

Imagining Improved Interactions: Patients' Designs To Address Implicit Bias

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ABSTRACT

Implicit biases may negatively influence healthcare providers' behaviors toward patients from historically marginalized communities, impacting providers' communication style, clinical decision-making, and delivery of quality care. Existing interventions to mitigate negative experiences of implicit biases are primarily designed to increase recognition and management of stereotypes and prejudices through provider-facing tools and resources. However, there is a gap in understanding and designing interventions from patient perspectives. We conducted seven participatory co-design workshops with 32 Black, Indigenous, People of Color (BIPOC), Lesbian, Gay, Bisexual, Transgender, Queer/Questioning (LGBTQ+), and Queer, Transgender, Black, Indigenous, People of Color (QTBIPOC) individuals to design patient-centered interventions that help them address and recover from provider implicit biases in primary care. Participants designed four types of solutions: accountability measures, real-time correction, patient enablement tools, and provider resources. These informatics interventions extend the research on implicit biases in healthcare through inclusion of valuable, firsthand patient perspectives and experiences.

INTRODUCTION

Implicit biases are unconscious attitudes and stereotypes based on race, gender, sexual orientation, and other characteristics of an individual's physical or perceived identities that may influence healthcare providers' behaviors towards patients.^{1,2,3} These biases are often expressed through discriminatory behaviors, such as nonverbal communication (e.g., lack of eye contact, verbal dominance, speech interruptions),⁴ and have been associated with disparities in quality of patient-provider interactions, provider communication, treatment decisions, and patient outcomes.² Implicit biases towards marginalized patient groups, including Black, Indigenous, People of Color (BIPOC), Lesbian, Gay, Bisexual, Transgender, Queer/Questioning (LGBTQ+), and Queer, Transgender, Black, Indigenous, People of Color (QTBIPOC) individuals are well documented. Compared with non-Hispanic White patients, Black patients are less likely to receive appropriate treatment for heart attacks,⁶ less likely to be prescribed pain medication,⁷ and more likely to be perceived as having poor treatment adherence.⁸ LGBTQ+ patients disproportionately experience health inequities and barriers to quality care due to discrimination and stigmatization.⁹ One in five transgender patients report being denied access to health services because of their gender identity, and one in three report postponement of necessary care to avoid discrimination.¹⁰ Reduced cancer screening rates^{11,12} and access to preventative care¹² by LGTBQ+ patients are other examples of adverse impacts of biases on care. Although often hidden in patient-provider interactions, implicit biases undermine mutual trust and patient engagement, and further exacerbate health inequities. For example, providers with higher implicit bias scores were associated with lower ratings of patient confidence, lower positive affect during visits, and lower patient-centered communication with Black patients.⁵ Providers exhibiting implicit racial attitudes demonstrated greater verbal dominance and spoke slower when interacting with Black patients compared with White patients.⁵ Such nonverbal communication cues are potential signals of implicit biases that can be targeted by interventions to raise provider awareness of otherwise unconscious discriminatory behaviors.⁵

While unequal treatment from discrimination has been studied for over a decade,¹³ interventions to address and mitigate implicit biases have been slower to emerge.^{14,15} To date, there are no known long-term interventions that eliminate implicit bias. Existing strategies are primarily designed to increase provider recognition and management of biases, stereotypes, and prejudices.¹⁵ Clinical training and continuing medical education on culturally affirming care and patient communication equip providers with self-awareness, knowledge, and skills to deliver equitable patient care.¹² Mental imagery,¹⁶ perspective taking,^{17,18} individuating,¹⁹ and positive image priming¹⁶ are examples of empathy-building strategies to counter bias activation and improve patient-provider communication. Other interventions, such as multisource feedback and observed clinical evaluations, focus on deepening provider awareness of the effects of bias on patients.¹⁴ System-level, structural, and procedural changes, such as diversity hiring of healthcare professionals and patient self-identification in data collection,¹² have also been proposed to subvert institutional sources of bias.

Despite this progress, descriptive patient accounts detailing continued experiences of biases and discrimination on the basis of race, ethnicity, and health-related characteristics persist.²⁰ Current implicit bias interventions are largely provider-facing¹⁴ and fail to include valuable patient perspectives on how to address and recover from biased healthcare interactions. Understanding patient preferences is critical for the design of patient-centered solutions that reduce harm in ways deemed appropriate and effective for those impacted. Moreover, positioning interventions around the patient, rather than exclusively the provider, and empowering proactive partnerships may promote more equitable interactions. Researchers have demonstrated that patient-focused mechanisms, such as patient activation (e.g., patients asking questions, having self-advocacy, and raising concerns), can counter effects of provider implicit racial bias and promote higher quality interactions.²¹ “Activated” patients encountering implicit biases reported higher ratings of interaction quality as a result of higher quality communication, increased shared decision-making, and higher care satisfaction, compared with “typical” patients.²¹ There exists an opportunity for health informatics research to further advance patient-centered interventions at the critical point of the patient-provider interaction.

Participatory design (PD) methods, including co-design, aim to democratize the design process and encourage empowerment by placing individuals who are directly impacted by the issue at the center of co-creation.^{22,23,24} In health informatics research, opening up the design process to the input of historically marginalized patient groups previously excluded from such collaborative dialogue, is critical for confronting power imbalances in healthcare⁹ and addressing health inequities through a sociotechnical lens.^{25,26,27} For example, design workshops were conducted with low-income, older Black individuals to meaningfully conceptualize future technologies for personal health challenges.²⁸ Web-based PD engagements with transgender and gender-diverse individuals solicited needs that shaped design and development of an accessible and credible health information resource.²⁹ Given that the voice of patients is largely missing from research on implicit bias recognition and management systems, PD methods provide an ideal medium to begin involving perspectives of patient groups most impacted.

In this study, we explore patients’ perspectives on the design of interventions that mitigate negative experiences of provider implicit bias in patient-provider interactions. Through participatory co-design workshops with representation from marginalized groups, we answer the following research question: *What design recommendations do BIPOC, LGBTQ+, and QTBIPOC individuals envision for tools or resources that help patients address and recover from biased patient-provider interactions in primary care?* This research builds on the broader UnBIASED project (<https://www.unbiased.health/>), which investigates novel computational approaches to addressing implicit biases in healthcare through non-verbal communication cues.³⁰

METHODS

We conducted seven participatory co-design workshops to generate new ideas for patient-centered interventions through speculative, future-oriented lenses of patients with firsthand experiences of discrimination in primary care settings. Each two-hour workshop session was structured with a topical focus on either BIPOC, LGBTQ+, or QTBIPOC experiences to create intentional space for common ground and shared perspectives amongst participants when engaging in design activities. Workshops were facilitated by an experienced lead researcher (CY, LC) and one or two supporting researchers (EB, JTG, NE, RCP) — all of whom represent participant groups through their intersectional identities. Notably, lead researchers both identify as cisgender females with one of them being first generation Asian American (CY) and the other being Black American (LC). Workshops were held in-person (n=5) at local community settings (e.g., public libraries) or over remote video conferencing and Miro digital collaboration platform (n=2) to accommodate participants’ preferences and increase access. Study procedures were reviewed and determined exempt by the Institutional Review Board at the University of Washington.

Participants & Recruitment

We recruited participants for the participatory co-design workshops from online community forums, local organization networks, and physical community settings (e.g., public libraries, community centers, and grocery stores) to reach diverse groups. Additional participants were engaged through snowball sampling. Our recruitment strategy and channels were informed through our community champion engagements.³¹

To participate, a prospective participant needed to 1) identify as a BIPOC, LGBTQ+, or QTBIPOC person; 2) be 18 years or older; and 3) live and have received healthcare in the United States. In our screener survey, participants self-selected into one workshop session based on personal preference for topic and scheduling. Participants were cautioned before the workshop session that co-design activities could provoke negative feelings from past experiences and opportunities to withdraw participation were provided.

Data Collection

The participatory co-design workshop guided participants through a series of activities to introduce the UnBIASED project, create a safe, inclusive environment for participation, establish shared understanding of the problem space, and engage in co-design of interventions. Following introductions, we facilitated a *group discussion icebreaker* to encourage reflection on personal experiences of discrimination related to past challenges with biased provider interactions. Facilitators participated in the sharing of stories to provide common ground scaffolds for participants to react and discuss their opinions without forcing self-disclosure of harmful experiences. Next, participants engaged in two *generative co-design activities* to brainstorm and design interventions for identified challenges, including (i) rapid ideation and (ii) storyboarding. During these activities, our research team collected and noted down quotes, observations, and context for analysis. Sessions were also audio recorded for later review and analysis.

i. Rapid ideation prompted participants to engage individually in divergent brainstorming using futuring³² as a speculative design technique to generate solutions broadly without feasibility constraints. Each participant noted down as many succinct, descriptive ideas on sticky notes (paper or Miro) within a seven-minute period to the design prompt: *'If I could design a future healthcare visit, what would I need or use to empower myself and improve communication with my doctor?'* Participants were encouraged to brainstorm solutions to previously shared stories or draw from additional experiences in their own lives.

ii. Storyboarding²⁸ involved participants working in small groups of two or three to build off one or more brainstormed solutions and extend it further to the design prompt: *'Now imagine that you have a device that has the power to detect when you're not being heard by a doctor. Create a storyboard to show how you might use this device during a visit to empower yourself and improve communication with your doctor.'* Participants were asked to illustrate the use of their solutions by a patient character in a standardized scenario from start to finish. Emotions, dialogue between characters, and descriptions of use cases were captured by participants and shown in their stories. A storyboard template was adapted for in-person (paper) and remote (Miro) workshops to provide participants with an outline for their stories.

We asked questions after each co-design activity to encourage participants to explain and elaborate on their ideas, share their motivations, and answer questions from other participants for additional clarification. Participants also completed a brief demographic survey (e.g., age, gender, race, ethnicity) to capture intersectional identities for gender and race constructs before the end of the workshop.

Data Analysis

We performed thematic analysis of workshop data (e.g., audio recordings, summary notes, sticky notes, storyboards) through inductive affinity diagramming.³³ Thematic analysis is a well suited qualitative data analysis method that allows for experiences and thoughts in a data set to be critically appraised under social, cultural, and structural lenses.³⁴ Six researchers (CY, LC, RCP, DM, EB, NE) independently reviewed anonymized workshop artifacts and qualitative data over iterative rounds to identify emergent themes. Researchers then met as a group over four analysis sessions to build consensus on a set of common themes and definitions. Emergent themes were organized and coded with considerations for underlying patient pain points solicited in co-design activities, primary function of the interventions, and positionality of interventions (patient- or provider-facing).

RESULTS

We conducted seven participatory co-design workshops (denoted by W#) with a total of 32 participants (Table 1) after reaching information saturation, as indicated by repeated designs of interventions. Workshop attendance ranged from one to eight participants.

Rapid ideation generated a breadth of loosely defined interventions, such as patient feedback surveys and symptom word charts, that served as starting points for further elaboration in storyboards (Table 2).

Table 1. Participant characteristics by workshop session topic and number.

Workshop Session Topic	LGBTQ+ (n=13)		QTBIPOC (n=9)		BIPOC (n=10)		
	W1	W6	W2	W7	W3	W4	W5
Age							
Mean (SD), Range	37.2 (15.4), 22 - 71		26.9 (4.3), 21 - 35		40.6 (22.3), 19 - 77		
Gender							
Woman	6 (46.1%)		3 (33.3%)		6 (60%)		
Man	6 (46.1%)		5 (55.6%)		4 (40%)		
Non-binary	1 (7.7%)		1 (11.1%)				
Transgender	2 (15.4%)						
Cisgender					2 (20%)		
Gender Fluid	2 (15.2%)		1 (11.1%)				
Another gender: "Lesbian"	1 (7.7%)						
Race							
White	5 (38.5%)						
Black or African American	3 (23.1%)		6 (66.7%)		6 (60%)		
American Indian or Alaska Native	1 (7.7%)				2 (20%)		
Chinese	1 (7.7%)						
Filipino			1 (11.1%)				
Asian Indian			2 (22.2%)		1 (10%)		
Korean	2 (15.4%)						
Japanese					1(10%)		
Other Asian			1 (11.1%)		1 (10%)		
Other Pacific Islander			1 (11.1%)				
Some Other Race	3 (23.1%)				1 (10%)		
Prefer Not to Disclose	1 (7.7%)						
Ethnicity							
Not of Hispanic, Latino, or Spanish Origin	9 (100%)		9 (100%)		10 (100%)		
Mexican, Mexican American, Chicano	1 (7.7%)						
Puerto Rican	1 (7.7%)						
Another Hispanic, Latino, or Spanish Origin	2 (15.4%)						

Table 2. Examples of design interventions generated from rapid ideation in each workshop topic.

LGBTQ+	QTBIPOC	BIPOC
<ul style="list-style-type: none"> • Alarm that sounds when it detects condescending words or tones • Patient feedback survey on provider and visit experience • Panic button for patients to call a neutral third party into the exam room 	<ul style="list-style-type: none"> • Board of healthcare professionals who oversee provider misconduct • Wristwatch that indicates to the provider to stop asking questions about medication • Recording devices in exam rooms to capture instances of discrimination 	<ul style="list-style-type: none"> • Word chart to help patients describe symptoms • Online reviews of patient experiences with providers • Patient access to view/edit providers' clinical notes

Across the participatory co-design workshops, we identified four themes capturing participants' design of interventions to help patients address and recover from biased patient-provider interactions: *accountability measures*, *real-time correction*, *patient enablement tools*, and *provider resources*. Themes occurred across all topical sessions unless specified. Next, we describe each theme with storyboard examples and illustrative quotes.

1. Accountability measures: Recording, third-party involvement, and real-world consequences

Provider accountability measures were prominent in seven of 13 storyboards. Mechanisms and processes to (1) *record patient-provider interactions*, (2) address problems through *third-party involvement*, and (3) *enforce real-world consequences* were discussed as actionable strategies during and after healthcare visits to hold providers accountable for biased behaviors and prevent future misconduct.

1.1 Recording patient-provider interactions: Participants across BIPOC, LGBTQ+, and QTBIPOC topical sessions suggested use of audio or video devices to record or livestream visits for objective documentation and oversight of biased encounters. For example, a storyboard from W2 illustrates a patient character initiating an audio recording on a hidden device in the examination room during moments of discomfort in the patient-provider interaction. P3 noted: *“With the audio recording, you know exactly what was said, instead of a he said-she said situation.”* Since provider implicit bias can be subjective, participants designed recording interventions with the intent to reduce uncertainty and validate their experiences of discrimination. P5 referenced providers’ roles as authority figures in healthcare settings as a reason to record provider interactions, despite cautioning against overreliance on surveillance technology: *“I feel like it can get ‘Black Mirror’ very quick if we’re monitoring everything on cameras. But at the same time, I think certain people need to be monitored and held to standards, like police and doctors.”* Some participants emphasized the importance of obtaining patient consent or allowing patients to start and stop recordings as protective safeguards for privacy. Others considered variable placements of recording devices in hidden locations from providers to avoid influencing behaviors.

1.2 Third-party involvement: Participants commonly described third-party involvement as a real-time or retrospective mechanism to govern biased or discriminatory behaviors among providers. Third-party individuals or groups (e.g., interdisciplinary committees, patient advocates, social workers, medical staff) were represented in storyboards as impartial mediators with authority to whom providers must answer: *“I like the idea of a third-party patient advocate involved. It diffuses the pressure between the doctor and patient”* (P7). In all cases, participants ascribed responsibilities of monitoring providers’ future behaviors and administering appropriate consequences to the third-party individual or group. For example, one storyboard from W1 depicts the separation of the offending provider and patient character when discriminatory behavior is perceived, and the subsequent investigation by a committee of healthcare professionals to understand the source of escalation in the interaction.

1.3 Enforcing real-world consequences: Participants expressed a desire for transparent, real-world consequences for providers who behave in biased ways: *“We need real consequences. The issue is that so often, nothing happens to the doctors”* (P1). In designing interventions, participants recommended disciplinary actions ranging in severity from reprimand, audits, and additional training to monetary fines and license suspensions as learning tools or deterrents against future transgressions. A storyboard from W2 shows an offending provider’s medical license revoked as the result of a board review following a discriminatory incident. While participants believed consequences were important, one participant recognized: *“It’s important that doctors are also given chances so that it’s fair to them”* (P8).

2. Real-time correction: Dialogue correctors and panic/escape buttons

Real-time correction mechanisms were incorporated into seven of 13 storyboards to help patients identify implicit biases expressed in patient-provider interactions and act immediately to address them during healthcare visits. Among participants, recognizing moments of bias were deemed challenging and often only realized in retrospect after the visit. One participant from W6 reflected: *“I left the visit being like, ‘what the hell was that?’ when I realized I had been discriminated against”* (P27). Correction mechanisms designed included (1) *dialogue correctors* and (2) *“panic” or “escape” buttons*, which aim to increase awareness of provider implicit biases and present options for patients to resolve or exit the interaction as it unfolds. Both mechanisms were commonly combined together or with other tools or resources as interventions.

2.1 Dialogue correctors: Dialogue correctors were imagined as devices that monitor patient-provider interactions and produce audio alerts when inappropriate verbal or nonverbal communication patterns, such as condescending tones or mislabeling of pronouns by providers, are detected. For example, a different storyboard from W2 illustrates a small device in the exam room that beeps when it picks up offensive words in conversation (Figure 1). Audio feedback produced by the device draws attention to instances of discrimination associated with provider implicit bias and surfaces it to both the patient and provider, before initiating subsequent corrective events to resolve the event. In another example, the provider character uses signals from the dialogue corrector to adjust their behavior and communication in real-time to remediate the interaction.

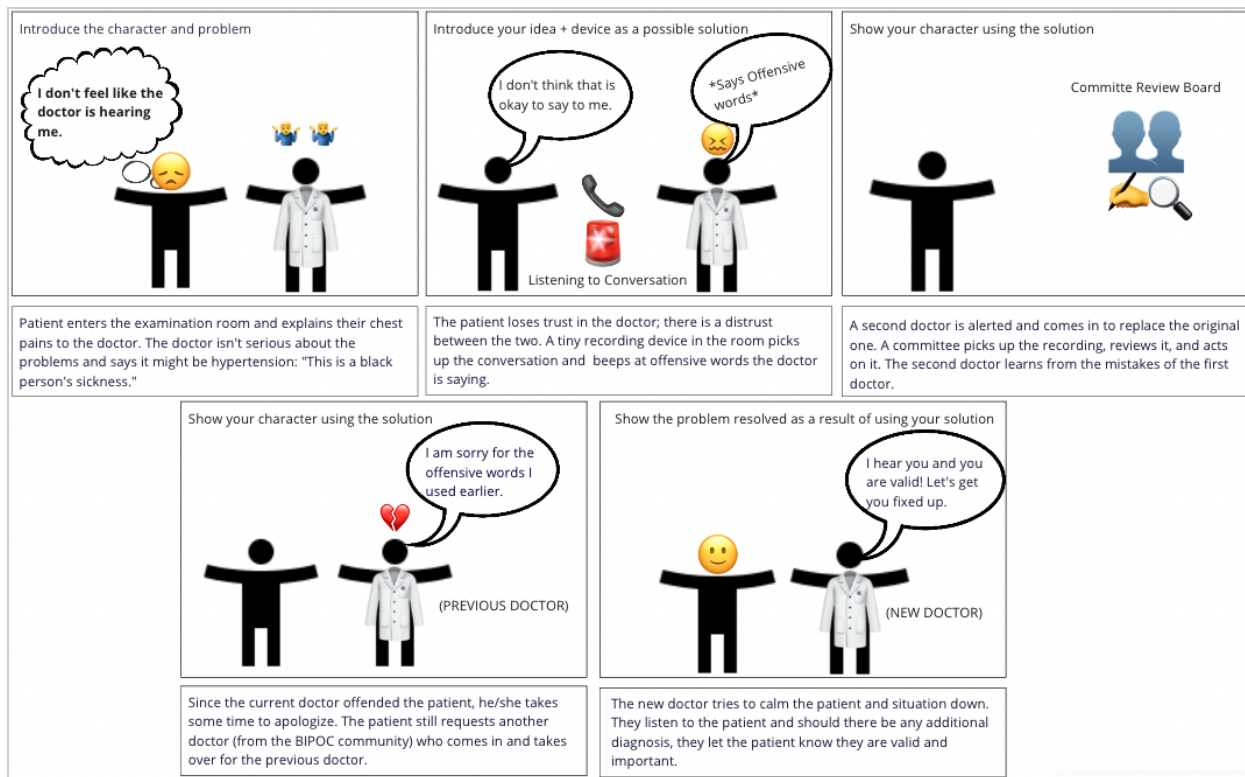


Figure 1. Storyboard from W2 depicting a dialogue corrector intervention that produces audio alerts at inappropriate words used by the provider, signaling an instance of discrimination.

2.2 Panic/escape buttons: Participants in LGBTQ+ and QTBIPOC workshops (W1,2,6,7) also described patient-oriented “panic” or “escape” buttons to summon assistance or mediation from a third-party (e.g., patient advocate, social worker, or medical staff), or initiate emergency exits out of unwanted interactions. One storyboard from W6 shows the patient character using a discreet button when they feel disregarded by the provider to alert a patient advocate into the examination room for support facilitating the clinical conversation. Design of these buttons serve as immediate, protective mechanisms that de-escalate the interaction and separate the patient from the provider to prevent further discrimination. “*The patient pushes a call button in the middle of the room to alert the receptionist or other medical staff that they don't feel safe and probably won't get the care they need with the current doctor. The current doctor understands that this is the patient's decision, someone comes in and removes the doctor.*” [P9] In some cases, buttons were also designed with additional functions, such as a control for triggering the release of visit recordings or adding time in the appointment with the provider.

3. Patient enablement tools: Communication aids and evidence or documentation resources

Patient enablement tools were present in six of 13 storyboards as interventions that empower patients to communicate their needs and collaborate effectively with providers during healthcare visits. Participants noted during the icebreaker that patients hold rich knowledge as experts of their own bodies and experiences but are not always treated with respect or acknowledged for this expertise. Personal stories shared by participants recounted negative experiences of providers dominating interactions with their own opinions and assumptions, rather than considering patients' perspectives: “*The medical provider ignored my symptoms and made it feel like it wasn't something I had ... She just didn't want to acknowledge that*” (P4). Primary pain points focused on concerns about not being taken seriously by providers and misunderstanding patients' symptoms. Storyboards elaborated on patient-facing (1) *communication aids* and (2) *evidence or documentation resources* to garner credibility of patients' expertise and promote reciprocal exchange of information.

3.1 Communication aids (patient-facing): Communication aids were brainstormed by participants as tools to help patients express their needs, preferences, and concerns with providers. For example, one storyboard from W1 illustrates an interactive smartboard as a communication aid that helps patients clearly articulate their symptoms

through auto-generated descriptors, word suggestions, and visuals: “We focused on language, it can make a difference [for care received] when describing symptoms”. Two other storyboards from W2 and W6 describe wearable sensors that detect physiological signals of discomfort or stress (e.g., mood, stress levels, heart rate) and prompt patients to share their feelings as a mindful strategy to create space for concerns and facilitate two-way dialogue (Figure 2). The envisioned technologies promote self-advocacy and active participation by supporting patients in speaking up for themselves.

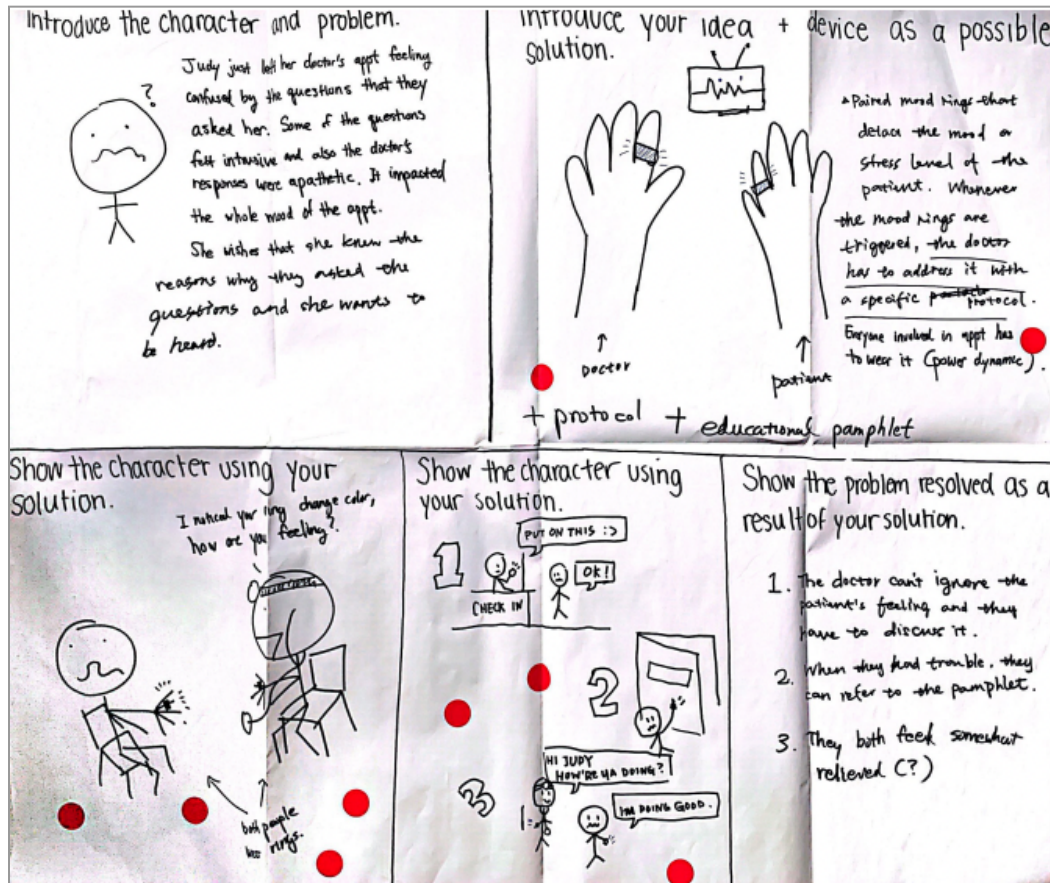


Figure 2. Storyboard from W6 depicts rings that reflect the mood and stress levels of its users, worn by patients and providers as communication aids to facilitate open dialogue.

3.2 Evidence or documentation resources: Storyboards illustrated documentation resources as strategies for patients to advocate for their health concerns when experiencing challenging communication barriers with biased providers. Designs devised by participants focus on equipping patients with evidence to reinforce their personal expertise and health concerns with credibility in a way that can be understood by providers. For example, one storyboard from W7 illustrates a biodegradable device (“scannable sticker”) that collects personal symptom data (symptom diary) at the time of a health incident for later review with a provider during the healthcare visit.

4. Provider resources: Communication aids and training

Provider resources – interventions that help providers communicate clinical information and collaborate effectively with patients during visits – were brought up as solutions in three of 13 storyboards to support information exchange and mitigate implicit bias. During the icebreaker, some participants reflected on past negative experiences of providers’ communication of clinical diagnoses, treatment recommendations, and medication options, sharing that delivery of information felt forceful, oriented around blame, or insensitive at times: “My doctor did not care about the shame that I was feeling after the HIV+ diagnosis. One provider said, ‘You do know where you got this?’ It made me feel more shame and he absolutely blamed me for the diagnosis.” (P29). To address such experiences, participants suggested (1) provider-facing communication aids and (2) training via provider-facing solutions that reduce the impact of provider implicit biases and improve patient-centered communication.

4.1 Communication aids (provider-facing): Supportive tools and resources to help providers convey their medical knowledge to patients were proposed as provider-oriented communication aids. One storyboard from W3 describes an interactive smartboard that presents objective information and visuals to help providers explain diagnoses, treatments, and complex medical jargon to patients. Other recommendations for provider communication aids included a self-evaluation questionnaire on visit comfort levels administered together with the patient during visits and a standardized list of check-in questions on patient emotions to proactively attend to throughout the interaction.

4.2 Training: Beyond the visit setting, participants reinforced provider training in empathy and cultural awareness as formalized learning opportunities after instances of discrimination. A storyboard in W2 illustrates use of visit recordings as learning tools for providers to playback, review, and recognize how instances of discrimination associated with implicit bias emerge in their interactions with patients.

DISCUSSION

Implicit biases in healthcare disproportionately affects people from marginalized groups and contributes to health disparities and inequities through its impact on patient-provider interactions and clinical decision-making.² Extensive research on implicit bias interventions explore various provider-facing approaches;¹⁴ however, patient perspectives remain a gap. We engaged 32 BIPOC, LGBTQ+, and QTBIPOC participants in the collaborative co-design of patient-centered interventions that help patients address and recover from experiences of discrimination associated with provider implicit bias. From the 13 storyboards generated by participants across seven participatory co-design workshops, four themes emerged: *accountability measures*, *real-time correction*, *patient enablement tools*, and *provider resources*. Here, we reflect on higher level principles that guide design considerations for patient-centered, informatics interventions to mitigate provider implicit bias and improve quality of patient-provider interactions: rebalancing control, two-way collaboration, and service re-design of patient-provider interactions.

Prior research on implicit bias interventions positions providers as the primary actors in healthcare interactions,¹⁴ neglecting patients' roles as active partners capable of effecting change. In the themes, '*accountability measures*', '*real-time correction*', and '*patient enablement tools*', we observed a desire to reclaim control over certain aspects of the patient-provider interaction in a way that is responsive to patients' experiences of discrimination. Participants emphasized the importance of centering power around patients to enable them to initiate solutions and influence subsequent corrective events, rather than remaining inconsequential actors in the interaction. For example, "panic" and "escape" buttons were designed to be triggered by patients to impact and change the course of a healthcare visit upon recognition of a biased interaction. Both explicit (manual) and implicit (automatic) controls, such as the intentional push of a button or passive start of a video recording based on physiological signals, act as entry points into patient-centered interventions. Such controls may benefit patients' propensity towards 'fight' or 'flight' reactions in response to biased treatment.³⁵ Notably, implicit controls may be deemed useful for instances where biases are not immediately recognized by the patient or to accommodate varying levels of comfort with provider confrontation.

Considerations around balance of control and power in the design of interventions draw parallels with that of police body cameras. Police officers, as authority figures in law enforcement interactions, retain full autonomy and control over the operation of body cameras, starting or stopping recordings when they feel threatened or anticipate confronting a dangerous circumstance. Imbalance of control over the device concentrates the narrative power around the officers' perspectives and limits participation from the public whom they interact with, which can result in consequences that disproportionately harm racially and ethnically minoritized groups. Designing for interventions that mitigate provider implicit bias in healthcare contexts meet similar tensions, whereby inequitable control over the solution may inadvertently disempower one group in the recovery of a discriminatory event and perpetuate perceived power differentials. Thus, centering control mechanisms around patients presents opportunities to balance power and foster patients' confidence in the immediate interaction and broader healthcare system.

While the patient actor was a major focus of interventions designed in our co-design workshops, participants acknowledged roles that providers and other healthcare professionals (e.g., patient advocates and social workers) play in improving patients' experiences of discrimination. We found two-way collaboration present in the themes, '*patient enablement tools*' and '*provider resources*', where reciprocity, acknowledgement of needs, and mutual action by both patients and providers were instrumental for ensuring patients were understood and engaged in their health experiences and decision-making. Dyadic interventions designed by participants, such as mood rings worn by both patients and providers for emotional visibility, suggest a focus on patient- and provider-facing features to

address biased interactions. Considering the patient-provider dichotomy and evolving paradigm of roles in clinical care, enablement of strong, collaborative partnerships benefit patients' experiences across their care continuum.

Beyond the patient-provider interaction, participants envisioned solutions for interpersonal implicit bias that occur at varying interactions before, during, and after the healthcare visit. Since care experiences are formed through the culmination of different service encounters and touchpoints along the patients' journey,³⁶ interventions may be well-equipped to address discrimination through end-to-end service design considerations. For example, preventative measures leading up to the patient-provider interaction (e.g., online reviews informing the selection of a provider, collection of evidence for symptoms) and subsequent actions following the visit (e.g., completion of patient feedback surveys, patient view/edit access to clinical notes) were brainstormed by participants in workshops. Patient interactions with peripheral medical staff, health technologies, resources, and infrastructure in the broader healthcare system during their healthcare service journeys suggest additional opportunities to improve interpersonal implicit bias through structural and systemic interventions.

This study has several limitations and strengths. One limitation was the differing in-person and remote formats of co-design workshops, which may have influenced participants in their co-creation process. For example, the freehand sketching nature of in-person storyboarding was adapted for remote participants, who were provided with emojis in Miro to communicate their design solutions. However, through offering various formats of the workshops, we were able to recruit broadly for participants representing different communities, technical literacy, and backgrounds (e.g., individuals from diverse neighborhoods in Seattle for in-person sessions and individuals from online public channels across the United States for remote sessions). Another major strength of this study was our diverse research team, whose intersectional identities and lived experiences of healthcare discrimination allowed for representative facilitation across each workshop topic. Future work should investigate feasibility and implementation considerations for the development of suggested solutions and incorporate patient perspectives into interventions that address system-level, structural, and procedural sources of implicit bias in healthcare.

CONCLUSION

Through participatory co-design workshops with BIPOC, LGTBQ+, and QTBIPOC participants, we explore patients' perspectives on tools and resources that help them address and recover from provider implicit bias. Participants described four themes: *accountability measures*, *real-time correction*, *patient enablement tools*, and *provider resources*, which feed up into high-level design considerations for interventions, such as rebalancing control, two-way collaboration, and service design approaches. Our findings contribute to the growing body of research on implicit bias interventions in healthcare through inclusion of patient perspectives.

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