The Vision of Cardiovascular Medicine from 2022 to the Next Decade

Dipti Itchhaporia, MD, MACC, FAHA, FESC, FRCP

Immediate Past President , American College of Cardiology

Eric and Sheila Endowed Chair in Cardiovascular Health

Director of Disease Management, Hoag Hospital

Professor, University of California, Irvine

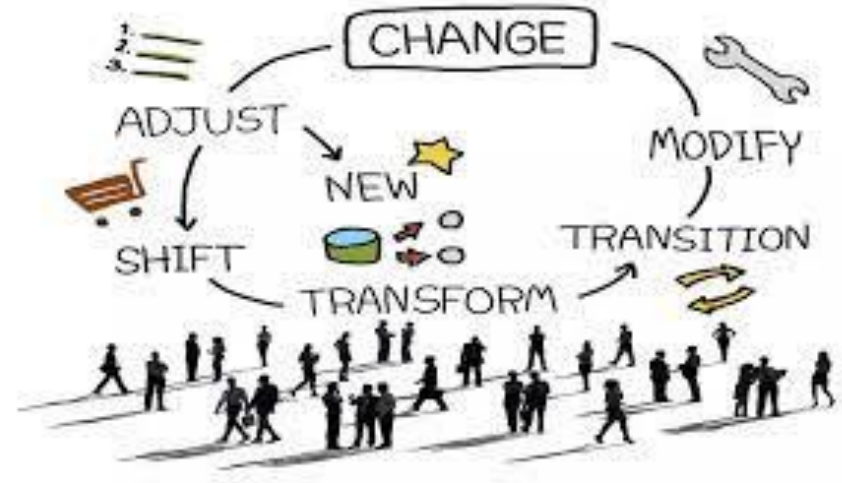AMERICAN COLLEGE *of* CARDIOLOGY

The State of Cardiovascular Medicine

- Effect of COVID-19

- Health Equity

- Digital Transformation

- Medicine As Data Science

- Communication and Miscommunication of Science

- Workforce Changes

- Clinician Burnout
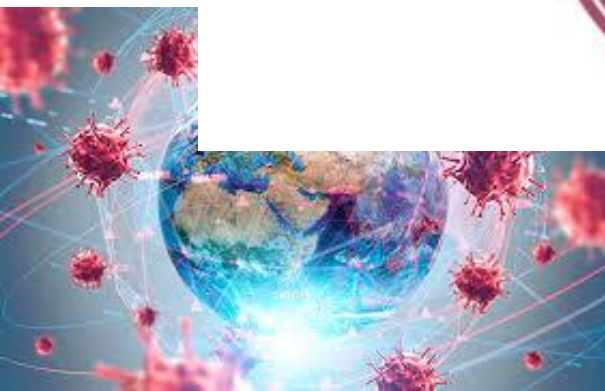
- Opportunities for the future

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What is Impacting CV Clinicians, Patients, and the Healthcare Industry in 2022?

Constant Change

For he who has health has hope; and he who has hope, has everything.

Owen Arthur

Lessons Learned From COVID

The Power in Community — Global crisis underscores strength, resilience and courage of the ACC Family
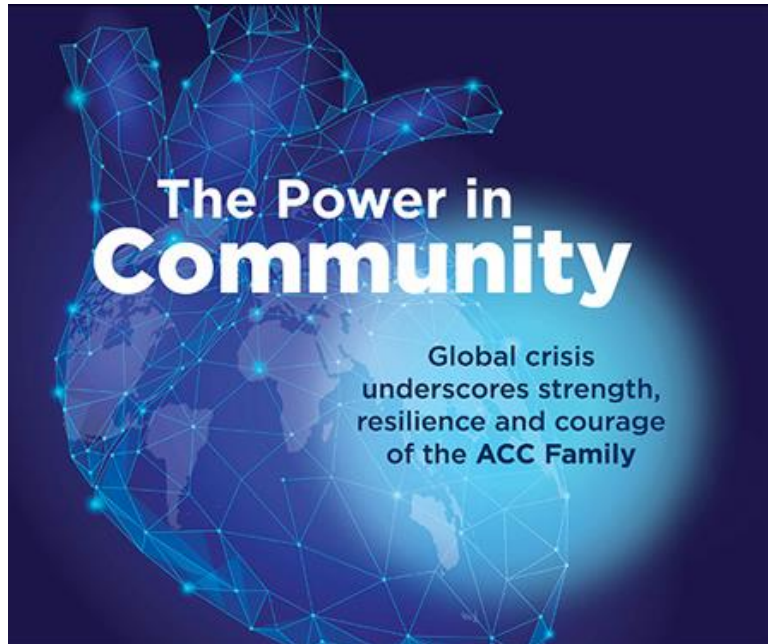
ACC's COVID-19 Hub
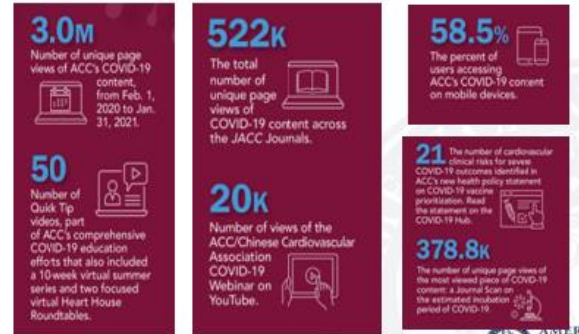
Global Collaboration is Critical & Effective
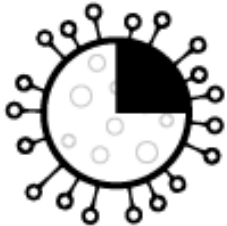
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COVID-19 inequity in the US, by the numbers

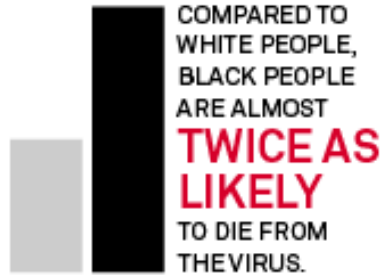**BLACK PEOPLE REPRESENT**

13% OF THE U.S. POPULATION

BUT ALMOST

25% OF COVID-19 DEATHS

As of July 28, 2020.
Credit: Cat Weeks
Source: Gilead Sciences Inc.

COMPARED TO WHITE PEOPLE, BLACK PEOPLE ARE ALMOST **TWICE AS LIKELY** TO DIE FROM THE VIRUS.

AN ESTIMATED **60%** OF COVID-19 DEATHS OCCURRED IN DISPROPORTIONATELY BLACK COUNTIES.

BLACK PEOPLE ARE ABOUT **FIVE TIMES** MORE LIKELY TO BE INFECTED WITH THE VIRUS THAN WHITE PEOPLE.

Exposure: How COVID-19 Amplifies Healthcare Inequities in America

The current national **COVID**-19 mortality rate for Black Americans is 2.1 times higher than that of Whites.

The pandemic has brought to light significant health inequities that have existed in our society for decades.

Johnson-Agbakwu, C.E., Ali, N.S., Oxford, C.M. *et al.* Racism, COVID-19, and Health Inequity in the USA: a Call to Action. *J. Racial and Ethnic Health Disparities* (2020)

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IMPACT OF SOCIAL DETERMINANTS OF HEALTH

Social determinants of health have tremendous affect on an individual's health regardless of age, race, or ethnicity.

Socioeconomic Factors

- Education
- Job Status
- Family/Social Support
- Income
- Community Safety

40%

Physical Environment

10%

Health Behaviors

- Tobacco Use
- Diet & Exercise
- Alcohol Use
- Sexual Activity

30%

Health Care

- Access to Care Quality of Care

20 %
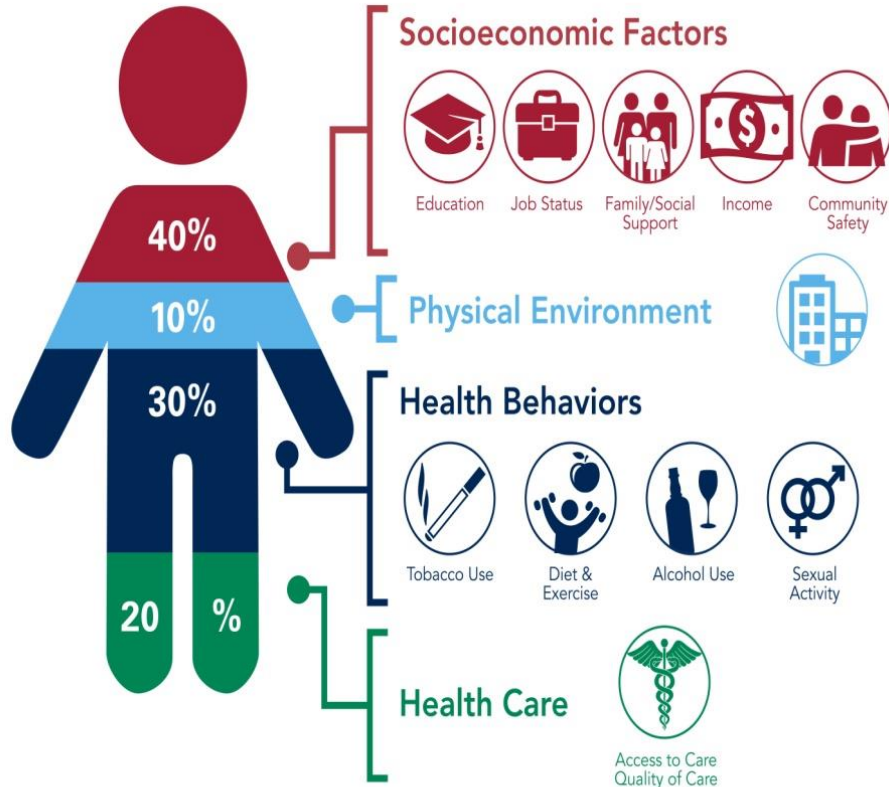
> **SDOH Impact**

→ **20 percent** of a person's health and well-being is related to **access to care** and **quality of services**

→ The **physical environment, social determinants** and **behavioral factors** drive **80 percent** of health outcomes

20%

80%

COVID has highlighted the importance of SDOH's on risk and outcomes

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LEADERSHIP PAGE

Paving the Way for Health Equity in Cardiology

Why Does it Matter?

Dipti Itchhaporia, MD, FACC, *President, American College of Cardiology*

I have been impressed with the urgency of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do.
—Leonardo da Vinci (1)

Health equity has long been an ideal. It is rooted in medicine going back into the mid-nineteenth century when it was recognized that social and class inequalities lead to health inequalities. The core of health equity is the intention to eliminate unfair and avoidable differences in disadvantaged groups that have poorer survival rates, life conditions, and health status that perpetuate their disadvantages. In spite of the fact that many organizations have pursued the ideal, this has not translated into equitable and healthy societies.

The coronavirus disease 2019 (COVID-19) pandemic

What is known is that social determinants of health—the conditions in which people are born, grow, live, work, and age—have significant impact on health, quality of life, and health care costs. Conditions such as economic stability, physical environment, education, food, and access to care also support or inhibit our health (Figure 1). There is evidence that determinants of health are interlinked with class, ethnicity, gender, education level, as well as social vulnerabilities.

In the United States, recent data from the Centers for Disease Control and Prevention (CDC) have shown that Blacks, Latinx, and Asians have substantially higher rates of infection, hospitalization, and death from COVID-19 compared with Whites (4). Vaccine and testing rates are also lower in these populations,

Health equity means that **everyone has a fair and just opportunity to be healthy.**
Robert Wood Johnson Foundation
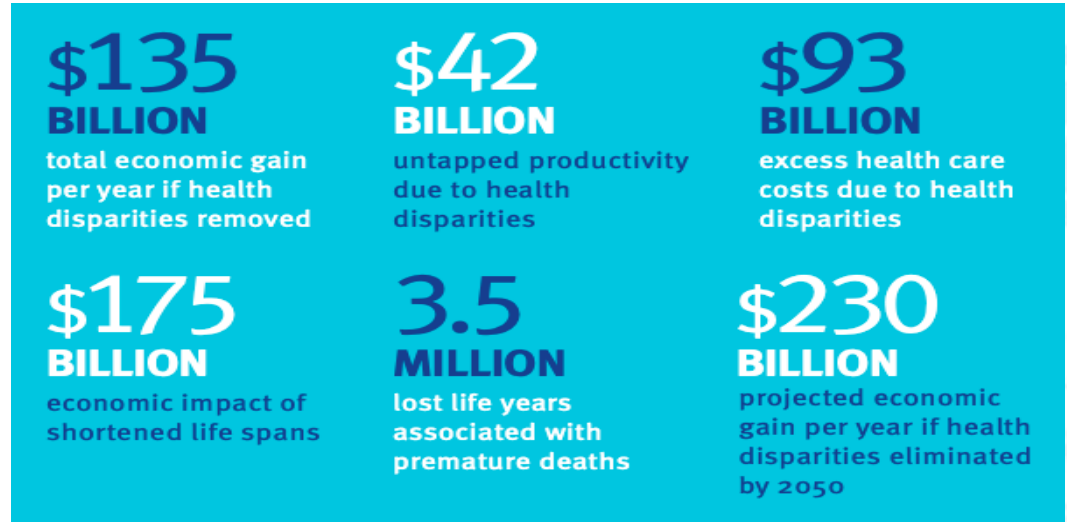
WHAT IS HEALTH EQUITY?

"Health Equity is defined as **the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically**".

World Health Organization

The Business Case for Health Equity

-Health disparities are costly and there would be a positive economic impact if health equity is better implemented

-It has been estimated by the Institute of Healthcare Improvement, that health inequities cost the United States $83 billion and this is anticipated to grow to $300 billion by the year 2050

$135 BILLION total economic gain per year if health disparities removed

$42 BILLION untapped productivity due to health disparities

$93 BILLION excess health care costs due to health disparities

$175 BILLION economic impact of shortened life spans

3.5 MILLION lost life years associated with premature deaths

$230 BILLION projected economic gain per year if health disparities eliminated by 2050

•https://www.commonwealthfund.org/blog/2021/any-medicare-solvency-effort-must-include-advancing-health-equity

https://altarum.org/sites/default/files/uploaded-publication-files/WKKellogg_Business-Case-Racial-Equity_National-Report_2018.pdf
https://cmelearning.com/resources/the-case-for-health-equity/#business
https://www.astho.org/Programs/Health-Equity/Economic-Case-Issue

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Lesson Learned From COVID

We Must Address Health Equity
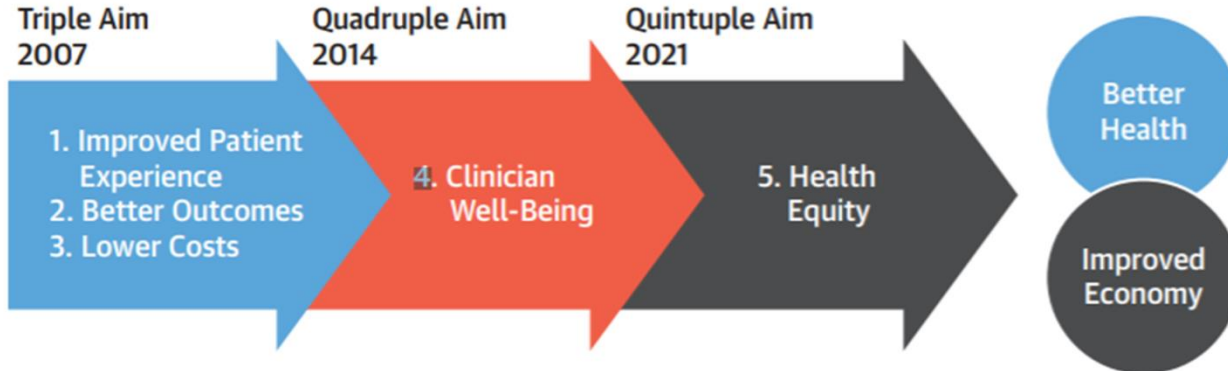
Transformative Times, Transformative Health Care.

1954 First open-heart procedure (Gibbon)

1958 Coronary arteriography developed (Sones)

1961 Risk factors defined

1961 Coronary care unit developed (Julian)

1962 First beta-blocker developed (Black)

1969 First description of CABG (Favaloro)

1972 NHBPEP

1976 First HMG CoA reductase inhibitor described (Endo)

1979 Coronary angioplasty developed (Grüntzig)

1980 First implantable cardioverter–defibrillator developed (Mirowski)

1983 CASS

1985 TIMI 1

1985 NCEP

1986 GISSI and ISIS-2

1992 SAVE

1993 Superiority of primary PCI vs. fibrinolysis in acute MI noted

2002 Efficacy of drug-eluting vs. bare-metal stents determined

2002 ALLHAT

2007 Benefit of cardiac resynchronization therapy in heart failure demonstrated

2009 Left-ventricular assist device as destination therapy in advanced heart failure shown to be effective

2009 Genomewide association in early-onset MI described

2009 Deep gene sequencing for responsiveness to cardiovascular drugs performed

Deaths per 100,000 Population

Year

From: Nabel EG, Braunwald E. NEJM 2012

Historical Wave of Innovations

Invasive Hemodynamics
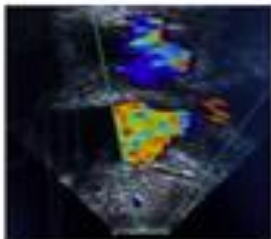
Echocardiography

Valvuloplasty

PTCA

IMPACT ON INTERVENTIONAL CARDIOLOGY

COMPETENCY
Formal Training
Certification Exams

CARE TEAM
Patient Selection
Credentialing
Guidelines

IC PRACTICE
Salary Structure
Ultra-Specialization
Workforce Issues
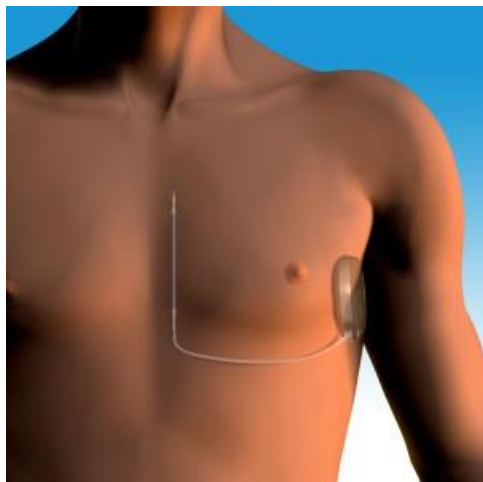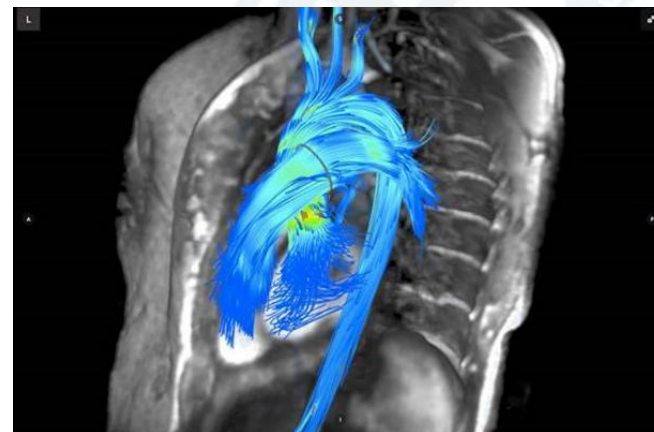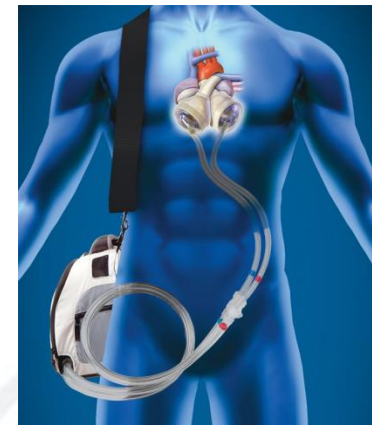
Current Wave of Innovations

Endovascular Interventions

TAVR

LAA Occlusion

Transcatheter Mitral Repair

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Balloon-expandable devices	
Sapien XT	Sapien 3

Self-expanding devices			
Evolut R	Acurate Neo	Portico	Allegra

Mechanically-expandable devices
Lotus

iFR 0.89

iFR Distal 0.46
iFR at current 0.70

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A Digital "World"
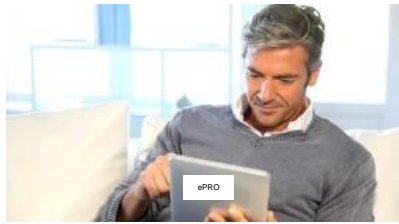
1956 ----------------------------- 2022

Hospital waiting room

Hospital waiting room

COVID-19: A Catalyst for Telehealth

70 - 90 %

5 %

0 - 40 %

$130.5 billion

The projected value of the worldwide telehealth market by 2025

"The Before-times"   March 2020   Present
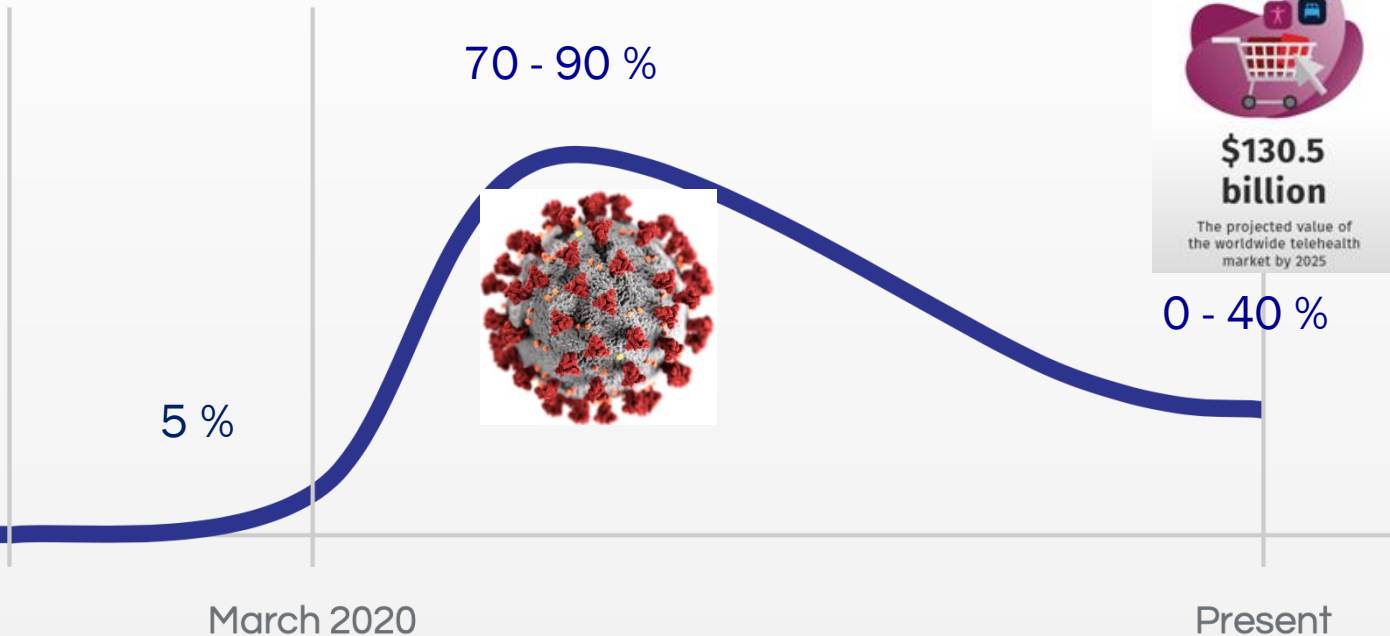
Propelled by the 'new normal' associated with the COVID-19 pandemic, we have witnessed a surge in technology innovation to assure continuity in care delivery.

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Digital Transformation(DT)

- **DT refers to the disruptive improvement process** that introduces changes in information management, computing, communication, and connectivity technologies that impact organizational operations, structure, and business strategy.

- A common misconception about DT is that the disruption is merely technological; instead, DT is a wider philosophical framework that **entails improving clinical processes** by leveraging the vast amount of data, supporting clinical decision-making, and ensuring resource utilization towards **improved quality of care and increased patient satisfaction** by enhancing clinical data communication and patient engagement.

CHANGE MANAGEMENT

Digital Transformation Is Not About Technology

by Behnam Tabrizi, Ed Lam, Kirk Girard, and Vernon Irvin

MARCH 13, 2019

Summary   Save   Share   Comment   Text Size   Print
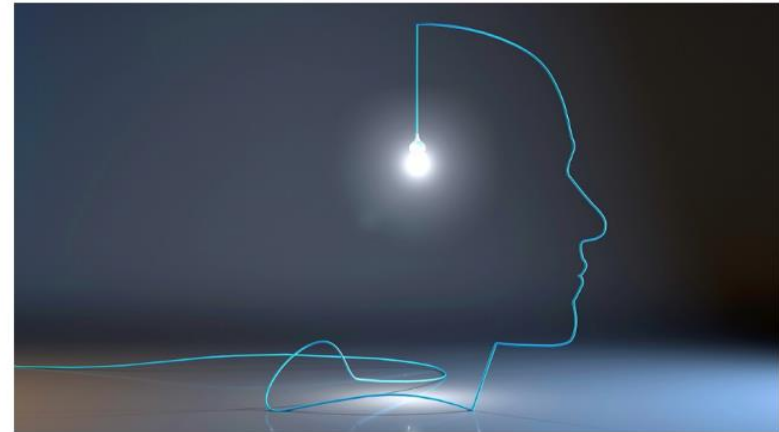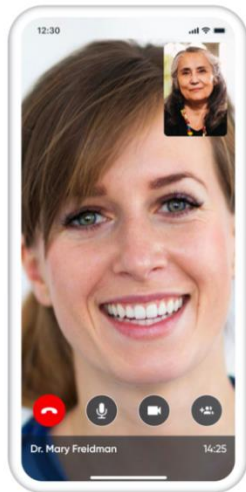
COLIN ANDERSON PRODUCTIONS PTY LTD/GETTY IMAGES

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DX of Healthcare

Virtual Care ✕ Remote Monitoring ✕ AI-Driven Care

From : Kamal Jethvani
Sr. Director, Connected Health Innovation, Partners Healthcare
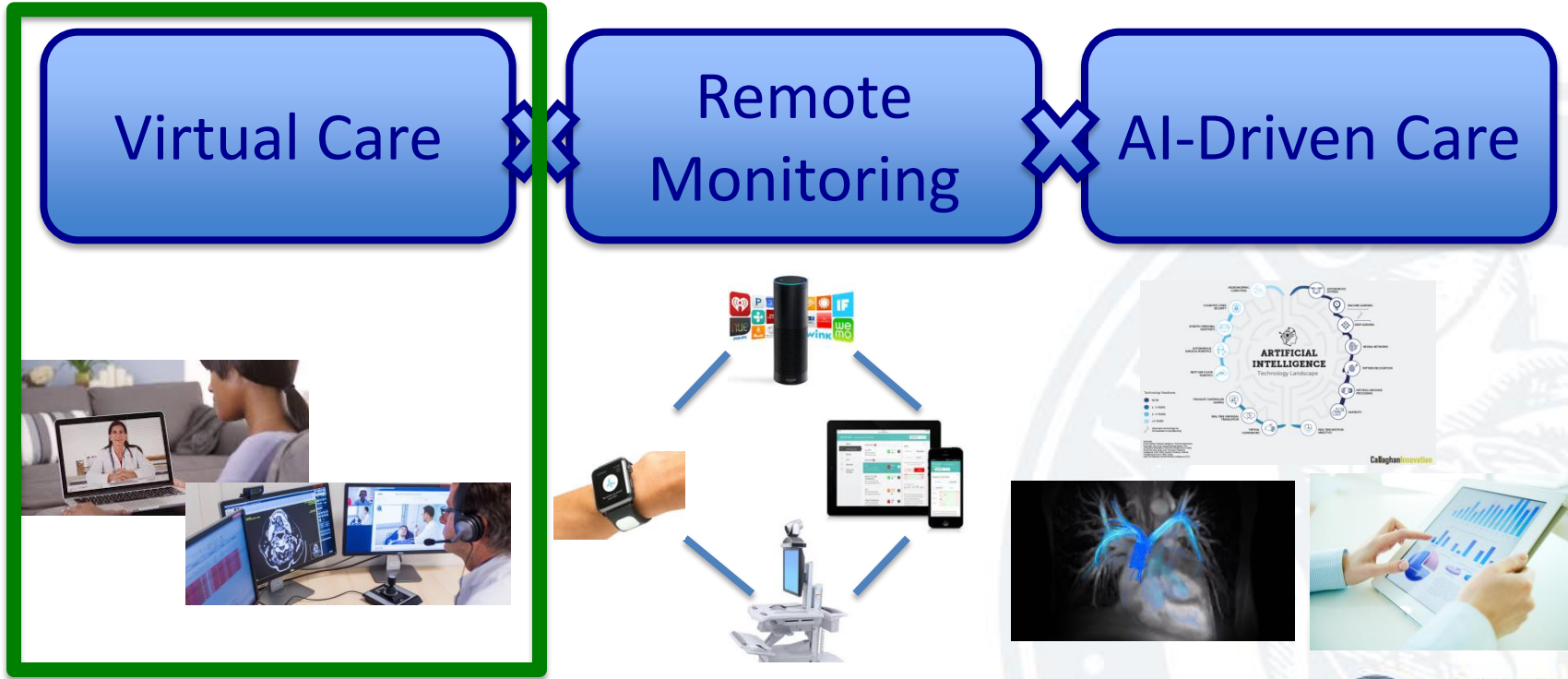
Getting to virtual care

Audio → Asynchronous Messaging → Video → Remote patient monitoring → Management pathways → Therapeutic programs

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Digitization: an enabler for AI/ML

Data is the new game-changer, everywhere

Organizing **large** volumes of **real-time data** from several sources is time-consuming and slow

To reduce the human effort involved in this and decrease the required time, *AI and ML are being employed*

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"ML is capable of making sense of an immense amount of high-content biological data, most of which is too high-dimensional for humans to interpret." - Daphne Koller

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Medicine is becoming an information science.

By Harlan M. Krumholz

Big Data And New Knowledge In Medicine: The Thinking, Training, And Tools Needed For A Learning Health System

ABSTRACT Big data in medicine—massive quantities of health care data accumulating from patients and populations and the advanced analytics that can give those data meaning—hold the prospect of becoming an engine for the knowledge generation that is necessary to address the extensive unmet information needs of patients, clinicians, administrators, researchers, and health policy makers. This article explores the ways in which big data can be harnessed to advance prediction, performance, discovery, and comparative effectiveness research to address the complexity of patients, populations, and organizations. Incorporating big data and next-generation analytics into clinical and population health research and practice will require not only new data sources but also new thinking, training, and tools. Adequately utilized, these reservoirs of data can be a practically inexhaustible source of knowledge to fuel a learning health care system.

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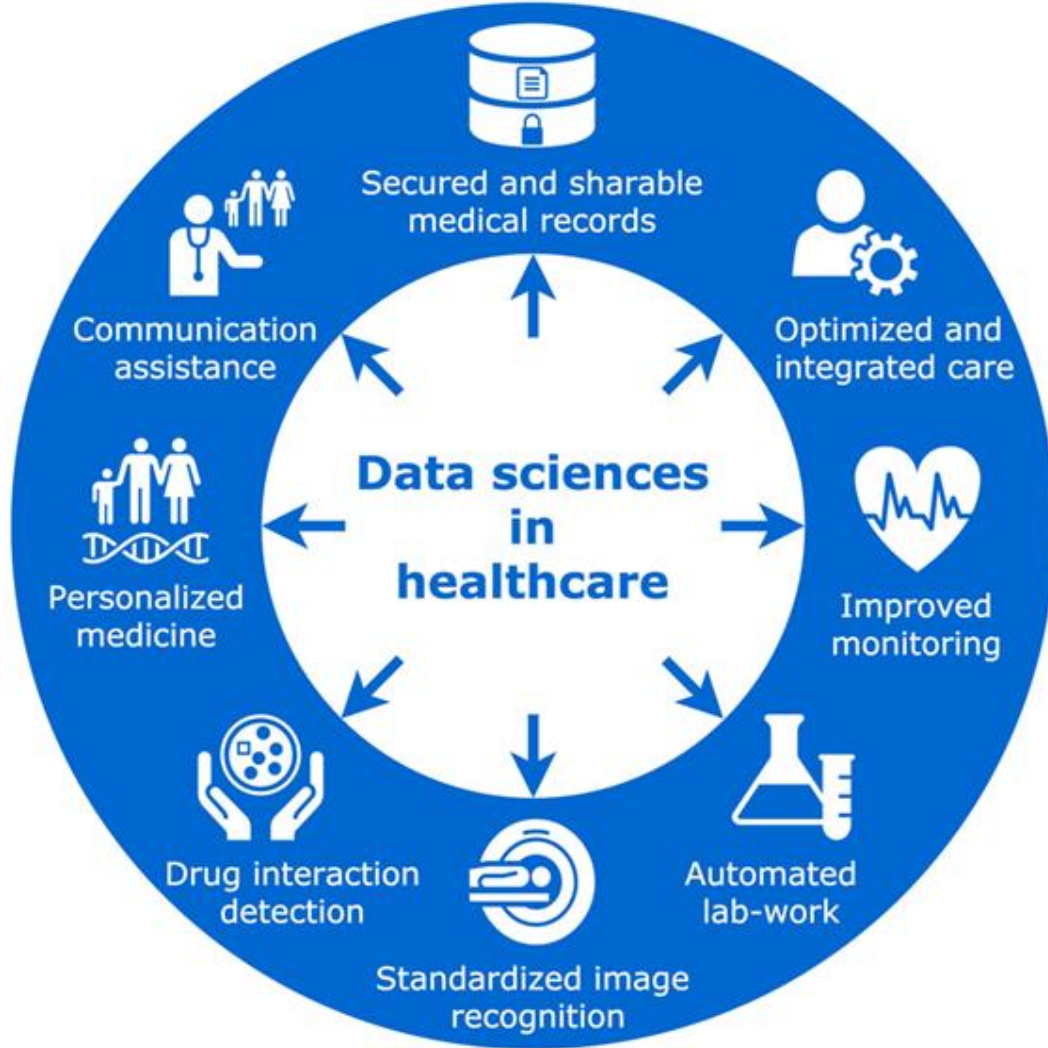
Cardiology and Creative Approaches to Care

AI Driven Care In Cardiology
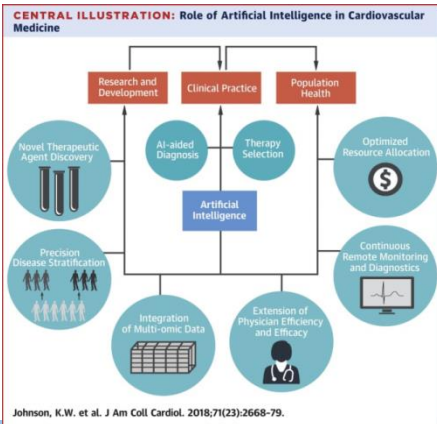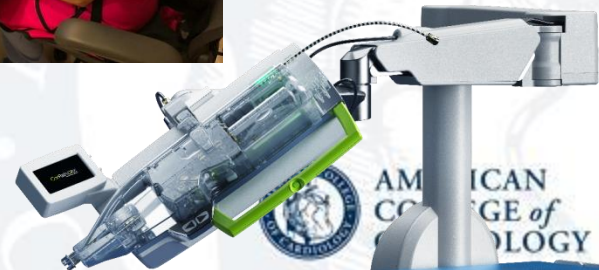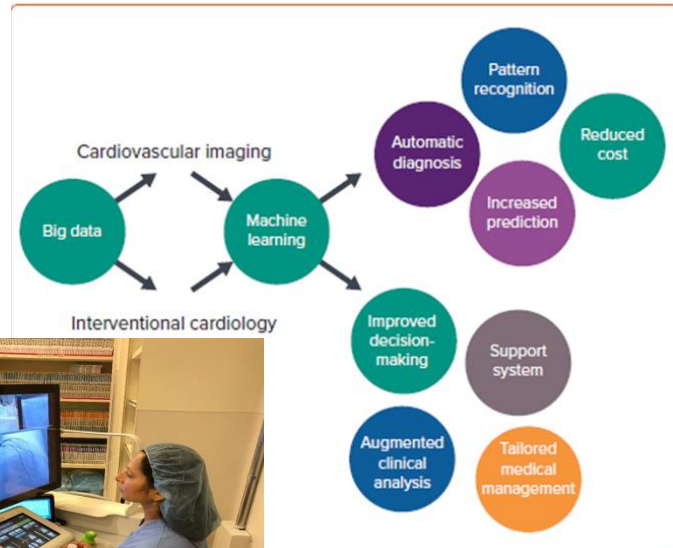
Use of Artificial Intelligence in STEMI Management

- Artificial intelligence may be able to use predictive modeling of features of STEMI and provide a standardized approach to care, which can eliminate implicit bias in the care of women and improving STEMI care and eliminating sex disparities.

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Cardiac CT and AI
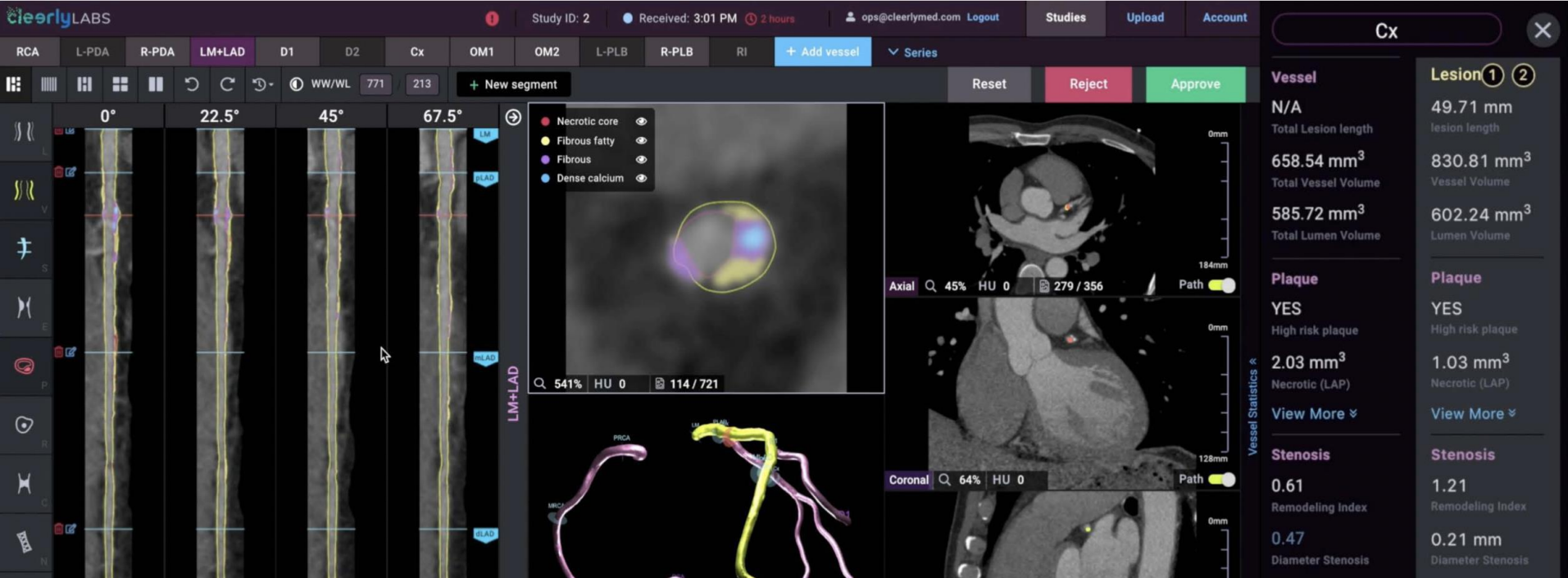
Stenosis Map   3D Reconstruction   Structure/Function   Analytics

AI = "Augmented Intelligence", facilitated reads more efficient, reduced cost, increased accuracy.

Choi A, et al. JCCT June 3, 2021 (on-line)

AI Facilitated Acute Stroke Care

NC-HCT:
ICH?
Risk Area
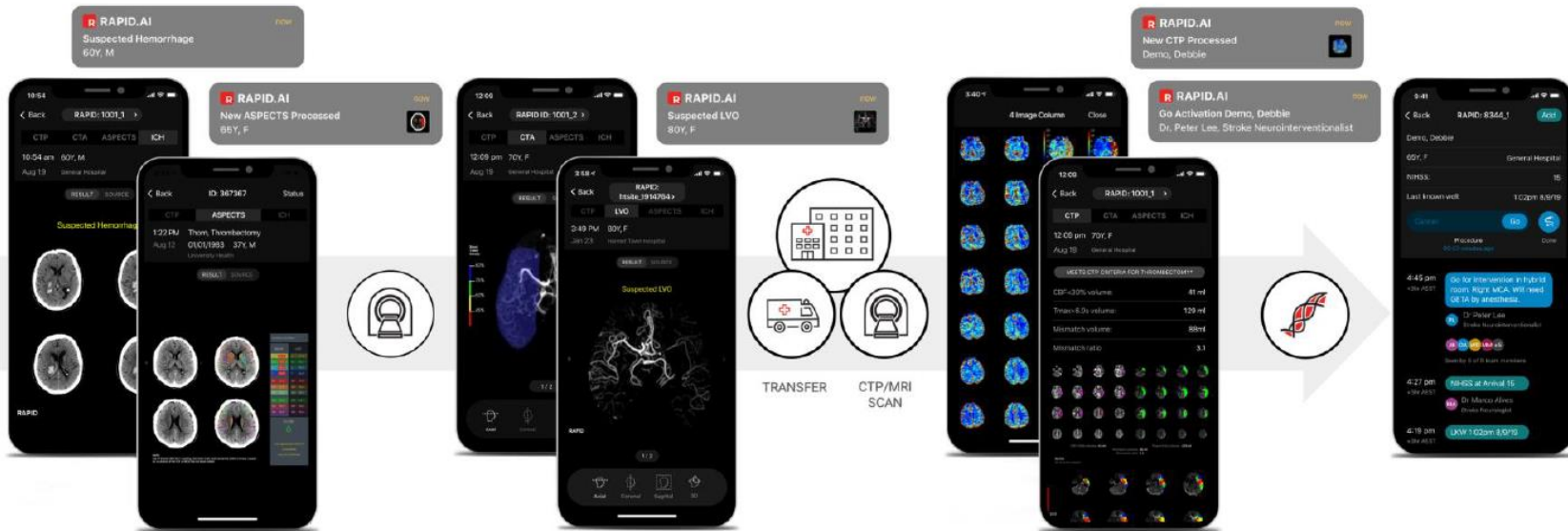
CTA:
LVO?
Map

CT Perfusion
MR
Perfusion

Diagnostics
Communications
Work-Flow

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Norton Health (KY) Pilot: Reduced Door-to-Thrombectomy 119 min to 90 min

AI/ML - use in the general population.

Session: **Predicting sudden death with artificial intelligence (AI)/machine-learning (ML)**

Topic: **Sudden Death in Patients with Atrial Fibrillation**

Event **EHRA 2022**

AI/ML - use in patients with electrophysiological disorders.

Session: **Predicting sudden death with artificial intelligence (AI)/machine-learning (ML)**

Event **EHRA 2022**

Role of artificial intelligence in heart failure diagnosis.

Session: **Artificial Intelligence: ready for implementation in clinical practice?**

Event: **Heart Failure 2022**

AI/ML - use in patients with ischemic cardiomyopathy.

Session: **Predicting sudden death with artificial intelligence (AI)/machine-learning (ML)**

Event **EHRA 2022**

Artificial Intelligence (AI) in Preventive Cardiology – where is the Future?

Session: **Inaugural session**

Topic: **European Association of Preventive Cardiology (EAPC)**

Event: **ESC Preventive Cardiology 2022**

2022

Future of artificial intelligence in remote heart failure monitoring.

Session: **Remote monitoring in heart failure: past, present, and future**

Event **Heart Failure 2022**

Digital health and AI in cardiology: where do we stand?

Session: **Artificial intelligence and digital health for cardiac devices**

Event: **EHRA 2022**

Artificial intelligence algorithms for the recognition of Brugada type 1 pattern on standard 12-leads ECG

Session: **e-Cardiology award session**

Event **EHRA 2022**

Future directions: artificial intelligence for early detection of AF.

Session: **To screen or not to screen for atrial fibrillation (AF)**
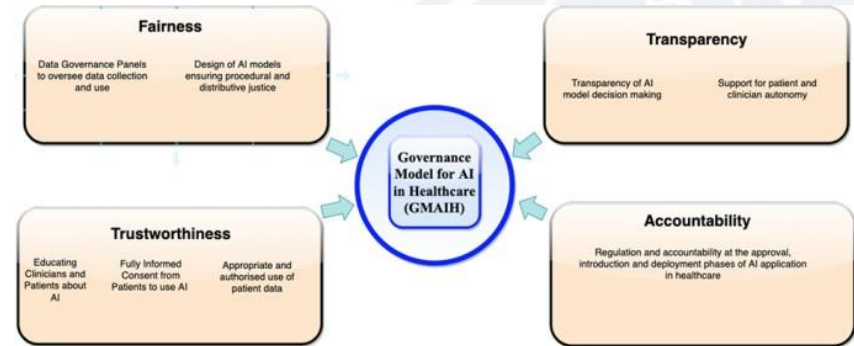
Event **EHRA 2022**

The Future of AI

Challenges?

Ethical and Regulatory Concerns

➢ ?Biases

➢ ?Lack of transparency

➢ ?Privacy concerns with the data used for training AI models

➢ ?Safety and liability issues with AI applications in clinical environments

➢ ?Does it work in real life?

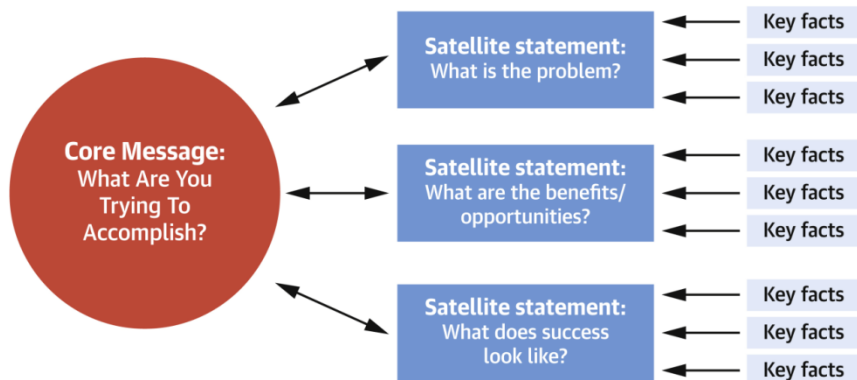- "…automation won't replace physicians, but those using automation will replace those that don't."

In the Pandemic World, Science Under a Microscope: Focus on Communication and Trust

Leadership Page

Dipti Itchhaporia

Message Map: Communicating Science With Clarity And Credibility

Core Message: What Are You Trying To Accomplish?

Satellite statement: What is the problem? — Key facts / Key facts / Key facts

Satellite statement: What are the benefits/opportunities? — Key facts / Key facts / Key facts

Satellite statement: What does success look like? — Key facts / Key facts / Key facts

Core message - A succinct, streamlined one-sentence statement that serves as your primary message.
Satellite statements - Clearly stated messages that support the core message and answer specific questions like the ones above.
Key facts - Essential pieces of information, including data points, that provide more details on each of the satellite statements to use in longer conversations and messaging.

We learned that scientists and health care professionals need to learn to effectively communicate the risks, benefits, and latest scientific findings beyond the academic and scientific arena.

Restoring public faith in science is then an imperative in the coming years.

In his book *The Demon-Haunted World: Science as a Candle in the Dark*, Carl Sagan wrote, "Science is an attempt, largely successful, to understand the world, to get a grip on things, to get a hold of ourselves, to steer a safe course." Doing this well and steering the course starts with communication, and it starts with us.

Operational Impacts

CV Management in COVID-19: "Old Dogs, New Tricks"

Pre-COVID	**"COVID Modified Management"**
Cath/PCI	CCTA/SDD
Exercise Stress Testing	Pharm MPI, stress cMRI, CCTA, CT-FFR
Echocardiography	Limited-View Echo, POCUS
TEE/TEE-Cardioversion	Structure: CTA, CMRI Cardioversion: CTA
Consultation	Video Consultation/e-Consultation
CRM Device F/U	Remote Device Monitoring
CHF	E-Clinic, RPM

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PCI During COVID: Same Day Discharge

↑80%

N = 28,018
Source: ADSI

- **Trans-radial or vascular Closure**
- **Angio and clinical criteria met**
- **Elective <u>and</u> ACS cases**
- **Post-PCI protocol driven**
- **Care coordination**

Data points: October 2019: 19.68, November 2019: 19.26, December 2019: 19.28, January 2020: 18.98, February 2020: 17.84, March 2020: 22.40, April 2020: 22.37, May 2020: 22.82, June 2020: 26.89, July 2020: 25.67, August 2020: 28.50, September 2020: 26.02, October 2020: 26.16, November 2020: 35.63, December 2020: 33.97, January 2021: 31.21, February 2021: 31.87

Economic Headwinds for 2022 and Beyond

- Volumes (inpatient and outpatient) initially slow to return

- Shift to outpatient care (lower cost, lower revenue)

- Increased cost of care (Inflation)

- Increased patient acuity and Chronic Medical Issues

- Shortage of key clinical and support staff

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Health Care Professionals: Critical Condition

- 3600 HCW in U.S. died from COVID in 2020 (115,000 worldwide)

- 22% of RN's may leave nursing in the next year, 25% PTSD

- 30% of RN's are >60 years old

- Only 8% of new RN's want to do bedside nursing = crisis!

1. https://khn.org/news/article/us-health-workers-deaths-covid-lost-on-the-frontline/
2. https://www.forbes.com/sites/coronavirusfrontlines/2021/08/09/covid-19-has-ravaged-the-global-healthcare-workforce-we-need-to-invest-in-their-future/?sh=15beb336dd05
3. https://www.aha.org/system/files/media/file/2021/05/fact-sheet-workforce-infrastructure-0521.pdf
4. https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/nursing-in-2021-retaining-the-healthcare-workforce-when-we-need-it-most

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Workforce Crisis : Nurses

Headwinds and tailwinds — state of the nursing profession includes COVID-19 impact

Declining workforce

510K
RN shortfall by 2030 (expected to grow due to COVID pandemic).

South and West regions of the US expected to have hire shortages.

21% of nurses have indicated they would transfer to non-patient care roles after the pandemic.

10% of nurses are reporting plans to leave the profession after the pandemic.

22% of nurses are reporting they will retire soon after the pandemic.

RN vacancy rate has grown to **10% nationally.**

The annual growth in RN jobs projection has grown from **175,000** pre-pandemic to **200,000** per year through 2026.

The RN recruitment difficulty index has grown to **81 days** with OR and ICU nurses being the highest at **93 and 91 respectively.**

However, **med surg** does not fall far behind at **76 days.**

Clinical practice opportunities

Emerging literature regarding the growing gap for transition to practice **8% of nursing graduates** are **prepared for entry level practice,** dropping from 23% in 2015.

Emerging nursing literature demonstrates **poor EHR usability** leads to **increased burnout, decreased job satisfaction and intention to leave.**

RN burnout has grown as a result of the pandemic to **94% of nurses** reporting some level of burnout.

National annual turnover 2020 (with COVID impact) **18.7%** with the Southeast, North Central and South Central regions of the US having turnover at **19.2 -24.9%**
(These are the regions Ascension practices within.)

Changing landscape

COVID pandemic has increased the **gap in transition to practice** and knowledge for new graduate nurses. First year turnover has grown to **30% nationally.**
Increasing **experience-complexity gap** demonstrated through **shift in CMI.**

Call from the AACN, AONL, RWJ foundation and nurses have a **population health responsibility** regardless of their education level or their work assignment.

Changing economic landscape decreased interest in nursing support roles.

Physician Workforce Shortage

Exhibit 2: Total Projected Physician Shortage Range, 2019-2034

Cardiology gap: ~4000

2034 Range: 124,000 — 37,800

19,800
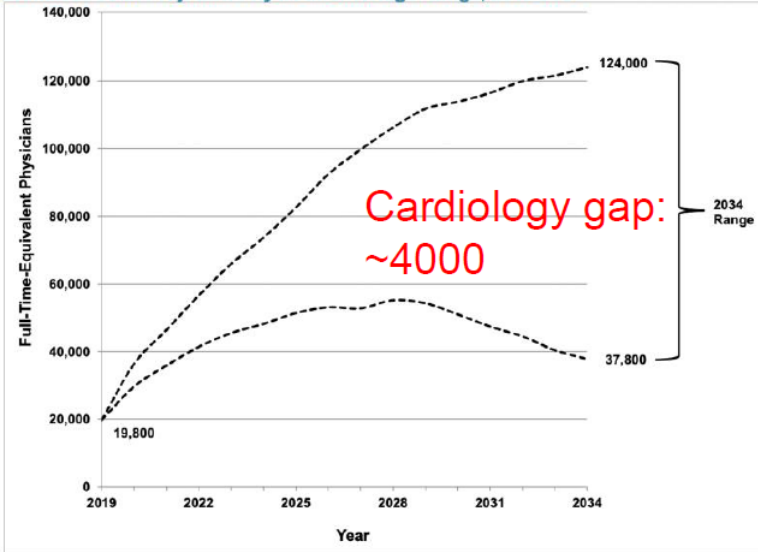
SHORTAGE OF CARDIOLOGISTS
MEDAXIOM — AN ACC COMPANY

1 IN 4 CARDIOLOGISTS (26.5%) is now over the age of 61!!

7,563 MEDIAN wRVUs per FTE over age 61 (9,642 overall)

There's a whole FTE missing here

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US CARDIOLOGY PROJECTIONS

Practicing Cardiologist[1]	32,000
Over the Age of 61[2]	8,480
Estimated Annual FTE losses[3]	(2,000)
Current Total US Fellows[4]	3,745
Annual Number Entering Workforce[4]	1,453
Net Annual Workforce Impact	**(547)**

[1] Source: Joint American College of Cardiology (ACC)/MedAxiom calculations
[2] Source: MedAxiom Cardiovascular Provider Compensation & Production Survey
[3] Source: MedAxiom projections based on both wRVU production reductions and physician departures
[4] Source: Accreditation Council for Graduate Medical Education, 2018 – 2019

AAMC. "Complexities of Physician Supply and Demand: Projections from 2019 to 2034. June 2021

Sauer J. MedAxiom 2021

Drivers: Aging, Burnout, Deferred Retirement
Solutions: GME, Top-of-License, Innovation

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NATIONAL HEADWINDS: The Pandemic

The Great Resignation

66 % of workers seeking a new job

Remote Work

21% would refuse a return to the office

Staffing Shortages

30 % healthcare workers considering leaving profession

Nationwide, health systems spending $24 billion more per year on qualified labor versus pre-pandemic

Competition for Talent

$2500 to $75K Incentives driving worker mobility
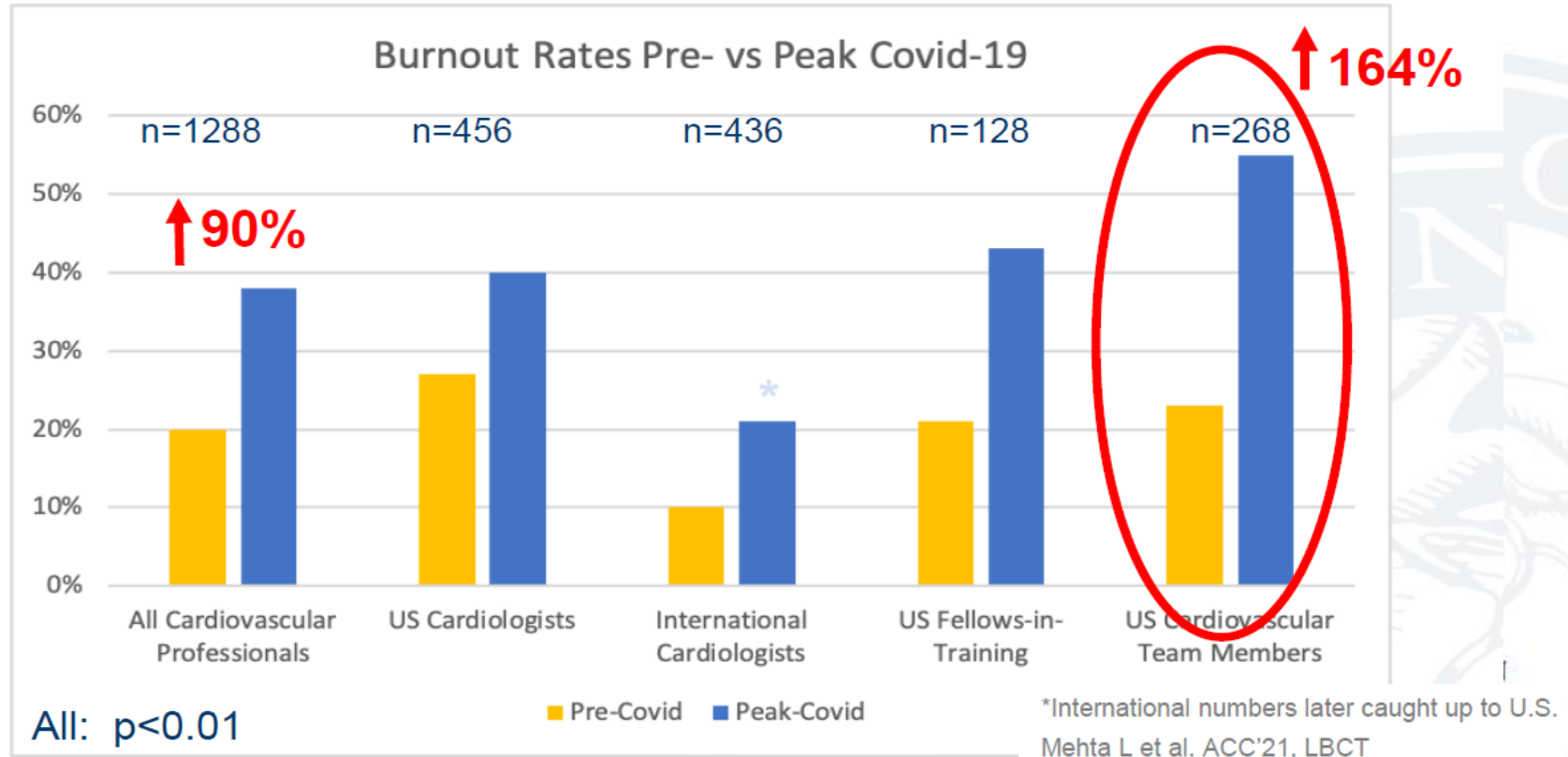
Traveler incentives **4 X base pay**

Burnout

55 % front line workers experiencing mental and physical exhaustion

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Clinician Burnout

Care Transformation **MUST** promote clinician wellbeing

Burnout Rates Pre- vs Peak Covid-19

n=1288, n=456, n=436, n=128, n=268

↑90% ↑164%

All: p<0.01

Pre-Covid Peak-Covid

All Cardiovascular Professionals, US Cardiologists, International Cardiologists, US Fellows-in-Training, US Cardiovascular Team Members

*International numbers later caught up to U.S.
Mehta L et al. ACC'21, LBCT

Clinician Wellness: Environment of Professionalism

Clinicians Can't Help Their Patients If They Don't Take Care of Themselves

- Optimized Work Environment
  - Eliminate burdens, Value time
- Culture of Professionalism
  - Engagement, respect, leadership
- Self-Resilience, Self-Leadership
  - Empathy, balance, remove stigma's

CWB Hub: www.acc.org/ClinicianWellBeing

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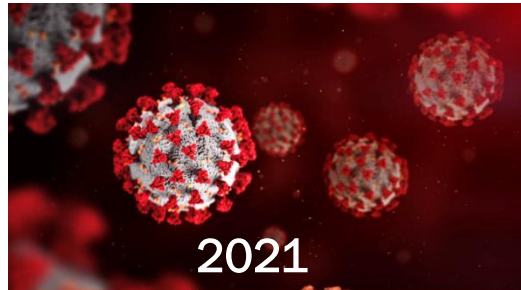
Disruption 2001-2022:
Negative disruption can result in positive disruption

2001

Security
Safety
Unity*

Financial
reform
Transparency

2021

Health Equity
Digital Transformation
Value Based Care
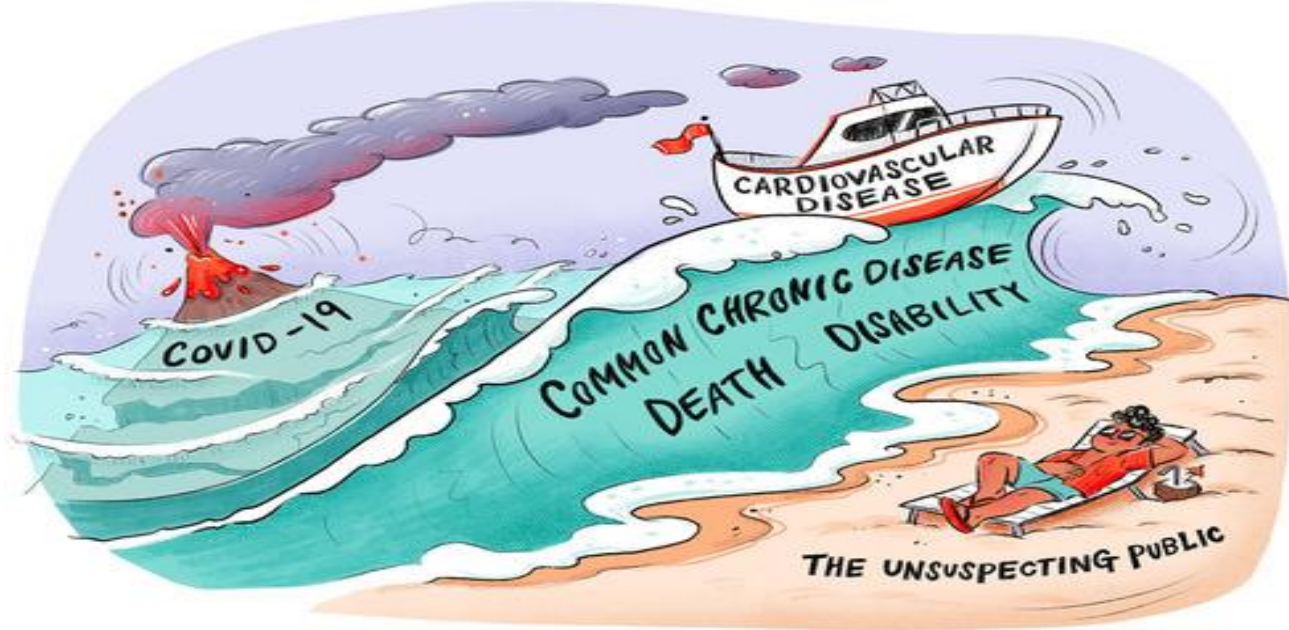Communication

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Reflections:

- COVID is and has been a Global problem with broad impact.
- COVID is a negative and positive disruptor
- COVID taught us new ways to deliver CV care- promoted innovation and digital transformation of care
- COVID exposed health inequities and the SDOH
- COVID further threatened Clinician well being
- COVID has exposed weaknesses of our health care delivery system …
- But has created opportunities to transform care and deliver higher value.

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Projected Future Cardiovascular Risk Factors and Cardiovascular Disease by 2060

Projections of Future Cardiovascular Risk Factors and Cardiovascular Disease in the United States From 2025 to 2060

Cardiovascular Risk Factors

Diabetes: ↑ of 39.3% to 55 million persons
Hypertension: ↑ of 27.1% to 162 million persons
Dyslipidemia: ↑ of 27.6% to 126 million persons
Obesity: ↑ of 18.3% to 126 million persons

Cardiovascular Diseases

Ischemic heart disease: ↑ of 30.7% to 29 million persons
Heart failure: ↑ of 33.4% to 13 million persons
Myocardial infarction: ↑ of 16.9% to 16 million persons
Stroke: ↑ of 33.8% to 15 million persons

Key points

- Projections for future cardiovascular risk factors and cardiovascular disease were based on NHANES data combined with 2020 U.S. Census projections for future population distributions

- Although steep rise in cardiovascular risk factors and cardiovascular diseases are expected in upcoming years, differences between women and men will largely remain stable over time

- Disproportionate increase in cardiovascular risk factors and cardiovascular disease are projected to impact racial and ethnic minority populations

- The results from this study have important implications for motivating policy decisions regarding equitable delivery of quality health care to all Americans

"Worrisome" rise in cardiovascular disease predicted out to 2060
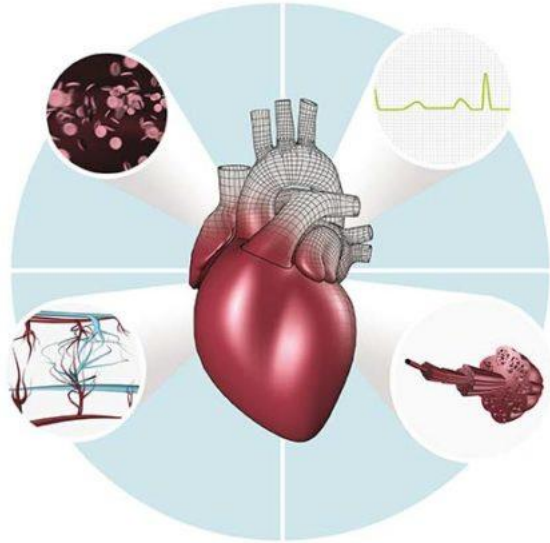
Projected rates of cardiovascular risk factors and disease will increase significantly in the USA by 2060 in line with changing demographics:

- Ischemic heart disease: 21.9 million to 28.7 million
- Heart failure: 9.7 million to 12.9 million
- Myocardial infarction: 12.3 million to 16.0 million
- Stroke: 10.8 million to 14.5 million
- Moreover, by 2060, there will be 54.6 million Americans with diabetes, 162.5 million with hypertension, 125.7 million with dyslipidemia, and 125.7 million with obesity,.
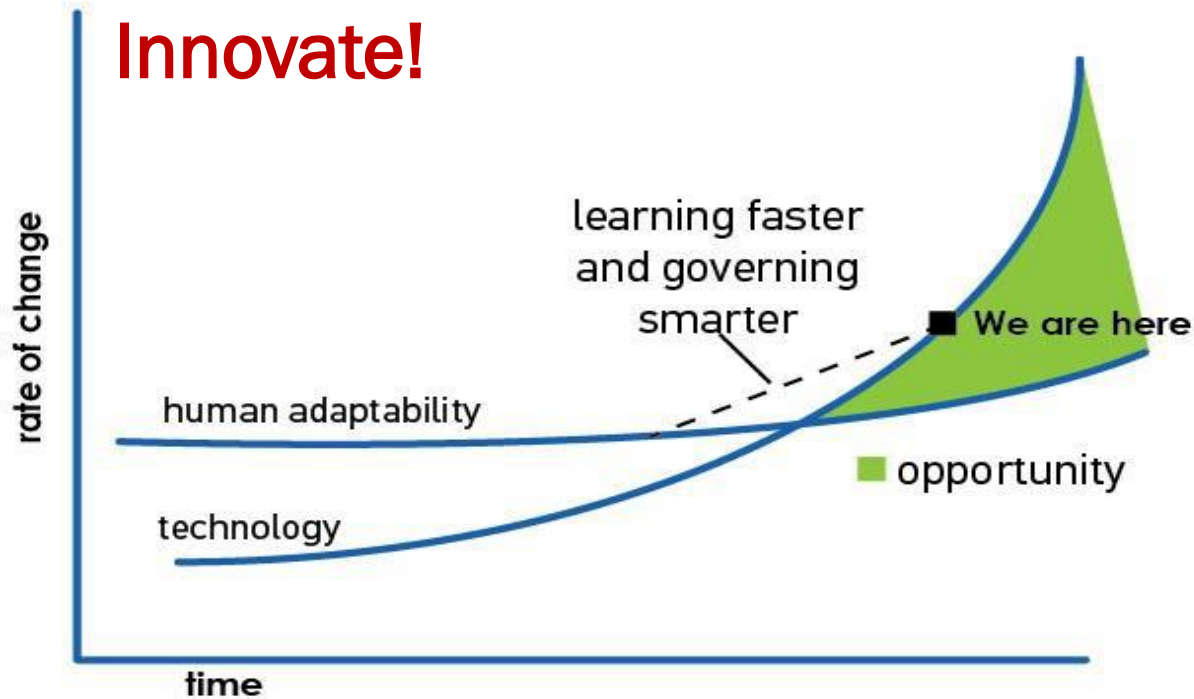
Substantial increases in cardiovascular trends may contribute to a rising burden on the US healthcare system and highlight the need for equitable access to prevention education and treatments now to prevent future disease
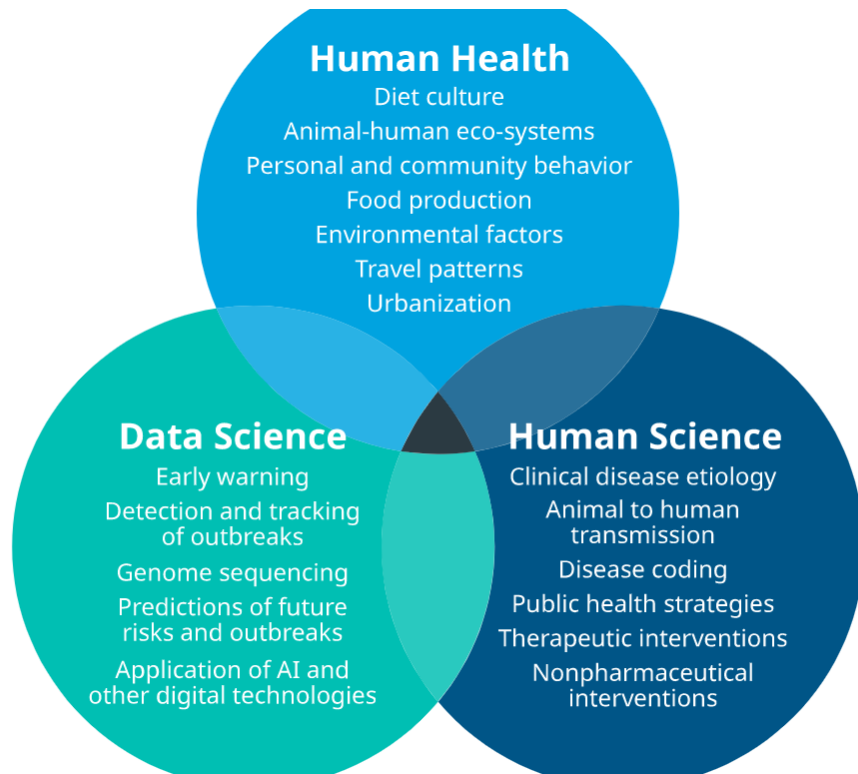

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Acceleration of Change: Eric "Astro" Teller's Curve

Thank You for Being Late – Thomas Freidman, 2016, p. 34

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A Turning Point in Healthcare

Human Health
Diet culture
Animal-human eco-systems
Personal and community behavior
Food production
Environmental factors
Travel patterns
Urbanization

Data Science
Early warning
Detection and tracking of outbreaks
Genome sequencing
Predictions of future risks and outbreaks
Application of AI and other digital technologies

Human Science
Clinical disease etiology
Animal to human transmission
Disease coding
Public health strategies
Therapeutic interventions
Nonpharmaceutical interventions

Health Equity
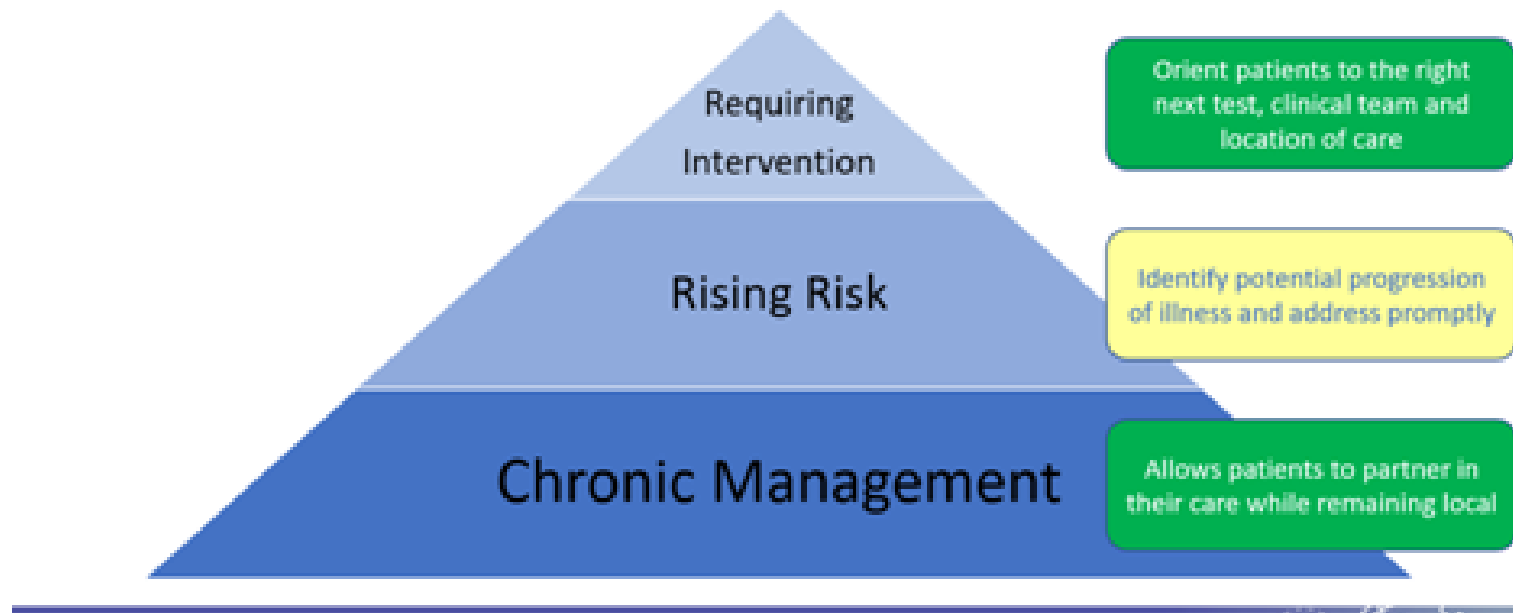Digital Transformation
Medicine As a Data Science
Value Based Care
Communication
Collaboration

The Opportunity

- Biomedical science and technology are in an amazing period of discovery and development

- Yet these advantages are not resulting in superior health and outcomes for the population

- **The intersection of biomedical science, technology and communication if handled with good policies, investment and communication could usher in an new era of better health for the US and the world**

- CV disease is the tip of the spear
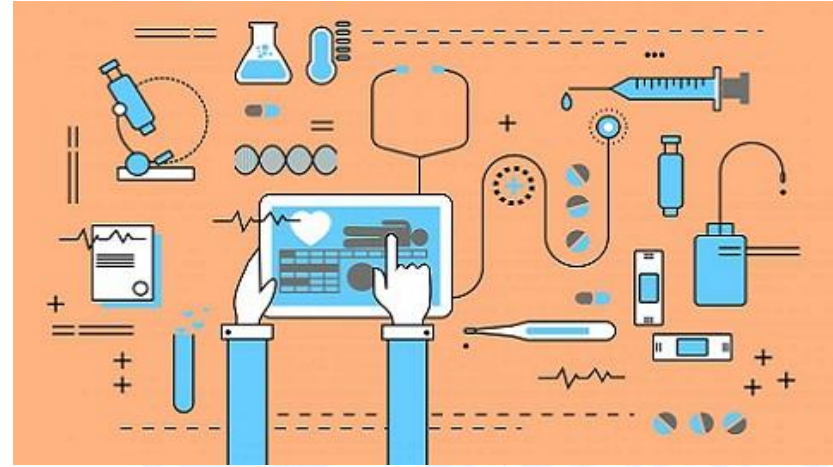
A Digital Health Strategy Personalizes Population Health
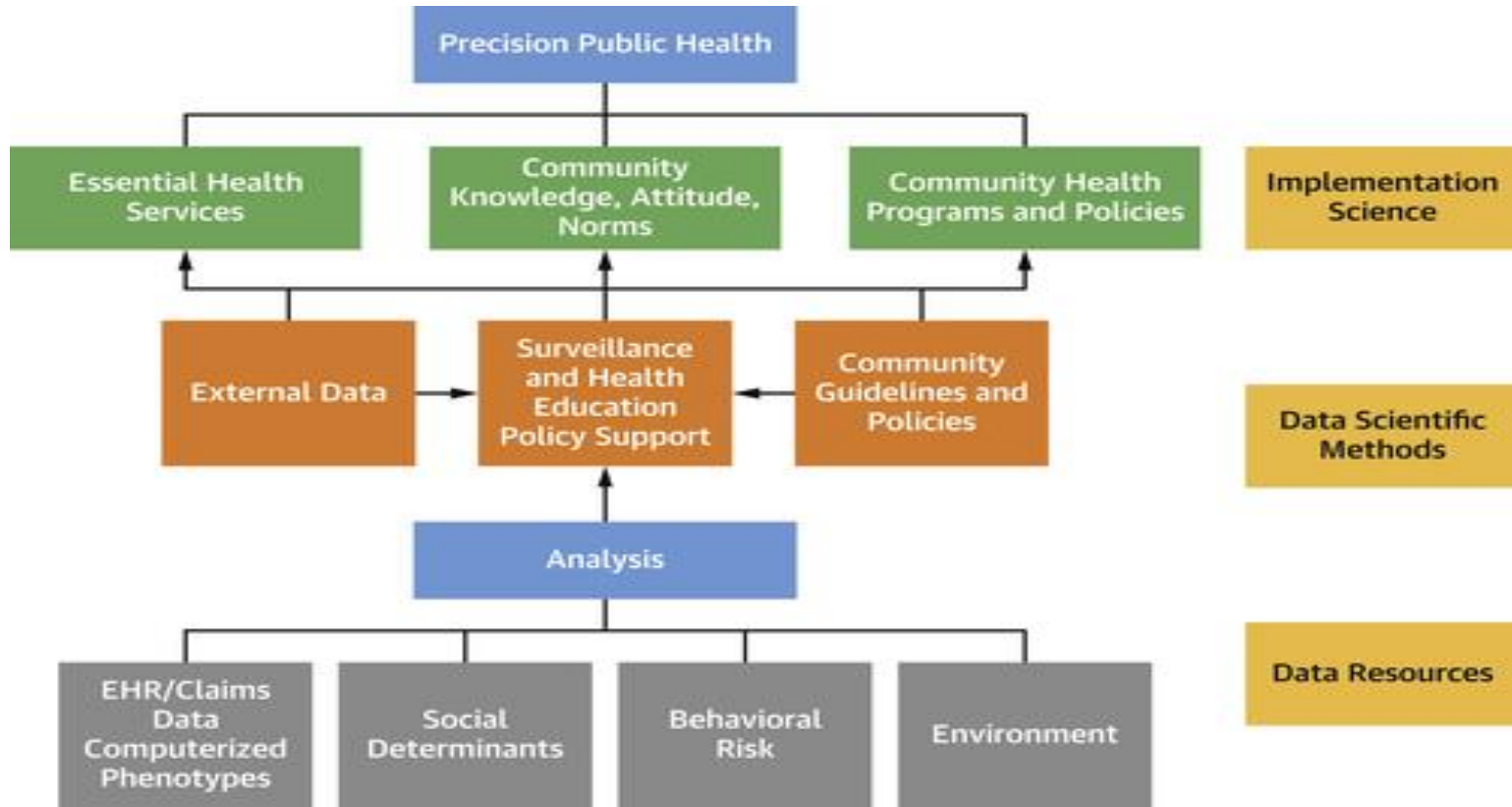
Embrace Technology for Patient Monitoring: Facial/Voice Recognition, Ingestibles

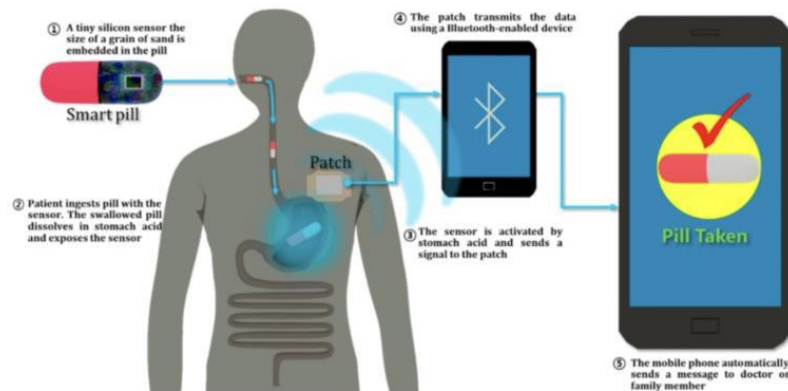

FACE
- **Pain**
- **Depression**
- **PE**
- **Genetics**

FACE2GENE

Voice
- Vocal "biomarker"
- 2.6x more ACS
- 3x more CAD

Ingestibles

U.S. FOOD & DRUG ADMINISTRATION

Home / News & Events / FDA Newsroom / Press Announcements / FDA approves pill with sensor that digitally tracks if patients have ingested their medication

FDA NEWS RELEASE

FDA approves pill with sensor that digitally tracks if patients have ingested their medication

- Medication Compliance
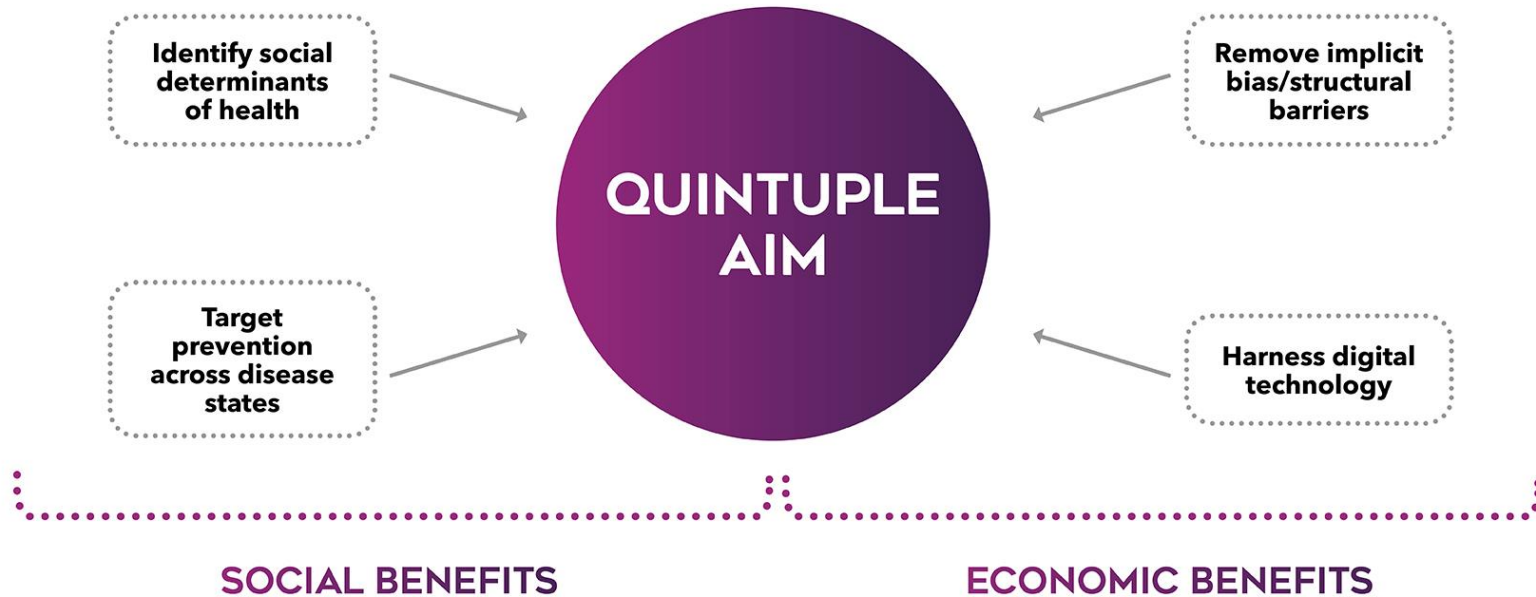- Microbiome Analysis
- Virtual Endoscopy

① A tiny silicon sensor the size of a grain of sand is embedded in the pill
Smart pill

② Patient ingests pill with the sensor. The swallowed pill dissolves in stomach acid and exposes the sensor

③ The sensor is activated by stomach acid and sends a signal to the patch

Patch

④ The patch transmits the data using a Bluetooth-enabled device

⑤ The mobile phone automatically sends a message to doctor or family member

Pill Taken

ELEMENTS OF HEALTH CARE TRANSFORMATION

Digital Transformation
- Enables Expanded Clinician Education
- Enables New Care Delivery Models (i.e., Telehealth)

Data
- Enables Population Health and Well-Being Focus (i.e., Data Gathering, Remote, Patient Monitoring, Wearable Sensors)
- Impacts Data Governance, Harmonization and Protection of Real-Time Data Exchange

Community Partnerships
- Creates Social Programs
- Informs New and Imperative Financial Models

PATIENT

Public Policies/ Programs

Value-Based Care
- Advocates for Health Care, Not Sick care
- Utilizes Care Models to Focus on Outcomes

Social Determinants of Health
- Informs and Improves Health Equity

Teamwork/Shared Decision-Making

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Lessons Learned

- What the pioneers of TAVI did took courage and commitment, and we can learn so much from their efforts.

- They taught us that true transformation of health care sometimes means radical, disruption of long-standing practices and getting comfortable with the uncomfortable.[
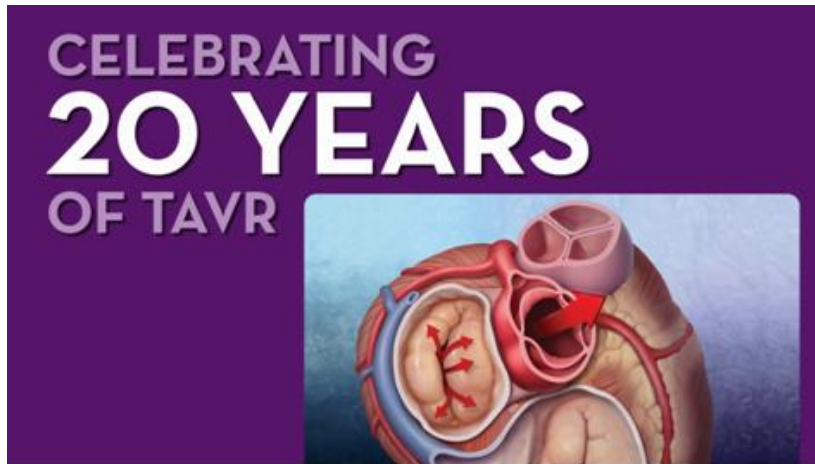
We can't solve problems by using the same kind of thinking we used when we created them.

– Albert Einstein

Looking to the Future

- This is a historic moment in medicine.

- There is a remarkable opportunity to recognize and **promote medicine as a data or information science and create learning health care systems** defined by the Institute of Medicine as one "**designed to generate and apply the best evidence**" for personalized healthcare, "**to drive the process of discovery as a natural outgrowth of patient care and to insure innovation, quality, safety and value in health care**"
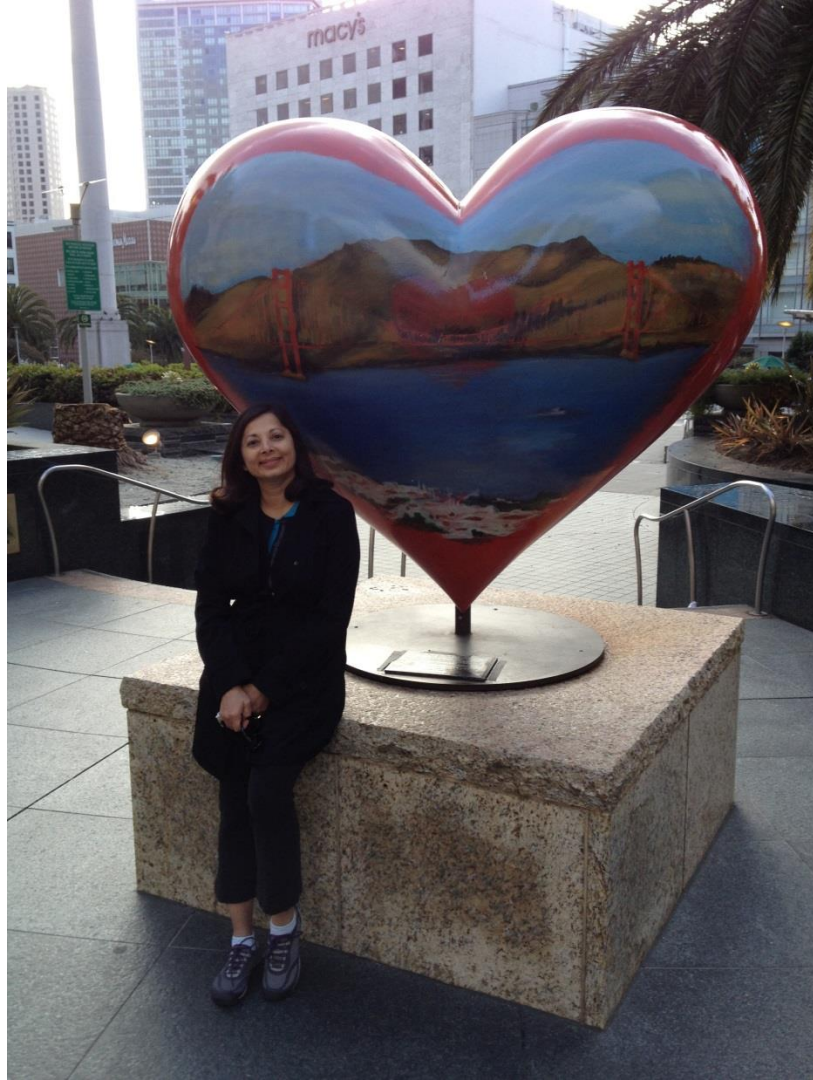
The Future is Now

Thank you

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