

How health informatics interventions can worsen inequality

By: Tiffany Veinot, MLS, PhD

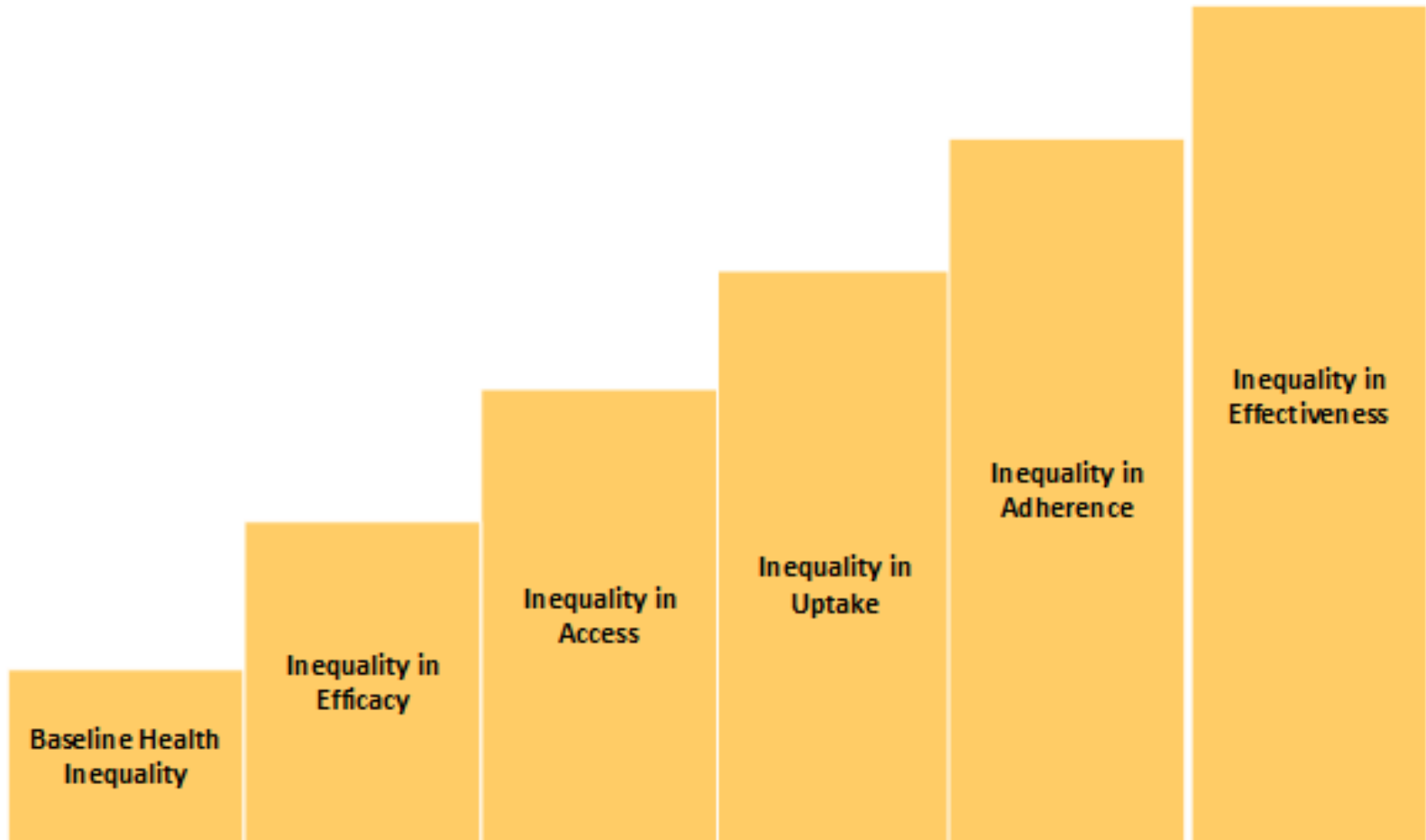
Key Takeaways

- Health informatics interventions are at particular risk of fostering Intervention-Generated Inequalities (IGI)
- IGI can emerge at 5 stages of the intervention cycle
- Precautionary measures are necessary to guard against IGI emerging from informatics interventions

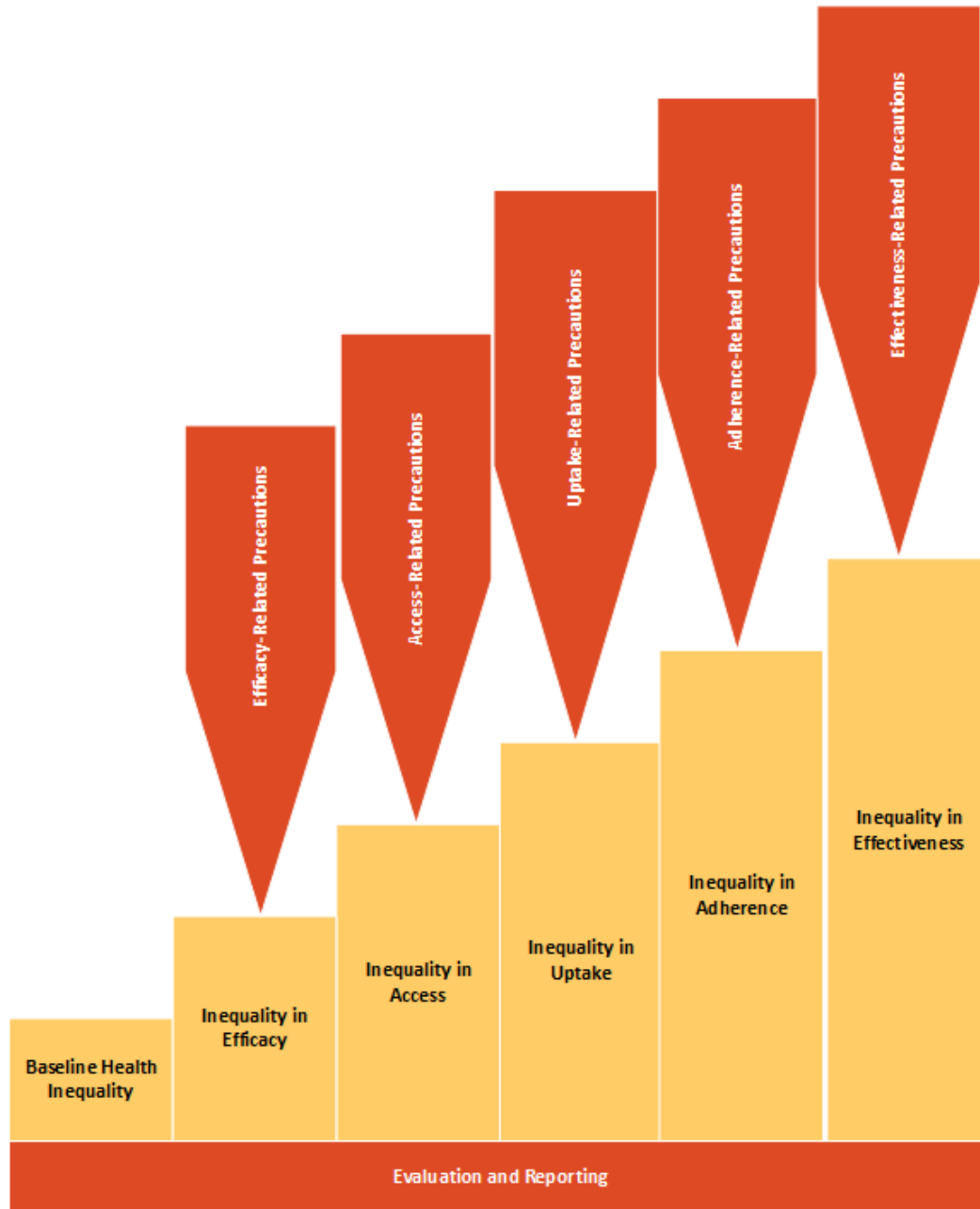
Intervention- Generated Inequality (IGI):

when interventions
disproportionately benefit
advantaged groups.

IGI and Intervention Stages



Taking Action to Prevent IGI



STAGE 1: EFFICACY — *Design of investigational interventions*

Stage 1: Efficacy

- Gender and informatics interventions for physical activity (PA)
 - PA interventions for older adults
 - Greater increase in PA for men than women
 - Pedometer + accelerometers + nurse visits, goal setting, PA diary
 - Stronger effects for men than women
 - Print vs web-delivered PA intervention – visualizations, education, tailored content
 - web version produced a decrease in PA days for women but not men.

(Elbert, Dijkstra, Oenema, 2016; Haapala et al., 2009; Harris et al., 2015; Partridge et al., 2016; Peels et al., 2014; Springviolet et al., 2015)

Stage 1: Efficacy

How do differences arise?

- More able to advantage of & be supported by tech
- Gender
 - Gender roles - likelihood & level of use
- Socioeconomic status
 - Education, money, time (e.g., multiple jobs)
 - Networks with novel information and tech skills
- Neighborhood factors – local resources
- Racial inequities
 - Discrimination + cumulative effects of stressors
 - Differential treatment in medical contexts
 - Less likely to have a usual source of care

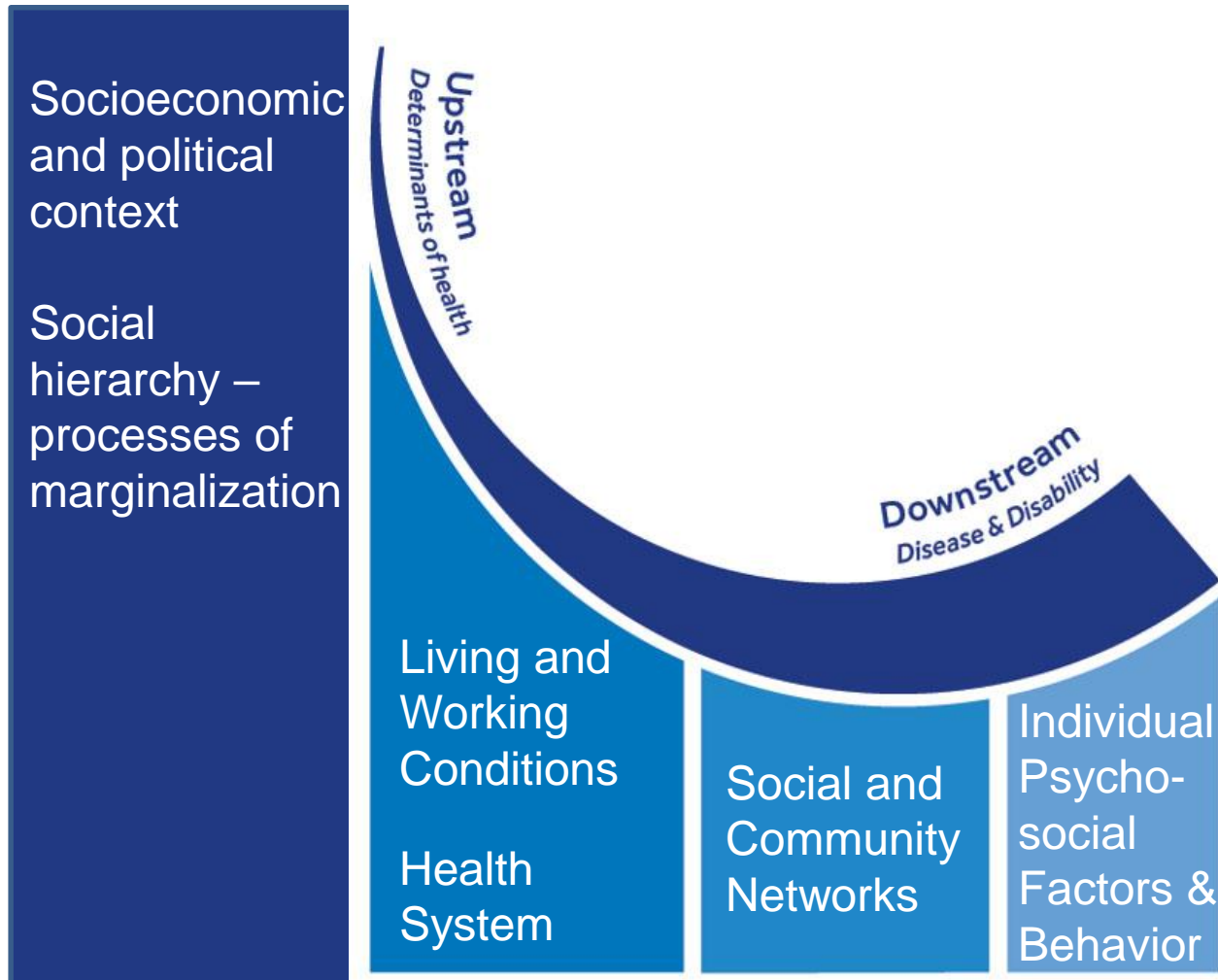
Stage 1: Efficacy

Precautions to avoid IGI

- Develop targeted interventions for health disparity populations
 - But pay attention to the diversity within the “vulnerable” group:
 - not monolithic and there are further within-group disparities (e.g., Black women living longer than Black men)
 - There is a need for more intersectional work

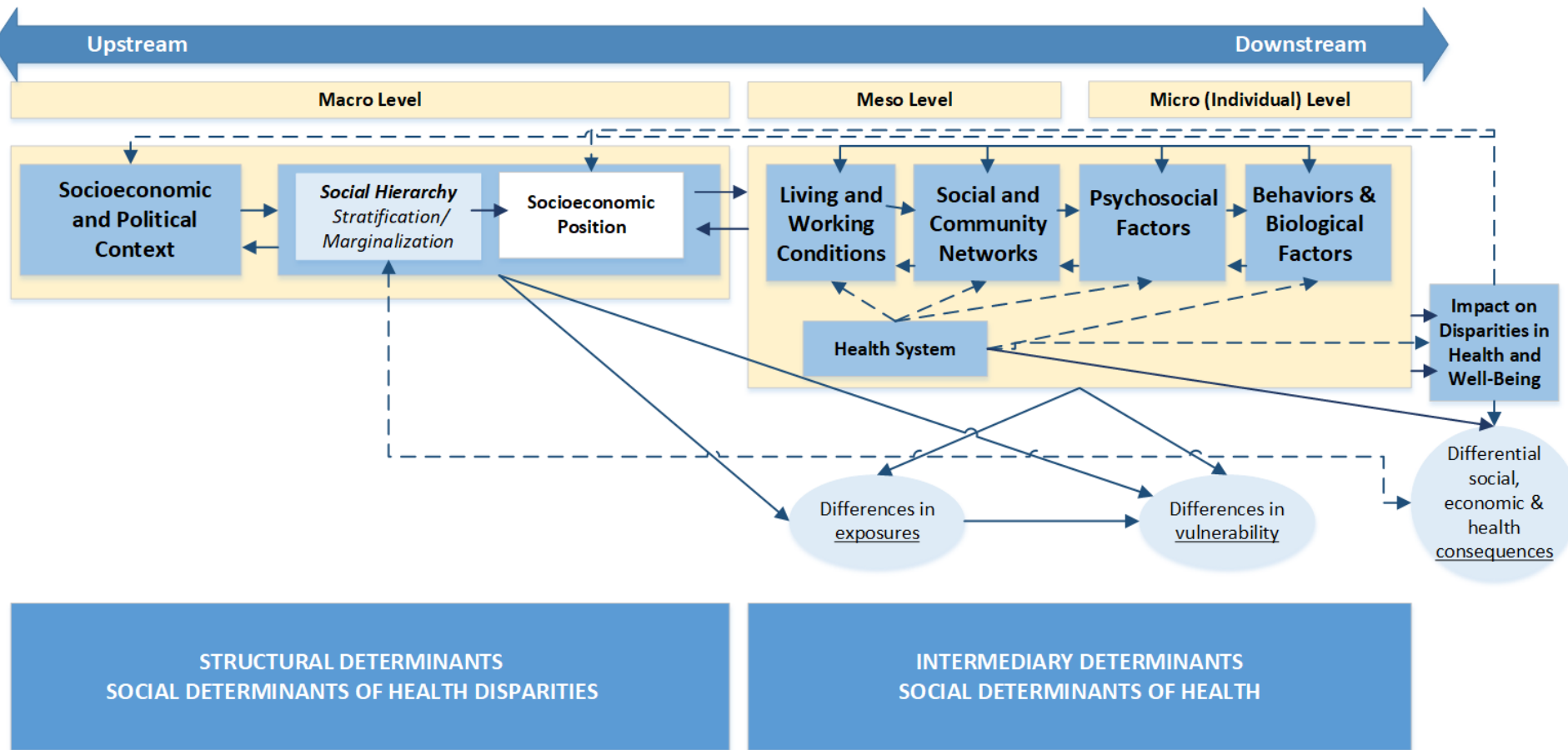
Stage 1: Efficacy

Precautions to avoid IGI



Stage 1: Efficacy

Precautions to avoid IGI



(Veinot et al., 2019)

STAGE 2: ACCESS — *Opportunities to use health informatics interventions*

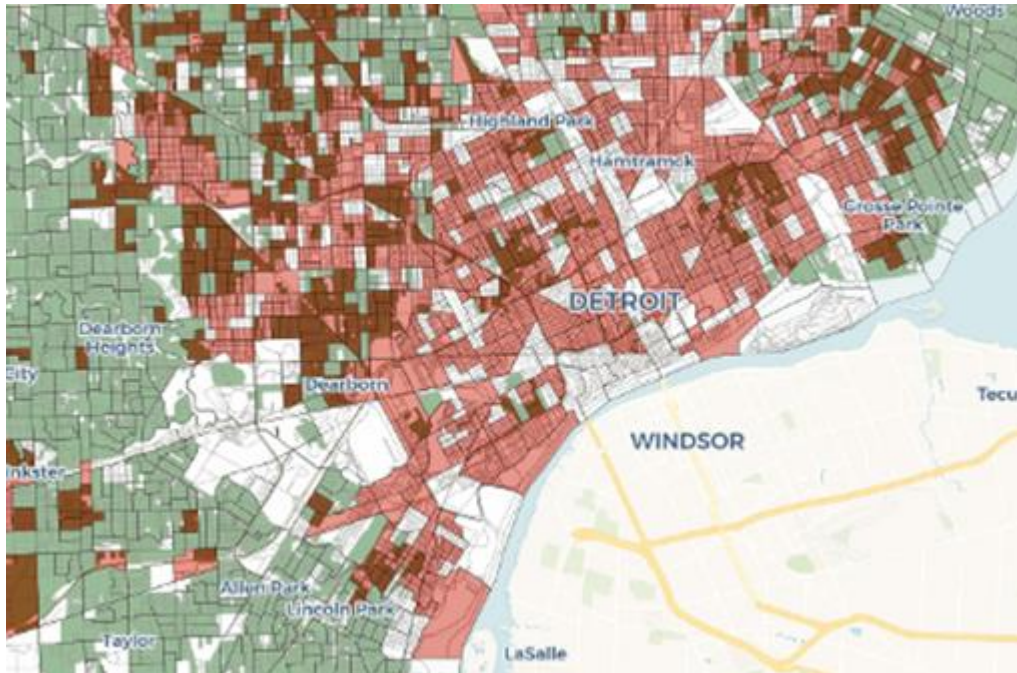
Stage 2: Access

- Non-adoption of patient portals associated with lack of broadband in zip code
 - 33% of rural Americans lack access to high-speed broadband internet to support video-based telehealth visits
- Telehealth usage post-COVID
 - People living in zip codes characteristics with lower broadband access significantly less likely to have a video vs phone visit
 - Spanish-speaking people less likely to have a video visit vs. phone visit

(FCC, 2020; Perzynski et al., 2017; Rodriguez et al. 2021)

Stage 2: Access

How do differences arise?



Red: Census block groups poverty rate >35%

Green: AT&T VDSL or FTTH at max advertised download speeds of 18 mbps+

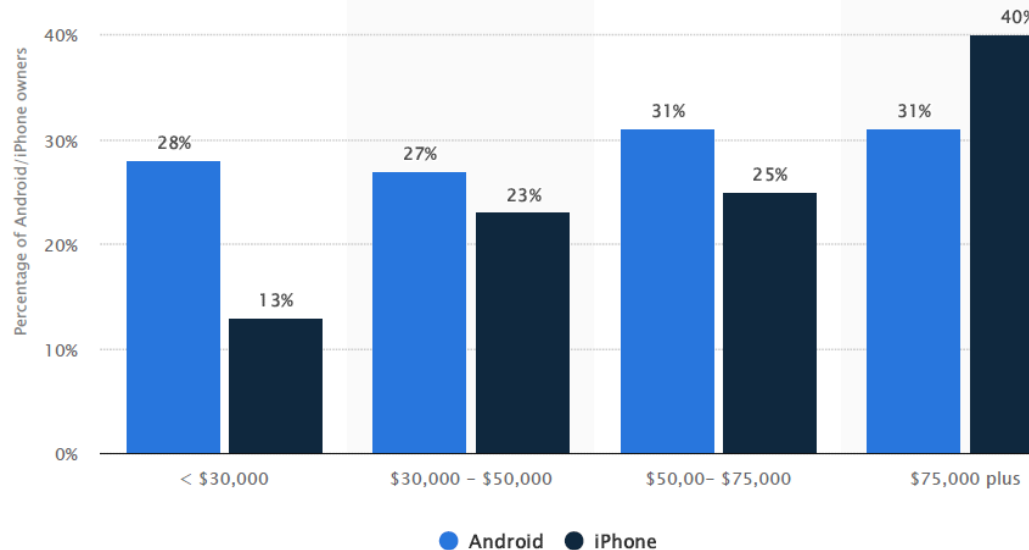
(June 2016)

(Benda, Veinot, Sieck & Ancker, 2020)

Stage 2: Access

How do differences arise?

- Android devices more common among low-income people and African Americans
- Telehealth applications may not be available for Android devices



(Statista, 2013)

Preparing for Your Video Visit

To participate in a video visit you will need:

- A smartphone or tablet (not a computer)
- An active MyUofMHealth Patient Portal account
- The MyUofMHealth mobile app downloaded on your smartphone or tablet
- A strong wireless or cellular data connection
- To be in the state of Michigan at the time of the appointment.

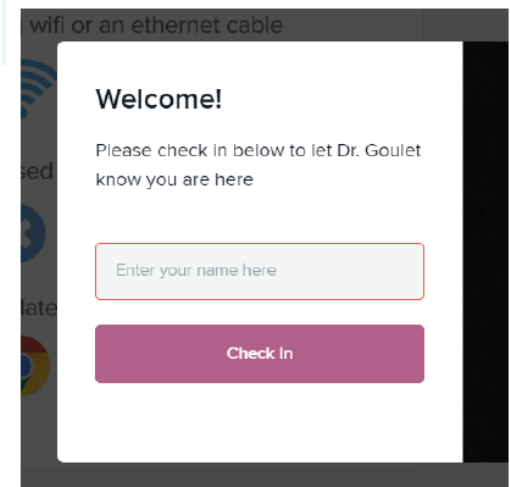
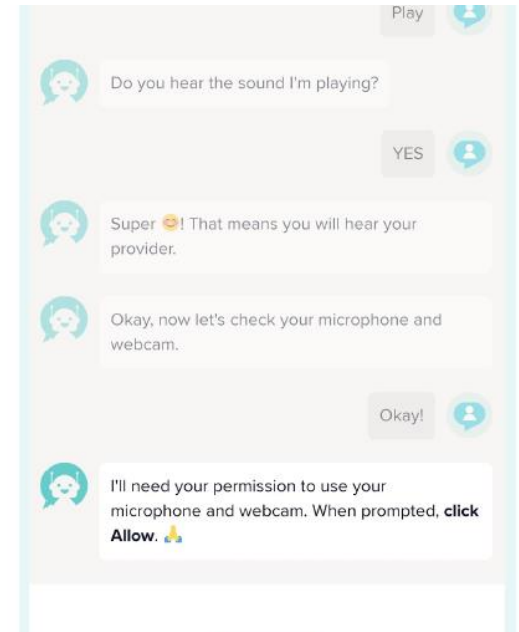
- Choose a location that is safe, comfortable, private and well lit for your video visit.
- Test your app connection in that location before your appointment.
 - Log in to the MyUofMHealth mobile app on your smartphone or tablet.

- If you are using the MyChart app, or using the MyUofMHealth app on an Android device, you may not be able to test the video connection.

Stage 2: Access

How do differences arise?

- Incomplete Spanish versions of technology
 - Patient portal registration material arrives in English despite Spanish preference
 - Video visit testing and visit notifications only in English
 - *“They can't read English. So when they get the text message about the waiting room in [name of program], they don't even know that they're supposed to click on it or what they're supposed to do with it.” (P5, NP)*



Stage 2: Access

Precautions to avoid IGI



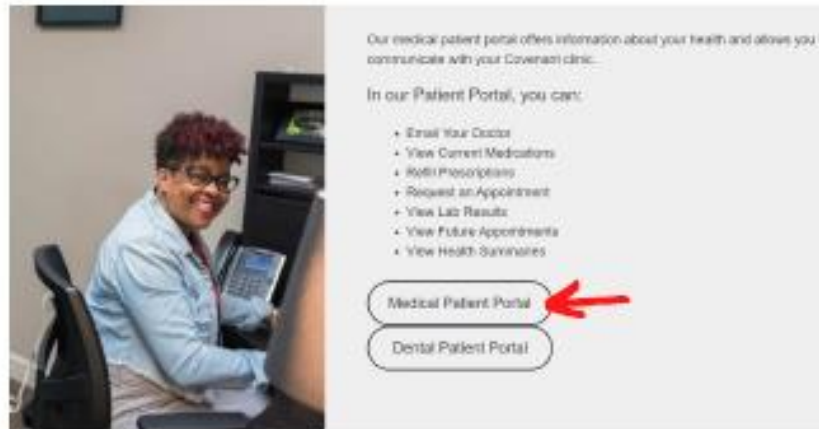
Stage 2: Access

Precautions to avoid IGI

DIAS ANTES DE SU VISITA

■ **Firme el documento de consentimiento de telesalud en su Portal de Paciente**

1. Ve a: <https://covenantcommunitycare.org/welcome/patient-portal/>
Elige "Medical Patient Portal"



STAGE 3: UPTAKE —

Who adopts health informatics interventions (when there is access)

Stage 3: Uptake

Characteristics of survey respondents who did and did not use an online patient portal during the prior 12 months, 2017

Characteristic	All (N = 2,325)	Used a portal	
		Yes (n = 868)	No (n = 1,457)
Offered access by health care provider or insurer**			
Yes	60.3%	94.9%	41.2%
No	39.7	5.1	58.8
Sex**			
Female	53.9	58.5	51.3
Male	46.1	41.5	48.7
Race/ethnicity			
Non-Hispanic white	68.9	71.3	67.6
Non-Hispanic black	13.3	10.7	14.7
Hispanic	9.8	9.1	10.2
Non-Hispanic other	8.0	8.8	7.5
Age (years)**			
18-30	15.9	15.7	16.1
31-40	15.7	16.9	14.9
41-50	20.2	23.8	18.3
51-64	28.6	28.1	28.9
65 or older	19.6	15.6	21.7
Education***			
College or more	39.0	51.2	32.3
Some college	33.8	31.3	35.2
High school or less	27.2	17.5	32.5
Employment status***			
Employed	60.5	68.1	56.2
Not employed	39.5	31.9	43.8
Location**			
Urban	84.9	88.6	82.8
Rural	15.1	11.4	17.2
Insurance type***			
Private	61.4	71.8	55.6
Medicaid*	18.2	11.1	22.2
Medicare	18.7	15.8	20.4
Other	1.7	1.4	1.8
Has a regular health care provider***			
Yes	75.9	85.2	70.8
No	24.1	14.8	29.2

(Anthony, Campos-Castillo & Lim, 2018)

Stage 3: Uptake

How do differences arise?

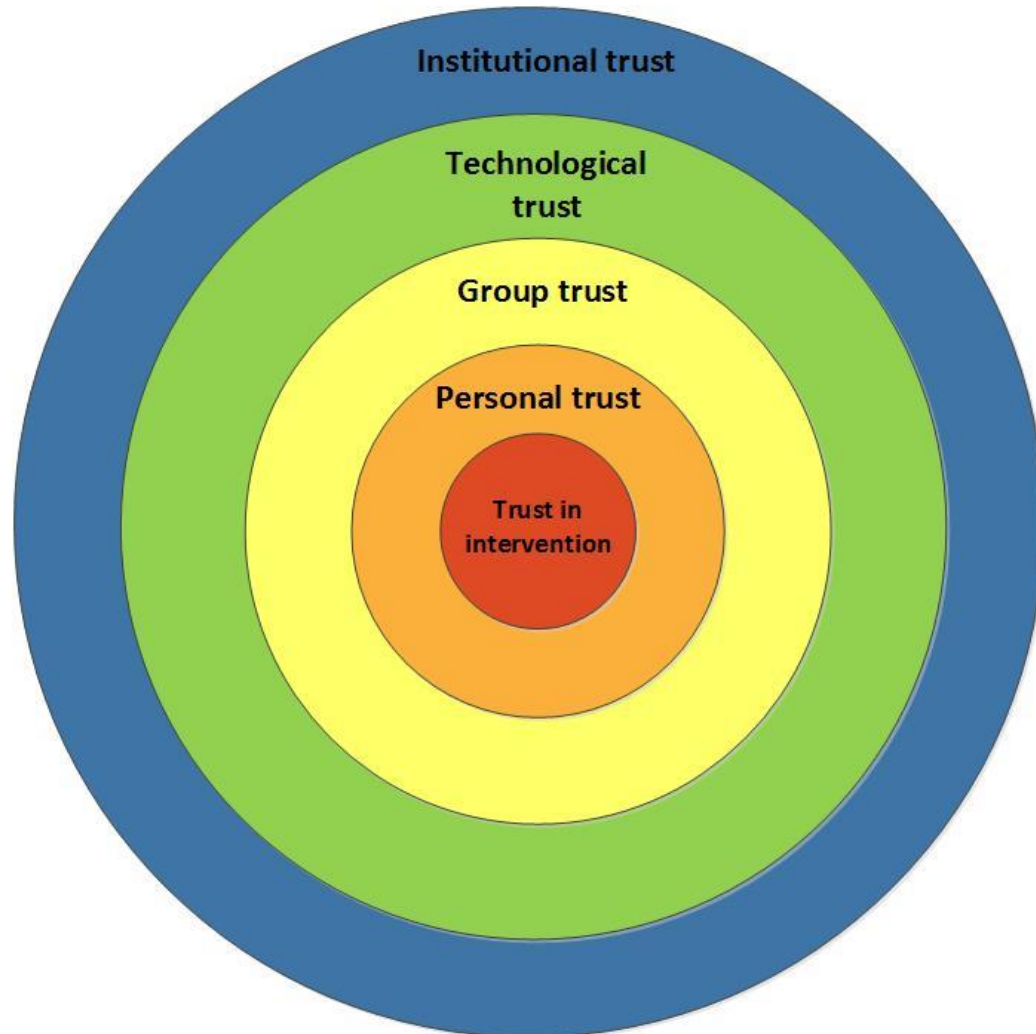
Uptake influenced by usability and digital literacy barriers:

	Limited Health Literacy	Adequate Health Literacy
Mean # portal tasks completed without assistance	1.3	4.2
% of participants with novice computer barrier	69%	10%

(Tieu et al., 2017)

Stage 3: Uptake

How do differences arise?



(Veinot et, al, 2013).

Stage 3: Uptake

Precautions to avoid IGI

Step	Task	Tools Used	Initiated by
1	Requesting appointment	Phone, Web Portal	Patient, Staff
2	Pre-appointment call with staff	Phone	Staff
3	Validating insurance	Phone	Patient
4	Registering for patient portal	Email/Text, Web Portal	Staff, Patient
5	Consenting to telehealth	Web Portal	Reminder
6	Check-in	Phone	Staff
7	Being in the right place at the right time	--	Patient
8	Noticing and clicking visit call/link (nudge)	Mobile Phone Text	Patient
9	Accepting telehealth permissions	Mobile Phone	Software
10	Waiting in waiting room	Mobile Phone	Software
11	Interacting with provider	Mobile Phone	Software
12	(Troubleshooting with provider)	Mobile Phone	Staff
13	Making a payment/co-payment	Web Portal	Reminder
14	Determining next steps (e.g., referrals)	Web Portal, Mail	Patient, Staff
15	Scheduling follow-up appointments	Phone	Staff

Stage 3: Uptake

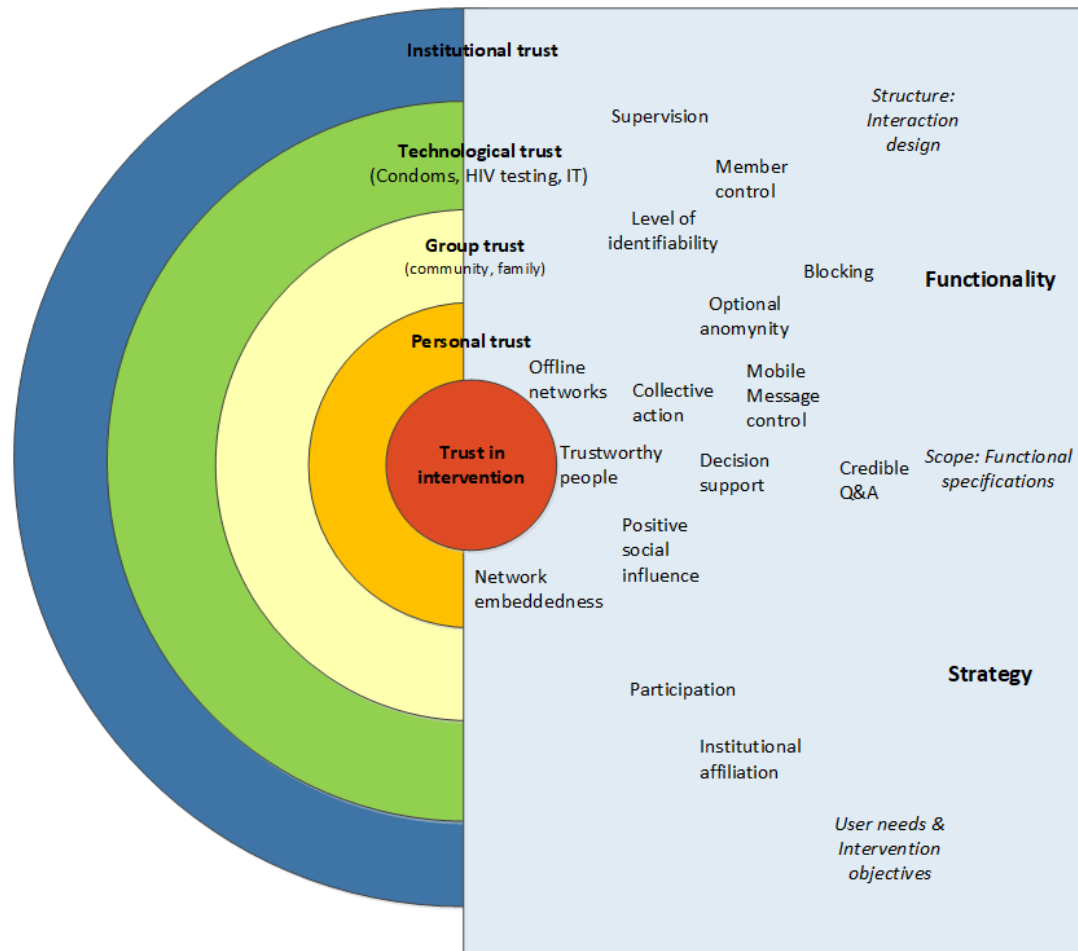
Precautions to avoid IGI

- Adding resources: Intermediaries
 - *“I think some coaching...more than what the front desk and the nurses and even myself can do would be really helpful just to make sure that it's efficient in joining the meeting.” (P3, PA, FQHC)*
 - Intermediaries assist in technology use for people with little prior experience, especially older adults
 - Importance of empathy and warmth

(Bakardjieva, 2005; Barnard et., 2013; Francis et. al., 2018; Hunsaker et. al, 2019; Selwyn et. al, 2016; Taipale, 2019)

Stage 3: Uptake

Precautions to avoid IGI



STAGE 4: ADHERENCE —

Ongoing usage of health informatics interventions

Stage 4: Adherence

Mental Health

- Internet-Based Relaxation RCT (Alfonsson et al. 2016)
- Web-based Psychotherapy Interventions RCT (Karyotaki et al. 2015)

Smoking

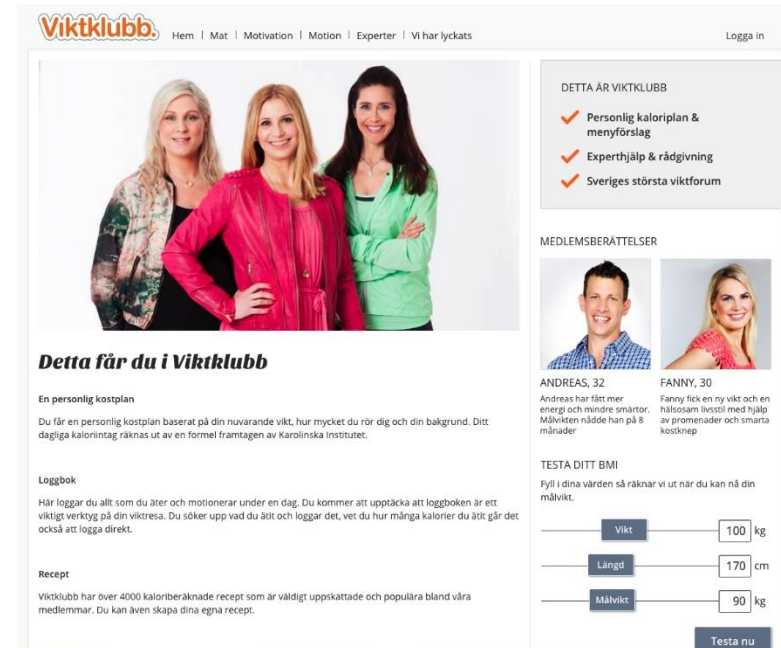
- Quitting via web-based and/or phone (Nash et al. 2015)
- Web-based quitting (Strecher et al. 2008)
- Mobile app for cessation (Ey et al. 2015)

Alcohol Consumption

- Adherence & retention for web-based intervention (Murray et al. 2013)
- Web-based game for adolescents (Jander et al., 2016)

Physical Activity and Nutrition

- Web based weight loss program (Svensson et al. 2014)



Viktklubb. Hem | Mat | Motivation | Motion | Experter | Vi har lyckats Logga in

DETTA ÄR VIKTKLUBB

- ✓ Personlig kaloriplan & menyförslag
- ✓ Expert hjälp & rådgivning
- ✓ Sveriges största viktforum

MEDLEMSBERÄTTELSE

ANDREAS, 32
Andreas har fått mer energi och mindre smärtor. Målvikten nådde han på 8 månader.

FANNY, 30
Fanny fick en ny vikt och en hälsosam livsstil med hjälp av promenader och småa kostknep.

TESTA DITT BMI
Fyll i dina värden så räknar vi ut när du kan nå din målvikt.

Vikt: 100 kg
Längd: 170 cm
Målvikt: 90 kg

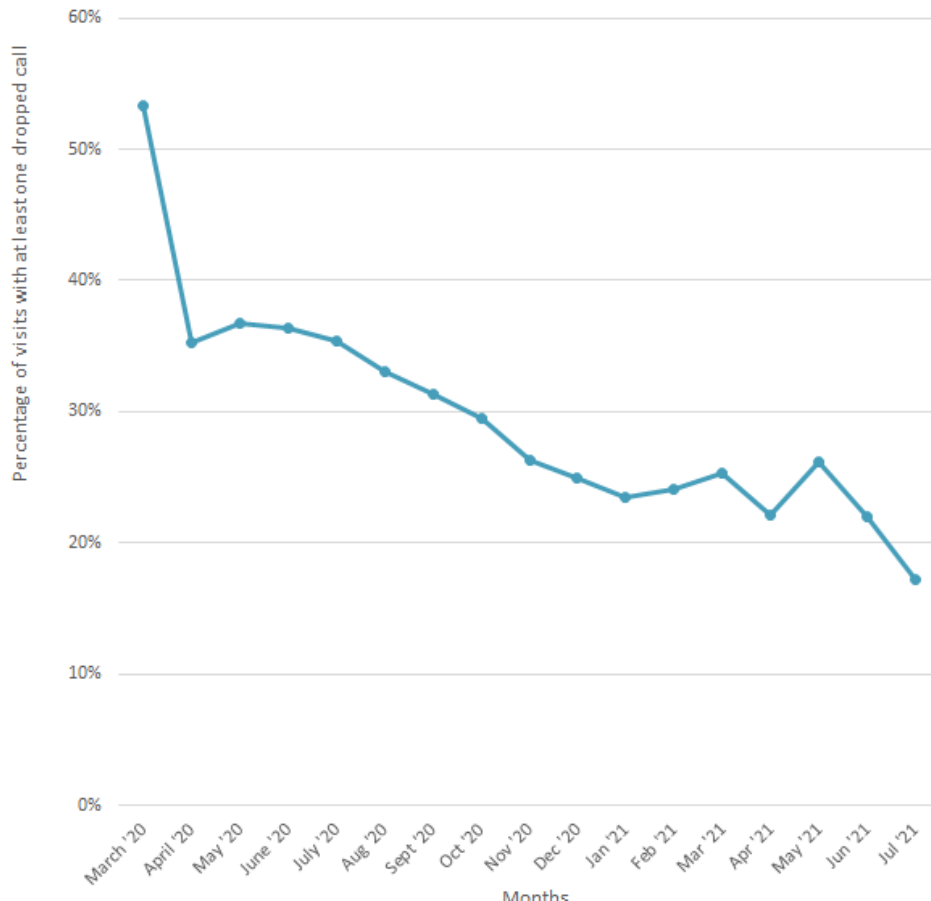
Testa nu

(Svensson et al. 2014)

Stage 4: Adherence

- Analysis of video call logs at FQHC

Proportion of Visits with at Least One Dropped Call March 2020-July 2021



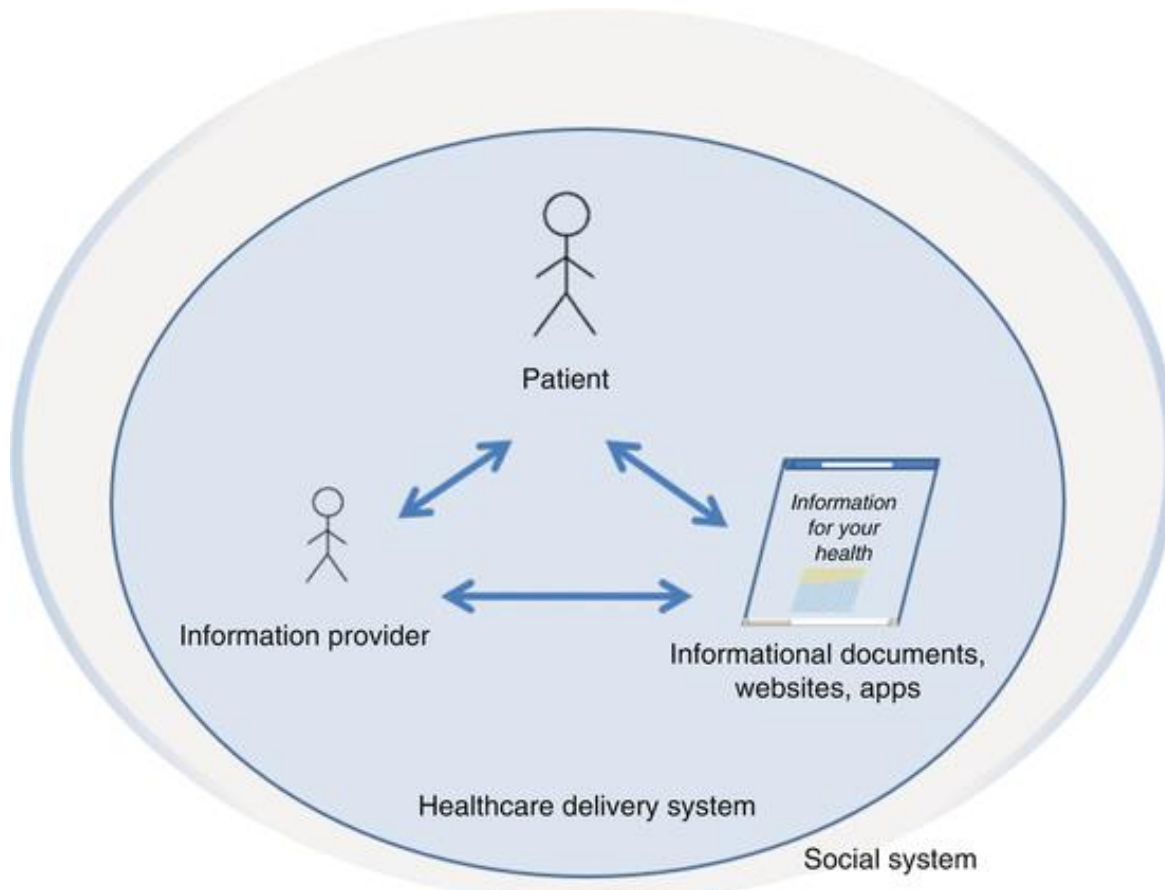
Yearly Call Information for Distinct Visits

Year	Total Distinct Visits	Visits with Dropped Calls	% Visits with at Least One Dropped Call
2020	4311	1451	33.66%
2021	1579	368	23.31%

Stage 4: Adherence

How do differences arise?

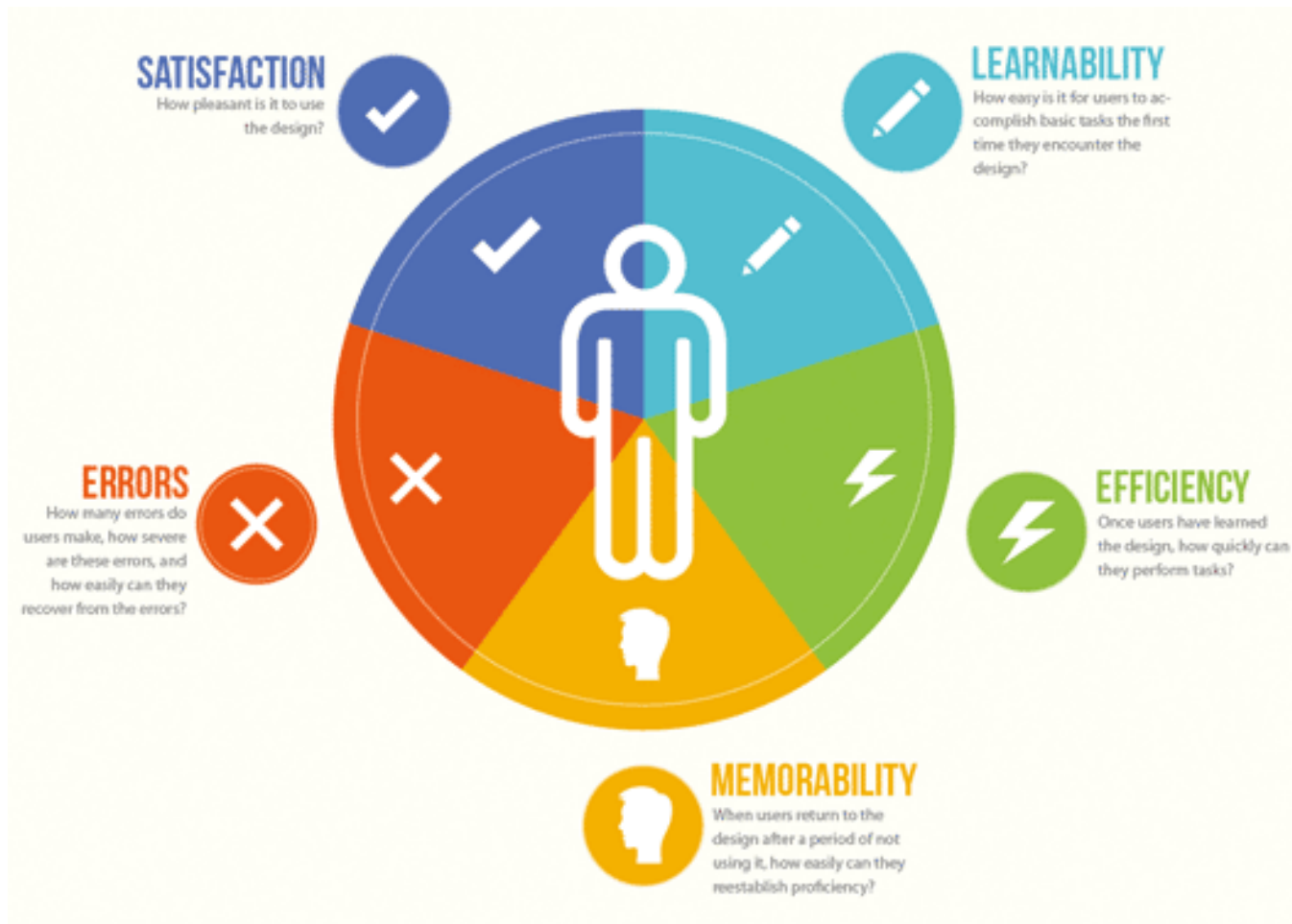
Health
Literacy and
Numeracy



(Ancker, 2017)

Stage 4: Adherence

How do differences arise?



(Rossler, 2015)

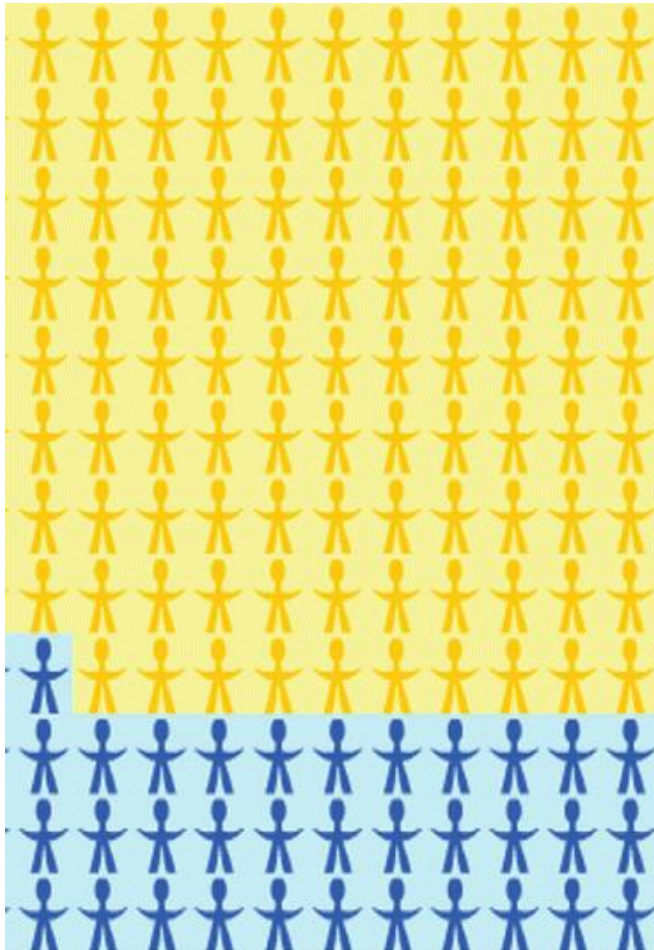
Stage 4: Adherence

How do differences arise?

- Technical problems during calls
 - *“...we started talking, about within 30 seconds to a minute, we can no longer hear each other. So we were just kind of doing sign language...So I was telling her how to turn the audio of hers on and off, because I found that that helps a lot. And then I was also turning the audio of mine on and off, but it didn't work. She rejoined the meeting and then I rejoined the meeting and still didn't work. But then when I rejoined the meeting, second time, it did work, but it was just kind of frustrating. That happens...a couple of times throughout the day...If we still can't figure it out, even though we both rejoined and left and turned the audio on, then I'll just say, I'm going to call you.”* (P2, PA)
- Switches to phone after 5 minutes
 - “...if it's not working then...we just call them.* (P5, NP)

Stage 4: Adherence

Precautions to avoid IGI

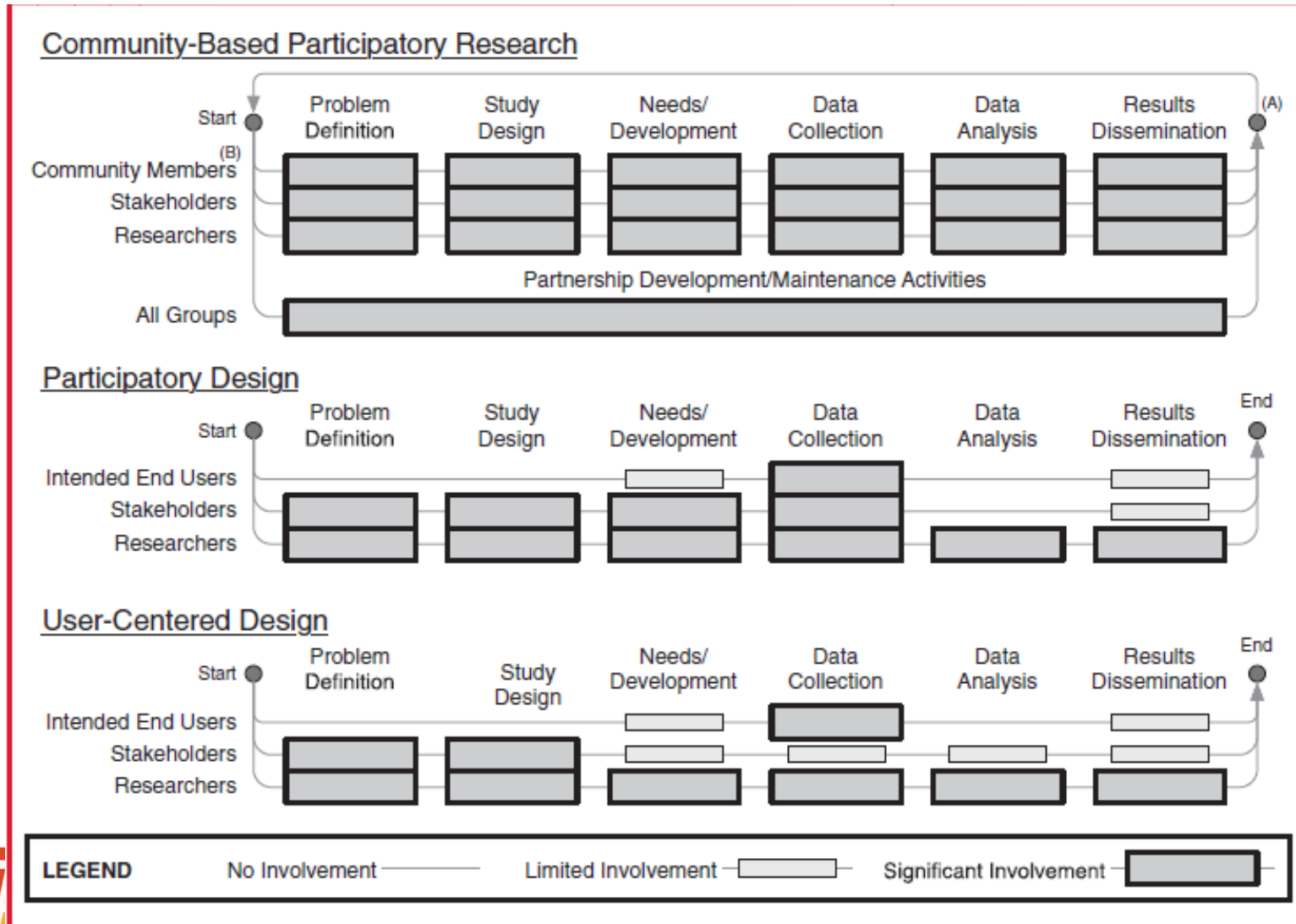


Screenshot showing how myfamily app shows actionable content in the myfamily app.

(Ancker, 2017; Broderick et al., 2014)

Stage 4: Adherence

Precautions to avoid IGI



(Unertl
et
al., 2016)



Stage 4: Adherence

Precautions to avoid IGI

Table 1. Inclusive design decisions and affected groups

Design element	Some affected groups	Example	Relevant literature
Interaction design			
Modes of input	Deaf people, People with cognitive impairments, people with low literacy	Due to literacy challenges, Deaf people may be more able to input information using icon selection and manipulation	118–121
Error handling	People with cognitive impairments, people with low literacy, seniors	People with low literacy make more spelling errors; thus search interfaces should have high error tolerance regarding spelling	118,122
Information architecture	People with Cognitive Impairments, Seniors	Due to memory issues, seniors find it easier to find information within a system with a shallow information hierarchy	123,124
Information design			
Visual presentation of information	Blind people, deaf people, people with low literacy, seniors	Tonal feedback can ensure comprehension of graphs and data visualizations by blind people	115,125–127
Auditory presentation of information	People with cognitive impairments, people with low literacy, seniors	People with low literacy or cognitive impairments may better comprehend textual information accompanied by audio narration	126,128,129
Interface design			
Layout	Blind people, seniors	For seniors, information should be placed in the center of the screen so as to address reduced peripheral vision	130,131
Buttons and icons	People with cognitive impairments, seniors	Older adults may find it easier to tap on larger buttons and icons	132,133
Navigation design	Blind people, people with low literacy, seniors	People with low literacy find it easier to navigate within mobile applications that use linear (versus hierarchical) navigation	131,134,135

STAGE 5: EFFECTIVENESS —

How well, and for whom, informatics interventions work in the “real world”

Stage 5: Effectiveness

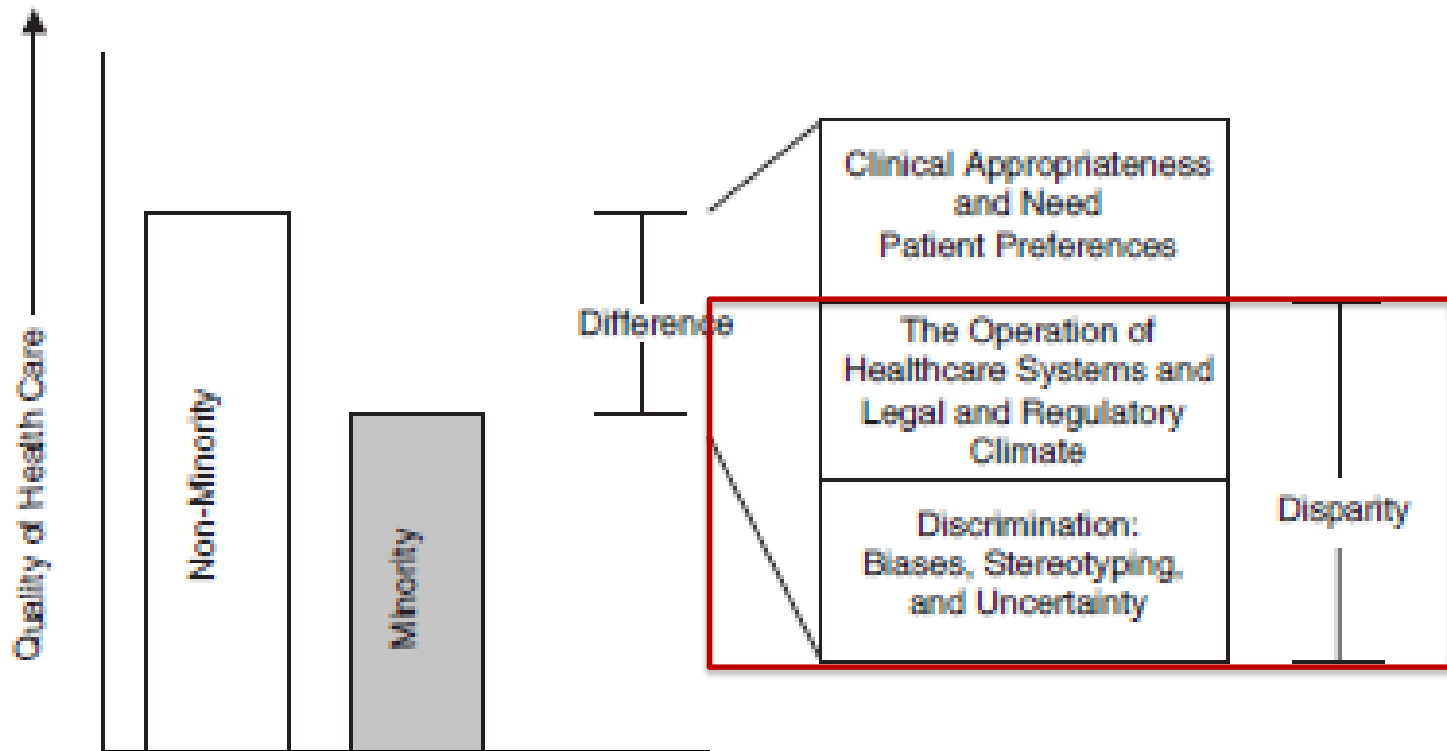


FIGURE S-1 Differences, disparities, and discrimination: Populations with equal access to healthcare. SOURCE: Gomes and McGuire, 2001.

(Gomes & McGuire, 2001)

Stage 5: Effectiveness

- Informatics intervention strategies for reducing disparities
 - Prompting actions
 - Default care processes
 - Provider self-regulation

Prompting via reminders

- Race, gender and equity effects for diabetes care are mixed:
 - Prompting screening actions – 3 studies:
 - Screening for smoking, diabetes, cancer – may favor disparity groups (1 study) or have no effect (2 studies)
 - Prompting treatment actions – 2 studies:
 - Neutral or mixed effects on equity in process outcomes
 - No impact on intermediate health outcomes

(Cato, Hyun & Bakken, 2014; Mishurish & Linder, 2014; Zera et. al, 2015)

(Jean-Jacques et. al, 2011; Hicks et al., 2008)

Default care processes: Order sets, care pathways

Differential Effects	Disparity Group	Intervention Description	Study Type	Setting	Outcome(s)	Citation
Positive Effect (Targeted Intervention)	South Asian Immigrants Low SES (Medicaid)	Order Sets (Culturally tailored), Alerts (Used less: Registries, Feedback)	Stepped-wedge quasi-experiment	14 primary care practices	<u>Treatment Effects:</u> Practice Level: Improvement in BP control Medicaid patients: Reduction in SBP and DBP	(Lopez et. al, 2019)
Positive Effect (Targeted Intervention)	Cambodian Immigrants and Refugees	HIT mental health screening and care pathway	CRCT	18 primary care providers	<u>Treatment Effects:</u> Increased depression and PTSD diagnosis More guideline-concordant and trauma-informed care	(Sorkin et. al, 2019)

Audit and Feedback

Differential Effects	Disparity Group	Intervention Description	Study Type	Setting	Outcome(s)	Citation
Favors advantaged groups	White vs. Blacks White non-Hispanic vs. Hispanic Low SES	Population and practice-level comparative feedback, Registries	Descriptive, No control group	198 primary care practices	Favors Whites: BP Control Favors non-Hispanics: BP control Favors high SES: BP control	(Fortuna et. al, 2018)

Stage 4: Adherence

How do differences arise?

- Intervention strategy may matter:
 - prompting actions
 - default care processes
 - audit and feedback
- Emphasis on individual behavior change vs. defaults in systems?
- Effectiveness differentials may be rooted in poor access, uptake, or adherence

(Vasquez, 2021)

Stage 5: Effectiveness

Precautions to avoid IGI

1. Identify equity-relevant independent variables
2. Choose at least one equity-relevant outcome variable
3. Report sociodemographics of:
 - those who participate
 - those who refuse (if possible)
 - those who are lost to follow up
4. Ensure sufficient statistical power for stratified, subgroup, or interaction analyses
5. Analyze effect of differential uptake and adherence rates on outcomes

Place of residence

Race/ethnicity/language

Occupation

Gender/sex

Religion

Education

Socioeconomic status (SES)

Social capital

Plus: Age, sexual orientation, disability

PROGRESS-PLUS

O'Neill *Journal of Clinical Epidemiology* 2014

Key Takeaways

- Health informatics interventions are at particular risk of fostering Intervention-Generated Inequalities (IGI)
- IGI can emerge at 5 stages of the intervention cycle
- Precautionary measures are necessary to guard against IGI emerging from informatics interventions

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References

Benda, N.C., **Veinot, T.C.**, Sieck, C.J., Ancker, J.S. 2020. Broadband Internet Access is a Social Determinant of Health!. *American Journal of Public Health*. 2020, 110: 1123-1125.

Veinot, T.C., Ancker, J.S., Cole-Lewis, H., Mynatt, Elizabeth D., Parker, A.G., Siek, K., Mamykina, L. Levelling up: On the Potential of Upstream Health Informatics Interventions to Enhance Health Equity. *Medical Care*. 2019, 57: S108-114.

Veinot, T.C., Campbell, T.R., Kruger, D., Grodzinski, A., Franzen, S. A question of trust: User-centered design requirements for an informatics intervention to promote the sexual health of African-American youth. *Journal of the American Medical Informatics Association (JAMIA)*. 2013, 20(4):758-765.

Veinot, T.C., Mitchell, H., Ancker, J.S. Good intentions are not enough: Taking action to ensure that informatics interventions do not worsen inequality. *Journal of the American Medical Informatics Association*. 2018, 25: 1080-1088.

Siek, K., **Veinot, T.C.**, Mynatt, E. Research Opportunities in Sociotechnical Interventions for Health Disparities. Washington, DC: Computing Community Consortium, Computing Research Association. Available online: <https://cra.org/ccc/wp-content/uploads/sites/2/2018/01/17602-CCC-Health-Disparities-ReportFinal.pdf>

Unertl, K.M., Schaeffbauer, C.L., Campbell, T., Senteio, C., Siek, K.A., Bakken, S., **Veinot, T.C.** Integrating Community-Based Participatory Research and Informatics Approaches to Improve the Engagement and Health of Underserved Populations. *Journal of the American Medical Informatics Association (JAMIA)*. 2016, 1(1): 60-73.