

Health IT for Multiple Chronic Conditions

Lipika Samal, MD, MPH

David Dorr, MD, MS

Purpose

People with Multiple Chronic Conditions (MCC) are especially prone to harm from lack of coordination and communication.

Health Information Technology (HIT) solutions can bring together data, information and knowledge – and facilitate communication - to help people with MCC optimize their overall health.

HIT solutions also bring risk – of adding complexity, fragmentation, and burden – and may be challenging to use.

Our paper discusses the role of HIT in helping people with MCCs; we need to elicit gaps and solutions from you all.

Betsy Johnson

- 60 years old
- Type 2 Diabetes and Congestive Heart Failure
- Progressive CKD eGFR<30
- Unemployed
- Lives in Springfield, IL

About Betsy

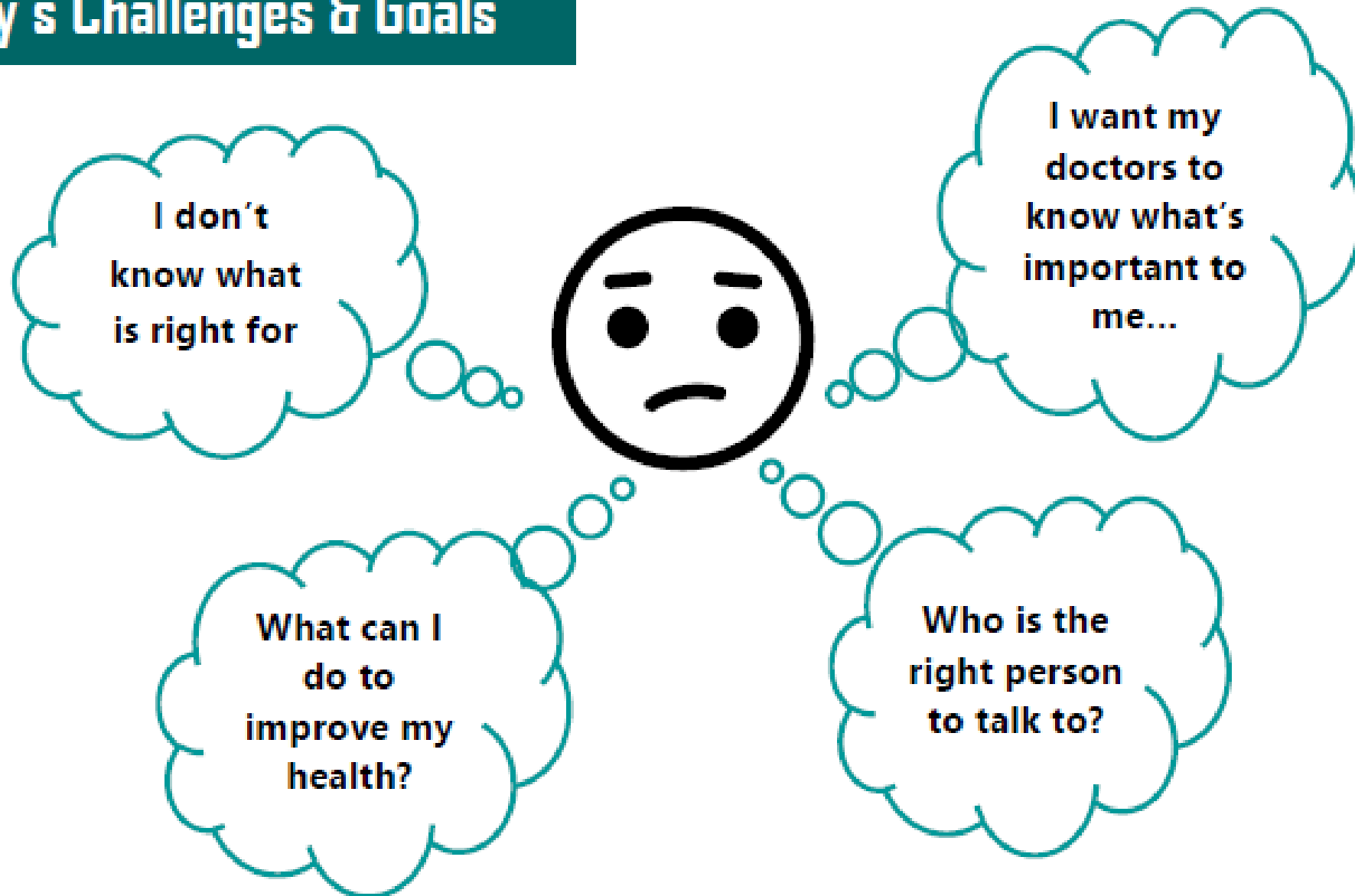
Betsy is a retired school teacher. Her husband passed away a few years ago, and she currently lives with her daughter. She also has a son who lives in a different city. Betsy has had:

- **Type 2 diabetes** for 20 years
- **Chronic kidney disease** for 10 years
- **Congestive heart failure** for 2 years

Her doctor has been encouraging her to **think about what treatment she would prefer if her kidneys fail**, but the **options are confusing** and **thinking about it is stressful** for her.



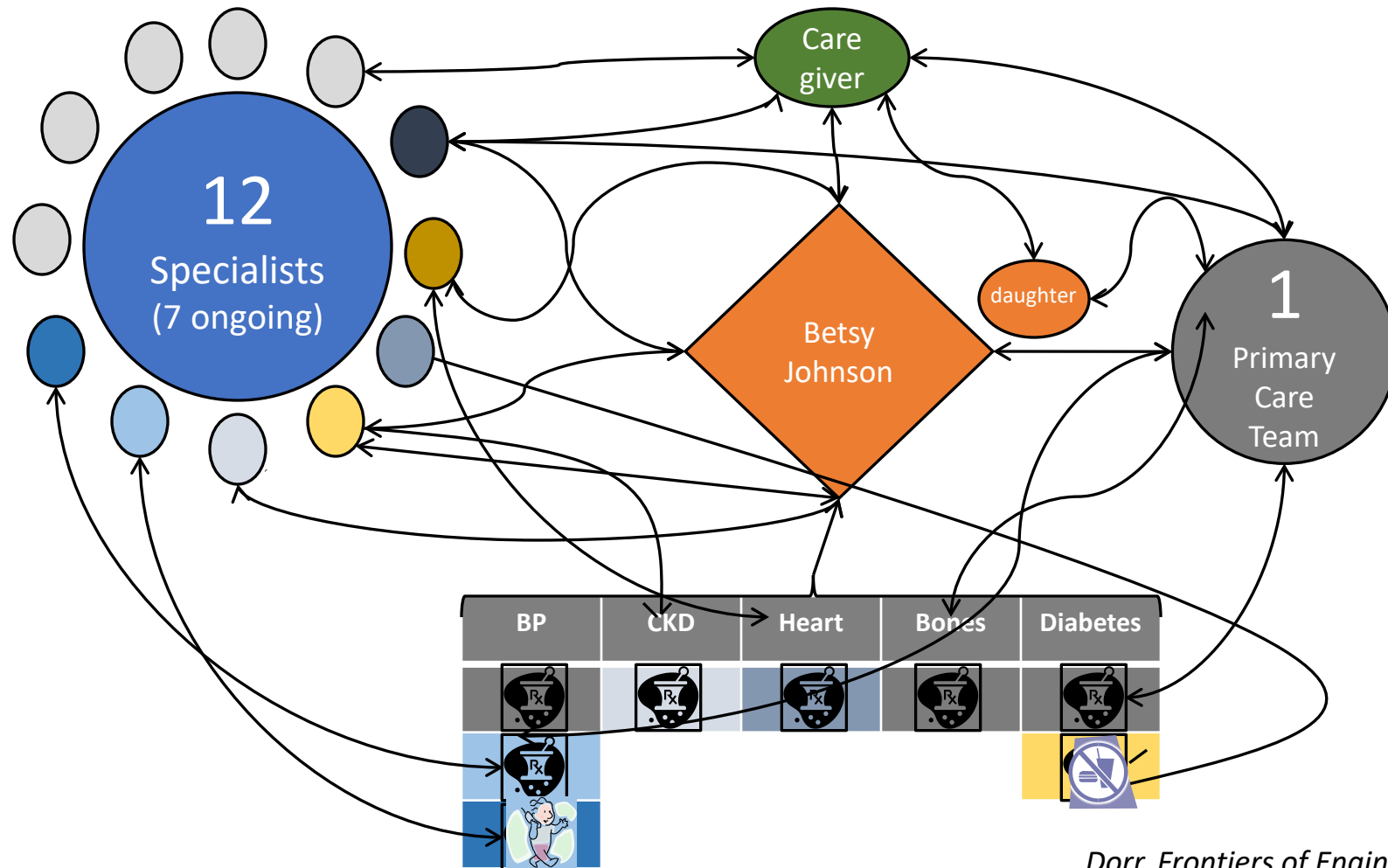
Betsy's Challenges & Goals



3 Domains and 2 cross-cutting topics

- Care planning / care coordination
 - Patient and family self-management and patient reported outcomes
 - Algorithm / predictive modeling / artificial intelligence
-
- Cross cutting topics: equity, complexity

The Norm: (Un)Coordinated Care



Care planning with HIT – eCare Plan

Careplan Patricia Noelle, DOB: 10/17/1954 👤 📁 ⚙️

Name: Patricia Noelle	Date of Birth: 10/17/1954	Sex: Female	Race: White	Ethnicity: Not Hispanic or Latino
Title: CKD Care Plan	Status: Active	Period: 06/01/2018 onward	Addresses: Type 2 diabetes, Chronic kidney disease	Patient Id: ID-900

Health and Social Concerns
Goals and Preferences
Health Maintenance & Interventions
Health Status Evaluation & Outcomes
Care Team

Partitioner Goals				
Priority	Goal	Created	Target Date	Status
!	Stabilize Hemoglobin A1c	11/30/2016	11/10/2020	In Progress
	Diastolic blood pressure	01/12/2019	09/22/2019	In Progress
	Systolic blood pressure	06/30/2017	09/22/2019	In Progress
!	Phosphorus in blood	02/20/2018	11/10/2020	In Progress
	Exercise at least 30 minutes per day	12/07/2017		In Progress

Patient Goals				
Priority	Goal	Created	Target Date	Status
!	Maximize Quality of Life	11/30/2016		In Progress
	Avoid addiction to narcotics	10/30/2015		In Progress
	Stay as Active and Healthy as possible	10/30/2015		In Progress
!	Control diabetes to avoid dialysis	10/30/2015		In Progress
!	Target weight is 160 to 180 lbs.	04/05/2015	04/05/2016	

Target Laboratory/Clinical Values			
Measure	Most Recent Result	Test Date	Target (if available)
Hemoglobin A1c total in Blood			<7 %
Diastolic blood pressure			<80 mmHg
Systolic blood pressure			<140 mmHg
Serum phosphorus			2.5 - 4.5 mg/dL
Exercises			None
			160 - 180 lbs

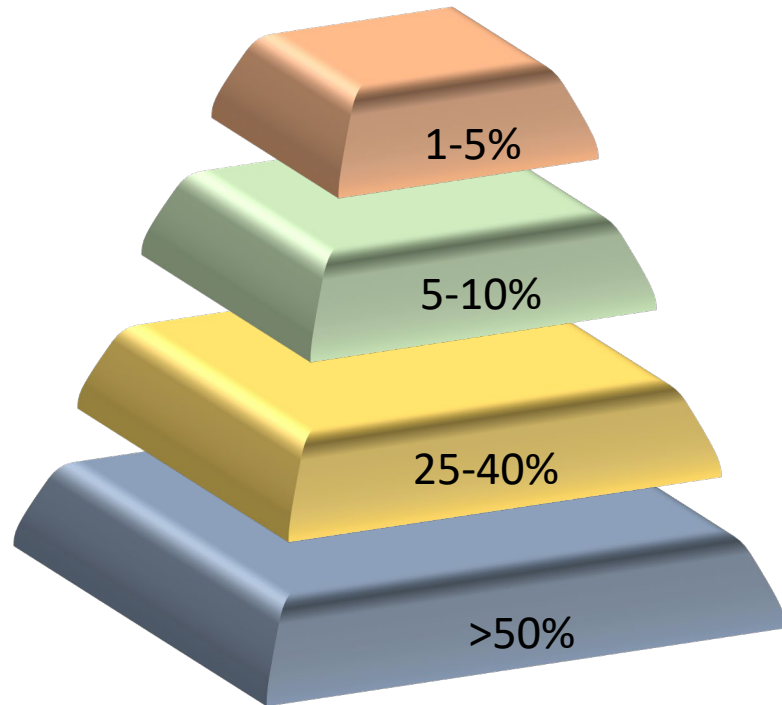
Patient Choices

Renal Replacement Therapy:

Patient Self-management

- Most activities that affect health are away from health care
- Key issues that HIT can support
 - Self-management data collection
 - Education
 - Shared decision making
 - Motivational support
 - Goal-setting
 - Non-pharmacologic treatments
 - Monitoring and follow-up

Algorithms and 'Artificial intelligence'

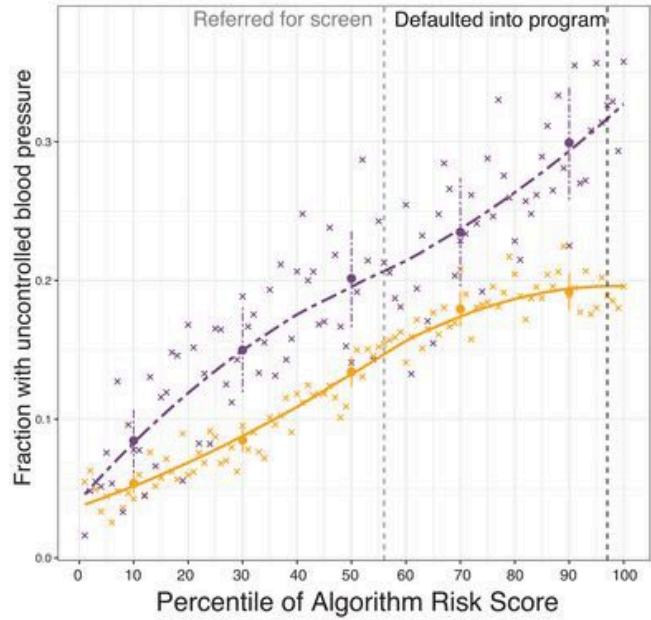


Risk	Definition (e.g.)
Highest	Multiple Social, Behavioral, Mental, and Chronic issues
High	Severe/ uncontrolled illness or multiple controlled issues
Moderate	Controlled, stable issues
Low	Preventive needs or limited chronic issues

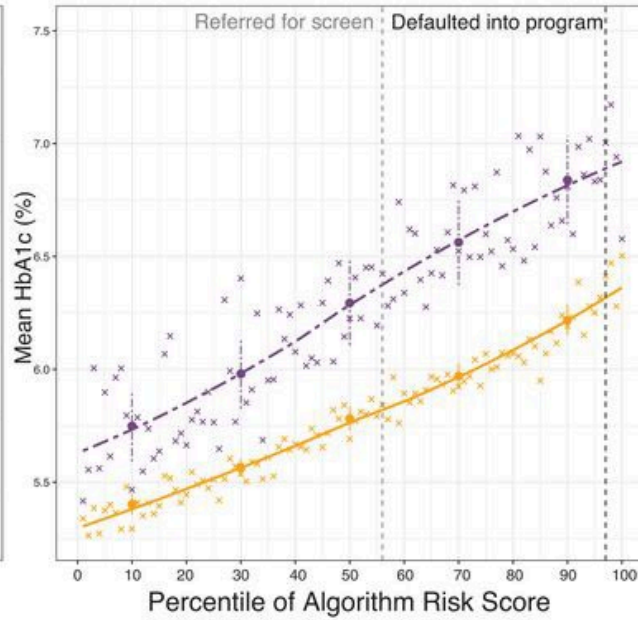
Cross – cutting : Ethics/ Bias and Complexity

Race --●-- Black --●-- White

A Hypertension: Fraction clinic visits with SBP >139 mmHg



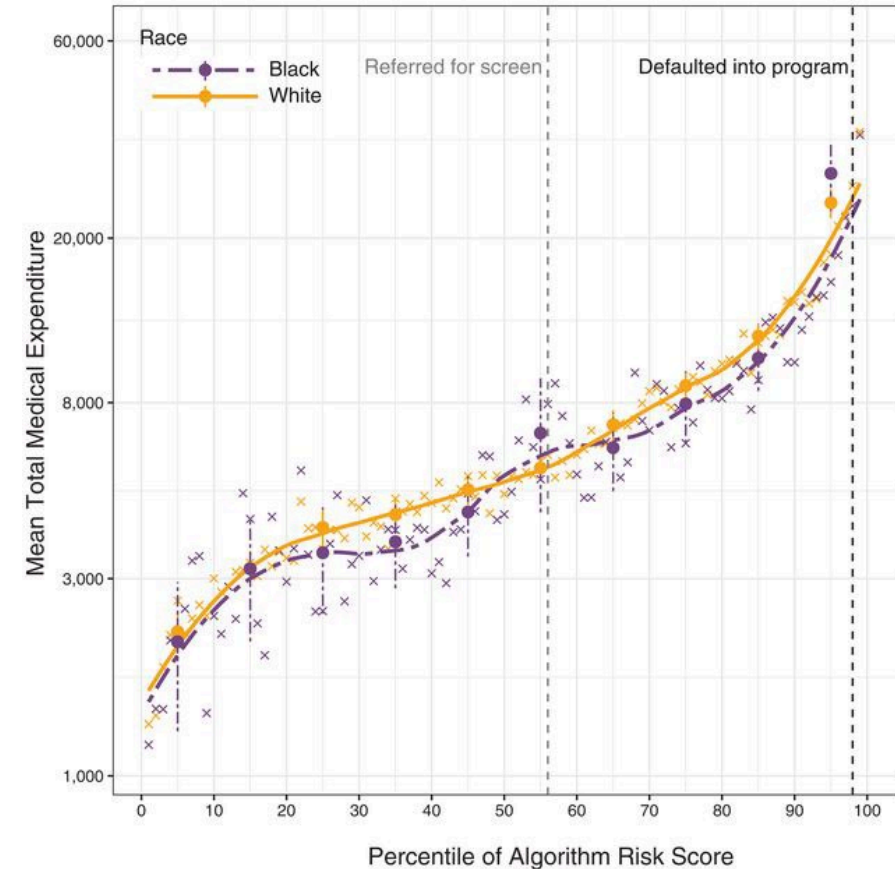
B Diabetes severity: HbA1c



Ziad Obermeyer et al. *Science* 2019;366:447-453

Complexity : add layers to workflow; don't interchange data;
can worsen burnout amongst care teams

A



5 Grand Challenges / Discussion Setup

- 1) Summarization / Granularity : many related terms used for medical care are only for billing and diagnosis, so presentation of these terms on an eCare Plan need to be grouped at the appropriate level while still allowing for precision when it is available;
- 2) Simplification / Synonymy : understanding of medical terminology is limited, and certain descriptors may be more accessible, especially for patients. A wide variety of consumer health terminologies are available to address this problem; as well, numeracy and graph literacy are variable
- 3) Prioritization by criteria : who wants to see what and when will vary substantially and tough choices will have to be made, given the limited screen space and attention; current application has limited prioritization
- 4) Adjudication of duplicate and erroneous material : a normal patient will have substantial amounts of duplicated (by concept, not code) material and erroneous information; how will adjudication happen within the application
- 5) Actionability : what displays are more likely to spur action / generate revelations

Appendix

Improving outcomes for patients with Multiple Chronic Conditions : informatics issues and solutions

David A. Dorr, MD, MS

Lipika Samal, MD, MPH

(co-author Arlene Bierman, MD)

May 19, 2020 planning meeting

The current HIT landscape is changing

- Health Information Technology has many extant problems: usability, workflow, fragmentation, lack of interoperabilities
- Policy changes and
- Maturation of HIT systems and prediction capabilities = many opportunities

21st Century Cures: U.S. Core Data for Interoperability (USCDI) + FHIR APIs 'without special effort'

USCDI v1		
Assessment and Plan of Treatment • Consultation Note • Discharge Summary Note	Laboratory • Tests • Values/Results	Provenance *NEW • Author • Author Time Stamp • Author Organization
Care Team Members Clinical Notes *NEW • History & Physical • Imaging Narrative • Laboratory Report Narrative • Pathology Report Narrative • Procedure Note • Progress Note	Medications • Medications • Medication Allergies	Smoking Status Unique Device Identifier(s) for a Patient's Implantable Device(s)
Goals • Patient Goals	Patient Demographics • First Name • Last Name • Previous Name • Middle Name (including middle initial) • Suffix • Birth Sex • Date of Birth • Race • Ethnicity • Preferred Language • Address *NEW • Phone Number *NEW	Vital Signs • Diastolic Blood Pressure • Systolic Blood Pressure • Body Height • Body Weight • Heart Rate • Respiratory rate • Body Temperature • Pulse oximetry • Inhaled oxygen concentration Pediatric Vital Signs *NEW - BMI percentile per age and sex for youth 2-20 - Weight for age per length and sex - Occipital-frontal circumference for children >3 years old
Health Concerns	Problems	
Immunizations	Procedures	

- Organizations are, in general, not ready for new era
- Can these changes help persons with multiple chronic conditions

What are scalable systems that improve outcomes for people with Multiple Chronic Conditions?

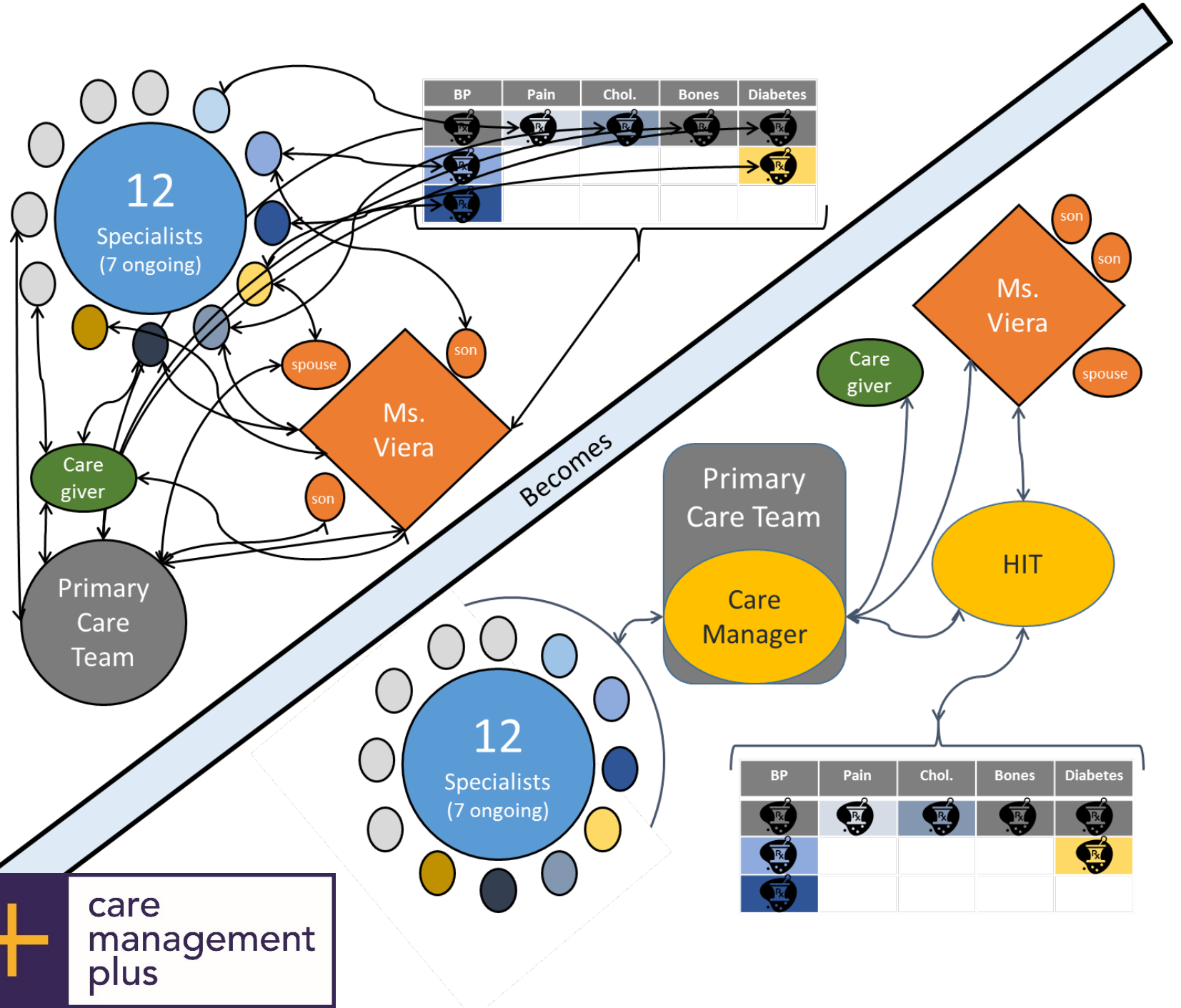
For care teams?

For health systems?

For payors?

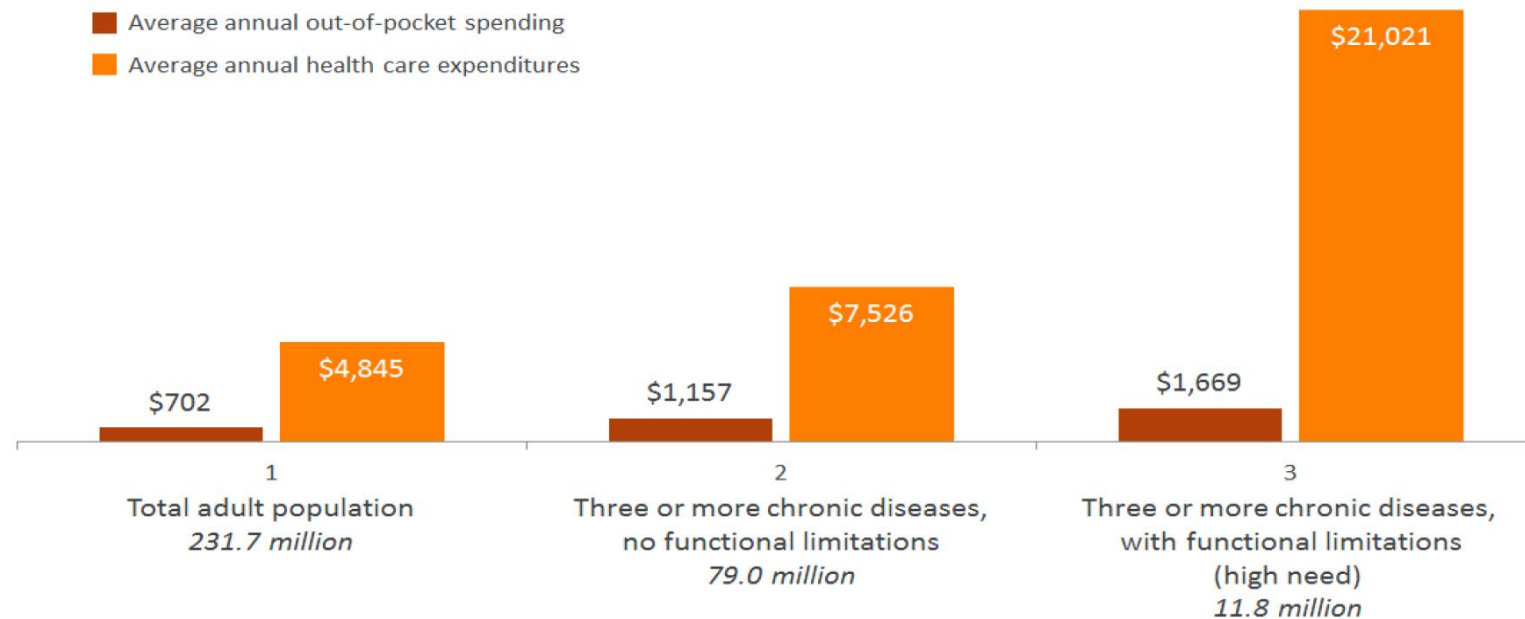
For policy-makers?

Funded by **John A. Hartford Foundation**, NLM, AHRQ, and Gordon and Betty Moore Foundation



What data are needed to understand care and outcomes for people with MCCs? Just chronic conditions?

Adults with High Needs Have Higher Health Care Spending and Out-of-Pocket Costs



Note: Noninstitutionalized civilian population age 18 and older.
Data: 2009–2011 Medical Expenditure Panel Survey (MEPS). Analysis by C. A. [Salzberg](#), Johns Hopkins University.

SOURCE: S. L. Hayes, C. A. Salzberg, D. McCarthy, D. C. Radley, M. K. Abrams, T. Shah, and G. F. Anderson, High-Need, High-Cost Patients: Who Are They and How Do They Use Health Care? The Commonwealth Fund, August 2016.

Biopsychosocial factors play a significant role in MCC outcomes

Figure 1. Overlapping Biopsychosocial Domains

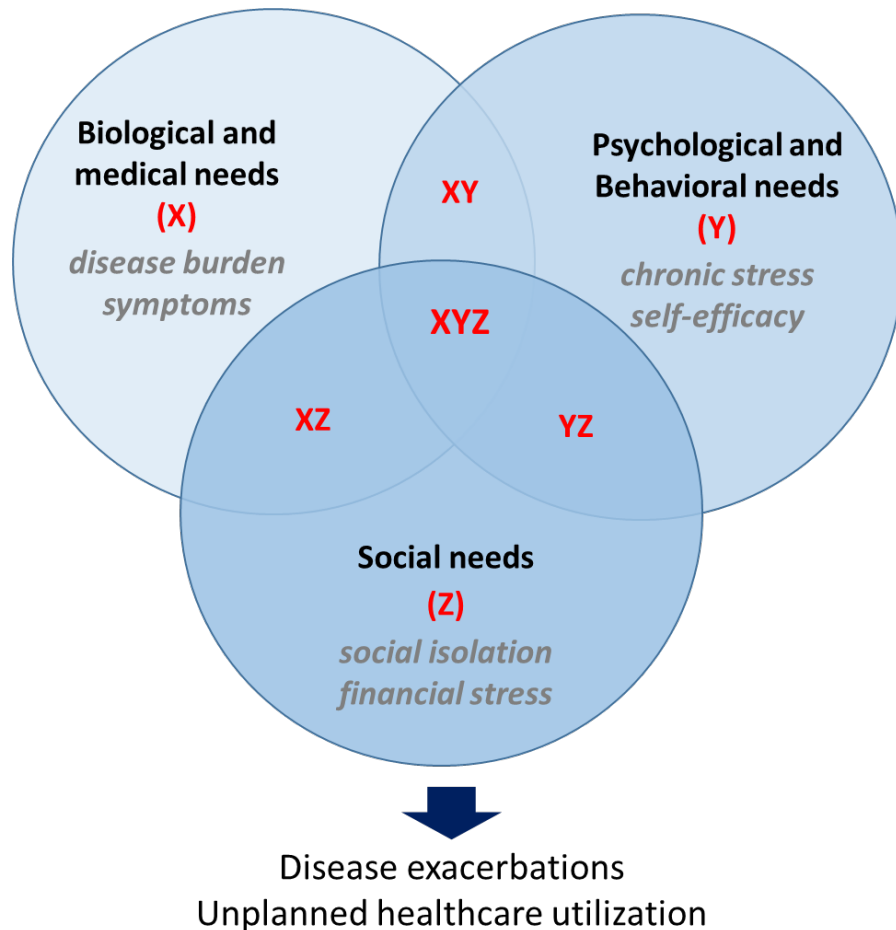
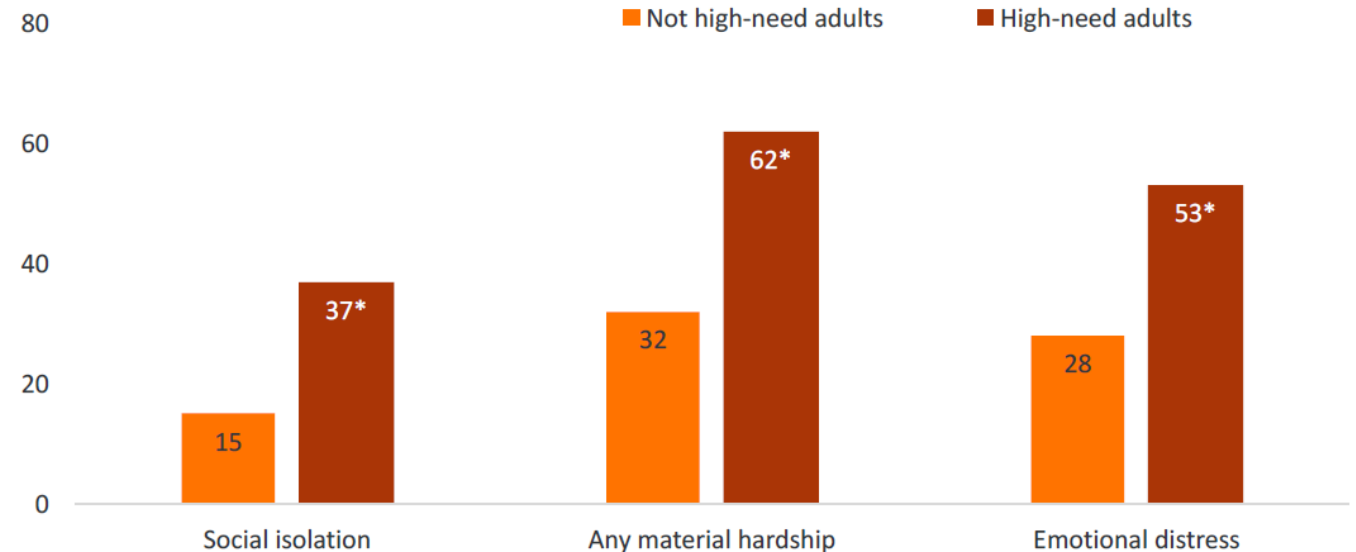


Exhibit 1

Poverty and Social Isolation Are More Prevalent Among High-Need Patients

Percent reporting experiencing . . .



Notes: Social isolation = Reported often feeling left out, lacking companionship, or feeling isolated from others. Any material hardship = Reported worry or stress about having enough money to pay rent/mortgage, pay gas/oil/electric, or buy nutritious meals in the past year.

* Significantly different from not high-need adults at the $p < 0.05$ level.

Data: The 2016 Commonwealth Fund Survey of High-Need Patients, June–September 2016.

And the factors that may predict outcomes vary in impact and over time

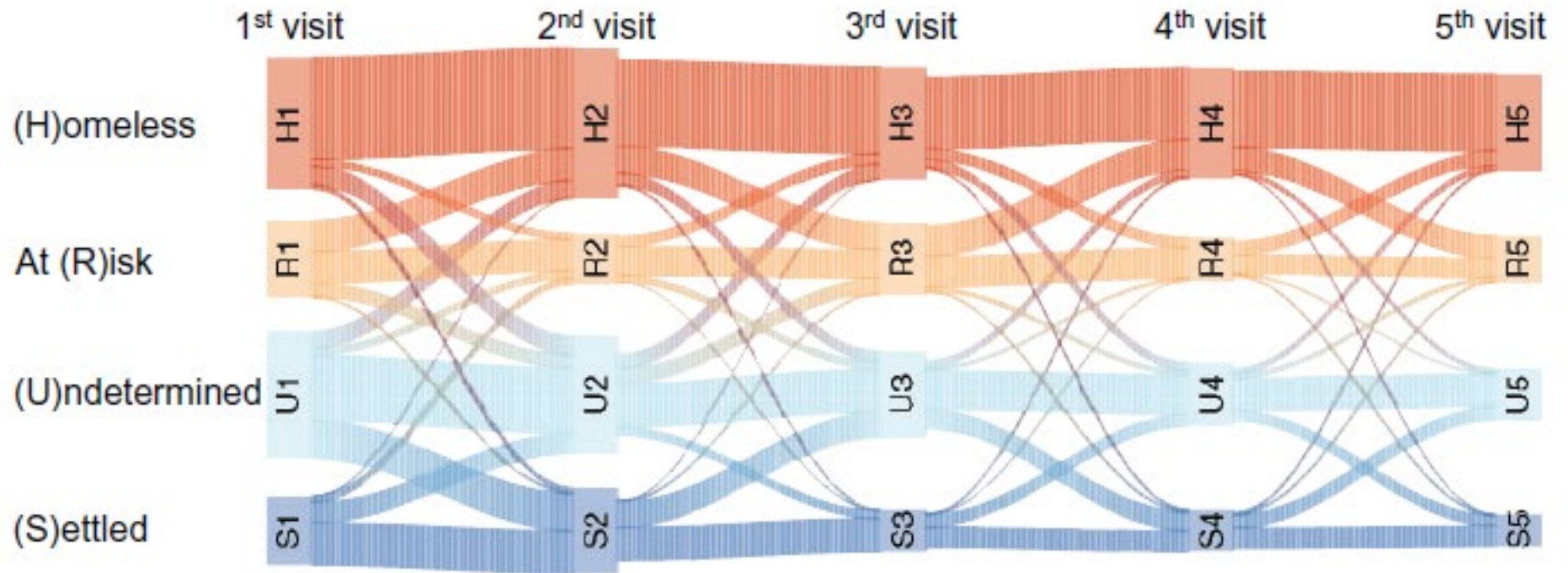


Figure 6. Trends in homelessness status across patient visits

Digital divide

- Only 29.1% of patients at an urban health care system used the patient portal.

Perzynski AT, Roach MJ, Shick S, Callahan B, Gunzler D, Cebul R, Kaelber DC, Huml A, Thornton JD, Einstadter D. Patient portals and broadband internet inequality. *J Am Med Inform Assoc.* 2017 Sep 1;24(5):927-932.

- Lower education and older age negatively impact portal use.
- Higher % of Hispanic patients associated with lower portal use.
- Internet broadband access is associated with portal use even after controlling for sociodemographic factors.

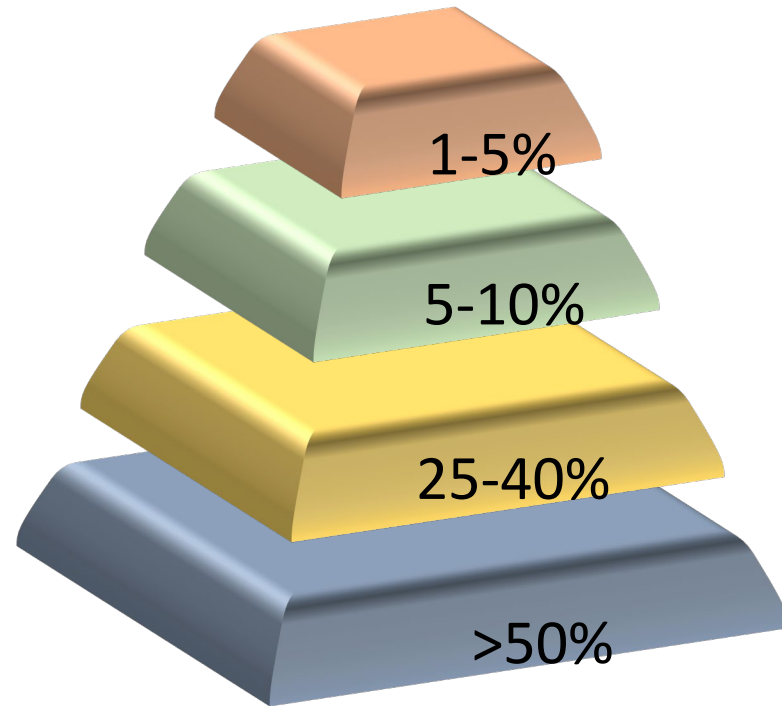
Rodriguez JA, Lipsitz SR, Lyles CR, Samal L. Association Between Patient Portal Use and Broadband Access: a National Evaluation [published online ahead of print]. *J Gen Intern Med.* 2020

The Current* Capabilities of Health Information Technology to Support Care Transitions

AHRQ Care Coordination Activities	Current Capability of HIT	Potential for HIT
Establish Accountability or Negotiate Responsibility	+	++
<i>Communicate</i>		
Interpersonal Communication	+	+
Information Transfer	++	+++
Facilitate Transitions	+	++
Assess Needs and Goals	+	++
Create a Proactive Plan of Care	+	++
Monitor, Follow Up, and Respond to Change	++	+++
Support Self-Management Goals	+	+++
Link to Community Resources	+	+++
Align Resources with Patient and Population Needs	+++	+++

Samal BMC Health Services 2016, * updated for 2020

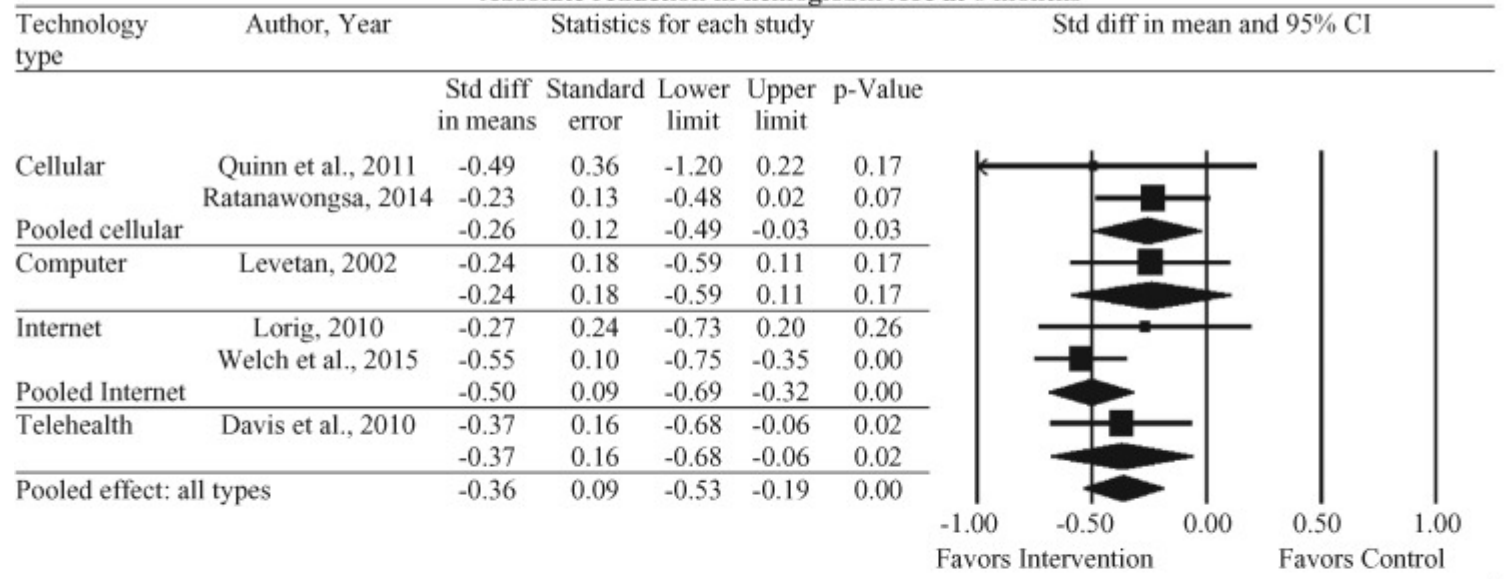
Prediction of meaningful outcomes for at risk, vulnerable populations



Risk	Definition (e.g.)
Highest	Multiple Social, Behavioral, Mental, and Chronic issues
High	Severe/ uncontrolled illness or multiple controlled issues
Moderate	Controlled, stable issues
Low	Preventive needs or limited chronic issues

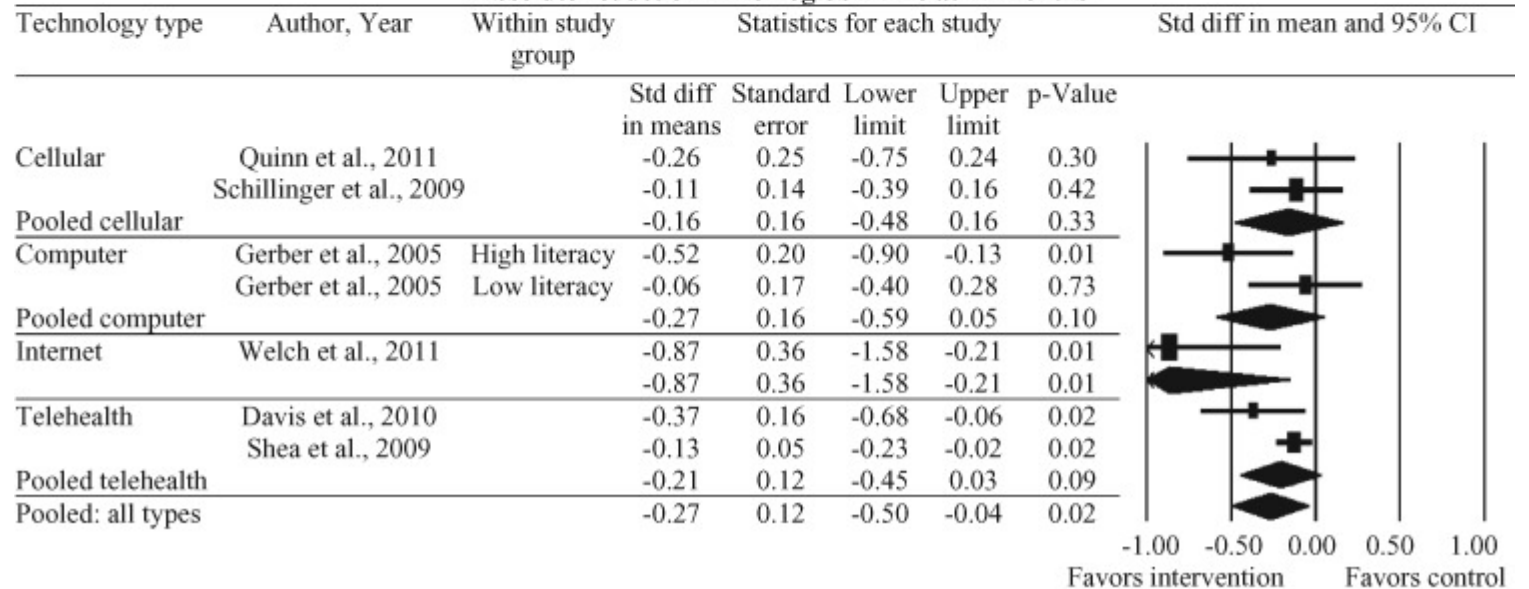
Self-management support with HIT

Absolute reduction in hemoglobin A1c at 6 months



Random effects model, Cochran Q = 5.0, p-Value = 0.41, I square = 35.1%

Absolute reduction in hemoglobin A1c at 12 months



Random effects model, Cochran Q = 10.4, p-Value = 0.11, I square = 42.4%

[J Am Med Inform Assoc. 2017 Sep; 24\(5\): 1024–1035.](#)

Examples of meeting needs of patients with MCCs via HIT solutions

- Electronic care plan for CKD

Draft-CKD-DESS-7-29-19-for-web.xlsx [Protected View] - Excel

PROTECTED VIEW Be careful—files from the Internet can contain viruses. Unless you need to edit, it's safer to stay in Protected View. [Enable Editing](#)

A83 : Immunizations

A	B	L	N
Indicator (Question, measurement)	Data Element Definition	SNOMED ID	RxNorm Code (notation)
Medications			
Angiotensin Receptor Blocker (ARB)	Perscription of RAAS blocker (ARB)	410683008 Angiotensin II receptor antagonist therapy (procedure) > 395010006 Angiotensin II receptor antagonist prophylaxis (procedure) 448531000124107 Prescription of angiotensin II receptor antagonist (procedure) 96308008 Product containing angiotensin II receptor antagonist (product)	n/a
Angiotensin Converting Enzyme Inhibitor (ACEI)	Perscription of RAAS blocker (ACEI)	41549009 Angiotensin-converting enzyme inhibitor agent (product) 410682003 Angiotensin converting enzyme inhibitor therapy (procedure)	n/a
Candesartan cilexetil (Atacand)	Perscription of candesartan cilexetil	108587008 Product containing candesartan (medicinal product) 108589006 Product containing candesartan cilexetil (medicinal product) 376998003 Product containing precisely candesartan cilexetil 32 milligram/1 each conventional release oral tablet (clinical drug) 318980005 Product containing precisely candesartan cilexetil 16 milligram/1 each conventional release oral tablet (clinical drug) 318979007 Product containing precisely candesartan cilexetil 8 milligram/1 each conventional release oral tablet (clinical drug)	135481 Candesartan cilexetil 577780 Candesartan cilexetil 32 MG 577775 Candesartan cilexetil 16 MG 540788 Candesartan cilexetil 8 MG 540781 Candesartan cilexetil 4 MG 639535 Candesartan cilexetil 2 MG 215458 Atacand
Candesartan / Hydrochlorothiazide (Atacand HCT)	Perscription of candesartan hct	768800004 Product containing candesartan and hydrochlorothiazide (medicinal product) 768047007 Product containing candesartan and hydrochlorothiazide in oral dosage form (medicinal product form) 409181005 Product containing precisely candesartan cilexetil 32 milligram and hydrochlorothiazide 12.5 milligram/1 each conventional release oral tablet (clinical drug) 377262008 Product containing precisely candesartan cilexetil 16 milligram and hydrochlorothiazide 12.5 milligram/1 each conventional release oral tablet (clinical drug)	284662 Atacand HCT 1172182 Atacand HCT Pill 805861 Candesartan cilexetil 16 MG / Hydrochlorothiazide 12.5 MG 805857 Candesartan cilexetil 32 MG / Hydrochlorothiazide 12.5 MG 805853 Candesartan cilexetil 32 MG / Hydrochlorothiazide 25 MG 1172183 Atacand HCT Oral Product 805854 Candesartan / Hydrochlorothiazide Oral Tablet [Atacand HCT]
Irbesartan (Avapro)	Perscription of irbesartan	108585000 Product containing irbesartan (medicinal product) 318970006 Product containing precisely irbesartan 300 milligram/1 each conventional release oral tablet (clinical drug) 318969005 Product containing precisely irbesartan 150 milligram/1 each conventional release oral tablet (clinical drug) 318968002 Product containing precisely irbesartan 75 milligram/1 each conventional release oral tablet (clinical drug)	83818 Irbesartan 1161332 Irbesartan Oral Product 1161333 Irbesartan Pill 370704 Irbesartan Oral Tablet 316100 Irbesartan 75 MG 200094 Irbesartan 75 MG Oral Tablet 316098 Irbesartan 150 MG
Irbesartan / hydrochlorothiazide (Avalide)	Perscription of irbesartan hydrochlorothiazide	108585000 Product containing irbesartan (medicinal product) 91667005 Product containing hydrochlorothiazide (medicinal product) 398914000 Product containing hydrochlorothiazide and irbesartan (medicinal product) 134460003 Product containing precisely hydrochlorothiazide 12.5 milligram and irbesartan 300 milligram/1 each conventional release oral tablet (clinical drug)	1162157 Hydrochlorothiazide / Irbesartan Pill 1162156 Hydrochlorothiazide / Irbesartan Oral Product 370705 Hydrochlorothiazide / Irbesartan Oral Tablet 310792 Hydrochlorothiazide 12.5 MG / Irbesartan 150 MG Oral Tablet 310793 Hydrochlorothiazide 12.5 MG / Irbesartan 300 MG Oral Tablet

Header | Health Concerns | Goals | **Interventions** | HS Eval + Outcomes

Need to integrate these care plans with the voice of the person and their goals

Patient Worksheet and Care Plan

Care Actions					
Diabetes	Date/Value	Status	Preventative Care	Date/Value	Status
A1c in Last 6 mo	10/06/2009	OK	Patient > 50 needs flu shot at least once		YES
A1c < 7	9.1	A1c out of Range			
LDL Last Year	09/30/2009	OK			
LDL < 100	130	LDL HIGH			

Utilization			
ED Visit	12/22/2012	Last Office Visit	05/25/2014
Hospitalization	No Hospitalizations.	Next Visit	None Scheduled.

Wilcox, 2005
 Other examples
 Dalal et al, ACI, 2019
 Coleman EA – Care Transitions intervention

Goals:
What brings you joy?
What matters in life?
 or
 Increase walking 5 times per week.
 or
 A1c < 8.0%.

- Generate summarized clinical information
- Facilitate structured conversations

lamotrigine 150 mg tablet Take 150 mg by mouth once daily. Give at 5pm

Further references

- Unruh, Kenton T., and Wanda Pratt. 2007 "Patients as Actors: The Patient's Role in Detecting, Preventing, and Recovering from Medical Errors." *International Journal of Medical Informatics* 76(Supplement 1): 236-44.
- <https://pubmed.ncbi.nlm.nih.gov/30663782/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4841960/>
- <https://www.nap.edu/read/12821/chapter/18#113>

<https://ecareplan.ahrq.gov/>

Thank you!

David Dorr

- dorrd@ohsu.edu
- www.ohsu.edu/cmp

Lipika Samal

- lsamal@bwh.harvard.edu
- <https://connects.catalyst.harvard.edu/Profiles/display/Person/92446>