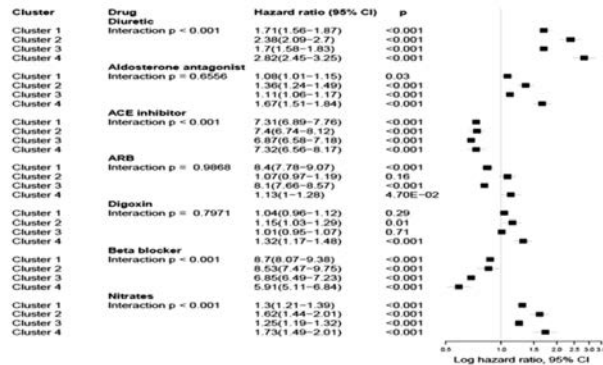
**Machine Learning Methods Improve Prognostication, Identify Clinically Distinct Phenotypes, and Detect Heterogeneity in Response to Therapy in a Large Cohort of Heart Failure Patients**

Tariq Ahmad, Lars H. Lund, Pooja Rao, Rohit Ghosh, Prashant Warier, Benjamin Vaccaro, Ulf Dahlström, Christopher M. O'Connor, G. Michael Felker, and Nihar R. Desai

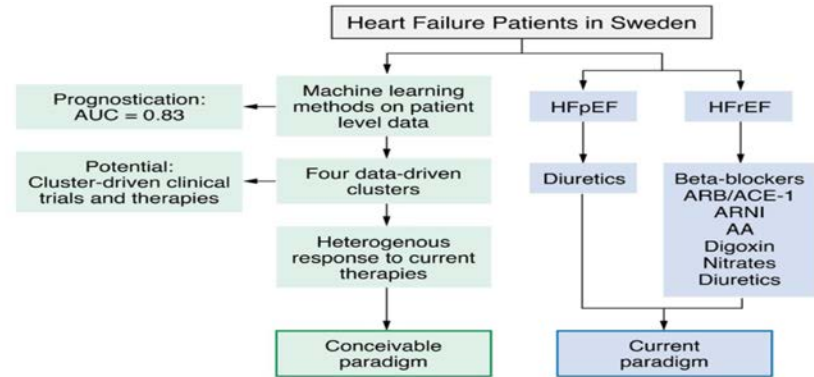
Originally published 12 Apr 2018 |  
Journal of the American Heart Association. 2018;7:e008081



# From individual impacts to modified recommendations



Machine Learning Methods Improve Prognostication, Identify Clinically Distinct Phenotypes, and Detect Heterogeneity in Response to Therapy in a Large Cohort of Heart Failure Patients, Volume: 7, Issue: 8, DOI: (10.1161/JAHA.117.008081)



Machine Learning Methods Improve Prognostication, Identify Clinically Distinct Phenotypes, and Detect Heterogeneity in Response to Therapy in a Large Cohort of Heart Failure Patients, Volume: 7, Issue: 8, DOI: (10.1161/JAHA.117.008081)



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# We work with strong partners to bring this approach to practical care



**Microsoft Intelligent Healthcare**

HERZ-HELD (Heart Hero)–  
Live better and more secure with Heart Failure

Till Oroszki  
Director Healthcare Industries  
Till.Oroszki@Microsoft.com



Gesundheitliche Versorgung mit  
Patienten mit Herz-Kreislauferkrankungen



- Assigning human-like qualities to digital experiences
- Perceives its environment
- Mimics cognitive functions

## What is AI?

- Learns from example in volumes of data
- Program that writes itself based on examples
- Classifies, recommends, predicts, groups, segments



Strong AI - AGI  
Combining weak AI with a consciousness or "mind"

AI

Weak AI  
Separate cognitive functions, see/natural language, vision

## Heart Hero Project Partners



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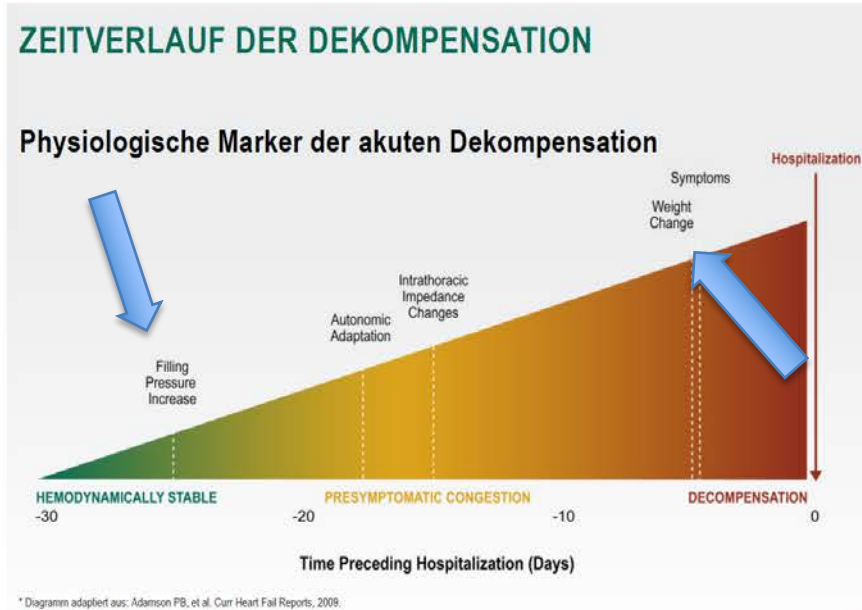
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Filling pressure indicates decompensation much earlier than the weight and/ or symptoms

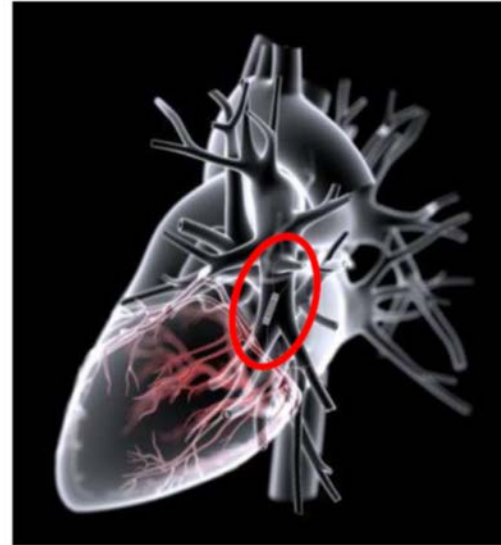
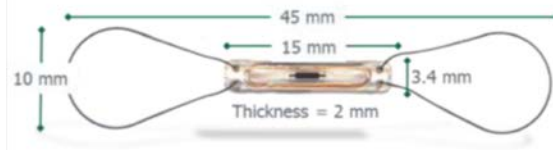


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# CardioMems HF System



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# CardioMems Measurement at Home

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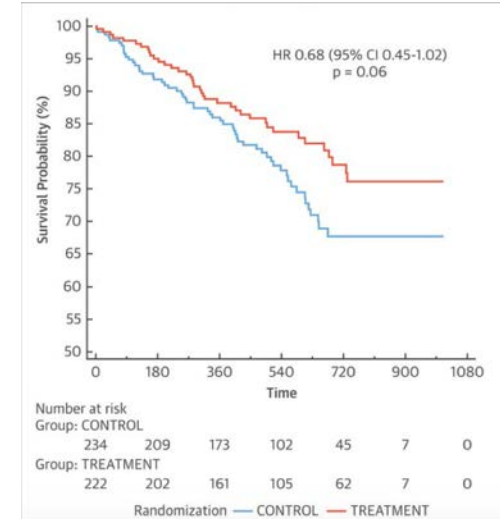
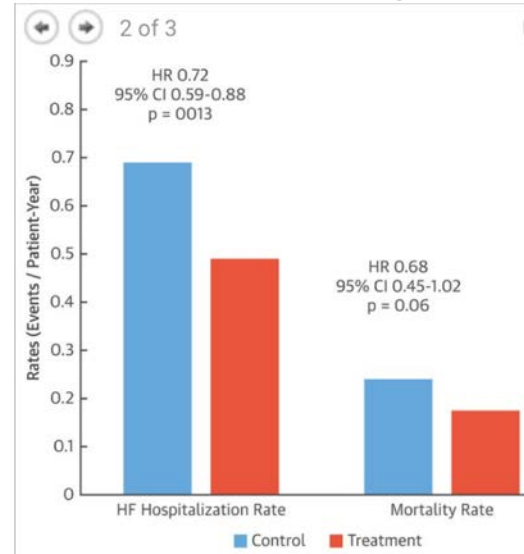
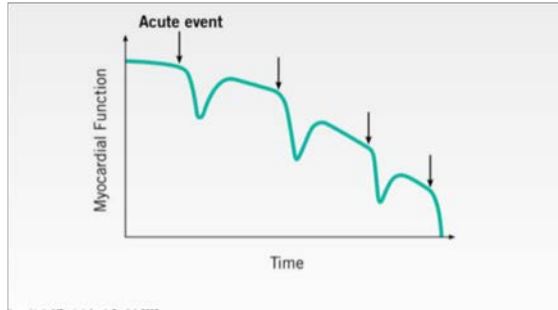
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# The goal: Avoid unscheduled hospitalization

- Every hospitalization worsens the prognosis

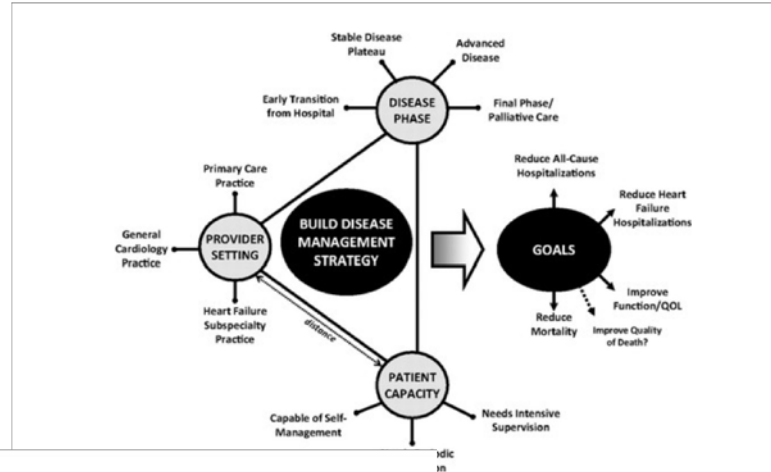


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# A lot of intersectoral work needs to be done...



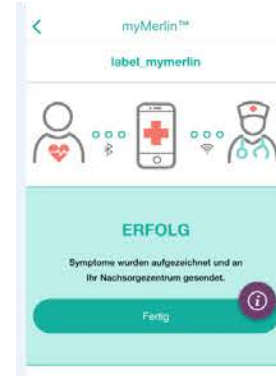
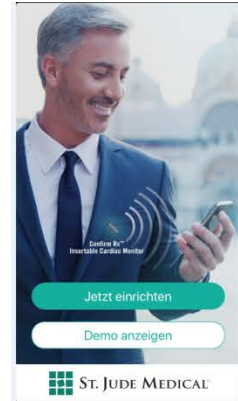
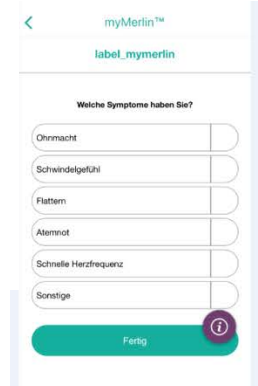
Akshay S. Desai. Circulation. Rehospitalization for Heart Failure, Volume: 126, Issue: 4, Pages: 501-506, DOI:

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...but we are capable to do it



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