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# Laying the Foundation for Understanding Health System Science in Education

**Raj Ratwani, PhD**

*Vice President of Scientific Affairs, MedStar Health Research Institute  
Director, MedStar Health National Center for Human Factors in Healthcare  
Associate Professor, Georgetown University School of Medicine*

# Pre-Workshop Recap

- A system is a way to understand a phenomenon through a set of components that:
  - Interact and are dynamic
  - Follow a set of rules and have boundaries
  - Result in outcomes that are greater/different than the sum of their parts
- System science is a systematic process for studying the *inputs*, *components*, *interactions*, and *outputs* of a system.



Nuclear



Defense



Aviation



Rail



# Systems Science and Healthcare

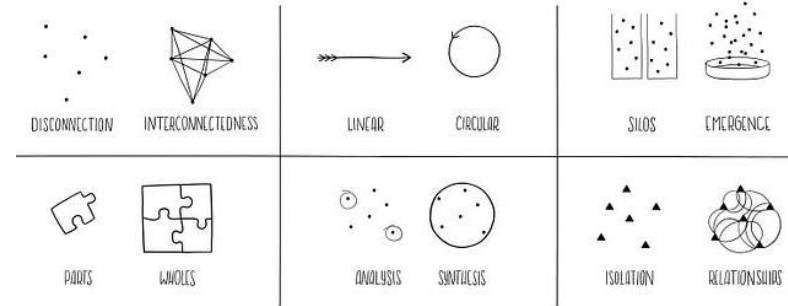
*Formal definition:* Health systems science is a foundational framework for the study and understanding of how care is delivered, how health professionals work together to deliver that care, and how the health system can improve patient care and health care delivery. (American Medical Association)



# Health System Science Education & Training

- System science pushes our “linear thinking”
- Education and training requires:
  - Understanding of system concepts
  - Collaboration across health professions
  - Organizational support

## TOOLS OF A SYSTEM THINKER



# Thank you

Contact: Raj Ratwani, PhD  
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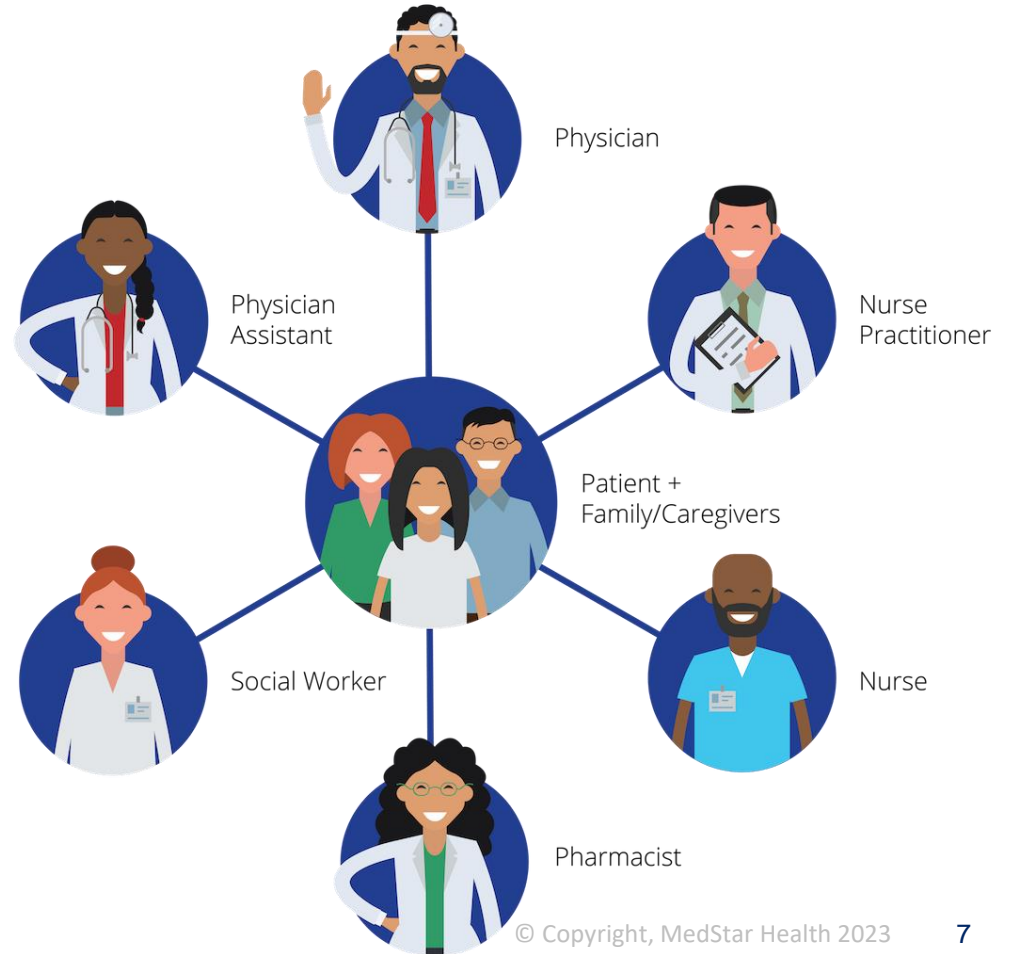
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Natasha Sood, MD, MPH, MEd  
PGY-1, Brigham and Women's Hospital

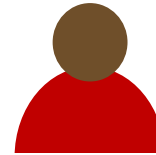
# Goal of Healthcare

- Provide efficient and effective care for our patients and their families
- Work within collaborative, diverse teams of providers to achieve this



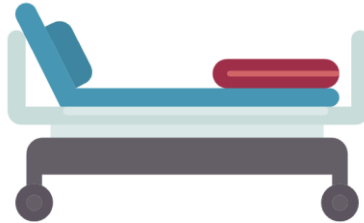
# IPE: Standardized Patient Cases

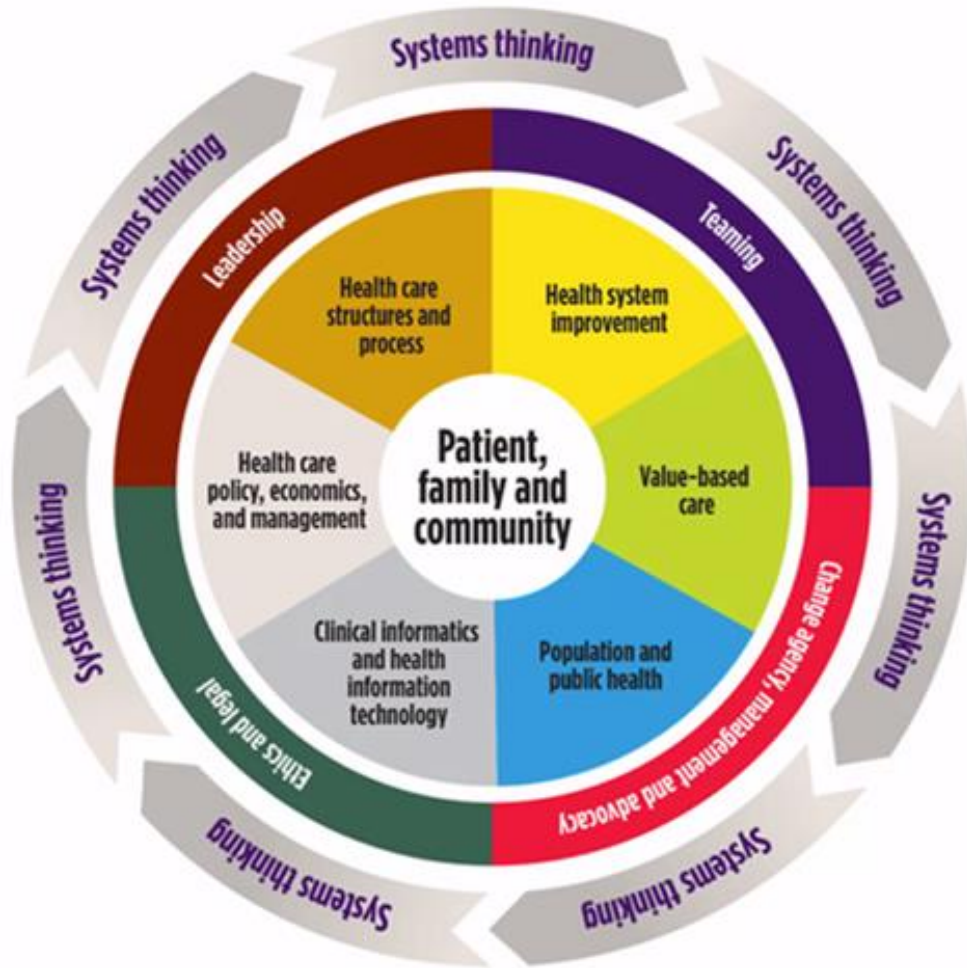
- Within groups of 6-7 interprofessional students, worked through cases in simulation lab
- Assessed for clinical knowledge and patient care
- Assess for interprofessional communication, collaboration



# Patient Navigation: Care connections

- Worked with Patient Navigator and Social Worker to address barriers to care for 1 patient for a year



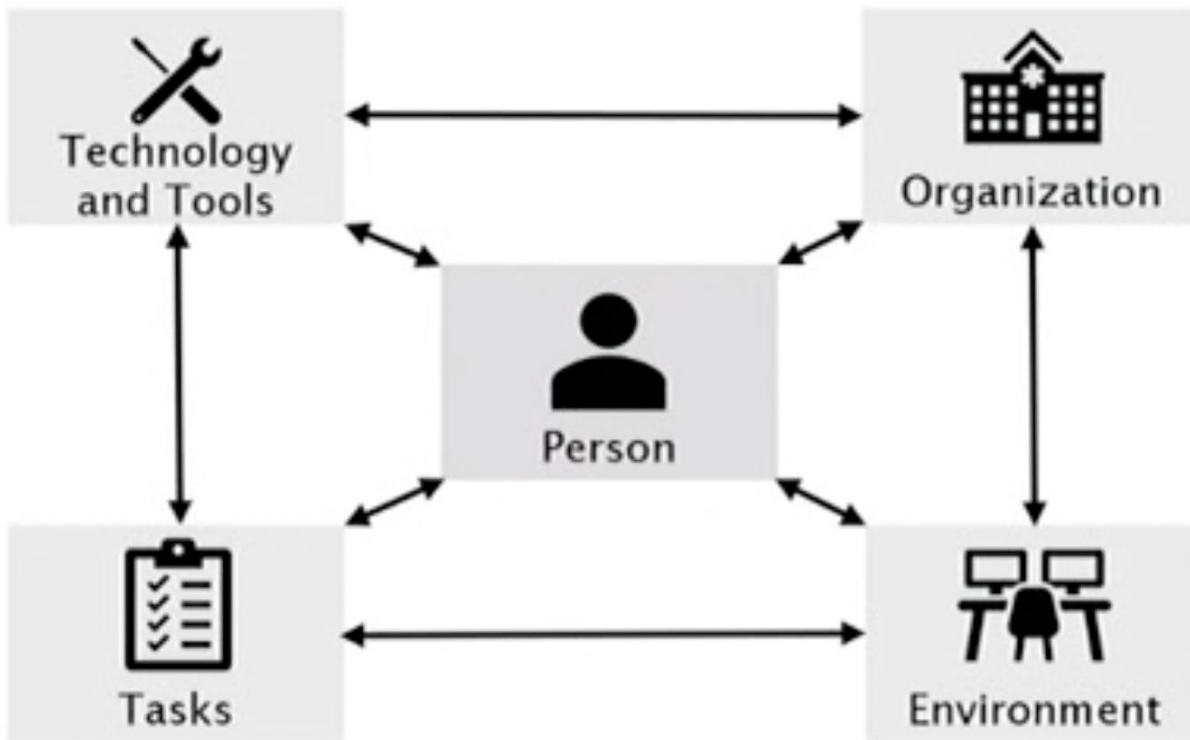


# 2020 COVID-19 & the 2021 Pacific NW Heat Wave

Hospital capacity exceeded

- Supply chains damaged
- Hospital resources strained
- Providers and care teams unable to provide effective care
- Patients and families suffered
- ***How do we make our systems resilient?***





Carayon et al., 2006; Carayon et al., 2015





# HSS Education: Core Domains

1. Structure and process
2. Policy and economics
3. Informatics and technology
4. Population, public, and social determinants of health
5. Value in healthcare
6. Health system improvement



**Table.** Health Systems Science Curricular Domains and Associated Traditional and Sustainability Content Focus

HSS Curricular Domain	Traditional HSS Content Focus	Sustainability Content Focus
Health care structure and process <sup>a</sup>	Processes, fragmentation, and insufficiencies occurring within patient settings. <sup>5</sup>	Increased energy efficiency, solid waste generated during patient encounters, and patient flows (eg, decreased transportation).
Health care policy and economics <sup>b</sup>	Principles of health care policy, health care financing, and various US payment models. <sup>5</sup>	How Medicare could establish “green loan” fund for energy efficiency to incentivize health systems to decarbonize, reducing costs and pollution long-term. <sup>16</sup>
Clinical informatics and health care technology <sup>c</sup>	Principles of informatics, patient security, and challenges facing health information exchange. <sup>5</sup>	Assess energy efficiency of information exchange systems.
Population, public, and social determinants of health <sup>d</sup>	Identifying patient risks and vulnerabilities (eg, low socioeconomic status, lack of insurance or transportation). <sup>5</sup>	How emissions and solid waste pollution disproportionately impact the health of vulnerable and marginalized populations. <sup>33</sup>
Value in health care <sup>e</sup>	Stakeholder perspectives on value in care and components of high-value health care systems. <sup>5,30</sup>	Placing value on reduced emissions and sustainable resource use for health system functioning.
Health system improvement <sup>f</sup>	Quality improvement plans (eg, Plan-Do-Study-Act and Lean Six Sigma methodologies). <sup>5</sup>	How investing in sustainable infrastructure ultimately builds health system capacity through system resilience and increased preparedness.

## HSS Curricular Domain

## Traditional HSS Content Focus

## Sustainability Content Focus

Health care structure and process<sup>a</sup>

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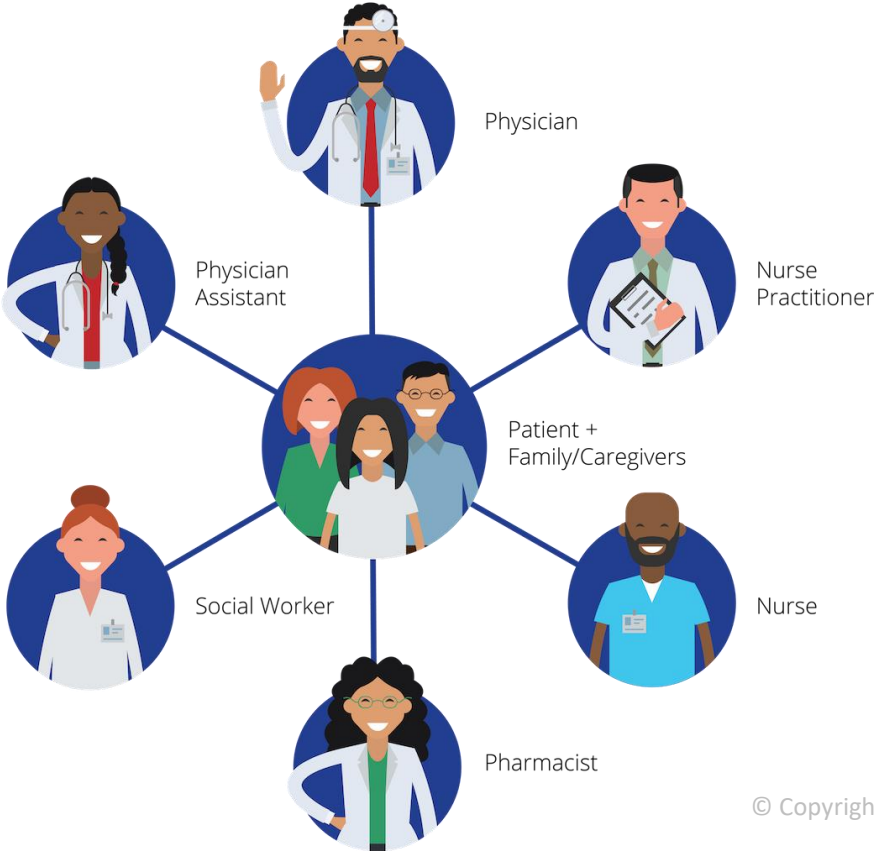


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# Goal of Healthcare



# Thank you!



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# Diagnostic Safety Systems: A Health Systems Science Case Study

**Kristen Miller, DrPH, MSPH, MSL, CPPS**

Sr. Scientific Director, National Center for Human Factors in Healthcare, MedStar Health

Associate Professor of Emergency Medicine, Georgetown University School of Medicine

Affiliate Faculty, Innovation Center for Biomedical Informatics, Georgetown Medical Center

“Doctors are still stumped;  
they’re basically spinning a  
“Wheel of Misdiagnosis”  
at this point.

But they don’t even buy a vowel,  
they just keep on spinning.

I really feel like it’s just a Russian  
Roulette of medication at this point.”

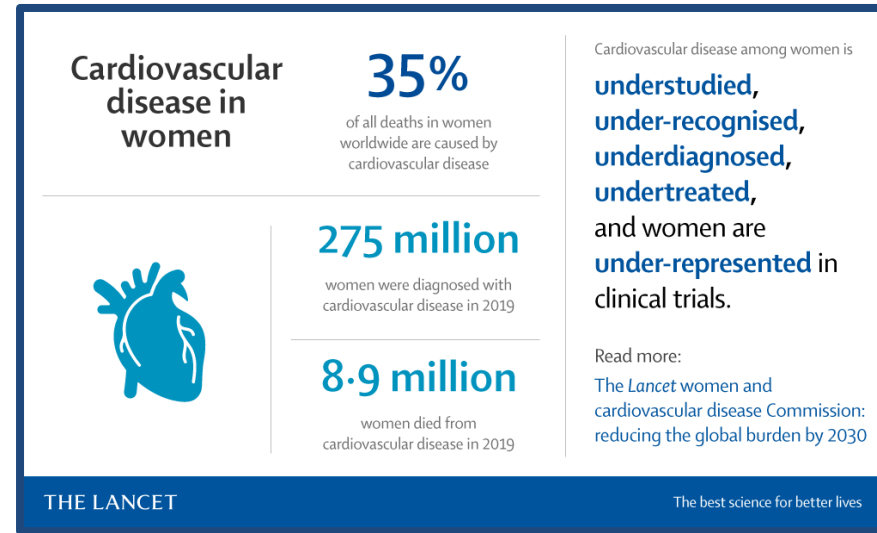
- 37 year old patient



# Background

## Confluence of events

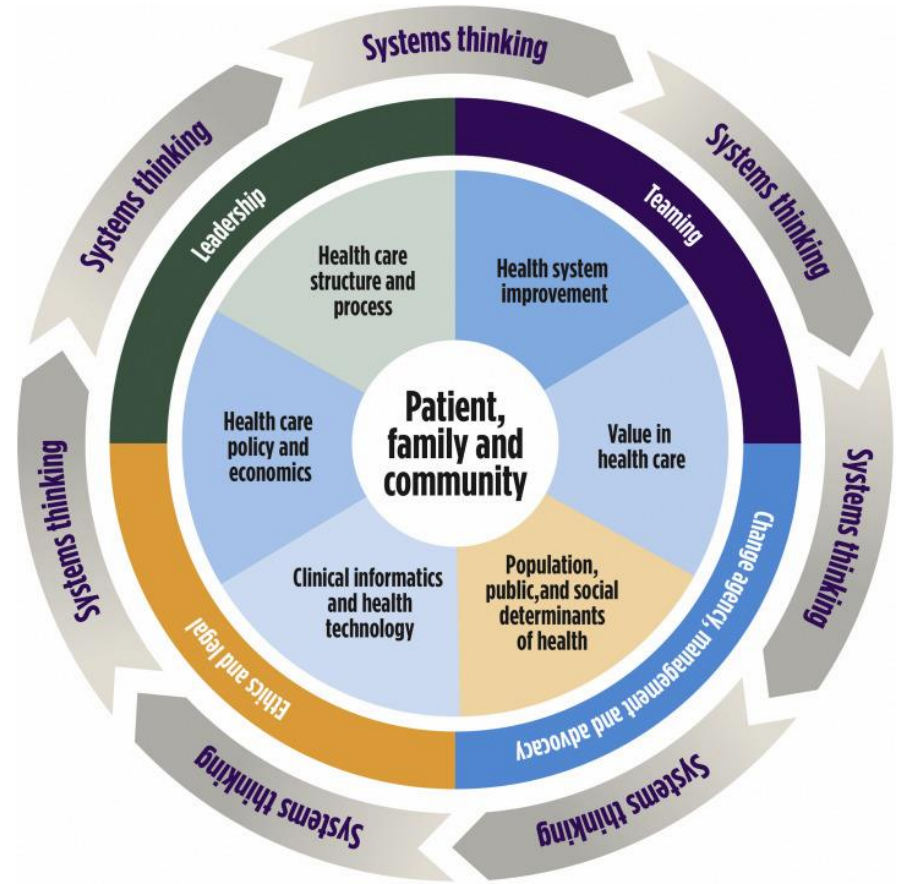
- “Atypical” presentation
- Public perception
- Female specific risks
- Provider training
- Guidelines designed for men (historically and today)



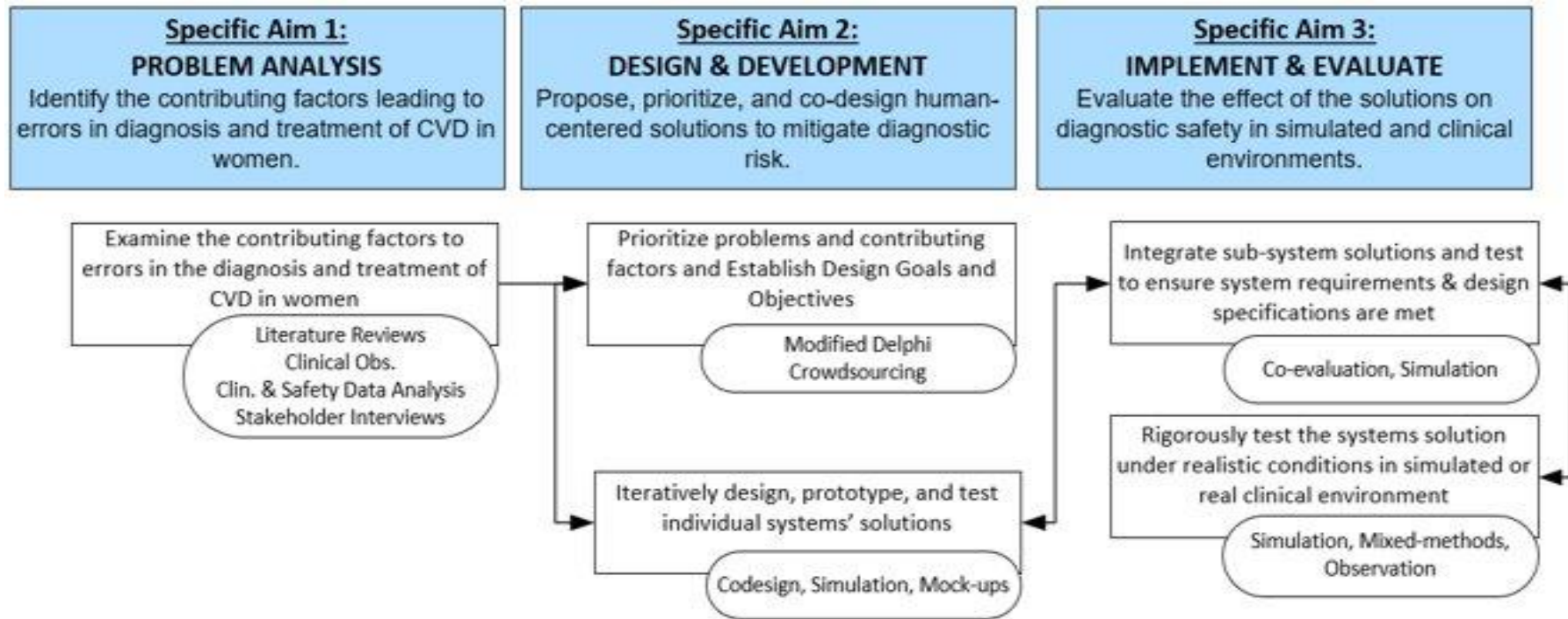
# Background

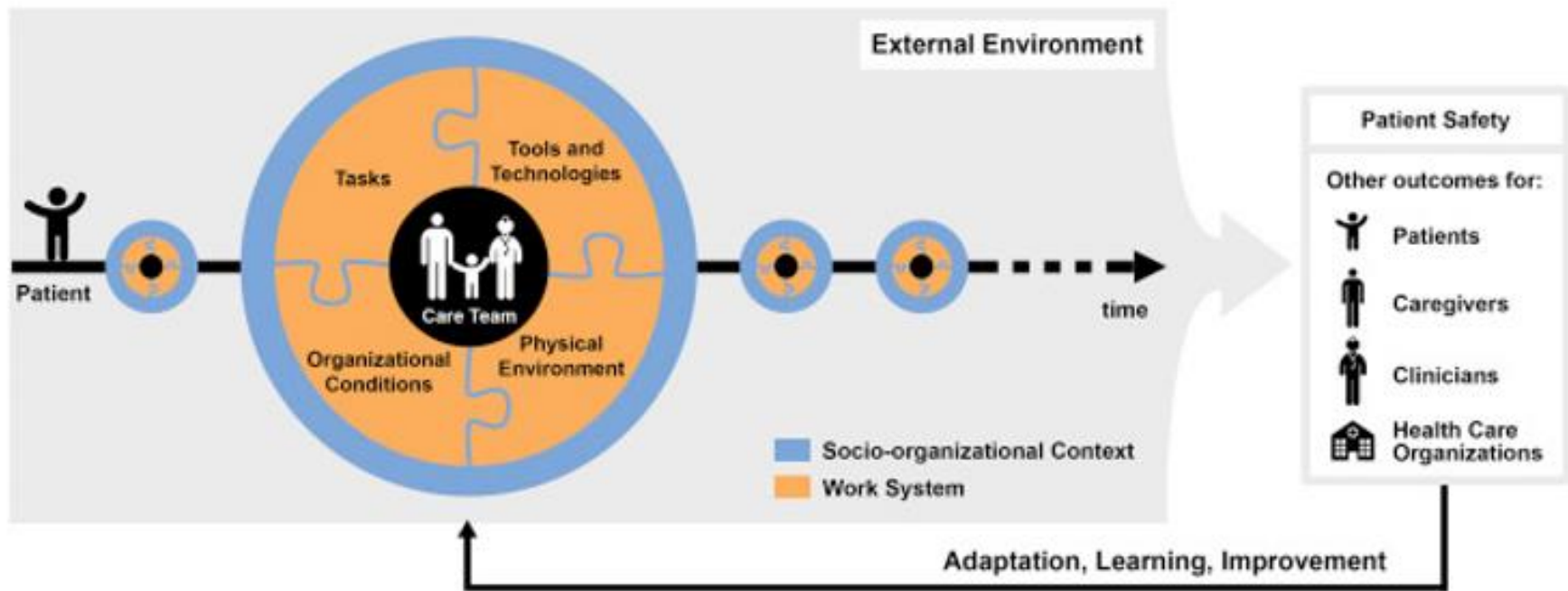
Perfect human factors problem  
= opportunity for a health  
systems science approach

- Healthcare delivery research
- Multiple stakeholders
- Requires a transdisciplinary team



# Approach





# Findings

- What we learned from the data
  - 25% of patient reported data report diagnostic breakdowns (accuracy, timeliness, communication)
  - Developing algorithms to identify diagnostic errors
  - Patient and provider facing guidelines are not actionable (soapbox for engagement)
- What we learned from the people
  - Communication is key; nearly every patient identified “listening” as a main priority
  - New tools required to equip patients as advocates

## Patient Experience Survey Data

“I had a telephone appointment with Dr. X which eliminated any possibility of him evaluating my vitals and heart function through EKG or listening directly.

### Sample Interview (34 yo AA woman)

“nothing was done regarding my concerns. I was denied care and deterred. I never heard from the office again even after I was hospitalized. I'm still having ongoing cardiac issues that can't be fully explained due to a bad initial work up”

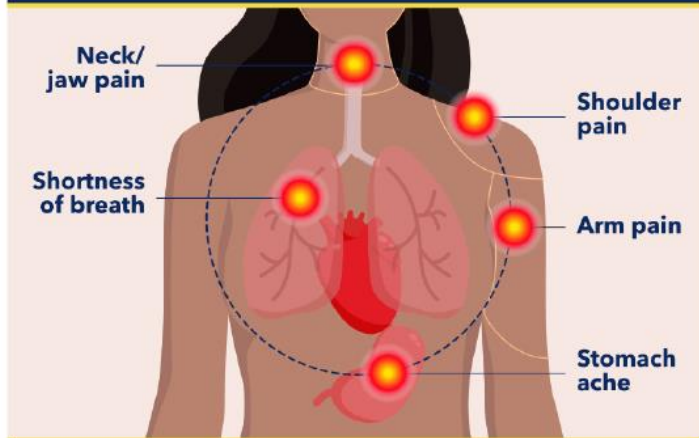


# Solutions

Improved patient-facing materials

- Incorporate generation education in healthcare settings, discharge instructions, social media

## Heart Attacks in Women Include Symptoms Near and Around the Heart



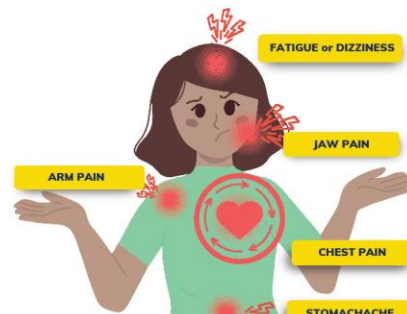
If you are feeling unwell, and have some of these symptoms  
**Dial 911.**  
Do not drive yourself to the hospital.

What women **NEED** to know about heart attack symptoms

ASK YOURSELF

*Is what I'm feeling normal?*

Symptoms don't always appear at the heart, sometimes you feel it in areas **AROUND** the heart.



# Solutions

## New agenda-setting tools

- Existing tools can be overwhelming (22 questions on average)
- Most questions focus on later stages of the diagnostic process (communication of the diagnosis, treatment, and outcomes)



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Patient name: \_\_\_\_\_

Date of birth: \_\_\_\_\_

Date: \_\_\_\_\_

### Be the expert on you.

Your provider needs your help to make a safe diagnosis and care plan. Please answer these five questions before your visit today.

#### Why are you here today?

New problem    Follow-up    Medicine refill    Pain    Something else

\_\_\_\_\_  
\_\_\_\_\_



#### Has there been a change in how you are feeling since your last visit?

Yes    No

When did it start?    Days    Weeks    Longer

How does it make you feel? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



#### Have you seen anyone else about your health?

Yes    No

Whom did you see? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



#### Do you have questions about...

Medicines?    Tests?    Treatments?    Something else?

\_\_\_\_\_  
\_\_\_\_\_



#### Is there anything else going on?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

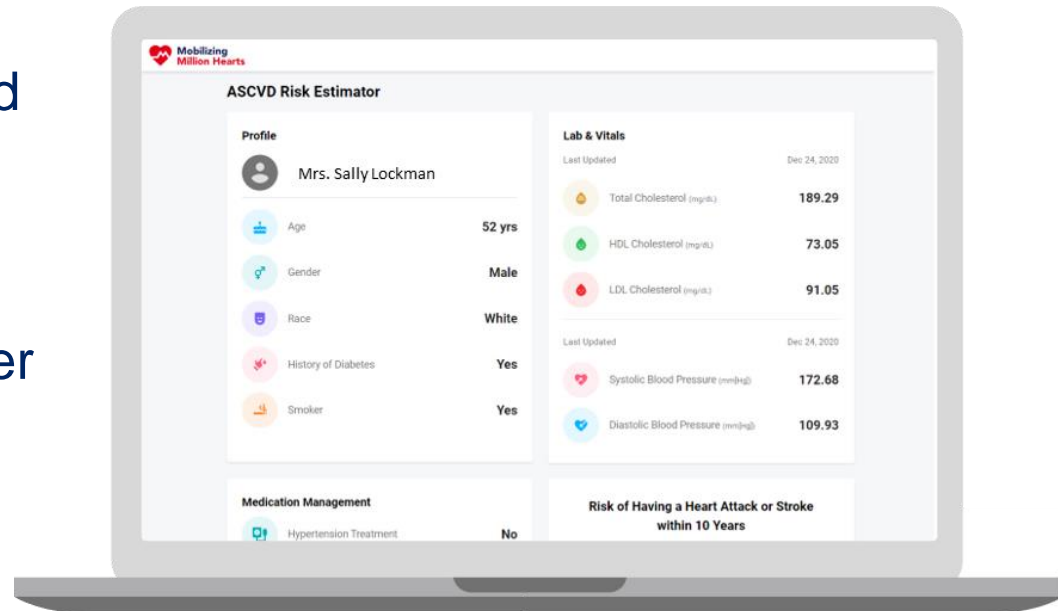




# Solutions

## Optimized clinical decision support tools (provider-facing)

- There are very few health IT solutions for this use case
- Models are inherently biased and do not always consider sex/gender
- Better disclaimers on CVD screening tools that may over or underestimate risk



# Solutions

## Mobile adjustable laptop table

- Observations revealed challenges working in with an underserved community in a facility with exam rooms that fall well short of today's standards
- Online photo survey identified differences in perceptions about exam rooms between men and women)



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### Exam Room Choice

Please consider the following scenario:

\*1.

**A 50.0%** You have significant concerns about your heart, and you have made an appointment to see a doctor. You are by yourself, and you are nervous. Look at the 6 photos below. Which exam room would make you feel **most relaxed** talking about your health concerns?

**B 50.0%** You have significant concerns about your heart, and you have made an appointment to see a doctor. You are by yourself, and you are nervous. Look at the 6 photos below. Which exam room would make you feel **most anxious** talking about your health concerns?



# Key Takeaways

- CVD continues to be misdiagnosed and undertreated in women
- Complex problems require complex approaches
- A health systems science approach helps us understand the populations we serve and advance a better awareness of issues in conducting real-world research that is inclusive of marginalized populations
- Improving CVD diagnosis in women requires a significant re-envisioning of the diagnostic process, the diagnostic team, and widespread commitment to change



# Thank you!





## Applied Systems Thinking in Action

# Improving Clinician Wellbeing Through Clinician-Driven Organizational Reform

MATTHEW D. MCHUGH, PhD, JD, MPH, RN, FAAN

Independence Chair and Professor of Nursing

Director, Center for Health Outcomes & Policy Research

University of Pennsylvania School of Nursing

[www.nursing.upenn.edu/chopr](http://www.nursing.upenn.edu/chopr)

# What is a good work environment?

## Hallmarks

- recognize contributions of clinician knowledge and expertise to clinical care quality and outcomes
- promote executive-level clinician leadership
- empower clinician participation in organizational decisions
- support professional development and clinical advancement programs
- expect collaborative relationships within the health care provider team
- ensure adequate staffing and resources
- use technological advances and information systems to improve clinical care with input from direct care providers at the interface

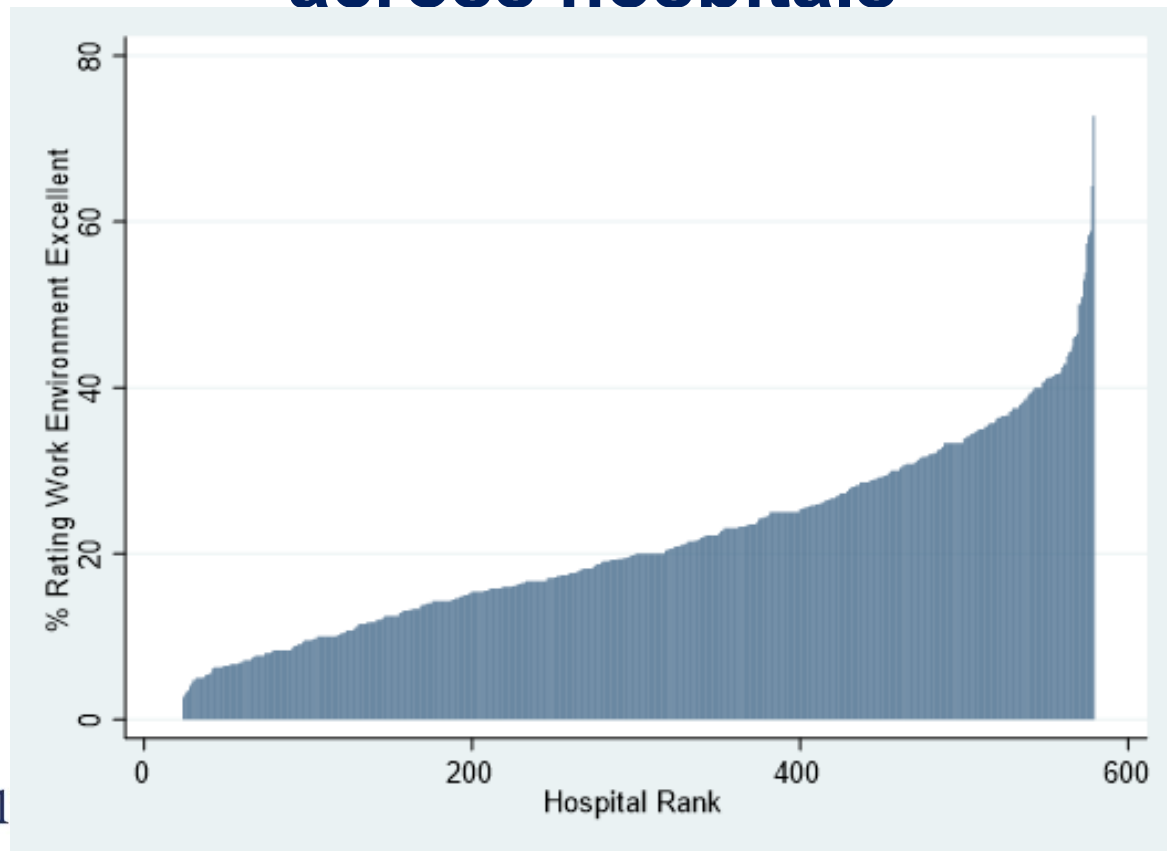
**Magnet hospitals shown empirically to be characterized by these features**



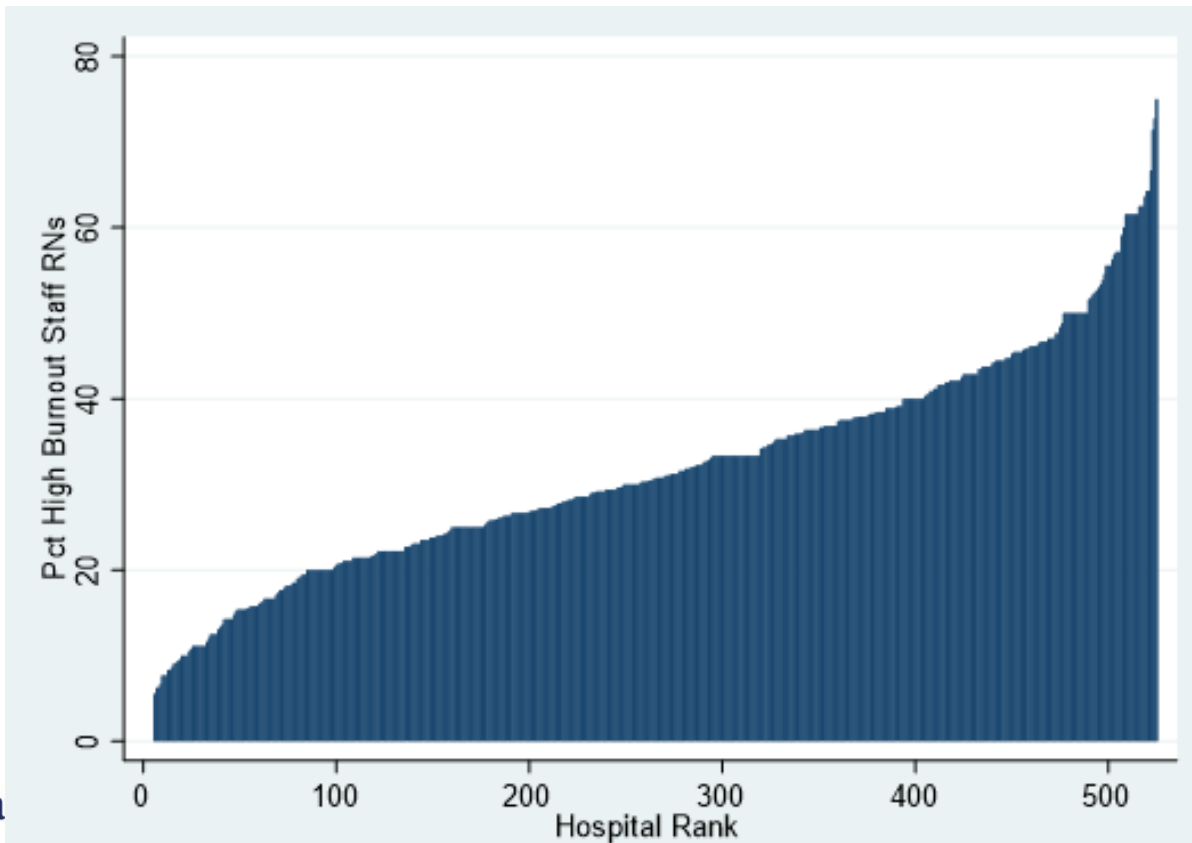
# Is the work environment specific to

Nurses	Physicians
<p>“Improvements in nurse work environments over time are associated with declines in the rates of nurse burnout”</p> <p>-- Kutney-Lee, A., Wu, E. S., Sloane, D. M., &amp; Aiken, L. H. (2013). Changes in hospital nurse work environments and nurse job outcomes: An analysis of panel data. <i>International Journal of Nursing Studies</i>, 50(2), 195-201.</p>	<p>“Drivers of this epidemic [physician burnout] are largely rooted within healthcare organizations and systems”</p> <p>-- West, C. P., Dyrbye, L. N., &amp; Shanafelt, T. D. (2018). Physician burnout: contributors, consequences and solutions. <i>Journal of Internal Medicine</i>, 283(6), 516-529.</p>
<ul style="list-style-type: none"> <li>• inadequate staffing and resources</li> <li>• inefficient operational failures and bureaucracy interfere with good care</li> <li>• lack of autonomy and authority to exercise professional judgment</li> <li>• limited participation in hospital affairs</li> <li>• management doesn't support nurses' actions and decision-making</li> <li>• poor nurse–physician relations</li> <li>• the culture of the organization does not value the professional contribution of nurses to high quality care.</li> </ul>	<ul style="list-style-type: none"> <li>• excessive workloads</li> <li>• inefficient work processes &amp; clerical burdens</li> <li>• work–home conflicts</li> <li>• lack of input or control for physicians with respect to issues affecting their work lives</li> <li>• organizational support structures and leadership culture.</li> </ul>

# Work environments vary significantly across hospitals



# Burnout also varies significantly



# Four Decades of Research Show Better Magnet Hospital Outcomes

- Magnet hospitals have better:
  - **Clinician outcomes**: lower clinician burnout, job dissatisfaction, and intent to leave
  - **Patient outcomes**: lower mortality rates, fewer complications, better patient satisfaction
  - **Financial outcomes**: shorter patient stays, fewer readmissions, lower clinician turnover

Research shows that these better outcomes are



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largely a function of the better work environments  
in Magnet hospitals.

# Magnet4Europe

## Purpose

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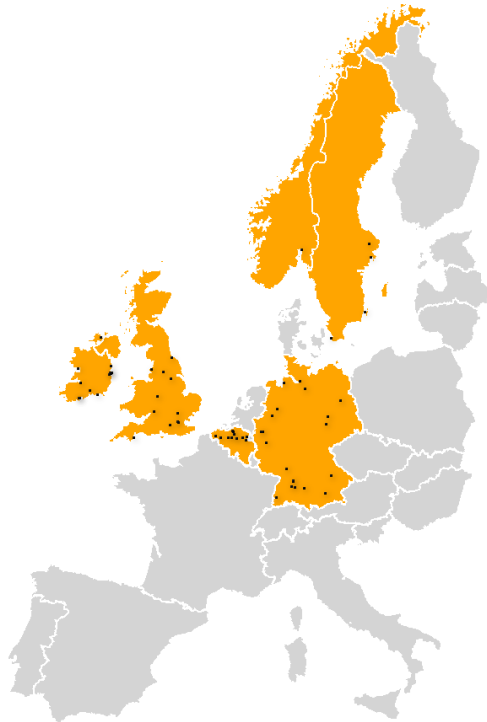
To determine if **redesign** of hospital work environments guided by **Magnet** principles is **feasible, effective, and sustainable in Europe** in improving **mental health/wellbeing of clinicians and care quality, safety, patient outcomes.**



# Magnet4Europe: An Intervention Trial

January 2020 through June 2024

European Magnet4Europe hospitals



- **Belgium** 14
- **Germany** 20
- **Ireland** 15
- **England** 11
- **Sweden** 4
- **Norway** 1

**TOTAL: 65 hospitals  
+ 68 US Magnet  
twins**

# Magnet4Europe Intervention

- Implement **Magnet principles** of organization shown to be associated with clinician wellbeing and better patient outcomes
- **Twinning** 1:1 with experienced US Magnets to co-design and implement workplace changes in European hospitals
- **Monthly Learning Collaborative & semi-annual in-person visits** foster sharing of best practices
- **Critical mass** of hospitals in multiple countries to foster sustainability

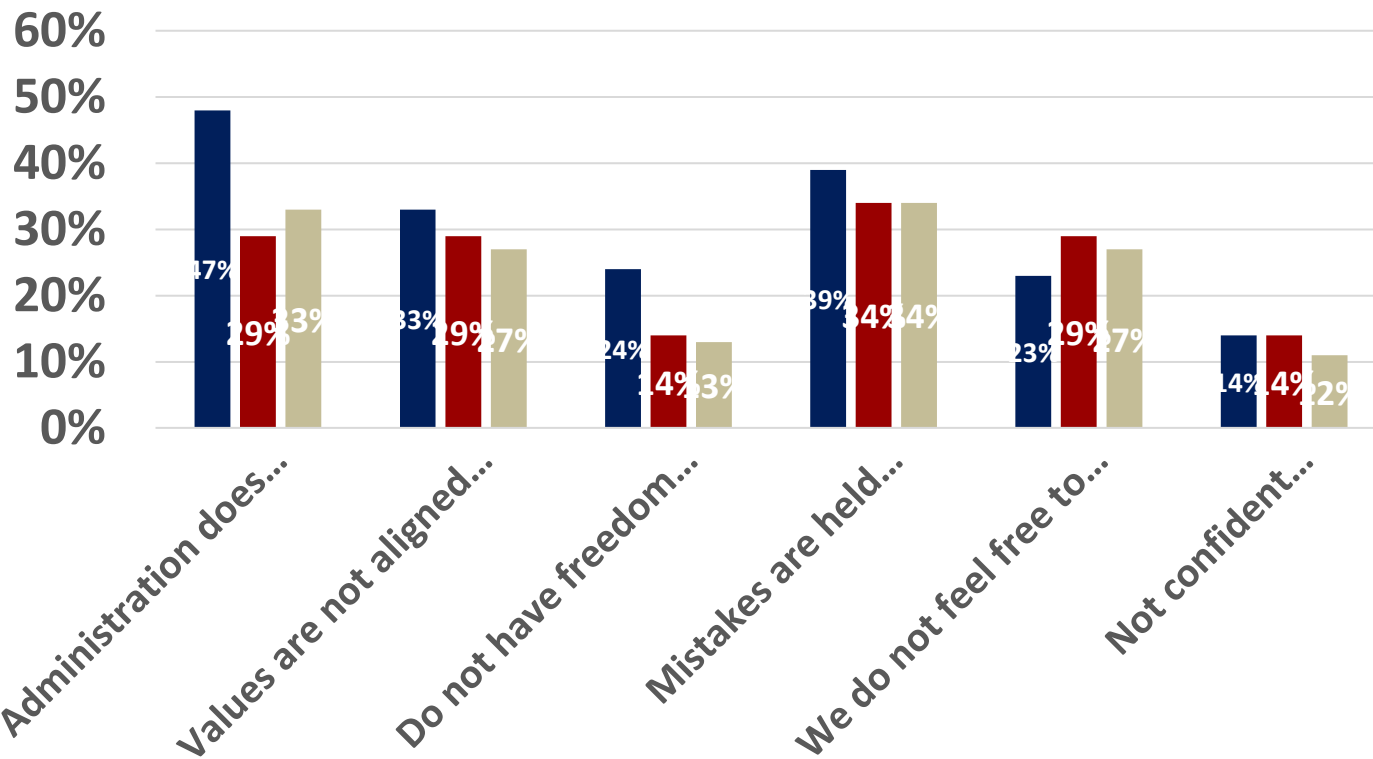


## Companion study in US shows clinician wellbeing challenges

	Nurses	Physicians
High Burnout	25%	23%
Job Dissatisfaction	24%	26%
Intent to Leave Your Hospital	31%	28%
Depressed	19%	16%
Anxious	22%	17%
Fair/Very Poor Overall Health	28%	17%
Work Does Not Leave Enough Time for Personal/Family Life	39%	56%



## Disconnect between clinicians and administration



# Nurses, physicians, APPs agree on most/least important interventions for improving work environment/reducing burnout

## MOST important

- Improve staffing (nurse and physician)
- Reduce documentation/EHR burden, bureaucracy, and red tape
- Allow for more time to spend with patients
- Uninterrupted breaks
- Work-Life balance

## LEAST important


- Wellness committees/champions
- Create time and place for meditation and reflection



# Take away messages

- Opportunities for interdisciplinary initiatives to address core health systems failures
- There is evidence for action
- Strong theoretical underpinnings; e.g., organizational sociology, operations management, and science of complex organizations
- Learning across organizations is a multiplier
- Clinician learners can and should be engaged in change activity





# The Future of Humanness in Learning

**Jennifer Graebe MSN, RN, NEA-BC**



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# How do we cure

**HUMAN  
HEALTH**

**ANIMAL  
HEALTH**

**ONE HEALTH**

**ENVIRONMENT**

**Poverty**

**Illness**

**Pollution**

**Violence**

**determinants**

Note: The associated factors are not exhaustive, they are examples, as there are many elements to consider.

**Food security**

**Diet**

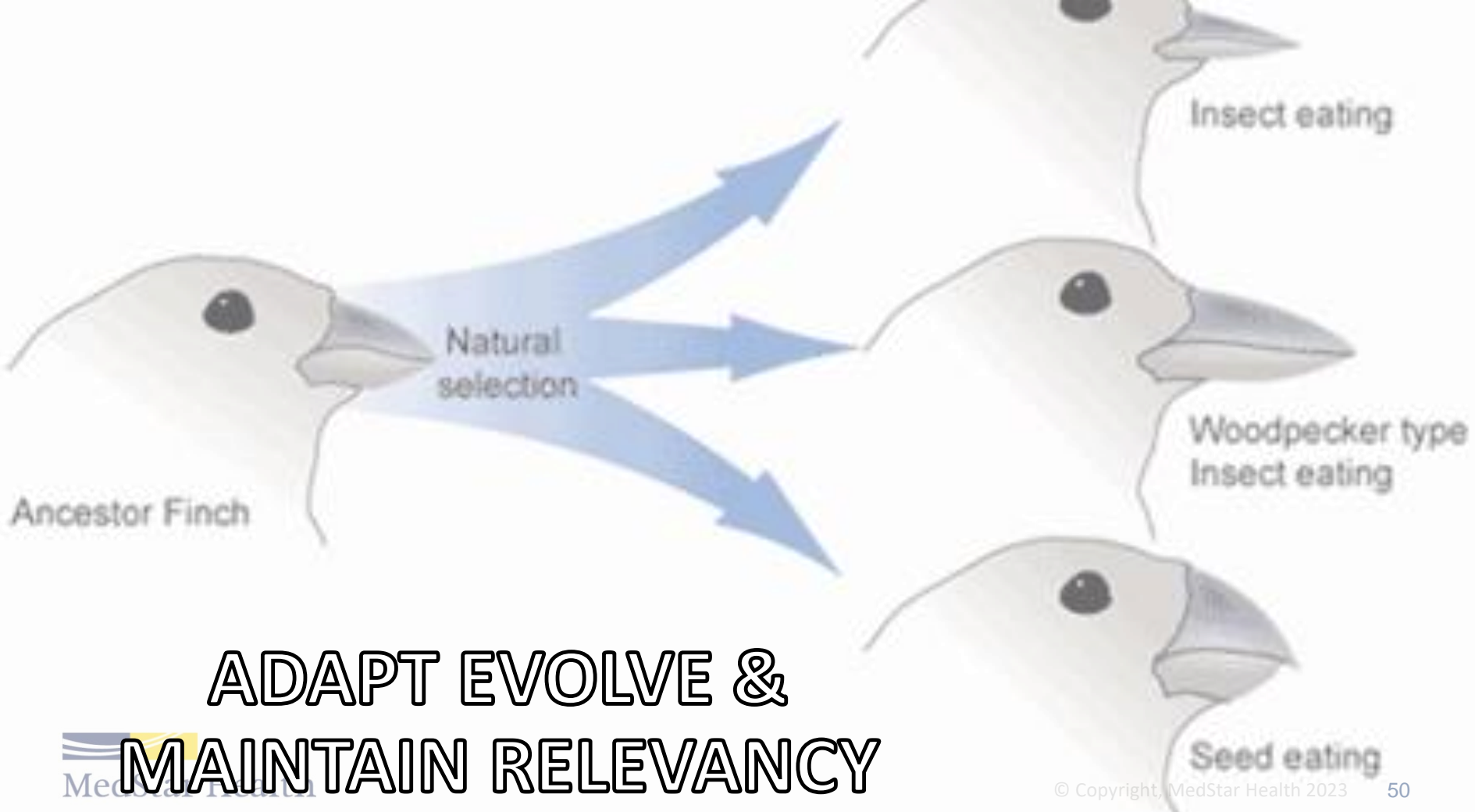
**Antibiotics and other antimicrobials**

**Intensive livestock farming**

**Population movements**

**Climate change**

**Water pollution**



JOAQUIN PHOENIX AMY ADAMS ROONEY MARA

OLIVIA WILDE AND SCARLETT JOHANSSON

# her

A SPIKE JONZE LOVE STORY

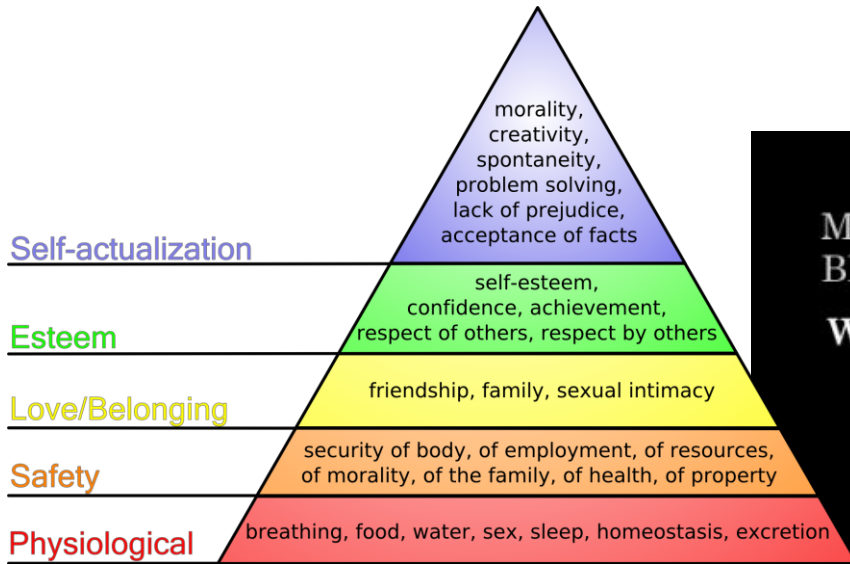
WARNER BROS. PICTURES PRESENTS

AN ANNAPOLINA PICTURES PRODUCTION "HER" JOAQUIN PHOENIX AMY ADAMS ROONEY MARA OLIVIA WILDE AND SCARLETT JOHANSSON

CASTING BY ELLEN LEWIS CASSANDRA KULLUNDINS COSTUME DESIGNER REN KLYVE MUSIC BY ERIC DE FERRI EDITOR CASEY STUBBS EXECUTIVE PRODUCERS ERIC ZIMBRUNNER A.E. JEFF BUCHANAN PRODUCED BY BARRETT  
DIRECTOR OF PHOTOGRAPHY HUYTTE VAN HOYTENMA, P.C.E. M.S.C. PRODUCERS DANIEL LUPU NATALIE PARSONS  
COMING

This Photo by Unknown Author is licensed under [CC BY-ND](https://creativecommons.org/licenses/by-nd/4.0/)

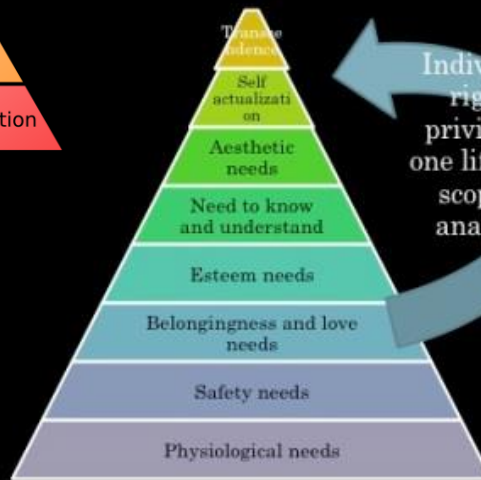
“Everything can be taken from a man but one thing: the last of the human freedoms—to choose one's attitude in any given set of circumstances, to choose one's own way.”  
“When we are no longer able to change a situation, we are challenged to change ourselves.” - Viktor Frankl



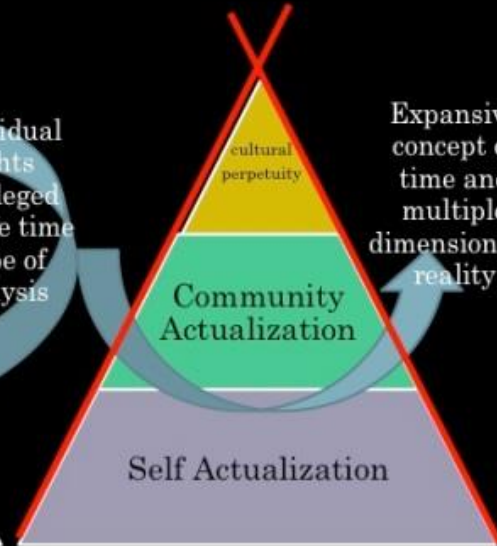
## MASLOW'S HIERARCHY OF NEEDS (INFORMED BY BLACKFOOT NATION (ALTA))

### Western Perspective

### First Nations Perspective



Individual rights privileged one life time scope of analysis



Expansive concept of time and multiple dimensions of reality

Huitt, 2004; Blackstock, 2008; Wadsworth,



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# TOOLS OF A SYSTEM THINKER



DISCONNECTION



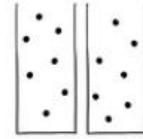
INTERCONNECTEDNESS



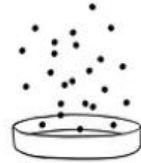
LINEAR



CIRCULAR



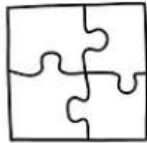
SILOS



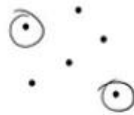
EMERGENCE



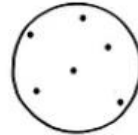
PARTS



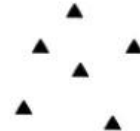
WHOLES



ANALYSIS



SYNTHESIS



ISOLATION

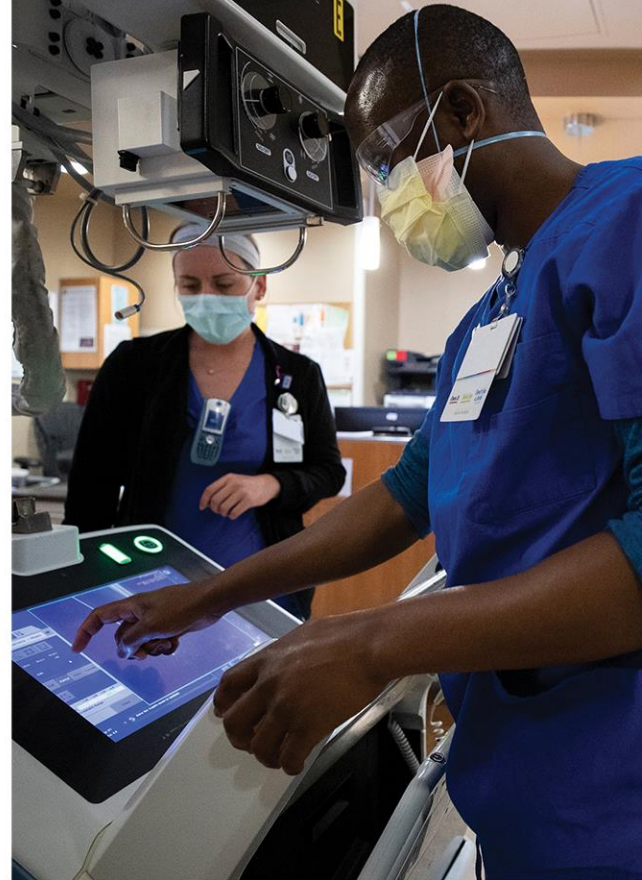


RELATIONSHIPS



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Barr, Koppel, Reeves, Hammick, & Freeth, 2005



**JPS Health Network**  
Fort Worth, Texas

Teneisha Kennard, LMSW  
Executive Director – Ambulatory Behavioral Health

# Program Creation

- Texas Child Mental Health Care Consortium (TCMHCC) was created by the 86<sup>th</sup> Texas Legislature in 2019 has been tasked with “improving mental health care and systems of care for children and adolescents of Texas.”
- Senate Bill 11, also out of the 86<sup>th</sup> Texas Legislature, is an effort to expand mental health initiatives and provide funding to increase safety and security on school campuses. This came after the Santa Fe High School tragedy.
- The projects under TCMHCC represent a coordinated effort to leverage the expertise of mental health professionals across the state in order to meet the needs of children and adolescents with mental health concerns. This is necessary due to a demand for services that exceeds the number of professionals qualified and available to provide the service. This coordinated effort has organized mental health professionals and prescribers to geographically cover the state with telehealth mental health access.

[TCMHCC – Texas Child Mental Health Care Consortium \(utsystem.edu\)](https://utsystem.edu)



**CPAN**  
Child Psychiatry  
Access Network

**TCHATT**  
Texas Child Health Access  
Through Telemedicine

A collaborative service offered through  
The University of North Texas Health Science Center  
and JPS Health Network



**acclaim**  
Improving health together  
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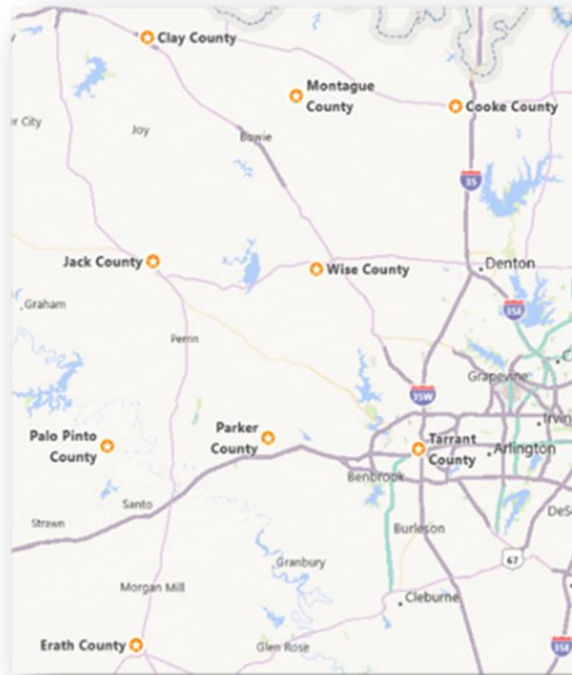
**JPS Health Network**  
Fort Worth, Texas

# TCMHCC Programs North Texas

Funding is provided through the Texas Mental Health Consortium (TCMHCC). This funding is provided by the Texas Higher Education Coordination Board (THECB) and is distributed amongst 12 hubs.

Hubs represent the partnership between a Health Related Institution (HRI) and an Academic institution.

The hub covering Tarrant and eight additional counties is a partnership between JPS Health Network and UNT Health Science Center.



- Tarrant County
- Parker County
- Wise County
- Cooke County
- Erath County
- Palo Pinto County
- Jack County
- Montague County
- Clay County



**CPAN**  
Child Psychiatry  
Access Network

**TCHATT**  
Texas Child Health Access  
Through Telemedicine

A collaborative service offered through  
The University of North Texas Health Science Center  
and JPS Health Network



**acclaim**  
Improving health together  
Acclaim Multi-Specialty Group

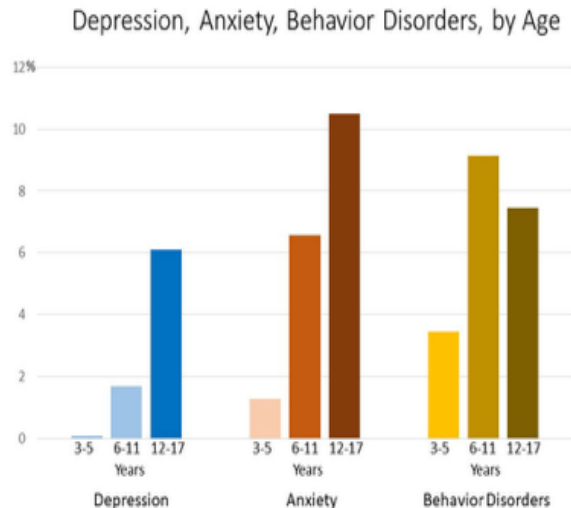


**JPS Health Network**  
Fort Worth, Texas

# Current Activity In TCHATT

Students referred to TCHATT are presenting with some of the following chief complaints:

- Anxiety
- Bullying
- Low self esteem
- Trauma
- Depression / lack of support and coping skills
- Self Harm/ lack coping skills
- Suicidal Ideation (passive)/ lack coping skills
- Grief/ loss
- Aggression/ Anger



Ghandour RM, Sherman LJ, Vladuti CJ, Ali MM, Lynch SE, Bitsko RH, Blumberg SJ. Prevalence and treatment of depression, anxiety, and conduct problems in U.S. children. *The Journal of Pediatrics*, 2018.

- Substance use
- Difficulty in school
- ADHD
- Parental concerns about changes in students behavior
- Loss of parents or friends
- Fears associated with future
- Children not feeling they have supports they can talk to that they feel will understand
- limited parent knowledge related to parenting students with behavioral health issues



CPAN  
Child Psychiatry  
Access Network

TCHATT  
Texas Child Health Access  
Through Telemedicine

A collaborative service offered through  
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# What do we provide?

The **Texas Child Health Access Through Telemedicine (TCHATT)** program provides telemedicine or telehealth programs to school districts to help identify and assess the behavioral health needs of children and adolescents and provide access to mental health services. Our Hub is currently partnered with 36 Independent School Districts (ISDs) (446 schools) in 9 counties which covers 307,372 lives. We currently have 19 MOUs in process (57 schools) that will cover an additional 38,600 students.

We are adding new ISDs each month, allowing us to increase the number of student lives we cover.



# Review of Current Partnerships

- 24 Active MOUs:
  - All 9 counties (see handout for ISD breakdown):
    - 9 in Tarrant
    - 5 in Montague
    - 4 in Parker
    - 1 each in Wise, Erath, Cooke, Palo Pinto, Jack, & Clay
  - 13 Pending MOUs (see handout for ISD breakdown):
    - 2 in Tarrant
    - 3 in Parker
    - 4 Wise
    - 2 in Cooke
    - 1 in Palo Pinto
    - 1 in Erath



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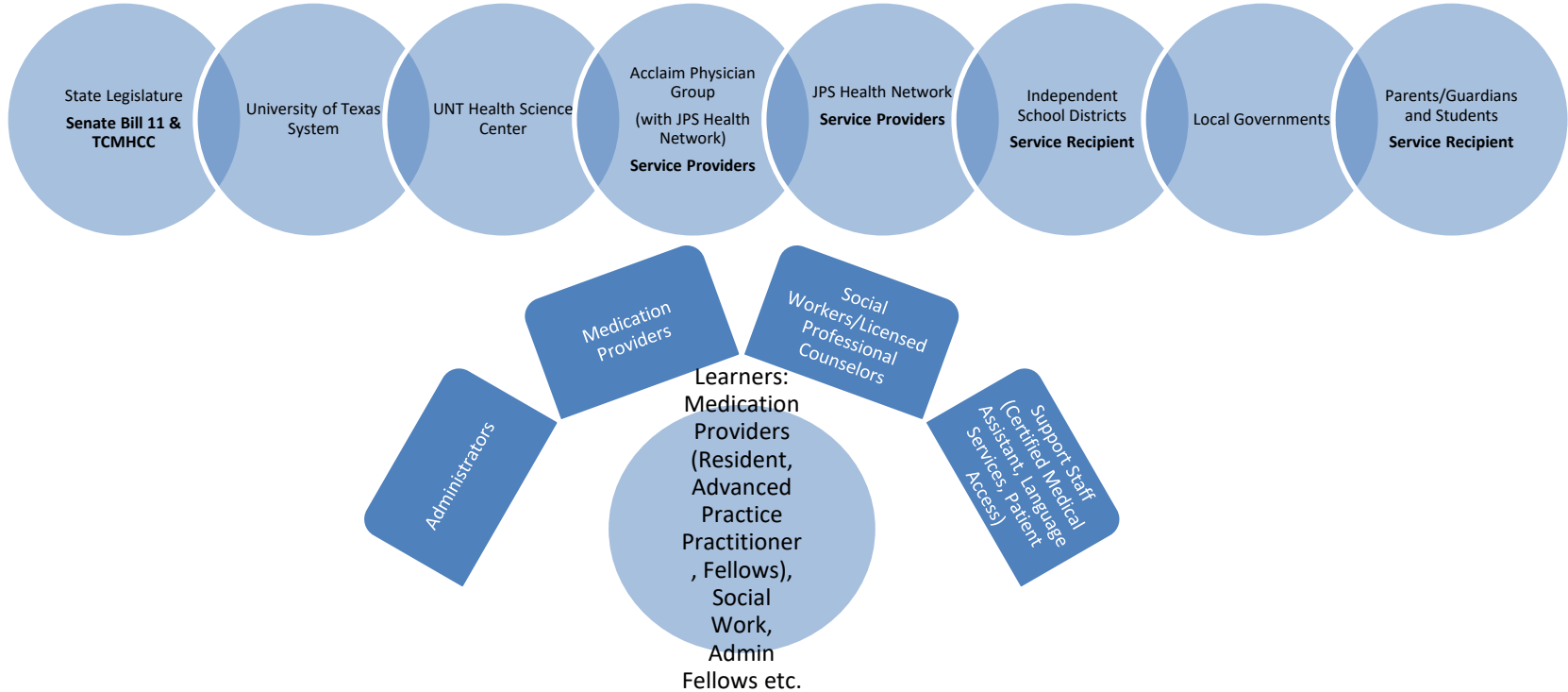


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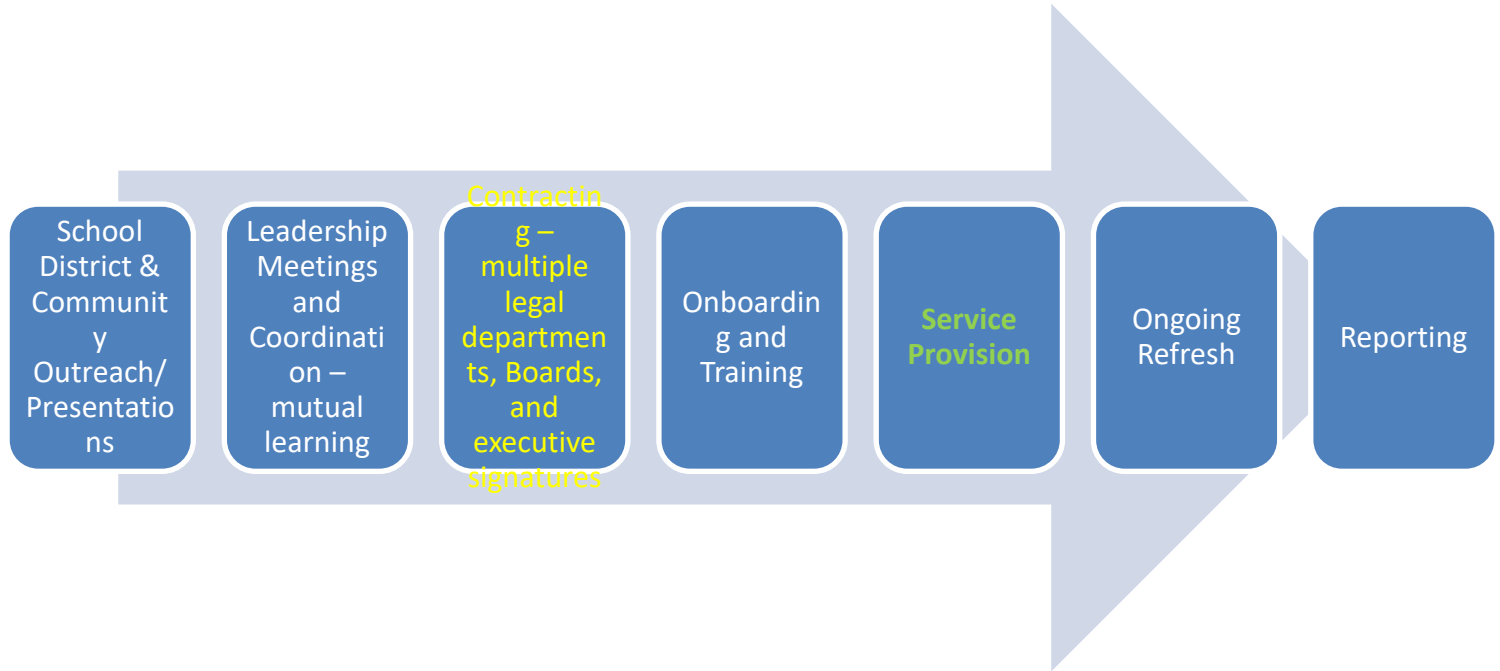


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# Who Are Our Partners?



# How does it all happen?



# Our Top 5 Keys to Successful Collaboration

1. Approaching each conversation as a learner first.
2. Finding ways that we can be flexible to meet the needs of future partners. Don't be afraid of a pilot project
3. Communicating openly and often.
4. Lean on the expertise of partners
5. Create a community with our partners to learn from each other by encouraging connection and creating learning opportunities

# *Thank You*



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