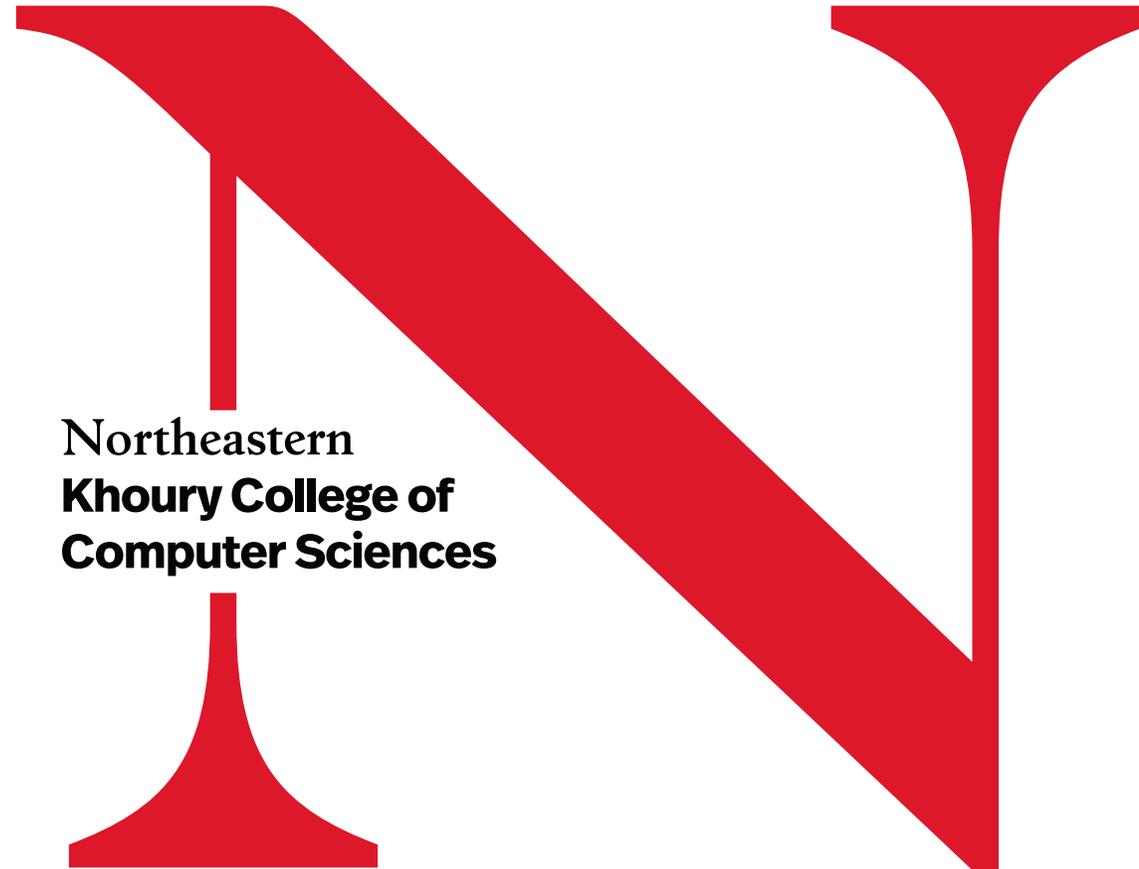


Socio-technical Approaches to Maintaining Health and Wellness

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Dean and Professor

May 4, 2022



Northeastern
**Khoury College of
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My beginning: Ubiquitous Computing at Xerox PARC / Georgia Tech

Understand the *transformation of everyday life as computing is ubiquitously integrated* into informal daily activities

Pervasive sensing
Natural interaction
Context-aware

Health is personal, social, and negotiated.



Charting Past, Present, and Future Research in Ubiquitous Computing

GREGORY D. ABOWD and ELIZABETH D. MYNATT
Georgia Institute of Technology

The proliferation of computing into the physical world promises more than the ubiquitous availability of computing infrastructure; it suggests new paradigms of interaction inspired by constant access to information and computational capabilities. For the past decade, application-driven research in ubiquitous computing (ubicomp) has pushed three interaction themes: *natural interfaces*, *context-aware applications*, and *automated capture and access*. To chart a course for future research in ubiquitous computing, we review the accomplishments of these efforts and point to remaining research challenges. Research in ubiquitous computing implicitly requires addressing some notion of scale, whether in the number and type of devices, the physical space of distributed computing, or the number of people using a system. We posit a new area of applications research, *everyday computing*, focussed on scaling interaction with respect to time. Just as pushing the availability of computing away from the traditional desktop fundamentally changes the relationship between humans and computers, providing *continuous* interaction moves computing from a localized tool to a constant companion. Designing for continuous interaction requires addressing interruption and resumption of interaction, representing passages of time and providing associative storage models. Inherent in all of these interaction themes are difficult issues in the *social implications* of ubiquitous computing and the challenges of *evaluating* ubiquitous computing research. Although cumulative experience points to lessons in privacy, security, visibility, and control, there are no simple guidelines for steering research efforts. Akin to any efforts involving new technologies, evaluation strategies form a spectrum from technology feasibility efforts to long-term use



Ubicomp, HCI and Healthcare

Ubicomp Principles

Pervasive Sensing
Natural Interaction
Context-Aware

HCI Design Process

Ethnographic inquiry and informants
Participatory design
Field evaluation

Interventions to Improve

Awareness
(self and by caregivers)

Problem Solving
("be a detective")

Patient Engagement

Compensatory Cognitive
Scaffolding

Health Theoretical Base

Locus of Control
Social Cognitive Theory
Identify presentation
Health Belief Model
Trans. Model of Change
Social Comparison Theory
Cultivation Theory
Sensemaking

Health Outcomes

Independence
Disease management
Behavior change
Scale of healthcare delivery



Digital Family Portrait: Designing for Peace of Mind

Caregiver awareness

Motion sensing to visualize 28 days of activity plus daily detail

Was today a normal day?

“Invisible” social connection



Rowan, Jim, and Elizabeth D. Mynatt. "Digital family portrait field trial: Support for aging in place." *Proceedings of the SIGCHI conference on Human factors in computing systems*. ACM, 2005.

NSF# 0121661- ITR/SY: The Aware Home: Sustaining the Quality of Life for an Aging Population



Tools for Diabetes Management

Mobile and web tools that empower patients to learn diabetes mgmt skills.

Patients can easily record and compare data from daily life activities.

Learn to be a detective.

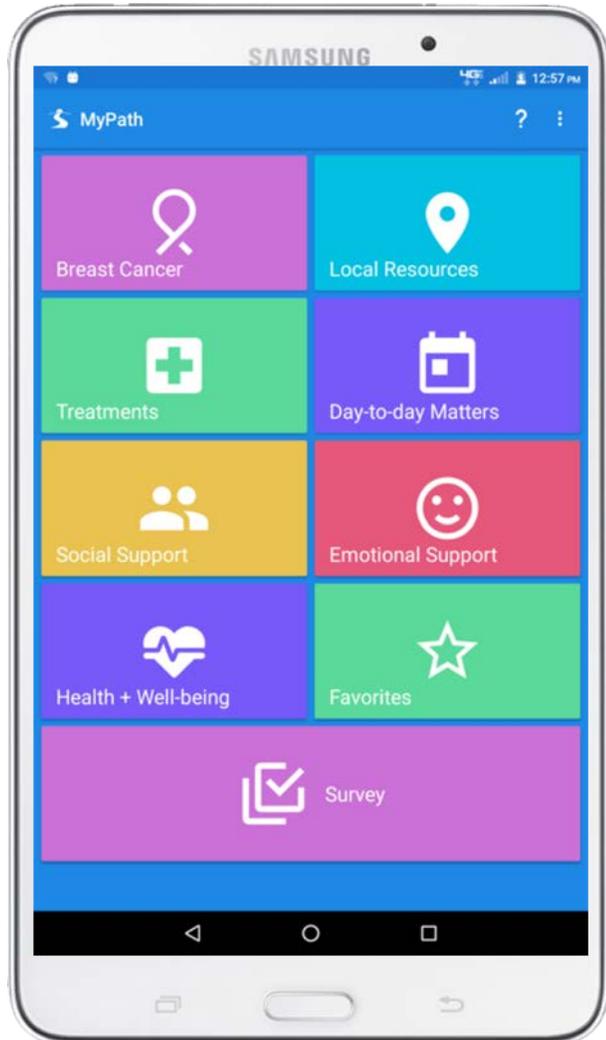
Mamykina, Lena, et al. "MAHI: investigation of social scaffolding for reflective thinking in diabetes management." CHI-CONFERENCE-. Vol. 1. ACM INC, 2008.

Mamykina, Lena, et al. "Constructing identities through storytelling in diabetes management." CHI-CONFERENCE-. Vol. 1. ACM INC, 2010.

NSF 0915934 - HCC: SMALL:Technologies for Nutrition and Diabetes Management



Designing for the Healthcare Journey



Supporting the cancer journey
Tailor information delivery and interaction to phases of care and recovery.

- 1 Holistic**
- 2 Personalized**
- 3 Adaptive**

Jacobs, M., Clawson, J., Mynatt, E.D. 2014. "Cancer Navigation: Opportunities and Challenges for Facilitating the Breast Cancer Journey," Proceedings of the ACM 2014 conference on Computer Supported Cooperative Work (CSCW 2014),

Jacobs, M., Clawson, J., Mynatt, E.D. 2014. "MJC: A Preliminary Investigation of a Mobile Tool for Cancer Patients," in Proceedings of the 32nd International Conference on Human Factors in Computing Systems (CHI '14)

Funded by GA DCH and ONC: Rome Challenge Project, Consumer Mediated Health Information Exchange #12036G-ARRA National Institute of Health (RO1 CA195653)



Google Home Hub Studies



Useful for: getting the weather, time of day, answering questions, finding recipes

Understand how people with MCI and their care partners (dyads) would use a conversational assistant “out of the box” comparing their use to other older adults

Naturalistic deployments; recruiting from the Cognitive Empowerment Program (CEP) at Emory; Log use of the GHH for a period of 10 weeks

Discern differences within dyads

Assess the impact of training on use and adoption

- Pod 1: Exploratory & training materials iteratively developed
- Pod 2: Training materials provided at onset
- Pod 3. Training materials @ onset + weekly emails and weekly support sessions

Assess specialized skills for medication management by “checking in”

Useful for: listening to songs, watching videos, listening to news, games

Useful for: weekly scheduling, medication management, pet coordination, mealtime reminding

Zubatiy, T., Mathur, N., Vickers, K.L., and Mynatt, E.D. (2021). Empowering Dyads of Older Adults with Mild Cognitive Impairment and Their Care Partners Using Conversational Agents. In *CHI Conference on Human Factors in Computing Systems (CHI'21)*, May 8-13, 2021. Yokohama, Japan. ACM. New York, NY, USA,



Caregiver
awareness



Low resolution
motion detection
+ social
connection

Motion sensing

Visualize 28 days of
activity plus daily detail

Was today a normal day?

**Embed into existing
social relationships**

NEED:

**Tailorable for different
relationships / contexts**

Caregiver awareness



Low resolution motion detection + social connection

Problem solving
"Be a detective"



Expose context to aid collaborative sense-making

Mobile and web tools that empower patients to learn diabetes mgmt skills.

Patients can easily record data from daily life activities.

Diabetes educator able to "see" details of decision making and frustrations

NEED:
Personalized goal setting and decision making



<p>Caregiver awareness</p>		<p>Low resolution motion detection + social connection</p>
<p>Problem solving "Be a detective"</p>		<p>Expose context to aid collaborative sense-making</p>
<p>Support cancer journey</p>		<p>Personalized healthcare coaches</p>

Tailor information delivery and interaction to phases of care and recovery. Respond to surveys with specific resources.

NEED:

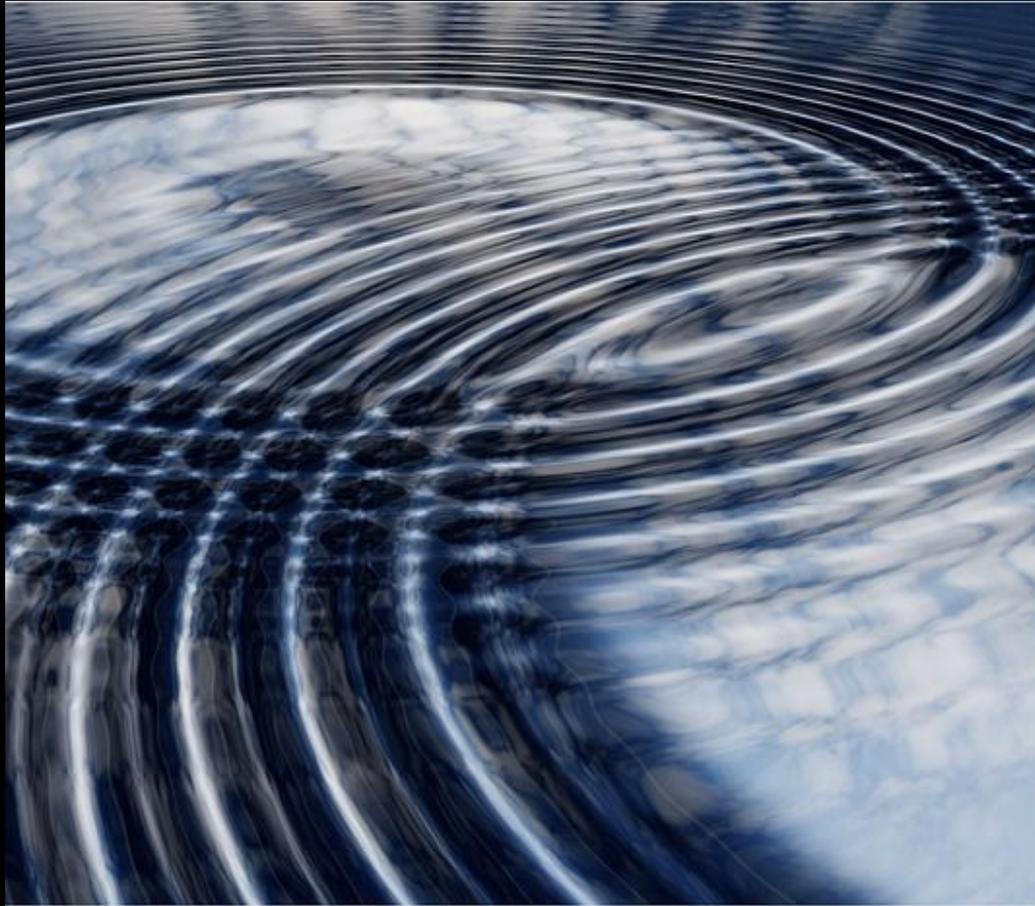
Hyper personalization;
Journey phenotyping

<p>Caregiver awareness</p>		<p>Low resolution motion detection + social connection</p>
<p>Problem solving "Be a detective"</p>		<p>Expose context to aid collaborative sense-making</p>
<p>Support cancer journey</p>		<p>Personalized healthcare coaches</p>
<p>Support daily activities</p>		<p>Conversational assistants for dyads; checking-in</p>

Support caregiver scaffolding, cohort training and "checking in" vs reminders

NEED:
Ability to initiate interaction; support for routines and flexible arenas

Critical Lenses



Disability Studies

Diffractive Analysis

Combating Intervention
Generated Inequality and Health
Disparities



Living Disability Theory: Reflections on Access, Research, and Design

Ableism: Prejudice against and erasure of disabled people's perspectives

Oversimplification: Framing disability as discrete and isolated blocks of diagnosis

Connection: Undervaluing supports, systems of professional, familiar, and caring relationships

- Destabilize on-going obsessions with clear, static, decontextualized conceptions of disability.
- Embracing contextualized and embodied lived experiences of disabled people

Megan Hofmann, Devva Kasnitz, Jennifer Mankoff, and Cynthia L Bennett. 2020. Living Disability Theory: Reflections on Access, Research, and Design. In The 22nd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '20). Association for Computing Machinery, New York, NY, USA, Article 4, 1–13.



Diffraction Analysis

IoT for the Home

- Monitoring and automation
- Social connection, peace of mind

IoT for Aging

- Reminders
- Safety

Older Adults NOT for IoT

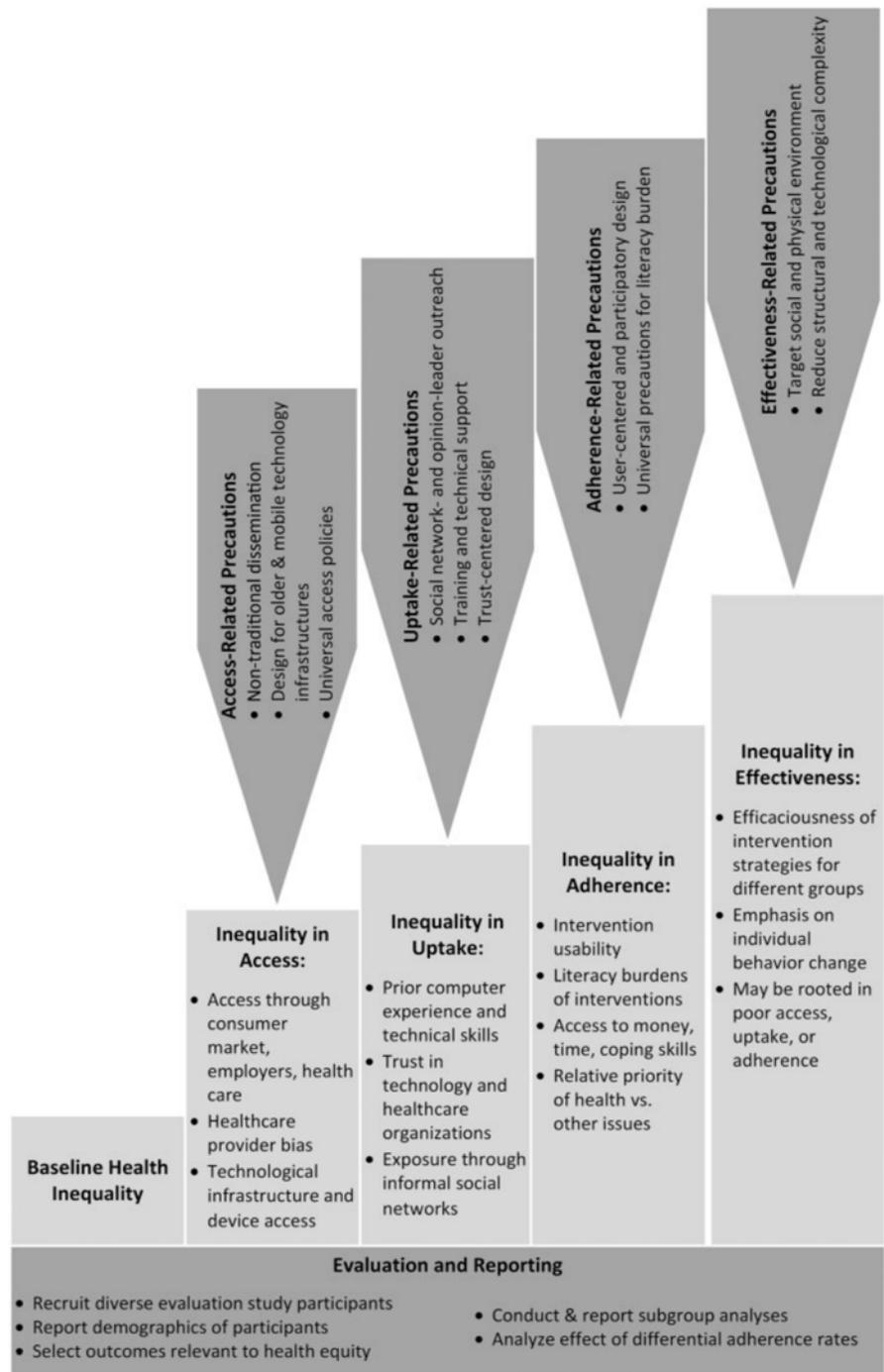
- Critical reflection
- Performative, Sex, Drinking



The goal is to learn more about what does or does not ripple through the apparatus, to better understand the phenomena being studied and/or the apparatus itself.

- Research Futures: Holiday Decorating
- Transferability and Novelty
- Methodological Approaches





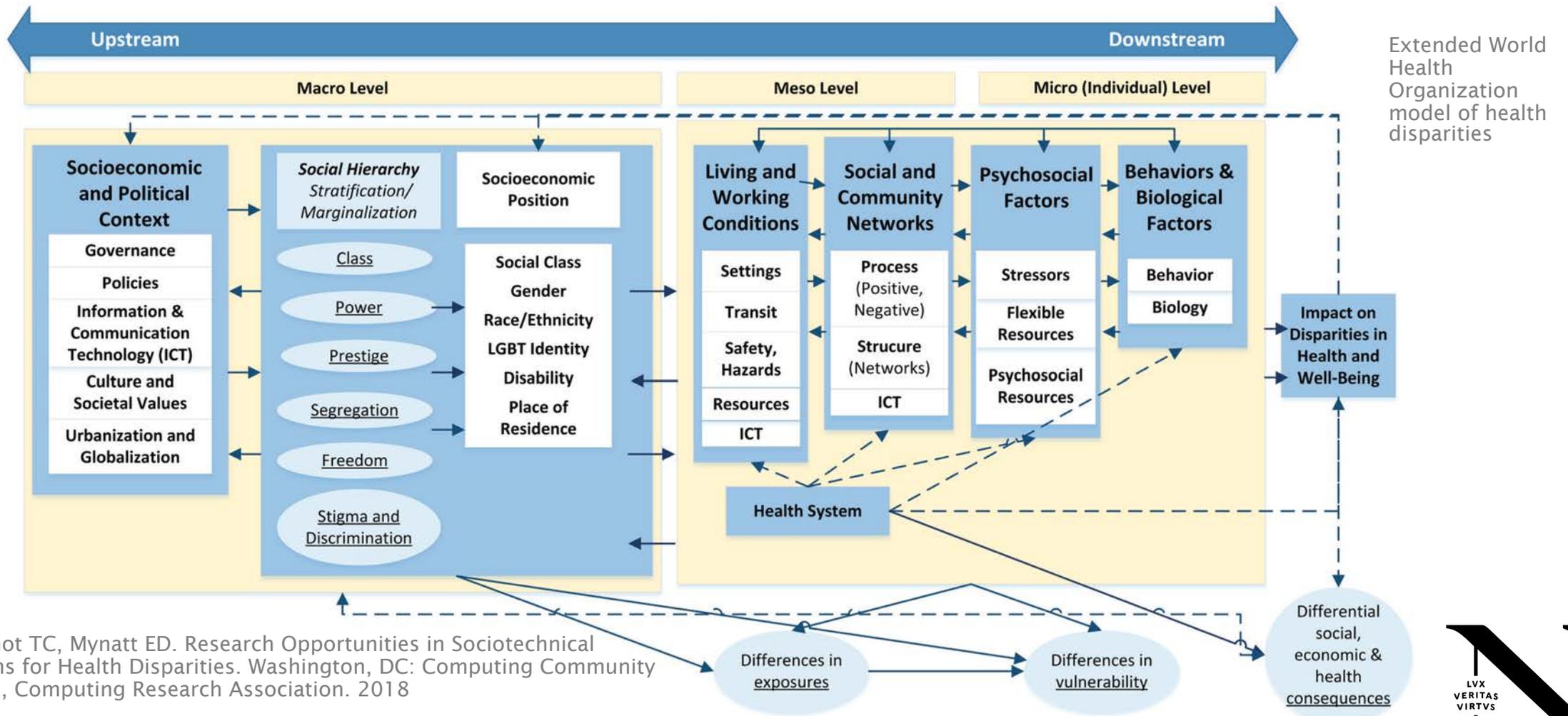
Combating Intervention Generated Inequality

- Inequality in Access
- Inequality in Uptake
- Inequality in Adherence
- Inequality in Effectiveness

Veinot TC, Mitchell H and Ancker JS. Good intentions are not enough: how informatics interventions can worsen inequality. Journal of the American Medical Informatics Association. 2018;25:1080-1088.



Combatting Health Disparities

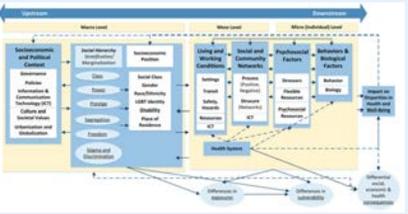


Extended World Health Organization model of health disparities

Siek K, Veinot TC, Mynatt ED. Research Opportunities in Sociotechnical Interventions for Health Disparities. Washington, DC: Computing Community Consortium, Computing Research Association. 2018

Veinot, Tiffany & Ancker, Jessica & Cole-Lewis, Heather & Mynatt, Elizabeth & Parker, Andrea & Siek, Katie & Mamykina, Lena. (2019). Leveling Up: On the Potential of Upstream Health Informatics Interventions to Enhance Health Equity. Medical care. 57 Suppl 6 Suppl 2. S108-S114.



<p>Caregiver awareness</p>		<p>Low resolution motion detection + social connection</p>	<p>Tailorable for different relationships</p>	<p>Design for varying degrees of trust, disclosure and privacy. How to support non dyadic family relationships.</p>
<p>Problem solving "Be a detective"</p>		<p>Expose context to aid collaborative sense-making</p>	<p>Personalized goal setting and decision making</p>	<p>Community centric advice and support. Culturally relevant suggestions. How to establish trust?</p>
<p>Support cancer journey</p>		<p>Personalized healthcare Coaches</p>	<p>Hyper personalization; Journey phenotyping</p>	<p>Connect to community services and peer support. How to establish trust?</p>
<p>Support daily activities</p>		<p>Conversational assistants for dyads; checking-in</p>	<p>Ability to initiate interaction; support for routines and flexible arenas</p>	<p>Social modeling based on trust, power and autonomy.</p>
<p>Inclusive Equitable Healthcare</p>		<p>Community-based interventions</p>	<p>Age-proof holistic design. New socio-technical-economic models</p>	<p>Design for the most vulnerable. Capability models (not deficits) Interrogate all data. Create multi-sided, upstream interventions</p>

Ubicomp, HCI and **Inclusive, Equitable** Healthcare

Ubicomp Principles

Pervasive Sensing
Natural Interaction
Context-Aware
Longitudinal Collaborative AI

HCI Design Process

Ethnographic inquiry and informants
Participatory design
Service design
Diffractive reading
Field evaluation

Interventions to Improve

Awareness
(self and by caregivers)

Problem Solving
("be a detective")

Wellness Empowerment

Trusted Person-Centered Care

Equitable access and outcomes

Health Theoretical Base

Disability Studies

Social Cognitive Theory

Identify presentation

Health Belief Model



Social Comparison Theory

Cultivation Theory

Sensemaking

Health Outcomes

Independence

Community engagement

Disease management

Behavior change

Scale of healthcare delivery

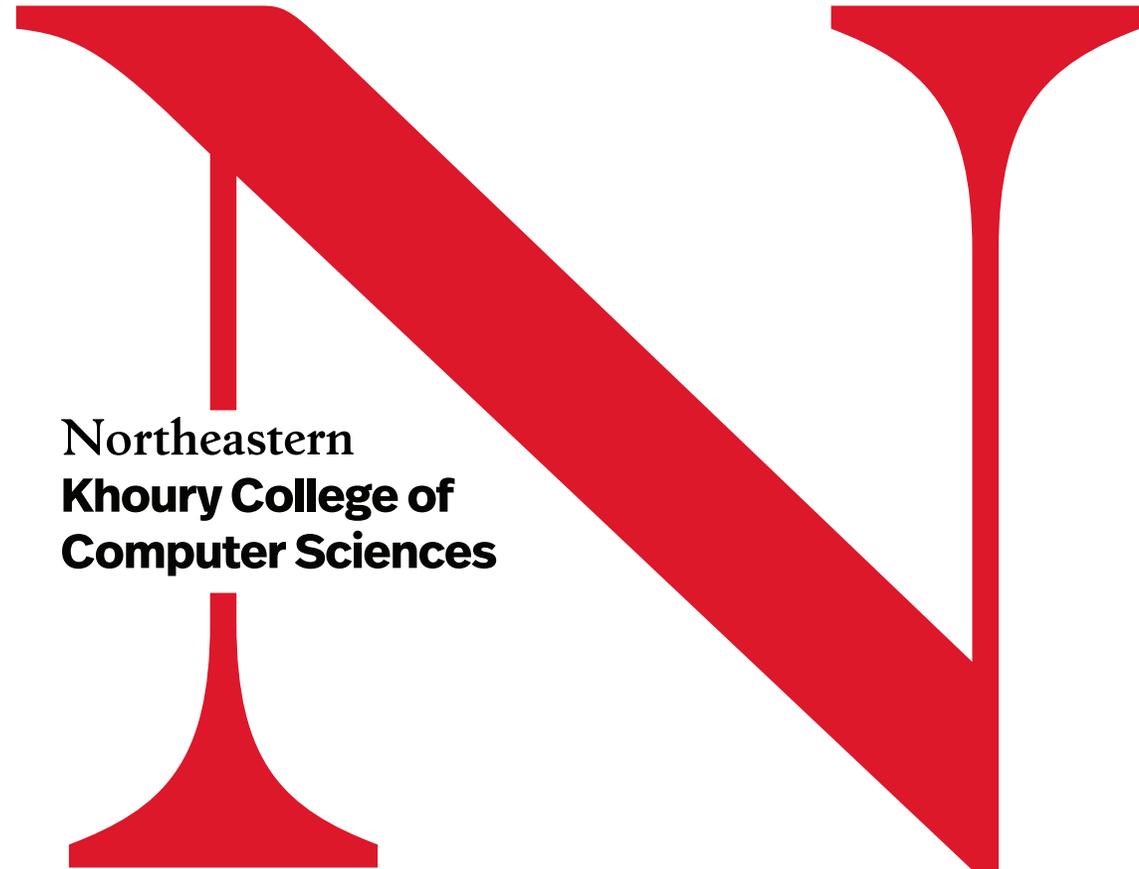


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